

The Marine Biological Laboratory

Ninety-Third Report for the Year 1990 One-Hundred and Third Year

Officers of the Corporation

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of Trustees*

Prosser Gifford, *Chairman of the Board of Trustees*

Harlyn O. Halvorson, *President of the Corporation and
Director*

Robert D. Manz, *Treasurer*

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Report of the President and Director

I began last year's report by discussing the Laboratory's needs and reminding the Corporation of the pressing need for a new Marine Resources Center capable of providing a reliable, healthy, and genetically defined supply of marine organisms. I closed that discussion of the long-awaited, many-times-planned MRC with the hope that this important facility would become a reality "before too many more director's reports are filed."

I begin this director's report, my fourth, the Laboratory's ninety-third (covering its one-hundred third year) with the very good news that the new MRC will indeed be a reality—very soon. As I write this report (in the spring of 1991), the building is going up outside my window. Where we used to have a carpenters' shop and a parking lot, we now have pilings on top of which the walls of a state-of-the-art facility for holding marine animals are rising. The key step toward the MRC in 1990 was the passage, in October, of a Federal appropriation bill that included \$4.75 million toward the MRC. Coupled with earlier Federal support, this brought funding for the MRC and related projects to a total of \$8.95 million.

Part of the planning for the new MRC involved making alternate plans for parking and a re-location of the carpenters' shop. The plan at the close of 1990 is to build a new carpenters' shop on the MBL campus next to the Broderick House and to put a new, off-site parking lot in the MBL Woods off Oyster Pond Road near Memorial Circle. In the next director's report, I fully expect to be able to report that these auxiliary projects are completed and that the new MRC is up and very close to going on-line.

While preparations for construction of the MRC occupied much of our attention in 1990, we simultaneously continued to plan for an Advanced Studies Laboratory (ASL), which together with the MRC will constitute the Marine Biomedical Institute

for Advanced Studies. At the close of 1990, the new ASL was in the second of three design phases.

The construction of the new Marine Resources Center and the progress toward a new Advanced Studies Laboratory are important steps toward ensuring a bright future for the Laboratory, but other long-standing and well-documented needs remain. To address these additional needs, the Trustees at their June 22 meeting initiated a long-range development program. The Executive Committee approved the use of a development consultant to help us review our readiness for mounting a major fund raising campaign. The consultant, Browning Associates, presented a cogent analysis of the Laboratory, which will help us greatly expand our development operation in 1991 and beyond.

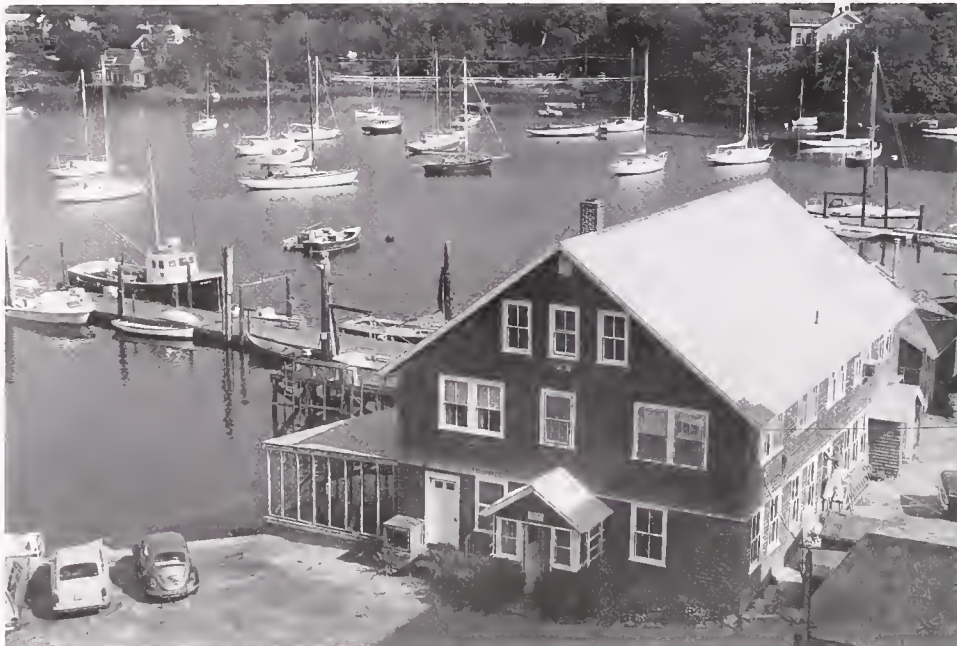
Research

At the urging of the External Scientific Advisory Committee, we established in 1990 a Scientific Council to function in an advisory capacity to the Executive Committee. The Council is charged with guiding the Laboratory in:

- the development of scientific and educational programs
- the use of scientific resources
- the evaluation and promotion of scientific staff
- the recruitment of new scientific positions
- the initiation of institutional grant proposals.

The council is to work in conjunction with existing committees, such as the Research Space Committee and the Instruction Committee.

Council members are appointed by the director, with the approval of the Executive Committee. The council is to include up to three members of the year-round



Aerial view of the MBL's Marine Resources Center. Photo by Robert Golder.

scientific community, up to three members of the summer community, two non-MBL scientists, the MBL director who serves *ex officio*, and an *ex officio* executive secretary. The first council is composed of: year-round MBL scientists Drs. John Hobbie (vice-chairman), Mitchell Sogin, and Felix Strumwasser; summer MBL scientists Drs. Barbara Ehrlich, Gerald Fischbach, and Joseph Sanger; Dr. Holger Jannasch, Woods Hole Oceanographic Institution, and Dr. Howard Hiatt, Brigham and Women's Hospital. Dr. Leslie Garrick serves as *ex officio* executive secretary, and, as director of the MBL, I serve as *ex officio* chairman of the council.

The council met throughout 1990 to evaluate scientists for appointment and promotion and to set directions for future scientific development and expansion. They completed a draft of one position paper on Laboratory directions in cellular and developmental biology. The council plans to prepare additional position papers on environmental sciences/ecology, microbiology, molecular evolution, neurobiology, and plant sciences. These documents are targeted for completion in 1991 and 1992.

Instruction

The instruction program continued in 1990 with its unanimously acclaimed courses. One new short course was added: Pathogenesis of Neuroimmunologic Diseases, co-directed by J. Murdoch Ritchie, Yale

University, and Byron H. Waksman, Harvard University and New York University.

At the urging of the External Scientific Advisory Committee, we have been taking a careful look at the cost of the courses. The Instruction Committee looked at cost containment in 1990, and, while there is as yet no consensus on how to proceed, it is clear that we will have to do something about spiraling cost increases in this age of decreasing federal support for advanced training.

New fellowships in 1990 included the Nikon Fellowship; a Bernard Davis Fellowship for studies in microbiology or molecular evolution; the Daniel S. Grosch Scholarship Fund for studies in environmental toxicology; and the Porter Fellowships for Minority Students/Investigators for work in physiology. A list of fellowship recipients appears later in this issue.

Library

The Library made continued progress toward applying computing technology to library services. As described in the Report of the Librarian, Jane Fessenden, the MBL Librarian of 29 years, retired in 1990. In December, Dr. David Stonehill accepted the position of Director of the MBL/WHOI Library and Scientific Information Research Center. Dr. Stonehill has been a national leader in the development of modern information services, having worked for



Jelle Atema, the new director of the Boston University Marine Program.
Photo by Judith Anderson.

NASA, a number of leading universities, and—most recently—the President of the United States.

Governance

In August, Dr. Prosser Gifford announced his intention to step down from the chairmanship of the MBL Board of Trustees. Dr. Gifford led the MBL for 14 years, through a period of unprecedented change and growth. In a little short of a decade and a half, he worked with 4 of the 11 directors the Laboratory has had in its 103 year existence. Under his leadership, the Laboratory's facilities were significantly upgraded, the year-round science program grew substantially, the educational program maintained its character, the library prospered and began an exciting modernization program, and the administrative and development staffs were strengthened.

Neurobiologist Dr. Jelle Atema assumed the directorship of the Boston University Marine Program in August. He replaces Dr. Rudi Strickler, who had directed BUMP since 1987. Dr. Atema has energetic plans for BUMP's graduate and undergraduate programs, and his long acquaintance with the MBL bodes well for our partnership with Boston University.

In their February meeting, the Trustees approved a new Long Range Financial Planning Committee charged with reporting to the Trustees and/or the Executive Committee on the existence and appropriateness of long-range financial planning mechanisms of the laboratory. Responsibility for planning remains with the administration of the laboratory, while the new committee is to assure that

the financial risks of growth have been properly anticipated and planned for. The committee is to include two at-large trustees, two corporate trustees, and the treasurer, *ex officio*. Treasurer Robert Manz chaired the new committee, which began by making a comprehensive review of the new MRC. In August, the Long Range Financial Planning Committee gave the Trustees a favorable report on the financial planning for the MRC. That favorable report was an important part of the briefing that led to the Trustees' decision to proceed toward construction of the new MRC.

Personnel

A group of MBL employees, including service, maintenance, and clerical workers, voted in February to affiliate with the Hospital Workers Union, Local 767. Collective bargaining negotiations began almost immediately after the election, and with the union and management both negotiating in a spirit of cooperation and mutual respect, we were able to negotiate our first contract in an impressively short time. A fair, reasonable, and workable contract was signed in July, and the work of the Laboratory proceeded without disruption.

Long-time manager of marine resources John Valois retired in November after 40 years at the MBL. In addition to running the collecting operation, Mr. Valois has served for years as a spokesman for marine biology and has appeared regularly in newspapers and on television extolling the virtues of marine animals as models for research. On his departure, Edward Enos was promoted to Superintendent of Marine Resources. Mr. Enos has been a collector for many years and was eminently well-prepared to take the reins of the department.



MBL Science Writing Fellows in the Hands-On Laboratory Course.
Photo by James Hrynshyn.

The Biological Bulletin

Under the editorship of Michael J. Greenberg, *The Biological Bulletin* continued to publish well-presented reports of outstanding research that is of general interest to biologists throughout the world. In 1990, Dr. Greenberg announced that all page charges would be dropped, and that authors would be offered 100 free reprints for publishing in the journal. Most importantly, he noted in his 1990 report to the corporation, a *carefully prepared* manuscript can now appear in print as soon as 3.6 months after its submission. In fact, some manuscripts meeting the criteria of the new Research Notes section—which features brief communications of high quality and currency—may appear in print even sooner. All of these initiatives have been highlighted in the journal's newsletter, *The Biological Board*. The newsletter, which is published "occasionally" by the editorial staff, was created to highlight and promote the articles appearing in, and the policies of, the journal.

Dr. Greenberg has also been attempting to adjust the mix of papers appearing in the *Bulletin* so that the journal more closely reflects research here at the MBL. To assist in this effort, Dr. Greenberg has recruited three Associate Editors to aid in the review and solicitation of manuscripts. Drs. J. Malcolm Shick (University of Maine, Orono), Peter A. V. Anderson (The Whitney Laboratory), and David Epel (Hopkins Marine Station) will serve four-year terms as Associate Editors in their respective fields of physiology and metabolism, neurobiology, and developmental biology.

Science Writing Fellowships

In its fifth year, the MBL Science Writing Fellowships Program evolved a one-week, hands-on course in cellular and molecular biology for science writers. Co-directed by Dr. Robert Goldman, Northwestern University Medical School, and Boyce Rensberger, *The Washington Post*, the course began with an introduction to cells and a microscopy demonstration, and ended five days later with the writers cloning and sequencing DNA. The course, which will be expanded to include a neurobiology component in 1991, is open to all science writers and serves as an orientation for the MBL Science Writing Fellows.

Directorship of the Science Writing Program has passed from founding director James Shreeve to Dr. Byron Waksman. Mr. Shreeve will continue to serve on the program's advisory board.



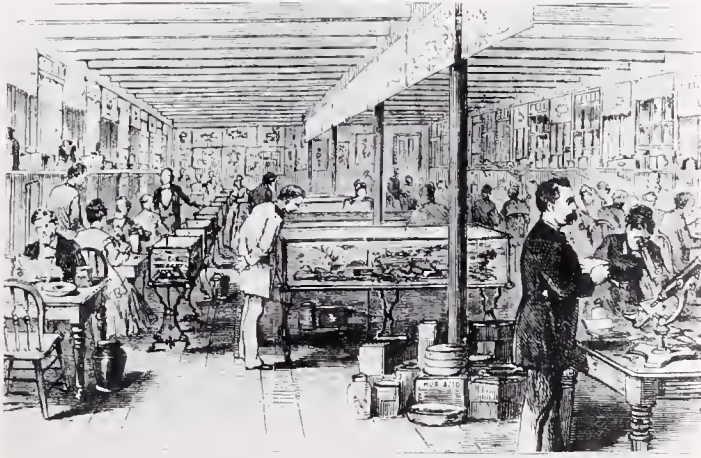
The Tokyo String Quartet. Photo by Christian Steiner.

Public programs

We continued to offer a few modest programs for our non-scientist neighbors on the Upper Cape. In July we held a public symposium on Science and Public Policy. The keynote address was delivered by Massachusetts Senator John Kerry, who urged the science community to become more involved in the very political process of forging a coherent national science policy. The symposium was followed by the second annual MBL Chamber Music Concert, featuring the Tokyo String Quartet.

The first annual Falmouth Forum concluded in early 1990 with presentations by Dr. Allen Counter on Black Arctic explorer Matthew Henson, Anne Hawley on the government as patron of the arts, a musical portrait of Harry Truman by David McCullough, and a panel discussion on energy and the environment. The series was well enough received by local audiences that the MBL Associates brought it back for the winter of 1990-91. Marshall Goldman began the second Falmouth Forum series in November with a presentation on Perestroika, and in December actress Julie Harris read from *Lucifer's Child*, her new one-woman play.

—Harlyn O. Halvorson



THE LABORATORY

Report of the Treasurer

The year 1990 was one of building for the Laboratory. Total support and revenues increased from \$16.2 to \$17.1 million due primarily to the initiation of construction of the Marine Resources Center, supported by a grant from the federal government; \$1.4 million was received and expended on this project in 1990. Gifts received decreased approximately \$1.6 million; 1989 was the last year of the receipt of significant funds from the Howard Hughes Foundation multi-year grant for the Library and the Education programs. Dining hall revenues rose \$170,000 due to increases in food service functions, attendees, and meal card prices. Investment income grew \$200,000 from 1989 to 1990 due to increases of long- and short-term investments and the length of time that they were available to the Laboratory during the respective years. Recovery of indirect costs related to research and instruction grew by approximately \$150,000, all of which was attributable to the growth of MBL sponsored research. Other operating revenues were essentially unchanged from 1989.

Total expenses grew approximately \$700,000, from \$15 million in 1989 to \$15.7 million in 1990. The most significant increases were in Research Services and Plant Operations; the former is due primarily to the expansion of the operations of the Mass Spectrometry Laboratory, the Instrument Development Laboratory, and the Protein and Nucleic Acid Chemistry Center operated jointly with the Woods Hole Oceanographic Institution; the latter is due primarily to increased utility, insurance, and labor costs, as well as significant expenses involving the removal of asbestos and other repairs and renovations of our housing. It is also worth noting that the Laboratory was able to offer approximately \$100,000 more scholarships, fellowships, and stipends in 1990 than in 1989, a 35% increase. While our aim is to provide much more, the trend is

very heartening, as we have almost doubled the amount of scholarships, fellowships, and stipends from 1988.

The Current Unrestricted Fund ended the year with an excess of support and revenues over expenses of \$93,407. This combines the results of the Housing and Dining Auxiliary with all other Operations. The Housing and Dining Auxiliary had an excess of support and revenues over expenses of \$267,761, of which \$65,000 was used for scheduled repayment of debt owed on the Memorial Circle cottages and \$199,863 was transferred to the Repairs and Replacements Reserve for housing. More sobering and troublesome, however, is that the operations of the Laboratory without the Housing and Dining operation experienced a deficiency of revenues to expenses of \$174,354. The single greatest reason for this was our inability to meet budgeted goals for unrestricted current gifts.

The balance sheet shows that we ended 1990 with a significant degree of liquidity as cash and short-term investments accounted for approximately two-thirds of current assets. Investments at market grew by approximately \$400,000. Essentially all of that was attributable to gifts for endowment, as the net impact of the market on the valuation of our investments was a decline of less than \$100,000.

Land, buildings and equipment, net of accumulated depreciation, grew by almost \$1 million due primarily to the beginning of construction of the Marine Resources Center. When completed, the cost of this project is expected to total \$9 million.

The operating budget for 1991 reflects a determination to maintain the current level of services at the Laboratory in the most cost-effective manner possible, while we redouble our efforts to generate more funds to support operations.

Our greatest single challenge is still the need to find a cost-effective way to provide services that are primarily

used during the summer months. The strategy of the Laboratory for the last 20 years has been to increase the size of the year-round program to provide a more stable financial base for the Laboratory. The Ecosystems Center has been the most notable success to date, and we trust that this will be a model for other MBL sponsored programs. The principal financial benefit of this strategy is the potential to achieve efficiencies in the cost of administration and services by spreading them across a broader base. We recognize that these will only be achieved by focusing on ways to be as efficient as possible.

The principal financial cost of this strategy is the capital cost of the laboratory building and equipment to house the scientists and their science, as well as the reserve or endowment funds necessary to attract scientists. Through the federal funding to date of the MBIAS project, we are well on our way towards funding the necessary buildings. The next significant challenge will be generating the necessary program support funds.

This strategy presumes the continued excellence of the summer research and education programs. Our education program shows many signs of health and vitality. Courses are oversubscribed; we have had renewed success in obtaining grants, and funding remains in place to support the overhead costs of the program for the next few years. Our single greatest challenge at the moment is the renewal of this support either through endowment or renewed medium-term funding.

Our summer research program shows signs of financial stress. Applications, occupancy, and revenues have been flat to marginally declining for the last couple of years. It is clear that reductions in federal funding have placed a greater budgetary burden on scientists seeking to come to the MBL in the summer, and some have had to withdraw.

The Laboratory has long subsidized the cost of a summer stay for all scientists from its discretionary resources—the summer laboratory fee falls significantly short of the fully allocated cost of the space—but our

ability to do so is limited. We can selectively support a few scientists, principally young investigators, and we have had some success recently with the establishment of two Nikon fellowships for young summer scientists, but we need to do much more.

It is clear that increased attention needs to be paid to the summer research program to continue its financial vitality. We need to attract more applicants; we need to find more funds to allow young scientists to become familiar with the MBL; and we need to be as efficient as possible in offering and delivering the services that make a stay at the MBL the most productive scientific experience possible.

Financially, your Laboratory lives on the edge. On the positive side, we have continued to demonstrate our ability to attract funds from the federal government, from foundations, and from individuals. We are in the process of significantly upgrading our physical plant, to make the Laboratory an even more attractive place to do science. Our housing budget is currently generating the funds necessary to assure that we will be able to continue to maintain and upgrade those facilities. Our endowment has continued to grow. On the negative side, our endowment is not large enough to provide a financial cushion for any of our major programs with the significant exception of the Ecosystems Center. We have limited funds to recruit scientists whether for summer or year-round programs. Our support services do not cover their costs through charges for their services, and operations aside from Housing and Dining are in deficit.

To move off the edge we will need to do three things:

- More clearly define, articulate, and communicate the MBL's special contribution to science and society
- Significantly improve our generation of capital and operating support through fund raising
- Redefine for ourselves what constitutes the most effective delivery of services in the most efficient manner.

—Robert D. Manz

Coopers
& Lybrand

certified public accountants

REPORT OF INDEPENDENT ACCOUNTANTS

To the Trustees of
Marine Biological Laboratory
Woods Hole, Massachusetts

We have audited the accompanying balance sheet of Marine Biological Laboratory as of December 31, 1990 and the related statement of support, revenues, expenses and changes in fund balances for the year then ended. We previously examined and reported upon the financial statements of the Laboratory for the year ended December 31, 1989, which condensed statements are presented for comparative purposes only. These financial statements are the responsibility of the Laboratory's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Marine Biological Laboratory at December 31, 1990, and its support, revenues, expenses and changes in fund balances for the year then ended in conformity with generally accepted accounting principles.

Our audit was conducted for the purpose of forming an opinion on the basic financial statements taken as a whole. The supplemental schedules of support, revenues, expense and changes in fund balances for current funds (Schedule I), endowment funds (Schedule II) and plant funds (Schedule III) as of December 31, 1990 are presented for purposes of additional analysis and are not a required part of the basic financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements 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 19, 1991

Coopers & Lybrand

MARINE BIOLOGICAL LABORATORY

BALANCE SHEETS

December 31, 1990

(with comparative totals for 1989)

	<u>1990</u>	<u>1989</u>	<u>LIABILITIES AND FUND BALANCES</u>	<u>1990</u>	<u>1989</u>
ASSETS					
Cash and savings deposits	\$ 304,980	\$ 496,014	Current portion of long-term debt	\$ 65,000	\$ 65,000
Restricted cash	545,796	—	Accounts payable and accrued expenses	774,139	1,127,944
Short-term investments (Notes B and H)	1,654,044	965,000	Deferred income	679,849	120,137
Accounts receivable, net of allowance for uncollectible accounts	540,983	500,644	Total current liabilities	1,518,988	1,313,081
Receivables due for costs incurred on grants and contracts	581,880	1,200,558	Mortgage and notes payable (Note G)	1,200,000	1,265,000
Other assets	35,679	35,098	Deferred support (Note K)	4,774,618	4,450,222
Total current assets	<u>3,663,362</u>	<u>3,197,314</u>	Annuities payable (Note B)	117,381	105,355
Investments, at market (Notes B and H)	16,395,852	15,971,459	Total long-term liabilities	6,091,999	5,820,577
Deposits with trustees (Note G)	143,006	133,000	Total liabilities	7,610,987	7,133,658
Land, buildings and equipment (Notes B and C)	22,433,590	20,869,811	Current unrestricted fund balances	19,518	21,030
Less accumulated depreciation	<u>(9,459,548)</u>	<u>(8,858,047)</u>	Endowment funds:		
	12,974,042	12,011,764	Quasi-endowment unrestricted	237,279	426,982
			Endowment, income for unrestricted purposes	3,291,503	3,234,878
			Endowment, income for restricted purposes	5,122,448	4,804,006
			Quasi-endowment restricted	4,565,674	4,480,887
				<u>12,979,625</u>	<u>12,519,771</u>
				13,216,904	12,946,753
			Plant fund balances:		
			Unrestricted	9,908,615	10,272,954
			Repairs and replacement reserve	450,525	148,820
			Restricted	1,969,713	790,322
			Total plant funds	<u>12,328,853</u>	<u>11,212,096</u>
Total assets	<u>\$33,176,262</u>	<u>\$31,313,537</u>	Total liabilities and fund balances	<u>\$33,176,262</u>	<u>\$31,313,537</u>

The accompanying notes are an integral part of the financial statements.

MARINE BIOLOGICAL LABORATORY

STATEMENT OF SUPPORT, REVENUES, EXPENSES AND CHANGES IN FUND BALANCES

for the year ended December 31, 1990
(with comparative totals for 1989)

	Current Funds		Endowment Funds		Plant Funds		1990		1989	
	Unrestricted	Restricted	Unrestricted	Restricted	Unrestricted	Restricted	All Funds	Total	All Funds	Total
SUPPORT AND REVENUES:										
Grant reimbursement of direct cost		\$4,872,529				\$1,429,322	\$ 4,872,529	\$ 5,090,117		
Grant for capital additions							1,429,322	574,821		
Recovery of indirect costs related to research and instruction programs	\$3,136,240						3,136,240	2,948,406		
Tuition		484,749					484,749	440,562		
Support activities:										
Dormitories	906,292						906,292	869,768		
Dining hall	802,447						802,447	632,463		
Library	273,475						273,475	249,128		
<i>Biological Bulletin</i>	172,085						172,085	188,681		
Research services	491,642	236,366					728,008	708,368		
Marine resources	149,555						149,555	141,143		
Investment income	466,931	674,423					1,141,354	942,951		
	6,398,667	6,268,067				1,429,322	14,096,056	12,786,408		
	634,428	1,979,547			\$ 314,972		2,928,947	4,597,591		
Gifts (Note I)		(324,396)					(324,396)	(1,498,560)		
Change in deferred support (Note K)		1,655,151		314,972			2,604,551	3,099,031		
	634,428	224,740					339,256	269,657		
Miscellaneous revenue	114,516									
	7,147,611	8,147,958		314,972			17,039,863	16,155,096		
Total support and revenues										

MARINE BIOLOGICAL LABORATORY

STATEMENT OF SUPPORT, REVENUES, EXPENSES AND CHANGES IN FUND BALANCES

for the year ended December 31, 1990
(with comparative totals for 1989)
(continued)

	Current Funds		Endowment Funds		Plant Funds		1990	1989
	Unrestricted	Restricted	Unrestricted	Restricted	Unrestricted	Restricted	Total All Funds	Total All Funds
EXPENSES:								
Instruction		1,370,282					1,370,282	1,328,404
Research		5,228,030					5,228,030	5,070,730
Scholarships, fellowships, and stipends		356,253					356,253	264,699
Support activities:								
Dormitories	638,531						638,531	736,272
Dining hall	690,644						690,644	543,797
Library	579,898	172,398					752,296	761,654
<i>Biological Bulletin</i>	141,118						141,118	192,741
Research services	658,115	347,996					1,006,111	843,511
Marine resources	443,676	6,791					450,467	373,571
Administration	1,979,541	35,014					2,014,555	1,897,994
Sponsored projects								
administration	278,221						278,221	316,501
Plant operations	1,644,460	1,009			\$ 111,922		1,757,391	1,481,382
Depreciation					601,501		601,501	589,120
Other		432,408			8,500		440,908	574,696
Total expenses	7,054,204	7,950,181			721,923		15,726,308	14,975,072
Excess (deficit) of support and revenues over expenses	93,407	197,777		314,972	(721,923)	1,429,322	1,313,555	1,180,024
Realized gain on investments		1,649		481,361			492,498	560,853
Unrealized gain (loss) on investments		19,868		(429,074)			(420,657)	994,541
Total gain (loss) on investments		21,517		52,287			71,841	1,555,394
Transfers	(94,919)	(219,294)		92,595	659,289	(249,931)		
Net change in fund balances	(1,512)			459,854	(62,634)	1,179,391	1,385,396	2,735,418
Fund balances, beginning of year	21,030			12,519,771	10,421,774	790,322	24,179,879	21,444,461
Fund balances, end of year	\$ 19,518			\$12,979,625	\$10,359,140	\$1,969,713	\$25,565,275	\$24,179,879

The accompanying notes are an integral part of the financial statements.

Marine Biological Laboratory

Notes to Financial Statements

A. Purpose of the Laboratory:

The purpose of Marine Biological Laboratory (the "Laboratory") is to establish and maintain a laboratory or station for scientific study and investigations, and a school for instruction in biology and natural history.

B. 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 specified activities or objectives. Separate accounts are maintained for each fund; however, in the accompanying financial statements, funds that have similar characteristics have been combined into fund groups. Accordingly, all financial transactions have been recorded and reported by fund group.

Externally restricted funds may only be utilized in accordance with the purposes established by the donor or grantor 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 as the related costs are incurred (see Note K).

Endowment funds are subject to restrictions requiring that the principal be invested in perpetuity with income available for use for restricted or unrestricted purposes by the Laboratory. Quasi-endowment funds have been established by the Laboratory for the same purposes as endowment funds; however, the principal of these funds may be expended for various restricted and unrestricted purposes.

Fixed assets

Fixed assets are recorded at cost. Depreciation is computed using the straight-line method over estimated useful lives of fixed assets.

Contracts and grants

Revenues associated with contracts and grants are recognized in the statement of support, revenues, expenses and changes in fund balances as the related costs are incurred (see Note K). The Laboratory reimbursement of indirect costs relating to government contracts and grants is based on negotiated indirect cost rates with adjustments for actual indirect costs in future years. Any over or underrecovery of indirect costs is recognized through future adjustments of indirect cost rates.

Investments

Investments purchased by the Laboratory are carried at market value. Money market securities are carried at cost which approximates market value. Investments donated to the Laboratory are carried at fair market value at the date of the gift. For determination of gain or loss upon disposal of investments, cost is determined based on the average cost method.

The Laboratory is the beneficiary of certain endowment investments reported in the financial statements which are held in trust by others. Every ten years the Laboratory's status as beneficiary of these funds is reviewed to determine that the Laboratory's use of these funds is in accordance with the intent of the funds. The market values of these investments are \$4,125,093 and \$4,039,803 at December 31, 1990, and 1989, respectively.

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 market value unit basis (Note L).

Annuities payable

Amounts due to donors in connection with gift annuities is determined based on remainder value calculations which generally assure a rate of return at 10%, maximum payout terms of eighteen years, and interest payout rate of 8%.

C. Land, buildings and equipment:

The following is a summary of the unrestricted plant fund assets:

	<i>1990</i>	<i>1989</i>
Land	\$ 689,660	\$ 689,660
Buildings	16,955,015	16,926,715
Equipment	2,819,202	2,672,838
Construction in progress	1,969,713	580,598
	22,433,590	20,869,811
Less accumulated depreciation	(9,459,548)	(8,858,047)
	\$12,974,042	\$12,011,764

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D. Retirement plan:

The Laboratory participates in the defined contribution pension program of the Teachers Insurance and Annuity Association College Retirement Equities Fund. Contributions amounted to \$451,665 in 1990 and \$393,422 in 1989.

E. Restricted pledges and grants:

As of December 31, 1990, the Laboratory reported active pledge and grant commitments outstanding of \$492,939 (unaudited) to be received. The restricted pledges are not included in the financial statements since it is not practicable to estimate the net realizable value of such pledges. Restricted pledges of \$467,337, and \$14,151 and \$11,451 are scheduled to be paid in 1991, 1992, and 1993, respectively.

F. Interfund borrowings:

Current fund interfund balances at December 31 are as follows:

	1990	1989
Due to restricted endowment fund	\$(4,750)	\$(2,190)
Due to restricted quasi-endowment funds	<u>(1,650)</u>	<u>(200)</u>
	<u>\$(6,400)</u>	<u>\$(2,390)</u>

G. Mortgage and notes payable:

Long-term debt at December 31, 1990 amounted to \$1,265,000. The aggregate amount of redemption due for each of the next five fiscal years is as follows:

	<i>Amount</i>
1991	\$ 65,000
1992	60,000
1993	60,000
1994	60,000
1995	60,000
Thereafter	<u>960,000</u>
	1,265,000
Less current portion	<u>65,000</u>
	<u>\$1,200,000</u>

In 1989, the Laboratory issued \$1,330,000 Massachusetts Industrial Finance Authority (MIFA) Series 1989 Bonds, which pay varying annual interest rates and mature on October 31, 2011. The Series 1989 bonds are collateralized by a first mortgage on certain Laboratory property.

The interest rate is adjustable and was 7.25% and 6.5% at December 31, 1990 and 1989. In compliance with the Laboratory's MIFA bond indenture, deposits with Shawmut Bank N.A., as trustee, represent investments in the debt service reserve fund of \$143,006 in 1990 and \$133,000 in 1989.

H. Investments:

The following is a summary of the cost and market value of investments at December 31, 1990 and 1989 and the related investment income and distribution of investment income for the years ended December 31, 1990 and 1989.

	<i>Cost</i>		<i>Market</i>		<i>Investment Income</i>	
	<u>1990</u>	<u>1989</u>	<u>1990</u>	<u>1989</u>	<u>1990</u>	<u>1989</u>
<i>Endowment and Quasi-Endowment</i>						
U.S. Government securities	\$ 1,934,834	\$ 2,595,407	\$ 1,957,512	\$ 2,607,537	\$ 214,300	\$134,394
Corporate fixed income	6,663,376	5,900,736	6,809,264	6,032,642	506,490	363,439
Common stocks	4,284,165	3,392,001	6,346,778	5,901,724	234,690	196,452
Money market securities	590,735	595,467	590,735	593,544	121,787	87,994
Real estate	343,247	345,749	343,247	345,749	—	—
Total	<u>13,816,357</u>	<u>12,829,360</u>	<u>16,047,536</u>	<u>15,481,196</u>	<u>1,077,267</u>	<u>782,279</u>
Less custodian and management fees					<u>(55,592)</u>	<u>(49,318)</u>
Total	<u>13,816,357</u>	<u>12,829,360</u>	<u>16,047,536</u>	<u>15,481,196</u>	<u>1,021,675</u>	<u>732,961</u>
<i>Restricted Current Fund</i>						
Certificates of deposits	502,360	490,263	502,360	490,263	20,312	34,785
Money market securities	1,500,000	965,000	1,500,000	965,000	99,367	175,205
Total	<u>2,002,360</u>	<u>1,455,263</u>	<u>2,002,360</u>	<u>1,455,263</u>	<u>119,679</u>	<u>209,990</u>
Total investments	<u>\$15,818,717</u>	<u>\$14,284,623</u>	<u>\$18,049,896</u>	<u>\$16,936,459</u>	<u>\$1,141,354</u>	<u>\$942,951</u>

I. Gift support for instruction:

Current year unrestricted gifts includes \$500,000 of gifts for the support of the Laboratory's instruction program available for indirect costs attributable to the instruction program.

J. Tax-exempt status:

The Laboratory is exempt from federal income tax under Section 501(c)3 of the Internal Revenue Code.

K. Restricted current funds deferred support:

The Laboratory defers recognition of revenue on current restricted funds until the related costs are incurred. Amounts received in excess of expenses are recorded as deferred support. The following summarizes the activity in the deferred support account for 1990 and 1989, respectively:

	<u>1990</u>	<u>1989</u>
Balance at beginning of year	\$4,450,222	\$2,951,662
Additions:		
Gifts, endowment income and grants received	8,499,360	9,382,212
Unrealized gains	19,868	30,672
Realized gain	1,649	—
Deductions:		
Funds expended under gifts and grants	7,977,187	7,542,909
Transfers	219,294	371,415
Balance at end of year	<u>\$4,774,618</u>	<u>\$4,450,222</u>

L. Accounting for pooled investments:

The major portion of investment assets is pooled for investment purposes with each participating fund subscribing to, or disposing of, units at market value at the beginning of the current quarter. The unit participation of the funds at December 31, 1990 and 1989, respectively, is as follows:

	<u>1990</u>	<u>1989</u>
Endowment and similar funds:		
Quasi-unrestricted	3,909	3,887
Quasi-restricted	7,436	7,416
Restricted endowment	39,401	36,488
	<u>50,746</u>	<u>47,791</u>

Pooled investment activity on a per-unit basis was as follows:

Unit value at beginning of year	\$109.57	\$100.00
Unit value at end of year	<u>108.90</u>	<u>109.57</u>
Increase (decrease) in realized and unrealized appreciation	(.67)	9.57
Net income earned on pooled investments	<u>5.99</u>	<u>5.73</u>
Total return on pooled investments	<u>\$ 5.32</u>	<u>\$ 15.30</u>

Investment income is distributed to individual funds as earned.

MARINE BIOLOGICAL LABORATORY

STATEMENT OF SUPPORT, REVENUES, EXPENSES AND CHANGES IN FUND BALANCES

CURRENT FUNDS

for the year ended December 31, 1990

	<i>Operating Fund</i>	<i>Auxiliary Enterprises Fund</i>	<i>Total Current Unrestricted Fund</i>	<i>Current Restricted Fund</i>	<i>Total</i>
SUPPORT AND REVENUES:					
Grant reimbursement of direct costs				\$4,872,529	\$4,872,529
Recovery of indirect costs related to research and instruction programs	\$3,136,240		\$3,136,240		3,136,240
Tuition				484,749	484,749
Support activities:					
Dormitories		\$ 906,292	906,292		906,292
Dining hall		802,447	802,447		802,447
Library	273,475		273,475		273,475
<i>Biological Bulletin</i>	172,085		172,085		172,085
Research services	491,642		491,642	236,366	728,008
Marine resources	149,555		149,555		149,555
Investment income	466,931		466,931	674,423	1,141,354
	<u>4,689,928</u>	<u>1,708,739</u>	<u>6,398,667</u>	<u>6,268,067</u>	<u>12,666,734</u>
Gifts	634,428		634,428	1,979,547	2,613,975
Change in deferred support	—		—	(324,396)	(324,396)
	<u>634,428</u>		<u>634,428</u>	<u>1,655,151</u>	<u>2,289,579</u>
Miscellaneous revenue	114,516		114,516	224,740	339,256
Total support and revenues	<u>5,438,872</u>	<u>1,708,739</u>	<u>7,147,611</u>	<u>8,147,958</u>	<u>15,295,569</u>
EXPENSES:					
Instruction				1,370,282	1,370,282
Research				5,228,030	5,228,030
Scholarships, fellowships, and stipends				356,253	356,253
Support activities:					
Dormitories		638,531	638,531		638,531
Dining hall		690,644	690,644		690,644
Library	579,898		579,898	172,398	752,296
<i>Biological Bulletin</i>	141,118		141,118		141,118
Research services	658,115		658,115	347,996	1,006,111
Marine resources	443,676		443,676	6,791	450,467
Administration	1,867,738	111,803	1,979,541	35,014	2,014,555
Sponsored projects administration	278,221		278,221		278,221
Plant operations	1,644,460		1,644,460	1,009	1,645,469
Other	—		—	432,408	432,408
Total expenses	<u>5,613,226</u>	<u>1,440,978</u>	<u>7,054,204</u>	<u>7,950,181</u>	<u>15,004,385</u>
Excess (deficit) of support and revenues over expenses	<u>(174,354)</u>	<u>267,761</u>	<u>93,407</u>	<u>197,777</u>	<u>291,184</u>
Unrealized gain on investments				19,868	19,868
Realized gain on investments				1,649	1,649
Total gain on investments				<u>21,517</u>	<u>21,517</u>
TRANSFERS AMONG FUNDS:					
Debt service		(65,000)	(65,000)		(65,000)
Acquisition of fixed assets				(144,881)	(144,881)
To unrestricted plant fund	(21,653)		(21,653)		(21,653)
Housing transfer	2,898	(199,863)	(196,965)		(196,965)
To support operations	190,000		190,000	135,209	325,209
Instruction	(5,045)		(5,045)	5,045	—
Capitalize ecosystems income				(215,764)	(215,764)
Other	6,642	(2,898)	3,744	1,097	4,841
Total transfers among funds	<u>172,842</u>	<u>(267,761)</u>	<u>(94,919)</u>	<u>(219,294)</u>	<u>(314,213)</u>
Net change in fund balance	<u>(1,512)</u>	<u>—</u>	<u>(1,512)</u>	<u>—</u>	<u>(1,512)</u>
Fund balances, beginning of year	21,030	—	21,030	—	21,030
Fund balances, end of year	<u>\$ 19,518</u>	<u>—</u>	<u>\$ 19,518</u>	<u>—</u>	<u>\$ 19,518</u>

MARINE BIOLOGICAL LABORATORY

STATEMENT OF SUPPORT, REVENUES, EXPENSES AND CHANGES IN FUND BALANCES

ENDOWMENT FUNDS

for the year ended December 31, 1990

	<u>Unrestricted</u>	<u>Restricted</u>				<u>Total</u>
		<u>Quasi- Endowment</u>	<u>Endowment, Income for Unrestricted Purposes</u>	<u>Endowment, Income for Restricted Purposes</u>	<u>Quasi- Endowment</u>	
SUPPORT AND REVENUES:						
Gifts			\$ 312,522	\$ 2,450	\$ 314,972	\$ 314,972
Total support and revenues			<u>312,522</u>	<u>2,450</u>	<u>314,972</u>	<u>314,972</u>
Excess of support and revenues over expenses			<u>312,522</u>	<u>2,450</u>	<u>314,972</u>	<u>314,972</u>
Realized gains on investments	\$ 9,488	\$ 165,441	121,543	194,377	481,361	490,849
Unrealized gain (loss) on investments	<u>(11,451)</u>	<u>(110,737)</u>	<u>(113,465)</u>	<u>(204,872)</u>	<u>(429,074)</u>	<u>(440,525)</u>
Total gain (loss) on investments	<u>(1,963)</u>	<u>54,704</u>	<u>8,078</u>	<u>(10,495)</u>	<u>52,287</u>	<u>50,324</u>
TRANSFERS AMONG FUNDS:						
Capitalize ecosystems income				215,764	215,764	215,764
Endowment transfers	(190,000)			(135,209)	(135,209)	(325,209)
Other transfers	<u>2,260</u>	<u>1,921</u>	<u>(2,158)</u>	<u>12,277</u>	<u>12,040</u>	<u>14,300</u>
Total transfers among funds	<u>(187,740)</u>	<u>1,921</u>	<u>(2,158)</u>	<u>92,832</u>	<u>92,595</u>	<u>(95,145)</u>
Net change in fund balances	<u>(189,703)</u>	<u>56,625</u>	<u>318,442</u>	<u>84,787</u>	<u>459,854</u>	<u>270,151</u>
Fund balances, beginning of year	<u>426,982</u>	<u>3,234,878</u>	<u>4,804,006</u>	<u>4,480,887</u>	<u>12,519,771</u>	<u>12,946,753</u>
Fund balances, end of year	<u>\$237,279</u>	<u>\$3,291,503</u>	<u>\$5,122,448</u>	<u>\$4,565,674</u>	<u>\$12,979,625</u>	<u>\$13,216,904</u>

MARINE BIOLOGICAL LABORATORY

STATEMENT OF SUPPORT, REVENUES, EXPENSES AND CHANGES IN FUND BALANCES

PLANT FUNDS

for the year ended December 31, 1990

	<i>Unrestricted</i>		<i>Restricted</i>	<i>Total</i>
	<i>Unrestricted</i>	<i>Repairs and Replacement Reserve</i>		
SUPPORT AND REVENUES:				
Grant for capital additions			\$1,429,322	\$ 1,429,322
Total support and revenues			<u>1,429,322</u>	<u>1,429,322</u>
EXPENSES:				
Depreciation	\$ 601,501		\$ 601,501	601,501
Plant operations		\$111,922	111,922	111,922
Other	8,500		8,500	8,500
Total expenses	<u>610,001</u>	<u>111,922</u>	<u>721,923</u>	<u>721,923</u>
Excess (deficit) of support and revenues over expenses	<u>(610,001)</u>	<u>(111,922)</u>	<u>1,429,322</u>	<u>707,399</u>
TRANSFERS AMONG FUNDS:				
Debt service	65,000		65,000	65,000
Acquisition of fixed assets	180,662		180,662	180,662
Transfers to unrestricted plant fund		(14,128)	(14,128)	(14,128)
Housing transfers		199,863	199,863	199,863
Other transfers		227,892	227,892	(249,931)
Total transfers among funds	<u>245,662</u>	<u>413,627</u>	<u>659,289</u>	<u>(249,931)</u>
Net change in fund balances	<u>(364,339)</u>	<u>301,705</u>	<u>(62,634)</u>	<u>1,179,391</u>
Fund balances, beginning of year	<u>10,272,954</u>	<u>148,820</u>	<u>10,421,774</u>	<u>790,322</u>
Fund balances, end of year	<u>\$ 9,908,615</u>	<u>\$450,525</u>	<u>\$10,359,140</u>	<u>\$1,969,713</u>



Report of the Librarian

Library directors

In 1990, Jane Fessenden, who had been the librarian and worked at the MBL for 29 years, retired. Jane made the Library a productive home for its users, improved the collection whenever financially possible, and lead the Library through innumerable changes. During her tenure, the Library was converted from the Dewey Decimal System to Library of Congress, the first "stack move" took place (after three years of planning), the reading rooms were redone, the Rare Books Room was created, the Copy Service Center was developed in its present location, staff was increased, and new technology was initiated. She will be best remembered, however, for her unique ability to provide the services and support most desired by our users.

In December, Dr. David Stonehill accepted the position of Director of the MBL/WHOI Library and Scientific Information Research Center. Dr. Stonehill managed computer facilities on various NASA projects and directed computing services at academic institutions. From 1988 until his move to MBL, he was Director of Information Resources Managements for the Executive offices of the President of the United States. Under Dr. Stonehill, the Library plans to launch a Scientific Information Research Center, and we look forward to his leadership as we meld the traditional with the new methods of scientific information management.

New age information delivery

Using the report created by the Hughes Committee, the Library immediately began to implement some of its recommendations. A network manager was hired, and the network design was completed. What followed

was a frenzy of equipment ordering and the installation of cable and wires to extend the network out of the library and into classrooms and labs in the Lillie and Loeb buildings and the Ecosystems Center. Because of the ease of communicating over the network, some of the traditional methods of the reference librarians moved into a new era during 1990. One advance, Current Contents loaded onto the librarians' computers, allowed us to send weekly up-dated bibliographies to requesters over the MBLnet.

The Library's catalog has been converted to electronic records, and all the books in the library were barcoded as part of the automation of library systems. The CLAMS network of libraries came on-line in 1990, and scientists in their laboratories, who are on the Woods Hole network, can connect to the catalog and see whether the library holds the book they are seeking.

Journal rates increase

Our Library has studied the effect of rising book and subscriptions costs beginning with the comprehensive Rockefeller Journal Use study. In 1990, the close to 30% projected journal price increase reduced our options and resulted in the cancellation of 338 current subscriptions. Our User Panel worked throughout the summer with lists of journals targeted for cancellation, using criteria established by the Joint Users Committee, to insure the best possible preservation of our collection and services.

This was not the only journal crisis of 1990—the space allocation for housing the journals had reached saturation. For over a year, the creation of a design to preserve our stack space has been developed and refined and the periodical collection will be moved during the beginning of 1991. The logical placement of the



Educational Programs

Summer Courses

Biology of Parasitism (June 10 to August 10)

Co-Directors

John Donelson, University of Iowa College of Medicine
Carole Long, Hahnemann Medical College

Faculty

Steven Anderson, University of Iowa
John Boothroyd, Stanford University
Ted Bianco, Imperial College of Science & Technology, UK
Patrick Farley, Hahnemann Medical College
Steven Hajduk, University of Alabama, Birmingham
Peter Ham, Liverpool School of Tropical Medicine, UK
Michael E. Harris, University of Alabama, Birmingham
Mary Alice Hartman, University of Kentucky
Kwang S. Kim, University of Iowa
Peter Kima, Hahnemann Medical College
Yien Ming Kuo, Imperial College, UK
Rick Martin, University of Iowa
David Moser, University of Iowa
Elonne Petrin, University of Cincinnati
David Russell, New York University
David Sachs, NIH
Judy Sakanari, University of California, San Francisco
Sam Turco, University of Kentucky

Lecturers

Nina Agabian, University of California, San Francisco
Steven Beverley, Harvard Medical School
Kent Campbell, Centers for Disease Control

Dickson Despommier, Columbia University
Paul Englund, Johns Hopkins School of Medicine
Don Harn, Harvard University
Stephanie James, NIH
Keith Joiner, Yale University School of Medicine
Patricia J. Johnson, UCLA
Don Krogstad, Washington University, St. Louis
Ira Mellman, Yale University School of Medicine
George Nelson, Liverpool School, UK
Ruth Nussenzweig, New York University
Victor Nussenzweig, New York University
Richard Olds, Brown University
Bill Petri, University of Virginia
Robert Sauer, Massachusetts Institute of Technology
Alan Sher, NIH
Irwin Sherman, University of California, Riverside
Larry Simpson, UCLA
Mitch Sogin, MBL
Rick Tarleton, University of Georgia
Merv Turner, Merck Sharp & Dohme Research Laboratory
C. C. Wang, University of California, San Francisco
Leon Weiss, University of Pennsylvania
Don Wiley, Harvard University
Dyann Wirth, Harvard University

Students

Wanida Asawanahasakda, Mahidol University, Thailand
Fernanda R. Gadelha, University of Illinois
Eileen S. Gruszynski, University of California, Los Angeles
Michael J. Howard, Vanderbilt University
Christopher A. Hunter, University of Glasgow, Scotland
Gregory J. Jennings, Tulane University
Christopher L. Leptak, Yale University
Congjun Li, Worcester Foundation for Experimental Biology

Leo X. Liu, Beth Israel Hospital/Harvard University
James J. McCoy, University of Virginia
Gloria I. Palma, Univ. del Valle, Colombia
Laura J. Rocco, Johns Hopkins University
Nicola N. Schweitzer, Imperial College of Science,
UK
Frank Seeber, Institut für Tropenhygiene, Germany
Philippe G. Vandekerckhove, University of Leuven,
Belgium
Gayl Wall, University of Dundee, Scotland

***Embryology: Cell Differentiation and Gene
Expression in Early Development***

(June 21 to July 30)

Directors

Eric Davidson, California Institute of Technology
J. Richard Whitaker, MBL (Assistant Director)

Faculty

Michael Akam, University of Cambridge, UK
Amy Bejsovic, University of Cambridge, UK
Marianne Bronner-Fraser, University of California,
Irvine
Scott Fraser, University of California, Irvine
Katherine Harding, Columbia University
Janet Heasman, University of Cambridge, UK
Linda Huffer, MBL
Wendy Katz, California Institute of Technology
Robert Kingsbury, Carnegie Institution, Baltimore
Thomas Lallier, University of California, Irvine
Robert Leclerc, University of Maryland
Michael Levine, Columbia University
David McClay, Duke University
Steven McKnight, Carnegie Institution of
Washington
Robert Nickells, California Institute of Technology
Jerome Regier, University of Maryland
John Shuman, Carnegie Institution, Baltimore
Paul Sternberg, California Institute of Technology
Nicholas Torpey, University of Cambridge, UK
Kellie Whittaker, California Institute of Technology
Christopher Wylie, University of Cambridge, UK

Students

Kamran Ahmad, University of Utah
Michael J. Bank, Columbia University
Peter B. Bokor, Rockefeller University
James B. Castelli-Gair, University of Madrid, Spain
Robert A. Cornell, University of Washington
Maria G. Di Bernardo, Italian National Research
Council, Italy

Win J. Dictus, University of Utrecht,
The Netherlands
Anne D. Donaldson, MRC Laboratory, UK
Bruce W. Draper, University of Washington
Silvia B. Frenk, King's College, Cambridge, UK
Kareen M. Guida, University of Paris, France
Nan Ho, University of California, Berkeley
Jon F. Kayyem, California Institute of Technology
Dangeruta Kersulyte, Academy of Sciences of
Lithuania, USSR
Daniel S. Kessler, Rockefeller University
Mary Ellen Lane, Columbia University
Thierry Lepage, University of Nice, France
Donal T. Manahan, University of Southern
California, Los Angeles
Jeffrey R. Miller, Duke University
Anne Marie Murphy, Johns Hopkins University
Christof Niehrs, European Molecular Biology Lab.,
Germany
Mary E. Pownall, University of Virginia
Inge J. Van Wijk, Max-Planck Institute, Germany
Tongweng Wang, University of Florida

***Marine Ecology: Concepts, Techniques and
Applications of Molecular Probes***

(June 17 to July 28)

Director

J. Woodland Hastings, Harvard University

Faculty

Cheryl Booth, Falmouth, MA
Ann Bucklin, Marine Biological Laboratory
Thomas T. Chen, Center of Marine Biotechnology,
University of Maryland
Clara Cheng, University of Maryland
Toby Cole, Hopkins Marine Station, Stanford
University
Lynna Hereford, Hopkins Marine Station, Stanford
University
Chun-Mean Lin, University of Maryland
Kenneth Neilson, Great Lakes Research Center,
University of Wisconsin, Milwaukee
Dennis Powers, Hopkins Marine Station, Stanford
University
T. Roenneberg, University of Munich, Germany
Simona Sorger, Hopkins Marine Station, Stanford
University
Keno Truper, Bonn, Germany
Barbara Wimpee, Great Lakes Research Center,
University of Wisconsin, Milwaukee
Charles Wimpee, University of Wisconsin,
Milwaukee

Lecturers

David Caron
 Colleen Cavanaugh
 Penny Chisholm
 Ed De Long
 Paul Dunlap
 Brian Fry
 Linda Goff
 John Kessler
 Lynn Margulis
 James McCarthy
 Dan Morse
 Rob Olsen
 Hans Paerl
 Jack Palmer
 Ned Ruby
 G. Saylor
 Ann Sesholz
 Bob Simon
 Mitch Sogin
 Felix Strumwasser
 John Waterbury

Students

Abdiel J. Alvarez, University of Puerto Rico
 Brian J. Binder, Massachusetts Institute of Technology
 Alice F. Brown, Brown University
 Ka Hou Chu, Chinese University of Hong Kong, Hong Kong
 Peter J. Edmunds, Northeastern University
 Oivind Enger, University of Bergen, Norway
 Jonathan B. Geller, University of Oregon
 Gregory J. Hinkle, University of Massachusetts, Amherst
 Robert E. Hodson, University of Georgia
 Eric R. Holm, Duke University
 Jerilyn Jewett-Smith, Whitman College
 Lisa M. Kann, University of Rhode Island
 James S. Maki, Harvard University
 Kirk D. Malloy, University of Delaware
 Adam G. Marsh, University of New Hampshire
 Tracie-Lynn Nadeau, University of Wisconsin
 Martin Polz, University of Vienna, Austria
 Michael C. Schmale, University of Miami
 Robin M. Schneider, University of Southern Louisiana
 Lynda P. Shapiro, Bigelow Laboratory for Ocean Sciences
 Robert L. Sinsabaugh, Clarkson University
 Erika Stephens, Harvard University
 Stephen C. Tsoi, University of Hong Kong, Hong Kong
 Karl E. Wommack, University of Maryland

Microbiology: Molecular Aspects of Cellular Diversity (June 10 to July 26)*Co-Directors*

Martin Dworkin, University of Minnesota
 John Breznak, Michigan State University

Faculty

Richard Behmlander, University of Minnesota
 Pamela Contag, University of Minnesota
 Christiane Dahl, University of Bonn, Germany
 Deborah Eastman, University of Minnesota
 Andrew M. Kropinski, Queen's University, Canada
 Hans Truper, University of Bonn, Germany
 Stefan Wagener, Michigan State University

Lecturers

Paul Dunlap, Woods Hole Oceanographic Institution
 Holger Jannasch, Woods Hole Oceanographic Institution
 J. Waterbury, Woods Hole Oceanographic Institution

Students

Diane K. Arwood, University of Southern Mississippi
 Joanna S. Brooke, University of Western Ontario, Canada
 Joseph P. Calabrese, West Virginia University
 Neena Din, University of British Columbia, Canada
 Arnis Druka, Latvian State University, USSR
 Olivia T. Harriott, University of Connecticut
 Robert Huber, University of Regensburg, Germany
 Jennifer B. Klenz, University of Saskatchewan, Canada
 Judith A. Koskella, New York University
 Bridget E. Laue, University of Colorado
 Jared R. Leadbetter, Goucher College
 Timothy C. Lilburn, University of British Columbia, Canada
 Shi Liu, University of Oklahoma
 Lynn V. Mendelman, Harvard Medical School
 Elizabeth J. Orle, Colorado State University
 Mechthild Pohlschroder, University of Massachusetts, Amherst
 Frank J. Slack, Tufts University
 Barth F. Smets, University of Illinois
 Claire S. Ting, Cornell University
 Mary A. Wyka, Merck & Co., Inc.

Neural Systems & Behavior (June 10 to August 1)*Co-Directors*

Ronald Calabrese, Emory University
 Martha Constantine-Paton, Yale University

Faculty

Arthur Arnold, University of California, Los Angeles
 Alexander Borst, Max-Planck-Institut für Biologisch
 Kybernetick, Germany
 John Byrne, University of Texas Medical School
 Thomas Carew, Yale University
 Leonard Cleary, University of Texas Medical School
 at Houston
 Robin Cloues, Harvard University
 Michael Davis, Yale University
 Robert M. Douglas, University of British Columbia,
 Canada
 Lise Eliot, Center for Neurobiology & Behavior
 Russell Fernald, University of Oregon
 Leslie Fischer, Columbia University
 William Frost, University of Texas Medical School
 Cole Gilbert, University of Arizona
 Dennis Gorlick, Columbia University
 Jon Hayashi, Arizona Research Laboratory
 Sally Hoskins, City College of CUNY
 John Koester, New York State Psychiatric Institute
 Richard B. Levine, University of Arizona
 Yurin Levy, Brandeis University
 Margaret Livingstone, Harvard Medical School
 Anne Lohoff, Columbia University
 Eduardo R. Macagno, Columbia University
 Emilie Marcus, Yale University
 Eve Marder, Brandeis University
 Michael P. Nusbaum, University of Alabama,
 Birmingham
 Mu-Ming Poo, Columbia University
 David J. Sandstrom, University of California
 Patricia Steen, Yale University
 Nacita Tabti, Columbia University
 Janis C. Weeks, University of Oregon
 Angela Wenning, Universität Konstanz, Germany
 Michael Nitabach, Columbia University

Lecturers

Catherine Carr, University of Rochester
 Joe Martinez, Jr., University of California

Students

Robert A. Berkowitz, Washington University
 James P. Burke, University of Alabama, Birmingham
 Belinda S. Chang, Harvard University
 Miles G. Cunningham, Massachusetts Institute of
 Technology
 Graeme W. Davis, University of Massachusetts,
 Amherst
 Mayra Garcia-Ruiz, University of Nat. Autonoma,
 Mexico
 John F. Hamilton, Meharry Medical College,
 Nashville

Tamara L. Harris, University of Ottawa, Canada
 Valerie L. Kilman, University of Illinois
 Barlett W. Mel, California Institute of Technology
 Brett D. Mensch, Baylor College of Medicine
 Alison R. Mercer, University of Otago, New Zealand
 Edward P. Monaghan, University of California,
 Berkeley
 Tanja Quenzer, Max-Planck-Institut, Germany
 Adina L. Roskies, University of California,
 San Diego
 Hyunjune S. Seung, Harvard University
 Deana L. Shackelford, University of Oklahoma
 Petra Skiebe, Universität Hamburg, Germany
 John E. Spiro, University of California, San Diego
 Douglas Syme, University of California, Irvine

Neurobiology (June 10 to August 11)*Co-Directors*

Leonard Kaczmarek, Yale University
 Irwin Levitan, Brandeis University
 Christopher Miller, Brandeis University

Faculty

Cecilia Armstrong, University of Pennsylvania
 Gary Banker, University of Virginia
 Synnove Beckh, Max-Planck-Institut für
 Biophysikalische Chemie, Germany
 Andrew Czernik, Rockefeller University
 Jan De Weer, Duke University
 Judith Drazba, NINDS/NIH
 Keith Elmslie, Case Western Reserve University
 Stuart Firestein, Yale University School of Medicine
 Paul Forscher, Yale University
 Robert French, University of Calgary, Canada
 Sara Garber, University of Alabama, Birmingham
 Allison Hall, Case Western Reserve University
 Richard Horn, Roche Institute for Molecular Biology
 Richard Huganir, HHMI, Johns Hopkins Medical
 School
 Stephen Jones, Case Western Reserve University
 Richard Kramer, Columbia University
 Kyu-Ho Lee, Johns Hopkins Medical School
 Andrew Matus, Friedrich Meischer Institute,
 Switzerland
 Robert Miller, Case Western Reserve University
 Angus Nairn, Rockefeller University
 Randall Reed, HHMI, Johns Hopkins Medical
 School
 Thomas Reese, NINDS/NIH
 Talvinder Sihra, Rockefeller University
 Carolyn Smith, NINDS/NIH
 Walter Stuhmer, Max-Planck-Institut für
 Biophysikalische Chemie, Germany

Students

Ricardo C. Araneda, Albert Einstein Medical School
 Sylwester Chyb, Wesleyan University
 Dan H. Cox, Tufts University
 Stuart D. Critz, University of Texas Medical School
 Peter F. Drain, MIT
 Kathryn J. Edson, University of Minnesota
 Julie A. Haack, University of Utah
 Lise R. Heginbotham, Harvard University
 Marc A. Post, University of Michigan
 Haohua Qian, University of Illinois
 Hanno M. Roder, Massachusetts Institute of
 Technology
 Maria A. Sosa, University of Florida

Physiology: Cell and Molecular Biology
 (June 10 to July 21)

Director

Thomas D. Pollard, Johns Hopkins University

Faculty

Steven Almo, Johns Hopkins Medical School
 Kerry Bloom, University of North Carolina
 William Busa, Johns Hopkins University
 Antony Galione, Johns Hopkins University
 Neal R. Glikzman, University of North Carolina
 Robert Jensen, Johns Hopkins School of Medicine
 Margaret Kenna, University of North Carolina
 John Maslanski, Johns Hopkins University
 Jonathan McMenamin-Balano, University of
 Massachusetts, Boston
 Robert Palazzo, Marine Biological Laboratory
 Katherine Pollard, Johns Hopkins Medical School
 Ted Salmon, University of North Carolina
 Sue Schmidt, Glyndon, MD
 John Simon, University of North Carolina
 John Sinard, Johns Hopkins Medical School
 Tammy Smith, University of North Carolina
 Cynthia V. Stauffacher, Purdue University
 Murray Stewart, Medical Research Council, UK
 Elaine Yeh, University of North Carolina

Students

Robert L. Bacallao, University of California,
 Los Angeles
 Sandra A. Brockman, Carnegie Mellon University
 Thomas O. Carpenter, Yale University
 Isabelle A. Carre, SUNY, Stony Brook
 Joseph A. Cerro, Columbia University
 Marc D. Coltrera, University of Washington
 Tod A. Critchlow, Scripps Institute of Oceanography
 Spencer J. Danto, Cornell Medical College
 Michele I. Flatters, Tufts University

Holly V. Goodson, Stanford University
 Supriya Jayadev, Duke University
 John R. Jordan, University of Utah
 David L. Keefe, Yale University
 Karen L. King, Florida State University
 Qingwen Li, University of Kansas
 Helen McNeill, University of Pennsylvania
 Michael E. Mendelsohn, Harvard/Brigham &
 Women's Hospital
 Christa S. Merzdorf, Harvard University
 Robert Mirro, University of Tennessee
 Karen M. Page, Dartmouth College
 Alice P. Pentland, Washington University, St. Louis
 Zhican Qu, Johns Hopkins University
 Joe W. Ramos, University of Virginia
 Jean F. Regal, University of Minnesota
 Eric A. Shelden, University of Massachusetts,
 Amherst
 Charles B. Shuster, Tufts University
 Thomas W. Smith, Brigham & Women's/Harvard
 Medical School
 Robin L. Stears, SUNY, Stony Brook
 Salme Taagepera, University of Virginia
 Charlotte M. Vines, Harvard Medical School
 Yingjian Wang, University of Miami
 Christiane Wiese, Johns Hopkins Medical School
 Elizabeth L. Winter, City College of New York
 Vicki L. Wolff, Brandeis University
 Qi Yang, University of Connecticut
 Guangwen Zhou, Oregon State University

Short Courses

***Analytical and Quantitative Light Microscopy
 in Biology, Medicine, and Materials Science***
 (May 10 to 18)

Co-Directors

Edward D. Salmon, University of North Carolina
 Greenfield Sluder, Worcester Foundation for
 Experimental Biology
 David E. Wolf, Worcester Foundation for
 Experimental Biology

Faculty and Course Assistants

Brad Amos, MRC, Cambridge, UK
 Orit Baha, Worcester Foundation for Experimental
 Biology
 Steven M. Block, Rowland Institute for Science
 Richard Cardullo, Worcester Foundation for
 Experimental Biology
 Walter Carrington, University of Massachusetts
 Medical School

Gordon Ellis, University of Pennsylvania
 Fred Fay, University of Massachusetts Medical School
 Jeff Gelles, Brandeis University
 Richard Haugland, Molecular Probes, Eugene, OR
 Linda Huffer, MBL
 Shinya Inoué, MBL
 Anthony Moss, Worcester Foundation for Experimental Biology
 Rudolf Oldenbourg, MBL
 Stephen Parsons, University of North Carolina
 Robert V. Skibbens, University of North Carolina
 Kenneth R. Spring, NIH
 D. Lansing Taylor, Carnegie-Mellon University
 Richard Walker, University of North Carolina

Students

Julia Barsony, NIDDK/NIH
 Harold G. Bohlen, Indiana University Medical School
 Daniel J. Brat, Mayo Graduate School
 Barry J. Burbach, SUNY, Stony Brook
 John P. Caufield, Harvard Medical School
 Wendy Cheng, International Paper Company, Tuxedo, NY
 Matthew H. Chestnut, The Procter and Gamble Co., Cincinnati, OH
 Diana M. Cordova, Alcon Laboratories, Inc., Ft. Worth, TX
 Sascha Dho, The Hospital for Sick Children, Toronto, Canada
 Ulrich Dirnagl, Forschungslabor, Germany
 Cynthia J. Forehand, University of Vermont
 John J. Freeman, Monsanto Co., St. Louis, MO
 Jill Gemmill, University of Alabama, Birmingham
 John A. Hammer, III, NHLBI/NIH
 Ray S. Hartman, Children's Hospital of Los Angeles
 Donald T. Haynie, The Johns Hopkins University
 Walter J. Koroshetz, Massachusetts General Hospital

Julia M. Lash, Indiana University School of Medicine
 Michael I. Lethem, University of North Carolina
 Steve Paddock, University of Wisconsin
 Shoshana Paglin, Boston University School of Medicine
 James R. Sellers, NHLBI/NIH
 Anna Spudich, Stanford University
 Fei Wang, Syracuse University

Measurement and Control of Chemical Stimuli (April 25 to 30)

Director

Greg A. Gerhardt, University of Colorado

Faculty and Course Assistants

Barry W. Ache, C.V. Whitney Laboratory, University of Florida
 Jelle Atema, Boston University Marine Program, MBL
 Scott Brock, University of Colorado
 Marilyne Friedemann, University of Colorado
 John S. Kauer, Tufts—New England Medical Center
 Stuart Firestein, Yale University School of Medicine
 Paul Moore, Boston University Marine Program, MBL
 Mike Palmer, University of Colorado
 Michael Parrish, University of Colorado
 Wayne L. Silver, Wake Forest University

Students

Carol E. Diebel, SUNY Health Science Center
 Richard L. Doty, Hospital of the University of Pennsylvania
 Heather L. Eisthen, Indiana University
 Tim Granata, Southeastern Massachusetts University
 Kristina-Viveka Hillegaard, Astra Research Centre, Sweden
 Herman K. Lehman, University of Arizona
 Celia Marrase, Boston University Marine Program, MBL
 Pricilla E. Purniek, Columbia University
 John R. Welborn, University of Southern California

Methods in Computational Neuroscience (August 5 to September 1)

Co-Directors

James M. Bower, California Institute of Technology
 Christof Koch, California Institute of Technology



Dan Green (left) demonstrates a ratio imaging package from Universal Imaging during an AQLM course session.

Lecturers and Instructors

Paul Adams, SUNY, Stony Brook
 Edward Adelson, Massachusetts Institute of Technology
 Daniel Alkon, NIH
 Richard Anderson, Massachusetts Institute of Technology
 David Beeman, University of Colorado, Boulder
 Avis H. Cohen, Cornell University
 Norberto Grzywacz, Massachusetts Institute of Technology
 Nancy Kopell, Boston University
 Rudolfo Llinas, NYU Medical Center
 Kevan Martin, MRC, Oxford, UK
 Michael Mascagni, Washington, DC
 Kenneth Miller, University of California, San Francisco
 Mark Nelson, California Institute of Technology
 John Rinzel, NIH
 David Rumelhart, Stanford University
 Sylvia Ryckebusch, California Institute of Technology
 Terrence Sejnowski, Salk Institute
 Allen I. Selverston, University of California, San Diego
 John Uhley, California Institute of Technology
 David Van Essen, California Institute of Technology
 Lucia Vaina, Boston University
 Matthew Wilson, California Institute of Technology

Students

Aric Agmon, University of California, Irvine
 Hagai Agmon, Hebrew University of Jerusalem, Israel
 Dale Anders, University of California, San Diego
 Evyatar Av-Ron, The Weizmann Institute of Science, Israel
 Ellen Barton, University of Pennsylvania
 Eyal Bartfeld, Rockefeller University
 David Berkowicz, Yale University School of Medicine
 Neil J. Berman, Oxford University, UK
 Peter J. Braam, University of Utah
 Dennis Bray, Colorado State University
 Trevor Darrell, Massachusetts Institute of Technology
 Gyongyi Gaal, University of Pennsylvania
 Kurt Haas, Albert Einstein College of Medicine
 Dirk Kautz, University of Oregon
 Markus Lappe, NIH
 Sean Marrett, Montreal Neurological Institute, Canada
 Douglas Morton, Case Western Reserve University

Dietmar Rapf, MPI für biologische Kybernetik, Germany
 Walter Schneider, University of Pittsburgh
 Nelson Spruston, Baylor College of Medicine
 Christoph Staub, Brain Research Institute, Switzerland
 Fan-Gang Zeng, Syracuse University

*Molecular Evolution (August 19 to 31)**Director*

Mitchell L. Sogin, MBL

Faculty

Michael Clegg, University of California, Riverside
 Daniel B. Davison, University of Houston
 W. Ford Doolittle, Dalhousie University, Canada
 Robert Dorit, Harvard University
 John W. Drake, National Institute of Environmental Health Sciences
 Joseph Felsenstein, University of Washington
 Walter M. Fitch, University of California, Irvine
 Barry G. Hall, University of Rochester
 Andrew Knoll, Botanical Museum of Harvard University
 David R. Maddison, Harvard University
 Peter Maloney, The Johns Hopkins Medical School
 Roger Milkman, The University of Iowa
 Gary Olsen, University of Illinois
 Norman R. Pace, Indiana University
 David Joseph Patterson, University of Bristol, UK
 Margaret Riley, University of Massachusetts, Amherst
 David A. Shub, SUNY, Albany
 Steve Smith, Harvard University
 Temple F. Smith, Dana Farber Cancer Institute
 Mark Wheelis, University of California, Davis
 Allan C. Wilson, University of California, Berkeley
 Elizabeth A. Zimmer, Smithsonian Institution

Students

Alexandra L. Basolo, University of Texas, Austin
 Heidi G. Blair, SUNY, Albany
 Judith Anne Blake, Smithsonian Institution
 Laura Blinderman, San Diego State University
 David J. Bogler, University of Texas, Austin
 Diane M. Bridge, Yale University
 Henner Brinkmann, Technische Universität, Germany
 James R. Brown, Simon Fraser University, Canada
 Bruce E. Byers, University of Massachusetts, Amherst
 Robert E. Calhoon, Queens College

Bruce J. Cochrane, University of South Florida
 Rafael O. De Sa, University of Texas, Austin
 Marcela Descalzi, University of Houston
 Philippe Djian, Harvard Medical School
 James W. Edwards, Salem College
 Bruce A. Eichhorst, University of North Dakota
 William Fischer, Los Alamos National Laboratory
 Dean A. Glawe, University of Illinois
 Robert M. Gould, New York State Institute for Basic Research
 Sharon P. Gowan, Harvard University Herbaria
 Lawrence I. Grossman, Wayne State University
 Radhey S. Gupta, McMaster University, Canada
 Raymond W. Holton, University of Tennessee
 Bradford E. James, Dartmouth College
 Matthew D. Kane, University of Illinois
 Jessica C. Kissinger, Indiana University
 Paul J. Kores, Tulane University
 Maja Krickler, National Institute of Environmental Health Sciences
 Uri Lador, Chicago Medical School
 Laura Landweber, Harvard University
 Bang-Ning Lee, University of Texas, Houston
 Heikki Lehtinen, University of Helsinki, Finland
 Wayne S. Leibel, Lafayette College
 Enrique P. Lessa, University of California, Berkeley
 Louise Ann Lewis, Ohio State University
 Paul O. Lewis, Ohio State University
 John M. Logsdon, Jr., Indiana University
 Kenneth L. McNally, University of California
 Linda K. Medlin, University of Bristol, UK
 Thomas Mills, University of Houston
 Judith Mongold, University of Massachusetts, Amherst
 Barbara Moore, Massachusetts Institute of Technology
 Rana Muzaffar, Florida State University
 Lena M. Nielsen, University of Lund, Sweden
 Elizabeth A. Oakenfull, MRC Haematology Unit, Oxford, UK
 Yves P. Quentin, Los Alamos National Laboratory
 James Ramsay, University of Utah
 Judith M. Rhymer, Smithsonian Institution
 Kenneth A. Rice, Harvard University
 Bernardo Rudy, NYU Medical Center
 Frank G. Salinas, University of Houston
 Leo C. Schalkwyk, Dalhousie University, Canada
 Michael Schloemann, Yale University
 Jeffrey D. Silberman, University of Miami
 Rama S. Singh, McMaster University, Canada
 Elizabeth M. Snella, Indiana University
 Elizabeth T. Snow, NYU Medical Center
 Peter L. Starkweather, University of Nevada
 Jeffrey L. Stein, University of California, San Diego

Youngbae Suh, Louisiana State University
 Thomas R. Sutter, CIIT, Research Triangle Park, NC
 Cheryl L. Tarr, University of North Dakota
 Richard N. Williams, Boise State University
 Charles G. Wray, Yale University

Optical Microscopy & Imaging in the Biomedical Sciences (October 6 to 12)

Co-Directors

Nina Strömberg Allen, Wake Forest University
 Colin S. Izzard, SUNY, Albany

Faculty and Course Associates

Steven M. Block, Rowland Institute for Science
 Joseph De Pasquale, SUNY, Albany
 Alec Harootunian, HHMI, University of California, San Diego
 Fredric S. Fay, University of Massachusetts Medical Center
 Kenneth A. Jacobson, University of North Carolina
 John M. Murray, University of Pennsylvania
 Kenneth Orndorff, Dartmouth College
 Julia S. Sizemore, Wake Forest University
 Stephen J. Smith, Stanford University School of Medicine
 Kenneth R. Spring, NHLBI/NIH
 Anna Spudich, Stanford University School of Medicine
 Roger Tsien, HHMI, University of California, San Diego

Lecturers

Jan Hinsch, Leica, Inc., Rockleigh, NJ
 Shinya Inoué, MBL
 Ernst Keller, Carl Zeiss, Inc., Thornwood, NY
 Rudolf Oldenbourg, MBL

Students

Lawrence W. Argenbright, Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT
 Elikplimi K. Asem, Purdue University
 Thomas G. Burke, City of Hope National Medical Center
 Dean Cole, Los Alamos National Laboratory
 R. Ford Denison, USDA
 Camille DiLullo, University of Pennsylvania
 Harold F. Dvorak, Beth Israel Hospital
 David H. Eidelman, McGill University, Canada
 T. R. Gowrishankar, University of Chicago
 John W. Hanrahan, McGill University, Canada
 Christopher M. Kenyon, Centre Hospitalier Thoracique de Montreal, Canada

Jeff Lansman, University of California,
San Francisco
Stephen Lin, Harvard Medical School
William W. Mantulin, University of Illinois,
Urbana—Champaign
Jose A. Mari Mutt, University of Puerto Rico
Jane E. Minturn, Yale University School of Medicine
Spring A. Scott, Purdue University
Jacqueline Sterner, University of Rochester
Scott J. Sternberg, Colorado State University
Xiao-Ying Tien, Case Western Reserve University
Susan M. Wall, NIH
David C. Zawieja, Texas A&M University

Pathogenesis of Neuroimmunologic Diseases
(August 19 to 31)

Co-Directors

J. Murdoch Ritchie, Yale University School of
Medicine
Byron H. Waksman, Foundation for Microbiology

Faculty

Vahi E. Amassian, SUNY Health Science Center
Barry G. W. Arnason, University of Chicago
Joel A. Black, Yale University
Pietro DeCamilli, Yale University Medical School
Judah A. Denburg, McMaster Medical Center,
Canada
Marc A. Dichter, University of Pennsylvania
Charles A. Dinarello, Tufts University Medical
School
Diane Griffin, The Johns Hopkins University
Stephen L. Hauser, Massachusetts General Hospital
Henry Khachaturian, NIMH/NIH
Norman Latov, College of Physicians and Surgeons
of Columbia University
Carl M. Leventhal, NINDS/NIH
W. Ian Lipkin, University of California, Irvine
Cathy G. McAllister, University of Pittsburgh
Dale E. McFarlin, NINDS/NIH
John Newsom-Davis, Oxford University, UK
Robert B. Nussenblatt, NEI/NIH
Nathanial G. Pitts, National Science Foundation
Jerome B. Posner, Memorial Sloan-Kettering Cancer
Center
Donald L. Price, Johns Hopkins Hospital
Richard W. Price, University of Minnesota Health
Center
James W. Prichard, Yale University Medical School
Cedric S. Raine, Albert Einstein College of Medicine
Anthony T. Reder, University of Chicago
David M. Regan, York University, Canada
Stephen C. Reingold, National Multiple Sclerosis
Society

Benjamin F. Roy, Georgetown University School of
Medicine
Clifford B. Saper, University of Chicago
Randolph B. Schiffer, Strong Memorial Hospital
Eli E. Sercarz, University of California, Los Angeles
Moon L. Shin, University of Maryland, Baltimore
Michael E. Shy, Thomas Jefferson University
Hospital
Lawrence Steinman, Stanford Medical Center
Stephen G. Waxman, Yale University Medical
School
Howard L. Weiner, Brigham and Women's Hospital
Jerry Wolinsky, University of Texas Health Science
Center at Houston

Students

Anat Achiron, Beilinson Medical Center, Israel
Peter-Brian Andersson, Sir William Dunn School of
Pathology, UK
Jody L. Baron, Yale University School of Medicine
Bruce F. Bebo, Jr., Texas A&M University
John R. Bethea, University of Alabama, Birmingham
Helen Clare Bodmer, Institut de Chimie Biologique,
France
Arlene R. Collins, SUNY, Buffalo
Steven W. Dow, Colorado State University
Lorise C. Gahring, Research Institute of Scripps
Clinic
Maureen N. Gannon, Rockefeller University
Claude Paul Genain, University of Kentucky
Koenraad Gijbels, University of Leuven, Belgium
Jonathan D. Glass, Johns Hopkins Hospital
John J. Hemperly, Becton Dickinson Research
Center
Nancy A. Johnson, Washington University Medical
School
Abraham Kessler, Weizmann Institute of Science,
Israel
Judith Lubner-Narod, University of Massachusetts
Medical School
Mary Ann McKee, Columbia Presbyterian Hospital
Rune Midgard, Molde County Hospital, Norway
Nicholas T. Potter, University of Connecticut School
of Medicine
Reijo Salonen, University of Turku, Finland
Jun-ichi Satoh, University of British Columbia,
Canada
Tiziana Savio, Istituto Superiore di Sanita, Italy
Daryth D. Stallone, University of Pennsylvania
School of Medicine
Sharon A. Stranford, Hahnemann University
Ursula I. Wesselmann, Northwestern University
Jurgen Zielasek, Diabetes Research Institute,
Germany

Summer Research Programs

Principal Investigators

- Alkon, Daniel, NIH, LMCN
Armstrong, Clay M., University of Pennsylvania
Armstrong, Peter, University of California
Augustine, George J., University of Southern California
- Baker, Robert, New York University Medical Center
Barlow, Robert, Syracuse University
Barry, Daniel, University of Michigan Medical Center
Barry, Susan R., University of Michigan
Bass, Andrew H., Cornell University
Bates, William R., Carleton University, Canada
Bearer, Elaine L., University of California
Beauge, Luis, Instituto M. y M. Ferreyra, Argentina
Begenisich, Ted, University of Rochester Medical Center
Bennett, Michael V. L., Albert Einstein College of Medicine
Bezanilla, Francisco, University of California, Los Angeles
Bloom, George S., University of Texas Southwestern Medical Center
Bodznick, David, Wesleyan University
Borgese, Thomas A., Lehman College, CUNY
Boron, Walter F., Yale University School of Medicine
Borst, David W., Illinois State University
Boyer, Barbara C., Union College
Brady, Scott, University of Texas Southwestern Medical Center
Brehm, Paul, SUNY, Stony Brook
Brown, Joel E., Washington University School of Medicine
Bryant, Shirley, University of Cincinnati
Bug, William J., Columbia University
Burdick, Carolyn J., Brooklyn College
Burger, Max M., Friedrich Miescher-Institute, Switzerland
- Callaway, Joseph C., University of North Carolina
Cariello, Lucio, Stazione Zoologica, Italy
- Chang, Donald C., Baylor College of Medicine
Chappell, Richard L., Hunter College, CUNY
Charlton, Milton, University of Toronto, Canada
Charmantier, Guy, Université des Sciences et Techniq. du Languedoc, France
Charmantier-Daures, Mireille, Université des Sciences et Techniq. du Languedoc, France
Clay, John, NIH, NINDS
Cohen, Lawrence B., Yale University School of Medicine
Cohen, William D., Hunter College, CUNY
Collin, Shaun P., University of California, San Diego
Cooperstein, Sherwin J., University of Connecticut Health Center
Cuppoletti, John, University of Cincinnati
- D'Alessio, Giuseppe, University of Naples, Italy
D'Avanzo, Charlotte, Hampshire College
De Weer, Paul, Washington University School of Medicine
Deitmer, Joachim W., University of Kaiserslautern, Germany
Dunlap, Kathleen, Tufts Medical School
- Eckberg, William R., Howard University
Ehrlich, Barbara E., University of Connecticut Health Center
- Feinman, Richard, SUNY Health Science Center
Ferguson, Donald, University of Cincinnati
Fieber, Lynne A., University of Miami
Fink, Rachel, Mount Holyoke College
Fishman, Harvey M., University of Texas Medical Branch
- Gadsby, David C., Rockefeller University
Gainer, Harold, NIH, NINDS
Garrick, Rita Anne, New Jersey Medical School and Fordham University
Giuditta, Antonio, University of Naples, Italy

Glynn, Paul, Hunter College
 Goldman, Robert D., Northwestern University Medical School
 Gonzalez-Serratos, Hugo, University of Maryland School of Medicine
 Griff, Edwin, University of Cincinnati

Haimo, Leah T., University of California
 Hardin, John A., Yale University
 Heiny, Judith, University of Cincinnati
 Hernandez-Cruz, Arturo, Roche Institute of Molecular Biology
 Highstein, Stephen M., Washington University
 Holman, Molly A., The Whitney Laboratory, University of Florida
 Hoskin, Francis C.G., Illinois Institute of Technology
 Hoy, Ronald R., Cornell University
 Hummon, William, Ohio University

Ilan, Joseph, Case Western Reserve University
 Ilan, Judith, Case Western Reserve University
 Ip, Wallace, University of Cincinnati

Johnston, Daniel, Baylor College of Medicine
 Josephson, Robert K., University of California

Kaminer, Benjamin, Boston University School of Medicine
 Kaneshiro, Edna S., University of Cincinnati
 Kaplan, Ehud, Rockefeller University
 Kaplan, Ilene M., Union College
 Karp, Richard, University of Cincinnati
 Kremer, James N., University of Southern California
 Kriebel, Mahlon, SUNY Health Science Center, Syracuse

Langford, George, University of North Carolina, Chapel Hill
 Laufer, Hans, University of Connecticut
 Lee, Youngsook, Harvard University
 Lehman, Michael, University of Cincinnati
 Levin, Jack, University of California School of Medicine, San Francisco
 Levine, Robert Paul, Washington University School of Medicine
 Lian, Jane, University of Massachusetts Medical School
 Linck, Richard W., University of Minnesota
 Lipicky, Raymond John, U. S. Food and Drug Administration
 Lisman, John, Brandeis University

Llinas, Rodolfo R., New York University Medical Center
 Loewenstein, Werner R., University of Miami School of Medicine
 Lohmann, Kenneth J., University of Washington

Malchow, Robert Paul, University of Illinois College of Medicine
 Malinowska, D. H., University of Cincinnati
 Martinez, Joe L., Jr., University of California
 Matteson, Donald R., University of Maryland
 Meinertzhausen, Ian A., Dalhousie University, Canada
 Metuzals, Janis, University of Ottawa, Canada
 Mitchison, Timothy, University of California, San Francisco
 Moreno, Alonso P., Albert Einstein College of Medicine

Nasi, Enrico, Boston University School of Medicine
 Nelson, Leonard, Medical College of Ohio
 Noe, Bryan D., Emory University School of Medicine
 Northcutt, R. Glenn, University of California, San Diego

Obaid, Ana Lia, University of Pennsylvania School of Medicine

Pant, Harish, NIH, NINDS
 Pappas, George D., University of Illinois, Chicago
 Parysek, Linda, University of Cincinnati
 Peckol, Paulette, Smith College
 Pierce, Sidney K., University of Maryland, College Park
 Pierson, Beverly K., University of Puget Sound

Rafferty, Nancy S., Northwestern University
 Rakowski, Robert F., UHS/The Chicago Medical School
 Render, JoAnn, Hamilton College
 Ripps, Harris, University of Illinois College of Medicine
 Rose, Birgit, University of Miami School of Medicine
 Ross, William N., New York Medical College
 Ruderman, Joan V., Harvard Medical School
 Russell, John M., University of Texas Medical Branch, Galveston
 Ryan, Una S., Washington University

Salzberg, Brian M., University of Pennsylvania School of Medicine
 Segal, Sheldon, Rockefeller Foundation

Sheetz, Michael P., Washington University Medical School
Silver, Robert B., Cornell University
Sloboda, Roger D., Dartmouth College
Speksnijder, Johanna E., Utrecht University, The Netherlands
Sperelakis, Nicholas, University of Cincinnati
Spiegel, Evelyn, Dartmouth College
Spiegel, Melvin, Dartmouth College
Spray, David C., Albert Einstein College of Medicine
Stein, Gary, University of Massachusetts Medical School
Steinacker, Antoinette, Washington University
Stracher, Alfred, SUNY Health Science Center, Brooklyn
Stuart, Ann E., University of North Carolina
Swandulla, Dieter, Max-Planck-Institut, Germany
Swenson, Katherine L., Harvard Medical School

Tanguy, Joelle, Northwestern University
Telzer, Bruce R., Pomona College
Terada, Hirotooshi, Hamamatsu Photonics, K. K., Japan
Treistman, Steven N., Worcester Foundation for Experimental Biology
Trinkaus, John Philip, Yale University
Troll, Walter, New York University Medical Center
Tucker, Edward B., Baruch College
Tykocinski, Mark L., Case Western Reserve University
Tytell, Michael, Bowman Gray School of Medicine of Wake Forest University

Vaisberg, Eugeni A., Protein Research Institute, USSR
Vallee, Richard, Worcester Foundation for Experimental Biology
Van Egeraat, Jan M., Vanderbilt University
Vogel, Steven S., NIH, NIDDK

Weiss, Dieter G., Zoology Institute, Germany
Welsford, Jan G., University of Pennsylvania School of Medicine
Wolszon, Laura R., Columbia University
Worden, Mary Kate, Harvard Medical School

Yeh, Jay Z., Northwestern University

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 Humes, Arthur G. (Professor of Biology Emeritus)
 Strickler, J. Rudi (Professor of Biology, Program Director)
 Tamm, Sidney L. (Professor of Biology)
 Valiela, Ivan (Professor of Biology)

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 Boulanger, Lisa
 Brand, Michelle (University of California, San Diego)
 Carrama, Carolyn
 Christine, Stephanie
 Collumb, Chris (Trinity University)
 Christman, Laurie
 Cruse, Jennifer
 Deiner, Michael (Tulane)
 DeSantis, Michael
 Dougall, David (University of Pittsburg, Johnstown)
 Fernandez, Cecilia
 Forrest, Davina
 Fox, Pamela
 Gibson, Mark (Wesleyan)
 Goodbred, Steven
 Guertin, Laura (Bucknell)
 Harris, Matthew
 Havert, Michael
 Hoyer, Eric (Lawrence University)
 Kinkade, Christopher
 Kozlowski, Wendy
 MacDonald, Robin
 McKee, Nancy (Middlebury)
 McNeil, Sean
 Polsky, Matthew
 Russell, John (Franklin & Marshall)
 Seton-Haris, Genevieve
 Shaz, David
 Smith, Douglas
 Smith, Kirsten
 Spradlin, Trevor
 Staunton, Edward
 Steenburgh, Eric
 Stousland, Brett (Lawrence University)
 Tello, Christine
 Valdes, Hugo
 Warner, Jacqueline



BUMP graduate student Diane Cowan explains the finer points of the lobster to BUMP undergrads.

Youngberg, Jill
 Ziemba, Robert

Visiting graduate students Fall 1990 WIMS

Burner Michael (Lawrence University)
 Jones, Fynn (Vanderbilt)
 Klaper, Rebecca (University of Illinois)
 Maselli, Andrew (Knox College)
 Naessig, Tricia (Augusta College)
 Theis, Lisa (Lawrence University)

Summer undergraduate interns

Altes, Hester
 Bergles, Dwight
 Butler, Nina (Westown School, PA)
 Casterline, Jennifer
 Call, Christopher
 Hoagland, Todd (Bucknell)
 Lacomis, Lynne (SUNY, Binghamton)
 Pfeifer, Shaili
 Pardo, Alex (Five Colleges)
 Reischauer, Alyssa (USC)
 Sanders, Sophie (Dalton School)
 Short, Graham
 Szulgit, Greg

Fall undergraduate intern

Waggett, Caryl (Brown)

Laboratory of Jelle Atema

Organisms use chemical signals as their main channel of information about the environment. These signals are transported in the marine environment by turbulent currents, viscous flow, and molecular diffusion. Receptor cells extract signals through various filtering processes. Currently, the lobster with its exquisite sense of taste and smell, is our major model to study the signal filtering capabilities of the whole animal and its narrowly tuned receptor cells. Research focuses on amino acids (food signals) and pheromones (courtship and dominance) neurophysiology of receptor cells, behavior guided or modulated by chemical signals, and computational models of odor plumes and neural filters.

Laboratory of Arthur G. Humes

Research interests include systematics, development, host specificity, and geographical distribution of copepods associated with marine invertebrates. Current research is on taxonomic studies of copepods from invertebrates in the tropical Indo-Pacific area, and poecilostomatoid and siphonostomatoid copepods from deep-sea hydrothermal vents and cold seeps.

Laboratory of Ivan Valiela

Our major research activity involves the Waquoit Bay Land Margin Ecosystems Research Project. This work examines how human activity in coastal watersheds (including landscape use and urbanization) increases nutrient loading to groundwater and streams. Nutrients in groundwater are transported to the sea, and, after biogeochemical transformation, enter coastal waters. There, increased nutrients bring about a series of changes. The Waquoit Bay LMER is designed to help us to understand and model the coupling of land use and consequences to receiving waters, and to study the processes involved.

A second long-term research topic is the structure and function of salt marsh ecosystems, including the processes of predation, herbivory, decomposition, and nutrient cycles.

The Ecosystems Center

The Center was established in 1975 to promote research and education in ecosystems ecology. Eleven senior scientific staff and forty research assistants and support staff study the terrestrial and aquatic ecology of a wide variety of ecosystems ranging from northern Europe (trace gas emission from acid-rain affected forests) to the Alaskan Arctic (long-term studies of the controls of tundra, lake, and stream biota) to the Harvard Forest (long-term studies of the effects of disturbance in forest ecosystems) to Buzzards Bay (controls of anaerobic decomposition). Many projects, such as those dealing with sulfur transformations in lakes and nitrogen cycling in the forest floor, investigate the movements of nutrients and make use of the Center's mass spectrometry laboratory (directed by Brian Fry) to measure the stable isotopes of carbon, nitrogen, and sulfur. The research results are applied wherever possible to questions of the successful management of the natural

resources of the earth. In addition, the ecological expertise of the staff is made available to public affairs groups and government agencies who deal with such problems as acid rain, ground water contamination, and possible carbon dioxide-caused climate change. Opportunities are available for postdoctoral fellows.

Staff and consultants

Hobbie, John E., Co-Director	Kicklighter, David
Melillo, Jerry M., Co-Director	Kracko, Karen
Banta, Gary	Laundre, James
Bauman, Carolyn	Michmerhuizen, Catherine
Berger, Laurel	Miliefsky, Michelle
Bowles, Francis	Moller, Bernard
Bowles, Margaret	Nadelhoffer, Knute
Castro, Nancy	Padien, Daniel
Cochran, Wendy	Pallant, Julie
Davis, Sarah	Parmentier, Nancy
Deegan, Linda	Peterson, Bruce
Dornblaser, Mark	Raich, James
Downs, Martha	Rastetter, Edward
Fafinski, Stephen	Regan, Kathleen
Fry, Brian	Ricca, Andrea
Garritt, Robert	Russell, Ann
Giblin, Anne	Saupe, Susan
Gregg, Tim	Schwamb, Carol
Griffin, Elisabeth	Schwarzman, Elisabeth
Helfrich, John	Semino, Suzanne
Hopkinson, Charles	Shaver, Gaius
Hullar, Meredith	Shulman, Laura
Jesse, Martha	Stuedler, Paul
Jordan, Marilyn	Tholke, Kristin
	Tucker, Jane

Postdoctorals

Bowden, Richard	Peterjohn, William
Castro, Mark	Ryan, Michael
Kling, George	Wainright, Sam
McKane, Robert	

Visiting scholars

Joyce, Linda, U.S.D.A. Forest Service
McGuire, David, U.S.D.A. Forest Service
Neill, Christopher, University of Massachusetts, Amherst

Laboratory for Marine Animal Health

The laboratory provides diagnostic, consultative research, and educational services to the institutions and scientists of the Woods Hole community concerned with marine animal health. Diseases of wild, captive, and cultured animals are investigated.

Staff

Abt, Donald A., Director and The Robert R. Marshak Term Professor of Aquatic Animal Medicine and Pathology, School of Veterinary Medicine, University of Pennsylvania



A view of Alaska's Brooks Range form the Ecosystems Center's Toolik Lake research station. Photo by Mark Dornblaser.

Bullis, Robert A., Research Associate in Microbiology,
University of Pennsylvania
Leibovitz, Louis, Director Emeritus
McCallerty, Michelle, Histology Technician, University of
Pennsylvania
Moniz, Priscilla C., Secretary
Smolowitz, Roxanna, Research Associate in Pathology,
University of Pennsylvania
Wadman, Elizabeth A., Microbiology Technician, University
of Pennsylvania

Laboratory of Aquatic Biomedicine

This laboratory investigates leukemias of soft shell clams. Monoclonal antibodies developed by this laboratory and techniques in molecular biology are used to investigate the differences between normal and leukemic cells and their ontogeny. The impact of pollutants on leukemogenesis is currently being studied with an emphasis on regional superfund sites.

Staff

Reinisch, Carol L., Investigator, MBL, and Chairperson
Department of Comparative Medicine, Tufts University
School of Veterinary Medicine
Miosky, Donna, Laboratory Technician
White, Marja, Postdoctoral Fellow

Laboratory of Cell Biochemistry

This laboratory studies developmental, metabolic, and environmental influences on the genetic regulation of cellular enzymes. Current emphasis is on the gene products involved in hepatic heme biosynthesis and utilization in marine fish. These processes are responsive to hormonal and nutritional signals as well as to environmental pollutants and carcinogens. This work is being conducted with fish liver *in vivo*, with primary cultures of normal hepatocytes, and with cultured hepatoma cells isolated from a fish tumor. Gene activity is quantitated with cDNA probes, and the relevant genes are being cloned in bacteria to define better the actions of chemical inducers. Other research is concerned with translocation of proteins between various subcellular compartments both in fish hepatocytes and in invertebrate eggs before and after fertilization.

Staff

Cornell, Neal W., Senior Scientist
Bruning, Grace, Research Assistant
Foley, Kathleen, Research Assistant

Visiting scientist

Fox, T. O., Harvard Medical Center

Laboratory of Developmental Genetics

This research group studies the early gene control of cellular differentiation pathways (cell lineage determination) in the embryos of tunicates and other marine invertebrate species.

Staff

Whittaker, J. Richard, Senior Scientist
Crowther, Robert, Research Assistant
Loescher, Jane L., Research Assistant
Meedel, Thomas H., Assistant Scientist

Visiting investigators

Collier, J. R., Brooklyn College
Lee, James J., Columbia University, College of Physicians & Surgeons

Laboratory of Judith P. Grassle

Studies on the population genetics and ecology of marine invertebrates living in disturbed environments, especially of sibling species in the genus *Capitella* (Polychaeta).

Staff

Grassle, Judith P., Senior Scientist
Feinsilber, Sigalit, Research Assistant
Mills, Susan W., Research Assistant

Laboratory of Haryln O. Halvorson

This laboratory is interested in the molecular process of sporulation and germination in members of the genus *Bacillus*. Our earlier work has involved characterization of the *gerJ* gene in *Bacillus subtilis*, and determination of the germination requirements of marine endospore-forming bacteria.

Over the past year, we have isolated a large number of sporeformers from various marine environments like deep sea cores and sediments. Our intention is to characterize these bacteria at the molecular level, with emphasis on genes associated with sporulation and germination. Protocols based on DNA fingerprinting and quantitative hybridizations have been developed to differentiate these bacteria from one another, as well from terrestrial sporeformers. The hybridization data has shown that the bacterial isolates are not closely related to one another.

Numerical taxonomic methods are also being used to cluster the various isolates. The physiologically interesting sporeformers will also be characterized by physical mapping using rare-cutting restriction endonucleases.

Staff

Halvorson, Harlyn O., Principal Investigator
Chikarmane, Hemant, Assistant Scientist
Glick, Beatriz, Research Assistant
Pratt, Sara, Research Assistant
VanLooy, Lori, Research Assistant

Visiting investigators

Anderson, Porter, University of Rochester
Keynan, Alex, Hebrew University, Jerusalem, Israel
Kornberg, Hans, Christ's College, Cambridge, UK
Vincent, Walter, University of Delaware
Yashphe, Jacob, Hebrew University, Jerusalem, Israel

Laboratory of Shinya Inoué

Mechanism of mitosis and related motility. Development of high resolution 3-D video microscope systems. High resolution polarized light microscopy of muscle fibrils. Physical origin of edge birefringence and image formation in the polarized light microscope.

Staff

Inoué, Shinya, Distinguished Scientist
Knudson, Robert, Instrument Development Engineer
Oldenbourg, Rudolf, Visiting Assistant Scientist
Stukey, Jetly, Research Assistant
Szent-Gyorgyi, David, Research Assistant
Taracka, Richard, Instrument Maker
Woodward, Bertha M., Laboratory Manager

Visiting investigators

Inoué, Theodore, Universal Imaging Corporation, West Chester, Pennsylvania
Silver, Robert B., Cornell University, Ithaca, New York
Stemmer, Andreas, University of Basel, Switzerland

Laboratory of Alan M. Kuzirian

The research explores the functional morphology and ultrastructure of various organ systems in opisthobranch mollusks. The program includes mariculture of the nudibranch, *Hermisenda crassicornis*, with emphasis on developing reliable culture methods for rearing and maintaining the animal as a research resource. Studies include optimization of adult and larval nutrition, control of facultative pathogens and disease, and development of morphologic criteria for staging larvae and juveniles. These morphologic studies stress the ontogeny of neural and sensory structures. Concurrent with these studies is the development of a new technique to obtain and reconstruct serial block face images (SBFI) of epoxy embedded tissue actually sectioned inside an SEM by an *in situ* miniature ultramicrotome. Additional collaborative research includes histochemical investigations on strontium's role in initiating calcification in molluscan embryos (shell and statoliths), as well as immunocytochemical labelling of cell-surface and secretory product antigens of neurosecretory neurons in the eye of *Aplysia*.

Staff

Alan M. Kuzirian, Assistant Scientist
Catherine T. Tamse, Research Assistant



Dr. Alan Kuzirian and Catherine Tamse in the laboratory. Photo by George Liles.

Laboratory of Molecular Evolution

The major research effort of this laboratory is the structure analysis of ribosomal RNA. Similarities between small subunit ribosomal RNA sequences are used to infer the evolutionary history of eukaryotic microorganisms and to design molecular probes for studies in marine ecology.

Staff

Sogin, Mitchell L., Director
 Bhattacharya, Debashish, Postdoctoral Fellow
 Bibeau, Claude, Research Technician
 Bucklin, Ann, Visiting Scientist
 Stickel, Shawn, Research Technician
 Wainwright, Patricia, Postdoctoral Fellow

Laboratory of Neuroendocrinology

This laboratory studies the molecular and cellular bases of two neural programs that regulate different important behaviors in the model mollusk *Aplysia*. Research is conducted on the mechanisms of the neuronal circadian oscillators located in the eyes. These circadian oscillators drive the circadian activity rhythm of the animal, which is concerned with the daily timing of food gathering and of prolonged rest. Additional research is conducted on a group of neuroendocrine cells that produce a peptide, "egg-laying hormone," that initiates egg laying and associated behaviors. The laboratory is interested in how the three-dimensional shape of this peptide hormone allows a highly specific interaction with its receptor and the intracellular processes

that are triggered by it. In another project, the laboratory has discovered and is continuing research on a novel second messenger enzyme, an NADase, in the oocytes of *Aplysia*, that generates cyclic ADPR, a Ca^{2+} -mobilizing product.

Staff

Strunwasser, Felix, Director
 Cox, Rachel L., Senior Research Assistant
 Glick, David, Senior Postdoctoral Fellow
 Hellmich, Mark, Postdoctoral Fellow
 Rainville, Carol, Laboratory Assistant
 Vogel, Jackie, Research Assistant

Laboratory of Robert E. Palazzo

This laboratory studies the biochemical regulation of cellular events during meiosis and mitosis. An integral part of the research effort is the design of reconstitution systems that faithfully execute cell cycle dependent events under defined conditions. Current cell biological, immunochemical, biochemical, and microscopic methodologies are employed. Using marine eggs as a material source, assays have been developed that allow the study of germinal vesicle breakdown (GVBD), aster formation, and reactivation of isolated mitotic apparatus *in vitro*. Current focus of the laboratory is on the identification of cell cycle dependent regulatory events with major emphasis on protein phosphorylation and other post-translational modifications. The ultimate goal is the identification of key enzymes and target substrates that are involved in the regulation of cell division and are highly conserved during evolution.

Laboratory of Monica Riley

Research in this laboratory focuses on the molecular evolution and gene expression in the bacterium *Escherichia coli*. In a collaborative effort, a database containing information on the intermediary metabolism and biochemical pathways of *E. coli* is being developed. When completed, this database is expected to contain information on each metabolic reaction, the enzyme, the reactants, products, cofactors, activators, inhibitors, kinetics, equilibrium constants, binding constants, etc.

Related research is on the evolution of the *E. coli* DNA and organization of the genes in the chromosome. Comparative nucleotide and amino acid sequence data provide information on the evolutionary relationships of *E. coli* genes to homologous genes in related bacteria.

Laboratory of Sensory Physiology

Since 1973, the laboratory has conducted research on various aspects of vision. Current studies focus on photoreceptor cells, on their light-absorbing pigments, and on their biochemical reactions initiated by light stimulation. Microspectrophotometric and biochemical techniques are used to study the receptors of both vertebrates (amphibia, fish, and mammals) and invertebrates (horseshoe crab and squid).

Staff

Harosi, Ferenc, Director, Associate Scientist, MBL, and Boston University School of Medicine
Szuts, Ete, Associate Scientist, MBL, and Boston University School of Medicine

Visiting investigators

Evans, Barbara I., University of Oregon, Eugene
Hawryshyn, Craig W., University of Victoria, Canada
Lall, Abner B., Johns Hopkins University

Laboratory of Osamu Shimomura

Biochemical studies of the various types of bioluminescent systems. Preparation of the improved forms of aequorin for measuring intracellular free calcium.

Staff

Shimomura, Osamu, Senior Scientist, MBL, and Boston University School of Medicine
Shimomura, Akemi, Research Assistant

Visiting investigator

Nakamura, Hideshi, Harvard University

Laboratory of Raquel Sussman

We investigate the molecular mechanism of DNA damage-inducible functions in *E. coli*. Present studies deal with novel genes that affect radiation-induced mutagenesis and analysis of RecA functions.

Staff

Sussman, Raquel, Associate Scientist
Hemant Chikarmane, Postdoctoral Research Associate
Dudley, Karen, Research Assistant

National Vibrating Probe Facility

We are exploring the roles of ionic currents, gradients, and waves in controlling development. We focus on controls of pattern and controls by calcium ions.

Staff

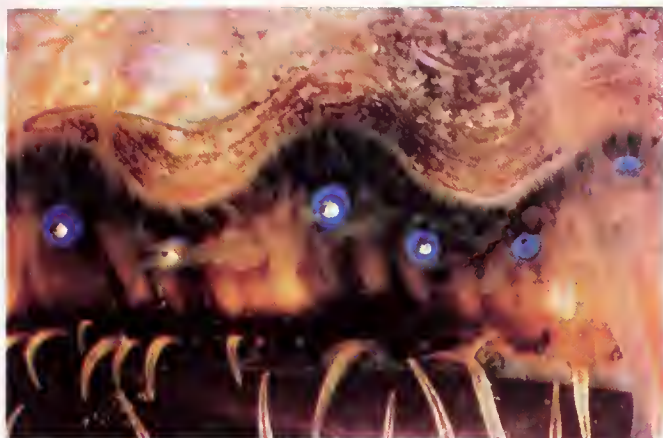
Jaffe, Lionel, Senior Scientist and Facility Director
Kuhntreiber, Willem, Physiologist
McLaughlin, Jane, Research Assistant
Miller, Andrew, Research Associate
Sanger, Richard, Technician
Shipley, Alan, Technician

Visiting investigators

Allen, Nina, Wake Forest College
Bates, William, Carleton University, Canada
Buonano, Mark, Massachusetts Institute of Technology
Chrystal, Jane, University of Sidney, Australia
Cornwall, Carter, Boston University
Danilchik, Michael, Wesleyan University
Gillot, Isabelle, Station Zoologique, Villefranche-sur-mer, France
Isaacs, Hugh, Brookhaven National Laboratories
Kinnamon, Sue, Colorado State University
Koshian, Leon, Cornell University
Lucas, William, University of California, Davis
McConnaughey, Ted, Marine Biological Laboratory
O'Donnell, Michael, McMaster University, Canada
Ripps, Harris, University of Illinois College of Medicine
Rubinacci, Alessandro, University of Milan, Italy
Sardet, Christian, Station Zoologique, Villefranche-sur-mer, France
Saunders, Mary Jane, University of South Florida, Tampa
Schiefelbein, John, University of Michigan
Shapiro, James, University of Chicago
Smith, Peter, Cambridge University, UK
Speknsnijder, Johanna, University of Utrecht, The Netherlands

Other Year-Round Investigators and Staff

Stephens, Raymond E., Principal Investigator
Szent-Gyorgy, Gwen, Research Assistant
Warren, Lisa, Research Assistant



Honors

Friday Evening Lectures

- Dennis Powers, Stanford University, Hopkins Marine Station, 29 June *"Adapting to a Changing Environment: Genetic and Physiological Mechanisms"*
- Joan Ruderman, Harvard Medical School, 6 July *"Controlling Cell Division"*
- James Spudich, Stanford University School of Medicine, 13 July *"Manifestation of a Molecular Motor: From Muscle to Amoebae"*
- Ricardo Miledi, University of California, 19, 20 August (Forbes Lectures) *"How to Study the Brain Using Frog Oocytes"*
- James Tiedje, Michigan State University, 27 July *"Destruction of PCBs and Other Pollutants by a New Class of Anaerobic Sediment Microorganisms"*
- Ruth Sager, Dana-Farber Cancer Institute, 3 August *"Tumor Repressor Genes"*
- A. James Hudspeth, University of Texas Southwestern Medical Center, 10 August *"How the Ear's Works Work: Mechano-electrical Transduction, Frequency Tuning, and Synaptic Transmission by Hair Cells of the Internal Ear"*
- Phil Leder, Harvard Medical School, 17 August *"Limb Deformity: A Pleiotropic Mutation Governing Embryonic Pattern Formation in the Mouse"*
- Brian Fry, MBL Ecosystems Center, 24 August *"Consumers and Carbon Isotopes: Good Chemistry in the Sea"*
- Thoru Pederson, Worcester Foundation for Experimental Biology, 31 August *"Between Nucleus and Cytoplasm: The Baroque Process of Making mRNA as Studied from the Perspective of Cell Biology"*

Fellowships

Robert Day Allen Fellowship

Eugeni A. Vaisberg, Protein Research Institute, USSR

Frederick B. Bang Fellowship Fund

Elaine Bearer, University of California, San Francisco

Jean and Katsuma Dan Fellowship

Douglas E. Koshland (financial support by Japanese Dan Fellowship), Carnegie Institution of Washington

M. G. F. Fuortes Fellowship

Joseph Charles Callaway, University of North Carolina, Chapel Hill

Stephen W. Kuffler Fellowship

Joachim W. Deitmer, University of Kaiserslautern, Zoologie, Germany
Dieter Swandulla, Max-Planck-Institut, Germany

Hayden-Baille Fellowship

Neena Din, University of British Columbia, Canada
Anne Donaldson, MRC Laboratory of Molecular Biology, UK

Faith Miller Fellowship

Elaine L. Bearer, University of California, San Francisco
Youngsook Lee, Harvard University

Nikon Fellowship

Timothy Mitchison, University of California,
San Francisco

Science Writing Fellowships

Robin Henig, Freelance
Bruce Jacobs, Freelance
Bill Krasean, *Kalamazoo Gazette*
June Kinoshita, Freelance
Keming Kuo, Voice of America
Beth Livermore, Freelance
Michael Skoler, National Public Radio
Pamela Weintraub, *Omni*
Rick Weiss, *Science News*

H. Burr Steinbach Memorial Fellowship

Youngsook Lee, Harvard University

**Steps Toward Independence—
MBL Summer Fellowship**

Elaine Bearer, University of California, San Francisco
Robert Paul Malchow, University of Illinois
JoAnn Render, Hamilton College
Katherine Swenson, Harvard Medical School
Johanna E. Speksnijder, Utrecht University,
The Netherlands
Eugeni Vaisberg, Protein Research Institute, USSR

Scholarships**APA Fellow**

Maria A. Sosa, University of Florida
John F. Hamilton, Meharry Medical College

ARCS Foundation Fellow

Daniel S. Kessler, Rockefeller University

ASCB Fellows

Abdiel J. Alvarez, University of Puerto Rico
Robert L. Bacallao, University of California,
Los Angeles
Miles G. Cunningham, Massachusetts Institute of
Technology
Charlotte M. Vines, Harvard Medical School

Biology Club of CUNY

Elizabeth L. Winter, City College of New York

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Haohua Qian, University of Illinois

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Technology

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Kong

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Shi Liu, University of Oklahoma
Lynn V. Mendelman, Harvard Medical School
Elizabeth J. Orle, Colorado State University
Mechthild Pohlschroder, University of Massachusetts,
Amherst

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Sylwester Chyb, Wesleyan University

Caswell Grave Scholarship

Ricardo Araneda, Albert Einstein College of Medicine
Sylwester Chyb, Wesleyan University
Karen M. Guida, University of Paris, France

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Anne Marie Murphy, Johns Hopkins University

Arthur Klorfein Fund Scholarship

Dangeruta Kersulyte, Academy of Science, Lithuania,
USSR

Thierry Lepage, University of Nice, France
 Karen M. Guida, University of Paris, France

Edwin S. Linton Memorial Scholarship

Michael C. Schmale, University of Miami

S. O. Mast Founders Scholarship

Peter J. Edmunds, Northeastern University
 Ka Hou Chu, Chinese University of Hong Kong,
 Hong Kong

Center for Microbial Ecology, Michigan State Scholarship

Olivia T. Harriott, University of Connecticut

Alberto Monroy Fellow

Maria G. DiBernardo, Instituto di Biologia dello
 Sviluppo, CNS, Italy

James S. Mountain Memorial Fund Scholarship

Karen M. Page, Dartmouth College
 Eric A. Sheldon, University of Massachusetts, Amherst
 Salme Taagepera, University of Virginia
 Sandra A. Brockman, Carnegie-Mellon University
 Tod A. Critchlow, Scripps Institute of Oceanography

Planetary Biology Internship

Jennifer E. Klenz, University of Saskatchewan, Canada

William Townsend Porter Foundation Fellowship

Abdiel J. Alvarez, University of Puerto Rico
 Robert L. Bacallao, University of California,
 Los Angeles
 Miles G. Cunningham, Massachusetts Institute of
 Technology
 Domingo T. Rivera, Worcester Foundation for
 Experimental Biology
 Charlotte M. Vines, Harvard Medical School
 Ebenezer Yamoah, University of Alberta, Canada

Herbert W. Rand Scholarship

Brian J. Binder, Massachusetts Institute of Technology
 Sandra A. Brockman, Carnegie-Mellon University
 Isabelle Carre, SUNY, Stony Brook
 Joseph Cerro, Columbia University
 Ka Hou Chu, Chinese University of Hong Kong,
 Hong Kong

Tod A. Critchlow, Scripps Institute of Oceanography
 Michele I. Flatters, Tufts University
 Holly Y. Goodson, Stanford University
 Jerilyn Jewett-Smith, Whitman College
 John R. Jordan, University of Utah
 David L. Keefe, Yale University
 Karen L. King, Florida State University
 Qingwen Li, University of Kansas
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 Qi Yang, University of Connecticut

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 Holly Y. Goodson, Stanford University
 Daniel S. Kessler, Rockefeller University

Marjorie W. Stetten Fund

Haohua Qian, University of Illinois

Surdna Foundation Scholarship

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 Oivind Enger, University of Bergen, Norway
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 Martin Polz, University of Vienna, Austria
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 Technology

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Natalie Angier, *The New York Times*

MBL Tour Guides Award for Outstanding Science Presentation to the General Public

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 Seymour Zigman, University of Rochester School of
 Medicine

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Stanley W. Watson, Associates of Cape Cod, Inc., Falmouth, MA

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Carol L. Reinisch, Tufts University School of Veterinary Medicine,
Boston, MA
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Sheldon J. Segal, The Rockefeller Foundation, New York, NY

Emeriti

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Seymour S. Cohen, Woods Hole, MA
Arthur L. Colwin, Key Biscayne, FL
Laura Hunter Colwin, Key Biscayne, FL
D. Eugene Copeland, MBL, Woods Hole, MA
Sears Crowell, Indiana University, Bloomington, IN
Alexander T. Daignault, Boston, MA
William T. Golden, New York, NY
Teru Hayashi, Woods Hole, MA
Ruth Hubbard, Cambridge, MA
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Maurice E. Krahl, Tucson, AZ
Charles B. Metz, Miami, FL
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C. Ladd Prosser, University of Illinois, Urbana, IL
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W. D. Russell-Hunter, Syracuse University, Syracuse, NY
John Saunders, Jr., Waquoit, MA
Mary Sears, Woods Hole, MA
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 Baum, Mr. Richard T.
 Baylor, Drs. Edward and Martha
 Beckman, Mrs. Barbara
 Beers, Mrs. Yardley
 Belesir, Mr. Tasos
 Bennett, Drs. Michael and Ruth
 Berg, Mr. and Mrs. C. John
 Bernheimer, Drs. Alan W. and
 Harriet P.
 Bernstein, Mr. and Mrs. Norman
 Bicker, Mr. Alvin
 Bigelow, Mr. and Mrs. Robert O.
 Bihle, Dr. William
 Bird, Mr. William R.
 Bishop, Mrs. John
 Bleck, Dr. Thomas B.
 Blumefeld, Ms. Olga
 Boche, Mr. Robert
 Bodeen, Mr. and Mrs. George H.
 Boettiger, Dr. and Mrs. Edward
 G.
 Boettiger, Mrs. Julie
 Bolton, Mr. and Mrs. Thomas C.
 Bonn, Mr. Theodore H.
 Borg, Dr. and Mrs. Alfred F.
 Borgese, Dr. and Mrs. Thomas
 Bowles, Dr. and Mrs. Francis P.
 Bradley, Dr. and Mrs. Charles C.
 Bradley, Mr. Richard
 Brown, Ms. Cornelia
 Brown, Mrs. Frank A., Jr.
 Brown, Mr. James
 Brown, Mrs. Neil
 Brown, Mr. and Mrs. T. A.
 Brown, Dr. and Mrs. Thornton
 Browne, Dr. John M.
 Broyles, Dr. Robert H.
 Buck, Dr. and Mrs. John B.
 Buckely, Mr. George D.
 Bunts, Mr. and Mrs. Frank E.
 Burt, Mrs. Charles E.
 Burwell, Dr. and Mrs. E.
 Langdon
 Bush, Dr. Louise
 Butler, Dr. Dore
 Buxton, Mr. and Mrs. Bruce E.
 Buxton, Mr. E. Brewster
 Cadwalader, Mr. George
 Calkins, Mr. G. N., Jr.
 Campbell, Mrs. David G.
 Carlson, Dr. and Mrs. Francis
 Carlton, Mr. and Mrs. Winslow
 G.
 Case, Mrs. Barbara L.
 Case, Mrs. James
 Chaet, Mrs. Alfred
 Chandler, Mr. Robert
 Chase, Mr. Thomas H.
 Chevalier, Mr. Randall H.
 Child, Dr. and Mrs. Frank M.,
 III
 Chisholm, Dr. Sallie W.
 Church, Dr. Wesley
 Claff, Mr. and Mrs. Mark
 Clark, Dr. and Mrs. Arnold M.
 Clark, Mr. and Mrs. Hays
 Clark, Mr. James McC.
 Clark, Mr. and Mrs. John
 Clark, Mr. and Mrs. Leroy, Jr.
 Clark, Dr. Peter L.
 Clarke, Dr. Barbara J.
 Clement, Mrs. Anthony C.
 Cloud, Dr. Laurence P.
 Clowes Fund, Inc.
 Clowes, Dr. and Mrs. Alexander
 W.
 Clowes, Mr. Allen W.
 Clowes, Mrs. G. H. A., Jr.
 Cobb, Dr. Jewel P.
 Coburn, Mr. and Mrs. Lawrence
 Cohen, Mrs. Seymour S.
 Coleman, Drs. John and Annette
 Collum, Mrs. Peter
 Colt, Dr. LeBaron C., Jr.
 Connell, Mr. and Mrs. W. J.
 Cook, Dr. and Mrs. Joseph
 Cook, Dr. and Mrs. Paul W., Jr.
 Copel, Mrs. Marcia N.
 Copeland, Dr. and Mrs. D.
 Eugene
 Copeland, Mr. Frederick C.
 Copeland, Mr. and Mrs. Preston
 S.
 Costello, Mrs. Donald P.
 Cowan, Mr. and Mrs. James F.,
 III
 Cowan, Ms. Stacy
 Cowling, Mr. John
 Cowling, Dr. Vincent
 Crabb, Mr. and Mrs. David L.
 Crain, Mr. and Mrs. Melvin C.
 Cramer, Mr. and Mrs. Ian D. W.
 Crane, Mrs. John O.
 Crane, Josephine B., Foundation
 Crane, Mr. Thomas S.
 Crosby, Miss Carol
 Cross, Mr. and Mrs. Norman C.
 Crossley, Miss Dorothy
 Crossley, Miss Helen
 Crowell, Dr. and Mrs. Sears
 Currier, Mr. and Mrs. David L.
 Daignault, Mr. and Mrs.
 Alexander T.
 Daniels, Mr. and Mrs. Bruce G.
 Davidson, Dr. Morton
 Davis, Mr. and Mrs. Joel P.
 Day, Mr. and Mrs. Pomeroy
 Decker, Dr. Raymond F.
 DeMello, Mr. John
 DiBerardino, Dr. Marie A.
 DiCecca, Dr. and Mrs. Charles
 Dickson, Dr. William A.
 Dierolf, Dr. Shirley H.
 Donnette, Mr. and Mrs. Joseph
 Donovan, Mr. David L.
 Dorman, Dr. and Mrs. Craig
 Dreyer, Mrs. Frank
 Drummey, Mr. and Mrs. Charles
 E.
 Drummey, Mr. Todd A.
 DuBois, Dr. and Mrs. Arthur B.
 Dudley, Dr. Patricia
 Dugan, Mr. and Mrs. William P.
 DuPont, Mr. A. Felix, Jr.
 Dutton, Mr. and Mrs. Roderick
 L.
 Ebert, Dr. and Mrs. James D.
 Egloff, Dr. and Mrs. F. R. L.
 Engles, Mr. and Mrs. George
 Enos, Mr. Edward, Jr.
 Eppel, Mr. and Mrs. Dudley
 Epstein, Mr. and Mrs. Ray L.
 Estabrooks, Mr. Gordon C.
 Evans, Mr. and Mrs. Dudley
 Farley, Miss Joan
 Farmer, Miss Mary
 Faull, Mr. J. Horace, Jr.
 Fausch, Mr. David
 Ferguson, Dr. and Mrs. James J.,
 Jr.
 Fisher, Mrs. B. C.
 Fisher, Mr. Frederick S., III
 Fisher, Dr. and Mrs. Saul H.
 Fluck, Mr. Richard A.
 Folino, Mr. John W., Jr.
 Forbes, Mr. John M.
 Ford, Mr. John H.
 Fowlkes, Mr. Aaron
 Francis, Mr. Lewis W., Jr.
 Frenkel, Dr. Krystyna
 Fribourgh, Dr. James H.
 Friendship Fund
 Fries, Dr. and Mrs. E. F. B.
 Frosch, Dr. and Mrs. Robert A.
 Funkhouser, Dr. John J.
 Fye, Mrs. Paul M.
 Gabriel, Dr. and Mrs. Mordecai
 L.
 Gagnon, Mr. Michael
 Gaiser, Mrs. David W.
 Gallagher, Mr. Robert O.
 Garcia, Dr. Ignacio
 Garfield, Miss Eleanor
 Gault, Ms. Christine
 Gellis, Dr. and Mrs. Sydney
 Gephard, Mr. Stephen
 Gerhard, Mrs. Sylvia K.
 German, Dr. and Mrs. James L.,
 III
 Gewecke, Mr. and Mrs. Thomas
 H.
 Gifford, Mr. and Mrs. Cameron
 Gifford, Dr. and Mrs. Prosser
 Gilbert, Drs. Daniel L. and
 Claire
 Gildea, Dr. Margaret C. L.
 Gillette, Mr. and Mrs. Robert S.
 Glad, Mr. Robert
 Glass, Dr. and Mrs. H. Bentley
 Glazebrook, Mr. James G.
 Glazebrook, Mrs. James R.
 Glenn, Mr. Gary
 Gmeiner, Mr. and Mrs. John
 Goldman, Mrs. Mary
 Goldring, Mr. Michael
 Goldstein, Dr. and Mrs. Moise
 H., Jr.
 Goodgal, Dr. Sol H.
 Goodwin, Mr. and Mrs. Charles
 Gould, Miss Edith
 Grace, Miss Priscilla B.
 Grant, Mrs. Philip
 Grassle, Mrs. J. K.
 Greene, Mrs. Davis Crane
 Greenberg, Noah and Mosher,
 Diane
 Greer, Mr. and Mrs. W. H., Jr.
 Griffin, Mrs. Robert W.
 Griffith, Dr. and Mrs. B. Herold
 Grosch, Dr. and Mrs. Daniel S.
 Gross, Mrs. Mona
 Gunning, Mr. and Mrs. Robert
 Haakonsen, Dr. Harry O.
 Hadamard, Dr. Antoine F.
 Haigh, Mr. and Mrs. Richard H.
 Hall, Mr. Peter A.
 Hall, Mr. Warren C.
 Halvorson, Dr. and Mrs. Harlyn
 O.
 Hamstrom, Miss Mary Elizabeth
 Harrington, Mr. Robert D., Jr.
 Harrington, Mr. Robert B.
 Harvey, Dr. and Mrs. Richard B.
 Hassett, Mr. and Mrs. Charles
 Hastings, Dr. and Mrs. J.
 Woodland
 Hathaway, Ms. Elizabeth E.
 Haubrich, Mr. Robert R.
 Hay, Mr. John
 Hays, Dr. David S.
 Heaney, Mr. John D.
 Hedberg, Mrs. Frances
 Hedberg, Dr. Mary
 Hersey, Mrs. George L.
 Hiatt, Dr. and Mrs. Howard
 Hichar, Dr. Barbara

- Hill, Mrs. Samuel E.
Hirschfeld, Mrs. Nathan B.
Hobbie, Dr. and Mrs. John
Hocker, Mr. and Mrs. Lon
Hodge, Dr. and Mrs. Stuart
Hodosh, Mrs. Helen
Hokin, Mr. Richard
Holmes, Mrs. George
Honor, Mr. Townsend
Horwitz, Dr. and Mrs. Norman H.
Hoskin, Dr. and Mrs. Francis C. G.
Hough, Mr. John T.
Houston, Mr. and Mrs. Howard E.
Howard, Mrs. L. L.
Hoyle, Dr. Merrill C.
Huckle, Mrs. Eleanor L.
Huettner, Ms. Susan A.
Huettner, Dr. and Mrs. Robert J.
Hutchinson, Mr. Alan D.
Hyde, Mr. and Mrs. Robinson
Hynes, Mr. and Mrs. Thomas J., Jr.
Inouë, Dr. and Mrs. Shinya
Issokson, Mr. and Mrs. Israel
Jackson, Miss Elizabeth B.
Jaffe, Dr. and Mrs. Ernst R.
Janney, Mrs. F. Wistar
Jewett, G. F., Foundation
Jewett, Mr. and Mrs. G. F., Jr.
Jewett, Mr. and Mrs. Raymond L.
Jones, Mrs. Barbara W.
Jones, Mr. and Mrs. DeWitt C., III
Jones, Mr. and Mrs. Frederick, II
Jones, Mr. Frederick S., III
Jordan, Dr. and Mrs. Edwin P.
Juterbock, Mrs. Barbara J.
Kaan, Dr. Helen W.
Kahn, Dr. Harry S.
Kahler, Mrs. Robert W.
Kaminer, Dr. and Mrs. Benjamin
Kanellopoulos, Mrs. Barbara
Karpus, Mrs. Alan K.
Karush, Dr. and Mrs. Fred
Kavaru, Dr. Madhav
Kelleher, Mr. and Mrs. Paul R.
Kendall, Mr. and Mrs. Richard E.
Keosian, Mrs. Jessie
Keoughan, Miss Patricia
Ketchum, Mrs. Paul
Kinnard, Mrs. L. Richard
Kirschenbaum, Mrs. Donald
Kissam, Mr. and Mrs. William M.
Kivy, Dr. and Mrs. Peter
Koller, Dr. Lewis R.
Korgen, Dr. Ben J.
Kraco, Ms. Karen
Kravitz, Dr. and Mrs. Edward
- Kroll, Dr. Peter
Kuffler, Mrs. Stephen W.
Kutner, Dr. Lawrence
Laderman, Mr. and Mrs. Ezra
Lafferty, Miss Nancy
Lahner, Mrs. Alta S.
Lakian, Mr. and Mrs. John
Larmon, Mr. Jay
Lash, Ms. Rebecca
Laster, Dr. and Mrs. Leonard
Latham, Mrs. Eunice
Laufer, Dr. and Mrs. Hans
Laufer, Jessica, and Weiss, Malcolm
Laufer, Dr. Marc R.
La Vigne, Mrs. Richard J.
Lawrence, Mr. Frederick V.
Lawrence, Mr. William
Leach, Dr. and Mrs. Berton J.
Leatherbee, Mrs. John H.
LeBlond, Mr. and Mrs. Arthur
Leeson, Mr. and Mrs. A. Dix
LeFevre, Dr. Marian E.
Lefler, Dr. Charles W.
Lehman, Miss Robin
Lenher, Dr. and Mrs. Samuel
Leprohon, Mr. Joseph
Levine, Mr. Joseph
Levine, Dr. and Mrs. Rachmiel
Levitz, Dr. Mortimer
Levy, Mr. and Mrs. Stephen R.
Libbin, Mr. Edwin M.
Light, Mr. and Mrs. Donald W.
Lindner, Mr. Timothy P.
Little, Mrs. Elbert
Livingstone, Mr. and Mrs. Robert
Lloyd, Mr. and Mrs. James
Loeb, Mrs. Robert F.
Loessel, Mrs. Edward
Londergan, Mr. Bob
Lovell, Mr. and Mrs. Hollis R.
Lovering, Mr. Richard C.
Low, Miss Doris
Lowe, Dr. and Mrs. Charles U.
Lowengard, Mrs. Joseph
Mackey, Mr. and Mrs. William K.
MacLeish, Mrs. Margaret
MacNary, Mr. B. Glenn
MacNichol, Dr. and Mrs. Edward F., Jr.
Maddigan, Mrs. Thomas
Magee, Ms. Chris
Maher, Miss Anne Camille
Mahler, Mrs. Henry
Mahler, Mrs. Suzanne
Mansworth, Miss Marie
Manual, Dr. Isabelle
Maples, Dr. Philip B.
Marken, Mrs. Madeline
Marsh, Dr. and Mrs. Julian
Martyna, Mr. and Mrs. Joseph C.
Mason, Mr. and Mrs. Appleton
- Mastroianni, Dr. and Mrs. Luigi, Jr.
Mather, Mr. and Mrs. Frank J., III
Matherly, Mr. and Mrs. Walter
Matthiessen, Dr. and Mrs. G. C.
Mauzerall, Mrs. Miriam J.
McClane, Mrs. Louise
McCusker, Mr. and Mrs. Paul T.
McElroy, Mrs. Nella W.
McIlwain, Dr. Susan G.
McMurtrie, Mrs. Cornelia Hanna
Meigs, Mr. and Mrs. Arthur
Meigs, Dr. and Mrs. J. Wister
Melillo, Dr. and Mrs. Jerry M.
Mellon, Richard King, Trust
Mellon, Mr. and Mrs. Richard P.
Mendelson, Dr. Martin
Metz, Dr. and Mrs. Charles B.
Meyers, Mr. and Mrs. Richard
Miller, Dr. Daniel A.
Miller, Mr. and Mrs. Paul
Mills, Mrs. Margaret A.
Mirro, Dr. Robert
Mixer, Mrs. Florence E.
Mizell, Dr. and Mrs. Merle
Monroy, Mrs. Alberto
Montgomery, Dr. and Mrs. Charles H.
Montgomery, Mrs. Raymond B.
Moore, Drs. John and Betty
Morgan, Miss Amy
Morse, Mrs. Charles L., Jr.
Morse, Dr. M. Patricia
Moul, Mrs. Edwin T.
Munson, Mr. William
Murchelano, Dr. Robert
Murray, Mr. David M.
Myles-Tochko, Drs. Christina J. and John
Nace, Dr. and Mrs. Paul
Nace, Mr. Paul F., Jr.
Naugle, Mr. John E.
Neill, Mr. William G.
Nelson, Dr. and Mrs. Leonard
Nelson, Dr. Pamela
Newton, Mr. William E.
Nickerson, Mr. and Mrs. Frank L.
Norman, Mr. and Mrs. Andrew E.
Norman Foundation
Norris, Mr. and Mrs. Barry
Norris, Mr. and Mrs. John A.
Norris, Mr. William
Norton, Mrs. Thomas J.
O'Connell, Dr. and Mrs. Clifford
Offenback, Dr. Jack A.
O'Herron, Mr. and Mrs. Jonathan
Olszowka, Dr. Janice S.
O'Neil, Mr. and Mrs. Barry T.
O'Rand, Mr. and Mrs. Michael
O'Sullivan, Dr. Renee Bennett
- Ott, Drs. Philip and Karen
Palmer, Mr. and Mrs. David
Pappas, Dr. and Mrs. George D.
Park, Mr. and Mrs. Malcolm S.
Parmenter, Dr. Charles
Parmenter, Miss Carolyn L.
Pearce, Dr. John B.
Pearson, Mrs. Oscar H.
Peltz, Mr. and Mrs. William L.
Pendergast, Mrs. Claudia
Pendleton, Dr. and Mrs. Murray E.
Peri, Mr. and Mrs. John B.
Perkins, Mr. and Mrs. Courtland D.
Person, Dr. and Mrs. Philip
Peters, Mr. and Mrs. Frederick S.
Peterson, Mr. and Mrs. E. Gunnar
Peterson, Mr. and Mrs. E. Joel
Peterson, Mr. Raymond W.
Petty, Mr. Richard F.
Pfeiffer, Mr. and Mrs. John
Plough, Ms. Frances
Plough, Mr. and Mrs. George H.
Plough, Mrs. Harold H.
Pointe, Mr. Albert
Pointe, Mr. Charles
Porter, Dr. and Mrs. Keith R.
Pothier, Dr. and Mrs. Aubrey
Press, Dr. Frank
Proskauer, Mr. Joseph H.
Proskauer, Mr. Richard
Prosser, Dr. and Mrs. C. Ladd
Psaledakis, Mr. Nicholas
Psychoyos, Dr. Alexandre
Putnam, Mr. and Mrs. Allan Ray
Putnam, Mr. and Mrs. William A., III
Rankin, Mrs. John
Raphael, Ms. Ellen S.
Raymond, Dr. Samuel
Reese, Miss Bonnie
Regis, Ms. A. Kathy
Reingold, Mr. Stephen C.
Reynolds, Mrs. George
Reynolds, Dr. John L.
Reynolds, Mr. and Mrs. Robert M.
Reznikoff, Mrs. Paul
Ricca, Dr. and Mrs. Renato A.
Richter, Mr. and Mrs. Harold
Riina, Mr. John R.
Riley, Dr. Monica
Robb, Mrs. Alison A.
Roberts, Miss Jean
Roberts, Mr. Mervin F.
Robertson, Mrs. C. W.
Robinson, Dr. Denis M.
Robinson, Mr. John G.
Robinson, Mr. and Mrs. Marius A.
Root, Mrs. Walter S.
Rosenthal, Miss Hilde

Roslansky, Drs. John and Priscilla	Sharp, Mr. and Mrs. Robert W.	Swope, Mr. and Mrs. Gerard L.	Warren, Dr. and Mrs. Leonard
Ross, Dr. and Mrs. Donald	Shemin, Dr. and Mrs. David	Szent-Györgyi, Dr. Andrew	Watt, Mr. and Mrs. John B.
Ross, Dr. Robert	Shepro, Dr. and Mrs. David	Taber, Mr. George H.	Weeks, Mr. and Mrs. John T.
Ross, Dr. Virginia	Sherblom, Dr. James P.	Talamas-Rohana, Dr. Eduardo	Weiffenbach, Dr. and Mrs. George
Roth, Dr. Stephen	Sichel, Dr. Enid	Taylor, Mr. James K.	Weinstein, Miss Nancy B.
Rowan, Mr. Edward	Siegel, Mr. and Mrs. Alvin	Taylor, Dr. and Mrs. W. Randolph	Weisberg, Mr. and Mrs. Alfred M.
Rowe, Dr. Don	Simmons, Mr. Tim	Tietje, Mr. Emil D., Jr.	Weissmann, Dr. and Mrs. Gerald
Rowe, Mrs. William S.	Simon, Mr. and Mrs. Stephen	Timmins, Mrs. William	Wheeler, Dr. and Mrs. Paul S.
Rugh, Mrs. Roberts	Singer, Mr. and Mrs. Daniel M.	Tochko, Dr. John S.	Wheeler, Dr. William M.
Ryder, Mr. Francis C.	Smith, Drs. Frederick E. and Marguerite A.	Todd, Mr. and Mrs. Gordon F.	Whitehead, Mrs. Fred
Sager, Dr. Ruth	Smith, Mr. and Mrs. Homer P.	Tolkan, Mr. and Mrs. Norman N.	Whitney, Mr. and Mrs. Geoffrey G., Jr.
Sanidas, Dr. and Mrs. Dennis J.	Smith, Mr. Van Dorn C.	Trager, Mrs. William	Wickterman, Dr. and Mrs. Ralph
Sardinha, Mr. George J.	Snyder, Mr. Robert M.	Trigg, Mr. and Mrs. D. Thomas	Wichersham, Mr. and Mrs. A. A. Tilney
Saunders, Dr. and Mrs. John W.	Solomon, Dr. and Mrs. A. K.	Troll, Dr. and Mrs. Walter	Wiese, Dr. Konrad
Saunders, Mrs. Lawrence	Sonnenblick, Mrs. Perle	Trousof, Miss Natalie	Wilber, Mrs. Clare M.
Saunders, Lawrence, Fund	Specht, Mr. and Mrs. Heinz	Tucker, Miss Ruth	Wilhelm, Dr. Hazel S.
Sawyer, Mr. and Mrs. John E.	Speck, Dr. William T.	Tully, Mr. and Mrs. Gordon F.	Willis, Mr. Herbert F.
Saz, Mrs. Ruth L.	Spiegel, Drs. and Mrs. Melvin and Evelyn	Ulbrich, Mr. and Mrs. Volker	Wilson, Mr. and Mrs. Leslie J.
Schlesinger, Dr. and Mrs. R. Walter	Spotte, Mr. Stephen	Valois, Mr. and Mrs. John	Wilson, Mr. and Mrs. T. Hastings
Schwamb, Mr. and Mrs. Peter	Steele, Mrs. John H.	Vancouver Public Aquarium	Winn, Dr. William M.
Schwartz, Dr. Lawrence	Steele, Dr. Robert E.	Van Buren, Mrs. Harold	Winsten, Dr. Jay A.
Scott, Mrs. George T.	Stein, Mr. Ronald	Van Holde, Mrs. Kensal E.	Witting, Miss Joyce
Scott, Mr. and Mrs. Norman E.	Steinbach, Mrs. H. Burr	Veeder, Mrs. Ronald A.	Woitkoski, Miss Nancy
Sears, Mr. Clayton C.	Stetson, Mrs. Thomas J.	Veeder, Ms. Susan	Wolfsohn, Mrs. Wolf
Sears, Mr. and Mrs. Harold B.	Stetten, Dr. Gail	Vincent, Mr. and Mrs. Samuel W.	Woodwell, Dr. and Mrs. George M.
Sears, Mr. Harold H.	Stetten, Dr. and Mrs. H. DeWitt, Jr.	Vincent, Dr. Walter S.	Wrigley, Mrs. Roland
Seaver, Mr. George	Stracher, Dr. Dorothy	Vonderhaar, Dr. William	Yntema, Mrs. Chester L.
Seder, Mr. John	Sudduth, Dr. William	Wagner, Mr. Mark	Young, Miss Nina L.
Segal, Dr. and Mrs. Sheldon J.	Swain, Mr. Albert H.	Waksman, Dr. and Mrs. Byron H.	Zinn, Dr. and Mrs. Donald J.
Selby, Dr. Cecily	Sussman, Dr. and Mrs. Maurice	Ware, Dr. Robert T.	Zipf, Dr. Elizabeth
Senft, Dr. and Mrs. Alfred	Swanson, Mrs. Carl P.	Ware, Mr. and Mrs. J. Lindsay	
Shanklin, Dr. D. R.	Swift, Mr. and Mrs. E. Kent	Warren, Dr. Henry B.	
Shapiro, Mr. and Mrs. Howard	Swope, Mrs. Gerard, Jr.		
Shapley, Dr. Robert			

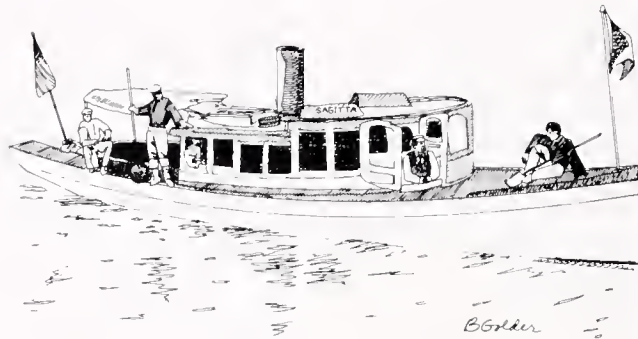
Gift Shop Volunteers

Marian Adelberg	Michael Goldring	Bertha Person
Louise Atkins	Rose Grant	Julia Rankin
Barbara Atwood	Martha Griffin	Virginia Reynolds
Gloria Borgese	Edith Grosch	Lilyan Saunders
Jennie Brown	Jean Halvorson	Elsie Scott
Elisabeth Buck	Helen Hodosh	Deborah Senft
Patricia Case	Adele Hoskins	Charlotte Shemin
Summers Case	Pauline Hyde	Marilyn Shepro
Shirley Chaet	Sona Jones	Cynthia Smith
Julia Child	Sally Karush	Marguerite Smith
Vera Clark	Ruth Ann Laster	Louise Specht
Margaret Clowes	Barbara Little	Judith Stetson
Villa Crowell	Sarah Loessel	Dorothy Stracher
Elizabeth Daignault	Winnie Mackey	Mary Ulbrich
Janet Daniels	Constance Martyna	Barbara van Holde
Alma Ebert	Florence Mixer	Barbara Whitehead
Margaret German	Lorraine Mizell	Clare Wilber
Rebeckah Glazebrook	Phyllis Meyers	

MBL Tour Guides

Betsy Bang	Teru Hayashi	Lola Robinson
John Buck	Sally Loessel	Donald Zinn
Sears Crowell	Isabel Mountain	Margery Zinn
	Julie Rankin	

Certificate of Organization Articles of Amendment Bylaws of the MBL



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 fifteenth 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)

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 the meeting 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)

Bylaws of the Corporation of the Marine Biological Laboratory

(Revised August 17, 1990)

(These Bylaws have been extensively amended by the Board of Trustees and are subject to approval by the Corporation. If these amendments are not approved by the Corporation, the existing Bylaws will then remain in place.)

ARTICLE I—THE CORPORATION

A Name and Purpose. 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 Nondiscrimination. The Corporation shall not discriminate on the basis of age, religion, color, race, national or ethnic origin, sex or sexual preference in its policies on employment and administration or in its educational and other programs.

ARTICLE II—MEMBERSHIP

A Members. The Members of the Corporation ("Members") shall consist of persons elected by the Board of Trustees (the "Board"), upon such terms and conditions and in accordance with such procedures, not inconsistent with law or these Bylaws, as may be determined by the Board. At any regular or special meeting of the Board, the Board may elect new Members. Any Member may vote at any meeting of the Members either in person or by proxy executed no more than three months prior to the date of such meeting. Except as otherwise limited therein, proxies shall entitle the persons named therein to vote at any adjournment of such meeting, but shall not be valid after final adjournment of such meeting. Proxies need not be sealed or attested and proxy purported to be executed by or on behalf of a Member entitled to vote shall be deemed valid unless challenged at or prior to its exercise. 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 retired from his or her home institution may, on written request to the Corporation, be designated a Life Member. Life Members shall not have the right to vote and shall not be assessed for dues.

B Meetings. The annual meeting of the Members shall be held on the Friday following the second Tuesday in August of each year, at the Laboratory of the Corporation in Woods Hole, Massachusetts, at 9:30 a.m. If no annual meeting is held in accordance with the foregoing provision, a special meeting may be held in lieu thereof with the same effect as the annual meeting, and in such case all references in these Bylaws, except in this Article II.B., to the annual meeting of the Members shall be deemed to refer to such special meeting. Members shall transact business as may properly come before the meeting. Special meetings of the Members may be called by the Chairman or the Trustees, and shall be called by the Clerk, or in the case of the death, absence, incapacity or refusal by the Clerk, by any other officer, upon written application of Members representing at least ten percent of the smallest quorum of Members required for a vote upon any matter at the annual meeting of the Members, to be held at such time and place as may be designated. The Chairman of the Board shall preside at all meetings of the Corporation.

C Notice of Meetings. Notice of any annual meeting or special meeting of Members, if necessary, 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.

D Waiver of Notice. Whenever notice of a meeting is required to be given a Member under any provision of the Articles or Organization or Bylaws of the Corporation, a written waiver thereof, executed before or after the Meeting by such Member, or his or her duly authorized attorney, shall be deemed equivalent to such notice.

E Adjournments. 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, or by any officer entitled to preside at or to act as Clerk of such meeting, if no Member is present or represented. It shall not be necessary to notify any Members of any adjournment unless no Member is present or represented at the meeting which is adjourned, in which case, notice of the adjournment shall be given in accordance with Article II.E. Any business which could have been transacted at any meeting of the Members as originally called may be transacted at an adjournment thereof.

ARTICLE III—ASSOCIATES OF THE CORPORATION

Associates of the Corporation. 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. The Associates of the Marine Biological Laboratory shall have no voting rights.

ARTICLE IV—BOARD OF TRUSTEES

A Powers. The Board of Trustees shall have the control and management of the affairs of the Corporation. The Trustees shall annually elect a Chairman of the Board who shall serve until his or her successor is selected and qualified. They shall

annually elect a President of the Corporation who shall also be the Vice Chairman of the Board and Vice Chairman of meetings of the Corporation. They shall annually elect a Treasurer. They shall elect a Clerk, who shall be a resident of Massachusetts and shall serve a term of four years. Eligibility for re-election of the Clerk shall be in accordance with the content of this Article IV as applied to Corporate or Board Trustees. They shall elect Trustees-at-Large as specified in this Article IV. 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 shall think best. They may fix the compensation of all 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 shall have the power to choose an Executive Committee from their own number as provided in Article V, and to delegate to such Committee such of their own powers as they may deem expedient in addition to those powers conferred by Article V. 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.

B Composition and Election. 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 ("Trustees-at-Large"). Nominees for Trustees-at-Large shall be introduced at the annual meeting of the Corporation for subsequent election by the Board according to such procedures, not inconsistent with these Bylaws, as the Trustees shall have determined. Such Trustees-at-Large shall be divided into four classes of four Trustees, 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, Trustees-at-Large, shall be individuals who have not been considered for elections as Corporate Trustees.

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

(4) Trustees *emeriti* shall include any Member who has retired from his or her home institution and has requested to serve as a Trustee *emeritus* provided he or she has served at least two terms as a Trustee. A Trustee *ex officio* is eligible to serve as a Trustee *emeritus* provided he or she has served as Trustee *ex officio* for at least eight years. Trustees *ex officio* and *emeriti* shall have all the rights of the Trustees, except that Trustees *emeriti* shall not have the right to vote.

(5) The total number of Corporate Trustees and Trustees-at-Large elected in any year (excluding Trustees elected to fill vacancies which do not result from expiration of a term) shall not exceed ten. The number of Trustees-at-Large so elected shall not exceed four and, unless otherwise determined by vote of the Trustees, the number of Corporate Trustees so elected shall not exceed six. Corporate Trustees shall always constitute a majority on the Board of those elected or approved by the Members.

(6) Newly elected Trustees shall take office at the February meeting of the Board, but may participate in discussions at intervening meetings following their election, without voting rights.

(7) The Trustees and officers shall hold their respective offices until their successors are chosen and qualified.

C Eligibility. A Corporate Trustee or a Trustee-at-Large who has served an initial term of at least two 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/she has last served as a Trustee.

D Removal. Any Trustee may be removed from office at any time without cause, by vote of a majority of the Members entitled to vote in the election of Trustees; 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 to be so removed shall have been given reasonable notice and opportunity to be heard before the body proposing to remove him or her.

E Vacancies. Any vacancy in the Board, unless and until filled by the Members at any annual or special meeting of the Members, may be filled by vote of a majority of the remaining Trustees present at a meeting of Trustees at which a quorum is present or by appointment of all of the Trustees if less than a quorum shall remain in office.

F Meetings. The annual meeting of the Trustees shall be held promptly after the annual meeting of the Members at the Laboratory in Woods Hole, Massachusetts. Special meetings of the Trustees may be called by the Chairman, the President or

by any seven Trustees to be held at such time and place as may be designated. The Chairman of the Board, when present, shall preside over all meetings of the Trustees. Written notice shall be sent to a Trustee's usual or last known place of residence at least two weeks before the meeting. Notice of a meeting need not be given to any Trustee if a written waiver of notice executed by such Trustee before or after the meeting is filed with the records of the meeting, or if such Trustee shall attend the meeting without protesting prior thereto or at its commencement the lack of notice given to him or her.

G Quorum 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.

H Transfers of Interests in Land There shall be no transfer of title or long-term lease of real property held by the Corporation without prior approval of not less than two-thirds of the Trustees. Such real property transactions shall be finally acted upon at a meeting of the Board only if presented and discussed at a prior meeting of the Board. Either meeting may be a special meeting and no less than four weeks shall elapse between the two meetings. Any property acquired by the Corporation after December 1, 1989 may be sold with the prior approval of not less than two-thirds of the Trustees (other than any Trustee or Trustees with a direct or indirect financial interest in the transaction being considered for approval) who are present at a regular or special meeting of the Board at which there is a quorum.

ARTICLE V—COMMITTEES

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

Beginning with the Members elected for terms ending in 1990, one of the Trustees elected to serve on the Executive Committee shall be a Trustee-at-Large. Beginning with the Members elected for terms ending in 1991, the Trustees will elect, to the Executive Committee, Trustees to ensure that the Committee includes four Corporate Trustees and two Trustees-at-Large.

The Chairman of the Board shall act as Chairman of the Executive Committee and the President as Vice Chairman. The Executive Committee shall meet at such times and places and upon such notice and appoint such subcommittees as the Committee shall determine.

The Executive Committee shall have and may exercise all the powers of the Board during the intervals between meetings of the Board except those powers specifically withheld, from time to time, by vote of the Board or by law. The Executive Committee may also appoint such committees, including persons who are not Trustees, as it may, from time to time, approve to make recommendations with respect to matters to be acted upon by the Executive Committee or the Board.

The Executive Committee shall keep appropriate minutes of its meetings, which shall be reported to the Board. Any actions taken by the Executive Committee shall also be reported to the Board.

The elected Members of the Executive Committee shall constitute a Standing Committee for the Nomination of Officers, responsible for making nominations at each annual meeting of the Members and of the Board for candidates to fill each office as the respective terms of office expire (Chairman of the Board, President, Treasurer, Clerk and Director of the Laboratory).

B Board Committees Generally The Board shall have the power, by vote of a majority of the Trustees then in office, to elect an Investment Committee, a Nominating Committee and any other committee and, by like vote, to delegate thereto some or all of the powers of the Board except those which by law, the Articles of Organization or these Bylaws they are prohibited from delegating. The members of any such committee shall have such tenure and duties as the Trustees shall determine. The Investment Committee, which shall oversee the management of the Corporation's endowment funds and marketable securities shall include as *ex officio* members, the Chairman of the Board, the Treasurer and the Chairman of the Audit Committee, together with such Trustees as may be required for not less than two-thirds of the Investment Committee to consist of Trustees. Except as otherwise provided by these Bylaws or determined by the Trustees, any such committee may make rules for the conduct of its business, but, unless otherwise provided by the Trustees or in such rules, its business shall be conducted as nearly as possible in the same manner as is provided by these Bylaws for the Trustees.

C Actions Without a Meeting Any action required or permitted to be taken at any meeting of the Executive Committee or any other committee elected by the

Trustees may be taken without a meeting if all Members of such committees consent to the action in writing and such written consents are filed with the records of meetings. Members of the Executive Committee or any other committee elected by the Trustees may also participate in any meeting by means of a telephone conference call, or otherwise take action in such a manner as may, from time to time, be permitted by law.

ARTICLE VI—OFFICERS

A Enumeration The officers of the Corporation shall consist of a President, a Treasurer and a Clerk, and such other officers having the powers of President, Treasurer and Clerk as the Board may determine, and a Director of the Laboratory. The Corporation may have such other officers and assistant officers as the Board may determine, including (without limitation) a Chairman of the Board, and one or more Vice-Presidents, Assistant Treasurers or Assistant Clerks. Any two or more offices may be held by the same person. An officer need not be a Member or Trustee of the Corporation. If required by the Trustees, any officer shall give the Corporation a bond for the faithful performance of his or her duties in such amount and with such surety or sureties as shall be satisfactory to the Trustees.

B Tenure Except as otherwise provided by law, by the Articles of Organization or by these Bylaws, the President, Treasurer, and all other officers shall hold office until the first meeting of the Board following the annual meeting of Members and thereafter, until his or her successor is chosen and qualified.

C Resignation Any officer may resign by delivering his or her written resignation to the Corporation at its principal office or to the President or Clerk and such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

D Removal The Board may remove any officer with or without cause by a vote of a majority of the entire number of Trustees then in office, at a meeting of the Board called for that purpose and for which notice of the purpose thereof has been given, provided that an officer may be removed for cause only after having an opportunity to be heard by the Board at a meeting of the Board at which a quorum is personally present and voting.

E Vacancy A vacancy in any office may be filled for the unexpired balance of the term by a vote of a majority of the Trustees present at any meeting of Trustees at which a quorum is present or by written consent of all of the Trustees if less than a quorum of Trustees shall remain in office.

F Director The Director shall be the chief operating officer and, unless otherwise voted by the Trustees, the chief executive officer of the Corporation. The Director shall, subject to the direction of the Trustees, have general supervision of the Laboratory and control of the business of the Corporation. At the annual meeting, the Director shall submit a report of the operations of the Corporation for such year and a statement of its affairs, and shall, from time to time, report to the Board all matters within his or her knowledge which the interests of the Corporation may require to be brought to its notice.

G Deputy Director The Deputy Director, if any, or if there shall be more than one, the Deputy Directors in the order determined by the Trustees, shall, in the absence or disability of the Director, perform the duties and exercise the powers of the Director and shall perform such other duties and shall have such other powers as the Trustees may, from time to time, prescribe.

H President The President shall have the powers and duties as may be vested in him or her by the Board.

I Treasurer and Assistant Treasurer The Treasurer shall, subject to the direction of the Trustees, have general charge of the financial affairs of the Corporation, including its long-range financial planning, and shall cause to be kept accurate books of account. The Treasurer shall prepare a yearly report on the financial status of the Corporation to be delivered at the annual meeting. The Treasurer shall also prepare or oversee all filings required by the Commonwealth of Massachusetts, the Internal Revenue Service, or other Federal and State Agencies. The account of the Treasurer shall be audited annually by a certified public accountant.

The Assistant Treasurer, if any, or if there shall be more than one, the Assistant Treasurers in the order determined by the Trustees, shall, in the absence or disability of the Treasurer, perform the duties and exercise the powers of the Treasurer, shall perform such other duties and shall have such other powers as the Trustees may, from time to time, prescribe.

J Clerk and Assistant Clerk The Clerk shall be a resident of the Commonwealth of Massachusetts, unless the Corporation has designated a resident agent in the manner provided by law. The minutes or records of all meetings of the Trustees and Members shall be kept by the Clerk who shall record upon the record book of the Corporation minutes of the proceedings at such meetings. He or she shall have custody of the record books of the Corporation and shall have such other powers and shall perform such other duties as the Trustees may, from time to time, prescribe.

The Assistant Clerk, if any, or if there shall be more than one, the Assistant Clerks in the order determined by the Trustees, shall, in the absence or disability of the Clerk, perform the duties and exercise the powers of the Clerk and shall perform such other duties and shall have such other powers as the Trustees may, from time to time, prescribe.

In the absence of the Clerk and an Assistant Clerk from any meeting, a temporary clerk shall be appointed at the meeting.

K Other Powers and Duties. Each officer shall have in addition to the duties and powers specifically set forth in these Bylaws, such duties and powers as are customarily incident to his or her office, and such duties and powers as the Trustees may, from time to time, designate.

ARTICLE VII—AMENDMENTS

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 the (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 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 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.

ARTICLE VIII—INDEMNITY

Except as otherwise provided below, the Corporation shall, to the extent legally permissible, indemnify each person who is, or shall have been, a Trustee, director or officer of the Corporation or who is serving, or shall have served at the request of the Corporation as a Trustee, director or officer of another organization in which the Corporation directly or indirectly has any interest as a shareholder, creditor or otherwise, against all liabilities and expenses (including judgments, fines, penalties, and reasonable attorneys' fees and all amounts paid, other than to the Corporation or such other organization, in compromise or settlement) imposed upon or incurred by any such person in connection with, or arising out of, the defense or disposition of any action, suit or other proceeding, whether civil or criminal, in which he or she may be a defendant or with which he or she may be threatened or otherwise involved, directly or indirectly, by reason of his or her being or having been such a Trustee, director or officer.

The Corporation shall provide no indemnification with respect to any matter as to which any such Trustee, director or officer shall be finally adjudicated in such action, suit or proceeding not to have acted in good faith in the reasonable belief that his or her action was in the best interests of the Corporation. The Corporation shall provide no indemnification with respect to any matter settled or comprised unless such matter shall have been approved as in the best interests of the Corporation, after notice that indemnification is involved, by (i) a disinterested majority of the Board of the Executive Committee, or (ii) a majority of the Members.

Indemnification may include payment by the Corporation of expenses in defending a civil or criminal action or proceeding in advance of the final disposition of such action or proceeding upon receipt of an undertaking by the person indemnified to repay such payment if it is ultimately determined that such person is not entitled to indemnification under the provisions of this Article VIII, or under any applicable law.

As used in the Article VIII, the terms "Trustee," "director" and "officer" include their respective heirs, executors, administrators and legal representatives, and an "interested" Trustee, director or officer is one against whom in such capacity the proceeding in question or another proceeding on the same or similar grounds is then pending.

To assure indemnification under this Article VIII of all persons who are determined by the Corporation or otherwise to be or to have been "fiduciaries" of any employee benefits plan of the Corporation which may exist, from time to time, this Article VIII shall be interpreted as follows: (i) "another organization" shall be deemed to include such an employee benefit plan, including without limitation, any plan of the Corporation which is governed by the Act of Congress entitled "Employee Retirement Income Security Act of 1974," as amended, from time to time, ("ERISA"); (ii) "Trustee" shall be deemed to include any person requested by the

Corporation to serve as such for an employee benefit plan where the performance by such person of his or her duties to the Corporation also imposes duties on or otherwise involves services by, such person to the plan or participants or beneficiaries of the plan; (iii) "fines" shall be deemed to include any excise tax plan pursuant to ERISA; and (iv) actions taken or omitted by a person with respect to an employee benefit plan in the performance of such person's duties for a purpose reasonably believed by such person to be in the interest of the participants and beneficiaries of the plan shall be deemed to be for a purpose which is in the best interests of the Corporation.

The right of indemnification provided in this Article VIII shall not be exclusive of or affect any other rights to which any Trustee, director or officer may be entitled under any agreement, statute, vote of Members or otherwise. The Corporation's obligation to provide indemnification under this Article VIII shall be offset to the extent of any other source of indemnification of any otherwise applicable insurance coverage under a policy maintained by the Corporation or any other person. Nothing contained in the Article shall affect any rights to which employees and corporate personnel other than Trustees, directors or officers may be entitled by contract, by vote of the Board or of the Executive Committee or otherwise.

ARTICLE IX—DISSOLUTION

The consent of every Trustee shall be necessary to effect a dissolution of the Marine Biological Laboratory. In case of dissolution, the property shall be disposed of in such a manner and upon such terms as shall be determined by the affirmative vote of two-thirds of the Trustees then in office in accordance with the laws of the Commonwealth of Massachusetts.

ARTICLE X—MISCELLANEOUS PROVISIONS

A Fiscal Year Except as otherwise determined by the Trustees, the fiscal year of the Corporation shall end on December 31st of each year.

B Seal. Unless otherwise determined by the Trustees, the Corporation may have a seal in such form as the Trustees may determine, from time to time.

C Execution of Instruments All checks, deed, leases, transfers, contracts, bonds, notes and other obligations authorized to be executed by an officer of the Corporation in its behalf shall be signed by the Director or the Treasurer except as the Trustees may generally or in particular cases otherwise determine. A certificate by the Clerk or an Assistant Clerk, or a temporary Clerk, as to any action taken by the Members, Board of Trustees or any officer or representative of the Corporation shall as to all persons who rely thereon in good faith be conclusive evidence of such action.

D Corporate Records The original, or attested copies, of the Articles of Organization, Bylaws and records of all meetings of the Members shall be kept in Massachusetts at the principal office of the Corporation, or at an office of the Corporation's Clerk or resident agent. Said copies and records need not all be kept in the same office. They shall be available at all reasonable times for inspection by any Member for any proper purpose, but not to secure a list of Members for a purpose other than in the interest of the applicant, as a Member, relative to the affairs of the Corporation.

E. Articles of Organization. All references in these Bylaws to the Articles of Organization shall be deemed to refer to the Articles of Organization of the Corporation, as amended and in effect, from time to time.

F Transactions with Interested Parties In the absence of fraud, no contract or other transaction between this Corporation and any other corporation or any firm, association, partnership or person shall be affected or invalidated by the fact that any Trustee or officer of this Corporation is pecuniarily or otherwise interested in or is a director, member or officer of such other corporation or of such firm, association or partnership or is a party to or is pecuniarily or otherwise interested in such contract or other transaction or is in any way connected with any person or persons, firm, association, partnership, or corporation pecuniarily or otherwise interested therein; provided that the fact that he or she individually or as a director, member or officer of such corporation, firm, association or partnership is such a party or is so interested shall be disclosed to and have been known by the Board of Trustees or a majority of such Members thereof as shall be present at a meeting of the Board of Trustees at which action upon any such contract or transaction shall be taken; any Trustee may be counted in determining the existence of a quorum and may vote at any meeting of the Board of Trustees for the purpose of authorizing any such contract or transaction with like force and effect as if he/she were not so interested, or were not a director, member or officer of such other corporation, firm, association or partnership, provided that any vote with respect to such contract or transaction must be adopted by a majority of the Trustees then in office who have no interest in such contract or transaction.