THE

BIOLOGICAL BULLETIN

PUBLISHED BY THE MARINE BIOLOGICAL LABORATORY

THE MARINE BIOLOGICAL LABORATORY

SEVENTY-NINTH REPORT, FOR THE YEAR 1976—EIGHTY-NINTH YEAR

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I. TRUSTEES

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CERTIFICATE OF ORGANIZATION

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II. CERTIFICATE OF ORGANIZATION

(On File in the Office of the Secretary of the Commonwealth)

No. 3170

We, Alpheus Hyatt, President, William Stanford Stevens, Treasurer, and William T. Sedgwick, Edward G. Gardiner, Susan Mims and Charles Sedgwick Minot being a majority of the Trustees of the Marine Biological Laboratory in compliance with the requirements of the fourth section of chapter one hundred and fifteen of the Public Statutes do hereby certify that the following is a true copy of the agreement of association to constitute said Corporation, with the names of the subscribers thereto:-

We, whose names are hereto subscribed, do, by this agreement, associate ourselves with the intention to constitute a Corporation according to the provisions of the one hundred and fifteen chapter of the Public Statutes of the Commonwealth of Massachusetts, and the Acts in amendment thereof and in addition thereto.

The name by which the Corporation shall be known is THE MARINE BIOLOGICAL LABORATORY.

The purpose for which the Corporation is constituted is to establish and maintain a laboratory or station for scientific study and investigations, and a school for instruction in biology and natural history.

The place within which the Corporation is established or located is the city of Boston within said Commonwealth.

The amount of its capital stock is none.

In Witness Whereof, we have hereunto set our hands, this twenty seventh day of February in the year eighteen hundred and eighty-eight, Alpheus Hyatt, Samuel Mills, William T. Sedgwick, Edward G. Gardiner, Charles Sedgwick Minot, William G. Farlow, William Stanford Stevens, Anna D. Phillips, Susan Mims, B. H. Van Vleck.

That the first meeting of the subscribers to said agreement was held on the thirteenth day of March in the year eighteen hundred and eighty-eight.
In Witness Whereof, we have hereunto signed our names, this thirteenth day of March in the year eighteen hundred and eighty-eight, Alpheus Hyatt, President, William Stanford Stevens, Treasurer, Edward G. Gardiner, William T. Sedgwick, Susan Mims, Charles Sedgwick Minot.

(Approved on March 20, 1888 as follows:

I hereby certify that it appears upon an examination of the within written certificate and the records of the corporation duly submitted to my inspection, that the requirements of sections one, two and three of chapter one hundred and fifteen, and sections eighteen, twenty and twenty-one of chapter one hundred and six, of the Public Statutes, have been complied with and I hereby approve said certificate this twentieth day of March A.D. eighteen hundred and eighty-eight.

CHARLES ENDICOTT
Commissioner of Corporations)

III. ARTICLES OF AMENDMENT
(On file in the office of the Secretary of the Commonwealth)

We, James D. Ebert, President, and David Shepro, Clerk of the Marine Biological Laboratory, located at Woods Hole, Massachusetts 02543, do hereby certify that the following amendment to the Articles of Organization of the Corporation was duly adopted at a meeting held on August 15, 1975, as adjourned to August 29, 1975, by vote of 444 members, being at least two-thirds of its members legally qualified to vote in meetings of the corporation:

VOTED: That the Certificate of Organization of this corporation be and it hereby is amended by the addition of the following provisions:

"No Officer, Trustee or Corporate Member of the corporation shall be personally liable for the payment or satisfaction of any obligation or liabilities incurred as a result of, or otherwise in connection with, any commitments, agreements, activities or affairs of the corporation.

"Except as otherwise specifically provided by the Bylaws of the corporation, meetings of the Corporate Members of the corporation may be held anywhere in the United States.

"The Trustees of the corporation may make, amend or repeal the Bylaws of the corporation in whole or in part, except with respect to any provisions thereof which shall by law, this Certificate or the Bylaws of the corporation, require action by the Corporate Members."

The foregoing amendment will become effective when these articles of amendment are filed in accordance with Chapter 180, Section 7 of the General Laws unless these articles specify, in accordance with the vote adopting the amendment, a later effective date not more than thirty days after such filing, in which event the amendment will become effective on such later date.

In Witness Whereof and Under the Penalties of Perjury, we have hereto signed our names this 2nd day of September, in the year 1975, James D. Ebert, President; David Shepro, Clerk.

(Approved on October 24, 1975, as follows:

I hereby approve the within articles of amendment and, the filing fee in the amount
of $10 having been paid, said articles are deemed to have been filed with me this 24th
day of October, 1975.

PAUL GUZZI
Secretary of the Commonwealth)

IV. BYLAWS OF THE CORPORATION OF THE MARINE
BIOLOGICAL LABORATORY
(Revised February 13, 1976)

I. (A) The name of the Corporation shall be The Marine Biological Laboratory. The Corporation’s purpose shall be to establish and maintain a laboratory or station for scientific study and investigation, and a school for instruction in biology and natural history.

(B) Marine Biological Laboratory admits students without regard to race, color, sex, national and ethnic origin to all the rights, privileges, programs and activities generally accorded or made available to students in its courses. It does not discriminate on the basis of race, color, sex, national and ethnic origin in employment, administration of its educational policies, admissions policies, scholarship and other programs.

II. (A) The members of the Corporation ("Members") shall consist of persons elected by the Board of Trustees, upon such terms and conditions and in accordance with such procedures, not inconsistent with law or these Bylaws, as may be determined by said Board of Trustees. Except as provided below, any Member may vote at any meeting, either in person or by proxy executed no more than six months prior to the date of such meeting. Members shall serve until their death or resignation unless earlier removed, with or without cause, by the affirmative vote of two-thirds of the Trustees then in office. Any Member who has attained the age of seventy years or has retired from his home institution shall automatically be designated a Life Member provided he signifies his wish to retain his membership. Life Members shall not have the right to vote and shall not be assessed for dues.

(B) 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.

III. The officers of the Corporation shall consist of a Chairman of the Board of Trustees, President, Director, Treasurer and Clerk, elected or appointed by the Trustees as set forth in Article IX.

IV. 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. Subject to the provisions of Article VIII(2), at such meeting the Members shall choose by ballot six 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 Chairman or Trustees to be held at such time and place as may be designated.

V. Twenty-five Members shall constitute a quorum at any meeting. Except as otherwise required by law or these Bylaws, the affirmative vote of a majority of the Members voting in person or by proxy at a meeting attended by a quorum (present in person or by proxy) shall constitute action on behalf of the Members.

VI. (A) 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.

(B) Any meeting of the Members may be adjourned to any other time and place by the vote of a majority of those Members present or represented at the meeting, whether or not such Members constitute a quorum. It shall not be necessary to notify any Member of any adjournment.

VII. The Annual Meeting of the Trustees shall be held promptly after the Annual Meeting of the Corporation at the Laboratory in Woods Hole, Massachusetts. Special meetings of the Trustees shall be called by the Chairman, the President, or by any seven Trustees, to be held at such time and place as may be designated. Notice of Trustees' meetings may be given orally, by telephone, telegraph or in writing; and notice given in time to enable the Trustees to attend, or in any case notice sent by mail or telegraph to a Trustee's usual or last known place of residence, at least one week before the meeting shall be sufficient. Notice of a meeting need not be given to any Trustee if a written waiver of notice, executed by him before or after the meeting is filed with the records of the meeting, or if he shall attend the meeting without protesting prior thereto or at its commencement the lack of notice to him.

VIII. (A) There shall be four groups of Trustees:

(1) Trustees (the "Corporate Trustees") elected by the Members according to such procedures, not inconsistent with these Bylaws, as the Trustees shall have determined. Except as provided below, such Trustees shall be divided into four classes of six, one class to be elected each year to serve for a term of four years. Such classes shall be designated by the year of expiration of their respective terms.

(2) Trustees ("Board Trustees") elected by the Trustees then in office according to such procedures, not inconsistent with these Bylaws, as the Trustees shall have determined. Except as provided below, such Board Trustees shall be divided into four classes of three, one class to be elected each year to serve for a term of four years. Such classes shall be designated by the year of expiration of their respective terms. It is contemplated that, unless otherwise determined by the Trustees for good reason, Board Trustees shall be individuals who have not been considered for election as Corporate Trustees.

(3) Trustees ex officio, who shall be the Chairman, the President, the Director, the Treasurer, and the Clerk.

(4) Trustees emeriti who shall include any Member who has attained the age of seventy years (or the age of sixty-five and has retired from his home institution) and who has served a full elected term as a regular Trustee, provided he signifies his wish to serve the Laboratory in that capacity. Any Trustee who qualifies for emeritus status shall continue to serve as a regular Trustee until the next Annual Meeting whereupon his office as regular Trustee shall become vacant and be filled by election by the Members or by the Board, as the case may be. The Trustees ex officio and emeriti shall have all the rights of the Trustees, except that Trustees emeriti shall not have the right to vote.

(B) The aggregate number of Corporate Trustees and Board Trustees elected in any year (excluding Trustees elected to fill vacancies which do not result from expiration of a term) shall not exceed nine. The number of Board Trustees so elected shall not exceed three and unless otherwise determined by vote of the Trustees, the number of Corporate Trustees so elected shall not exceed six.

(C) The Trustees and Officers shall hold their respective offices until their successors are chosen in their stead.

(D) Any Trustee may be removed from office at any time with or without cause, by vote of a majority of the Members entitled to vote in the election of Trustees;
BYLAWS OF THE CORPORATION

or for cause, by vote of two-thirds of the Trustees then in office. A Trustee may be removed for cause only if notice of such action shall have been given to all of the Trustees or Members entitled to vote, as the case may be, prior to the meeting at which such action is to be taken and if the Trustee so to be removed shall have been given reasonable notice and opportunity to be heard before the body proposing to remove him.

(E) Any vacancy in the number of Corporate Trustees, however arising, may be filled by the Trustees then in office unless and until filled by the Members at the next Annual Meeting. Any vacancy in the number of Board Trustees may be filled by the Trustees.

(F) A Corporate Trustee or a Board Trustee who has served an initial term of at least 2 years duration shall be eligible for re-election to a second term, but shall be ineligible for re-election to any subsequent term until two years have elapsed after he last served as a Trustee.

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 elect a Treasurer and Clerk to serve one year, and Board Trustees as described in Article VIII (B). 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 of the Corporation and may remove them at any time. They may fill vacancies occurring in any of the offices. The Board of Trustees shall have the power to choose an Executive Committee from their own number as provided in Article X, and to delegate to such Committee such of their own powers as they may deem expedient in addition to those powers conferred by Article X. They shall from time to time elect Members to the Corporation upon such terms and conditions as they shall have determined, not inconsistent with law or these bylaws.

X. (A) The Executive Committee is hereby designated to consist of not more than ten members, including the ex officio Members (Chairman of the Board of Trustees, President, Director and Treasurer); and six additional Trustees, two of whom shall be elected by the Board of Trustees each year, to serve for a three-year term.

(B) The Chairman of the Board of Trustees shall act as Chairman of the Executive Committee, and the President as Vice Chairman. A majority of the members of the Executive Committee shall constitute a quorum and the affirmative vote of a majority of those voting at any meeting at which a quorum is present shall constitute action on behalf of the Executive Committee. The Executive Committee shall meet at such times and places and upon such notice and appoint such sub-committees as the Committee shall determine.

(C) The Executive Committee shall have and may exercise all the powers of the Board during the intervals between meetings of the Board of Trustees except those powers specifically withheld from time to time by vote of the Board or by law.

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

(E) The elected Members of the Executive Committee shall constitute as a standing "Committee for the Nomination of Officers", responsible for making nominations, at
XI. A majority of the Trustees then in office shall constitute a quorum. A lesser number than a quorum may adjourn any meeting from time to time without further notice.

XII. Any action required or permitted to be taken at any meeting of the Trustees or of the Executive Committee may be taken without a meeting if all the Trustees or members of the Executive Committee, as the case may be, consent to the action in writing and such written consents are filed with the records of meetings. Such a consent shall be treated for all purposes as a vote at a meeting.

XIII. 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 then in office.

XIV. These Bylaws may be amended by the affirmative vote of the Members at any meeting, provided that notice of the substance of the proposed amendment is stated in the notice of such meeting. As authorized by the Articles of Organization, the Trustees, by a majority of their number then in office, may also make, amend, or repeal these Bylaws, in whole or in part, except with respect to (a) the provisions of these Bylaws governing (i) the removal of Trustees and (ii) the amendment of these Bylaws and (b) any provisions of these Bylaws which by law, the Articles of Organization or these Bylaws, requires action by the Members.

No later than the time of giving notice of the meeting of Members next following the making amending or repealing by the Trustees of any Bylaw, notice thereof stating the substance of such change shall be given to all Corporation Members entitled to vote on amending the Bylaws.

Any Bylaw adopted by the Trustees may be amended or repealed by the Members entitled to vote on amending the Bylaws.

XV. The account of the Treasurer shall be audited annually by a certified public accountant.

XVI. The Corporation will indemnify every person who is or was a trustee, officer or employee of the Corporation or a person who provides services without compensation to an Employee Benefit Plan maintained by the Corporation, for any liability (including reasonable costs of defense and settlement) arising by reason of any act or omission affecting an Employee Benefit Plan maintained by the Corporation or affecting the participants or beneficiaries of such Plan, including without limitation any damages, civil penalty or excise tax imposed pursuant to the Employee Retirement Income Security Act of 1974; provided, (1) that the Act or omission shall have occurred in the course of the person's service as trustee or officer of the Corporation or within the scope of the employment of an employee of the Corporation or in connection with a service provided without compensation to an Employee Benefit Plan maintained by the Corporation, (2) that the Act or omission be in good faith as determined by the Corporation (whose determination made in good faith and not arbitrarily or capriciously shall be conclusive), and (3) that the Corporation's obligation hereunder shall be offset to the extent of any otherwise applicable insurance coverage, under a policy maintained by the Corporation or any other person, or other source of indemnification. (August 13, 1976).
V. REPORT OF THE DIRECTOR

TO: THE TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY

As the Laboratory enters its ninetieth year, its objectives have not changed one whit from those set forth by its founders. It remains a center whose primary function is to provide opportunities and to serve as an unexcelled setting for innovation. It recognizes, as Caryl Haskins put it, "the fundamental individuality of innovation and the narrow human and material bases whence it springs." It stresses the uniqueness of discovery at a time when information and originality are often confused.

It has always been so at MBL, but until a scant decade ago the Laboratory's resources were limited largely to summer investigators and students. The need to develop year-round research and teaching programs, while holding fast to the best features of the renowned summer offerings, was enunciated clearly in 1966 in Philip B. Armstrong's final report, when he wrote "... the Trustees of the Laboratory have been keenly interested in realizing the full potentialities of the Laboratory not only during the summer months but during the rest of the year." In the following year, his successor, H. B. Steinbach, observed that "The use of our facilities throughout the year continues to grow," and he went on to announce the formation of a committee to "explore the possibility of instituting special training programs and of finding an individual who might give general direction to implementing the plans."

While it is clear that the Laboratory's policy has been established by a series of Executive Committees and four Directors over a decade, the potentialities immanent in its resources and rich tradition have been realized only slowly—much too slowly. The reasons are manifold, not the least being the dwindling of the Nation's material resources for science. Others are less obvious, but possibly more crucial: the confusion between the need to protect the original mind in whatever guise it appears and "personal privilege," and between intellectual elitism and "clubbishness," resulting in corporate inertia and in a preoccupation with the smaller, rather than the larger problems. Thus we inch forward, rather than move ahead with determination.

The challenges to the Laboratory remain grave. The stakes are high, involving the continued development of our total resources. Although in the period under review, July 1, 1976 through mid-May, 1977 we have made significant progress on several fronts, including an improvement in our financial outlook as revealed in our Treasurer's Report, we could be in serious danger of regression if we do not move forward with verve.

I would emphasize that such progress as can be reported in the sections to follow has accrued during the tenure of two Directors, Keith Porter (until December 31, 1976) and myself.

A center for postgraduate and continuing education

In recent years the Laboratory has been one of the first centers to recognize and address a problem of increasing national concern, the failure of young investigators to play significant roles in research beyond their immediate postdoctoral years. The transition from postdoctoral fellow or trainee to independent scientist is a "sensitive period" during which young scientists' careers can be shaped and often lifelong research careers established. Our Steps Toward Independence Program has evolved to meet this need. Untenured young faculty members from the Nation's universities are furnished the facilities, associations and training needed for them to apply and develop their research abilities, enabling them to assume responsibilities as independent scientists.

In recent summers, thanks to the generous support of a number of foundations, the Laboratory has been able to provide opportunities for eight to ten young investigators—eight in 1976, with another eight anticipated in 1977. Now thanks to an award from
the National Science Foundation’s RIAS (Research Initiation and Support) Program, these numbers will be increased to twelve in 1978, increasing to twenty-four by 1980.

The Steps Toward Independence Program has been coordinated with the recently established Macy Scholars Program which provides similar opportunities for younger faculty members and students in predominantly black institutions.

Since 1966 the Josiah Macy, Jr. Foundation has been deeply committed to efforts to increase minority representation in medicine and the related health professions. The Foundation’s programs have played a significant role in bringing more members of the minority groups, particularly blacks, into the medical profession. As a result of its experience over the past decade, the Foundation concluded that its first priority in this area should be to replenish and expand the minority group pool of potential applicants. Therefore, it has begun to concentrate on programs designed to strengthen preparation for medicine and the related health professions, especially within the historically black colleges where the greatest reservoir of talent is developed.

Frequently, biology programs being offered in such colleges do not include quantitative courses at cellular and molecular levels. One way of strengthening the curricula of such institutions is to provide selected faculty members with intensive courses in quantitative biology and with opportunities to renew their interests in research in an environment providing opportunity for enrichment in the basic sciences underpinning modern medicine.

Since 1971, the Foundation has been sponsoring summer institutes for health professions advisors and biology teachers. In 1976 the Foundation announced a grant to MBL to support a program to support blacks and members of other minority groups in modern biology and biomedicine. Entrance to the program may be through any of several routes: one of the summer courses at MBL, a January short-term course, the MBL’s Year in Science program, or a semester or a year in the Boston University Marine Program. Depending on the previous experience of the participant, after two summer courses or a short-term course and a summer course, an individual’s program would be capped by at least a summer in the Laboratory’s Steps Toward Independence Program.

The summer of 1976 found eleven Macy Scholars in residence, five as independent investigators and six as students in courses. Another nine graduate and undergraduate students were enrolled in January 1977, short-term courses, and as many as fifteen Macy Scholars are anticipated in the summer of 1977—six investigators, one junior investigator, and possibly eight students in courses.

These programs are now an integral part of the life of the Laboratory. They are not, however, what Steinbach and his committee envisioned a decade ago when the Director spoke of “special training programs.” They had in mind intensive one- and two-week programs throughout the year intended to provide ten to twenty professional scientists with a working knowledge of techniques on timely new subjects. Ten years after that committee (which was chaired by the late Mac V. Edds, Jr.) made its principal recommendations, the program is at last underway, and an invitation extended to a Coordinator of Continuing Education, Dr. Morton Maser, who is expected to take up residence on July 1, 1977. His responsibilities will include the development of six to ten short courses annually (the ambitious course offered in the spring of 1977, “Electron Microscopy in the Biological Sciences” is a prototype) and the management of the Steps Toward Independence Program. Since Dr. Maser’s professional research and technical skills lie in electron microscopy and the physical sciences, he will, at summer’s end, also be charged with the supervision of our electron microscopy and radiation laboratories. Drs. Bruce Szamier and Anthony Liuzzi will continue their respective roles until September 1, 1977. This seems an appropriate place to acknowledge their contributions to the Laboratory.
Graduate and undergraduate instruction

The past year has seen only one significant change in the summer and January courses, which have continued unabated in the manner to which we have become accustomed—uniformly superior. Ivan Valiela of the Boston University Marine Program and John Teal of the Woods Hole Oceanographic Institution will be Co-Instructors-in-Charge of the Ecology course beginning in the summer of 1977. John and Ivan have been working together productively in research, and there is every reason to believe they will make a good team in teaching as well.

I am also pleased to be able to report three significant new departures in the offing. (1) Dr. Lucena J. Barth, who has contributed far more than anyone other than the Director can ever know, has accepted appointment as Director of Admissions, effective September 1, 1977. The several segments of our course and scholarship programs have each been done well, but in several different offices; consequently coordination and, all too often, timely promotion have been lacking. We are especially grateful for Florence Butz’s past herculean efforts. (2) In keeping with our policy of encouraging colleges and universities to offer courses for which our facilities are uncommonly well suited, the Schools of Veterinary Medicine of Cornell University and the University of Pennsylvania together will offer a new course in Marine Veterinary Medicine (“Aquavets”) in the late spring, 1977. The Schools will be joined in this effort by MBL and BUMP and by the Woods Hole Oceanographic Institution and the NOAA Northeast Fisheries Center. (3) Finally, to our “standard” January offerings (Behavior, Developmental Biology, Ecology, Neurobiology), we will add in 1978 another new course, Comparative Pathology of Marine Invertebrates, with a stellar cast headed by Frederik Bang and including Austin Farley, Jack Levin, Jack Marchalonis, Robert Prendergast and Carol Reinisch.

Year-round research

Six years ago the Laboratory took the first steps in a long-range program designed to augment and reinforce its capability for serving the Nation as a year-round center of advanced study and research in the genetics, development, neurobiology and ecology of marine organisms. The Laboratory’s Officers and Trustees developed a comprehensive plan encompassing three closely related new programs, in ecology, neurobiology and the genetics of marine organisms, respectively. These fields were selected not only in recognition of the need to advance basic science in each of them, but also to improve their usefulness in the management of basic resources.

Two of these new initiatives are already well underway, The Ecosystems Center, under the direction of George Woodwell, and a series of programs in neurobiology and behavior in the Laboratory of Sensory Physiology and Laboratory of Biophysics of the National Institute of Neurological and Communicative Disorders and Stroke, headed by E. F. MacNichol, Jr. and W. J. Adelman, Jr.

The Laboratory now proposes to establish a research and training program in the genetics, development, pathobiology and pharmacology of marine organisms, and to develop a Marine Resources Center, which will not only provide laboratory space offering new research opportunities in these emerging fields, but will also make available expanded facilities for the collection and cultivation of marine organisms, responding to the demand for increasingly sophisticated research throughout the Nation.

The program will provide a vital underpinning for the technologies of aquaculture and mariculture. So much is written about “food from the sea” that we are inclined to think of it as a fait accompli. As we reflect, however, we realize that the field of mariculture (if indeed it can be called a field), is, in terms of its development, at about the level of the agricultural sciences some four decades ago, before genetics had made a significant impact.
For example, we know next-to-nothing about disease resistance in marine animals and plants; consequently many attempts to cultivate them en masse are doomed, almost from the start. We need to know the genetic basis (and the pathology) of disease, especially in those forms with the potential to supply significant amounts of protein.

Although the plans for the physical setting of the new Center are just being developed, its intellectual components, the scientists themselves, have already begun to interact. Throughout its history, the Laboratory has relied heavily on the catalysis provided by young minds. The development of the Marine Resources Center is no exception.

There has been a surprising concatenation of year-round investigators with related interests: Daniel Alkon and the able mariculturist, June Harrigan, in the Laboratory of Biophysics; Fred Lang of BUMP; James Oschman and Betty Wall; Ray Stephens, Kenneth Edds and Lewis Tilney in cell motility; and Judith Grassle and her colleagues in genetics. Although this array can hardly be said to be a "group," they make a significant nucleus.

The library

Our dialogue with the Woods Hole Oceanographic Institution, looking toward the establishment of a working-financial partnership in the operation of the Library, continues. I have invited Keith Porter to continue to represent the Laboratory in these discussions, as Chairman of an ad hoc organizational committee which includes Garland Allen, Clay Armstrong, Frederik Bang, John Buck, Harlyn Halvorson and David Shepro. Several drafts of an agreement have been completed, with the most recent being reviewed by the committee at this writing.

Gifford succeeds Robinson as Chairman

At their winter meeting in Woods Hole on February 11, the Trustees elected Dr. Prosser Gifford, Professor of History and Dean of the Faculty at Amherst College, as their Chairman to succeed Dr. Denis Robinson, who has served with distinction since 1971. Dr. Gifford, who was first elected to the MBL Board in 1975, has long taken an active interest in the Woods Hole scientific community, being deeply involved also in the Corporation of the Woods Hole Oceanographic Institution.

Both Dean Gifford and I spoke of Robinson's legacy of excellence. Like his predecessor, Gerard Swope, Jr., Dr. Robinson gained the affection and respect of the entire community for his statesmanship in creating at MBL an environment for year-round research and teaching destined to match the Laboratory's renowned summer programs.

Regrettably, Dr. Robinson's responsibilities as Chairman of the Board of High Voltage Engineering prevented him from attending the meeting. However, the Robinsons expect to be back at their home on Gosnold Road, Woods Hole, again this coming summer.

Honors

I am pleased to report that three members of the Corporation were elected to the National Academy of Sciences: Roderick Clayton, Aron Moscona and Ruth Sager.

1. The Staff
   Ecology
   I. Instructors

Frederick E. Smith, Harvard University, director of course
REPORT OF THE DIRECTOR

GEORGE M. WOODWELL, The Ecosystems Center, associate director of course
DANIEL B. BOTKIN, The Ecosystems Center
CHARLES A. S. HALL, Cornell University and The Ecosystems Center
JOHN E. HOBIE, The Ecosystems Center
EDGAR LEMON, Cornell University
KENNETH H. MANN, Dalhousie University, Canada
JERRY M. MELILLO, The Ecosystems Center
THEODORE PACKARD, Bigelow Laboratory, Booth Bay Harbor, Maine
MARIO M. PAMATMAT, Auburn University
BRUCE J. PETERSON, The Ecosystems Center

II. ASSISTANTS

TIMOTHY E. WOOD, The Ecosystems Center
JOHN V. HELFRICH, The Ecosystems Center
JAMES T. MORRIS, The Ecosystems Center
JOHN F. MURATORE, Yale University
DAVID W. JUERS, The Ecosystems Center

III. SPECIAL LECTURERS

THOMAS K. DUNCAN, Boston University
ROBERT R. GUILLARD, Woods Hole Oceanographic Institution
THOMAS E. LOVEJOY, World Wildlife Fund
MARY E. NICOTRI, Woods Hole Oceanographic Institution
HOWARD L. SANDERS, Woods Hole Oceanographic Institution
WESLEY N. TIFFNEY, University of Massachusetts, Nantucket Field Station
IVAN VALIELA, Boston University
ROBERT H. WHITTAKER, Cornell University

IV. LECTURES

F. E. SMITH
G. M. WOODWELL
H. L. SANDERS
D. B. BOTKIN
H. L. SANDERS
F. E. SMITH
F. E. SMITH
T. E. WOOD
W. N. TIFFNEY
D. B. BOTKIN
I. VALIELA
R. R. GUILLARD
T. K. DUNCAN
F. E. SMITH
F. E. SMITH
D. B. BOTKIN
D. B. BOTKIN
C. A. S. HALL
C. A. S. HALL
C. A. S. HALL

An introduction to ecology
The metabolism of ecosystems
Benthic ecology
Gas exchange measurements
Community analysis
Problems with trophic levels
Logistics and chemostats
Dimension analysis
Sand dunes and cedar swamps
Succession
Salt marsh ecosystems
Phytoplankton ecology
Rocky intertidal ecosystems
Diversity-stability hypotheses
Density dependence in ecosystems
Spatial heterogeneity
Spruce-moose interactions on Isle Royale
Stability of ecosystems
Measuring aquatic ecosystem respiration
New Hope Creek: a study of ecosystem behavior
Ecosystem view of salmon life histories
G. M. Woodwell  Energy and carbon flow in land systems
J. E. Hobbie  Energy and carbon flow in a tundra pond
J. E. Hobbie  Primary production in aquatic systems
J. E. Hobbie  Bacteria in ecosystems
J. E. Hobbie  Respiration of plankton by long-term measurements of 
O₂ and CO₂ change
J. E. Hobbie  Respiration of bacteria and alga using ¹³C techniques
T. Packard  Respiration of plankton by measuring the electron trans-
port system
C. A. S. Hall  Respiration and energy flow in marsh-estuary ecosystems
J. Day  Estuarine ecology of Louisiana
F. E. Smith  Feeding links in models
F. E. Smith  Behavior of food-chain models
J. M. Melillo  Nutrient cycling in northern hardwoods
J. M. Melillo  Nitrogen cycling in forest ecosystems
M. M. Pamatmat  Introduction to benthic respiration
M. M. Pamatmat  Benthic metabolism
B. J. Peterson  Phosphorous cycling in aquatic ecosystems
D. B. Botkin  Contrasts of African and N. American ecosystems
G. M. Woodwell  Nutrient budgets of an estuarine marsh
M. E. Nicotri  Rocky-intertidal plant-herbivore interactions
K. H. Mann  Destruction of kelp beds by sea urchins: a cycle or an ir-
reversible degradation?
K. H. Mann  Kelp bed ecosystems
K. H. Mann  Herbivores and detritivores in coastal waters
F. E. Smith  Natural selection in ecosystems
F. E. Smith  Ecosystem evolution
E. Lemon  Tropical rain forests: CO₂ exchange by shoestring
E. Lemon  CO₂ flux techniques
F. E. Smith  Planets as environments
G. M. Woodwell  Energy and the world carbon budget
G. M. Woodwell  Biotic impoverishment
R. H. Whittaker  Community structure, I and II
R. H. Whittaker  Indirect ordination and community evolution, I and II
T. E. Lovejoy  Endangered species
C. A. S. Hall  Modeling: philosophy
C. A. S. Hall  Modeling: basic terms and principles
J. T. Morris  Modeling: introduction to FOCAL
C. A. S. Hall  Flow diagrams
C. A. S. Hall  Fundamental relational concepts
J. T. Morris  Introduction to programming
F. E. Smith  Human ecology—some views
F. E. Smith  Urban ecology

EMBRYOLOGY

I. INSTRUCTORS

Tom Humphreys, University of Hawaii, Pacific Biomedical Research Center, co-
director of course
David Epel, University of California, San Diego, Scripps Institution of Oceanography,
co-director of course
Laurence H. Keedes, Stanford School of Medicine
REPORT OF THE DIRECTOR

MICHAEL ROSBASH, Brandeis University  
BARBARA A. HAMKALO, University of California, Irvine  
JOAN V. RUDERMAN, Massachusetts Institute of Technology

II. STAFF ASSOCIATE

LINDA S. FREGIEN, University of Hawaii

III. ASSISTANTS

ROGER DUNCAN, University of Hawaii  
KENNETH C. KLEENE, University of Hawaii

IV. LECTURES

J. D. EBERT  
G. STENT  
D. EPHEL  
T. HUMPHREYS  
D. EPHEL  
J. V. RUDERMAN  
J. M. MORRILL  
T. HUMPHREYS  
J. R. WHITTAKER  
R. A. FIRTEL  
B. P. BRANDHORST  
L. H. KEDES  
J. M. ARNOLD  
L. H. KEDES  
T. HUMPHREYS  
M. ROSBASH  
M. NEMER  
B. A. HAMKALO  
B. A. HAMKALO  
M. ROSBASH  
J. PAUL  
R. GRAINGER  
K. VAN HOLDE  
J. PAUL  
R. ROEDER  
R. ROEDER  
J. C. HALL  
K. ILLMENSEE  
B. E. ROBERTS

History of embryology at Woods Hole  
Information in embryos  
The role of Ca++, Na+, and K+ in the activation of sea urchin eggs  
Activation of maternal mRNA  
Echinoid eggs and embryos in developmental studies  
In vitro translational analysis of mRNA in sea urchin and amphibian early development  
Gastropod eggs and embryos in developmental studies  
RNA synthesis in sea urchin embryos  
Ascidian eggs and embryos in developmental studies  
Gene activity during Dicyostelium development  
Two-dimensional gel electrophoretic analysis of protein in early sea urchin embryos  
Expression of histone genes during cleavage in sea urchin embryos  
Squid eggs and embryos in developmental studies  
Cloning and organization of the sea urchin histone genes  
Nuclear and mRNA metabolism during sea urchin development  
Kinetic considerations of molecular hybridization  
Nuclear and messenger RNA classes in sea urchin embryos  
Structure of chromosomes and chromatin  
Visualization of transcription  
Evolutionary relatedness of mRNA and non-mRNA sequences in different species  
Complexity of poly(A) mRNA and nuclear RNA in mouse friend cells  
Measurement of synthesis and turnover of RNA by density labeling  
Properties of nucleosomes  
Chromatin transcription and reconstruction  
Structure and function of eukaryotic RNA polymerases  
Transcription of eukaryotic genes in vitro  
Fate mapping and the analysis of behavioral and developmental mutants in Drosophila  
Developmental plasticity of mouse teratocarcinoma cells  
A direct method for locating protein coding regions within eukaryotic DNA
EXPERIMENTAL INVERTEBRATE ZOOLOGY

I. INSTRUCTORS

MICHAEL J. GREENBERG, Florida State University, director of course
BRIAN L. BAYNE, Institute for Environmental Research, Plymouth, U. K.
STEPHEN H. BISHOP, Baylor College of Medicine, Houston
JOHN H. CROWE, University of California, Davis
ROSEVELT L. PARDEY, University of California, Irvine
SIDNEY K. PIERCE, JR., University of Maryland
DAVID J. PRIOR, University of Kentucky
THOMAS J. M. SCHOFF, University of Chicago

II. CONSULTANTS

F. A. BROWN, JR., Northwestern University
C. LADD PROSSER, University of Illinois
ALFRED C. REDFIELD, Woods Hole Oceanographic Institution
W. D. RUSSELL-HUNTER, Syracuse University
JAMES CASE, University of California, Santa Barbara
ROBERT K. JOSEPHSON, University of California, Irvine

III. ASSISTANTS

ROY WHITE, University of Illinois
WENDY WILTSE, University of Massachusetts Marine Station
STEVEN O’DELL, University of California, Davis

IV. SECRETARY

TONICIA M. SMITH, Marine Biological Laboratory

V. SPECIAL LECTURERS

HAROLD L. ATWOOD, University of Toronto, Canada
THOMAS EISNER, Cornell University
ESTHER M. GOUDSMIT, Oakland University, Michigan
KJELL JOHANSEN, University of Aarhus, Denmark
GILBERT Y. KENNEDY, Sheffield University, U. K.
FREDERICK LANG, Boston University Marine Program
CHARLOTTE P. MANGUM, College of William and Mary
LINDA H. MANTEL, City College, The City University of New York
BETTY J. WALL, Marine Biological Laboratory
PETER H. WIEBE, Woods Hole Oceanographic Institution

VI. LECTURES

M. J. GREENBERG
Introductory notes

T. J. M. SCHOFF
Marine speciation: genetic and morphological differentiation
REPORT OF THE DIRECTOR

T. J. M. SCHOFF The Cape Cod environment
T. J. M. SCHOFF Marine faunal diversity: steady-state or an upward spiral?
T. J. M. SCHOFF Marine faunal extinctions: crises in the history of life
S. K. PIERCE Salinity, osmosis, diffusion and, briefly, membrane structure
S. K. PIERCE Mechanisms of salinity tolerance: cell volume regulation
M. J. GREENBERG The distribution of animals with salinity: the horohaline as a physiological island
L. H. MANTEL Mechanisms of ionic regulation
L. H. MANTEL Hormonal control of ion regulation
L. H. MANTEL Adaptations of decapod crustaceans to various habitats
S. K. PIERCE The pause that refreshes: water balance through excretion
M. J. GREENBERG Circulation: volume, pressure and flow
M. J. GREENBERG Circulation: compartmentalization and filtration
J. H. CROWE Transport of free amino acids by marine invertebrates
S. H. BISHOP Ammonia: formation, utilization, excretion and physiological role
S. H. BISHOP Control of amino acid pool sizes
F. LANG Fight or flight in the lobster: growth and development of the claws and giant axons
S. H. BISHOP Nitrogen "detoxification"
S. H. BISHOP Phosphogens and the central role of arginine
J. H. CROWE Anhydrobiosis: life without water
B. J. WALL Water and ion regulation in the insect rectum
J. H. CROWE Life in xeric environments
B. L. BAYNE Gas exchange theory with examples of various types of gas exchangers in marine invertebrates
P. H. WIEBE North Atlantic cold core rings and their effect on the distribution, abundance and physiology of euphausids
M. J. GREENBERG Pigments, respiratory, invertebrate, four (4)
B. L. BAYNE Oxygen consumption related to weight and to temperature
B. L. BAYNE Oxygen consumption related to pO2, aerial exposure and salinity
B. L. BAYNE Oxygen consumption related to ration; ecological aspects of gas exchange
B. L. BAYNE Heart rate, and control of gas exchange
R. L. PARDY Fuels and metabolism
E. M. GOUDSMIT Neurosecretory control of reproduction in the land snail, Helix pomatia: regulation of galactogen and glycogen synthesis
R. L. PARDY Animal energetics
R. L. PARDY Cellular aspects of algal symbiosis
R. L. PARDY Metabolic/energetic aspects of symbiosis
C. P. MANGUM How oxygen transport systems work in unstable environments
D. J. PRIOR Neural and hormonal control systems
D. J. PRIOR Neural control of behavior
H. L. ATWOOD Crustacean neuromuscular physiology, with some ecological afterthoughts
D. J. PRIOR Integration—sites for modification of neural output
D. J. PRIOR Adaptation of nervous systems to environmental pressures
K. JOHANSEN How animals obtain oxygen when there is little of it (a fishy story)
G. Y. Kennedy
Porphyrrins in invertebrates

T. Eisner
Social defense strategy in a termite

T. Eisner
A beetle's approach to survival: sticky feet and a fecal parasol

T. Eisner
Insect and plant co-evolution: a chemical approach (with implications to humans?)

EXPERIMENTAL MARINE BOTANY

(Comparative Biology and Biochemistry of Algae)

I. Instructors

Jerome A. Schiff, Brandeis University, director of course
David Mauzerall, The Rockefeller University
Robert F. Troxler, Boston University
Richard J. Ellis, Bucknell University, laboratory instructor
James R. Sears, Southeastern Massachusetts University, laboratory instructor

II. Consultants

Robert L. Guillard, Woods Hole Oceanographic Institution
Frank A. Loewus, Washington State University
Ralph S. Quatrano, Oregon State University

III. Staff Associates

Hans Gaffron, University of Florida
Gary Harris, Wellesley College

IV. Assistants

Sherry Sass, Southeastern Massachusetts University
Rosemarie Vonusa

V. Lectures

J. A. Schiff
Chemical phase of evolution: biogeochemistry

J. A. Schiff
The appearance of oxygen

J. A. Schiff
Evolution of procaryotes

R. J. Ellis
The dinoflagellate nucleus: a link in the evolution of eucaryotes?

J. A. Schiff
Evolution of eucaryotes and organelles

J. A. Schiff
Evolution of life cycles

J. A. Schiff
Nutritional cycles

M. L-S. Tsang
Metabolism of nitrogen and sulfur

U. Goodenough
Mating interactions in Chlamydomonas

R. J. Ellis
Heme and chlorophyll biosynthesis: early steps

R. F. Troxler
Heme and chlorophyll biosynthesis: later steps

R. F. Troxler
Biosynthesis of open chain tetrapyroles

H. W. Siegelman
Carotenochlorophyll protein of the dinoflagellates

D. Mauzerall
Chromatic adaptation

J. R. Sears
Vertical distribution of benthic algae

D. Mauzerall
Photochemistry of photosynthesis
J. Gibson                Photosynthetic electron transport
S. Cohen                (with R. J. Ellis, G. Harris, A. Holowinsky, D. Mauzerall,
A. I. Stern             J. A. Schiff, R. F. Troxler and others: informal discus-
                        sion on organelle structure, development, origin and
H. Gaffron              evolution)
G. Harris               Photophosphorylation
J. Waterbury            Catalytic effects of CO₂ on the Hill Reaction
E. E. Conn              Ribulose bisphosphate carboxylase/oxygenase
S. Cohen                Biology of the blue green algae
R. D. Simon             Viruses of blue green algae (cyanophages)
N. Lazaroff             Cyanogenesis in plants
R. E. Stephens          Cyanophycin granules
R. Jones                Photocatalysis of morphogenesis in blue green algae
R. L. Guillard          Microtubules in plant development
                        Concepts involved in the hypothesis that environmental
M. Gibbs                factors influence the distribution of phytoplankton
J. R. Sears             species
A. Coleman              Chlorophyta I, II
R. J. Ellis and J. R. Sears III (colonial green flagellates)
J. A. Schiff            Chlorophyta IV
J. R. Ellis             Euglenophyta
J. R. Sears             Pigment synthesis in Euglenophyta
J. R. Ellis             Phaeophyta I, II, III
H. W. Siegelman        High pressure liquid chromatography
R. J. Ellis             Pigment methodology
R. J. Ellis and R. F. Troxler
J. R. Sears             Phycobilin methodology
R. J. Ellis             Algal productivity and pigments
J. R. Ellis             Physiology, reproduction and development
R. J. Ellis             Phototaxis and chemotaxis
R. J. Ellis             Osmotic relations and ion absorption
J. R. Sears             Rhodophyta I, II, III
R. J. Ellis             Xanthophyta
J. R. Sears             Chrysophyta
R. J. Ellis             Heterotrophy, mixotrophy and obligate autotrophy
L. Murphy               Algal genetics, phytoplankton ecology

NEUROBIOLOGY

I. Instructors

Edward A. Kravitz, Harvard Medical School, co-director of course
Antony O. W. Stretton, Wisconsin University, co-director of course
Philippa Claude, Harvard Medical School
Gerald D. Fischbach, Harvard Medical School
Edwin J. Fursphan, Harvard Medical School
John Heuser, University of California, San Francisco
Paul O’Lague, Harvard Medical School
II. Staff Associates

BARBARA A. BATTELLE, Harvard Medical School
LOUISE BRAMS, National Institutes of Health
MARGARET LIVINGSTONE, Harvard Medical School
BARBARA REESE, National Institutes of Health
LEE RUBIN, Harvard Medical School
WILLIAM WOODWARD, Harvard Medical School

III. Assistants

JUDY DONMOYER, Wisconsin University
RUTH SIEGEL, Harvard Medical School
QUAN YANG DUH, National Institutes of Health

IV. Special Lecturers

C. ANDERSON, University College, London, U. K.
CLAY M. ARMSTRONG, University of Pennsylvania
M. V. L. BENNETT, Albert Einstein College of Medicine
LAWRENCE B. COHEN, Yale University
MICHAEL D. CALAHAN, University of Pennsylvania
ROBERT L. DEHAAN, Emory University
KATHY DUNLOP, University of California, Los Angeles
ALAN FINKELSTEIN, Albert Einstein College of Medicine
BERTIL HILLE, University of Washington School of Medicine
WILLIAM T. KEETON, Cornell University
YORAM LASS, Tel Aviv University, Israel
PETER MARLER, The Rockefeller University
JOANNA B. OLMSTEAD, University of Rochester
JIM OSCHMAN, Marine Biological Laboratory
HARVEY B. POLLARD, National Institutes of Health
KEITH R. PORTER, MBL and University of Colorado, Boulder
JACK ROSENBLUTH, New York University
STEPHEN SMITH, University of Washington
CHARLES F. STEVENS, Yale University
ANN E. STUART, Harvard Medical School
ASHER E. TREAT, American Museum of Natural History
BETTY WALL, Marine Biological Laboratory
EDWARD O. WILSON, Harvard University

V. Lectures

C. ANDERSON Conductance and gating kinetics of single postsynaptic ionic channels
G. D. FISCHBACH Tissue culture technique
B. HILLE Structure and function of sodium channels in axon membranes
C. M. ARMSTRONG Gating currents from axons
C. F. STEVENS Analysis of neurotransmitter-induced conductance increases
G. D. Fischbach
Development of electrical excitability
J. B. Olmstead
Microtubules and the development of cell shape
G. D. Fischbach
Development of chemical excitability
G. D. Fischbach
Synapse formation
Y. Lass
Temperature dependence of ACh noise in cultured myoballs
E. Frank
Reinnervation of peripheral ganglia and muscles
K. D. Dunlop
Calcium spikes in paramecia
K. R. Porter
Scanning microscopy and some biological applications
E. O. Wilson
The organization of insect societies
P. Marler
The development of stimulus recognition systems in animals
W. T. Keeton
Bird navigation: new developments in an old mystery
T. S. Reese
General cytological features of nervous systems
J. Oschman and B. Wall
Calcium, phosphate and membranes
T. S. Reese
Nonsynaptic junctions in the nervous system
J. E. Heuser
Structure of synapses: the presynaptic membrane, I and II
J. Rosenbluth
Intramembranous particle distribution at the node of Ranvier and adjacent axolemma in myelinated axons of the frog brain
T. S. Reese
Structure of synapses: the postsynaptic membrane
P. Claude
Axoplasmic flow
M. V. L. Bennett
Correlations between electrophysiological properties and intramembranous particles
J. E. Heuser
Chromatolysis
A. Finkelstein
The interaction of black widow spider venom with lipid bilayer membranes
P. Claude
Development of synapses: cytological aspects
A. E. Stuart
Initial stages in transmission of visual signals in the nervous system of the giant barnacle
H. B. Pollard
Secretory vesicles, cyclic AMP and transmembrane potentials
A. O. W. Stretton
Acetylcholine
A. O. W. Stretton
Catecholamines
E. A. Kravitz
GABA
E. A. Kravitz
Octopamine and other amines in lobsters: possible physiological roles
E. A. Kravitz
Central nervous system: I. Peptides
A. E. Treat
Who's who in a moth ear: a tale of two species
B. A. Battelle
Cyclic nucleotides
E. A. Kravitz
Central nervous system: II. Amines and modulation
L. B. Cohen
Optical measurements of neuron activity
M. D. Calahan
Pharmacological modification of sodium channels
S. Smith
Calcium ions and bursting pacemaker activity in molluscan neurons
R. L. DeHaan
Action currents in embryonic heart cells in culture

PHYSIOLOGY

I. Instructors

John J. Cebra, The Johns Hopkins University, director of course
Gary Ackers, University of Virginia
DENNIS BARRETT, University of Denver
PIEN-CHIEN HUANG, The Johns Hopkins School of Hygiene and Public Health
RU-CHIH C. HUANG, The Johns Hopkins University
JEAN LINDENMANN, University of Zurich
JERRY B. LINGREL, University of Cincinnati College of Medicine
JOANNA B. OLMSTED, University of Rochester
THOMAS D. POLLARD, Harvard Medical School
DENNIS A. POWERS, The Johns Hopkins University
ROBERT A. PRENDERGAST, The Johns Hopkins School of Medicine
ROGER B. TAYLOR, University of Bristol, U. K.
GERALD WEISSMANN, New York University School of Medicine

II. Consultants

GERALD COLE, The Johns Hopkins School of Hygiene and Public Health
PHILIP B. DUNHAM, Syracuse University
DANIEL GOODENOUGH, Harvard Medical School
WILLIAM MARZLUFF, Florida State University
CAROL REINISCH, Harvard Medical School

III. Staff Associates

PAULA BARBIAZ, Syracuse University
JUDITH A. CEBRA, The Johns Hopkins University
REBECCA EMMONS, The Johns Hopkins University
HAROLD DRABKIN, Wesleyan University
MARCUS FECHHEIMER, The Johns Hopkins University
ALAN ISRAEL, New York University School of Medicine

IV. Assistants

MARTHA B. BARRETT, University of Colorado
PATRICK GALVIN, University of Colorado

V. Special Lecturers

R. D. ALLEN, University of New Hampshire
SHINYA INOUE, University of Pennsylvania
NORMAN KLINMAN, University of Pennsylvania
ROBERT KRETZINGER, University of Virginia
SALVADOR E. LURIA, Massachusetts Institute of Technology
JOEL ROSENBAUM, Yale University
ANDREW G. SZENT-GYÖRGyi, Brandeis University
WILLIAM TRAGER, Rockefeller University
DANIEL KIEHART, University of Pennsylvania
MARGARET A. LEONG, University of California, Davis
PAUL MIED, The Johns Hopkins University
MARK M. MOOSEKER, Harvard Medical School
JEFFREY MOSHIER, The Johns Hopkins University
LOUISE RAMM, University of Virginia
GLENN SMITH, The Johns Hopkins University
JAMES STANCHFIELD, Dartmouth College
HENRY STEINBERG, The Johns Hopkins University
VI. Lectures

D. Goodenough  
The structure of biomembranes: historical perspectives
D. Goodenough  
The structure of biomembranes: current theories
D. Goodenough  
Structure and function of some intercellular junctions
G. Weissmann  
Lysosomes and the vacuolar system
G. Weissmann  
Liposomes as model membrane systems
P. Dunham  
Enzymes of the cell membrane: the ion pump
J. Cebra  
Antibodies: relationships of structural features to their various activities and specificities
R. B. Taylor  
The antibody response: cellular and humoral aspects
R. A. Prendergast  
Cell-mediated immune responses
R. B. Taylor  
Control of the immune response: specific regulation of a complex system
J. Cebra  
B-lymphocyte ontogeny: the development of the secretory immunoglobulin-A system
N. Klinman  
Expression of the B-cell repertoire
R. B. Taylor  
Recognition of self vs. nonself
R. A. Prendergast  
Sea star coelomocyte protein and modulation of the vertebrate immune response
G. Cole  
Host responses to virus infections
G. Weissmann  
Lysosomes and immune reactions
J. Lingrel  
Messenger RNA: general structural features and their relation to function; mRNA turnover
J. Lingrel  
Is there a precursor to mRNA?
P. C. Huang  
Cell proliferation, DNA replication and repair
J. Lindenmann  
T-cell receptors for alloantigens
P. C. Huang  
Genome and primary transcripts; signals in the base sequences
P. C. Huang  
Chromosomal nucleoproteins: structure and function
D. Barrett  
Transcriptional control in eukaryotic development
D. Barrett  
Translational control in eukaryotic development
J. Lingrel  
The number of globin genes: genetic studies and the use of molecular probes
R. Huang  
Tissue-specific mRNAs and proteins of highly-differentiated systems
R. Huang  
Specificities of chromatin templates and RNA polymerases
R. Huang  
Assay systems for RNA synthesis and transcription in vitro of specific genes
D. Powers  
Hemoglobin: a protein for all seasons
D. Powers  
Genes and demes: a biochemical approach to the study of genetic variability
G. Ackers  
How do macromolecules interact?
G. Ackers  
What do hemoglobin subunits do to each other when they get together?
J. Olmsted  
Microtubule structure and chemistry
J. Olmsted  
Microtubule assembly
S. Inoué  
Mitosis
T. Pollard  
Contractile protein biochemistry and structure
T. Pollard  Force-generating mechanisms in muscle and nonmuscle cells
A. Szent-Györgyi  Mechanisms regulating contractile proteins
M. Mooseker  Model motile systems
R. D. Allen  Cellular aspects of motility
T. Pollard  Cytoplasmic matrix
T. Pollard  Primitive motile systems
J. Olmsted  Microtubules and motility
J. Rosenbaum  Flagellar assembly
P. Dunham  Na-K transport in erythrocytes of sheep and goats: antibody-induced alterations
W. Marzluff  Synthesis and maturation of RNA: an in vitro approach
S. Libria  Uses of membrane energy
J. Lindenmann  Host antigens in enveloped viruses: I and II
W. Trager  Human malaria parasites in continuous culture
R. Kretsinger  X-ray crystallography of calcium-binding proteins

JANUARY COURSES 1976

BEHAVIOR

(Offered Jointly by Boston University Marine Program and the Marine Biological Laboratory)

I. INSTRUCTOR

Robert L. Jeanne, Boston University, director of course

II. ASSISTANT

Stuart Jacobson, Boston University Marine Program

III. SPECIAL LECTURERS

Jelle Atema, Boston University
Stanley Fox, Boston University
Donald Griffin, The Rockefeller University
Jeremy Hatch, University of Massachusetts, Boston
Adrianus Kalmijn, Woods Hole Oceanographic Institution
George Michel, Boston University
Celia Moore, University of Massachusetts, Boston
Bori Olla, Middle Atlantic Coastal Fisheries Center
Alastair Stuart, University of Massachusetts, Amherst

IV. LECTURES

R. L. Jeanne  Introduction to the course; basic statistical concepts
J. Atema  Sensory physiology and behavior
J. Atema  Structure and function of chemoreceptors and mechano-receptors
J. Atema  Evolution of chemoreception
A. Kalmijn  Electroeception in object and prey detection
A. Kalmijn  Orientation and navigation in electric and magnetic fields
R. L. Jeanne  Endogenous vs. exogenous control of biological rhythms
G. Michel  The role of learning in behavior
C. Moore
Constraints on learning
C. Moore
Hormones and experience in ring dove reproduction
G. Michel, C. Moore, J. Atema, and R. L. Jeanne
Discussion: Description and analysis of behavior
J. Atema
Mating behavior in the lobster
R. L. Jeanne
Introduction to orientation
D. Griffin
Orientation behavior in bats and birds
D. Griffin
Information transfer in bee dances
D. Griffin
The question of mental continuity
D. Griffin and A. Kalmijn
The evidence for sensitivity to the earth's magnetic field
R. L. Jeanne
Introduction to sociobiology
B. Olla
Natural history and behavior of marine fishes: the importance of defining habits under natural conditions
B. Olla
Behavioral measures of environmental stress
B. Olla
Social interactions of marine fishes: schooling and feeding facilitation
B. Olla
Film session: feeding and schooling in pelagic fish; aggression and territoriality in demersal fish
G. Michel
Primate socialization
G. Michel
Kidnapping and care-taking in primates
R. L. Jeanne
Introduction to communication
R. L. Jeanne
Information theory and the analysis of communication
J. Atema
Social behavior and communication in catfish
S. Fox
Territory, aggression, and dispersal
S. Fox
Natural selection among behavioral phenotypes of the lizard Uta stansburiana
J. Hatch
Bird song
J. Hatch
Seminar
A. Stuart
Social behavior of the termites
A. Stuart
Termite communication
R. L. Jeanne
Social behavior in the Hymenoptera
R. L. Jeanne
Adaptations of nest architecture in the social wasps
R. L. Jeanne
Altruism and group selection

DEVELOPMENTAL BIOLOGY

I. INSTRUCTORS

WALTER S. VINCENT, University of Delaware, director of course
LOUIS E. DELANNEY, Ithaca College
JAMES D. EBERT, Carnegie Institution and Marine Biological Laboratory
SUSAN GERBI, Brown University
EVE MACDONALD, Wilson College
J. RICHARD WHITTAKER, Wistar Institute

II. STAFF ASSOCIATE

STANLEY KRANE, Fitchburg State College

III. ASSISTANT

WILLIAM D. BATES, University of Pennsylvania
IV. Special Lecturers

Eugene Bell, Massachusetts Institute of Technology
Noel de Terra, Institute for Cancer Research
Kenneth T. Edds, Marine Biological Laboratory
Elizabeth Hay, Harvard University
Arthur G. Humes, Boston University and Marine Biological Laboratory
W. D. Massover, Brown University
S. Meryl Rose, Woods Hole
Raymond E. Stephens, Brandeis University and Marine Biological Laboratory
Gladys K. Schlanger, Cornell Medical College
Emile Zuckerkandl, University of Delaware and Marine Biological Laboratory

V. Lectures

W. S. Vincent: Introduction to the Developmental Biology course
W. S. Vincent: The egg as a lesson in cell biology
W. S. Vincent: Ovary vs. testis: genetics vs. environment
W. S. Vincent: Oocyte development: I. Cell organelles
W. S. Vincent: Oocyte development: II. The germinal vesicle nucleus
W. S. Vincent: Oogenesis, an exercise in future think
E. MacDonald: Spermiogenesis
E. MacDonald: Techniques of transmission and scanning electron microscopy
L. Delanney: Immune systems as a model for development: I, II, III
J. R. Whittaker: Cytoplasmic information in development: I. Mosaic development
J. R. Whittaker: Cytoplasmic information in development: II. Germ plasm and axiation factors
J. R. Whittaker: Cytoplasmic information in development: III. Nuclear-cytoplasmic interactions
J. R. Whittaker: Is differentiation reversible?
J. R. Whittaker: Developmental approaches to malignancy
N. de Terra: New ideas about cleavage
S. Gerbi: Mitosis and meiosis
S. Gerbi: DNA replication
S. Gerbi: Chromosome structure: I. Chromatin
S. Gerbi: Chromosome structure: II. Cytology
S. Gerbi: Chromosome structure: III. and IV. Molecular architecture
S. Gerbi: Evolution of satellite and ribosomal DNA’s
J. D. Ebert: Interacting systems in development
J. D. Ebert: Ionic regulation of embryonic induction
S. M. Rose: Regeneration in denervated limbs in amphibians
A. G. Humes: Post-embryonic development of Copepoda
E. Bell: Genome utilization during differentiation
S. Krane: Restriction enzymes
G. K. Schlanger: Development of chloroplast ribosomes
W. S. Vincent: Rate control of gene expression
R. E. Stephens: Ciliogenesis
W. D. Massover: New concepts of vitellogenesis
N. de Terra: Stentorian development
S. Inoué: Spicule morphogenesis
REPORT OF THE DIRECTOR

H. LODISH Messenger RNA in slime mold development
H. O. HALVORSON Sporulation as a developmental model
K. R. PORTER Microtubules in cellular morphogenesis
S. GERBII Evolution of satellite and ribosomal DNA's
J. D. EBBERT The role of microfilaments in sea urchin development
K. T. EDDS Tissue interaction in the developing cornea
E. ZUCKERKANDL Programs of gene action and progressive evolution
E. BELL Films on morphogenesis
A. SZENT-GYÖRGVI New theories of cancer

ECOLOGY

I. INSTRUCTORS

GEORGE M. WOODWELL, The Ecosystems Center, Marine Biological Laboratory, director of course
DANIEL B. BOTKIN, The Ecosystems Center
CHARLES A. S. HALL, Cornell University, and The Ecosystems Center
BRUCE J. PETERSON, The Ecosystems Center

II. ASSISTANTS

TIMOTHY E. WOOD, The Ecosystems Center
PAUL A. STEUDLER, The Ecosystems Center
JOHN V. K. HELFRICH, The Ecosystems Center
RICHARD A. HOUGHTON, The Ecosystems Center
DAVID W. JUERS, The Ecosystems Center

III. SPECIAL LECTURERS

LYNN MARGULIS, Boston University
HOWARD L. SANDERS, Woods Hole Oceanographic Institution
KENNETH O. EMERY, Woods Hole Oceanographic Institution
JOHN M. TEAL, Woods Hole Oceanographic Institution
STEPHEN H. BERWICK, Yale University
EVILLE GORHAM, University of Minnesota
HOLGER W. JANNASCH, Woods Hole Oceanographic Institution
KENNETH H. MANN, Dalhousie University, Canada
MARILYN J. JORDAN, Cornell University
EDWARD O. WILSON, Harvard University
JERRY M. MEILLO, Yale University
IVAN VALIELA, Boston University
J. GUSTAVE SPETH, Natural Resources Defense Council
THOMAS COCHRAN, Natural Resources Defense Council
RICHARD C. HENNEMUTH, National Marine Fisheries
FREDERICK E. SMITH, Harvard University
EUGENE BELL, Massachusetts Institute of Technology
J. GUSTAVE SPETH, Natural Resources Defense Council

IV. LECTURES

G. M. WOODWELL Introduction to the MBL
G. M. WOODWELL The biosphere: a set of interacting ecosystems
D. B. Botkin  The history of the earth: the evolution of the biosphere
L. Margulis  Microbial evolution and the precambrian environment
H. L. Sanders  Natural communities and evolutionary strategies, I and II
K. O. Emery  Continental drift
G. M. Woodwell  Climates of the world
G. M. Woodwell  Plant geography: the vegetation of the earth
J. M. Teal  Oceans of the world
C. A. S. Hall  Lakes of the world
D. B. Botkin  The earth as a thermodynamic system
G. M. Woodwell  Primary production and the metabolism of the earth
S. H. Berwick  Zoogeography: Southern Asia as a paradigm, I and II
C. A. S. Hall  Secondary productivity: aquatic, I and II
D. B. Botkin  Succession
D. B. Botkin  Secondary productivity: terrestrial
E. Gorham  Paleoeocology, I and II
G. M. Woodwell  Basic ecology from worldwide pollution
G. M. Woodwell  Experimental eutrophication of terrestrial and aquatic ecosystems
B. J. Peterson  Nutrient limitation in freshwater systems
C. A. S. Hall  Nutrient limitation in saltwater systems
H. W. Jannasch  The microbial sulfur cycle
H. W. Jannasch  Heterotrophic microbial activities in the deep ocean
K. H. Mann  Primary production in marine systems
M. J. Jordan  Industrial pollution
T. E. Wood  Acid precipitation
E. O. Wilson  Sociobiology
J. M. Melillo  Nutrient cycles, I and II
I. Valiela  Nutrient cycling in a salt marsh
G. M. Woodwell  Ecosystems and world politics
D. B. Botkin  The stability of ecosystems, I
J. E. Hobbie  The stability of ecosystems, II
J. G. Speth and  Environment and law
T. Cochran
J. G. Speth and  New forces of change
T. Cochran
A. Szent-Gyorgyi  New directions in cancer research
R. C. Hennemuth  The future of fish, I and II
F. E. Smith  Darwinian selection among urban ecosystems
F. E. Smith  Urban ecosystems, I and II
E. Bell  The world food problems
G. M. Woodwell  Biotic impoverishment and the threshold dilemma

NEUROBIOLOGY

(Offered jointly by Boston University Marine Program and the Marine Biological Laboratory)

I. INSTRUCTORS

Frederick Lang, Boston University Marine Program, director of course
Alan Fein, Marine Biological Laboratory
Edward F. MacNichol, Jr., Assistant director, Marine Biological Laboratory
II. CONSULTANTS

FREDERICK A. DODGE, The Rockefeller University
STANELY B. KATER, University of Iowa

III. ASSISTANTS

WALTER J. COSTELLO, Boston University
DANIEL G. GIBSON, Boston University

IV. SPECIAL LECTURERS

WILLIAM J. ADELMAN, National Institutes of Health
DANIEL L. ALKON, National Institutes of Health
JELLE ATEMA, Boston University
MELVIN J. COHEN, Yale University
DONALD T. FRAZIER, University of Kentucky
ROBERT J. FRENCH, National Institutes of Health
EDWARD A. KRAVITZ, Harvard Medical School
PETER MACLEISH, Harvard Medical School
PAUL O'BRYAN, Boston University School of Medicine

V. LECTURES

E. F. MACNICHOL, JR. Electrophysiological techniques
A. FEIN Neuron doctrine—anatomy of the nervous system
A. FEIN Membrane structure
R. J. FRENCH Bookkeeping for a cell—an ionic balance sheet
R. J. FRENCH Ionic diffusion across liquid junctions and cell membranes
R. J. FRENCH Criteria for independence and active transport
W. J. ADELMAN Membrane potentials
W. J. ADELMAN The nerve impulse
W. J. ADELMAN Membrane currents
W. J. ADELMAN Components of membrane conductance
W. J. ADELMAN Channels and model systems
F. LANG Synaptic transmission—the soups vs. the sparks
F. LANG Ionic basis of synaptic potentials
F. LANG Quantal release: excitation-secretion coupling
F. LANG Vesicle hypothesis
F. LANG Electrical synapses: facilitation and arthropod neuromuscular systems
A. FEIN Crustacean stretch receptor: Pacinian corpuscle
A. FEIN Invertebrate photoreceptors
A. FEIN Muscle spindles
J. ATEMA Functions of taste and smell
M. COHEN Factors influencing dendritic structure and function in identified central neurons
F. A. DODGE A quantitative description of the vertebrate motor neuron from dendrite to terminal: I. Excitability and propagation of nerve impulses in myelinated nerve fibers; II. Excitability of spinal motor neurons
D. T. FRAZIER Neural control of respiration in vertebrates
E. A. KRAVITZ Octopamine neurons in lobster
S. B. KATER Neural basis of feeding in the pulmonate snail *Heliosoma trivolvis*
YEAR-IN-SCIENCE
1975—1976

I. Instructors

George M. Woodwell, The Ecosystems Center, Marine Biological Laboratory, director of course
Daniel B. Botkin, The Ecosystems Center
Charles A. S. Hall, Cornell University and The Ecosystems Center
John E. Hobbie (spring semester 1976), The Ecosystems Center
Bruce J. Peterson, The Ecosystems Center

II. Assistants

John V. K. Helfrich, The Ecosystems Center
Richard A. Houghton, The Ecosystems Center
David W. Juers, The Ecosystems Center
James T. Morris, The Ecosystems Center
Paul A. Steudler, The Ecosystems Center
Timothy E. Wood, The Ecosystems Center

III. Special Lecturers

Stephen H. Berwick, Yale University
Howard L. Sanders, Woods Hole Oceanographic Institution
Robert R. Parker, Commonwealth Scientific and Industrial Research Organization
Jerry M. Melillo, Yale University
John Milton, Thresholds, Washington, D. C.
Walter E. Westman, University of California
Myron L. Heinelman, U. S. Forest Service (retired)
John P. Holdren, University of California, Berkeley
Arturo Gomez-Pompa, Biological Institute, Mexico City
Jo-Ann P. Roskoski, Yale University
John D. Aber, Yale University
John Todd, The New Alchemy Institute, Falmouth, Massachusetts
Jawahar Tiwari, The Ecosystems Center
James Haney, University of New Hampshire

IV. Lectures

Fall 1975

G. M. Woodwell The vegetation of the earth
S. H. Berwick Zoogeography: Southern Asia as a paradigm
H. L. Sanders Marine benthic diversity
R. R. Parker A systems analysis of an ecosystem
L. S. Collins* Trophic structure of ecosystems
B. F. Leon* Succession I
R. D. Boone* Succession II
G. M. Woodwell Carbon metabolism/energy I
REPORT OF THE DIRECTOR

D. B. Botkin
The carbon budget II: effects of enhancement of atmospheric CO2
J. M. Melillo
Nitrogen metabolism in ecosystems
B. F. Leon* and T. E. Wood
Ecology and international development
J. Milton
Land use in the Himalayas
J. Milton
Nutrient cycles: sodium in a temperate zone ecosystem
D. B. Botkin
The world sulfur budget
C. L. Van Dover*
The Redfield Hypothesis
M. L. Heinsemann
Fire in terrestrial communities
G. M. Woodwell
Ecological effects of toxic substances
W. E. Westman
Vegetation modification for fire control: a case study in Southern California chaparral
W. E. Westman
Resiliency in vegetation: studies in Australian coastal vegetation
W. E. Westman
Water pollution control legislation in the U. S. and Australia
R. A. Houghton
Design of ecosystems
R. A. Houghton
A ten-year record of atmospheric CO2 in the northeast U. S

Spring 1976
R. A. Houghton
Carbon models: state of the art
L. S. Collins*
Effects of atmospheric CO2 on climate
J. P. Holdren
Energy from fusion: how much difference will it make?
B. A. Pierce*
The ocean buffer system
J. Tiwari
Random differential equations and information theory approach to the modelling of ecosystems
R. M. Hurd*
The effects of CO2 fertilization
D. W. Juers
Carbon components in sea water and techniques of measurement
J. Haney
Regulation of grazing by Cladocera
T. B. Brown*
Carbon on a geologic time scale
J. Todd
Designing contained food-producing ecosystems
T. E. Wood
Limits to production of CO2
B. J. Peterson
Carbon budget for lakes
J. P. Roskoski
Nitrogen fixation in a forest ecosystem
C. L. Van Dover*
The detrital component of marine ecosystems
B. J. Peterson
Relationship between 14C uptake and net particulate carbon production
J. D. Aber
Competition for light and nutrients in northern forests
R. A. Houghton
A single year model of the global carbon cycle
A. Gomez-Pompa
The effects of industrialization in Mexico
J. T. Morris and T. E. Wood
The consequences of varying parameters in the long-term carbon cycle model

THE LABORATORY STAFF
(Including all whose services began or ended during the year.)

HOMER P. SMITH, General Manager

FRANCIS P. BOWLES, Coordinator of Re-
A. ROBERT GUNNING, Superintendent,
search Services
Buildings and Grounds

* Year-in-Science student seminar.
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

TERESA M. BRAUN, Assistant Editor, The Biological Bulletin
EDWARD G. CASEY, Controller
JANE FESSENDEN, Librarian

Jim A. Hancock, Manager, Research Services
Lewis M. Lawday, Assistant Manager, Supply Department
John J. Valois, Manager, Supply Department

DIRECTOR’S OFFICE
Marie B. Abbott, Curator, Gray Museum
Lucena J. Barth
Pamela J. Foote
Edward F. MacNichol, Jr., Assistant Director for Research Services

Maureen M. Morris
Charles A. Ossola, Assistant Director for Finance and Development
George M. Woodwell, Assistant Director for Education and Director of The Ecosystems Center

GENERAL MANAGER’S OFFICE
Florence S. Butz
Elaine C. Crocker

CONTROLLER’S OFFICE
Doris Carmo
Doris C. Davis
Shirley J. Delisle
Nancy L. Ellis

Joan E. Howard
Lorraine A. Ruddick
Mary R. Tavares

LIBRARY
Judith A. Ashmore
Rebecca J. Bailey
Nancy M. Capuano
David J. Fitzgerald
Charlotte F. Goudreau
Joan H. Grice

Catherine Herrity
E. Lenora Joseph
Holly E. Karalekas
Theresa K. McKee
M. Ann White

BUILDINGS AND GROUNDS
Lee E. Bourgoin
John V. Day
Manuel P. Dutra
Glenn R. Enos
Charles K. Fuglister
Elizabeth J. Geggatt
Richard E. Geggatt, Jr.
Robert J. Golder
Robert L. Grosch
Robert A. Hinze
Thomas N. Kleindinst
Elisabeth Kuit
Donald B. Levy

Ralph H. Lewis
William M. Lochhead
Daniel Loewus
Richard C. Lovering
Alan G. Lunn
John B. MacLeod
John E. Maurer
Stephen A. Mills
Glenn I. Shear
Frederick E. Thrasher
Frederick E. Ward
Ralph D. Whitman
William Whitmacker
DEPARTMENT OF RESEARCH SERVICES

Thomas R. Anthony  Linda M. Goldner
Franklin D. Barnes  Kathryn L. Helfrich
John Barnes  Lowell V. Martin
Julie A. Caissie  Joan A. Peters-Gilmartin
Gail Cavanaugh  Frank E. Sylvia

SUPPLY DEPARTMENT

Edward G. Enos, Jr.  A. Dickson Smith
Joyce B. Enos  Eugene A. Tassinari
Robert M. Heden  Bruno F. Trapasso
Mark W. Munson  John M. Varao
John H. Ryther, Jr.  Frederick W. von Arx

2. INVESTIGATORS; RESEARCH FELLOWSHIPS; STUDENTS

Independent Investigators, 1976

Ackers, Gary K., Professor and Chairman of Biophysics, University of Virginia
Adelman, William J., Jr., Chief, Laboratory of Biophysics, NINCDS, National Institutes of Health
Akaike, Tadashi, Visiting Associate, NINCDS, National Institutes of Health
Alkon, Daniel L., Research Medical Officer, NINCDS, National Institutes of Health
Allen, Nina Strömgren, Assistant Professor, Dartmouth College
Allen, Robert D., Professor and Chairman of Biology, Dartmouth College
Almers, Wolfram, Assistant Professor of Physiology and Biophysics, University of Washington
Armstrong, Clay M., Professor of Physiology, University of Pennsylvania
Armstrong, Peter B., Associate Professor of Zoology, University of California, Davis
Arnold, John M., Professor, University of Hawaii
Arnold, Michael, Investigator, National Foundation for Cancer Research
Atwood, Harold L., Professor of Zoology, University of Toronto, Canada
Ball, Eric G., Professor Emeritus, Harvard Medical School
Barlow, Robert B., Jr., Associate Professor, Institute for Sensory Research, Syracuse University
Battelle, Barbara-Anne, Research Fellow, Harvard Medical School
Bauer, G. Eric, Associate Professor of Anatomy, University of Minnesota
Baumgold, Jesse, Staff Fellow, NIMH, National Institutes Health
Bayne, Brian L., Principal Scientific Officer, Institute for Marine Environmental Research, United Kingdom
Beeson, Karl W., Research Associate, Columbia University
Begenisch, Ted, Assistant Professor of Physiology, University of Rochester
Bennett, Michael V. L., Professor of Neuroscience, Director, Division of Cellular Neurobiology, Albert Einstein College of Medicine
Berg, Carl J., Jr., Research Associate, Harvard University
Bezanilla, Francisco, Professor, University of Chile, Chile
Bishop, Stephen H., Assistant Professor, Baylor College of Medicine
Blaustein, Mordecai P., Professor of Physiology and Biophysics, Washington University School of Medicine
Borgese, Thomas A., Associate Professor, Herbert H. Lehman College, The City University of New York
Borisy, Gary G., Professor of Molecular Biology and Zoology, University of Wisconsin
Boros, Walter F., Medical Scientist Training Program Fellow, Washington University School of Medicine
Bosler, Robert B., Principal Associate, Harvard Medical School
Brinley, F. J., Jr., Associate Professor of Physiology, The Johns Hopkins University
Brodmick, Malcolm S., Assistant Professor, University of Texas Medical Branch
Brown, Frank A., Jr., Morrison Professor of Biology, Northwestern University
BROWN, JOEL E., Professor of Physiology, State University of New York at Stony Brook
BURDICK, CAROLYN J., Associate Professor of Biology, Brooklyn College, The City University of New York
BURGER, MAX M., Chairman of the Biocenter, Biocenter of the University of Basel, Switzerland
BURGOS, MARIO H., Full Professor, Director, Instituto de Histologia y Embriologia, N. Cuyo University, Mendoza, Argentina
CALAHAN, MICHAEL D., Postdoctoral Fellow, University of Pennsylvania
CEBRA, JOHN J., Professor of Biology, The Johns Hopkins University
CHANG, DONALD C., Assistant Professor, Baylor College of Medicine
CHAPPELL, RICHARD L., Associate Professor, Hunter College, The City University of New York
CHARLTON, J. SHERWOOD, Research Associate, Marine Biological Laboratory
CLAUDE, PHILIPPA, Assistant Scientist, University of Wisconsin Primate Research Center
CLOUD, JOSEPH G., Postdoctoral Fellow, The Johns Hopkins University
COHEN, LAWRENCE B., Associate Professor, Yale University School of Medicine
COHEN, YEHUDA, Lecturer, Hebrew University, Jerusalem
COLE, GERALD A., Professor of Epidemiology, The Johns Hopkins University, School of Hygiene
COLE, KENNETH S., Research Biophysicist, National Institutes of Health
COOPERSTEIN, SHERWIN J., Professor of Anatomy, University of Connecticut
CREMER-BARTELS, GERTRUD, Priv. Dozent, University of Munster, West Germany
CROW, TERRY J., Extramural Fellow, NICHD, National Institutes of Health
CROWE, JOHN H., JR., Associate Professor of Zoology, University of California, Davis
DE FELICE, LOUIS J., Associate Professor of Anatomy, Emory University
DE TERRA, NOEL, Research Associate Professor, Hahnemann Medical College
DEVVEER, PAUL, Associate Professor of Physiology and Biophysics, Washington Medical School
DIPOLO, REINALDO, Associate Investigator, Instituto Venezolano de Investigaciones Científicas, Venezuela
DODGE, FREDERICK A., Adjunct Professor, The Rockefeller University
DOWLING, JOHN E., Professor of Biology, Harvard University
DUBOIS, ARTHUR B., Professor of Epidemiology and Physiology, Yale University Medical School, and Director, John B. Pierce Foundation Laboratory
DUNHAM, PHILLIP B., Professor, Syracuse University
EATON, DOUGLAS C., Assistant Professor, University of Texas Medical Branch
EBERHARD, ANATOL, Associate Professor of Chemistry, Ithaca College
EDDS, KENNETH T., Postdoctoral Associate, Marine Biological Laboratory
EHRENSTEIN, GERALD, Research Physicist, National Institutes of Health
ELLIS, RICHARD J., Associate Professor, Bucknell University
ELLISON, REBECCA P., Trainee, The Population Council, The Rockefeller University
ELVIN, DAVID W., Visiting Assistant Professor, University of Vermont
EPPEL, DAVID, Professor of Biology, Scripps Institution of Oceanography
FALLON, JOHN T., Research Fellow in Pathology, Harvard Medical School, Massachusetts General Hospital, Shriners Burns Institute
FARMANFARMAIAN, A., Professor of Physiology, Rutgers—The State University of New Jersey
FISCHBACH, GERALD, Associate Professor, Harvard Medical School
FISCHMAN, GEORGE S., Professor of Operations Research and Systems Analysis, University of North Carolina at Chapel Hill
FISCHMAN, HARVEY M., Associate Professor of Physiology and Biophysics, University of Texas Medical Branch at Galveston
FOHLMIESTER, JÜRGEN, Lecturer, University of Minnesota
FRENCH, ROBERT J., Visiting Fellow, NICHD, National Institutes of Health
FURSHPAN, EDWIN J., Professor of Neurobiology, Harvard Medical School
GAINEY, HAROLD, Head, Section of Functional Neurochemistry, NICHD, National Institutes of Health
GASCOYNE, PETER, Research Student, University College of North Wales, United Kingdom
GIBSON, JANE, Associate Professor of Biochemistry, Molecular and Cell Biology, Cornell University
GILBERT, DANIEL L., Research Physiologist, NICHD, National Institutes of Health
GOLD, KENNETH, Research Ecologist, New York Zoological Society, New York Aquarium
GOLDMAN, DAVID E., Independent Investigator, Marine Biological Laboratory
GOLDSMITH, TIMOTHY H., Professor of Biology, Yale University
GORDON, JAMES, Associate Professor, Hunter College and The Rockefeller University
GREENBERG, Michael J., Professor of Biological Sciences, Florida State University
GRINVALD, Amiram, Research Associate, Yale University School of Medicine
GROSCH, Daniel S., Professor of Genetics, North Carolina State University, Raleigh
GROSSMAN, Albert, Professor, New York University Medical School
GROSSMAN, Yoram, Visiting Fellow, NINCDS, National Institutes of Health
GUERRTAUD, Jean P., Postdoctoral Fellow, Albert Einstein College of Medicine
GUTTMAN, Rita, Professor of Biology, Brooklyn College, The City University of New York
HALVORSON, Harlyn O., Director, Rosenstiel Basic Medical Sciences Research Center and Professor of Biology, Brandeis University
HAMKALO, Barbara Ann, Assistant Professor of Biology, University of California, Irvine
HANNA, Robert B., Instructor of Neuroscience, Albert Einstein College of Medicine
HARDING, Clifford V., Professor and Director of Research, Kresge Eye Institute, Wayne State University
HASCHEMeyer, Audrey E. V., Professor of Biology and Biochemistry, Hunter College, The City University of New York
HELDMAN, Eliahu, Staff Fellow, NINCDS, National Institutes of Health
HEREFORD, Lynna M., Postdoctoral Associate, Brandeis University
HEUSER, John, Assistant Professor, University of California, San Francisco
HEYER, Carolyn K., Research Associate, Max-Planck Institute for Psychiatry, West Germany
HIGINSTEIN, Stephen M., Assistant Professor of Neurosciences, Albert Einstein College of Medicine
HILLE, Bertil, Professor of Physiology and Biophysics, University of Washington School of Medicine
Hochachka, P. W., Visiting Investigator, British Columbia, Canada
Hoskin, Francis C. G., Professor, Illinois Institute of Technology
HUANG, P. C., Associate Professor of Biochemistry, The Johns Hopkins University
Humphreys, Tom, Associate Professor, University of Hawaii
Ilan, Joseph, Associate Professor of Anatomy, Case Western Reserve University, Medical School
INOUE, Isao, Visiting Fellow, NIH, National Institutes of Health
INOUE, Sadatoki, Assistant Professor, McGill University, Canada
JENKINS, Robert A., Professor of Zoology, University of Wyoming
JOHNSON, Ralph G., Professor and Chairman, University of Chicago
Josephson, Robert K., Professor, University of California, Irvine
Jumblatt, James E., Assistant, Biocenter, University of Basel, Switzerland
Kaminer, Benjamin, Professor and Chairman, Boston University School of Medicine
KAMINO, Kohtarou, Research Staff, Yale University School of Medicine
KAPLAN, Ehud, Postdoctoral Fellow, The Rockefeller University
KEDES, Laurence H., Assistant Professor, Stanford University
KEETON, William T., Professor and Chairman, Section of Neurobiology and Behavior, Cornell University
KENNEDY, Mary B., Postdoctoral Fellow, Harvard Medical School
KLEENE, Kenneth C., NIH Postdoctoral Fellow, University of Hawaii
KLEINSCHMIDT, Joehn, Postdoctoral Research Fellow, Laboratory of Sensory Physiology, Marine Biological Laboratory
KLINE, Richard P., NIH Postdoctoral Fellow, Harvard University
Kode, Samuel S., Associate Director, The Population Council, The Rockefeller University
KRavitz, Edward A., Professor of Neurobiology, Harvard Medical School
KRIEBEL, Mahlon E., Associate Professor, State University of New York, Upstate Medical Center
KRystal, Gershon, Postdoctoral Fellow, University of California, Irvine
KUFFLer, Stephen W., John Franklin Enders University Professor, Harvard Medical School
KUINS, William J., Associate Professor of Pathology, New York University School of Medicine
LANDOWNE, David, Associate Professor, University of Miami
LASH, James W., Professor of Anatomy, University of Pennsylvania, School of Medicine
Lasek, Raymond J., Associate Professor, Case Western Reserve University
LASS, Yoram, Research Fellow, Harvard Medical School
Lauper, Hans, Professor of Biology, University of Connecticut
LEADBETTER, E. R., Professor of Biology, Amherst College
Lee, John J., Professor of Biology, City College, The City University of New York
Lester, Roger, Professor of Medicine, Chief, Gastroenterology, University of Pittsburgh School of Medicine
Levin, Jack, Associate Professor of Medicine, The Johns Hopkins University School of Medicine
Levithal, Cyrus, Professor of Biological Sciences, Columbia University
Levy, Milton, Professor of Biochemistry, New York University School of Medicine
Lingrel, Jerry B., Professor of Biological Chemistry, University of Cincinnati, College of Medicine
Lipicky, Raymond J., Professor of Pharmacology and Medicine, Director of Clinical Pharmacy, University of Cincinnati
Liuzzi, Anthony, Associate Professor, University of Lowell
Llinas, R., Professor of Physiology and Biophysics, University of Iowa
Loewenstein, W. R., Professor and Chairman of the Department of Physiology and Biophysics, University of Miami, School of Medicine
Longo, Frank J., Associate Professor, University of Tennessee Center for the Health Sciences
Lorand, L. Professor of Biochemistry and Molecular Biology, Northwestern University
Lux, Hans Dieter, Head, Department of Neuropsychology, Max-Planck Institute for Psychiatry, West Germany
Marler, Peter, Professor of Ecology and Ethology, The Rockefeller University
Markiluff, William F., Jr., Assistant Professor, Florida State University
Mauzerall, David, Professor, The Rockefeller University
Mastroianni, Luigi Jr., Wm. Goodell Professor and Chairman, Obstetrics and Gynecology, University of Pennsylvania
Mathews, Rita W., Senior Research Associate, Hunter College, The City University of New York
Matsumoto, Gen, Guest Worker, NIMH, National Institutes of Health
Matsumura, Fumio, Professor, University of Wisconsin
Metuzals, J., Professor in charge of the Electron Microscopy Unit, University of Ottawa, Canada
Metz, Charles B., Professor, University of Miami
Mied, Paul A., Postdoctoral Fellow, The Johns Hopkins University
Miller, R. S., Professor, Yale University
Moore, John W., Professor of Physiology, Duke University
Moore, Lee E., Associate Professor of Physiology, Case Western Reserve University
Mosketer, Mark S., Research Fellow, Harvard Medical School
Morgan, John R., Research Student, National Foundation for Cancer Research
Mote, Michael I., Associate Professor of Biology, Temple University
Mueller, Paul, Senior Staff Scientist and Professor of Biophysics, University of Pennsylvania, Eastern Pennsylvania Psychiatric Institute
Mullins, L. J., Professor of Biophysics and Chairman, University of Maryland School of Medicine
Murphy, Dennis J., Postdoctoral Student, University of Maryland
Musick, James R., Instructor, University of Utah
Nagel, Ronald L., Associate Professor, Albert Einstein College of Medicine
Nakahashi, Toshio, Professor of Physiology and Pharmacology, Duke University Medical Center
Nicosia, Santo V., Assistant Professor of Obstetrics, Gynecology and Pathology, University of Pennsylvania School of Medicine
Nielsen, Jennifer B., Senior Research Associate, Hunter College, The City University of New York
Nishihara, David J., Postdoctoral Fellow, Scripps Institution of Oceanography
Noe, Bryan D., Assistant Professor of Anatomy, Emory University
O'Lague, Paul H., Assistant Professor of Biology, University of California, Los Angeles
Olmsted, Joanna B., Assistant Professor, University of Rochester
Osman, Richard W., Research Associate, University of Chicago
Oxford, Gerry S., Postdoctoral Research Fellow, University of North Carolina
Pant, Harish C., Senior Staff Fellow, NIMH, National Institutes of Health
Pappas, George D., Professor of Neurosciences and Anatomy, Albert Einstein College of Medicine
Pardy, Rosevelt L., Assistant Dean, School of Biological Sciences, University of California, Irvine
Patterson, John A., Research Associate, Hunter College, The City University of New York
Persson, Philip, Medical Investigator, Veterans Administration Hospital, Brooklyn
Pethig, R., University Lecturer, University College of North Wales, United Kingdom
Pierce, Sidney K., Associate Professor, University of Maryland
Pohl, Herbert A., Professor of Physics, Oklahoma State University
Polhoff, Alberto L., Assistant Professor, Boston University School of Medicine
PORTER, Harvey B., Senior Investigator and Medical Officer, National Institutes of Health
POLLARD, Thomas D., Associate Professor, Harvard Medical School
PORTER, Keith R., Chairman and Professor, Molecular, Cellular and Developmental Biology, University of Colorado, and Director, Marine Biological Laboratory
POTTER, David D. Professor of Neurobiology, Harvard Medical School
POUSSART, Denis, Associate Professor, Université Laval, Canada
PRENDERGAST, Robert A., Associate Professor of Ophthalmology, Associate Professor of Pathology, The Johns Hopkins University
PRIOR, David J., Assistant Professor, University of Kentucky
RAMON, Fidel, Assistant Medical Research Professor, Duke University
REBHUN, Lionel L., Professor, University of Virginia
REESE, Thomas, Head, Section on Functional Neuroanatomy, National Institutes of Health
REINISCH, Carol L., Research Associate, Sidney Farber Cancer Center and Harvard Medical School
REQUENA, Associate Investigator, Instituto Venezolano de Investigaciones, Venezuela
REYNOLDS, George T., Professor of Physics, Princeton University
RHEUBEN, Mary B., Intergovernmental Exchange Biologist, NIH, and Pennsylvania State University
RICE, Robert V., Professor and Head, Department of Biological Sciences, Mellon Institute of Carnegie-Mellon University
RIPPS, Harris, Professor of Ophthalmology and Physiology, New York University School of Medicine
RITCHIE, J. Murdoch, Professor and Director, Division of Biological Sciences, Yale University
ROSBASH, Michael M., Assistant Professor of Biology, Brandeis University
ROSS, Birgit, Assistant Professor, University of Miami, School of Medicine
ROSENBAUM, Joel L., Associate Professor, Yale University
ROSENBLUTH, Jack, Professor of Physiology, New York University Medical Center
ROSANSKY, Priscilla F., Research Associate, Carnegie-Mellon University
ROSS, William N., Postdoctoral Fellow, Harvard Medical School
RUBIN, Lee L., Postdoctoral Fellow, Harvard Medical School
RUDERMAN, Joan V., Postdoctoral Fellow, Massachusetts Institute of Technology
RUSHFORTH, Norman B., Professor and Chairman, Department of Biology, Case Western Reserve University
RUSSELL, John M., Assistant Professor, University of Texas Medical Branch
RUSSELL-HUNTER, W. D., Professor of Zoology, Syracuse University
SALZBERG, Brian Matthew, Assistant Professor of Physiology, University of Pennsylvania
SCARPA, Antonio, Associate Professor of Biochemistry and Biophysics, University of Pennsylvania
SCHIFF, Jerome A., Professor of Biology and Director of the Institute for Photobiology of Cells and Organelles, Brandeis University
SCHOFF, Thomas J. M., Associate Professor, University of Chicago
SCHUEL, Herbert, Associate Professor of Biochemistry, State University of New York, Downstate Medical Center
SCHUETZ, Allen W., Associate Professor, The Johns Hopkins University
SEARS, James R., Assistant Professor of Biology, Southeastern Massachusetts University
SEGAL, Sheldon J., Vice President and Director, Biomedical Division, The Population Council, The Rockefeller University
SEYAMA, Issei, Postdoctoral Research Associate, Duke University Medical Center
SHAPLEY, Robert, Assistant Professor, The Rockefeller University
SHERMAN, Irwin W., Professor of Zoology, University of California, Riverside
SHOUKIMAS, Jonathan J., Postdoctoral Fellow, Laboratory of Biophysics, NINDS, National Institutes of Health
SHRIVASTAV, Brij Bhushan, Assistant Medical Research Professor, Duke University Medical Center
SIEGEL, Irwin M., Professor of Experimental Ophthalmology, New York University Medical Center
SMITH, Frederick E., Professor of Resources and Ecology, Harvard University
SMITH, Michael A. K., Research Associate, Hunter College, The City University of New York
SOBEL, Matthew J., Associate Professor, Yale University
SPIEGEL, Evelyn, Research Associate, Dartmouth College
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

SPIEGEL, MELVIN, Professor of Biology, Dartmouth College
SPIRA, Micha E., Visiting Assistant Professor, Albert Einstein College of Medicine
SPRAY, David C., Research Fellow, Albert Einstein College of Medicine
STARZAK, Michael E., Assistant Professor, State University of New York at Binghamton
STEINACKER, Antoinette, Postdoctoral Fellow, Albert Einstein College of Medicine
STEPHENS, Raymond E., Resident Investigator, Marine Biological Laboratory and Associate Professor of Biology, Brandeis University
STETTEN, DeWitt, Jr., Deputy Director for Science, National Institutes of Health
STETTEN, Marjorie R., Biochemist, NIAID, National Institutes of Health
STEVENS, Charles F., Professor of Physiology, Yale University
STICKGOLD, Robert, Research Fellow, Harvard Medical School
STOKES, Darrell R., Assistant Professor, Emory University
STOREY, Kenneth B., Assistant Professor of Zoology, Duke University
STRETON, Antony O. W., Associate Professor, University of Wisconsin
STRICHARTZ, Gary R., Assistant Professor of Physiology and Biophysics, State University of New York at Stony Brook
STUART, Ann E., Assistant Professor, Harvard Medical School
STUNKARD, Horace W., Research Associate, American Museum of Natural History
SWARM, Richard L., Director of Experimental Pathology and Associate Director of Experimental Therapeutics, Hoffmann-La Roche, Inc Research Division
SZAMIER, Robert Bruce, Assistant Professor, Harvard Medical School
SZENT-GYÖRGYI, Albert, Principal Investigator, Marine Biological Laboratory
SZENT-GYÖRGYI, Andrew G., Chairman, Department of Biology, Brandeis University
SZUTS, Ede Soltan, NIH Postdoctoral Fellow, Marine Biological Laboratory
TAKASHIMA, Shiro, Associate Professor, University of Pennsylvania
TASAKI, Ichihi, Chief, Laboratory of Neurobiology, NIMH, National Institutes of Health
TAYLOR, Roger B., Reader in Immunology, University of Bristol, United Kingdom
TIFFERT, Teresa, Postdoctoral Fellow, The Johns Hopkins University
TRELSTAD, Robert L., Assistant Pathologist, Massachusetts General Hospital; Chief of Pathology, Shriners Burns Institute; Assistant Professor, Harvard Medical School
TRINKAUS, J. P., Professor of Biology, Yale University
TROLL, Walter, Professor of Environmental Medicine, New York University Medical School
TROXLER, Robert F., Associate Professor of Biochemistry, Boston University School of Medicine
VINCENT, Walter, Professor and Chairman, Department of Biological Sciences, University of Delaware
WALD, George, Professor of Biology, Harvard University
WALTON, Alan, Lecturer, Open University, United Kingdom
WANG, Howard H., Assistant Professor of Biology, University of California, Santa Cruz
WARREN, Leonard, Member, Wistar Institute, and Professor, University of Pennsylvania
WEBER, Annemarie, Investigator, University of Pennsylvania
WEIDNER, Earl, Assistant Professor, Louisiana State University
WEISSMANN, Gerald, Professor of Medicine, Director, Division of Rheumatology, New York University School of Medicine
WELLS, Jay B., Physiologist, National Institutes of Health
WHITTAKER, J. Richard, Associate Member, Wistar Institute
WILSON, Darcy B., Professor, University of Pennsylvania School of Medicine
WITTENBERG, Jonathan B., Professor of Physiology, Albert Einstein College of Medicine
WODLINGER, Harold M., Graduate Student, Institute of Biomedical Engineering, University of Toronto, Canada
WOLF, Don P., Assistant Professor, University of Pennsylvania
WOODWARD, William R., Instructor, Harvard Medical School
WU, Chau H., Medical Research Assistant Professor, Duke University Medical Center
YEH, J. Z., Assistant Medical Research Professor, Duke University Medical Center
YOKOHAMA, J., Instructor, Harvard Medical School
YOSHIOKA, Tohru, Visiting Associate, NIMH, National Institutes of Health
ZIGMAN, Seymour, Associate Professor of Ophthalmology and Biochemistry, University of Rochester School of Medicine and Dentistry
REPORT OF THE DIRECTOR

ZDUNSKI, Dulcine, Postdoctoral Fellow, Stanford University
ZIMMERBERG, Joshua, Medical Scientist Trainee, Albert Einstein College of Medicine

Lillie Fellow, 1976

PAUL, John, Director, Beatson Institute for Cancer Research, University of Glasgow, Scotland

Alexander Forbes Lecturer, 1976

PHILLIPS, Charles, Oxford University, Oxford, United Kingdom

Rand Fellow, 1976

LINDENMANN, Jean, Instructor, University of Zurich, Switzerland

Grass Fellows, 1976

FRAZIER, Donald T., Senior Fellow, Professor, University of Kentucky, School of Medicine
ABERCROMBIE, Ronald F., Predoctoral Fellow, University of Maryland at Baltimore
BARTON, Stuart B., Research Worker, University Laboratory of Physiology, Oxford, United Kingdom
BEISWANGER, Christine M., Postdoctoral Fellow, University of Kentucky
CATANE, Edward J., Graduate Student, Fordham University
FINGER, Thomas E., Postdoctoral Fellow, Washington University School of Medicine
HORNE, Nathan R., Hopkins Marine Station, Stanford University
JOHNSTON, Daniel, Assistant Professor, University of Minnesota
KIRSCH, Glenn E., Grass Foundation Fellow, and Purdue University
LIVINGSTONE, Margaret S., Harvard Medical School
MCCREERY, Michael J., Postdoctoral Fellow, George Washington School of Medicine
MOODY, William J., Jr., Graduate Student, Stanford University
ORNBERG, Richard L., Graduate Student, Pennsylvania State University
PATON, John A., Postdoctoral Research Associate, Cornell University
SHECKET, Gordon, Graduate Student, Case Western Reserve University

Macy Scholars, 1976

ADAMS, James A., Assistant Professor of Biology, Tennessee State University
ARMSTRONG, Earlene, Assistant Professor, Howard University
LANGFORD, George M., Assistant Professor of Biology, University of Massachusetts, Boston
MUNAVALLI, S., Professor and Chairman, Chemistry Department, Livingstone College

Summer Research Scholarships, 1976

(Steps Toward Independence)

BLOODGOOD, Robert Alan, Postdoctoral Fellow, Yale University
DRIEDZIC, William Richard, Postdoctoral Fellow, Pennsylvania State University
HARRIS, Gary C., Graduate Student, University of Massachusetts
HOBBS, Ann Snow, NIH Extramural Postdoctoral Fellow, NINCDS, National Institutes of Health
HORNE, Craig W. S., Research Associate, Memorial Sloan-Kettering Cancer Center
LIVENGOLD, David R., Research Physiologist, Armed Forces Radiobiology Research Institute
MORRIS, Shirley M., Postdoctoral Research Fellow, Boston University
PUMPLIN, David W., Visiting Scientist, NINCDS, National Institutes of Health, and University of Puerto Rico

Research Assistants, 1976

ANDERSON, David J., Harvard University
ARIA, Linda Nan, Mount Holyoke College
BABIAZ, Paula Susan, Syracuse University
BARKALOW, DEREK, Rutgers—The State University of New Jersey
BARRETT, MARTHA B., University of Colorado
BELECKIS, ROBERT A., University of Lowell
BELSKY, ELIZABETH, University of Pennsylvania
BENNETT, HOLLY V. L., Albert Einstein College of Medicine
BOLANOWSKI, STANLEY J., Institute for Sensory Research, Syracuse University
BRYANT, BRUCE, Cornell University
CARTWRIGHT, JOINER T., University of Hawaii
CHALAS, EVA, Albert Einstein College of Medicine
COLE, JAMES J., Boston University Marine Program
COSTA, CHARLES J., University of Maryland
CRISANTI, LYNN, University of Pittsburgh
CSEKNANSKY, JOHN, New York University
DEATON, LEWIS, Florida State University
DE ROSE, R., University of Toronto, Canada
DOMINELLO, GERALDINE, University of Connecticut Health Center
DONALDSON, PATRICIA LYNN, University of California, Irvine
DONMOYER, JUDITH E., University of Wisconsin
DRABKIN, HAROLD J., Wesleyan University
DUNCAN, ROGER, University of Hawaii
EBERHARD, CAROLYN, Cornell University
EDGINTON, DUANE R., Harvard University
ELLWOOD, ROSALIND E., North Carolina State University
EPEL, DEBRA L., Northwestern University
FECHHEIMER, MARCUS, The Johns Hopkins University
FELDMAN, BARBARA, Shriners Burns Institute
FELDMAN, LANCE, University of Texas Medical Branch
FITT, WILLIAM K., Jr., University of California, Irvine
FREGIEN, DEBRA, University of Hawaii
GLAD, RICHARD W., The Johns Hopkins School of Hygiene and Public Health
GREENE, SHARON I., University of Virginia
GRIFITH, LINDA M., Harvard University
GRKO, MARIANNE, University of Basel, Switzerland
HAND, R. TABER, Pomona College
HANKINS, CAROL A., Simmons College
HARRIS, ANDREW L., Albert Einstein College of Medicine
HUDSON, ALAN PAUL, City University of New York
HUNTER, ANN W., Emory University
HURST, TERRY W., University of Texas Medical Branch
HUSE, WILLIAM D., Albert Einstein College of Medicine
ISRAEL, ALAN, New York University School of Medicine
JACOBSEN, RONIE, Dartmouth College
JAMPOL, DELIA, Kresge Eye Institute
JASLOVE, STEWART, Duke University Medical Center
KAUFMANN, KARL, University of Chicago
KELLER, THOMAS C. S., III, University of Virginia
KELLER, LAURA R., University of Virginia
KIEHART, DANIEL P., University of Pennsylvania
KNOWLES, CHERYL A., Ithaca College
KORDIK, ELLEN R., Illinois Institute of Technology
KORMAN, GAIL, Beth Israel Hospital
KUHNS, FRED, Harvard College
LAFRATTA, JAMES M., Harvard Medical School
LAMBERTSEN, RICHARD H., University of Pennsylvania
LAUFER, JESSICA, Brandeis University
LIFSET, REID J., Swarthmore College
LOTTER, SHELLEY, Yale University
LOWENHaupt, MANUEL T., Massachusetts Institute of Technology
LOWRY, JOHN T., JR., Bucknell University
MADIN, Katherine A. C., University of California, Davis
MARKOWITZ, Leslie, Rutgers—The State University of New Jersey
MAKARETZ, Michael, Worcester Foundation Experimental Biology
MARTIN, Jill, University of Connecticut Health Center
MATHEWS, Sarah
MASTROPAOLO, Carmine, City College, The City University of New York
MILLER, Celeste D.
MOORE, Stephen T., Harvard University
MORALES, Eleanor A., Osborn Laboratories of Marine Sciences, New York Aquarium, New York

Zoological Society

MOSSHIER, Jeffrey A., The Johns Hopkins University
MURAKO TORE, John F., Yale University
NARAHASHI, Keiko, Duke University
OLIVE, CADER W., Michigan State University
OSBORN, Maria La Grange, University of Maryland
PARMENTIER, Carol A., Duke University
PAULSON, Andrew M., Yale University
PERRY, George, Scripps Institution of Oceanography
PERRY, J. Gavin, Washington University Medical School
PERSELL, Roger A., Hunter College, The City University of New York
REEVES, Charlotte, Duke University
REINHART, Thomas, Dartmouth College
REVEL, David, University of California, San Diego
RICHARDSON, Ann L., Louisiana State University
RINI, Frank J., Columbia University
ROBERTSON, Lola E., American Museum of Natural History
ROGART, Richard B., Yale University School of Medicine
ROMANO, Frank A., III, Syracuse University
ROSSI, Michael, Case Western Reserve University
SALEM, Esther, Boston University
SALING, Patricia M., University of Pennsylvania
SAMSON, Douglas A., The Johns Hopkins School of Hygiene
SANTIAGO, Eligio M., Washington University School of Medicine
SASS, Sherry L., Southeastern Massachusetts University
SCHAIKER, John, Albert Einstein College of Medicine
SCHERR, Les J., Albert Einstein College of Medicine
SCHOLTYSSEK, Birgit, Wilhelms-Universitat, Eye Hospital, West Germany
SCHRUGS, Virginia, University of Miami
SHE, Joseph, Scarborough College, University of Toronto, Canada
SIEGEL, Ruth E., Harvard Medical School
SMITH, Glenn D., The Johns Hopkins University
SMITH, Rick L., University of Hawaii
SMITH, Tonicia M., Marine Biological Laboratory
SOBOTA, Mary J. University of Minnesota
SPINDEL, Lawrence M., Boston University School of Medicine
STANCHFIELD, James E., Dartmouth College
STICH, Thomas J., The Johns Hopkins University, School of Medicine
SULLIVAN, Brian, AMR Corporation
TAYLOR, Barbara A., Brooklyn College, The City University of New York
THERAN, Ruthanne, St. Francis College
TUNA, Ishik C., The Johns Hopkins University
TUTTLEMAN, Jan, Ithaca College
VIJVERBERG, Henk P. M., Duke University, and University of Utrecht, The Netherlands
VINCENT, Walter S., Dartmouth College
VONUSA, Rosemarie
WALTON, Kerry, University of Iowa
WATSON, Patricia, The Johns Hopkins University
WEISSMAN, Stuart, State University of New York at Stony Brook
WESTERFIELD, Monte, Duke University Medical School
Annual Report of the Marine Biological Laboratory

White, Roy L., University of Illinois
Wilson, Andrew H., Jr., Worcester Foundation for Experimental Biology
Wiltse, Wendy, University of Massachusetts
Wilner, Andrew N., Yale University
Wright, Mary F., Wheelock College
Yonemoto, Wes, University of Hawaii
Yulo, Teresa S., University of Rochester School of Medicine and Dentistry
Zakevicius, Jane M., New York University School of Medicine
Zipkin, Paul H., Yale University
Zukowski, Anthony J., Marietta College

Library Readers, 1976

Adelberg, Edward A., Professor of Human Genetics, Yale University
Allen, Garland E., Associate Professor of Biology and History of Science, Washington University
Andersen, H. A., Research Fellow, Biological Institute of the Carlsberg Foundation
Armstrong, Clara Franzini, Associate Professor of Anatomy, University of Pennsylvania
Beale, Samuel I., Assistant Professor, The Rockefeller University
Bell, Eugene, Professor of Biology, Massachusetts Institute of Technology
Berg, Howard C., Professor of Molecular, Cellular and Developmental Biology, University of Colorado, Boulder
Burr, Arthur H., Assistant Professor, Simon Fraser University, Canada
Carlson, Francis D., Professor of Biophysics, The Johns Hopkins University
Carriere, Rita, Assistant Professor, State University of New York, Downstate Medical Center
Child, Frank M., Professor of Biology, Trinity College
Clare, Arnold M., Professor of Biological Sciences, University of Delaware
Clifford, Sister Adele, Professor of Biology, College of Mount St. Joseph
Colwin, Arthur L., Adjunct Professor, University of Miami
Cooper, Richard A., Chief, Hematology-oncology, University of Pennsylvania
Defendi, Vittorio, Professor and Chairman, Department of Pathology, New York University School of Medicine
De Toledo, Leyla, Associate Professor, Rush Medical College and University of Toronto
Edwards, Louise L., Research Associate, Children's Hospital Medical Center, Boston
Eder, Howard A., Professor of Medicine, Albert Einstein College of Medicine
Ehrenstein, Günter von, Director of the Department of Molecular Biology, Max-Planck Institute for Experimental Medicine, West Germany
Englander, S. W., Professor of Biochemistry and Biophysics, University of Pennsylvania
Etienne, Earl M., Associate Professor of Physiology, University of Massachusetts Medical Center, Worcester
Fell, Paul E., Associate Professor of Zoology, Chairman, Connecticut College
Festoff, Barry W., Associate Professor, Chief, Neurology Service, Kansas University Medical Center, Kansas City VA Hospital
Gabriel, Mordecai L., Dean, School of Science, Brooklyn College, The City University of New York
German, James L., III, Senior Investigator and Director, Laboratory of Human Genetics, The New York Blood Center, and Cornell University Medical College
Gillette, Peter, Assistant Professor of Medicine, State University of New York, Downstate Medical Center
Goldstein, Moise H., Jr., Professor, The Johns Hopkins University
Goudsmit, Esther M., Assistant Professor, Oakland University
Gould, Stephen J., Professor of Geology, Harvard University
Green, James W., Professor of Physiology, Rutgers—The State University of New Jersey
Handler, Philip, President, National Academy of Sciences
Hillman, Peter, Associate Professor of Biophysics, Hebrew University of Jerusalem, Israel
Hinsch, Gertrude W., Associate Professor, University of South Florida
Hopkins, Penny M., Assistant Professor, American Museum of Natural History, Ramapo College of New Jersey
Hunter, R. Douglas, Assistant Professor of Biological Sciences, Oakland University
Isenberg, Irvin, Professor of Biophysics, Oregon State University
LADERMAN, LASTER, LEVITAN, LEIGHTON, KRUPA, KOSOWER, KEOSIAN, KARUSH, KALTENBACH, KAISERMAN-ABRAMOF, ISSELBACHER, SAUNDERS, PEARLMAN, PALMER, MIZELL, PRZYBYLSKI, PRUSCH, PLOCKE, MUNAVALLI, MORRELL, MARSLAND, SHEPRO, SHELANSKI, SHEDLOVSKI, SUSSMAN, STONE, SPECK, STONE, JR., Sussman, MAURICE, Chairman, Department of Life Sciences, University of Pittsburgh
TILNEY, LEWIS, Associate Professor of Biology, University of Pennsylvania
TWEEDDELL, KENYON S., Professor, University of Notre Dame
VAN HOLDE, K. E., Professor of Biophysics, Oregon State University
WAHNO, WALTER, Professor and Chairman, Biochemistry, Rutgers—The State University of New Jersey
Students, 1976

All students listed completed the formal course programs. Asterisk indicates completing post-course research programs.

Summer Programs 1976

ECOLOGY

Andrews, Daniel
Boone, Richard D.
Brown, Aaron D.
Cooper, Rosalind (Sally) B.
de Mello, Richard P.
Fagerness, Vicki L.
Gilinsky, Ellen
Maurer, David R.
McBride, Margaret M.
McCoy, George L.
McNamara, Scott J.
Ryan, Patrick F.
Scholl, James E.
Schwartzkopf, Steven H.
Sullivan, Patricia E.
Wyman, Charles D.

EMBRYOLOGY

Baran, Madelyn M.
Bloom, Kerry S.
Braun, Barbara A.
Bremner, Theodore A.
Cheney, Clarissa M.
Flecha, Miguel
Fregien, Nevis L.
French, Cynthia K.
Fyberg, Eric A.
Golden, Lynn
Griffiths, Jeffrey K.
Hall, Terrence J.
Marchionni, Mark
Marco, Roberto
Merrifield, Peter A.
Nagle, Barbara W.
Parsons, Bruce
Phillips, Carey R.
*Pogel, Burton
*Rosenblith, Allen
States, David J.
Steele, Robert E.
Vaslet, Charles A.
Vito, Christine C.

EXPERIMENTAL INVERTEBRATE ZOOLOGY

*Arceneaux, Mila L.
*Augustine, George J., Jr.
*Battey, James F.
*Becker, Anthony J., Jr.
*Bergstrom, Peter W.
*Bertoldi, Roger V.
*Biela, Christina M.
*Burford, David R., Jr.
*Burke, Elaine M.
*Chaisson, Richard E.
*Colón, Rita D.
*Cook, George A.
*Cooper, Valerie F.
*Dickson, Kathryn A.
*Douglas, Ruth A.
*Earl, Christopher D.
REPORT OF THE DIRECTOR

Fetterer, Raymond H., Jr.
*Greene, Sharon I.
Grega, Debra S.
Lansman, Jeffrey B.
*Leitschuh, Mary K.
*Loest, Robert A.
Maxwell, Catherine S.
Miner, Martin M.
*Orida, Norman K.
Otto, James

Parsons, Pauline G.
Rome, Lawrence C.
*Schneiderman, Anne M.
*Serenian, Leslie A.
Sweeney, Thomas E.
*Vogt, Richard G.
Williams, Marta G.
Williamson, Craig E.
Yamin, Michael A.

EXPERIMENTAL MARINE BOTANY

*Collins, Yvonne
*Cosner, Jill
*Gale, James M.
Guarino, Linda A.
*Herz, Jeffrey M.
Howard, Diana
*Lohan, Christopher S.
Meeson, Blanche W.

*Mishkind, Michael L.
Moshkovski, Dror
*Pocratsky, Linda
*Shure, Richard L.
*Staiano, Lisa F.
Swanberg, Neil R.
Wolfe, James M.
Zullo, James F.

NEUROBIOLOGY

Damassa, David A.
Davis, Thomas L.
Fine, Alan
Fritz, Lawrence C.
Gitschier, Jane M.
Hawkins, Morris, Jr.

Johnston, Michael F.
Pardo, Jose V.
Schehr, Robert S.
Shotton, David M.
Siegel, Sharon B.
Weill, Cheryl L.

PHYSIOLOGY

*Apt, Rebecca L.
*Begg, David A.
*Boardman, Mark A.
Cawley, Michael F.
Chao, Nelson Jen An
*Cooper, David L.
*Dangott, Lawrence J.
Eckhardt, Laurie A.
Ellenbogen, Kenneth A.
*Fowler, Walter E.
*Gehlke, Lee
*Giannini, Michael
*Goetz, George H.
*Hansen, Dale A.
*Hatch, Christopher L.
*Haynes, John K.
*Hereman, Ira M.
Hsu, Ellen
Jackson, Susan
Katzel, Leslie I.
*Kaufman, Harvey W.

*Kielian, Margaret C.
*Lisa, James C.
*Moore, Patrick L.
Mordran, Lawrence J.
Patterson, Thomas A.
*Pratt, Melanie M.
*Price, Maureen G.
Redner, Robert L.
*Roberson, Marie M.
Ronnett, Gabriele V.
*Ryse, Jan S.
Sundborg, Michael A.
*Triplett, Barbara A.
Underwood, Eileen M.
Vafopolou-Mandalos, Xanthe
*Wang, Nancy S.
Wax, Amy L.
*Wilson, Douglas R.
*Wysocki, Lawrence J.
*Zeni, Aurelio

January Programs 1976

BEHAVIOR

Ackerman, William L.
Blatt, Gene J.

Bowles, Rebecca R.
Collins, Linda S.
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

Colomb, Etienne
Coon, Thomas G.
Dowd, Christina
Dyer, Betsey D.
Kolba, Clifford A.
Maciolek, Nancy J.
Miller, Robert E.

Nicholson, Deborah S.
Fitter, Timothy D.
Prince, Cameron E.
Seaborn, Charles R.
Stranger, Carolyn M.
Zimmer, Richard K.

DEVELOPMENTAL BIOLOGY

Arpke, Beth G.
Baird, Wilbur L.
Barrilleaux, Christopher N.
Bindek, Robert L.
Birchard, Geoffrey F.
Enenstein, Judy
Ferl, Robert J.
Herbert, Pamela
Laureno, Kenneth
Lipshtultz, Steven E.
Majocco, Michael D.
Middaugh, Robert E.
Moreau, Pierre
Morelli, Thomas A.
Oschsner, Jessica C.
Ptak, John A.

Raffio, Nancy
Rains, Ross
Reinhart, Thomas E.
Reiss, Paul M.
Richards, Henry M.
Roberts, Christopher W.
Ross, Marian S.
Rosenberg, Michael P.
Rothman, Mark A.
Schumacher, Christine M.
Shore, Scott K.
Smith, Nelson W.
Solomon, Howard M.
Strassman, Jeffrey C.
Van Dover, Cindy L.
Wadsworth, Patricia

ECOLOGY

Ashley, Peter J.
Bablanian, Gayne M.
Blokaw, Richard S., Jr.
Emslie, Margaret W.
Frede, Sascha
Houk, Kathleen A.
Hurd, Richard M.
Jepson, Karen A.
Kawano, Linda S.
Kessler, Steven J.
Lylela, JoAnn D.
Miller, Virginia M.
Moss, David E.
Motten, Alexander F.
Newell, Sandra J.

Patton, Ernest G.
Pierce, Barry A.
Pressley, Thomas A.
Readt, Neale E.
Richmond, Robert H.
Schaffner, Linda C.
Sims, Naomi
Smith, Francie L.
Snow, Allison A.
Spencer, Craig N.
Sussman, Richard
Vaughan, Joseph K.
Wernker, Susan M.
Zowada, Stephanie

NEUROBIOLOGY

Berman, Howard M.
Bertoldi, Roger
Buskirk, Daniel R.
Cohen, Bruce N.
Eisen, Judith S.
Espinosa E., Jose I.
French, Kathleen A.
Greene, Sharon L.
Gerking, Andrew A.
Gregg, Robert
Hayward, Russell A.
Johnson, Harold E., Jr.

Kaminer, Brian
Kuhls, Thomas L.
Lansman, Jeffrey B.
Levy, Edward J.
Mitz, Andrew R.
Paley, David A.
Pappas, Georgia
Pascoe, Natalie G.
Reisner, Peter J.
Sajovic, Peter
Spool, Peter R.
Stenzler, Daniel
YEAR-IN-SCIENCE

Fall 1975
RICHARD D. BOONE
LINDA S. COLLINS
BRUCE F. LEON
KATHRYN K. MATTHEW
CINDY L. VAN DOVER

Spring 1976
TIMOTHY B. BROWN
LINDA S. COLLINS
RICHARD M. HURD
BARRY A. PIERCE
CINDY L. VAN DOVER

3. Scholarships, 1976

Bio Club Scholarship: DORON MOSHKOVSKI
Gary H. Calkins Scholarship: ELAINE M. BURKE
Lucretia Crocker Scholarship: JAMES M. WOLFE
Macy Students: THEODORE BREMNER
YVONNE COLLINS
KITA COLÓN

JAMES F. ZULLO

4. Training Programs

Research Program in Microbial Ecology

I. Instructors
YEHUDA COHEN, The Hebrew University, Jerusalem
JANE A. GIBSON, Cornell University
HOLGER W. JANNASCH, Woods Hole Oceanographic Institution
EDWARD R. LEADBETTER, Amherst College

II. Consultants
HARLYN O. HALVORSON, Brandeis University
J. WOODLAND HASTINGS, Harvard University
ROGER Y. STANIER, Institut Pasteur, Paris
EDWARD O. WILSON, Harvard University

III. Staff Associates
RICHARD P. BLAKEMORE, Woods Hole Oceanographic Institution
JAMES G. FERRY, University of Georgia
KENNETH H. NEALSON, Scripps Institution of Oceanography
JEANNE S. POINDexter, Marymount College
CRAIG D. TAYLOR, Woods Hole Oceanographic Institution

IV. Special Lecturers
ARNOLD L. DEMAIN, Massachusetts Institute of Technology
HENRY EHRlich, Rensselaer Polytechnic Institute
JOEL C. GOLDMAN, Woods Hole Oceanographic Institution
J. WOODLAND HASTINGS, Harvard University
GALEN E. JONES, University of New Hampshire
JOHN W. KANWISHER, Woods Hole Oceanographic Institution
NORMAN LAZAROFF, State University of New York at Binghamton
BEVERLY J. PIERSON, University of Puget Sound, Tacoma
V. Trainees

Lisa Anderson
Barbara A. Hulick
*Steven J. LaCroix
*John A. Leigh
Beverly J. K. Pierson

*James P. Robeson
*Mohammed A. Rouf
Edward G. Ruby
*Richard Sussman

VI. Lectures

H. W. Janassch  Introduction to microbial ecology I and II
H. W. Janassch  Continuous culture in microbial ecology
H. W. Janassch  Theory and practice of the chemostat
H. W. Janassch  Experiments in deep sea microbiology
E. R. Leadbetter  The aerobic way of life
E. R. Leadbetter  Microbial attack of hydrocarbons
E. R. Leadbetter  Enrichment approaches to ecological analysis
J. A. Gibson  Photosynthetic bacteria I
J. A. Gibson  Nutrient uptake and its measurement
Y. Cohen  Photosynthetic bacteria II
Y. Cohen  The Solar Lake
Y. Cohen  The Solar Lake algal mats
J. G. Ferry  The microbial synthesis of acetate from CO₂
J. G. Ferry  Anaerobic microbial food chains
C. D. Taylor  The biology of methane-producing bacteria
C. D. Taylor  Interaction of sulfate reduction and methane production
R. P. Blakemore  Effects of PCBs on marine bacteria
R. P. Blakemore  Bacterial magnetotaxis
J. S. Poindexter  The prosthecate bacteria: where answers why
J. S. Poindexter  The Caulobacter stalk and its development
J. S. Poindexter  The viruses of the Caulobacter group
M. J. Wolin  The anaerobic way of life
M. J. Wolin  Species interaction in anaerobic systems
H. S. Vishniac  Marine fungi
H. S. Vishniac  Yeasts from the Antarctic
K. H. Nealson  Luminescent bacteria and their symbiosis with luminous fish
A. L. Demain  Production and possible function of extracellular antimicrobial metabolites
H. Ehrlich  The bacterial role in the genesis of manganese nodules
J. C. Goldman  Continuous culture of photosynthetic organisms
J. W. Hastings  The biology of bacterial luminescence
G. E. Jones  The microbial sulfur cycle in Oyster Pond
J. W. Kanwisher  Sense and nonsense in modern ecology
N. Lazaroff  Photocatalysis of morphogenesis in blue-greens
B. J. Pierson  Chlorofoxx, a gliding photosynthetic bacterium
D. Pope  The effect of hydrostatic pressure on microbial systems
J. H. Ryther  Aquaculture
R. D. Simon  Cyanophycin granules
J. B. Waterbury  Biology of blue-greens

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<td>Research Assistants</td>
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<td>119</td>
<td>123</td>
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<td>Summer courses</td>
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<td>Experimental Invertebrate Zoology</td>
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<td><strong>Trainees—Total</strong></td>
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<td><strong>Total Attendance</strong></td>
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<td><strong>Institutions Represented—Total</strong></td>
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<td><strong>Foreign Institutions Represented</strong></td>
<td>25</td>
<td>40</td>
<td>31</td>
<td>26</td>
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6. Institutions Represented, 1976

Alabama, University of  
Albert Einstein College of Medicine  
AMR Corporation  
American Museum of Natural History  
Amherst College  
Arizona, University of  
Armed Forces Radiobiology Research Institute  
Baruch College  
Baylor College  
Beth Israel Hospital  
Bloomsburg State College  
Boston College  
Boston University  
Boston University School of Medicine  
Brandeis University  
Brooklyn College, The City University of New York  
Brown University  
Bucknell University  
California, University of, Davis  
California, University of, Irvine  
California, University of, Los Angeles  
California, University of, Riverside  
California, University of, San Diego  
California, University of, San Francisco  
California, University of, Santa Barbara  
California, University of, Santa Cruz  
Cape Cod Community College  
Carnegie-Mellon University  
Case Western Reserve University  
Case Western Reserve University, Medical School  
Children's Hospital Medical Center, Boston  
Chicago, University of  
Cincinnati, University of  
Cincinnati, University of, College of Medicine  
City College, The City University of New York  
Clark University  
Colby College  
College of Mount St. Joseph on the Ohio  
College of St. Rose  
Colorado, University of  
Colorado, University of, Medical Center  
Colorado College
Columbia University
Columbia University, College of Physicians and Surgeons
Connecticut, University of
Connecticut, University of, Health Center
Connecticut College
Cornell University
Cornell University Medical College
Dakota Wesleyan University
Dartmouth College
Delaware, University of
Denison University
Drew University
Duke University
Duke University Medical Center
Eastern Pennsylvania Psychiatric Institute
Eastman Kodak Co.
Eisenhower College
Emory University
Fairleigh Dickinson University
Fitchburg State College
Florida State University
Fordham University
George Mason University
George Washington School of Medicine
Georgetown University
Georgia, University of
Goucher College
Hahnemann Medical College
Hamphire College
Harvard Medical School
Harvard University
Hawaii, University of
Herbert Lehman College, The City University of New York
Hiram College
Hoffmann-LaRoche, Inc., Research Division
Hollins College
Howard University
Hunter College, The City University of New York
Illinois, University of
Illinois Institute of Technology
Indiana University
Institute for Sensory Research
Iowa, University of
Ithaca College
John B. Pierce Foundation Laboratory
Johns Hopkins University, The
Johns Hopkins University, The, School of Hygiene
Kansas City VA Hospital
Kansas State University
Kansas University Medical Center
Kent State University
Kentucky, University of
Kresge Eye Institute, Detroit
Laboratory of Sensory Physiology
Livingstone College
Louisiana State University
Lowell, University of
Luther College
Maine, University of, Orono
Marine Research, Inc.
Marietta College
Maryland, University of
Maryland, University of, School of Medicine
Massachusetts, University of, Amherst
Massachusetts, University of, Boston
Massachusetts, University of, Medical Center, Worcester
Massachusetts General Hospital
Massachusetts Institute of Technology
Medical College of Pennsylvania
Medical University of South Carolina
Mellon Institute of the Carnegie-Mellon University
Memorial Sloan-Kettering Cancer Center
Miami, University of
Miami, University of, School of Marine and Atmospheric Science
Miami, University of, School of Medicine
Michigan, University of
Michigan State University
Minnesota, University of
Moravian College
Mount Holyoke College
Nasson College
National Academy of Sciences
National Foundation for Cancer Research
National Institute of Arthritis, Metabolism and Digestive Diseases
National Institute of Child Health and Development
National Institute of Dental Research
National Institute of Neurological Communicative Disorders and Stroke
National Institute of Scientific Research
National Institutes of Health
National Marine Fisheries Service
New College
New York Aquarium
New York Blood Center, The
New York Medical College
New York University
New York University Medical Center
New York University School of Medicine
New York Zoological Society
Nicholls State University
North Carolina, University of, at Chapel Hill
North Carolina State University, Raleigh
Northeast Fisheries Center
Northeastern University
Northwestern University
Notre Dame, University of
Oakland University
Oberlin College
Oklahoma, University of
Oklahoma State University
Oregon, University of
Oregon State University
Pacific, University of the
Pennsylvania, University of
Pennsylvania, Hospital of the University of
Pennsylvania, University of, School of Medicine
Pennsylvania State University
Pittsburgh, University of
Pittsburgh, University of, School of Medicine
Pomona College
Population Council, The
Postgraduate Center of Mental Health
Princeton University
Puget Sound, University of
Purdue University
Ramapo College of New Jersey
Reed College
Rhode Island, University of
Rochester, University of
Rochester, University of, School of Medicine and Dentistry
Rockefeller University, The
Rush Medical College
Russell Sage College
Rutgers—The State University of New Jersey
Rutgers University Medical School
St. Francis College
St. Lawrence University
Scripps Institution of Oceanography
Shriners Burns Institute
Sidney Farber Cancer Center
Simmons College
South Carolina, University of
South Florida, University of
Southeastern Massachusetts University
Stanford University
State University of New York, Downstate Medical Center
State University of New York, Upstate Medical Center
State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo
State University of New York at Plattsburgh
State University of New York at Stony Brook
Swarthmore College
Syracuse University
Syracuse University, Laboratory of Sensory Communication
Temple University
Tennessee, University of
Tennessee Center for Health Services, University of
Tennessee State University
Texas, University of
Texas, University of, Medical Branch
Texas Christian University
Toledo, University of
Trinity College, Hartford
Tulane University
Union University, Albany Medical College of
Upsala College
Utah, University of
Utah State University
Vassar College
Vermont, University of
Veteran's Administration Hospital, Brooklyn
Virginia, University of
Washington, University of
Washington State University
Washington University, St. Louis
Washington University, School of Medicine
Wayne State University
Wesleyan University
West Virginia State College
Wisconsin, University of
Wistar Institute
Wofford College
Woods Hole Oceanographic Institution
Worcester Foundation Experimental Biology
Wyoming, University of
Yale University
Yale University School of Medicine
FOREIGN INSTITUTIONS REPRESENTED, 1976
Autonoma, University of, Spain
Basel, The University of, Switzerland
Bristol, University of, United Kingdom
British Columbia, University of, Canada
Carlsberg Foundation, Biological Institute of the, Denmark
Central Baptist Seminary, Canada
Centre National de la Recherche Scientifique, France
Chile, University of, Chile
Dalhousie University, Canada
Glasgow, University of, Scotland
Hebrew University, The, Israel
Institute for Marine Environmental Research, United Kingdom
Instituto Venezolano de Investigaciones, Venezuela
Lausanne, University of, Switzerland
Macdonald College of McGill University, Canada
Max-Planck Institute for Experimental Medicine, West Germany
Max-Planck Institute for Psychiatry, West Germany
McGill University, Canada
Medical Research Council—Mammalian Development Unit, United Kingdom
Mexico National University, Mexico
Munster, University of, West Germany
N. Cuyo University, Mendoza, Argentina
7. Friday Evening Lectures, 1976

June 25

Arnold J. Levine................. Mechanisms of tumorigenesis of the small DNA tumor viruses
Princeton University

July 2

Howard C. Berg.................. How bacteria move about
University of Colorado

July 8

Charles Phillips................. Electrical stimulation of nerve centers I
Oxford University, England;
Alexander Forbes Lecturer, MBL

July 9

Charles Phillips................. Electrical stimulation of nerve centers II
Oxford University, England;
Alexander Forbes Lecturer, MBL

July 16

Mary Lou Pardue................. Structure and function in Drosophila chromosomes
Massachusetts Institute of Technology

July 23

Frank Ruddle.................... Cell genetic studies in man and mouse
Yale University

July 30

Frederik B. Bang................. Invertebrate pathology and human disease
The Johns Hopkins University

August 5

John Paul....................... Molecular biology of erythropoiesis
The Beatson Institute for Cancer Research, University of Glasgow;
Lillie Fellow, MBL
August 13

Jean Lindenmann............ Inborn resistance to influenza virus—a failure
University of Zürich; Rand story
Fellow, MBL

August 20

Peter Satir..................... Control of microtubule sliding in cilia
University of California, Berkeley

August 27

Richard Eakin................. "Glimpses of my life's work" by "Hans Spemann"
University of California, Berkeley (an impersonation)

8. Members of the Corporation, 1976
Including Action of 1976 Annual Meeting

Life Members

Adolph, Dr. Edward F., University of Rochester School of Medicine and Dentistry, Rochester, New York 14627
Barth, Dr. Lester G., Marine Biological Laboratory, Woods Hole, Massachusetts 02543
Beam, Dr. Harold W., Department of Zoology, State University of Iowa, Iowa City, Iowa 52240
Behre, Dr. Ellinor H., Black Mountain, North Carolina 28711
Bertholf, Dr. Lloyd M., 307 Phoenix Ave., Bloomington, Illinois 61701
Bodansky, Dr. Oscar, 16 Hawks Nest Road, Stony Brook, New York 11790
Bold, Dr. Harold C., Department of Botany, University of Texas, Austin, Texas 78712
Bridgman, Dr. A. Josephine, 715 Kirk Rd., Decatur, Georgia 30030
Brown, Dr. Dugald E. S., Cape Haze, Box 426, Placida, Florida 33946
Burdick, Dr. C. Lalor, The Lalor Foundation, 4400 Lancaster Pike, Wilmington, Delaware 19805
Clarke, Dr. George L., 44 Juniper Road, Belmont, Massachusetts 02178
Cole, Dr. Elbert C., 2 Chipman Park, Middlebury, Vermont 05753
Colwin, Dr. Arthur L., 320 Woodcrest Rd., Key Biscayne, Florida 33149
Colwin, Dr. Laura H., 320 Woodcrest Rd., Key Biscayne, Florida 33149
Crouse, Dr. Helen V., Institute of Molecular Biophysics, Florida State University, Tallahassee, Florida 32306
Diller, Dr. Irene C., 2417 Fairhill Avenue, Glenside, Pennsylvania 19038
Diller, Dr. William F., 2417 Fairhill Avenue, Glenside, Pennsylvania 19038
Ferguson, Dr. James K. W., 56 Clarkson St., Thornhill, Ontario, Canada
Fischer, Dr. Ernst, 3110 Manor Drive, Richmond, Virginia 23230
Fries, Dr. Erik F. B., 3870 Leafy Way, Miami, Florida 33133
Furth, Dr. Jacob, 99 Fort Washington Ave., New York, New York 10032
Gaffron, Dr. Hans, P. O. Box 308, Sanibel, Florida 33959
GALTSOFF, DR. PAUL S., National Marine Fisheries Service, Woods Hole, Massachusetts 02543
GRAY, DR. IRVING E., Department of Zoology, Duke University, Durham, North Carolina 27701
GRUNDFEST, DR. HARRY, Department of Neurology, Columbia University, College of Physicians and Surgeons, New York, New York 10032
HAMBERGER, DR. VIKTOR, Department of Zoology, Washington University, St. Louis, Missouri 63130
HIBBARD, DR. HOPE, 143 E. College St., Apt. 309, Oberlin, Ohio 44074
HISAW, DR. F. L., 5925 S. W. Plymouth Drive, Corvallis, Oregon 97330
HOLLAENDER, DR. ALEXANDER, Associated University, Inc., 1717 Massachusetts Ave., N. W., Washington, D. C. 20036
IRVING, DR. LAURENCE, University of Alaska, College, Alaska 99701
KAAN, DR. HELEN, 62 Locust St., Apt. 244, Falmouth, Massachusetts 02540
KAHLER, ROBERT, P. O. Box 423, Woods Hole, Massachusetts 02543
LYNN, DR. W. GARDNER, Department of Biology, Catholic University of America, Washington, D. C. 20017
MAGRUDER, DR. SAMUEL R., 270 Cedar Lane, Paducah, Kentucky 42001
MALONE, DR. E. P., 6610 North 11th Street, Philadelphia, Pennsylvania 19126
MANWELL, DR. REGINALD D., Department of Biology, Syracuse University, Syracuse, New York 13210
MARSLAND, DR. DOUGLAS, 3523 Loquat Ave., Miami, Florida 33101
MILLER, DR. JAMES A., Department of Anatomy, Tulane University, New Orleans, Louisiana 70112
MOUL, DR. E. T., 42 F. R. Lillie Rd., Woods Hole, Massachusetts 02543
PAGE, DR. IRVING H., Cleveland Clinic, Euclid at E. 93rd Street, Cleveland, Ohio 44106
PAYNE, DR. FERNANDUS, Wesley Manor, 1555 N. Main St., Frankfort, Indiana 46041
PLOUGH, DR. HAROLD H., 31 Middle Street, Amherst, Massachusetts 01002
POLLISTER, DR. A. W., Box 23, Dixfield, Maine 04224
POND, SAMUEL E., P. O. Box 63, E. Winthrop, Maine 04343
PORTER, DR. H. C., University of Pennsylvania, Philadelphia, Pennsylvania 19174
PRTZ, DR. MARGARET MCD., 21 McCouns Lane, Oyster Bay, New York 11771
RICHARDS, DR. A. GLENN, Department of Entomology, University of Minnesota, St. Paul, Minnesota 55101
RUGH, DR. ROBERTS, Grovenor Park, Apt. 1018, 10500 Rockville Pike, Rockville, Maryland 20852
SCHMITT, DR. FRANCIS O., 165 Allen Dale St., Jamaica Plain, Massachusetts 02130
SCHRADER, DR. SALLY, 2717 Dogwood Rd., Durham, North Carolina 27705
SCHRAPP, DR. J. R., Department of Plant Sciences, Indiana University, Bloomington, Indiana 47401
SEVERINGHAUS, DR. AURA E., 375 West 250th Street, New York, New York 10071
SICHEL, DR. ELSA K., 4 Whitman Rd., Woods Hole, Massachusetts 02543
SMITH, DR. DIETRICH C., 216 Oak Forest Ave., Catonsville, Maryland 21228
SONNEBORN, DR. T. M., Department of Zoology, Indiana University, Bloomington, Indiana 47401
REPORT OF THE DIRECTOR

SPEIDEL, DR. CARL C., 1873 Field Road, Charlottesville, Virginia 22903
STRAUS, DR. W. L., JR., Department of Anatomy, The Johns Hopkins University Medical School, Baltimore, Maryland 21205
STUNKARD, DR. HORACE W., American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024
TAYLOR, DR. W. RANDOLPH, Department of Botany, University of Michigan, Ann Arbor, Michigan 48104
TEWINNEL, DR. LOIS E., 4 Sanderson Ave., Northampton, Massachusetts 01060
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REPORT OF THE DIRECTOR

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Zorzoli, Dr. Anita, Department of Biology, Vassar College, Poughkeepsie, New York 12601
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VI. REPORT OF THE LIBRARIAN

At the beginning of the year the Library Committee members were asked to cut $20,000 from the annual subscription budget. A complete list of all journal titles, both MBL and WHOI, was circulated to the Committee before the summer meetings. Fortunately for the collection, all members resisted strenuously and, as a consequence, not one subscription was cancelled. However, in anticipation of such a cut, very few new books were ordered by the Laboratory, but the book collection did not suffer. The summer book exhibitors were very generous with their gifts of new books (in lieu of a fee for space) and the Woods Hole Oceanographic Institution spent $17,211 for library books; $3,200 of that amount for sorely needed reference books.

Our library places an even increasing burden on Laboratory funds, and this year the Library Committee was asked to draft a proposal that would involve both the MBL and WHOI in the responsibility of maintaining the collection at its present level of excellence. Many meetings were held and a final proposal was presented at the Annual Meeting in August. Lively debate ensued, and the Corporation Meeting was re-convened three times before final adjournment. At issue was the Library becoming a separate Corporation supported by both MBL and WHOI and governed by a Board of Trustees drawn from members of both institutions. By the end of the year no definite decision had been reached, but further proposals have been submitted and discussion is continuing.

The most valuable volumes in the collection are now protected and housed in a larger Rare Books Room on the third floor—the old xerox room. This move was made possible by a very generous gift from an anonymous donor. The present Rare Books Room in the library offices had shelf space for only 500 volumes. The new area can shelf 3,000 volumes. A security system has been installed and the oldest and most valuable journal volumes are now in this area. Dr. Garland Allen, an expert in the History of Science, donated much of his time helping us determine which volumes should be moved to this "secure" area.

Space is still one of our major problems. Room 306, which was renovated to aid with the increased volume of book purchases by the Oceanographic, is just about full, and some new journal sets in the Marine Policy section have had to be shelved there. Three new journal sets (large gifts) are shelved on the counters in the stacks awaiting major moves in the journal collection.

Interlibrary loan requests increased again this year: approximately 7,000 requests for articles were filled in 1976. Our copy department processed 660,000 sheets of xerox during the year, and we now have two staff members handling this operation on a year-round basis. Two operators were added during the peak
summer months. Total number of volumes in the collection at the end of 1976 is 161,864.

VII. REPORT OF THE TREASURER

The Marine Biological Laboratory had an excess of revenues over expenditures (excluding depreciation) of $106,197 in 1976 as compared to a deficit of $318,943 in 1975. The favorable difference of $425,140 reflects in large measure an increase in overhead related to research space of $308,248. The staff deserves great credit for their convincing presentation of the effect of the Laboratory's seasonal pattern of activity upon its costs of operation, which resulted in an increase in the allowed overhead rate from $16.23 to $31.29, a 93% increase. The change is retroactive to January 1, 1975. Accordingly, $110,631 of revenue recognized in 1976 is in fact related to 1975.

It has been pointed out in the past that the control of expenditures at the Laboratory has been effective, particularly taking into account inflation and its effect upon almost all elements of costs. However, prior to 1976, income had not kept pace with expenses resulting in annual cash deficits beginning in 1969. It is therefore gratifying to see the progress made in 1976 to correct this imbalance.

In addition to the increase in overhead rates, revenues also reflect first-time support for the Library in the amount of $10,000 each from the U. S. Fisheries and U. S. Geological Survey. The Woods Hole Oceanographic Institution increased its support from $20,000 to $30,000.

Income from Research Services (including the Supply Department) increased by $37,675 from $181,200 to $218,875.

Unrestricted gifts increased by $45,501 from $50,684 to $96,185 due in large measure to increased support from foundations and corporations.

Investment income for the year (on both unrestricted and restricted funds) amounted to $302,322 as compared to $261,540 in 1975, an increase of $40,782 or 16%. This represents a cash yield of 5.8% on the cost of the underlying investments. This yield reflects the percentage of the Laboratory's portfolio invested in common stocks. In addition to investment income, there were realized gains on the sales of investments of $175,732 which go to increase the Laboratory's endowment funds.

Grants and gifts of $1,549,931 were received in 1976, compared to $1,805,397 in 1975. Of the 1976 amount, $1,453,746 were designated to be used for specific programs. At year end 1976, there remained $1,279,573 in pledges for specific programs of the Laboratory ($887,109 at December 31, 1975). These amounts are scheduled to be received in the years 1977 to 1980 inclusive.

A year ago, the role of the mbl Associates in making possible the very attractive landscaping of the Quadrangle was recognized. In 1976 the Associates provided further funds, the income from which will go to maintain the area.

It should be noted here that the comparison of revenues and expenses for 1976 and 1975 is distorted by the effect of the change in the operation of the dining hall from the meal ticket system used in 1975 (under which the Laboratory collected the price of meal tickets and reimbursed the dining hall operator) to the "a la carte" system in 1976, with users making payment for meals directly to the
operator. This resulted in a $111,790 decrease in revenues, partially offset by a $97,753 decrease in dining hall operating expenses.

Adjusted for these changes, total operating expenses increased by $52,633 from $2,937,494 to $2,990,127. This was in turn the result of a decrease in unrestricted operating expenses of $170,705 and an increase in expenditures for designated purposes (i.e., restricted) of $223,338.

The decrease in unrestricted expenses reflects a $45,918 decline in repairs and remodeling and a $36,262 difference resulting from the write-off in 1975 of old issues of The Biological Bulletin. As can be seen, apart from these items, unrestricted expenses were still below the 1975 level with, of course, increases and decreases in specific categories of expense.

The increase in expenditures for designated purposes from $952,464 in 1975 to $1,175,802 in 1976, an increase of $223,338 or 23%, reflects in large part an increased level of activity in The Ecosystems Center, together with the addition of several new research grants or contract-supported programs administered by the MBL.

This increase was after a $91,171 decrease in restricted plant expenditures reflecting both the $125,718 expended in 1975 for the landscaping of the Quadrangle with funds provided by the MBL Associates and the expenditure of $30,000 in 1976 to renovate the Neurobiology class laboratory.

Noteworthy also is an increase in 1976 of $50,392 (from $108,590 to $158,982) in scholarships and stipends. This increase reflects the Josiah Macy Foundation grants, the higher level of awards under the Steps Toward Independence Program and the awards to students by The Ecosystems Center.

The increase in the overhead rate and other steps taken to improve income result in a more favorable outlook for the Laboratory than existed a year ago. However, further improvement is needed not only to keep pace with inflation but more importantly to support in full the programs for which the Laboratory is deservedly famous.

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 of December 31, 1976, and the related statements of current funds revenues, expenditures, and other changes and changes in fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included confirmation from the custodians of securities owned at December 31, 1976, and such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

As more fully described in Note B to the financial statements, the Laboratory excludes certain costs of buildings and equipment from the balance sheet. In our opinion, generally accepted accounting principles require that such costs be included as investment in plant in the financial statements.

In our opinion, except for the effects on the financial statements of the matter discussed in the preceding paragraph, the aforementioned financial
REPORT OF THE TREASURER

statements present fairly the financial position of Marine Biological Laboratory at December 31, 1976, and its current funds revenues, expenditures and other changes and the changes in its fund balances for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

The summary of investments included herein was obtained from the Laboratory's records in the course of our examination and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

Boston, Massachusetts
April 1, 1977

Coopers & Lybrand
MARINE BIOLOGICAL LABORATORY

Balance Sheet

December 31, 1976 and 1975

<table>
<thead>
<tr>
<th></th>
<th>1976</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSETS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current Funds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash, including deposits at interest</td>
<td>$213,950</td>
<td>$49,066</td>
</tr>
<tr>
<td>Accounts receivable, net of allowance for uncollectible accounts of $15,566 in 1976 and $20,000 in 1975</td>
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<td>292,477</td>
</tr>
<tr>
<td>Other assets</td>
<td>$6,141</td>
<td>5,927</td>
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<tr>
<td>Due to restricted current funds</td>
<td>$(124,371)</td>
<td>$(231,283)</td>
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<tr>
<td>Due from invested funds</td>
<td>$65,557</td>
<td>68,505</td>
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<tr>
<td>Total unrestricted</td>
<td>$608,018</td>
<td>184,692</td>
</tr>
<tr>
<td>Restricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>1,959</td>
<td>37,909</td>
</tr>
<tr>
<td>Investments, at cost; market value: 1976—$1,339,892; 1975—$1,169,931 (Note A, Schedule I)</td>
<td>1,305,084</td>
<td>1,170,009</td>
</tr>
<tr>
<td>Due from unrestricted current fund</td>
<td>$124,371</td>
<td>231,283</td>
</tr>
<tr>
<td>Due from invested funds</td>
<td>$136,124</td>
<td>—</td>
</tr>
<tr>
<td>Total restricted</td>
<td>$1,567,538</td>
<td>1,439,201</td>
</tr>
<tr>
<td><strong>Invested Funds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>3,297</td>
<td>23,571</td>
</tr>
<tr>
<td>Investments, at cost; market value: 1976—$4,482,948; 1975—$3,880,277 (Note A, Schedule I)</td>
<td>4,092,770</td>
<td>3,852,003</td>
</tr>
<tr>
<td>Due to unrestricted current fund</td>
<td>$(65,557)</td>
<td>$(68,505)</td>
</tr>
<tr>
<td>Due to restricted current funds</td>
<td>$(136,124)</td>
<td>—</td>
</tr>
<tr>
<td>Total invested funds</td>
<td>$3,895,821</td>
<td>$3,807,069</td>
</tr>
<tr>
<td><strong>Plant Fund</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land, buildings and equipment at cost (Note B)</td>
<td>12,345,587</td>
<td>12,378,202</td>
</tr>
<tr>
<td>Less accumulated depreciation</td>
<td>3,497,254</td>
<td>3,248,932</td>
</tr>
<tr>
<td>Total plant fund</td>
<td>$8,848,333</td>
<td>$9,129,270</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the financial statements.
REPORT OF THE TREASURER

MARINE BIOLOGICAL LABORATORY

BALANCE SHEET

December 31, 1976 and 1975

<table>
<thead>
<tr>
<th>LIABILITIES AND FUND BALANCES</th>
<th>1976</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current Funds:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts payable and accrued expenses</td>
<td>$173,387</td>
<td>$96,396</td>
</tr>
<tr>
<td>Deferred income</td>
<td>$60,335</td>
<td>$49,037</td>
</tr>
<tr>
<td>Fund balance</td>
<td>374,296</td>
<td>39,259</td>
</tr>
<tr>
<td>Total unrestricted</td>
<td>608,018</td>
<td>184,692</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fund balances:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpended gifts and grants</td>
<td>1,507,577</td>
<td>1,387,044</td>
</tr>
<tr>
<td>Unexpended income (Note E)</td>
<td>59,961</td>
<td>52,157</td>
</tr>
<tr>
<td>Total restricted</td>
<td>1,567,538</td>
<td>1,439,201</td>
</tr>
<tr>
<td>Total current funds</td>
<td>$2,175,556</td>
<td>$1,623,893</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Invested Funds:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endowment funds (Note E)</td>
<td>2,147,067</td>
<td>1,905,920</td>
</tr>
<tr>
<td>Quasi-endowment funds</td>
<td>1,260,509</td>
<td>1,462,894</td>
</tr>
<tr>
<td>Retirement fund (Note C)</td>
<td>488,245</td>
<td>438,255</td>
</tr>
<tr>
<td>Total invested funds</td>
<td>$3,895,821</td>
<td>$3,807,069</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plant Fund:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invested in plant</td>
<td>8,848,333</td>
<td>9,129,270</td>
</tr>
<tr>
<td>Total plant fund</td>
<td>$8,848,333</td>
<td>$9,129,270</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the financial statements.
## MARINE BIOLOGICAL LABORATORY

### STATEMENT OF CURRENT FUNDS REVENUES, EXPENDITURES, AND OTHER CHANGES

for the year ended December 31, 1976

(with comparative summary statement totals for the preceding year)

<table>
<thead>
<tr>
<th></th>
<th>Unrestricted</th>
<th>Restricted</th>
<th>Total 1976</th>
<th>Total 1975</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuition</td>
<td>$ 129,605</td>
<td>$ 43,100</td>
<td>$ 172,705</td>
<td>$ 135,400</td>
</tr>
<tr>
<td>Grants and contracts:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>5,394</td>
<td>125,301</td>
<td>130,695</td>
<td>242,549</td>
</tr>
<tr>
<td>Private</td>
<td>26,916</td>
<td>26,916</td>
<td>26,916</td>
<td>91,923</td>
</tr>
<tr>
<td>Research (Note D):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory rentals</td>
<td>483,952</td>
<td>483,952</td>
<td>371,523</td>
<td></td>
</tr>
<tr>
<td>Grants and contracts:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>192,101</td>
<td>373,454</td>
<td>565,555</td>
<td>211,441</td>
</tr>
<tr>
<td>Private</td>
<td>132,115</td>
<td>473,181</td>
<td>605,296</td>
<td>379,069</td>
</tr>
<tr>
<td>Dormitory</td>
<td>245,349</td>
<td>245,349</td>
<td>258,788</td>
<td></td>
</tr>
<tr>
<td>Dining hall</td>
<td>38,985</td>
<td>38,985</td>
<td>150,775</td>
<td></td>
</tr>
<tr>
<td>Library</td>
<td>120,318</td>
<td>120,318</td>
<td>92,851</td>
<td></td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>71,727</td>
<td>71,727</td>
<td>70,670</td>
<td></td>
</tr>
<tr>
<td>Support departments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research services</td>
<td>138,771</td>
<td>138,771</td>
<td>87,712</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>80,104</td>
<td>80,104</td>
<td>93,488</td>
<td></td>
</tr>
<tr>
<td>Investment income</td>
<td>147,625</td>
<td>28,016*</td>
<td>175,641*</td>
<td>178,172*</td>
</tr>
<tr>
<td>Gifts</td>
<td>96,185</td>
<td>105,834</td>
<td>202,019</td>
<td>218,849</td>
</tr>
<tr>
<td>Other</td>
<td>38,291</td>
<td>38,291</td>
<td>35,341</td>
<td></td>
</tr>
<tr>
<td><strong>Total revenues</strong></td>
<td>1,920,522</td>
<td>1,175,802</td>
<td>3,096,324</td>
<td>2,618,551</td>
</tr>
</tbody>
</table>

* Investment income from restricted funds is included only to the extent of its application to expenses. Total investment income on unrestricted and restricted funds including the retirement fund was $302,322 in 1976 and $261,540 in 1975 (see Schedule I).
### Operating expenditures:

<table>
<thead>
<tr>
<th></th>
<th>Unrestricted</th>
<th>Restricted</th>
<th>1976 Total</th>
<th>1975 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>86,351</td>
<td>109,347</td>
<td>195,698</td>
<td>312,332</td>
</tr>
<tr>
<td>Research</td>
<td>5,029</td>
<td>846,635</td>
<td>851,664</td>
<td>511,736</td>
</tr>
<tr>
<td>Scholarships and stipends</td>
<td></td>
<td>158,982</td>
<td>158,982</td>
<td>108,590</td>
</tr>
<tr>
<td>Dormitory</td>
<td>111,590</td>
<td></td>
<td>111,590</td>
<td>112,859</td>
</tr>
<tr>
<td>Dining hall</td>
<td>36,300</td>
<td></td>
<td>36,300</td>
<td>134,053</td>
</tr>
<tr>
<td>Library</td>
<td>185,669</td>
<td>19,075</td>
<td>204,744</td>
<td>189,990</td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>79,625</td>
<td></td>
<td>79,625</td>
<td>112,143</td>
</tr>
<tr>
<td>Support departments:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research services</td>
<td>243,891</td>
<td>2,500</td>
<td>246,391</td>
<td>205,529</td>
</tr>
<tr>
<td>Supply</td>
<td>197,919</td>
<td>45</td>
<td>197,964</td>
<td>225,404</td>
</tr>
<tr>
<td>Administration</td>
<td>398,868</td>
<td>4,671</td>
<td>403,539</td>
<td>397,569</td>
</tr>
<tr>
<td>Plant operation</td>
<td>469,083</td>
<td>34,547</td>
<td>503,630</td>
<td>626,919</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td>370</td>
</tr>
<tr>
<td><strong>Total expenditures</strong></td>
<td><strong>1,814,325</strong></td>
<td><strong>1,175,802</strong></td>
<td><strong>2,990,127</strong></td>
<td><strong>2,937,494</strong></td>
</tr>
<tr>
<td><strong>Excess (deficit) of revenues</strong></td>
<td><strong>106,197</strong></td>
<td><strong>—</strong></td>
<td><strong>106,197</strong></td>
<td><strong>(318,943)</strong></td>
</tr>
</tbody>
</table>

### Transfers and additions:

<table>
<thead>
<tr>
<th></th>
<th>Unrestricted</th>
<th>Restricted</th>
<th>1976 Total</th>
<th>1975 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess of restricted gifts and grants received over amounts expended</td>
<td></td>
<td>128,337</td>
<td>128,337</td>
<td>731,275</td>
</tr>
<tr>
<td>From plant fund—proceeds of sale of plant assets</td>
<td>29,040</td>
<td></td>
<td>29,040</td>
<td>75,000</td>
</tr>
<tr>
<td>From quasi-endowment fund</td>
<td>199,800</td>
<td></td>
<td>199,800</td>
<td>—</td>
</tr>
<tr>
<td>Utilized in current operations</td>
<td></td>
<td></td>
<td></td>
<td>267,320</td>
</tr>
<tr>
<td><strong>Net transfers and additions</strong></td>
<td><strong>228,840</strong></td>
<td><strong>128,337</strong></td>
<td><strong>357,177</strong></td>
<td><strong>1,073,595</strong></td>
</tr>
<tr>
<td><strong>Net increase in fund balances</strong></td>
<td><strong>$ 335,037</strong></td>
<td><strong>$ 128,337</strong></td>
<td><strong>$ 463,374</strong></td>
<td><strong>$ 754,652</strong></td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the financial statements.
**Marine Biological Laboratory**

**Statement of Changes in Fund Balances**

For the year ended December 31, 1976

<table>
<thead>
<tr>
<th>Current Funds</th>
<th>Invested Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unrestricted</td>
</tr>
<tr>
<td><strong>Revenues and other additions:</strong></td>
<td></td>
</tr>
<tr>
<td>Unrestricted current fund revenues</td>
<td>$1,920,522</td>
</tr>
<tr>
<td>Grants and gifts</td>
<td></td>
</tr>
<tr>
<td>Realized net gains (losses) on sale of investments</td>
<td></td>
</tr>
<tr>
<td>Investment income</td>
<td></td>
</tr>
<tr>
<td>Proceeds of sale of equipment</td>
<td></td>
</tr>
<tr>
<td>Addition to pension fund</td>
<td></td>
</tr>
<tr>
<td>Tuition</td>
<td></td>
</tr>
<tr>
<td><strong>Total revenues and other additions:</strong></td>
<td>$1,920,522</td>
</tr>
<tr>
<td><strong>Expenditures and other reductions:</strong></td>
<td></td>
</tr>
<tr>
<td>Instruction, research and general expenditures</td>
<td>1,814,325</td>
</tr>
<tr>
<td>Indirect costs</td>
<td></td>
</tr>
<tr>
<td>Payments to pensioners</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td></td>
</tr>
<tr>
<td><strong>Total expenditures and other reductions:</strong></td>
<td>1,814,325</td>
</tr>
<tr>
<td><strong>Transfers among funds—additions (deductions):</strong></td>
<td></td>
</tr>
<tr>
<td>Proceeds of sale of equipment</td>
<td>29,040</td>
</tr>
<tr>
<td>Transfer to current funds</td>
<td>199,800</td>
</tr>
<tr>
<td><strong>Total transfers:</strong></td>
<td>228,840</td>
</tr>
<tr>
<td><strong>Net increase (decrease) for the year:</strong></td>
<td>335,037</td>
</tr>
<tr>
<td>Fund balances at beginning of year, restated (Note E)</td>
<td>39,259</td>
</tr>
<tr>
<td><strong>Fund balances at end of year:</strong></td>
<td>$374,296</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the financial statements.
A. Significant Accounting Policies:

Basis of Presentation—Fund Accounting

In order to ensure observance of limitations and restrictions placed on the use of resources available to the Laboratory, the accounts of the Laboratory are maintained in accordance with the principles of “fund accounting.” This is the procedure by which resources are classified into separate funds in accordance with activities or objectives specified. In the accompanying financial statements, funds that have similar characteristics have been combined.

Externally restricted fund may only be utilized in accordance with the purposes established by the source of such funds. However, the Laboratory retains full control over the utilization of unrestricted funds. Restricted gifts, grants, and other restricted resources are accounted for in the appropriate restricted funds. Restricted current funds are reported as revenue when expended for current operating purposes. Unrestricted revenue is reported as revenue in the unrestricted current fund when received.

Endowment funds are subject to restrictions requiring that the principal be invested and only the income utilized. Quasi-endowment funds have been established by the Laboratory for the same purposes as endowment funds, however, any portion of these funds may be expended.

Investments

Investments purchased by the Laboratory are carried at cost. Investments donated to the Laboratory are carried at fair market value at date received. For determination of gain or loss upon disposal, cost is determined based on the specific identification method.

Investment Income and Distribution

The Laboratory follows the accrual basis of accounting except that investment income is recorded on a cash basis. The difference between such basis and the accrual basis does not have a material effect on the determination of investment income earned on a year-to-year basis.

Investment income includes income from the investments of specific funds and from the pooled investment account. Income from the pooled investment account is distributed to the participating funds on the basis of the market value at the beginning of the quarter, adjusted for the cost of any additions or disposals during the quarter.

Indirect Cost Recovery

The Laboratory recovers indirect costs by charging occupants of laboratory space fees based on an estimated indirect cost rate for the period the space is occupied. The estimated rate is adjusted on a retroactive basis upon determination of actual indirect costs for the year.

B. Land, Buildings and Equipment:

Following is a summary of the plant fund assets:

<table>
<thead>
<tr>
<th>Classification</th>
<th>1976</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>$ 639,693</td>
<td>$ 639,693</td>
</tr>
<tr>
<td>Buildings</td>
<td>10,143,088</td>
<td>10,148,461</td>
</tr>
<tr>
<td>Equipment</td>
<td>1,562,806</td>
<td>1,590,048</td>
</tr>
<tr>
<td></td>
<td>12,345,587</td>
<td>12,378,202</td>
</tr>
<tr>
<td>Less accumulated depreciation</td>
<td>3,497,254</td>
<td>3,248,932</td>
</tr>
<tr>
<td></td>
<td>$ 8,848,333</td>
<td>$ 9,129,270</td>
</tr>
</tbody>
</table>
The original cost of land, buildings and related initial furnishing equipment is capitalized when the assets are acquired. The cost of subsequent additions and purchases, repairs and remodeling is expensed when incurred. Equipment and remodeling expenditures amount to approximately $52,000 and $71,000 in 1976 and 1975, respectively.

Depreciation is computed using the straight-line method over estimated useful lives of 40 years for buildings and 20 years for equipment.

C. Retirement Fund:

The Laboratory has a noncontributory pension plan for substantially all full-time employees which complies with the requirements of the Employee Retirement Income Security Act of 1974. The actuarially determined pension expenses charged to operations in 1976 and 1975 were $54,973 and $43,353, respectively. The Laboratory’s policy is to fund pension costs accrued.

D. Research Revenues:

The 1976 research revenues include approximately $111,000 of retroactive overhead rate adjustments to amounts previously billed in 1975.

E. Reclassification of Endowment Fund Principal and Unexpended Income:

It was determined that $95,213 of principal in the endowment funds and $22,010 of unexpended income in the current restricted funds balances at January 1, 1975 actually represented unrestricted amounts which should have been included in current unrestricted funds. These amounts have been treated as a correction of the current unrestricted fund balance as of January 1, 1975.

F. Pledges and Grants:

As of December 31, 1976, approximately $1,280,000 remains to be received from previous gifts and grants for specific research and instruction programs, and is expected to be received as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>$ 891,000</td>
</tr>
<tr>
<td>1978</td>
<td>269,000</td>
</tr>
<tr>
<td>1979</td>
<td>114,000</td>
</tr>
<tr>
<td>1980</td>
<td>6,000</td>
</tr>
</tbody>
</table>

$1,280,000
REPORT OF THE TREASURER

SCHEDULE I

MARINE BIOLOGICAL LABORATORY

SUMMARY OF INVESTMENTS

December 31, 1976

<table>
<thead>
<tr>
<th>Invested Funds:</th>
<th>Cost Amount</th>
<th>%</th>
<th>Market Amount</th>
<th>%</th>
<th>1976 Investment Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. Government securities</td>
<td>$603,324</td>
<td>14.7</td>
<td>$626,116</td>
<td>14.0</td>
<td>$17,714</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>914,634</td>
<td>22.4</td>
<td>801,032</td>
<td>17.9</td>
<td>52,191</td>
</tr>
<tr>
<td>Common stocks</td>
<td>2,112,140</td>
<td>51.6</td>
<td>2,597,619</td>
<td>57.9</td>
<td>112,465</td>
</tr>
<tr>
<td>Commercial paper</td>
<td>326,367</td>
<td>8.0</td>
<td>326,367*</td>
<td>7.3</td>
<td>21,823</td>
</tr>
<tr>
<td>Preferred stocks</td>
<td>118,756</td>
<td>2.9</td>
<td>114,265</td>
<td>2.5</td>
<td>5,229</td>
</tr>
<tr>
<td>Real estate</td>
<td>17,549</td>
<td>.4</td>
<td>17,549*</td>
<td>.4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$4,092,770</td>
<td>100.0</td>
<td>$4,482,948</td>
<td>100.0</td>
<td>209,422</td>
</tr>
<tr>
<td>Less custodian fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,760</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>198,662</td>
</tr>
</tbody>
</table>

Current Restricted Funds:

| U. S. Government securities | $1,297,254 | 99.4 | $1,332,062 | 99.4 |
| Certificate of deposit     | 7,830      | .6   | 7,830*    | .6   |
| Total                      | $1,305,084 | 100.0 | $1,339,892 | 100.0 | 99,126                |

Current Unrestricted Funds:

Earned on corporate savings account | 4,534

Net investment income | $302,322

Disposition of investment income:

Unrestricted-utilized in current operations | 147,625

Restricted for current use:

Research | $101,985
Scholarships | 17,067
Library | 17,851

Retirement fund | 17,794

$302,322

* At cost.