

Faces of the MBL



MBL annual report 2003

MARINE BIOLOGICAL LABORATORY
Woods Hole, Massachusetts

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Daniel Myers, 2
Debbie Scanlon, 2
Tsoi/Kobus Architects, 3
Mindy Richlen, 4, 84
Martha Scanlon, 6
Steve Smith, 8
JSPS Photography, 9
Robert Palazzo, 11
Linda Golder, 13
Elizabeth Armstrong, 14, 111
Robert Barlow, 15
Erik Mellgren, 17
Dave Corcoran, 18
Chip Cruice, 19
Bonnie Keeler, 19, 28
Herb Luther, 22, 34, 39, 62, 64, 65, 74, 76, 85, 104
Andrew Hawkins, 22
David Mark Welch, 23, 40
Erik Red Zettler, 23
Hilary Morrison, 24
Adam Lazarus, 24
Robert Holmes, 26, 91
Rebecca Perry, 25, 37, 60, 61, 71, 72, 79
Tom Kleindinst, 27
Richard Mooney, 33
Andrew Barry, 36
Sarah E. Murphy, 36, 47, 51, 96, 116, 119
Karen Crawford, 41
Jim Valles, 44
Phillip Lobel, 45
Paul Barber, 46
Francisco Garcia de Leon, 46
Roger Hanlon, 48
Alan Kuzirian, 48
Jordi Ortega, 49
Sean P. Whelan, 49, 54
Rudolf Oldenbourg, 52
Lin Liu, 53
K.S. Matz, 55
Volker Steger, 56, 118
Lorraine Olendzenski, 57, 71, 88, 92
Jon Cherry, 58, 59, 69, 70
Alex Braun, 59
P. Murata and D. Matus, 66
Caitlin Hicks, 72
Jakob Wikstrom, 78
Catherine Norton, 80
Valeriya Gaysinskaya, 86
Anne Goldman, 93
Tim Sidie, 99
MBL Archives, 103
Susan Joslin, 112, 115
Umit Ali Kayisli, 114

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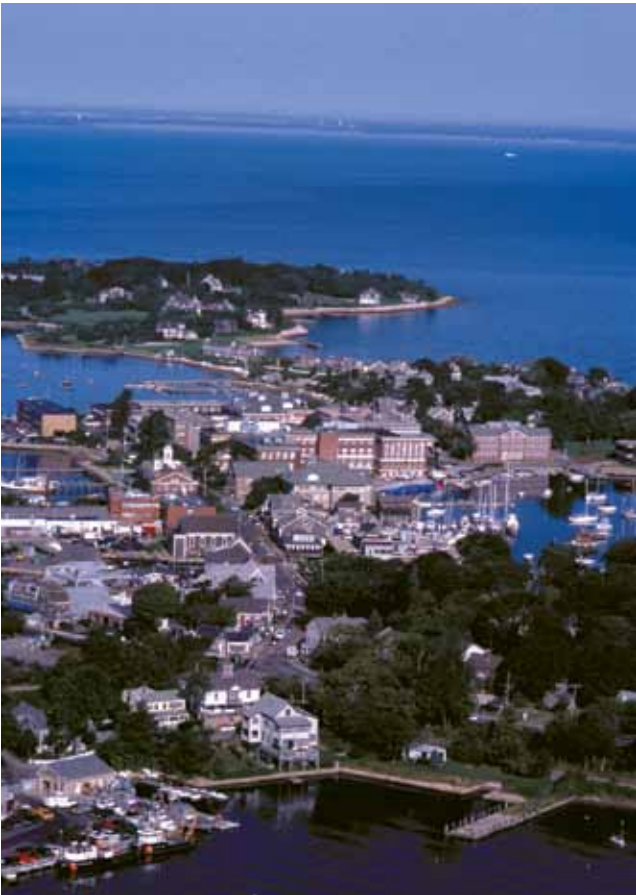
Office of Communications
Marine Biological Laboratory
7 MBL Street
Woods Hole, MA 02543
Phone: (508) 289-7423
Fax: (508) 289-7934
comm@mbi.edu
www.mbi.edu



Marine Biological Laboratory
7 MBL Street
Woods Hole, MA 02543

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Contents

2	Report of the Director and CEO: A New Vision for the MBL
	FACES OF THE MBL
8	Innovation: Shinya Inoué
10	Discovery: Avram Hershko
12	Persistence: Clay Armstrong
14	Inspiration: Vanessa Ruta
16	Initiative: William T. Golden
18	Commitment: Alexander Buck
20	Investment: Graciela Candelas
22	Research
58	Education
80	MBLWHOI Library
82	Financials
84	Gifts
104	Governance and Administration



REPORT OF THE DIRECTOR AND CEO

A New Vision for the MBL

The Marine Biological Laboratory's first strategic planning initiative was successfully completed in 2003, thanks in large part to the participation and commitment of hundreds of members of the MBL Community. My report describes the two-year effort, summarizes the recommendations that arose from various strategic planning task forces and were endorsed by the Board of Trustees, and notes the steps we've already begun taking towards implementing a very ambitious, yet achievable, 10-year vision for this institution.

Initial Steps

The satisfactory completion of the Marine Biological Laboratory's Capital Campaign in December 2000 and the recognition that the Laboratory was in a strong position financially, programmatically, and spiritually created a climate conducive to contemplation. As a result, the Board of Trustees decided in 2001 to begin a review process that would result in the creation of a five- to ten-year strategic vision for the MBL.



The Board asked MBL President John Dowling and me to assume responsibility for directing the planning process and selected the international consulting firm of McKinsey and Company to assist us in the effort. In commissioning the strategic plan, the Board asked that we assess both the reputation and the impact of the MBL within the broader scientific community. They asked us to develop a clear vision for how we will maintain and build on our research and educational strengths. This includes our aspirations for areas we will focus on, a description of how we will organize, and a plan to meet our financial requirements.

During the first phase of the process, we established a 19-person Steering Committee composed largely of members of the MBL Board of Trustees. The McKinsey group also interviewed individuals representing the MBL's various constituencies to gather background data on the laboratory and perspectives on MBL strategy today and in the future.

In early November 2001, the Steering Committee met for the first time. We discussed the preliminary data gathered by the McKinsey team and developed a set of shared beliefs and values that would help focus the planning process.

Shared Beliefs

- The MBL is a year-round institution
- The summer research and education programs set the MBL apart from every other institution in the world
- The MBL should make a disproportionate contribution to the advancement of the biological sciences
- MBL leadership should actively enhance the collaborative strength of the institution
- External talent should be more proactively recruited
- The MBL should focus on building its external reputation
- The MBL should continue to build the effectiveness of its governing bodies
- Growth of the MBL should be managed to ensure the Laboratory retains the culture and character that allow it to make its unique contributions to science
- Growth of the MBL must be done in a way that is consistent with the local environment and sensitive to the Woods Hole community

Building on these shared beliefs, the Committee also developed a vision statement designed to help guide the Laboratory's strategy in the years to come.

Vision Statement

Our aspiration is to be recognized for having a disproportionate impact on the advancement of biological sciences that improve the human condition. The MBL will achieve this impact in two, interdependent, ways:

- Driving fundamental advances in biological sciences through both resident and visiting research. The MBL will target areas where it has (or can reasonably develop) a distinctive position that benefits from the collaborative and cross-disciplinary strengths of the MBL.
- Catalyzing the scientific careers and contributions of the most promising and important scientists in the biological sciences by providing a unique opportunity to interact with leading scientists and collaborate across disciplines. The MBL's educational programs, its research programs, and its scientific interactions are all expected to contribute to this mission.

Task Forces Established



Whitman Building Renovation Advisory Committee

Robert Goldman, Chair
Northwestern University

Peter Armstrong
University of California, Davis

George Augustine
Duke University

Leah Haimo
University of California, Riverside

Avram Hershko
Technion-Israel Institute of Technology

Dan Johnston
Baylor College of Medicine

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Director of Education

Andrew Mattox
Director of Environmental Health & Safety

ARCHITECT

Jonathan Cohen
Tsoi/Kobus & Associates

PHASE I

During the spring of 2002, three task forces were established and charged with addressing a series of “researchable questions” regarding the laboratory’s research and educational programs. The first, charged with looking at the resident research programs, recommended that our year-round research initiatives be developed following the center model and that within five to ten years the MBL host four major resident research centers in the broad fields of molecular (Bay Paul Center), cellular (a proposed Cell Dynamics and Imaging Center), organismal (Marine Resources



Center), and systems science (The Ecosystems Center). Joint Ph.D. programs should be developed to provide a source of graduate students for these centers, and interdisciplinary research opportunities should be fostered among centers, with the education program, and among summer and visiting scientists. Finally, industrial alliances should be encouraged and functional services such as animal care, sequencing, imaging, and information

technology, should be linked to a center but administered to assure availability to the entire community.

A second task force explored ways to ensure continued excellence in education. It recommended that the MBL focus on graduate and post-graduate education year-round, with the understanding that some undergraduate programs may exist. It was strongly suggested that we establish a joint Ph.D. program(s) to provide a source of graduate students for our research programs, requiring a restructuring of the administrative organization that oversees education and the hiring of a Dean/Provost. In addition, the scope of the Education Committee’s assessment responsibilities should be broadened to cover all educational activities. Rigorous assessment criteria must be developed to ensure the distinctiveness

and impact of MBL courses relative to the MBL’s overall mission. Finally, the task force noted that institutional support for the education program should be expanded, especially in the areas of leadership, administrative support, housing and transportation, and modernized facilities.

A third task force looked at attracting the next generation of scientists to the summer and visiting research program. The group strongly encouraged the MBL to leverage the existing strength and uniqueness of the summer research program, which has made us world famous. We must also create more favorable conditions to attract the next generation of scientists by encouraging collaboration among investigators. The task force said this could be accomplished by focusing on major research themes; attracting new magnet scientists to move beyond current activities; providing additional fellowship funds; renovating the Whitman building; and developing a plan to address governance and administrative support issues for this activity.

PHASE II

During the summer of 2002 four additional task forces were established to build on the work of the earlier groups. A task force on governance was charged with recommending refinements to the MBL’s governance and administrative structure. It recommended creating a center for summer/visiting research and hiring a part-time director for that program; codifying the process by which centers are established, reviewed and terminated; eliminating the Board of Overseers, which duplicates the efforts of the Decennial Review Committee; hiring a Chief Scientific and Academic Officer and broadening the scope of the Education Committee so they are responsible for all undergraduate, graduate, and postgraduate educational activities at the laboratory; expanding the number of Trustees to create flexibility and enhance fundraising capabilities; further defining the role of the President of the Corporation; restructuring the Standing Committees of the Board of Trustees; and affirming that the Science Council serves in an

advisory capacity to the Director/CEO.

Another task force was asked to recommend affiliations to support the proposed graduate program and the overall mission of the laboratory. The group suggested that we amend the MBL charter to allow us to grant degrees and begin the accreditation process with New England Association of Schools and Colleges. It also recommended that we begin negotiations with potential affiliates.

A third task force on facilities was charged with developing a preliminary plan for expanding or modifying facilities, housing, and support services, based on the data produced earlier in the strategic planning process. The group recommended drafting a comprehensive site master plan for the campus that takes into consideration strategic planning initiatives, yet recognizes the unique quality of life issues within the Woods Hole community; renovating the Whitman, Loeb, and Swope buildings; providing additional off-campus housing and parking; creating a new animal care facility; and reconfiguring the library to accommodate new digital library initiatives and an information commons area, moving under-utilized materials off site, and providing additional research and office space. The issues addressed by this task force are ongoing, and will continue to be discussed by members of the Trustees' Campus Planning and Physical Assets Committee.

Finally, a fourth task force on finances was asked to quantify financial requirements and funding options to facilitate an informed prioritization of resources relative to the strategic vision. The group developed a flexible model to determine what it will cost to implement various components of the strategic plan and the requirements to sustain the program efforts. A final financial analysis will not be available until decisions concerning facilities and programs are finalized, however initial estimates indicate that we will need to embark on a campaign to raise at least \$100 million to fund the priorities emerging from the strategic planning effort. Again, the work of this group is ongoing and is now being ad-

dressed by the Trustees' Finance Committee.

Objectives Established

The Trustees have endorsed the Task Forces' overarching assessment that our three core activities—Visiting (Summer) Research, Resident Research, and Education—are key to the future of the institution. They also agree that these activities need to be strengthened with respect to quality and impact and should be more closely linked, reinforcing one of the MBL's most treasured traits—the personal interactions across disciplines and generations—and bolstering initiatives in one area with the capabilities of the others. The Board believes that the MBL leadership must be more rigorous in determining whether a proposed research activity or new course meets the tests of distinctiveness and furthers our goal towards having a disproportionate impact on the advancement of the biological sciences.

Resident Research

Specifically, the Board recognizes that our resident research program will be an increasingly important part of the MBL's mission over the coming decade. We envision growing from a core group of 31 to 45 Principal Investigators (PIs) over the next ten years. Our research will focus on areas in which the MBL can lead and will be built around centers and programs that have the critical mass to meet the impact test. The current plan is to add two centers—one in Cell Dynamics and another in Marine Resources—to the two that currently exist (Bay Paul and Ecosystems). We recognize that some research activities will continue to exist outside of these centers, but our intent is to cluster the MBL's investments in PI positions and fundraising around these four major areas.

Because The Ecosystems Center is already well established, growth here will be modest, with the number of PIs increasing from 11 to 14 over the next ten years. This Center will continue to build upon its talented and highly interactive set of researchers in the areas of coastal zone studies, global climate change,

conservation, and ecological policy.

Much of the MBL's growth in resident research will occur at the interfaces of molecular evolution, biodiversity, and parasitology, the aim being to catalyze research activities across the Woods Hole community. We anticipate that the total research staff of the Bay Paul Center will more than double over the next ten years, growing from 5 to 12 PIs. Much of this growth will be in the area of global infectious disease.

The MBL will build on its strong tradition of cellular imaging by establishing a new center that pulls together researchers focused on understanding the chemistry and biophysics of

the living cell. The growth of this program will likely take advantage of the MBL's close ties with commercial leaders in instrumentation.

Finally, we anticipate that growth in the programs within the Marine Resources building over the next decade will result in those combined programs

being given center status. We will continue to take advantage of our unique facilities and location by focusing on integrative organismal biology of marine animals and continue to provide them as models for research and education. Growth in this area could be significant, especially among the non-PI research staff, with a focus on scientific aquaculture, behavioral ecology, population genetics, and conservation.

Education

The MBL's activities in Education will increase significantly in the next decade and will focus on graduate and post-graduate education. The MBL will develop a joint Ph.D. program with one or more leading degree-granting institutions, and, when fully established,

anticipate hosting up to 25 graduate students a year. To ensure distinctiveness in graduate education, we will implement an upgraded leadership and administrative approach and rigorously evaluate the quality of all educational activities at the MBL.

Visiting Research

Along with the growth in resident research and graduate education, it is critical that the MBL retain its traditional source of distinctiveness—the summer and visiting research program. To ensure critical mass in the most important and exciting areas of science, we will cluster summer research activities, whenever appropriate, into collaborative groups established around themes and perhaps “magnet” scientists. The Whitman building, and eventually the Loeb building, will be renovated to ensure that the MBL remains an attractive and effective home for visiting science and education.

Meeting the Objectives

In December 2002, with the approval of the Board of Trustees, we established a list of objectives for the next 18 to 24 months. I'm pleased to report that we have already made significant progress towards meeting these objectives.

During the spring of 2003, Clerk of the Corporation Thomas Crane worked with us to rewrite the MBL's bylaws to enable us to meet some of the needs of the strategic vision. These changes, which were voted by the Trustees in July, include expanding the number of Trustees.

The MBL began exploring affiliations with a number of institutions. In the summer of 2003 we signed a memorandum of understanding to establish an affiliation with Brown University to develop a joint graduate program in biological and environmental science at the MBL. Our first two students, working in the Global Infectious Disease Program of the Bay Paul Center, were admitted in January 2004.



We also began the search for a Chief Academic and Scientific Officer (CASO). The CASO will report to the Director and CEO and will oversee all research and educational programs at the MBL. I am pleased to announce that William Beers will serve as the MBL's first Chief Academic and Scientific Officer. He will join the staff in the spring of 2004.

The Board of Trustees agreed that the Whitman building should be renovated and expanded, and authorized the hiring of an architect. In March 2003, the MBL selected the architectural firm of Tsoi/Kobus & Associates of Cambridge, MA. The Board also agreed to create the Whitman Center for summer and visiting research and asked that an interim director of the Whitman Center be appointed and an advisory committee be established to help with the redesign effort. In the fall of 2003, summer investigator Robert Goldman of Northwestern University agreed to serve as Director of the Whitman Center.

With preliminary designs for the Whitman renovation in hand and approval from the Board of Trustees, we will now begin fundraising for the project, which is currently estimated to cost \$20 million, including a program endowment and building maintenance fund. We must have a considerable portion of these funds raised before construction can begin. If fundraising is successful, we hope to begin renovating the Whitman building in the spring of 2005. The project is being designed and scheduled in a way that will minimize the impact on summer research activities even during actual construction.

Our efforts to establish a Cellular Dynamics Center, which will build on the MBL's strong tradition of cellular imaging, has begun. A committee, chaired by John Dowling, has been established to better define this initiative and to begin searching for a Director for this program. We expect to begin fundraising for this program in 2004.

In response to the recommendation that

visiting science be organized around themes when possible, summer investigators began establishing research "clusters" in the Whitman Center during the summer of 2003.

These groups included the Neural Imaging Cluster, the Clam Cluster, and the Innate Immunity Cluster. More clusters are being proposed for 2004. The MBL has also established, with the help of the Grass Foundation, The Neuroscience Institute.

The goal of this virtual institute is to bring all of neuroscience at the MBL under a central umbrella to foster collaboration and promote the presence, prominence and growth of neuroscience at the MBL.

Finally, we have engaged Tsoi/Kobus & Associates to help us develop a ten-year site master plan for the campus, both in the village and on a 29-acre parcel between Fay and Oyster Pond Roads. The site plan will help us consider ways to reconfigure and renovate space to meet the scientific needs outlined in the strategic plan. A preliminary site plan was presented and approved by the Board of Trustees at their November 8, 2003, meeting.

Conclusion

I want to thank the many individuals who participated in the Strategic Planning process. This plan is clearly a work in progress, something that is likely to evolve with time. However, it should provide the Laboratory with a useful roadmap as we move forward. As always, your thoughts and comments are most welcome.

—William T. Speck



Innovation

SHINYA INOUÉ

MBL Distinguished Scientist

Recipient of the 2003 International Prize for Biology

in action—have gained him an international reputation and made him a popular instructor of many MBL courses, including Embryology, Physiology, Neurobiology, Optical Microscopy, and Analytical and Quantitative Light Microscopy—a course of his own design.

Shinya Inoué has spent his career making his unique approach to scientific discovery and teaching look effortless. But swimming outside the school has taken a lifetime of work, unswerving focus, and innovation. “I have a desire to understand the workings of nature and to share discoveries with others,” he says. “I enjoy figuring out how to solve problems. I’m not satisfied by superficial answers.”

Standing out at the MBL is like trying to stand out in a large school of talented, brilliant fish. But MBL Distinguished Scientist Shinya Inoué, with his maverick ways and fearless attitude, often swims outside the school altogether—doing his



research on his own terms, inventing his own tools, and quietly shaping humankind's understanding of basic cellular processes and structures.

Inoué, Director of the Architectural Cell Dynamics Program since its founding in 1992 and a member of the MBL research community since 1949, says "the non-urban marine environment, the presence of fresh marine cells, and the freedom of interaction unmarred by academic politics, busy work, or departmental separation," all have contributed to his success

here.

He is known internationally for his expertise in cellular and developmental biology, and for his innovative work with polarized light microscopy, both of which he has elevated to entirely new levels. It's work that has gained the recognition of his peers, and netted him the 2003 International Prize for Biology from the Japan Society for the Promotion of Science.

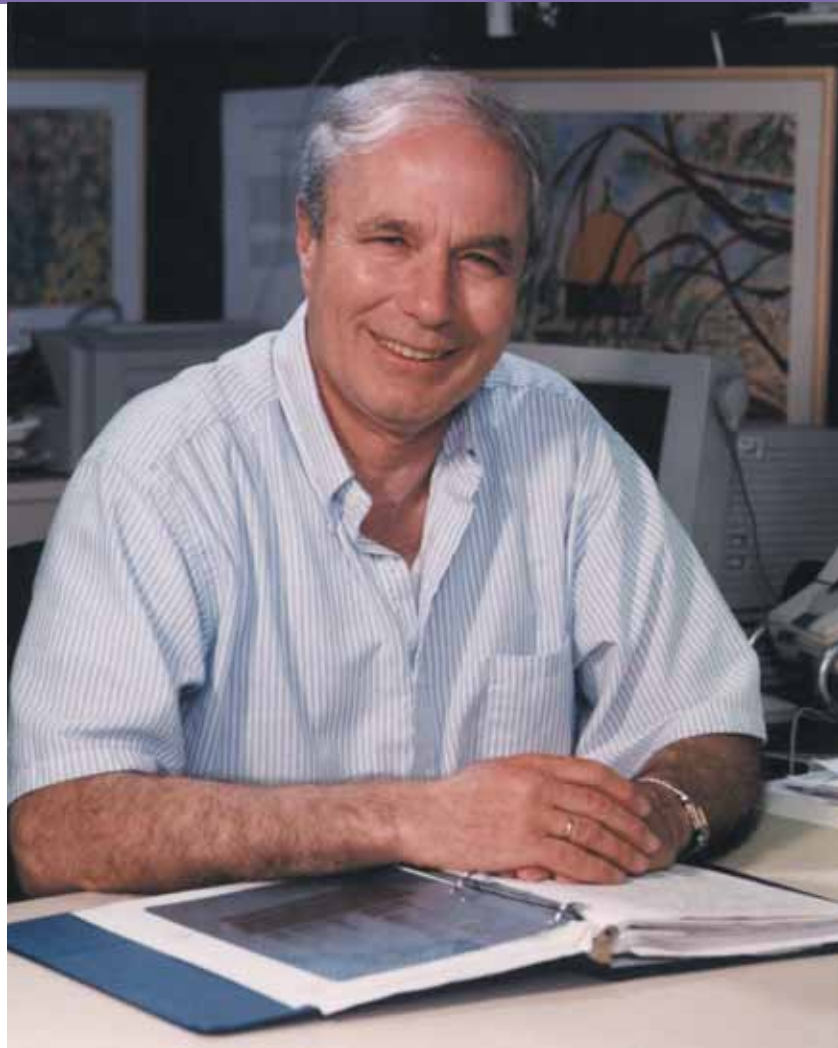
Most days Inoué can be found in his lab on the first floor of Lillie, focused on a seven-

foot microscope of his own creation, which he continuously upgrades and refines. One significant refinement was the introduction of a video camera to the microscope in 1980—an invention that revolutionized cell biology by revealing the pulsating movement and minute structures of cellular life that had never before been visible.

Such achievements seem to come easily to Inoué, especially at the MBL. His secret, he once told the American Society of Cell Biologists, is "devising new tools and letting nature herself tell what questions to ask." In fact, during one of his first MBL summers, he used his polarized light microscope to document the existence of spindle fibers—strand-like mechanisms that help move chromosomes during mitosis. Inoué's discovery changed the world's view of cell division forever and settled a 50-year debate over whether spindles existed at all. He was still a Princeton graduate student at the time.

Inoué's bold discoveries and optic inventions helped lay the foundation for the work of the MBL's Architectural Dynamics in Living Cells Program, where he and his colleagues study the structures that help cells function and differentiate, the spatial and temporal organization of these structures, and their physiological and genetic control. Could such a program—which also promotes the creation of new microscopes—succeed anywhere but the MBL? "It must be possible, but where?" says Inoué.

When he isn't peering into cells or refining his microscope, Inoué is likely to be teaching the next generation of scientists. His gift for teaching—and his amazing videos of cells



Discovery

AVRAM HERSHKO
MBL Visiting Investigator
Professor of Biochemistry, Technion-Israel Institute of Technology

regulation: Palazzo, who is now at Rensselaer Polytechnic Institute; Yosef Gruenbaum of Hebrew University of Jerusalem; and Robert Goldman of Northwestern University. The collaboration should pay big dividends to biomedical researchers who use surf clam eggs as research models. "We are reaching a barrier in our work, unless we obtain this important molecular knowledge," says Hershko. "Sequencing the clam genome should be a quantum leap for our research."

The kind of science Avram Hershko has done since he first arrived at the MBL exemplifies the collaborative spirit at the heart of our mission. And though his research generally takes less-traveled paths, he assures us he plans to take the well-traveled path to the MBL for many summers to come.

More than thirty years ago, Avram Hershko took the scientific road less traveled and began to study how cells rid themselves of unwanted or damaged proteins. It was a radical move during a time when his peers were studying the synthesis of proteins, not looking at their degradation. But with the help of his colleagues, Hershko ultimately discovered a fundamental process of protein regulation and how it impacts major physiological processes in the body.

Hershko's discovery was a breakthrough in the study of cell division, and ultimately may help scientists understand embryonic development, autoimmune diseases, and cancer. His work on ubiquitin, a protein that targets other proteins for elimination, made it a "hot" area of biomedical science. It also earned him a slew of awards—including the prestigious Albert Lasker Award for Basic Medical Research and the Wolf Prize in Medicine.

For the past fourteen years, the MBL has played a major role in Hershko's work. "The availability of an excellent experimental model system (clams), the outstanding scientific environment, and, I shall not deny it, the beauty and tranquility of the place, are the reasons I come here from Israel every summer," he says.

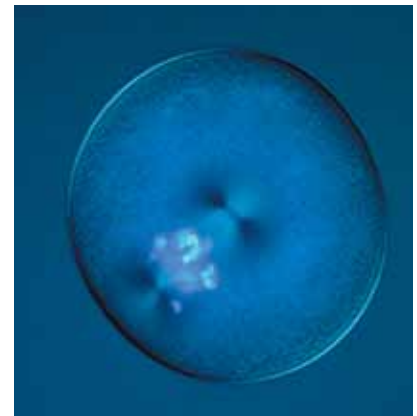
Hershko first traveled to Woods Hole in 1990, after becoming intrigued with the role of ubiquitin in cell division. MBL scientists had just discovered the importance of surf clam (*Spisula solidissima*) eggs—available locally in abundant supplies—as an ideal model for the test-tube study of cell-cycle-regulating proteins, including cyclins.

While at the MBL, he met Robert Palazzo, then of the University of Kansas, and Joan Ruderman, of Harvard University, and worked with them to clarify ubiquitin's role in the degradation of proteins, both during the cell cycle and at the end of mitosis—the final stage of cell division.

Today, Hershko is conducting more advanced studies of ubiquitin's role in mitosis, using both clam eggs and human cells. It's work he hopes will lead to a better understanding of abnormal cell division and, therefore, cancer.

Another important facet of Hershko's current work also originated at the MBL. It is the Clam Mini-Genome Project, an ambitious international effort to sequence most of the surf clam's "approximately 12,000 to 20,000 active genes" . . . within a one-year time frame.

The project unites Hershko and three other summer investigators from what MBL insiders call the "clam group." It features some leading researchers in the study of cell division





Persistence

CLAY ARMSTRONG

MBL Summer Investigator

Professor of Physiology, University of Pennsylvania School of Medicine

Clay Armstrong loves a challenge. Give him a mountain and he'll climb it. A marathon and he'll finish it. A Mozart piano sonata and he'll play it. So when he encountered the puzzle of ion channel gating—the cellular electrical signaling system underlying the thinking and movement needed to hike, run, and play a piano—he solved it.

Armstrong's map of the electrical workings of ion channels—pores that regulate the flow of ions like sodium and potassium through the cell membrane—shed new light on cell physiology and the generation of electrical signals in nerve and muscle. It also earned him the Albert Lasker Award for Basic Medical Research, the Louisa Gross Horwitz Prize, and the Gairdner Foundation International Award. Most importantly, his science may lead to treatments for medical conditions including heart disease, paralysis, and epilepsy.

Persistence, says Armstrong, is what drives his work. "I also have a feeling that

science is very important as well as being a great adventure," he says. So he was undeterred when his work was met by the usual challenges from other scientists in his field. He experimented for years to support his ideas regarding the existence of potassium and sodium channels in the membrane, their architecture, selectivity, and the mechanisms of 'gating' which allow them to open and close on demand.

Armstrong conducted many of his experiments here at the MBL. "Without the MBL, I would not have had a scientific career," he says. "I have a profound reverence for [its] tradition, for the great scientists who have worked there, and for their accomplishments."

According to Armstrong, great comrades and a supply of squid—his favored research model—have helped lure him here for many summers since 1963. Each spring, as Woods Hole squid (*Loligo pealei*) migrate to Cape Cod's waters, Armstrong prepares for his own migration to the MBL campus.

Over the years, he has formed many relationships at the MBL, including meeting his wife, scientist Clara Franzini-Armstrong. "It has been wonderful for communication [with other scientists] and a sense of support," he says. "Science is in the air!"

Armstrong's obvious love of science helped lead him to his current field. Initially, he wanted to become a doctor, so he went to medical school. But he soon gravitated toward electrophysiology and realized he preferred

the theoretical world of chemistry and physics to the empirical world of medicine. So, after receiving his M.D. and finishing a one-year internship, he left medicine for research.

That's when the scientific adventures really began. Armstrong landed research positions with Kenneth Stewart Cole (in Washington, D.C.) and Andrew Huxley (in London), two pioneers in the study of cellular electrical properties who influenced Armstrong's work. His science has taken him across the globe—to places like Chile and London, and even Woods Hole. And he has held coveted teaching positions and professorships at top universities that have enabled him to mentor others in his field.

Clay Armstrong's career has been rich with experience and adventure. He has persisted in making important contributions to medical research and education, worked in laboratories worldwide, and met—and conquered—his share of challenges. One can't help but wonder which mountain, race, sonata, or scientific puzzle he will attempt next.





Inspiration

VANESSA RUTA

MBL Course Alumna

2003 David Rockefeller Graduate Fellow, The Rockefeller University

channel—a protein pore that sits in a cell membrane and helps move potassium into and out of cells.” It was beautiful to see the first three-dimensional image of it and from a picture of that sort you feel you have insight into nature’s design,” says Ruta. “A very memorable part of the lecture was Rod’s description of having to drive through a snowstorm for five hours to get the last data set before he could see the structure. His portrayal of the discovery process really impacted me.” It had such impact that she soon approached MacKinnon about working in his lab at Rockefeller.

Today, Ruta is in her fourth year at the university, where she continues to work alongside MacKinnon. Would she be in this position if not for the MBL? “I suspect a lot has to do with the fact that he knew I had been in Woods Hole and at the MBL,” says Ruta. “I guess he knew I was the sort of scientist who would probably want to draw molecules in the sand given the opportunity.”

Molecules in the sand. 3-D renderings of ion channels. A scientist in a snowstorm. These are the images Vanessa Ruta uses to describe what led her to the MBL and to scientific inspiration. Ruta, a former ballerina whose father is a landscape painter, sees science with the eyes of an artist. Such vision surely contributed to the exciting events of 2003—when she was awarded The Rockefeller University’s David Rockefeller Fellowship, was first author on a paper published in *Nature*, and worked alongside her mentor, Rockefeller’s Roderick MacKinnon, the year he received the Nobel Prize in Chemistry.

Ruta’s decision to attend the MBL’s undergraduate Marine Models in Biological Research Program in 1997 changed everything. “Spending time at the MBL helped shape my scientific interests tremendously,” she says. She owes the decision, which she almost nixed, to an image given to her by Mike Tytell, the program’s director at the time. “He described Woods Hole as a sort of place where you can sometimes go to the beach and see people drawing molecules in the sand,” recalls Ruta. “It was a beautiful description . . . [of] a community of people who are so enthusiastic

about their work that it spills outside of the laboratory, and it changed my mind.”

Once at the MBL, Ruta was “completely struck by the unique atmosphere . . . It has such a diversity of scientists from all sorts of disciplines and a diversity of all scientific levels coming together,” she says.

So she returned a year later—and again the following year—to work with MBL Visiting Scientist Robert Barlow on the visual systems of horseshoe crabs. Ruta was still an undergraduate and the experience helped her appreciate scientific life. “In Woods Hole, no matter how small a scale you study, you feel you’re part of an investigation of the natural world,” she says.

A “convergence of influences” during Ruta’s third MBL summer ultimately led her to graduate school at The Rockefeller University. Barlow, a Rockefeller alumnus, suggested she consider it. Then she attended a Friday Evening Lecture and met Roderick MacKinnon, who during his own student years was a teaching assistant in the Neurobiology course (which Ruta took in 2000).

MacKinnon presented a description of the first structure obtained from a potassium





Initiative

WILLIAM T. GOLDEN
MBL Honorary Trustee
U.S. Science Policy Architect

of Sciences' Public Welfare Medal (its highest honor), the American Academy of Arts and Sciences' Scholar-Patriot Award, and a Special Tribute of Appreciation from the National Science Board.

Golden knows science from nearly every angle. As a naval officer during World War II, he invented a firing device for naval anti-aircraft machine guns that earned him several Letters of Commendation. He holds numerous honorary doctorates and earned a graduate degree in biological sciences from Columbia. And he has provided science-policy advice to almost every president since Truman, as well as the Atomic Energy Commission, the Department of State, and the second Hoover Commission.

Throughout his career, William Golden has invested heavily in the advancement of science and the public's understanding of it. The MBL and the Science Journalism Program are fortunate to have both Golden's pen and its master on our side.

If anyone knows the importance of writing to science, it's U.S. science policymaker William T. Golden. For five decades, he has used his mighty pen to advise our nation's presidents, to bring science to government, and to garner public support of the sciences. So when Golden pledged \$200,000 this year to kick start a \$2 million endowment fund for the Science Journalism Program, people took notice. His initiative has already elicited the support of the Arthur Ross Foundation, the Irving Weinstein Foundation, and the program's alumni. It helped tremendously that Golden was willing to use that pen of his to encourage others to follow his lead.

"I feel strongly that this is a superb program," Golden wrote in a fundraising letter he drafted personally. "I have great respect for this program which gives realistic support to efforts of the committees on public understanding of science of the American Association for the Advancement of Science (AAAS) and of the National Academy of Sciences (NAS) . . ."

Considering that Golden was co-chairman (with Joshua Lederberg) of the Carnegie Commission on Science, Technology, and Government—and has served on the boards of the AAAS, the American Museum of Natural History, the New York Academy of Sciences, and many other important scientific organizations—he is perhaps the strongest, most

informed supporter the Science Journalism Program could have.

In fact, he would likely feel right at home as a participant. The program, now in its nineteenth year, brings the MBL's top scientists and the world's best science journalists to Woods Hole for a week of DNA cloning, scientific seminars and lobster bakes, and late-night debates about the challenges of science and science writing. The goal of the program, which also grants MBL summer fellowships of up to eight weeks to some applicants, is to give journalists, authors, and broadcasters a first-hand view of scientific life and vice versa (see page 72 for a list of 2003 fellows).

Golden would, of course, ace the Science Journalism Program's application process. His recommendations to President Truman in 1950, known as the *Golden Memoranda*, helped establish the nation's first presidential science advisory organization and the National Science Foundation. His books and papers on governmental science advising have served as instruction manuals for those shaping science policy today. And he has received various honors for his science-policy leadership, including the National Academy





Commitment

ALEXANDER BUCK
President, Horizon Foundation

What intrigues Buck and his fellow Horizon Foundation Trustees about the *Atlas* is that the data will be communicated in a fashion that will reach various groups of people—conservation organizations, municipal planners, state regulators, local civic leaders, and the general public. “I’m counting on the MBL’s science to be not only the best science we have, but something that can be translated into a form that’s understandable to a broad number of people. That’s the way we’ll prove to citizens, developers, and others that there is a carrying capacity for our water and land, and that we have to pay attention to the science.”

Alexander (Sandy) Buck knows the beauty of Massachusetts' North Shore. An avid fly fisherman, he spends "as much time as he can get away with" on the water. Buck has lived amidst Plum Island Sound's expansive marshes and tidal creeks for over 25 years and is fully aware of its fragile state. "We have absolutely vast resources here on Plum Island and on the Great Marsh," he says. "Unless we're smart about how we allow growth to happen, we're going to lose it all."

Buck is President of Horizon Foundation, the foundation his family set up seven years ago. Buck, his parents, brother and sister-in-law, and wife all serve as Trustees. An important part of the Foundation's mission is to support projects and organizations that teach respect and care for the natural environment.

In 1999, in an effort to help expand philanthropy in the North Shore region, Buck helped start the Essex County Community Foundation. There he became part of the Foundation's Environmental Stewardship Initiative which brings together conservation organizations who work to avoid the negative impact of unplanned growth. "That's been my classroom for the last five years," he explains. "I've been learning what issues are threatening our natural environment and how they need to be addressed simultaneously

with youth education." As a result of Buck's involvement with the Community Foundation, the Horizon Foundation has since expanded its vision to include the support of efforts that advance smart growth.

In November, 2003 the Horizon Foundation awarded a grant to the MBL's Ecosystems Center for the *Atlas of Local Environmental Change* project which will portray, graphically, the culmination of a half-century of land-use changes in many of the communities located in North Shore's Ipswich and Parker River watersheds. Scientists at the MBL have been studying the region for over a decade with the goal of developing a predictive understanding of the effects of population increase, land use change, atmospheric nitrogen deposition, and climate change on water quality and quantity. The *Atlas* will depict the relationship between land use changes in the region and estuarine and river water quality using Ecosystems Center data. "We envision a graphical atlas containing maps, diagrams, and easily understood written descriptions of the visuals," says project leader and MBL Senior Scientist, Chuck Hopkinson.





Investment

GRACIELA CANDELAS
MBL Corporation Member
Professor of Biology, University of Puerto Rico

amino acid content.

Candelas has forged an impressive path in the world, and she credits her father, Teobaldo Casanova, a statistical psychologist, for encouraging her towards a career in science at an early age. She has also enjoyed support from family, friends and colleagues over the years, many of whom she sees at the MBL when she returns each summer. Of her long relationship with the MBL, Candelas says the laboratory has contributed in many important ways to her professional development. To recognize the role that the MBL has played in her life, Candelas has joined the New Century Society, having established a charitable gift annuity at the laboratory.

Most importantly, Candelas has spread the word of the MBL to a whole new generation of scientists, many of whom have spent summers in Woods Hole taking courses or conducting research.

Graciela Candelas has just about everything she needs in Puerto Rico: her family, an active, productive, and well-funded laboratory, excellent graduate and undergraduate students, an apartment on the campus where she teaches and does her research, and a home in the old city of San Juan. Yet every summer since the early 1960s, almost without exception, she has traveled to the Marine Biological

Laboratory in Woods Hole. The MBL is special, Candelas explains, "While things are informal there are constant lectures, seminars, and parties attended by an international group of scientists."

Candelas first came to the MBL in 1961 as a student in the Physiology course. She had heard about the richness of the summer experience from one of her mentors and good friend, Anna Diaz Collazo. The course stressed, among other topics, protein synthesis. "It exposed, under exquisite guidance, the contemporary technique of the field," explains Candelas. It was an experience that would jumpstart her interest in proteins and protein synthesis and help shape her career.

A few years later, while juggling motherhood

and completing her Ph.D. at the University of Miami, Candelas met renowned developmental biologist Alberto Monroy of Sicily, who was visiting as a guest lecturer at the University. Monroy had a summer lab at the MBL. Impressed by Candelas' research, Monroy invited her to work with him as a participant of the FERGAP program in Woods Hole. She looked forward to returning to the MBL. Candelas found the laboratory to be an ideal environment for continuing her early work on sea urchin protein synthesis elicited by fertilization. In 1968, she joined the MBL Corporation, becoming the first Puerto Rican to do so.

Today, more than 40 years after her first visit to the MBL, Candelas continues to study protein synthesis, but in a model system that she has developed. She now studies a pair of glands in the spider, which produce fibroins or silk. Because these fibroins are the strongest known natural fibers, they are also of great interest to biotechnology companies. The fibroin does not elicit an immune response in humans, meaning it has the potential to be an ideal tool for surgical repair. As lucrative as the glands have been as a model system in the laboratory, says Candelas, to date very little has been achieved commercially because the protein is very large and complex in its





research

Throughout its history, the MBL has been a place where the world's top biologists can focus on their research, not distracted by departmental affairs, committee work, or other aspects of university life. The MBL provides both the resource support and the intellectual environment that enable many scientists to do their best work.

Today 47 principal investigators and their staff conduct research at the Laboratory year-round in areas such as cellular, developmental, and reproductive biology; molecular biology and evolution; neurobiology and sensory physiology; ecology and ecosystems studies; global infectious diseases; and marine biotechnology and aquaculture.

The population of investigators grows dramatically each summer when hundreds of distinguished scientists from around the world gather here at the MBL's Whitman Center to do research.

During a typical MBL summer, researchers look for basic principles of life in organisms from squid to surf clams to zebrafish. They ask how nerve cells communicate, how cells regulate their complex processes, and how they proliferate. They explore how organisms reproduce and develop, how they fight disease, how sense organs gather information, and how brains process it. The investigators who gather each summer bring a diversity of approaches and questions. Along with the large number of faculty associated with the summer courses, they make the MBL the largest and most exciting biological laboratory in the world.



JOSEPHINE BAY PAUL CENTER FOR COMPARATIVE MOLECULAR BIOLOGY AND EVOLUTION

Single-cell organisms were the only forms of life for 80 to 90 percent of our evolutionary history. Through metabolic and biogeochemical processes, the microbial world imposed an overwhelming force on planetary change that set the stage for development of multicellular life. Today, all multicellular organisms including animals, plants, and fungi are completely dependent upon microbes for their continued survival. Microorganisms of untold diversity dominate every corner

of our biosphere where they orchestrate key processes in geochemical cycling, biodegradation, and in the protection of entire ecosystems from major environmental shifts. At the same time, certain microorganisms are formidable foes that threaten human health and our ability to sustain economic growth and development.

The Josephine Bay Paul Center for Comparative Molecular Biology and Evolution is an interdisciplinary research program that seeks to understand the molecular basis of microbial evolution as it pertains to global

infectious disease and environmental change. We capitalize on the intersection of microbial evolution, molecular biology, and genomics to understand mechanisms of disease, patterns of microbial diversity in extreme environments, and microbial-mediated processes that shape environmental change.

A unique feature of the Bay Paul Center is the formation of collaborations between infectious disease specialists, evolutionary biologists, and environmental scientists.



These linkages rarely occur in medical centers, but they have far-reaching implications for identifying and one day predicting the origins of pathogenicity and the dispersal of microbial species that play key roles in the environment. In many ways, technological advances in environmental microbiology have outstripped those used to study parasite diversity and function in human hosts. Yet, the very same techniques used to study microbial diversity in the environment are applicable to studies of human disease—only the “field site” is different. The questions *Who is there?* *What are they doing?* and *Where did they come from?* are directly applicable to both disciplines.

The portfolio of research projects in the Josephine Bay Paul Center includes studies

DIRECTOR
Mitchell Sogin

SENIOR SCIENTISTS
Stephen Hajduk
Monica Riley
Mitchell Sogin

ASSISTANT SCIENTISTS
Michael Cummings
Andrew McArthur
Robert Sabatini
Jennifer Wernegreen

ADJUNCT SCIENTISTS
Matthew Meselson, Harvard University
Roger Milkman, University of Iowa
David Patterson, University of Sydney, Australia
Harold Zakon, University of Texas, Austin

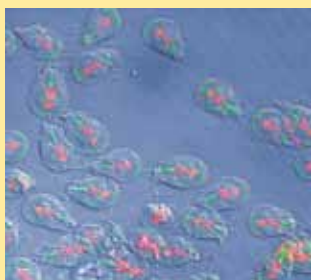
POSTDOCTORAL SCIENTISTS
Seth Bordenstein
Laura Cotlin
Byron Crump
Ashita Dhillon
Josh Herbeck
Jayleen Grams
Jessica Mark Welch
Mark Messerli
Torsten Ochsenreiter
Lorraine Olendzenski
Carmen Palacios

RESEARCH STAFF

In Search of a Vaccine: Proteins, Genes, and *Giardia*

Giardia, best known in the United States as a diarrheal disease of backpackers and children in daycare, also kills about 2 million people around the world each year. *Giardia* is an ancient organism, yet no one knows exactly what this bug does that makes people so sick, and no one knows how to create a vaccine for it. MBL Assistant Scientist Andrew McArthur and collaborators at the Laboratory's Global Infectious Disease program plan to change that. "A lot of people who get *Giardia* never get rid of it, and live lives of discomfort and lost productivity," says McArthur.

McArthur and his colleagues use state-of-the-art equipment to sequence DNA and RNAs (messengers for protein production) collected from *Giardia* at particular milestones in the bug's lifecycle. The researchers, who are nearing the end of a project to map the entire *Giardia* DNA code, then identify sequences of DNA responsible for producing specific RNAs. RNA is taken, for



example, from *Giardia* cultures as the parasite transforms into a cyst while being shed from its host animal. This outer shell allows the parasite to survive in water outside the host on its path to the intestine of a new host. Sequencing the RNA most conspicuously present as the cysts form and comparing those sequences to the *Giardia* genome shows what sequences

of DNA are active genes during cyst formation. McArthur presumes that genes that are highly active at this time are responsible for producing the proteins that make cyst formation possible. Researchers have already discovered one gene used only late in cyst formation, but which may produce large quantities of protein on the cyst's surface. "Cysts may go into the water stream just covered in that protein," says McArthur. The protein, McArthur says, may be critical to simply surviving in water or important for infecting the next host. The latter case might lead to a target for a vaccine.

The MBL collaboration between world-class computational biologists and parasitologists has also shown that the difficult-to-study bug, during its residence in a host's intestine, becomes a cyst at a later point in its life cycle than previously suspected. The collaboration has also yielded new genes and proteins that appear responsible for distinct characteristics of its transmission and ability to survive in different hosts. "You never know what might end up being a vaccine target," says McArthur.

The quick success of the giardial project has led to other work on trypanosomes and amoebae. Analogous work on schistosomiasis, a disease caused by infectious worms, is under consideration.

McArthur's work on Giardia is supported by the National Institute for Allergies and Infectious Diseases of the National Institutes of Health.



of RNA editing and DNA base modifications in trypanosomes, high-throughput gene expression studies in the human parasites *Giardia lamblia* and *Trypanosoma brucei*, investigations of microbial diversity both in extremely acidic environments and deep-sea hydrothermal vent sediments, genome-sequence and evolution studies of the human parasite *G. lamblia* and the microsporidian *Nosema locustae*, studies of the consequences of long-term asexuality on genome structure of Bdelloid rotifers, investigations of evolutionary processes that generate protein diversity, and analyses of mechanisms and consequences of endosymbiosis. Most recently we have initiated two large NIH-sponsored projects including a genome-wide survey of genes that are expressed in divergent free-living and pathogenic protists, and a new collaboration with the Woods Hole Oceanographic Institution to form a Center for Oceans and Human Health.

Staff, cont.

Marci Mangelson
Daniel Myers

NATIONAL SCIENCE FOUNDATION RESEARCH
EXPERIENCE FOR UNDERGRADUATE STUDENTS
Sarah Biber
Josh Larson

ADMINISTRATIVE STAFF
Richard M. Fox, System
Administration Consultant

Staff, cont.

Linda Amaral Zettler, Staff Scientist II
 Michele Bahr, Research Assistant II
 David Beaudoin, Research Assistant II
 Steven J. Biller, Research Assistant I
 Shanda Birkeland, Research Assistant I
 Michael Cipriano, Research Assistant I
 Amy Crump, Research Assistant II
 Patrick Degnan, Research Assistant I
 Courtney DiPaolo, Research Assistant I
 Sara Faulkner, Research Assistant I
 Sulip Goswami, Research Assistant II
 Jennifer Hsieh, Research Assistant I
 Ulandt Kim, Research Assistant II
 Abby Laatsch, Research Assistant I
 Erica Lasek-Nesselquist, Research Assistant I
 Adam Lazarus, Research Assistant I
 Bruce Luders, Research Assistant II
 David Mark Welch, Staff Scientist II
 Hilary Morrison, Staff Scientist II
 Maria Charisse Murray, Research Assistant I
 Bertil Olsson, Senior Research Assistant, Computation
 Sarah Pacocha, Research Assistant II
 Margrethe Serres, Staff Scientist I
 Jillian Ward, Research Assistant I
 Daniella Wilmot, Research Assistant I

VISITING INVESTIGATOR
 Robert Campbell, Ares Advanced Technologies

VISITING SCHOLARS
 Chris Hellman, University of Buffalo
 Christian Tschudi, Yale University
 Elisabetta Ullu, Yale University
 Noreen Williams, University of Buffalo
 Zac Wood, University of Oregon

GRADUATE STUDENTS
 Dan Golden
 Lynn Sherrer
 April Shiflett
 Justin Widener

HIGH SCHOOL INTERNS
 Megan Cohen, seasonal
 Dugan Hayes, seasonal
 Janina B. Kanin
 Alexandra Papa
 Avery Pierce, seasonal

SUMMER UNDERGRADUATES
 Adam Bazinet
 John Fuetsch

Publications

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THE ECOSYSTEMS CENTER

begetting warming. The critical next question is how long this positive feedback condition will last.

Where and how increased atmospheric CO_2 is stored is also an issue explored by scientists studying oceanic ecosystems. Some of the CO_2 ends up in the deep oceans, where the amount of carbon in dissolved organic compounds is equal in size to that of carbon in atmospheric CO_2 . The composition of this large pool of dissolved organic matter does not follow the rules of the element ratios of carbon to nitrogen to phosphorus, often referred to as the Redfield Ratio, discovered by Woods Hole scientist Alfred Redfield. Center scientists working on this puzzle are showing that there really are two parts to the pool of dissolved organic material in the oceans. One part that does not follow the rules is virtually inert,



thousands of years old, and extremely rich in carbon.

A second part that does follow the rules is being actively produced and decomposed by organisms on time scales of less than a thousand years and is also enriched in carbon relative to nitrogen and phosphorus. Recognition of the rules for element ratios for dissolved organic matter will allow prediction of the response of this large pool of ocean carbon to environmental changes in the future.

In 2003, the center again offered the Semester in Environmental Science, which was initiated in 1997.

This program brings undergraduates from a consortium of 60 liberal arts colleges and universities to the MBL campus for an intensive introduction to environmental sciences.

CO-DIRECTORS

John E. Hobbie
Jerry M. Melillo

SENIOR SCIENTISTS

Linda A. Deegan
Anne E. Giblin
John E. Hobbie
Charles S. Hopkinson
Jerry M. Melillo
Bruce J. Peterson
Edward B. Rastetter
Gaius R. Shaver

SENIOR RESEARCH SPECIALIST

Paul A. Steudler

ASSISTANT SCIENTISTS

Christopher Neill
Joseph J. Vallino

The Ecosystems Center, founded in 1975, is a collegial association of scientists led by co-directors John Hobbie and Jerry Melillo. Its mission is to understand how ecosystems are structured and how they function, to predict their response to changing environments, to apply the best scientific knowledge to the preservation and management of natural resources, and to educate scientists and citizens of the future.



The complex nature of modern ecosystems research requires a multi-disciplinary collaborative approach to address a variety of questions. Accordingly, center scientists work together on projects in many locations, from Alaska, Sweden, and Russia, to Brazil, and from the temperate forests of New England to the depths of the Earth's oceans.

In 2003, two research topics addressed by Ecosystems Center scientists involved efforts to understand how greenhouse gases interact with terrestrial and oceanic ecosystems.

Center investigators used mathematical models to estimate the global effects of climate changes in Alaska and other high-latitude ecosystems. Some of the most dramatic climate changes recorded to date have been recorded in these high-latitude ecosystems. Average warming since the 1950s in Alaska has been 4°F (2°C) and precipitation over most of the state has increased 30% between 1968 and 1990. A key issue is whether tundra and boreal woodlands and forests remove or release two important greenhouse gases, carbon dioxide (CO₂) and methane (CH₄). Land ecosystems above 45°N are taking CO₂ out of the atmosphere by photosynthesis and storing it as organic material in plants and soils, while at the same time releasing CH₄ to the atmosphere. Because CH₄ is a more powerful greenhouse gas than CO₂, these ecosystems are behaving as though they were releasing about 0.7 billion metric tons of CO₂ to the atmosphere each year. The conclusion is that the recent changes in climate observed in many high-latitude ecosystems are causing further climate change. Climate scientists call this a positive feedback condition, with warming

POSTDOCTORAL SCIENTISTS

Jonathan P. Benstead
Mary S. Booth
Laura C. Broughton
Alvarus S. K. Chan
Byron Crump
Solange Filoso
Heather Haas
Heather M. Rueth
Diane M. Sanzone
Martin Sommerkorn
Vinton J. Valentine
Zhenwen Wan
Michael R. Williams
Yuriko Yano
Qianlai Zhuang

RESEARCH STAFF

Michele P. Bahr, Senior Research Assistant
Zy F. Biesinger, Research Assistant
Donald W. Burnette, Research Assistant
Elizabeth H. Burrows, Research Assistant
Christopher P. Crockett, Research Assistant
Jeffrey A. Evans, Research Assistant
Benjamin Felzer, Research Associate
Emily F. Gaines, Research Assistant
Diana C. Garcia-Montiel, Staff Scientist
Robert H. Garritt, Senior Research Assistant
Marcus O. Gay, Research Assistant
Adrian C. Green, Research Assistant
Christie L. Hauptert, Research Assistant
Darrell A. Herbert, Staff Scientist
Robert M. Holmes, Staff Scientist

Research Staff, cont.

Shaomin Hu, Research Assistant
Jeffrey E. Hughes, Staff Scientist
J. Michael Johnson, Research Assistant
Bonnie L. Keeler, Research Assistant
Samuel Kelsey, Research Assistant
David W. Kicklighter, Research Associate
Bonnie L. Kwiatkowski, Research Assistant
James A. Laundre, Senior Research Assistant
Corey R. Lawrence, Research Assistant
John M. Logan, Research Assistant
Ann L. Lezberg, Research Assistant
Heidi Lux, Research Assistant
Roxanne Marino, Staff Scientist
Carmody K. McCalley, Research Assistant
James W. McClelland, Staff Scientist
Richard P. McHorney, Senior Research Assistant
Patricia Micks, Research Assistant
Sarah Morrisseau, Research Assistant
Marshall L. Otter, Senior Research Assistant
Suzanne Randazzo, Research Assistant
Carol Schwamb, Laboratory Assistant
Erica L. Stieve, Research Assistant
Kristin S. Tholke, Research Assistant
Suzanne M. Thomas, Research Assistant
Jane Tucker, Senior Research Assistant
Ian J. Washbourne, Research Assistant
Heidi S. Wilcox, Research Assistant

CONSULTANTS

Francis P. Bowles, Research Systems Consultant
Margaret C. Bowles, Administrative Consultant

VISITING SCIENTISTS AND SCHOLARS

Zoe Cardon, University of Connecticut
James Galloway, University of Virginia

ADJUNCT SCIENTISTS

Paul Colinvaux, Smithsonian Tropical
Research Institute
Robert Howarth, Cornell University

ADMINISTRATIVE STAFF

Dorothy J. Berthel, Administrative Assistant
Anthony J. Cave, Center Administrator
Suzanne J. Donovan, Graphics and
Website Specialist
Kenneth H. Foreman, Associate Director of
Semester in Environmental Science Program
Kelly R. Holzworth, Center Administrator
Frances Johnson-Horman, Administrative
Assistant
Deborah G. Scanlon, Projects and
Publications Coordinator
Mary Ann Seifert, Administrative Assistant

Plum Island Sound Projects Link Science to Local Community

As the pressures of human population and land development increase and the threat of global warming and rising sea level looms, coastal communities around the nation are all facing the same problem. How do they resolve issues like housing growth and the proper discharge of sewage effluent, yet preserve the delicate habitat around them?

There are no easy answers, and while it's true that science will provide the basis for making these decisions, once researchers identify the causes, deciding what to do (if anything) will

be a societal decision.

MBL Senior Scientist Linda Deegan and her colleagues at The Ecosystems Center realize that the fate of our country's coastal ecosystems relies upon the cooperation of scientists, policy makers, land managers, and citizens. Her research project based in the Plum Island Sound region of Massachusetts' North Shore is a testament to that belief.

Deegan, an aquatic ecologist, along with colleagues from the MBL and four other institutions from around the nation, is studying how salt marshes in the area are affected by nutrient inputs from upland activities, including development. Their large-scale project (named TIDE for Trophic cascades and Interacting control processes in a Detritus-based aquatic Ecosystem), involves enriching tidal creeks with nutrients to mimic nutrient overloading, and altering the population of a key salt marsh fish species, the mummichog, to better understand how

these multiple stresses may affect the sustainability of coastal ecosystems. "This project is the first of its kind in the world and has the potential to fundamentally change how we think about coastal ecosystems," said Deegan. "We have always thought that saltmarshes could tolerate nutrient enrichment better than other habitats. However, when we alter nutrients and the natural community at the same time, saltmarshes may incur more damage than we initially thought." –

Deegan's work is just one part of the National Science Foundation-funded Plum Island Estuary Long-Term Ecological Research Program (PIE-LTER), based on the North Shore. Plum Island Sound sits in the center of 20,000 acres of salt marsh that lie between Cape Ann and the New Hampshire border. Ecosystems Center scientists have been studying the embayment and marshes here since the mid 1980s. In 2003, the MBL purchased a five-acre farm in the North Shore community of Newbury to enable the expansion of Plum Island Sound research that focuses on understanding how coastal ecosystems are affected by changing land cover, climate, and sea level.

While one of the goals of the PIE-LTER is to contribute

scientific information that will help coastal communities nationwide, the information gleaned from the TIDE project and other PIE-LTER projects will be particularly beneficial to policy-makers in towns like Ipswich, Massachusetts, who view the research as providing the scientific basis of their future management decisions.

"With the development and approval of the MBL's TIDE project on the Great Marsh, the Ipswich Conservation Commission has taken a particular interest in the research conducted by MBL scientists in the Plum Island Estuary. The Ipswich Conservation Commission has not only granted permission for the project to proceed as proposed, but also recognizes the importance the research findings will have for future town management decisions," said Ipswich Conservation Commission Agent, David Pancoast, Esq. "The continued collaboration with Marine Biological Laboratory research in the Plum Island Sound region will enhance the outreach and education potential of this Conservation Commission and improve our ability to make informed decisions regarding resource management."

Community connections have and will continue to play an important role in PIE-LTER research. Deegan and colleague Chuck Hopkinson, MBL Senior Scientist and lead principal investigator of the PIE-LTER, have established partnerships with local, state, and federal agencies, conservation organizations, schools, and citizens who use their research results to better manage local resources. From working with citizen volunteers to develop a water monitoring program, to helping the Town of Ipswich evaluate the impacts of their sewage effluent on the environment, to providing a hands-on field experience for school children, the PIE-LTER has taken an active role in educating local stakeholders, young and old, about what their scientific findings may mean to the local community. "What started out as a 'minimalist program' has grown to be a broad, well-rounded suite of activities," said Hopkinson. "Our long-term goal is to establish an outreach office at our study site that would serve to integrate and promote our interactions with interested parties throughout New England."





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WHITMAN CENTER FOR VISITING RESEARCH

For 115 years, biologists from around the world have gathered at the MBL to conduct research, creating an institution that science writer and physician Lewis Thomas called the "uniquely national center for biology in this country." To date 49 Nobel Laureates, including this year's winner Rod McKinnon of The Rockefeller University, have taught, taken courses, or conducted research at the MBL.

Hundreds of distinguished biologists arrive in Woods Hole every summer with their graduate students and technicians, their equipment, their ideas and their passion to learn from each other, taking up residence at the laboratory as participants in the newly established Whitman Center for Visiting Research, directed by Robert D. Goldman of Northwestern University. These investigators find a scientific community that allows them to launch into research almost immediately upon their arrival. Free from academic duties at their home institutions, some veteran visiting investigators report they do more hands-on research in three months at the MBL than they do during the rest of the year at their home institutions.

In 2003, the Whitman Center welcomed 139 visiting investigators and 201 other researchers from 144 institutions and 18 countries. This was the largest number of visiting investigators to participate in the summer program in the past 10 years. Clusters of investigators focused their research on a number of research topics including neural imaging, innate immunity, and cell biology and the cell cycle. Investigators also teamed up to begin to sequence the clam genome, in an effort dubbed the Clam Mini-Genome Project. The investigators, led by Lasker Award-winner Avram Hershko of the Technion-Israel Institute of Technology, hope someday to know the clam's active DNA inside out, to have created useful antibodies and other molecular probes from that information, and to have begun experiments impossible to conduct without the availability of these new research tools.

With the help of the Grass Foundation, MBL also established a virtual Neuroscience Institute in 2003. Coordinated by David Bodznick of Wesleyan University, the goal of the institute is to bring all of neuroscience at the MBL under a central umbrella to foster collaboration and promote the presence, prominence and growth of neuroscience at the



DIRECTOR

Robert D. Goldman, Northwestern University

VISITING PRINCIPAL INVESTIGATORS

Albertini, David, Tufts University School of Medicine

Armstrong, Clay, University of Pennsylvania

Armstrong, Peter B., University of California, Davis

Augustine, George J., Duke University Medical Center

Ayvazian, Suzanne, Department of Fisheries, Australia

Baker, Robert, New York University Medical Center

Barlow, Jr., Robert B., SUNY Upstate Medical University

Barry, Susan, Mount Holyoke College

Bass, Andrew, Cornell University

Beaugé, Luis, Instituto de Investigacion Medica "Mercedes y Martin Ferreyra," Argentina

Bennett, Michael V. L., Albert Einstein College of Medicine

Bodznick, David, Wesleyan University

Boyer, Barbara, Union College

Boyle, Richard, NASA

Brady, Scott T., University of Illinois, Chicago

Brown, Joel, Albert Einstein College of Medicine

Burbach, Peter, Rudolf Magnus Institute for Neurosciences, The Netherlands

Burger, Max M., Novartis International AG, Switzerland

Burgess, David, Boston College

Buxbaum, Joseph, Mount Sinai School of Medicine

Chang, Fred, Columbia University



'Vocal Learners' Make Noise at the MBL

**Songbirds are a preferred
model to study speech
acquisition and development**

songbirds, produces several distinct songs, and seems to recognize and respond to them as distinct sounds. "We want to know how these brain areas are active during the utterance of different songs," says Mooney.

The second part of their project aims to determine whether a given subpopulation of premotor neurons are both active during a vocalization and stimulated by the auditory presentation of that same vocal sound. "We want to see if there is an equivalence of auditory and motor activity in this area," says Mooney, "which might be one way in which the nervous system facilitates auditory-vocal interactions important to learning song."

To finely resolve which neurons are being recorded, Mooney and Fee use a method known as "antidromic stimulation," in which action potentials are propagated from the axons of recorded neurons backwards up axons to cell bodies, where they are recorded by electrodes.

Auditory-guided vocal learning is found in both humans and birds, though they do not share a common ancestor who was a vocal learner, explains Mooney. In this sense, bird song is an analogue to human learning of speech, a case of convergent evolution that requires young animals to learn by hearing to achieve the ability to vocalize as an adult.

Even if the exact strategies are not used in birds and humans, Mooney says, the exact same problem is solved by the bird as in the human infant, of achieving a very high-order transformation from sensory to motor representations of the vocalization.

Fee and Mooney believe their research will shed light on all kinds of sequenced movements where many different kinds of activities have to be coordinated, including speech. With their work, they hope to open new doors to clinical treatment for speech perception problems and production, and perhaps shed light on various disorders which make other sequenced action difficult, such as Parkinson's disease.

On a more profound level, Mooney suggests, the ability to perceive sequences of movements or sounds may underlie our ability to appreciate music, but may also provide part of the ability to think. "The ability to generate or anticipate these sequences may be a form of thought, and may ultimately be a necessary prerequisite for consciousness," he says.

Visiting Principal Investigators, cont.

Technology, Israel
Highstein, Steven M., Washington University
School of Medicine
Hill, Susan, Michigan State University
Hines, Michael, Yale University School of Medicine
Holmgren, Miguel, National Institutes of Health

Johnston, Daniel, Baylor College of Medicine
Jonas, Elizabeth, Yale University School of
Medicine

Kaczmarek, Leonard, Yale University School
of Medicine
Kaplan, Ilene M., Union College
Kapoor, Tarun, The Rockefeller University
Kaupp, U.B., Institut für Biologische
Informationsverarbeitung, Germany
Khodjakov, Alexey, Wadsworth Center
Kirschner, Marc, Harvard University Medical School
Koonce, Michael, Wadsworth Center
Kuhlman, Sandra, Cold Spring Harbor Laboratory
Kuhns, William, The Hospital for Sick Children,
Canada

Lafer, Eileen M., University of Texas Health
Science Center, San Antonio
Lambert, Nevin, Medical College of Georgia
Landowne, David, University of Miami School
of Medicine
Langford, George, Dartmouth College
Larkum, Matthew, Max-Planck-Institute for
Medical Research, Germany
Laskin, Jeffrey, University of Medicine and
Dentistry of New Jersey
Laufer, Hans, University of Connecticut
LeBaron, Richard, University of Texas,
San Antonio
Lill, Roland, Phillips-Universität, Marburg, Germany
Lipicky, Raymond J., Lipicky, LLC.
Llinás, Rodolfo R., New York University Medical
Center
Lowe, Christopher, University of California,
Berkeley

Mabuchi, Issei, University of Tokyo, Japan
Magee, Jeff, Louisiana State University
Medical Center
Manor, Yair, Ben-Gurion University, Israel
Marshall, John, Brown University
Martensson, Lena, Göteborg University, Sweden
Martinez, Joe, University of Texas, San Antonio
McNeil, Paul, Medical College of Georgia
Mensingher, Allen, University of Minnesota, Duluth
Mitchison, Timothy, Harvard University
Medical School
Molina, Antony, University of Illinois, Chicago
Mooney, Richard, Duke University Medical Center
Moore, John W., Duke University Medical Center
Morgan, Jennifer, Yale University School of
Medicine
Murphy, Gabriel, University of California,
San Diego

Nasi, Enrico, Boston University School of Medicine

Chappell, Richard L., Hunter College,
City University of New York
Chung, S. Clare, University of California,
San Francisco
Clay, John, National Institutes of Health
Cohen, Lawrence B., Yale University School
of Medicine
Cohen, William D., Hunter College,
City University of New York
Crawford, Karen, St. Mary's College of Maryland
Cusato, Karen, Albert Einstein College of Medicine

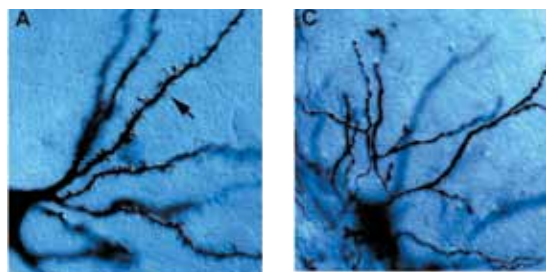
Davison, Ian, Simon Fraser University, Canada
De Weer, Paul, University of Pennsylvania School
of Medicine
DiPolo, Reinaldo, Instituto Venezolano
Investigaciones Cientificas, Venezuela
Dodge, Frederick, State University of New York
Upstate Medical University

Eckberg, William, Howard University
Edds-Walton, Peggy, Parmlly Hearing Institute of
Loyola University
Ehrlich, Barbara, Yale University
Elso de Berberian, Graciela, Instituto de
Investigacion Medica, Argentina
Engelender, Simone, Technion-Israel Institute of
Technology, Israel
Eugenin, Jaime, Universidad de Santiago de
Chile, Chile

Fay, Richard, Loyola University of Chicago
Fee, Michale, Bell Labs/Lucent Technology
Field, Christine, Harvard University Medical School
Fields, Douglas, National Institutes of Health
Fishman, Harvey M., University of Texas Medical
Branch, Galveston

Gadsby, David, The Rockefeller University
Gainer, Harold, National Institutes of Health
Galione, Antony, Oxford University, United
Kingdom
Gerhart, John, University of California, Berkeley
Gherardi, Francesca, University of Florence, Italy
Giuditta, Antonio, Universita di Napoli
"Federico II," Italy
Glanzman, David, University of California,
Los Angeles
Goldman, Robert D., Northwestern University
Medical School
Gould, Robert, New York State Institute for
Basic Research
Grant, Philip, National Institutes of Health
Green, William, University of Chicago
Gruenbaum, Yosef, The Hebrew University of
Jerusalem, Israel
Gundersen, Gregg, Columbia University

Haimo, Leah, University of California, Riverside
Harrington, John, SUNY New Paltz
Haspel, Gal, Ben-Gurion University, Israel
Heck, Diane, Rutgers University
Hershko, Avram, Technion-Israel Institute of



The swamp sparrow, like other songbirds, produces several distinct songs, and seems to recognize and respond to them as distinct sounds.

Squid. Mouse. Surf clam. Sparrow. Sea snail. Freshwater zebrafish. Giant sea slug. If you think it would be easy to pick out the organisms starring in research at the MBL, think again. In truth, all of these animals play key roles in projects. MBL, it seems, is not just for marine organisms anymore.

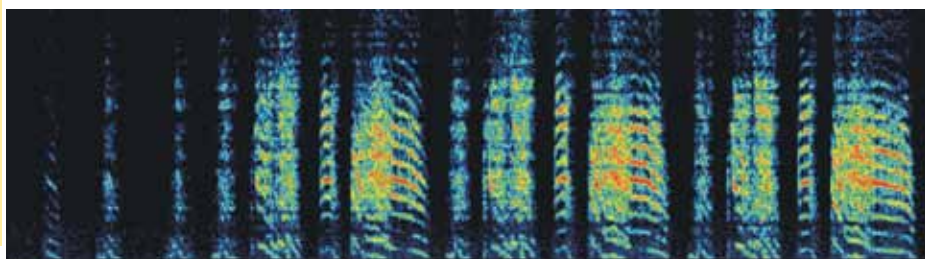
Songbirds, for example, are not a traditional model for neurobiology research at the MBL, which made the squid giant axon famous. Yet Michale Fee of Lucent Technologies and Richard Mooney of the Duke University Medical Center, MBL visiting investigators in 2003, say that the tradition of neurobiology at the Laboratory, combined with Woods Hole's summer draw for the best neurobiologists in the world, make it the perfect place for the two to study learning and memory in the swamp sparrow.

Neurobiologists refer to songbirds such as canaries, cardinals, and mockingbirds as "vocal learners." Vocalization plays a critical role in courtship for these birds, who must hear songs before they can generate the complex and varied songs themselves. Songbirds also need to hear themselves sing to maintain their songs. It's a rare form of learning also found in humans, whales, and bats, but few other animals.

Such similarities with human learning and production of speech have made songbirds a preferred model to study speech acquisition and development—in particular, how hearing sounds relates to the ability to produce them, and how the brain controls respiration and vocal organs.

To unravel the mysteries of song learning and vocalization in songbirds, Fee and Mooney record the electrical activity of individual brain neurons while birds sing. Their project tests the idea that different populations of premotor neurons are recruited to produce different song types. The swamp sparrow, like other

Michale Fee and Richard Mooney were 2003 Dart Fellows in Learning and Memory





FELLOWSHIPS

MBL Research Fellows

Nineteen scientists received awards from the Marine Biological Laboratory to conduct research at the laboratory in 2003.

Endowed Fellowship, The John O. Crane Fellowship Fund, and the H. Burr Steinbach Memorial Fellowship Fund.

Elisabetta Ullu, Ph.D.

Yale University School of Medicine

"The role of gene silencing pathways in trypanosome biology." Dr. Ullu was supported by the Baxter Postdoctoral Fellowship Fund, The Erik B. Fries Endowed Fellowship, The John O. Crane Fellowship Fund, The Charles R. Crane Memorial Fellowship Fund, and the James A. and Faith Miller Fellowship Fund.

Herman Wolosker, M.D., Ph.D.

Technion-Israel Institute of Technology, Israel

"Neurobiology of D-amino acids." Dr. Wolosker was supported by the Gruss Lipper Foundation.

Dejan P. Zecevic, Ph.D.

Yale University School of Medicine

"Signal integration in dendrites of individual vertebrate neurons." Dr. Zecevic was supported by the Herbert W. Rand Fellowship, The Stephen W. Kuffler Fellowship Fund, and the H. Keffer Hartline Fellowship Fund.

was supported by the Herbert W. Rand Fellowship.

Christopher Lowe, Ph.D.

University of California, Berkeley

"Early deuterostome evolution and the origin of chordates: Insights from hemichordate development."

Dr. Lowe was supported by The Laura and Arthur Colwin Endowed Summer Research Fellowship.

Issei Mabuchi, Ph.D.

University of Tokyo, Japan

"Mechanism of determination of the cleavage plane in sea urchin eggs." Dr. Mabuchi was supported by the Robert Day Allen Fellowship Fund.

Yair Manor, Ph.D.

Ben-Gurion University, Israel

"Neuromodulation of neuronal networks that produce rhythmic activity." Dr. Manor was supported by the Gruss Lipper Foundation.

Christian Tschudi, Ph.D.

Yale University School of Medicine

"Do gene silencing pathways operate in Giardia lamblia?" Dr. Tschudi was supported by the Baxter Postdoctoral Fellowship Fund, The Erik B. Fries

Visiting Principal Investigators, cont.

Palazzo, Robert, Rensselaer Polytechnic Institute
 Pant, Harish, National Institutes of Health
 Pappas, George, University of Illinois
 Parysek, Linda, University of Cincinnati
 Pieribone, Vincent, Yale University School of Medicine
 Ponka, Prem, McGill University, Canada

Quigley, James, Scripps Research Institute

Rabbitt, Richard, University of Utah
 Rakowski, Robert F., Ohio University
 Ratner, Nancy, University of Cincinnati
 Reese, Thomas S., National Institutes of Health
 Rhodes, Paul, New York University Medical School
 Rieder, Conly, Wadsworth Center
 Ripps, Harris, University of Illinois College of Medicine
 Rome, Larry, University of Pennsylvania
 Ross, William, New York Medical College
 Russell, James, National Institutes of Health

Salmon, Edward, University of North Carolina, Chapel Hill

Silver, Robert, Wayne State University School of Medicine

Sisneros, Joseph, Cornell University
 Sloboda, Roger D., Dartmouth College
 Sluder, Greenfield, University of Massachusetts Medical School

Spiegel, Evelyn, Dartmouth College
 Spiegel, Melvin, Dartmouth College
 Steinacker, Antoinette, University of Puerto Rico
 Stockbridge, Norman, Federal Department of Agriculture

Sugimori, Mutsuyuki, New York University Medical Center

Telzer, Bruce, Pomona College

Tschudi, Christian, Yale University Medical School

Ullu, Elisabetta, Yale University Medical School

Villalba-Galea, Carlos, Duke University Medical Center

Vollrath, Melissa Ann, Harvard University Medical School

Weidner, Earl, Louisiana State University

Whittaker, J. Richard, University of New Brunswick, Canada

Wolosker, Herman, Technion-Israel Institute of Technology, Israel

Zecevic, Dejan P., Yale University School of Medicine

Zeddies, David, Loyola University, Chicago

Zimmerberg, Joshua, National Institutes of Health

Zottoli, Steven, Williams College

Zukin-Bennett, R. Suzanne, Albert Einstein College of Medicine

OTHER RESEARCH PERSONNEL

Adam, Stephen, Northwestern University
 Ahuja, Nilesh, SUNY Upstate Medical University
 Alber, Merrill, University of Georgia
 Alliegro, Mark, Louisiana State University
 Health Sciences Center
 Ananth, Amitha, Boston University
 Anyatonwu, Georgia, Yale University School
 of Medicine
 Artigas, Pablo, The Rockefeller University
 Asokan, Sreeja, The University of North Carolina,
 Chapel Hill
 Ayliffe, Harold, University of Utah

Baker, Bradley, Yale University
 Ballester, Victoria, University of Sao Paulo, Brazil
 Barks, James, Nikon Instruments, Inc.
 Barrett, Lynda, Tufts University
 Bartman, Marc, Wayne State University
 Bearer, Elaine, Brown University
 Bernet, Jennifer, Wake Forest University
 Berquist, Rachel, University of Minnesota, Duluth
 Bertetto, Lisa, Wesleyan University
 Bettez, Neil, Cornell University
 Biber, Sarah, Earlham College
 Bindokas, Vytas, University of Chicago
 Blake, Charles, University of South Carolina
 Boal, Jean, Millersville University
 Boctor, Sherin, University of Texas, San Antonio
 Bras, Simone, Williams College
 Braun, Alexander, Hunter College
 Brosnahan, Michael, Dartmouth College
 Brown, Jeremiah, Dartmouth College
 Burbach, Peter, Rudolf Magnus Institute for
 Neurosciences, The Netherlands
 Burton, Oliver, Williams College

Cai, Diancai, University of California, Los Angeles
 Cameron, Lisa, University of North Carolina,
 Chapel Hill
 Cardon, Zoe, University of Connecticut
 Carroll, Amanda, Marine Biological Laboratory
 Cefaliello, Carolina, University of Naples, Italy
 Chambers, Jenica, Williams College
 Chen, Chu, Louisiana State University Health
 Sciences Center
 Chen, Shanping, House Ear Institute
 Chen, Xiaobing, National Institutes of Health
 Chen, Xixi, Baylor College of Medicine
 Chiao, Chuan-Chin, National Tsing Hau
 University, Taiwan
 Chludzinski, John, National Institutes of Health
 Choe, Chi-un, Yale University School of
 Medicine
 Clarkson, Melissa, Rensselaer Polytechnic
 Institute
 Clifford, Sarah, University of Utah
 Cohen, Lily, Yale University
 Colvin, Robert, Ohio University
 Conroy, Lou-Anne, Rivendell Academy
 Cusato, Karen, Albert Einstein College of
 Medicine

Dale, Benjamin, New York University School of

David Albertini, Ph.D.
 Tufts University School of Medicine
 "Origins of egg polarity." *Dr. Albertini was supported by The Laura and Arthur Colwin Endowed Summer Research Fellowship.*

Suzanne G. Ayvazian, Ph.D.
 Western Australia Marine Fisheries
 Laboratory, North Beach, Australia
 "Metapopulation analysis of bluefish (*Pomatomus saltatrix*) in estuaries and implications for linkages with offshore populations." *Dr. Ayvazian was supported by MBL Associates and the Lucy B. Lemann Fellowship Fund.*

Graciela Elso de Berberian, Ph.D.
 Instituto de Investigación, Argentina
 "Studies on the squid nerve cytosolic factor required for the Mg-ATP stimulation of Na⁺/Ca²⁺ exchange." *Dr. Elso de Berberian was supported by the Frederik B. Bang Fellowship Fund.*

Simone Engelender, M.D., Ph.D.
 Technion-Israel Institute of Technology,
 Israel
 "Molecular mechanisms of Parkinson's Disease." *Dr. Engelender was supported by the Gruss Lipper Foundation.*

Jaime L. Eugeni, M.D., Ph.D.
 Universidad de Santiago de Chile
 "pH sensitivity of respiratory neurons: Optical recording in the embryonic brain." *Dr. Eugeni was supported by the Evelyn and Melvin Spiegel Fellowship Fund.*

Francesca Gherardi, Ph.D.
 University of Florence, Italy
 "Investigating the existence and modalities of individual recognition in the long-wrist hermit crab, *Pagurus longicarpus*, a common shallow-water species in the Cape Cod area." *Dr. Gherardi was supported by the MBL*

Associates, the Plum Foundation John E. Dowling Fellowship Fund, the Ann E. Kammer Memorial Fellowship Fund, the H. Keffer Hartline Fellowship Fund, and the Frank R. Lillie Fund.

Gregg G. Gundersen, Ph.D.
 Columbia University
 "The role of microtubule capture in cytokinesis." *Dr. Gundersen was supported by an award from the Universal Imaging Corporation.*

Yosef Gruenbaum, Ph.D.
 The Hebrew University of Jerusalem,
 Israel
 "Molecular and functional dissection of the nuclear lamina in the surf clam." *Dr. Gruenbaum was supported by the Frank R. Lillie Fund, the Herbert W. Rand Fellowship, the Elisabet Samuelsson Director's Discretionary Fund, and the William T. Golden Fund.*

Alexey L. Khodjakov, Ph.D.
 Wadsworth Center
 "Development of semi-automatic laser microsurgery system." *Dr. Khodjakov was supported by Nikon Instruments, Inc.*

Nevin Alan Lambert, Ph.D.
 Medical College of Georgia, Augusta
 "The role of RGS proteins in regulation of slow synaptic transmission in the CNS." *Dr. Lambert was supported by the MBL Associates and The Stephen W. Kuffler Fellowship Fund.*

Matthew E. Larkum, Ph.D.
 University of Bern, Switzerland
 "Characterization of the active dendritic properties of the pyramidal cells of turtle cortex." *Dr. Larkum was supported by The Stephen W. Kuffler Fellowship Fund, the Baxter Postdoctoral Fellowship Fund, the M.G.F. Fuortes Memorial Fellowship Fund, and the MBL Associates.*

Roland Lill, Ph.D.
 Phillips-Universität Marburg, Germany
 "Studies on mitochondrial iron metabolism in yeast and mammals." *He*



Albert and Ellen Grass Faculty Grant Program

Four investigators were awarded the first Grass Faculty Awards at the MBL in 2003. The goal of this new Program is to take advantage of the collaborative environment of the MBL and bring together neuroscientists at the Assistant or Associate Professor level from different institutions to work together to conduct specific research in neuroscience.

The recipients of the 2003 Grass Faculty Awards were:

- Joseph D. Buxbaum, Ph.D., Mount Sinai School of Medicine
 - Vincent A. Pieribone, Ph.D., Yale University School of Medicine
- Together they investigated "The role of the Alzheimer's amyloid protein precursor (APP) in vesicle transport in axons."
- William N. Green, Ph.D., University of Chicago
 - John Marshall, Ph.D., Brown University
- Together they studied "Target and trafficking of glutamate receptors by PDZ domain receptors."

Dart Fellowships in Learning and Memory

The first three Dart Fellowships in Learning and Memory were awarded in 2003. Sponsored by a generous grant from the Dart Foundation, these fellowships bring top scientists in the field of learning and memory together to conduct research at the MBL for the summer.

The recipients of the 2003 Dart Fellowships were:

David Glanzman, Ph.D.
University of California, Los Angeles
 "Serotonin-induced release of calcium from intracellular stores in *Aplysia* motor neurons."

Michale S. Fee, Ph.D.
Bell Laboratories, Lucent Technologies, and Princeton University
 "Neural dynamics in avian song."

Richard D. Mooney, Ph.D.
Duke University Medical Center
 "Neural bases of learning and memory, and the developmental mechanisms that limit sensitive periods for such processes."

Other Research Personnel, cont.

Gulledge, Jay, University of Louisville
 Guo, Mira, Princeton University
 Gutierrez, Linda, Williams College

Hadrys, Thorsten, New York University School of Medicine

Hahnloser, Richard, Bell Laboratories

Hale, Rebecca, Hampshire College

Hardwick, J. Marie, The Johns Hopkins University

Harrington, John, SUNY New Paltz

Harrington, John, Jr., University of California, Davis

Helbig, Annika, Institut für Biologische Informationsverarbeitung, Germany

Hellemons, Anita, Rudolf Magnus Institute for Neuroscience, The Netherlands

Helm, Jessica, Yale University School of Medicine

Hernandez, Carlos, New York University School of Medicine

Hernandez, Ruben, University of Texas

Hess, Sam, National Institutes of Health

Hirsch, Rhoda, Albert Einstein College of Medicine

Hoffman, Dax, National Institutes of Health

Hogan, Fiona, Marine Biological Laboratory

Holthoff, Knut, Ludwig-Maximilians

Universität, Germany

Homsí, Sara, Wake Forest University

Hong, Min, New York Medical College

Hopp, Joshua, Washington & Jefferson College

Howell, Kethurah, Howard University

Huh, Philip, Wesleyan University

Isakova, Victoria, Hunter College

Jacob, Simon, Yale University School of Medicine

Jefford, Greg, University of Chicago

Jeyifous, Okun, University of Chicago

Jiang, Yuhui, Mount Sinai School of Medicine

Johnson, Michael, University of Connecticut

Jonas, Elizabeth, Yale University School of Medicine

Joseph, Jamie, University of Toronto, Canada

Kaltenbach, Jane, Mount Holyoke College

Katar, Malkhan, Wayne State University

Kim, Charles, Harvard Medical School

King, Curtis, University of Utah

Kisurina-Evgenieva, Olga, Wadsworth Center

Klimov, Andrei, University of Pennsylvania

Koester, Helmut, Baylor College of Medicine

Konnerth, Arthur, University of Munich, Germany

Kosmidis, Efstratios, Yale University School of Medicine

Kovalchuk, Yuriy, University of Munich, Germany

Kozhevnikov, Alexay, Bell Laboratories

Kron, Michelle, Williams College

Krusch, Alex, University of São Paulo, Brazil

La Terra, Sabrina, Wadsworth Center

LaPointe, Nichole, Northwestern University

Lasser-Ross, Nechama, New York Medical

Medicine

DeGiorgis, Joseph, National Institutes of Health
 De Stefano, Rosanna, University of Naples, Italy
 DeBrito, Denise, Howard University
 Delacruz, John, Dartmouth College
 Delsert, Claude, Northwestern University
 DeSelm, Carl, Dartmouth College
 Deutch, Jamie, Dickinson College
 Dineen, Shauna, Williams College
 Djuriscic, Maja, Yale University School of
 Medicine
 Dolan, Bridget, Brown University

Ehsanian, Reza, NASA Ames Research Center
 Elizondo, Randy, University of Texas, San
 Antonio
 Engelhaupt, Erika, University of Louisville
 Eseh, Rosemary, Williams College
 Evans, Louise, Harvard Medical School
 Eyman, Maria, University of Naples, Italy

Farber, Ilya, New York University School of
 Medicine
 Farrington, Jane, National Institutes of Health
 Feldman, Jack, University of California, Los
 Angeles
 Fernandez-Busquets, Xavier, Universitat de
 Barcelona, Spain
 Ferrara, Eugenia, University of Naples, Italy
 Fields, Melanie, National Institutes of Health
 Fleming, Matth, State University of New York
 Follett, Christopher, Marine Biological
 Laboratory
 Franzini-Armstrong, Clara, University of
 Pennsylvania School of Medicine
 Freeman, Chris, Connecticut College

Gaetz, Jedidiah, The Rockefeller University
 Gainer, Harold, National Institutes of Health
 Galbraith, James, National Institutes of Health
 Gallant, Paul, National Institutes of Health
 Gallo, Michael, Robert Wood Johnson Medical
 School
 Garber, Sarah, Chicago Medical School
 Garcia, Nelly, University of Texas, San Antonio
 Garnham, Clive, University of Oxford, United
 Kingdom
 Gasparini, Sonia, Louisiana State University
 Gaysinskaya, Valeriya, Hunter College
 Geise, William, Marine Biological Laboratory
 Gifford, Raeann, University of Kansas
 Gileadi, Opher, Quantomix, Israel
 Gilland, Edwin, New York University School of
 Medicine
 Giuffrida, Beth, Wareham Middle School
 Goda, Makoto, Japan Biological Information
 Research Center, Japan
 Goldman, Anne, Northwestern University
 Medical School
 Gomez, Maria del Pilar, Boston University
 School of Medicine
 Grant, Philip, National Institutes of Health
 Gray, Richard, Baylor College of Medicine
 Grice, Dorothy, University of Pennsylvania
 Groen, Aaron, Harvard University Medical School



Grass Fellows

Eleven young scientists were awarded fellowships by the Grass Foundation to conduct research in neurobiology at the MBL in 2003. The program was directed by Susan Barry, Mount Holyoke College. Melissa Ann Vollrath, Harvard Medical School, served as associate director.

The recipients of Grass Fellowships in 2003 were:

S. Clare Chung, Ph.D.
University of California, San Francisco
 "Electrophysiological and anatomical
 analysis of retinal ganglion cells in
 zebrafish: Comparison studies between
 wildtype and motion detection mutants"

Karen Cusato, Ph.D.
Albert Einstein College of Medicine
 "The role of gap junctions in cell death"

Ian Davison
Simon Fraser University
 "Spatial extent of GABA_B-dependent
 lateral inhibition in the olfactory bulb"

Gal Haspel
Ben-Gurion University of the Negev, Israel
 "Photoactivation of *C. elegans* neurons"

Sandra J. Kuhlman, Ph.D.
Cold Spring Harbor Laboratory
 "Role for fast GABAergic transmission in
 promoting synaptic competition"

Anthony Molina
University of Illinois at Chicago
 "Localization of retinal horizontal cell
 proton flux: New insights into extracellular
 microdomains and their role in visual
 processing"

Jennifer R. Morgan, Ph.D.
Yale University School of Medicine/HHMI
 "Mechanisms of actin regulations
 during synaptic vesicle endocytosis"

Gabriel J. Murphy
UCSD School of Medicine
 "Mechanisms of feedback inhibition
 in the retina"

Joseph Sisneros, Ph.D.
Cornell University
 "Steroid dependent plasticity of
 auditory hair cell tuning in the plainfin
 midshipman, *Porichthys notatus*"

Carlos A. Villalba-Galea, Ph.D.
Duke University Medical Center
 "The timing of protein-protein
 interactions involved in synaptic
 vesicle endocytosis"

David G. Zeddies, Ph.D.
Loyola University-Chicago
 "An optical measurement of the
 auditory brainstem response in larval
 zebrafish"

Domestic Institutions Represented

Albert Einstein College of Medicine

Baylor College of Medicine
Bell Laboratories
Boston College
Boston University
Boston University School of Medicine
Brandeis University
Brooklyn College
Brown University
Buffalo, University of

California, University of, Berkeley
California, University of, Davis
California, University of, Los Angeles
California, University of, Riverside
California, University of, San Francisco
Cincinnati, University of
Chicago, University of
Cold Spring Harbor Laboratory
Columbia University
Connecticut College
Connecticut, University of
Cornell University

Dartmouth College
Dickinson College
Duke University
Duke University Medical Center

Earlham College
Emory University

Federal Department of Agriculture

Georgia, University of

Hampshire College
Harvard University
Harvard University Medical School
House Ear Institute
Howard University
Hunter College

Illinois, University of

Johns Hopkins University, The

Kansas, University of

Lamont Doherty Earth Observatory
Louisiana State University
Louisville, University of
Loyola University of Chicago

Maryland, University of
Massachusetts, University of
Medical College of Georgia
Miami, University of, School of Medicine
Michigan State University
Millersville University

Minnesota, University of
Mount Holyoke College
Mount Sinai School of Medicine

NASA
National Institutes of Health
New Mexico State University
New York Medical College
New York State Institute for Basic Research
New York University
New York University School of Medicine
North Carolina, University of
Northwestern University Medical School

Ohio University
Oregon, University of

Penn State University
Pennsylvania, University of
Pomona College
Princeton University
Puerto Rico, University of

Reed College
Rensselaer Polytechnic Institute
Rivendell Academy
Robert Wood Johnson Medical School
Rockefeller University
Rutgers, the State University of New Jersey

Scripps Research Institute
South Carolina, University of
St. Mary's College of Maryland
State University of New York, Upstate Medical University

Texas Health Science Center, University of
Texas, University of, San Antonio
Tufts University

Union College
Utah, University of

Wadsworth Center
Wake Forest University
Wareham Middle School
Washington & Jefferson College
Washington University School of Medicine
Wayne State University School of Medicine
Wesleyan University
Williams College

Yale University
Yale University School of Medicine

Other Research Personnel, cont.

Palma, Francisco, University of Valparaiso, Chile
Palmer, Lucy, University of Minnesota, Duluth
Parsons, Deirdre, Dartmouth College
Patterson, David, University of Sydney, Australia
Pazar, Patrice, Marine Biological Laboratory
Pereira, Alex, Medical College of Georgia
Perot, Terry, Howard University
Pielak, Rafal, Hunter College
Pinkhasov, Ruben, Hunter College
Pintar, Jura, Harvard University
Pocovi, Maria, Instituto Venezolano de Investigaciones Cientificas, Venezuela
Pollema, Sarah, University of Minnesota, Duluth
Popovic, Marko, Yale University School of Medicine
Prather, Jon, Duke University

Quesada, Cristina, Universitat Autonoma de Barcelona, Spain
Quigley, James, Scripps Research Institute

Rabbitt, Richard, University of Utah
Raviola, Elio, Harvard University
Redenti, Stephen, Hunter College
Rengifo, Juliana, Yale University School of Medicine
Rieder, Leila, Reed College
Rinkwitz, Silke, Carl von Ossietzky University, Germany
Roschge, Ana, Instituto de Investigacion Medica "Mercedes y Martin Ferreyra," Argentina
Rose, Gary, University of Utah
Rosenbaum, Joel, Yale University
Roy, Arani, Duke University
Rupnik, Marjan, European Neuroscience Institute, Göttingen, Germany
Ryerson, Stephanie, Tufts University

Sabban, Alon, Quantomix, Israel
Saffo, Mary Beth, Harvard University
Saito, Takehiko, University of Tsukuba, Japan
Salvay, David, Northwestern University
Sanchez, Carlos, University of Texas, San Antonio
Saywell, Shane, University of California, Los Angeles
Schlecker, Christina, Yale University School of Medicine
Schwartz, Eric, University of Chicago
Scognamiglio, Rosa, University of Naples, Italy
Selak, Sanja, Mount Sinai School of Medicine
Shannon, Katie, University of North Carolina, Chapel Hill
Sheftel, Alex, McGill University, Canada
Shrier, Alvin, McGill University, Canada
Shuster, Charles, New Mexico State University
Sigworth, Fred, Yale University
Smith, Mark, Louisiana State University Health Science Center

College
 Le, Thuy Anh, Northwestern University
 Lee, Kyeng-Gea, Hunter College
 Lever, Mark, University of North Carolina,
 Chapel Hill
 Leznik, Elena, New York University School of
 Medicine
 Li, Quan, University of California, Los
 Angeles
 Lioy, Mary Jean, Union County College
 Lioy, Paul, Robert Wood Johnson Medical
 School
 Lipscombe, Diane, Brown University
 Lisman, John, Brandeis University
 Lloyd, Karen, University of North Carolina,
 Chapel Hill
 Lober, Robert, Medical College of Georgia
 Long, Michael, Brown University
 Louis, Lydia, Rutgers University
 Lyons, Mary Maille, Marine Biological
 Laboratory

 Machas, Raquel, Universidade do Algrave,
 Portugal
 MacKenzie, Simon, Universitat Autònoma
 de Barcelona, Spain
 Mahadevan, L., University of Cambridge,
 United Kingdom
 Marangoni, Maria Natalia, University of
 Buenos Aires, Argentina
 Markarenko, Vladimir, New York University
 School of Medicine
 McGinnis, Lynda, Tufts University
 McNeil, Anna, Medical College of Georgia
 Mellen, Nicholas, University of California, Los
 Angeles
 Mendez, Melissa, Northwestern University
 Mitchell, Cecilia, Marine Biological
 Laboratory
 Miyamoto, David, Harvard Medical School
 Molina, Anthony, University of Illinois at
 Chicago
 Mongeon, Rebecca, Brandeis University
 Monk, Kelly, University of Cincinnati
 Moran, Kimberly, New York University School
 of Medicine
 Moree, Ben, University of North Carolina
 Moreira, Jorge, University of São Paulo, Brazil
 Morfini, Gerardo, University of Illinois at
 Chicago
 Moshe, Yakir, Technion-Israel Institute of
 Technology, Israel
 Muttray, Annette, University of British
 Columbia, Canada

 Needleman, Leigh, Brown University
 Neel, Maile, University of Massachusetts
 Nesse, William, University of Utah
 Ng, Michelle, Boston College
 Nicaise, Ghislain, University of Nice, France
 Nicholls, John, Scuola Internazionale\
 Superiore di Studi Avanzati, Italy
 Nuccitelli, Richard, University of Connecticut
 Health Center

 Odde, David, University of Minnesota
 Ogden, David, National Institute for Medical
 Research, United Kingdom

Foreign Institutions Represented

Algarve, Universidade do, Portugal

 Barcelona, University of, Spain
 Ben-Gurion University, Israel
 Brain Science Institute, Japan
 British Columbia, University of, Canada
 Buenos Aires, University of, Argentina
 Bukyung National University, Korea

 Cambridge, University of, United Kingdom
 Carl von Ossietzky University Oldenburg
 Concepcion, Universidad de, Chile

 Department of Fisheries, Australia

 European Neuroscience Institute, Goettingen,
 Germany
 European Molecular Biology Laboratory,
 Germany

 Florence, University of, Italy

 Göteborg University, Sweden

 Hebrew University of Jerusalem, Israel
 Hospital for Sick Children, Canada

 Institut für Biologische Informationsverarbeitung,
 Germany
 Instituto de Investigacion Medica "Mercedes y
 Martin Ferreyra," Argentina
 Instituto Venezolano Investigaciones Cientificas,
 Venezuela

 Japan Biological Information Research Center,
 Japan

 Ludwig-Maximilians-Universität, Germany

 Max-Planck-Institute for Medical Research,
 Germany
 McGill University, Canada
 Munich, University of, Germany

 Napoli "Federico II," Università di, Italy
 National Institute for Medical Research,
 United Kingdom
 National Institute of Infectious Diseases, Japan
 National Tsing Hua University, Taiwan
 New Brunswick, University of, Canada
 Nice, University of, France
 Novartis International AG, Switzerland

 Oxford, University of, United Kingdom

 Quantomix, Israel

 Philipps-Universität Marburg, Germany

 Rudolf Magnus Institute for Neuroscience,
 The Netherlands

 Santiago, Universidad de, Chile
 São Paulo, University of, Brazil
 Scuola Internazionale Superiore di Studi
 Avanzati, Italy
 Simon Fraser University, Canada
 Sydney, University of, Australia

 Technion-Israel Institute of Technology, Israel
 Tokyo, University of, Japan
 Toronto, University of, Canada
 Tsukuba, University of, Japan

 Valparaiso, University of, Chile
 Victoria, University of, Canada



Other Research Personnel, cont.

Speier, Stephan, European Neuroscience
Institute Göttingen, Germany

Sprinzak, David, Quantomix, Israel

Stafford, Phillip, Dartmouth College

Stanford, W. Leo, Marine Biological
Laboratory

Stanley, Elise, Toronto Western Research
Institute, Canada

Steiglitz, Marc, Lamont Doherty Earth
Observatory

Stockbridge, Norman, Federal Department of
Agriculture

Suzuki, Kazuo, National Institute of Infectious
Diseases, Japan

Tzur, Yonatan, The Hebrew University of
Jerusalem, Israel

Umino, Uymiko, SUNY Upstate Medical
University

Valentin, Jose, New York University School
of Medicine

Vallejo, Yolanda, University of Chicago

Valles, James, Brown University

Van, Qui, Institut für Biologische
Informationsverarbeitung, Germany

Varshney, Anurag, Yale University School
of Medicine

Velasco, John Paul, New York University
School of Medicine

Villareal, Greg, University of California,
Los Angeles

Vin, Xunqin, Howard University

Vucinic, Dejan, Yale University School of
Medicine

Ward, Christopher, University of Maryland

Watanabe, Shigeo, New York Medical College

Weyand, Ingo, Institut für Biologische

Informationsverarbeitung, Germany

Whiticar, Michael, University of Victoria,
Canada

Williams, Anthony, Hunter College

Wollert, Torsten, Universität Rostock,
Germany

Wood, Zachary, University of Oregon

Yamasaki, Michiko, University of Oxford,
United Kingdom

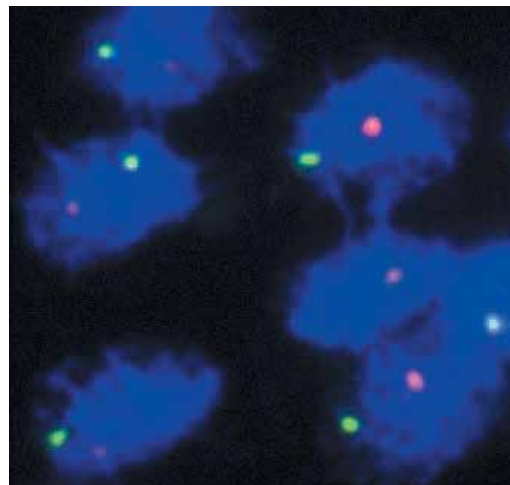
Yoo, Myongsuk, Bukyung National University,
Korea

Yulong, Li, Duke University

Zakevicius, Jane, University of Illinois College
of Medicine

Zarella, Mark, SUNY Upstate Medical
University

Zhang, Zhi, Wesleyan University



Friday Evening
Lecture Series 2003

June 20 – *Lang Lecture*

Martha McClintock, *The University of Chicago*

“Scents and Sensibility: Pheromones and Social Odors in Humans and
Other Animals”

June 27

Susan Lindquist, *Whitehead Institute for Biomedical Research*

“From Mad Cows to ‘psi-chotic’ Yeast: Strange Diseases and Strange
Genetics”

July 4

Tony McMichael, *Australian National University*

“Climate Change and Human Health: The Picture Begins to Clarify”

July 11

James Hudspeth, *The Rockefeller University*

“Making an Effort to Listen: Mechanical Amplification by Novel Molecular
Motors in the Ear”

July 17 and 18 – *Forbes Lectures*

Darcy Kelley, *Columbia University*

“Brain to Brain: A Neurobiology of Vocal Communication” &
“Generating Male and Female Brains: A Molecular Alphabet
for Sexual Differentiation”

July 25 – *Glassman Lecture*

R. John Collier, *Harvard Medical School*

“Addressing the Threat of Anthrax”

August 1

Joel Rosenbaum, *Yale University*

“Intraflagellar Transport and Cilia-Dependent Diseases”

August 8

Lenny Guarente, *Massachusetts Institute of Technology*

“Regulation of Aging by SIR2”

August 15

George Martin, *University of Washington*

“Gene Action in the Pathobiology of Aging”

GENERAL SCIENTIFIC MEETINGS AWARDS

The MBL's General Scientific Meetings have, for decades, been providing an informal forum for the presentation of research carried out at the MBL, thereby fostering scientific exchange within the MBL community. This year's meetings were held August 11 to 13 in the Lillie Auditorium and were co-chaired by Karen Crawford of St. Mary's College, Robert Gould of New York State Institute for Basic Research, Robert Paul Malchow of the University of Illinois, and Joe Vallino of the Marine Biological Laboratory.



To encourage greater participation in the Meetings, the MBL's Science Council recently approved a measure to institute the MBL Award for the best paper presented at the meetings in each of four categories: (1) paper presented by an undergraduate student, (2) paper presented by a graduate student, (3) paper presented by a postdoctoral fellow or junior faculty member, and (4) paper presented by a senior investigator. The winner in each category is acknowledged in the October issue of *The Biological Bulletin* and receives a commemorative medal and \$300. After peer-review of all papers and talks, the following awards were made:

Undergraduate Student

Winner:

"Neurochemical modulation of behavioral response to chemical stimuli in *Homarus americanus*," Anna Savage and Jelle Atema

Honorable Mentions:

"Cytoskeletal events preceding polar body formation in activated *Spisula* eggs," Rafal Pielak, Valeriya Gaysinskaya, and William Cohen

"Radiochemical estimates of submarine groundwater discharge to Waquoit Bay, Massachusetts," Daniel Abraham, Matthew Charette, Matthew Allen, Adam Rago, and Kevin Kroeger

Graduate Student

Winner:

"A liposome-permeating activity from the surface of the carapace of the American horseshoe crab, *Limulus polyphemus*," John Harrington and Peter Armstrong

Honorable Mentions:

"Intracellular release of caged calcium in skate horizontal cells using fine optical fibers," Anthony Molina, Katherine Hammar, Richard Sanger, Peter Smith, and Robert Malchow

"Description of *Vibrio alginolyticus* infection in cultured *Sepia officinalis*, *Sepia apama*, and *Sepia phararis*," Cheryl Sangster and Roxanna Smolowitz

Junior Investigator

Winner:

"Long duration three-dimensional imaging of calcium waves in zebrafish using multiphoton fluorescence microscopy," Edwin Gilland, Robert Baker, and Winfried Denk

Honorable Mention:

"An experimental approach to the study of gap-junction-mediated cell death," Karen Cusato, Jane Zakevicius, and Harris Ripps

Senior Investigator

Winner:

"Lithium chloride inhibits development along the animal vegetal axis and anterior midline of the squid embryo," Karen Crawford

Honorable Mention:

"Axotomy inhibits the slow axonal transport of tubulin in the squid giant axon," Paul Gallant

Publications

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ARCHITECTURAL DYNAMICS IN LIVING CELLS PROGRAM

DISTINGUISHED SCIENTIST

Shinya Inoué

SENIOR SCIENTIST

Rudolf Oldenbourg

STAFF SCIENTIST II

Michael Shribak

POSTDOCTORAL SCIENTIST

Yuki Kagawa

Publications

Inoué, S. 2003. Exploring living cells and molecular dynamics with polarized light microscopy. *Optical Imaging and Microscopy*, Vol. 87, P. Török and K. Kao, eds. Springer-Verlag, Berlin Heidelberg. Pp. 3-20.

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The Architectural Dynamics in Living Cells Program (ADLC), established at the MBL by Shinya Inoué in 1992, continues the pioneering research and educational activities in biophysical inquiries directly in living cells that Inoué started at Princeton University in 1949. The Program focuses on architectural dynamics in living cells: the timely and coordinated assembly and disassembly of macromolecular structures essential for the proper functioning and differentiation of cells, the spatial and temporal organization of these structures, and their physiological and genetic control.

The Program is also devoted to the development and application of powerful new imaging tools that permit such studies directly in living cells and functional cell-free extracts. Program members have special expertise in the use of polarized light for analyzing the local arrangement of molecular bonds and fine structure in biological specimens. Unique instrumentation developed by program members include the universal light microscope, centrifuge polarizing microscope, the liquid-crystal based LC-PolScope, and related technology. Biological phenomena currently under investigation include mitosis/meiosis and related motility, amoeboid movement, microtubule-centrosome interaction, and optical properties of green fluorescent protein. The Architectural Dynamics in Living Cells Program is an active component of the MBL's resident cell research group and promotes interdisciplinary research and training among its resident core researchers, visiting investigators, and collaborating manufacturers.

ADLC's mechanisms of chromosome positioning in insect spermatocytes, dynamics and stabilization of the meiotic spindle in mammalian oocytes, and correlating optical and magnetic anisotropy in single cell organisms. These and other collaborative projects made use of the special microscopes and their continued development supported by the program. A highlight was the first use of the Scanned Aperture PolScope for analyzing the three-dimensional arrangement of the microtubule-centrosome structure in isolated asters of the surf clam.

RESEARCH STAFF

Grant Harris, Research Assistant III
Robert Knudson, Instrument Development Research Associate
Gwen Szent-Györgyi, Research Assistant

VISITING INVESTIGATORS

Susan Gerbi, Brown University
Makoto Goda, Kyoto University, Japan
Min Gu, Swinburne University of Technology, Australia
Joseph Hoffman, Yale University School of Medicine
Ted Inoué, New Hope, Pennsylvania
Joseph Italiano, Brigham & Women's Hospital
Kaoru Katoh, National Institute of Advanced Industrial Science and Technology, Japan
David Keefe, Rhode Island Women & Infants Hospital
James LaFountain, University at Buffalo
Lin Liu, Rhode Island Women & Infants Hospital
Issei Mabuchi, University of Tokyo
Tim Megrew, University of Texas Southwestern Medical Center
Tim Mitchison, Harvard University
Ted Salmon, University of North Carolina
Kazuo Suzuki, National Institute of Infectious Diseases, Japan
James Valles, Brown University

ADMINISTRATIVE STAFF

Jane MacNeil, Executive Assistant

During 2003 biological inquiries included

BOSTON UNIVERSITY MARINE PROGRAM

DIRECTOR
Jelle Atema

FACULTY
Jelle Atema, Professor of
Biology, Director
Paul Barber, Assistant
Professor of Biology
Stjepko Golubic, Professor
of Biology
Les Kaufman, Associate
Professor of Biology
Phillip Lobel, Associate
Professor of Biology
Gil Rosenthal, Assistant
Professor of Biology
Ivan Valiela, Professor of
Biology

ADJUNCT FACULTY
Roger Hanlon, MBL
Gabriele Gerlach, MBL
Anne Giblin, MBL
Richard Goetz, MBL
Norman Wainwright, MBL

VISITING FACULTY
Bill Simmons, Sandia
National Laboratory

RESEARCH STAFF
Sarah Boyce, Senior
Research Technician,
Barber Lab
Devin Drown, Senior
Research Technician,
Barber Lab
Nick Neeley, Research
Technician, Rosenthal Lab
Joy Ramstack, Research
Assistant, Valiela Lab

ADMINISTRATIVE STAFF



In 2003 the Boston University Marine Program continued its momentum in an expanded research focus in behavioral ecology and population genetics. Our newly appointed assistant professors, Paul Barber (Berkeley Ph.D., Harvard postdoc) and Gil Rosenthal (U. Texas Ph.D., UC San Diego postdoc) settled in their newly renovated laboratories. Barber now has a flourishing lab in the Marine Resources building with several technicians and graduate students. He has been teaching courses in molecular ecology and marine population dynamics. One of his students, Eric Crandall, has organized a regular seminar in larval recruitment that attracts scientists and students from all Woods Hole institutions.

Rosenthal's arrival resulted in significant renovations in the Loeb building to accommodate his fish behavior research. He has two Ph.D. students and several M.A. students as well as a postdoctoral fellow all working together on behavioral ecology, sensory ecology and evolution with a great amount of time spent in the field in Central America. He has also been teaching courses in behavioral ecology and animal communication.



Joint planning with the MBL resulted in additional strength in this area with the appointment of MR associate scientist Gabi Gerlach (U. Konstanz). Gerlach is an adjunct associate professor at BUMP and has started to supervise several M.A. students; she is co-advising a Ph.D. student. MR senior scientist Rick Goetz, BUMP adjunct professor, further enhanced the scientific goals of the program with his expertise in molecular biology.

Similarly, Roger Hanlon, BUMP adjunct professor, continued to advise BUMP M.A. students resulting in publications and research theses. Anne Giblin of the Ecosystems Center and adjunct professor at BUMP accepted a Danish Ph.D. student. Besides MBL scientists, National Marine Fisheries Service,

and Woods Hole Oceanographic Institution scientists also serve as thesis advisors for several BUMP students. Overall, the research interactions across the village have been enhanced in 2003. An important sign of this interaction is the broad attendance at the weekly BUMP student research discussions where each student presents his or her research progress for the community. These



discussions are attended regularly by 20 to 40 people. Also, the BUMP/MBL weekly seminars, now split between BUMP in the Fall and MR in the Spring, have attracted wide participation.

Ivan Valiela's coastal ecology program continues to generate a stream of

graduate students, postdocs and international visiting scientists. In addition, the associated Research Experience for Undergraduates (REU) program brought outstanding undergraduates to Woods Hole doing research that results in regular publications. One of these students, Anna Savage, won the *Biological Bulletin* prize for best undergraduate research in the summer of 2003.

Jelle Atema's research program has broadened its scope to now include sensory neurobiology of lobsters and sharks and behavioral/chemical ecology of larval reef fishes. (The latter program is run jointly with Gerlach's in population genetics.) The shark program is intended to utilize state of the art engineering



to transmit brain signals to and from free-swimming animals. Phillip Lobel's ichthyology research is part of this effort. Lobel and his students continue to play an important role in research on military impact on marine environments. (Atema hosted MBL summer fellow, Francesca Gherardi from Florence University resulting in two publications on individual recognition in crustacea.)

The program took in a small class of highly competitive graduate students for both Ph.D. and Masters degrees continuing its mission to provide exceptional educational opportunities to students in Marine Biology. The undergraduate program also continued its mission successfully by providing eight challenging research-based courses to some 20 students primarily from BU. Here too, student research has led to several publications.

Mollie Oremland
Carley Schacter
Elizabeth Soule
Melissa Sweeny
Emily Weiss

UNDERGRADUATE STUDENTS

Joshua Allison
Robyn Brown
Shannon Carroll
Sean Ciullo
Kara Coffey
Trevor Conger
Bart Critser
Debra Giglia
Erica Halchak
Sarah Kirby
Catherine Lee Hing
Heather McManus
Julie Palakovich
Heather Reiff
Meghan Rodela

SUMMER REU INTERNS

Daniel Abraham
Amie Beth Aguiar
Jason Cavatorta
Madeline Galac
Kristin Henderson
Morgan Johnston
Jayson Morgan
Charles O'Connell
Elizabeth Orchard
Lindsey Sargent
Anna Savage
Jennifer Talbot
Suprawee Tepsuporn
Trisha Thoms
Courtney Walker

SUMMER VOLUNTEERS

Rachel Allen
Jillian Barber
Margaret Johnson
Sean Supcariu

SUMMER VISITING RESEARCHERS

Thomas Breithaupt
Arani Chandraparan
Francesc Gheraroli
Paulina Martinetto
Andrew Ringler

Publications

Sharifa Gulamhussein,
Senior Staff Coordinator
Sheri Hall, Program
Manager
Michelle McCafferty,
Program Coordinator
Linda Seeley, Senior Staff
Coordinator

GRADUATE STUDENTS

Ph.D. Students
Brendan Annett
Jennifer Bowen
Ruth Carmichael
Eric Crandall
Jennifer Culbertson
Joshua Drew
Heidi Fisher
Sara Grady
Ketil Koop-Jakobsen
Carolyn Miller
Vanessa Miller-Sims
Elizabeth Neeley
Ylva Olsen
Jason Philibotte
Mindy Richlen
Gregory Skomal
Molly Steinbach
Mirta Teichberg
Gabrielle Tomasky
Joanna York

Masters Students

Abby Atkinson
Kevin Blinkoff
Andrea Bogomolni
Lisa Bonacci
Chelsea Bouchard-Harnish
Jessica Buckingham
Michael Cermak
Christopher Florio
Sophia Fox
Sarah Good
Andrea Hsu
Alison Leschen
Nadine Lysiak
Vanessa Malley
Amea Mehta
Karen Morschauer
Catherine O'Keefe

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MARINE RESOURCES PROGRAMS

The Marine Resources Center (MRC) is a national facility for the development and use of aquatic organisms in basic biological research, biomedical research, aquaculture, and fisheries science. Our research programs focus on biological processes integrated at the level of the whole organism.

Program in Sensory Biology, Behavioral Ecology, and Population Genetics



Our studies of the physiological sensory and genetic mechanisms of behavior bridge neuroscience, behavior, and ecology. Such an approach allows us (1) to study evolutionary processes of natural and sexual selection that shape the lives of animals and humans, and (2) to investigate the genetic consequences of behavioral interactions in an ecological context, including the population level.

Sexual mimicry is known in several phyla, but the genetic success of sexual mimics has never been proven. We found that small males of the Giant Australian Cuttlefish, *Sepia apama*, sometimes use their changeable body patterning to mimic females, thus allowing them to approach and mate a female guarded by a large aggressive male. Using DNA fingerprints, we demonstrated that the sperm of these males is often used by the female to fertilize the next egg she lays. Such rapid, facultative "sex change" seems unique among animals and is noteworthy for its immediate genetic success.

DIRECTOR
Roger Hanlon

SENIOR SCIENTISTS
Frederick Goetz
Roger Hanlon

ASSOCIATE SCIENTISTS
Gabriele Gerlach
Alan Kuzirian

ASSOCIATE SCIENTIST/VETERINARIAN
Roxanna Smolowitz

ADMINISTRATIVE AND SUPPORT STAFF
James Carroll, Life Support Technical Assistant
Martha Delaney, Research Assistant
Edward Enos, Aquatic Resources Division Superintendent
William Grossman, Marine Organism Collector/Diving Safety Officer
Janice Hanley, Water Quality and Animal Health Technician
William Klimm, Licensed Boat Captain – R/V *Gemma*
Scott Lindell, Manager, Aquatic Resource Services and Aquaculture Research Specialist
Beth Linnon, Special Projects Coordinator
William Mebane, Aquaculture and Engineering Division Superintendent
Barbara Milligan, Executive Assistant
Andrew Sexton, Marine Organism Shipper
Daniel Sullivan, Boat Captain
Eugene Tassinari, Senior Biological Collector
Sean Whelan, Diver/Marine Specimen Collector
Erika Woods, Research Assistant

VOLUNTEERS
Bill Geise, AmeriCorps
Hank Maude, AmeriCorps
Joan Lemeix, Retired and Senior Volunteer Program
Joe Sheehy, AmeriCorps
Judy Sheehy, AmeriCorps
Leo Stanford, AmeriCorps

INTERNS
Ann Bodio, Cape Cod Community College
Amanda Carroll, Falmouth High School
George Gannon, Massachusetts Bay Community College
Cecilia Mitchell, Cape Cod Community College
Erika Woods, University of Massachusetts, Dartmouth

Camouflage is widespread throughout terrestrial and aquatic environments. Among all animals, cephalopods have the most refined system for rapid adaptive camouflage. We also made substantial gains in understanding how cephalopods visually sense the surrounding substrates and use simplified “sampling rules” to put on the correct camouflaged body pattern. In addition, we discovered how various types of reflecting cells in the skin act as broad-band reflectors to produce a variety of colors for the cephalopod’s numerous body patterns.

Significant progress was made to define the major time domains of short-term, long-term, and consolidated memory in the nudibranch mollusk, *Hermisenda*, using transcription and translation as well as cell adhesion molecule inhibitors. The completed quantitative immunocytochemical study of the effects of learning and memory on the “memory-protein” calyculin, was published, as well as four papers describing the memory domains and effects of the inhibitors.

Population studies continued on the connectivity of reef fish. At One Tree Island in the Great Barrier Reef, Australia, experiments were conducted to show whether larvae are able to return to their natal reef and which sensory mechanisms might be involved. The larvae used water-borne odor cues to differentiate between different lagoons, which might lead them back to their natal reefs. To analyze the degree of self recruitment in three fish species with different dispersal, we collected settled fish at different reefs and developed new DNA microsatellite markers. Experiments were also conducted to investigate chemical communication and reproductive suppression in zebrafish.

Laboratory of Roger Hanlon

STAFF

Roger Hanlon, Senior Scientist
Alexandra Barbosa, Graduate Student, Universidade do Porto
Jean Boal, Adjunct Scientist
Melissa Cox, Research Assistant
Chris Florio, Graduate Student, Boston University
Allen Mensinger, Adjunct Scientist
Mary Beth Saffo, Adjunct Scientist
Nadav Shashar, Adjunct Scientist

VISITING INVESTIGATORS

Chuan-Chin Chiao, National Tsing Hua University, Taiwan
Nuutti Kangas, Academy of Finland
Marie-Jose Naud, Flinders University, Australia

INTERNS

Phoenix Becker, University of Maine
AnneMarie Reeves, Cape Cod Community College

Laboratory of Alan Kuzirian

STAFF

Alan Kuzirian, Associate Scientist
Hemant Chikarmane, Investigator
Herman Epstein, Investigator

VISITING INVESTIGATORS

Frank Child
John Clay, National Institutes of Health

INTERNS

Rebecca Bonaiuto, Roger Williams University
Kati Dunham, University of Washington
Fiona Hogan, University of Dublin, Ireland
Megan E. Motta, University of New Hampshire
Catherine E. Oldenburg, Carnegie Mellon University
AnnMarie Reeves, Cape Cod Community College

Laboratory of Gabriele Gerlach

STAFF

Gabriele Gerlach, Associate Scientist
Martha Delaney, Research Assistant
Jenny Lusk-Yablick, Research Assistant

INTERNS

Rebecca Bonaiuto, Roger Williams University
Melissa Cox, Purdue University
Amy Dearborn, Massachusetts Maritime Academy
Kathleen Dunham, University of Washington
Chris Follett, Massachusetts Institute of Technology
Courtney Goecker, University of Southern California
Jessica Knox, University of New Hampshire
Kara Mann, Skidmore College
Elizabeth Turnell, Yale University





Program in Scientific Aquaculture

This program focuses on biotechnology research, applied research on biomedical and commercial organisms, and policy development in both of those areas. The biotechnology research is aimed at basic mechanisms that control growth, behavior, reproduction, and disease in commercially important finfish and shellfish. This includes studies on novel regulators of growth and reproduction in fish and shellfish, pathogen-regulated genes in fish, and the development of molecular-based diagnostic techniques.

During the past year a cDNA library of lipopolysaccharide-stimulated trout macrophages was constructed and a primary cell culture system for trout and cod macrophages developed and characterized. Research was completed on myostatin expression in brook trout at different reproductive and developmental stages, and in GH-transgenic coho salmon. The latter study is the first time that a definitive relationship has been observed between myostatin (negative regulator of growth) and GH (positive regulator of growth). Complimentary cDNA libraries and ESTs were also completed on the bay scallop muscle to look for regulators of muscle growth and the scallop myostatin gene was characterized. This was the first isolation of an invertebrate myostatin gene.

The cDNAs for the cod steroidogenic acute regulatory (StAR) protein mRNA and gene were isolated and characterized. Blood from wild cod was sampled semimonthly throughout the year for reproductive hormone analysis; and 1,500 ESTs from cod ovarian cDNA libraries were sequenced and annotated.

Studies on the pathogenesis of QPX disease in hard clams and resistance to infection in different strains of clams were completed. These studies showed that clam strain is important in the development of the disease. Disease resistance (MSX, Dermo, and JOD) was demonstrated in eastern oysters and was correlated with growth potential of resistant strains for use in commercial markets. Work continued on identifying the cause of lobster shell disease.

Laboratory of Frederick Goetz

STAFF

Frederick Goetz, Senior Scientist
 Scott Lindell, Manager, Aquatic Resource Services
 and Aquaculture Research Specialist
 Peggy Biga, Postdoctoral Investigator
 Linda McCauley, Research Assistant
 Steven Roberts, Staff Scientist
 Raquel Sussman, Investigator
 Andrew Sweetman, Graduate Student, University
 of Bergen, Norway
 Dimitar Iliev, Graduate Student, University of Notre Dame

INTERNS

Patrice Pazaar, University of Colorado
 Pheonix Becker, University of Maine

Laboratory of Roxanna Smolowitz

STAFF

Roxanna Smolowitz, Veterinarian and
 Associate Scientist
 Kevin Uhlinger, Research Assistant, Aquatic Animal Care
 Jet Stukey, Research Assistant, Mammalian Animal Care
 Heather Dalpe, Animal Care Assistant, Mammalian
 Animal Care
 Andrea Hsu, Graduate Student, Boston University
 Dan Johnson, Animal Care Assistant, Mammalian
 Animal Care

INTERNS

Krystal Baird, AmeriCorps Member
 Cheryl Sangster, Summer Veterinary Intern

Publications

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PROGRAM IN MOLECULAR PHYSIOLOGY

DIRECTOR/SENIOR SCIENTIST
Peter J. S. Smith

ADJUNCT SCIENTIST
George Holz, New York University

STAFF SCIENTIST
Mark Messerli

POSTDOCTORAL SCIENTIST
Damon Osbourn

RESEARCH ASSISTANTS
Craig Hamilton
Kasia Hammar
Laurel Moore
Richard Sanger

TECHNICIAN
Robert Lewis

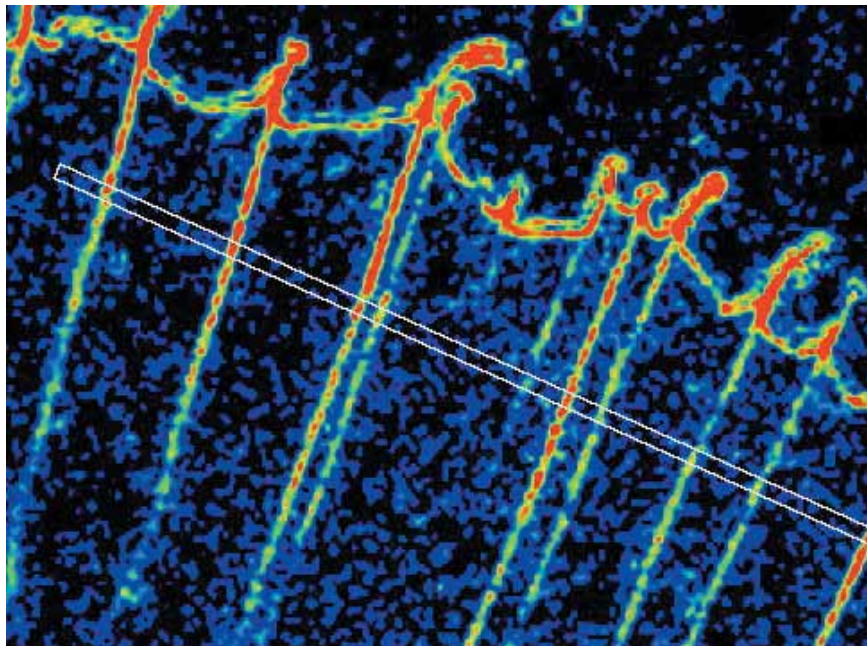
SUMMER STAFF
Daniel Bogorff
Michael Dacey

Laboratory of Ayse Dosemeci
ADJUNCT SCIENTIST
Ayse Dosemeci

Laboratory of Stefan McDonough
ASSISTANT SCIENTIST
Stefan McDonough

Laboratory for Reproductive Medicine
DIRECTOR/ADJUNCT SCIENTIST
David Keefe, Brown University

ADJUNCT SCIENTISTS
Lin Liu, Brown University
James Trimarchi, Brown University



The Molecular Physiology Program completed the first full year since its founding at the beginning of 2003. The year brought many achievements and a continued interaction with an extensive collaborative group. Approximately 40 investigators worked with program staff on projects ranging from diabetes research, to neurosciences, to unicellular adaptations to harsh environments. Of particular note was an award from the American Society for Reproductive Medicine (ART) to David Keefe, Lin Liu, and Jim Trimarchi of the MBL/Brown University Laboratory. Their work was then the subject of a follow-up review *in Achievements - Nature Science Update*, "Chromosomes key to IVF success" by Helen Pearson (October 2003).

Two past student visitors, Catherine Tamse (University of Rhode Island) and Anthony Molina (University of Illinois) received their Ph.D.s with work conducted within the program. Molina was also a Grass fellow within the BioCurrents Research Center in the summer of 2003, continuing a center interest in the physiology of signal processing.

The BioCurrents group brought several new applications forward over the past year, particularly in the development of advanced electrochemical sensors and their targeted use in biological systems. One instrument, the bioelectric field imager developed in collaboration with industry (RPN Enterprises), was the subject of a Small Business Innovation award from the NIH for clinical applications to skin physiology and disease. Another business interest spun off in 2003 with a Small Business Technology Transfer award from the NIH to Peter Smith for commercializing microsensor designs advanced within the BioCurrents Research Center.

Exciting times lie ahead for the Program as our funding base expands and the reach of both technologies and applications continues to diversify into many fundamental areas of cell physiology.

BioCurrents Research Center

Staff, continued

Laboratory of Orián Shirihai
ASSISTANT SCIENTIST
Orián Shirihai

POSTDOCTORAL SCIENTISTS
Sarah Haigh
Shana Katzman

RESEARCH ASSISTANTS
Erica Corson

Laboratory of Peter Smith
SENIOR SCIENTIST
Peter Smith

STAFF SCIENTIST
Mark Messerli

POSTDOCTORAL SCIENTIST
Abdollah Diarra

CONSULTANT
David Compton

*Publications*

Amaral Zettler, L. A., M. A. Messerli, A. D. Laatsch, P. J. Smith, and M. L. Sogin. 2003. From genes to genomes: Beyond biodiversity in Spain's Rio Tinto. *Biol. Bull.* 204(2): 205-9.

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Pepperell, J. R., D. M. Porterfield, D. L. Keefe, H.

Collaborators

L. Amaral Zettler, MBL
S. Breton, Harvard/MGH
D. Brown, Harvard/MGH
R. A. Colvin, Ohio University
B. Corkey, Boston University Medical Center
J. T. Deeney, Boston Medical Center
C. L. Devlin, Pennsylvania State University
M. Dodge, Harvard University
B. Furie, Beth Israel Hospital
S. Garber, Finch/Chicago Medical School
R. Gifford, University of Kansas
M. E. Harper, University of Ottawa
D. E. Heck, Rutgers University
R. Helton, Brown University
J. Joseph, University of Toronto, Canada
R. Khawaled, Technion-Israel Institute of Technology
A. D. Laatsch, MBL
K. Lamattina, Brown University
J. D. Laskin, UMDNJ-RWJ
R. Lew, York University, Canada
R. Lill, Philipps-Universität, Marburg, Germany
D. Lipscombe, Brown University
M. R. Loeken, Joslin Diabetes
R. P. Malchow, University of Illinois
L. Moitoso de Vargas, Boston University School of Medicine
A. J. A. Molina, University of Illinois
R. L. Nuccitelli, University of Connecticut Health Science Center
P. Ponka, McGill University
M. Rupnik, Max-Planck, Germany
A. Sheftel, McGill University
M. Sogin, MBL
S. Speier, Max-Planck, Germany
M. Wheeler, University of Toronto, Canada
J. Wikstrom, Uppsala, Sweden
G. S. Wilson, University of Kansas
D. Wirth, Harvard University
G. Yaney, Boston University School of Medicine

R. Behrman, and P. J. S. Smith. 2003. Control of ascorbic acid efflux in rat luteal cells: Role of intracellular calcium and oxygen radicals. *Am. J. Physiol. Cell Physiol.* 285(3): C642-651.

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LABORATORY OF AQUATIC BIOMEDICINE



SENIOR SCIENTIST
Carol L. Reinisch

POSTDOCTORAL
SCIENTISTS
Rachel L. Cox
Jill Kreiling

VISITING
INVESTIGATORS
Raymond Stephens,
Boston University
Sylvie St. Jean, Division
of Fisheries and Oceans,
Moncton, Canada

We use surf clam (*Spisula solidissima*) embryos to examine the effects of environmental toxins on neural development. At the same time we examine how specific genes involved in neural differentiation respond to environmental insults. In the first study, funded by the Environmental Protection Agency, we have examined how chemicals found in wells in Brick, New Jersey, impact the clam nervous system. Postdoctoral Scientist Jill Kreiling has found that a triple mixture of chemicals identical to those found in the wells targets the protein kinase (PKA) pathway. More specifically she has discovered that the R2 subunit of PKA is elevated following chemical exposure. Simultaneously, Postdoctoral Scientist Rachel Cox has characterized multiple homologs of the p73 gene in *Spisula*. The p53 gene family, of which p73 is a member, closely regulates neural development. How p73 interacts with other members of the larger p53 family is currently under investigation. More importantly, we need to resolve how both the structure and function of p73 are altered by environmental chemicals.

We are also examining the effects of

polychlorinated biphenyls (PCBs) using clam embryos. Unlike the Brick, New Jersey, toxins, PCBs selectively target developing neurons while sparing the overall growth of embryos. Furthermore, p53 mRNA is diminished following PCB exposure. In work funded by the National Institutes of Health, we are examining at the single cell level how gene expression (p53 family) is impacted by chemical exposure.

Lastly, Senior Scientist Carol Reinisch is involved in a long-term collaborative study, funded by Environment Canada, which examines the induction of leukemia in mussels by environmental contaminants. The sites of study are harbors in Pictou, Nova Scotia, and Vancouver, British Columbia. Using monoclonal antibodies developed by our laboratory, the American-Canadian team is resolving which suite of contaminants in the wild induce leukemia at the population level.

Publication

Cox, R. L., R. E. Stephens, and C. L. Reinisch. 2003. p63/73 homologues in surf clam: Novel signaling motifs and implications for control of expression. *Gene* 320: 49-58.

LABORATORY OF BARBARA FURIE AND BRUCE FURIE

γ -Carboxyglutamic acid is a calcium-binding amino acid that is found in the conopeptides of the predatory marine cone snail, *Conus*. This laboratory has been investigating the biosynthesis of this amino acid in *Conus* and the structural role of γ -carboxyglutamic acid in the conopeptides. This satellite laboratory relates closely to the main laboratory, the Center for Hemostasis, Thrombosis and Vascular Biology, on the Harvard Medical School campus in Boston.

The marine cone snail is the sole invertebrate known to contain the vitamin K-dependent amino acid, γ -carboxyglutamic acid (Gla). However, its synthetic pathway has been preserved in most animal phyla. We have cloned full length carboxylase from the beluga whale (*Delphinapterus leucas*), the toadfish (*Opsanus tau*), and the cone snail (*Conus textile*) to compare these structures to the known bovine, human, rat, and mouse cDNA sequences. In addition, the *Drosophila* genome contains the γ -carboxylase gene. The predicted amino acid sequence of the carboxylase cDNA from *Conus textile* shows most regions are nearly identical to the mammalian sequence, and that there is about 40% sequence similarity. This protein has been expressed, and the recombinant enzyme identified as a carboxylase and epoxidase. These results demonstrate the broad distribution of the vitamin K-dependent carboxylase gene, including a highly conserved motif that is likely critical for enzyme function. The vitamin K-dependent biosynthesis of Gla is a highly conserved function in the animal kingdom.

ADJUNCT SCIENTISTS

Barbara C. Furie, Harvard Medical School
Bruce Furie, Harvard Medical School
Alan Rigby, Harvard Medical School

VISITING INVESTIGATORS

Leisa Stenberg, Harvard Medical School
Johan Stenflo, University of Lund, Sweden

STAFF SCIENTIST II

Mark Brown



To identify novel Gla-containing proteins that are highly conserved in animal species, we are now identifying the vitamin K proteome. The laboratory has developed skills and instrumentation for fluorescence-based differential imaging gel electrophoresis, image analysis, and electrospray mass spectroscopy in order to identify Gla-containing proteins.

LABORATORY OF NORMAN WAINWRIGHT



SENIOR SCIENTIST
Norman Wainwright

RESEARCH ASSISTANTS
Alice Child
Kendra Williams

VISITING INVESTIGATOR
Porter Anderson

The mission of this laboratory is to understand the molecular defense mechanisms exhibited by marine invertebrates in response to invasion by bacteria, fungi, and viruses. Their primitive immune systems demonstrate unique and powerful strategies for survival in diverse marine environments.

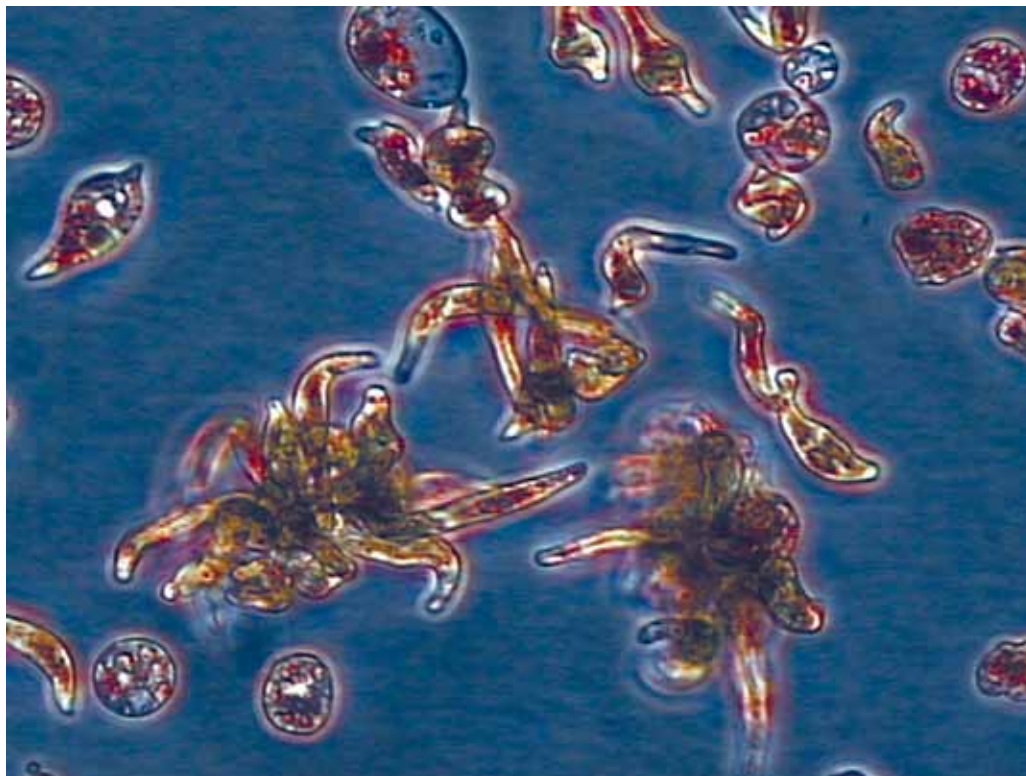


The key model has been the horseshoe crab *Limulus polyphemus*. *Limulus* hemocytes exhibit a very sensitive LPS-triggered protease cascade that results in blood coagulation. Several proteins found in the hemocyte and hemolymph display microbial binding properties that contribute to antimicrobial defense. *Limulus* amebocyte lysate (LAL) is being adapted for use as a tool to

assess bioburden on spacecraft and to search for microbial life in the universe. Collaborations with several NASA centers are actively developing technology in the field of Astrobiology.

Publication

Wainwright, N. R., A. Child, K. Williams, A. Baker, F. Jordan, K. Lynch, and J. Hedgecock. "Miniaturized instrument for planetary protection and life detection." ICES, July, 2003.



CENTER FOR ADVANCED STUDIES IN THE SPACE LIFE SCIENCES

ADMINISTRATOR

Diana E. Jennings

VISITING SCIENTIST

Stephen Moorman, Robert Wood Johnson Medical School

Meetings

"Optimization of Yeast Investigations
in Microgravity"
Sunnyvale, California
December 8, 2003

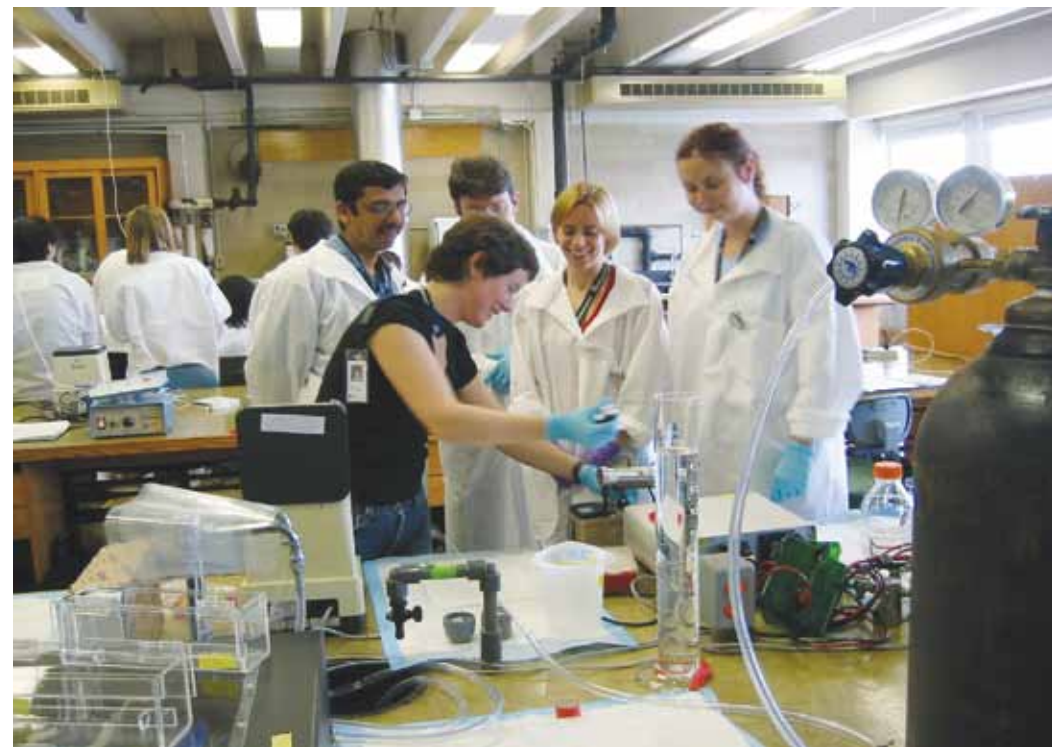
"Life and Living in Space"
Teacher workshop co-directed by Diana
Jennings and Lorraine Olendzenski,
Marine Biological Laboratory
December 4-6, 2003

"Evaluation of Plans for *C. elegans*
Studies in Microgravity"
NASA Ames Research Center, California
June 23, 24, 2003

Operating since 1995, the Center for Advanced Studies in the Space Life Sciences (CASLS at MBL) strives to increase awareness of NASA's life sciences interests and to expand NASA's interactions with talented biologists. In 2003 NASA faced the loss of the shuttle Columbia and the subsequent grounding of the shuttle fleet. CASLS' meeting portfolio shifted to the consideration of experiments using *C. elegans* and *S. cerevisiae* that could be carried out with limited flight resources. Additionally, in collaboration with NASA and MBL scientists, CASLS designed life sciences training opportunities for astronauts and outreach to the mainstream life science community. Additionally, CASLS co-sponsored a teacher enhancement workshop serving participants from the U.S. and Puerto Rico.

Publication

Sogin, M., and D. E. Jennings.
2003. Proceedings, Outcomes of
genome-genome interactions.
Biol. Bull. 204: 159-234.



education

The 2003 Education Program provided 474 students from 293 institutions and 46 countries an opportunity to study a range of biological topics with some of the best and brightest scientists in the world serving as course faculty and lecturers. The Laboratory welcomed 526 faculty members and staff and 187 lecturers to the Courses representing 229 institutions and 27 countries. Among the many outstanding lecturers last summer, we were especially pleased to host Doug Melton, Joan Brugge, Stanley Korsmeyer, Stuart Schreiber, and Lewis Wolpert.

In addition to the MBL's 6 major summer courses, we offered 14 special topics courses through the year.

At the end of the 2003 season, we bid farewell to Carrie Harwood and Alfred Spormann, directors of the Microbial Diversity course. Tom Schmidt of Michigan State University and Bill Metcalf of the University of Illinois are assuming the leadership for that course. In addition, Don Faber and Jeff Lichtman have stepped down as directors of the Neurobiol-

ogy course. Ed McCleskey of Vollum Institute for Advanced Biomedical Research and Rae Nishi of the University of Vermont will take the helm. We also said good-bye to Dave Garbers and Randy Reed as directors of the Physiology course. Ron Vale of the University of California, San Francisco and Tim Mitchison of Harvard Medical School are providing the new leadership for Physiology. And lastly, Doug Wallace and Lenny Guarente have relinquished the reins of the Biology of Aging course. Gary Ruvkun of Massachusetts General Hospital and Steve Austad of the University of Idaho will be the new directors for 2004.

The MBL's educational program was pleased to receive approval from the National Institutes of Health's competitive peer review process for new funding for the Molecular Mycology course. In addition, the Ellison Medical Foundation renewed its funding for the Biology of Parasitism course.

SUMMER COURSES

Biology of Parasitism: Modern Approaches

June 12 - August 9, 2003

COURSE DIRECTOR

Bangs, Jay, University of Wisconsin-Madison

FACULTY

Burleigh, Barbara, Harvard University
Grencis, Richard, University of Manchester
Matthews, Keith, University of Manchester
McFadden, Geoff, University of Melbourne
Rathod, Pradip, University of Washington
Sinai, Anthony, University of Kentucky
Tarleton, Rick, University of Georgia

LECTURERS

Beverley, Stephen, Washington University School of Medicine
Carruthers, Vern, Johns Hopkins University
Cowman, Alan, The Walter and Eliza Hall Institute
Deitsch, Kirk, Cornell Medical School
Englund, Paul, Johns Hopkins Medical School
Garside, Paul, University of Glasgow
Goldberg, Daniel, HHMI/Washington University School of Medicine
Goldman, William, Washington University
Haldar, Kasturi, Northwestern University
Holder, Anthony, National Institute for Medical Research
James, Anthony, University of California, Irvine
Johnson, Patricia, UCLA
Lightowers, Marshall, University of Melbourne
Lujan, Hugo, National University of Cordoba
McConville, Malcolm, University of Melbourne
Menard, Robert, Pasteur Institute
Nutman, Thomas, National Institutes of Health
Phillips, Meg, University of Texas Southwestern
Reiner, Steven, University of Pennsylvania
Riley, Eleanor, London School of Hygiene & Tropical Medicine
Roditi, Isabel, Institute of Cell Biology, Bern
Roos, David, University of Pennsylvania
Rudenko, Gloria, University of Oxford
Scherf, Artur, Pasteur Institute
Sher, Alan, National Institutes of Health
Stanley, Samuel, Washington University
Striepen, Boris, University of Georgia
Ward, Gary, University of Vermont
Wynn, Thomas, National Institutes of Health

TEACHING ASSISTANTS

Ganesan, Karthikeyan, University of Washington
Gruszynski, Amy, University of Wisconsin, Madison
Jiang, Lei, University of Washington
Martin, Diana, University of Georgia
Molestina, Robert, University of Kentucky
Mott, Adam, Harvard School of Public Health
Pennock, Joanne, University of Manchester
Ralph, Stuart, Pasteur Institute
vanDeursen, Frederick, University of Manchester
White, John, University of Washington

COURSE ASSISTANTS

Bridegam, Patrick, Texas A&M University
Plourde, Anna, University of Massachusetts, Amherst

STUDENTS

Albareda, Maria, Instituto Nacional de Parasitologia
Best, Alexander, Darmstadt University of Technology
Chaudhary, Kshitiz, University of Pennsylvania
Cliffe, Laura, University of Manchester
Del Rio, Laura, Cornell University
Dunn, Joe, Stanford University
Ellis, Louise, University of Cambridge
Evans, Krystal, The Walter & Eliza Hall Institute of Medical Research
Figueiredo, Juliana, Laboratoria de Glycobiologia
Malmquist, Nicholas, UT Southwestern Medical Center, Dallas
Omosun, Yusuf, University of Ibadan
Palenchar, Jennifer, University of Delaware
Prickett, Sara, University of London
Punkosdy, George, Centers for Disease Control & Prevention
Van Dooren, Giel, University of Melbourne
Wang, Qian, New York University Medical Center



Embryology: Concepts and Techniques in Modern Developmental Biology

June 15 - July 27, 2003

COURSE DIRECTORS

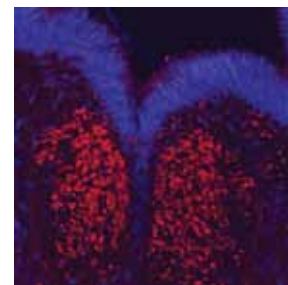
Harland, Richard, University of California, Berkeley
Rothman, Joel, University of California, Santa Barbara

FACULTY

Bronner-Fraser, Marianne, California Institute of Technology
Collazo, Andres, House Ear Institute
Dunaway, Marietta, University of California, Berkeley
Ettensohn, Charles, Carnegie Mellon University
Halpern, Marnie, Carnegie Institute of Washington
Henry, Jonathan, University of Illinois
Krumlauf, Robb, Stowers Institute for Medical Research
Levine, Michael, University of California, Berkeley
Martindale, Mark, University of Hawaii
Niswander, Lee, Sloan-Kettering Institute
Patel, Nipam, University of Chicago
Rokhsar, Dan, University of California, Berkeley
Rothenberg, Ellen, California Institute of Technology
Saunders, John, Retired
Sherwood, David, California Institute of Technology
Wessel, Gary, Brown University
Wiedemann, Leanne, Stowers Institute for Medical Research
Zeller, Robert, San Diego State University

LECTURERS

Anderson, Kathryn, Sloan-Kettering Institute
Davidson, Eric, California Institute of Technology
Gerhart, John, University of California, Berkeley
Halanych, Ken, Auburn University
Keller, Ray, University of Virginia
McGinnis, William, University of California, San Diego
Nagy, Lisa, University of Arizona
Peichel, Katie, Fred Hutchinson Cancer Research Center
Pourquie, Olivier, Stowers Institute for Medical Research
Robertson, Liz, Harvard University
Sanes, Joshua, Washington University
Strome, Susan, Indiana University
Trainor, Paul, Stowers Institute for Medical Research



Wallingford, John, University of California, Berkeley
Yelon, Deborah, Skirball Institute

S. MERYL ROSE LECTURER
Wolpert, Lewis, University College London

TEACHING ASSISTANTS

Chang, Chenbei, University of Alabama at Birmingham
Cheeks, Rebecca J., University of Oregon
Extavour, Cassandra, University of Cambridge
Gamse, Joshua, Carnegie Institution of Washington
Giorgianni, Matt, University of Chicago
Glickman, Nathalia, New York University School of Medicine
Gross, Jeffrey, Harvard University
Kuhlman, Julie, University of Oregon
Liu, Karen, University of California, Berkeley
Macurak, Michelle, Carnegie Institution
Maduro, Morris, University of California, Santa Barbara
Matus, David, University of Hawaii
Monsoro-Burq, Anne-Helene, University of California, Berkeley
Nouri, Ali, Princeton University
Senger, Kate, University of California, Berkeley
Solomon, Keely, Emory University
Weatherbee, Scott, Memorial Sloan Kettering Cancer Center
Wiellette, Elizabeth, Whitehead Institute
Wilson, Sara, Columbia University
Wilson, Val, ISCR, Edinburgh University
Witze, Eric, University of California, Santa Barbara
Wolfe, Adam, University of Illinois Urbana-Champaign

COURSE ASSISTANTS

Balligan, Sarah, University of Missouri-Columbia
McCluskey, Kathryn, St. Lawrence University
Tobey, Allison, University of Pittsburgh

STUDENTS

Adams, Meghan, California Institute of Technology
Bergter, Annette, Philipps-Universität Marburg
Boschetti, Chiara, Università degli Studi di Milano
Broussard, Christine, University of La Verne
Brubacher, John, University of Manitoba
Chamberlain, Chester, Harvard University
Das, Gishnu, Mount Sinai School of Medicine
Ericsson, Rolf, Uppsala University
Infante, Carlos, Harvard University
Lee, Jen-Yi, University of North Carolina, Chapel Hill
Li, Wei, University of Iowa College of Medicine
Lom, Barbara, Davidson College
Lunn, J. Simon, University of Dundee
Maxmen, Amy, Harvard University
Moustakas, Jacqueline, University of California
Murata, Patricia, University of Hawaii
Passamaneck, Yale, Woods Hole Oceanographic Institution
Plouhinec, Jean-Louis, Université Paris-Sud
Poulain, Morgane, UMR 7009 CNRS-Station Zoologique
Powell, Anahid, Max Planck Institute for Molecular Genetics
Tiso, Natascia, Università di Padova
Vogeli, Kevin, University of California
Voiculescu, Octavian, University College London
Wilding, Laura, Vanderbilt University



Microbial Diversity

June 15 – August 1, 2003

COURSE DIRECTORS

Harwood, Caroline, University of Iowa
Schmidt, Tom, Michigan State University
Spormann, Alfred, Stanford University

FACULTY

Behrens, Sebastian, MPI for Marine Microbiology
Gibson, Jane, Cornell University (Emerita)
Harrison, Faith, University of Iowa
Kappler, Andreas, California Institute of Technology
Marsh, Terence, Michigan State University
Martiny, Adam, BioCentrum-Danmark Tekniske Universitet
Mueller, Jochen, Stanford University
Wade, Brian, Arizona State University

LECTURERS

Bassler, Bonnie, Princeton University
Chisholm, Penny, Massachusetts Institute of Technology
Edwards, Katrina, Woods Hole Oceanographic Institution
Handelsman, Jo, University of Wisconsin
Leadbetter, Jared, California Institute of Technology
Lory, Stephen, Harvard Medical School
Lovley, Derek, University of Massachusetts
McCarter, Linda, University of Iowa
McFall-Ngai, Margaret, University of Hawaii
Moran, Mary Ann, University of Georgia
O'Toole, George, Dartmouth Medical School
Pace, Norm, University of Colorado
Ruby, Edward, University of Hawaii
Sackett, Liz, University of Nottingham
Waterbury, John B., Woods Hole Oceanographic Institution
Wolfe, Ralph, University of Illinois (Emeritus)

COURSE COORDINATOR

Hawkins, Andrew C., University of Iowa

STUDENTS

Anderson, Christine, Scripps Institution of Oceanography
Cadillo-Quiroz, Hinsby, Cornell University
Costello, Elizabeth, University of Colorado at Boulder
Daprato, Rebecca, Rice University
DeAngelis, Kristen, University of California, Berkeley
Dubinsky, Eric, University of California
Gescher, Johannes, Universität Freiburg
Lever, Mark, University of North Carolina, Chapel Hill
Martens-Habbena, Willm, University of Oldenburg
McCarren, Jay, Scripps Institution of Oceanography
Oerther, Daniel, University of Cincinnati
Petersen, Dorte, Göteborg University
Poretsky, Rachel, The University of Georgia
Sudek, Sebastian, Scripps Institution of Oceanography
Teitzel, Gail, Northwestern University
Tobler, Nicole, EAWAG/ETH
White, Helen, Woods Hole Oceanographic Institution
Zeidner, Gil, Technion-Israel Institute of Technology
Zitzmann, Sybille, Max-Planck-Institute for Marine Microbiology

Neural Systems & Behavior

June 15 – August 9, 2003

COURSE DIRECTORS

Carr, Catherine, University of Maryland
Levine, Richard, University of Arizona

FACULTY

Calabrese, Ronald, Emory University
Chitwood, Raymond, Baylor College of Medicine
Davis, Graeme, University of California, San Francisco
Ferrari, Michael, University of Missouri-Kansas City
Fetcho, Joseph, SUNY Stony Brook
French, Kathleen, University of California, San Diego
Glanzman, David, University of California, Los Angeles
Golowasch, Jorge, New Jersey Institute of Technology
Keith, Julian, University of North Carolina at Wilmington
Kristan, William, University of California, San Diego



Lee, Tzumin, University of Illinois
Lewis, John, University of Ottawa
McAnelly, Lynne, University of Texas
Mooney, Richard, Duke University
Nadim, Farzan, Rutgers University
Pflugger, H.J., Free University of Berlin
Philpot, Ben, Brown University
Prusky, Glen, University of Lethbridge
Reyes, Alex, New York University
Ribera, Angie, University of Colorado Health Sciences Center
Simon, Jonathan, University of Maryland
Stein, Wolfgang, Universitaet Ulm
Stewart, Bryan, University of Toronto
Szczipak, Lidia, Universidad de Buenos Aires
Weeks, Janis, University of Oregon
Wilson, Richard, University of Calgary
Wood, Debra, Case Western Reserve University
Zakon, Harold, University of Texas, Austin
Zhang, Bing, University of Texas, Austin
Zirpel, Lance, University of Minnesota Medical School

LECTURERS

Cline, Hollis, Cold Spring Harbor Laboratory

Delaney, Kerry, Simon Fraser University
Feldman, Jack, University of California, Los Angeles
Haas, Kurt, Cold Spring Harbor Laboratory
Rankin, Catharine, University of British Columbia
Wachowiak, Dale, Boston University

TEACHING ASSISTANTS

Beenhakker, Mark, University of Pennsylvania School of Medicine
Briggman, Kevin, University of California, San Diego
Bucher, Dirk, Volen Center, Brandeis University
Chen, Shanning, House Ear Institute
Coleman, Melissa, Duke University Medical Center
Dulcis, Davide, University of Arizona
Heiser, Ryan, University of Colorado Health Sciences Center
Macleod, Katrina, University of Maryland
Novak, Alicia, University of Colorado Health Sciences Center
Pineda, Ricardo, University of Colorado Health Sciences Center
Prather, Jonathan, Duke University
Roberts, Adam, UCLA
Siegel, Jennifer, Bowling Green State University
Soares, Daphne, University of Maryland
Sorensen, Michael, Georgia Institute of Technology
Taylor, Alison, University of Colorado Health Sciences Center
Villareal, Greg, UCLA
Zee, Michele, University of Oregon

COURSE ASSISTANTS

Low-Zeddies, Sharon, MusWorks, Inc.
Shaw, Abigail, Stanford University
Wark, Barry, Stanford University

STUDENTS

Baltzley, Michael, University of North Carolina, Chapel Hill
Caporale, Natalia, University of California, Berkeley
Evers, Jan Felix, Freie Universität Berlin
Frenkel, Lia, University of Buenos Aires
Grens, Kerry, Stanford University
Markham, Michael, Florida International University
Mora, Emanuel, Universidad de la Habana
Person, Abigail, University of Washington
Reid, Ashlan, University of Pennsylvania
Robie, Alice, California Institute of Technology
Rosenberg, Lior, Ben-Gurion University of the Negev
Rowland, Chris, Emory University
Sharath, Bennur, Tata Institute of Fundamental Research
Sponberg, Simon, University of California, Berkeley
Troncoso, Xoana, University College London
Uthaman, Smitha, University of Massachusetts
Whitchurch, Elizabeth, University of Oregon
Williams, Carrie, Georgia Institute of Technology
Winbush, Ari, University of Oregon
Zhou, Yi, Boston University

Neurobiology

June 8 – August 9, 2003

COURSE DIRECTORS

Faber, Donald, Albert Einstein College of Medicine
Lichtman, Jeff, Washington University

SECTION DIRECTOR

DeFranco, Donald, University of Pittsburgh School
of Medicine

FACULTY

Conchello, Jose-Angel, Oklahoma Medical
Research Foundation
Denk, Winfried, Max-Planck Institute for Medical Research
Gan, Wenbaio, New York University
Heuser, John, Washington University
Jacob, Michele, Tufts University
Kaprielian, Zaven, Albert Einstein College of Medicine
Kernan, Maurice, SUNY at Stony Brook
Khodakhah, Kamran, Albert Einstein College of Medicine
Lambert, Nevin, Medical College of Georgia
Levinthal, David, University of Pittsburgh
Lin, Jen-Wei, Boston University
McMahon, Lori, University of Alabama
Nedivi, Elly, Massachusetts Institute of Technology
Pimental, Aurea, Vanderbilt University
Reese, Thomas, National Institutes of Health
Schweizer, Felix, University of California, Los Angeles
Thompson, Wesley, University of Texas
Wong, Rachel, Washington University
Zenisek, David, Yale University School of Medicine

LECTURERS

Eberwine, James, University of Pennsylvania
Hoh, Jan, Johns Hopkins School of Medicine
Huguenard, John, Stanford University
Leapman, Richard, National Institutes of Health
Levitt, Pat, Vanderbilt University
Li, Chenjian, Weill Medical College of Cornell University
Malinow, Roberto, Cold Spring Harbor Laboratory
Marder, Eve, Brandeis University
McMahan, Uel, Stanford University School of Medicine
Sanes, Joshua, Washington University
Sweatt, David, Baylor College of Medicine
Tsien, Roger, University of California, San Diego
Tully, Tim, Cold Spring Harbor Laboratory

TEACHING ASSISTANTS

Allana, Tariq, Boston University
Gilthorpe, Jonathan, Stanford University
Hoang, Caroline, Albert Einstein College of Medicine
Kuhn, Bernd, MPI for Medical Research
Kummer, Terry, Washington University
Lin, Aerie, New York University
Meyer, Martin, Stanford University
Mirjany, Mana, Albert Einstein College of Medicine
Morgan, Josh, Washington University
Olsen, Doug, Tufts University
Schroeter, Eric, Washington University School of Medicine
Stetler, Ruth, University of Pittsburgh
Szabo, Theresa, Albert Einstein College of Medicine
Tapia, Juan, Washington University
Tian, Le, University of Texas, Austin
Walter, Joy, Albert Einstein College of Medicine
Wylie, John, Washington University School of Medicine
Zuo, Yi, New York University

COURSE ASSISTANTS

Bock, Natika, University of Victoria
McKinnon, Nicole, University of Victoria
Temburni, Murali, Tufts Medical School



STUDENTS

Carey, Megan, University of California, San Francisco
Conti, Lisa, University of California, Santa Barbara
Dunn, Felice, University of Washington
Ebrahim, Shamsah, Massachusetts Institute of Technology
Espinosa, Juan, Stanford University
Johnson, Ervin, University of California, Davis
McDermott, Carmel, Louisiana State University
O'Connor, Daniel, Princeton University
Rose, Matthew, Baylor College of Medicine
Wetherington, Jonathon, Medical College of Georgia
Wilms, Christian, Max Planck Institute for Brain Research
Yang, Guang, Tsinghua University
Young, Paul, Duke University Medical Center

Rossi, Kristen, University of Texas Southwestern
Medical Center

Swaney, Sara Love, University of Texas Southwestern
Medical Center

STUDENTS

Brady, James, Oregon Health Sciences University
Cheng, Ji-Xin, Harvard University
Costantin, Laura, Scola Normale Superiore
Csiszar, Anna, New York Medical College
French, Wendy, University of Texas Southwestern
Medical Center
Garza-Sánchez, Fernando, University of California
Helms, Rebecca, University of California, San Diego
Hiemenz, Matthew, University of Texas Southwestern
Medical Center
Jaumotte, Juliann, University of Pittsburgh
Jilek, Benjamin, Minnesota State University
Jones, Raymond, University of Texas at El Paso
Kitt, Khameeka, University of Arizona
Kumar, Vimlesh, Tata Institute of Fundamental Research
Nakachi, Mia, Keio University
Nally, Kenneth, Cork University Hospital
Phillips, Kelli, West Virginia University School of Medicine
Prodon, Francois, Laboratoire de Biologie du
Développement
Sahni, Vibhu, Northwestern University Institute
Sanchez-Esteban, Juan, Women and Infants' Hospital
Sergeant, Kate, University of Newcastle upon Tyne
Sigl, Reinhard, University of Innsbruck Medical School
Strünker, Timo, University of Cologne
Ungvari, Zoltan, New York Medical College
Zarnitsyna, Veronika, Georgia Institute of Technology
Zhong, Xiaoli, The Johns Hopkins University
School of Medicine

SPECIAL TOPICS COURSES

Physiology: The Biochemical and Molecular Basis of Cell Signaling

June 15 – July 26, 2003

COURSE DIRECTORS

Garbers, David, University of Texas Southwestern Medical Center
Reed, Randall, Johns Hopkins University

FACULTY

Carroll, Michael, University of Texas Southwestern Medical Center
Duncan, Tod, Cancer Research UK
Franco, Peter, University of Minnesota
Furlow, David, University of California, Davis
Kaupp, U. Benjamin, Institut für Biologische Informationsverarbeitung
Megraw, Timothy, University of Texas Southwestern Medical Center
Schultz, Nikolaus, University of Texas Southwestern Medical Center

LECTURERS

Clapham, David, HHMI/Children's Hospital
Comerford, Sarah, University of Texas Southwestern Medical Center
Flier, Jeffrey, Beth Israel Deaconess Medical Center
Hammer, Robert, University of Texas Southwestern Medical Center
Julius, David, University of California, San Francisco
Korach, Kenneth, National Institutes of Health
Lazar, Mitchell, University of Pennsylvania
McKearin, Dennis, University of Texas Southwestern Medical Center
Moore, David, Baylor College of Medicine
Nambu, John, University of Massachusetts Medical Center
Rama, Ranganathan, University of Texas Southwestern Medical Center
Reppert, Steven, University of Massachusetts Medical School
Stock, Ann, University of Medicine & Dental of NJ-RWJMS
Tilney, Lewis, University of Pennsylvania
Zhao, Guang-Quan, University of Texas Southwestern Medical Center

IRVIN ISENBERG LECTURER

Stanley Korsmeyer, Dana-Farber Cancer Institute

GERTRUDE FORKOSH WAXLER LECTURER

Joan Brugge, Harvard Medical School

ARTHUR K. PARPART LECTURER

Doug Melton, Harvard University, HHMI

TERU HAYASHI LECTURER

Stuart Schreiber, Harvard University

TEACHING ASSISTANTS

Beserra, Crystal, University of Texas Southwestern Medical Center
Kao, Ling-Rong, University of Texas Southwestern Medical Center
Lim, Wayland, University of California, Davis
Neff, Eric, University of California, Davis
Sugden, Sarah, University of Texas Southwestern Medical Center

COURSE ASSISTANTS

Grellhesl, Dana, University of Texas Southwestern Medical Center

Advances in Genome Technology & Bioinformatics

October 8 – November 6, 2003

COURSE DIRECTORS

Fraser, Claire, The Institute for Genomic Research
Sogin, Mitchell, Marine Biological Laboratory

FACULTY

Bateman, Alex, Wellcome Trust Sanger Institute
Blake, Judith, The Jackson Laboratory
Eisen, Jonathan, The Institute for Genomic Research
Feldblyum, Tamara, The J. Craig Venter Science Foundation
Heidelberg, John, The Institute for Genomic Research
Hoffman, Eric, Children's National Medical Center
Kirkness, Ewen, The Institute for Genomic Research
Klapa, Maria, University of Maryland
Landsman, David, National Institutes of Health
Lee, Norman, The Institute for Genomic Research
Miller, Lynn, Accelrys
Nierman, William, The Institute for Genomic Research
Olsen, Gary, University of Illinois
Pearson, William, University of Virginia
Pineda, Fernando, Johns Hopkins School of Public Health
Quackenbush, John, The Institute for Genomic Research
Reich, Claudia, University of Illinois
Salzberg, Steven, The Institute for Genomic Research
Tettelin, Hervé, The Institute for Genomic Research
Venter, Craig, The J. Craig Venter Science Foundation
White, Owen, The Institute for Genomic Research

LECTURERS

Churchill, Gary, The Jackson Laboratory
Gentleman, Robert, Harvard University
Gill, Steven, The Institute for Genomic Research
Myers, Eugene, University of California, Berkeley
Peterson, Scott, The Institute for Genomic Research
Pickett, Siobhan, Axon Instruments
Tamayo, Pablo, Whitehead Institute/MIT

TEACHING ASSISTANTS

Bhagabati, Nirmal, The Institute for Genomic Research
Braisted, John, The Institute for Genomic Research
Davidsen, Tanja, The Institute for Genomic Research
Friedman, Molly, The Institute for Genomic Research
Gill, John, The J. Craig Venter Science Foundation
Liang, Wei, The Institute for Genomic Research
Marko, Nicholas, The Institute for Genomic Research
Pop, Mihai, The Institute for Genomic Research
Radune, Diana, The Institute for Genomic Research
Rubio, Renee, The Institute for Genomic Research
Saeed, Alexander, The Institute for Genomic Research
Schobel, Seth, The Institute for Genomic Research
Sharov, Vasily, The Institute for Genomic Research
Vamathevan, Jessica, The Institute for Genomic Research
Verratti, Kathleen, The Institute for Genomic Research
White, Joseph, The Institute for Genomic Research

STUDENTS

Bristow, Christopher, Princeton University
Brown, Rebecca, University of Chicago
Caufield, Page, New York University
Cotlin, Laura, Marine Biological Laboratory
Czerwiec, Eva, Marine Biological Laboratory
D'Amato, Eugenia, University of Stellenbosch
Deng, Dewang, Alabama A&M University
Edsinger Gonzales, Eric, Friday Harbor Labs
Hilario, Elena, HortResearch, Ltd.
Hopper, Keith, United States Department of Agriculture
Lobo, Neil, University of Notre Dame
Mungpakdee, Sutada, SARS International Centre
O'Malley, Kathleen, Oregon State University

Racowsky, Catherine, Brigham & Women's Hospital
Richards, JoAnne, Baylor College of Medicine
Sarras, Michael, University of Kansas Medical Center
Suarez-Quian, Carlos, Georgetown Medical School
Yao, Humphrey, University of Illinois

TEACHING ASSISTANTS

Agoulnik, Irina, Baylor College of Medicine
Bhagabati, Nirmal, The Institute for Genomic Research
Brudney, Allison, University of Illinois at Chicago
Bryant, Winnifred, University of Virginia
Combelle, Catherine, Brigham and Women's Hospital
Currier, Tracey, The Institute for Genomic Research
DeMayo, Janet, Baylor College of Medicine
Galet, Colette, University of Iowa
Hadsell, Louise, Baylor College of Medicine
Huntress, Victoria, Tufts University School of
Veterinary Medicine
Ibanez de Sans, Maria Elena, Universitat Autònoma
de Barcelona
Jackson, Jodi, Case Western Reserve University
Kenny, Hilary, Northwestern University
Kim, Julie, University of Illinois at Chicago
Markoulaki, Styliani, Tufts University
Matson, Sara, Tufts-New England Medical Center
Mehlmann, Lisa, University of Connecticut Health Center
Miles, Lyndon, Brigham & Women's Hospital
Nureddin, Aida, Brigham & Women's Hospital
Rawe, Vanesa, Magee Research Institute
Reed, Allison, Case Western Reserve University
Runft, Linda, University of California, Santa Barbara
Stein, Paula, University of Pennsylvania
Susiarjo, Martha, Case Western Reserve University
Suzsko, Magdalena, Northwestern University
Wang, Min-Kang, Tufts University
Wang, Jie, Baylor College of Medicine

COURSE COORDINATOR

Cherry, Jonathan, Case Western Reserve University

COURSE ASSISTANT

Anderson, Amanda, Bridgewater State College

STUDENTS

Adams, Kristina, University of Washington
Buzzio, Oscar, University of Illinois, Chicago
Camejo, Maria, University Simon Bolivar
Germeyer, Ariane, Stanford University
Green, Melissa, Morehouse School of Medicine
Hastings, Julie, University of Illinois, Chicago
Ingman, Wendy, Albert Einstein College of Medicine
Jones, Rebecca, Prince Henry's Institute of
Medical Research
Modi, Deepak, National Institute for Research
in Reproductive Health
Norwitz, Errol, Yale University School of Medicine
Perry, Melissa, Harvard School of Public Health
Raychoudhury, Samir, Benedict College
Rinaudo, Paolo, University of Pennsylvania
Sasson, Isaac, Yale University School of Medicine
Schwarze, Juan-Enrique, University of Pennsylvania
Zambrano, Elena, National Institute of Medical Sciences
& Nutrition

Medical Informatics I

May 25 – June 1, 2003

COURSE DIRECTOR

Cimino, James, Columbia University

FACULTY

Ackerman, Michael, National Library of Medicine
Ash, Joan, Oregon Health & Science University
Canese, Kathi, National Library of Medicine
Cimino, Christopher, Albert Einstein College of Medicine
Hammond, W. Ed, Duke University
Hripcsak, George, Columbia University
Kingsland, Lawrence, National Library of Medicine
Kukafka, Rita, Columbia University
Lindberg, Donald, National Library of Medicine
McCray, Alexa, National Library of Medicine
Miller, Perry, Yale University
Starren, Justin, Columbia University

STUDENTS

Abrams, Matthew, Indiana University School of Medicine
Anderson, Brian, Fox Chase Cancer Center
Ash, Paul, Allina Hospitals and Clinics
Bader, Susan, Oregon Neurology, PC
Baldwin, Peggy, Baylor Health Sciences Library
Bedoian, Joyce, Providence Portland Medical Center
Benin, Andrea, Drexel University College of Nursing
Berthaud, Vladimir, Yale University
Brooks, Durado, Meharry Medical College
Burke, Marianne, University of Illinois at Chicago
Byrd, Gary, Madonna University
Certain, Edith, American Cancer Society
Cornelius, Frances, State of Washington Health
Care Authority
DiCarlo, Anthony, University of Vermont
Himelick, Tom, University of Buffalo-SUNY
Horner, Marcia, World Health Organization
Keels, Kara, Drexel University
Kennedy, Joanne, Beth Israel Medical Center
King, Samuel, Healthcare Insights
Knott, Teresa, Adena Health System
Koonce, Taneya, Lake County Health Department
Martin, Patricia, University of Montana
Patel, Arvind, Delaware Academy of Medicine
Phillips, Thomas, University of California, San Diego
Poretzsky, Leonid, Micromedex, Inc.
Rohr, Richard, Emory University School of Medicine
Rydesky, Mary, Kootenai Medical Center Library
Saddul, Reonel, United States Public Health Service
Sivam, Subbiah, Oregon Health & Science University Library
Wydra, Ellen, Case Western Reserve University

Medical Informatics II

September 28 – October 5, 2003

COURSE DIRECTOR

Cimino, James, Columbia University

FACULTY

Bhagwat, Medha, National Institutes of Health
Friedman, Charles, National Library of Medicine
and the University of Pittsburgh
Johnson, Kevin, Vanderbilt Medical Center
Kingsland, Lawrence, National Library of Medicine
Lorenzi, Nancy, Vanderbilt University
McCray, Alexa, National Library of Medicine
Miller, Perry, Yale University
Miller, Randolph, Vanderbilt Medical Center

Nahin, Annette, National Library of Medicine
Nesbitt, Thomas, University of California, Davis





Oppenheim, Sara, North Carolina State University
 Reiner, David, Univ of California, San Diego Medical Center
 Rueness, Eli, University of Oslo
 Salzburger, Walter, University Konstanz
 Shaw, Joseph, Dartmouth College
 Slikas, Beth, University of California, Berkeley
 Stewart, Jennifer, University of Hawaii, Manoa
 Thompson, Fabiano, Ghent University
 Yan, Qingshang, Yale University School of Medicine
 Zhu, Wei, State University of New York at Stony Brook

Analytical and Quantitative Light Microscopy

May 8 – May 16, 2003

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Sluder, Greenfield, University of Massachusetts
 Medical School
 Wolf, David, BioHybrid Technologies

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 Medical School

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Nordberg, Joshua, University of Massachusetts
 Medical School

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Apicella, Anthony, Northrop Grumman Information
 Technology
 Bean, James, The Rockefeller University
 Chaudhury, Arun, All India Institute of Medical Sciences
 Cheng, Chong Nam, The Hong Kong University of
 Science & Technology
 Connell, Samuel, LaJolla Institute for Allergy

and Immunology

Courtney, Patrick, Perkin Elmer
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 Yarar, Defne, The Scripps Research Institute
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Frontiers in Reproduction: Molecular and Cellular Concepts and Applications

May 18 – June 29, 2003

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 Medical Center
 Zhang, Jian, Texas Tech University Health Sciences Center

Molecular Mycology: Current Approaches to Fungal Pathogenesis

August 7 – August 25, 2003

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 Bassilana, Martine, Institute of Signaling, Developmental
 Biology and Center Research
 Biondo, Carmelo, Policlinico Universitario
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 Chiang, Lisa, Harbor-UCLA Research & Education Institute
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 Mylonakis, Eleftherios, Massachusetts General Hospital
 Onyewu, Chiatogu, Duke University Medical Center
 Ramsdale, Mark, University of Aberdeen
 Rydholm, Carla, Duke University

Neural Development and Genetics of Zebrafish

August 17 – August 30, 2003

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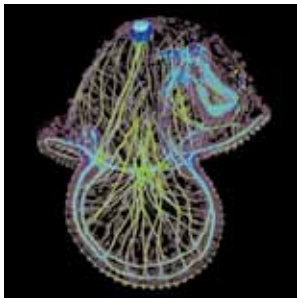
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Wieschaus, Eric, Princeton University

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 Troutman, William, Blue Shield of California
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Methods in Computational Neuroscience August 3 – August 31, 2003

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 Stony Brook
 Wierenga, Corette, Brandeis University
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Molecular Biology of Aging

August 5 – August 23, 2003

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 Bohr, Vilhelm, National Institutes of Health
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 de Lange, Titia, The Rockefeller University
 Donehower, Lawrence, Baylor College of Medicine

Sigurdson, Wade, SUNY at Buffalo

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Backer, Jonathan, Albert Einstein College of Medicine
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Graf, Beth, University of Rochester
Greeson, Jennifer, Rice University
Guo, Zhen, University of Science & Technology of China
Hahn, Michael, The Rockefeller University
Hernández-Deviez, Delia, University of Arizona
Hunter, Andrew, Medical University of South Carolina
Kaur, Jaswinder, University of Calgary
Lebensohn, Andres, Harvard Medical School
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Prince, Lance, University of Alabama, Birmingham
Rankin, Kathleen, University of Washington
Shvartsman, Stanislav, Princeton University
Vidraicre, Gaël, Université Laval
Whittaker, Scott, Smithsonian Institution
Wu, Lani, Harvard University



Ciornei, Radu-Tudor, University of Kentucky
Couture, Graeme, The Rockefeller University
Ginsburg, Dov, SUNY Downstate Medical Center
Hirose, Keiko, Cleveland Clinic Foundation
Karrenbauer, Virginija, Huddinge University Hospital
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Lee, Ji, Albert Einstein College of Medicine
Marta, Monica, Karolinska Hospital
Nozell, Susan, University of Alabama at Birmingham
Reed, Janelle, University of Kentucky
Silverberg, Jonathan, SUNY Downstate Medical Center
Soderblom, Cynthia, Karolinska Institute
Song, Ping, Yale University
Thangarajh, Mathula, Karolinska Institute
Venneti, Sriram, University of Pittsburgh

Pathogenesis of Neuroimmunologic Diseases

August 10 – August 23, 2003

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Brosnan, Celia, Albert Einstein College of Medicine
Rosenbluth, Jack, New York University School of Medicine

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Dalakas, Marinou, National Institutes of Health
Darnell, Robert, The Rockefeller University
Goldman, Steven, Cornell University Medical College
Griffin, Diane, Johns Hopkins
Griffin, John, Johns Hopkins
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Kuchroo, Vijay, Brigham and Women's Hospital
Patterson, Paul, California Institute of Technology
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Reder, Anthony, The University of Chicago
Sadofsky, Moshé, Albert Einstein College of Medicine
Salzer, James, New York University School of Medicine
Shrager, Peter, University of Rochester
Sonthheimer, Harald, The University of Alabama at Birmingham
Wiley, Clayton, University of Pittsburgh

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Chao, Moses, New York University School of Medicine
Colman, David, McGill University
Goverman, Joan, University of Washington
Harling-Berg, Christine, Brown University
Shin, Moon, University of Maryland School
Sternberg, Esther, National Institute of Mental Health
Tracey, Kevin J., North Shore-LIJ Research Institute
Vincent, Angela, Oxford University

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McCluskey, Kathryn, St Lawrence University

STUDENTS

Adamski, Jill, University of Alabama at Birmingham
Alvarez, Jorge, University of Texas Health Science Center
Antal, Ellen-Ann, Ullevaal University Hospital
Ballard, Eileen, M.D. Anderson Cancer Center
Bendkhale, Maneesha, University of Texas at Dallas
Chen, Lanfen, Albert Einstein College of Medicine

Summer Program in Neuroscience, Ethics, and Survival (SPINES)

June 21 – July 19, 2003

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Gonzalez-Lima, Francisco, University of Texas at Austin
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Johnston, Daniel, Baylor College of Medicine
Kravitz, Edward, Harvard Medical School
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Mensing, Allen, University of Minnesota
Nickerson, Kim, American Psychological Association
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Palazzo, Robert, Rensselaer Polytechnic Institute
Zakon, Harold, University of Texas, Austin

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 Mazanec, April, Zebrafish Institute of Neuroscience
 Stewart-Swift, Caitlin, Wheaton College

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Agarraberes, Fernando, Howard Hughes Medical Institute
 Anichtchik, Oleg, University of Helsinki
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Neuroinformatics

August 16 – August 31, 2003

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Optical Microscopy

October 8 – October 17, 2003

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 Rodenas-Ruano, Alma, University of Miami School of Medicine
 Rodriguez, Jesse, University of Texas at San Antonio
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Workshop on Molecular Evolution

July 27 – August 8, 2003

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Gene McDonald, Jet Propulsion Laboratory
Ken Nealson, University of Southern California
John Stolz, Duquesne University

INTERNS

Antonio Castrillo, Second University of Naples
Rebecca Ludwig, Max-Planck-Institute for Marine Microbiology
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Mary Parenteau, Portland State University
Rachel Schelble, University of Southern California
Ilyas Siddique, University of Aberdeen
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Living in the Microbial World: Teachers Workshop

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Olendzenski, Lorraine, Marine Biological Laboratory

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Waksman, George, Massachusetts Institute of Technology

PRESENTERS

Bermudes, David, Vion Pharmaceuticals, New Haven, Connecticut
Buchanan, Nicole, Pershing Middle School, California
Chico-Dib, Norma, Colegio Marista, Puerto Rico
Dyer, Betsey, Wheaton College
Edgcomb, Virginia, Marine Biological Laboratory
Edwards, Katrina, Woods Hole Oceanographic Institute
Guerrero, Ricardo, University of Barcelona, Spain
Margulis, Lynn, University of Massachusetts, Amherst

TEACHER PARTICIPANTS

Alpern, Mary, Penikese Island School, Massachusetts
Garcia-Mansilla, Frankin, West Roxbury High School, Massachusetts
Heelas, Anita, Dane Court Grammar School, Kent, UK
Jones, Douglas, West Haven High School, Connecticut
Lewis, Richard, New School for Arts and Sciences, New York
Lopez, Margaret, Monroe Clark Middle School, California
Martin, Geoff, Pershing Middle School, California
Misiyak-Chumney, Kim, Central Academy, Michigan
Palamar, Katherine, West Haven High School, Connecticut
Quantick, Owen, Community College Whitstable, Kent, UK
Rodriguez, Myrna Vazquez, Colegio de la Inmaculada Concepcion, Puerto Rico
Swartz, Brian, West Haven High School, Connecticut
Szeles, Susan, Columbia Middle School, New Jersey
Vickers, Sonya, Minnechaug Regional High School, Massachusetts
Wallace, Terri, Fairfax Baptist Academy Temple, Virginia
Warner, Aaron, Terre Haute South Vigo High School, Indiana
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Melillo, Jerry M.

Neill, Christopher

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Rastetter, Edward B.

Shaver, Gaius R.

Vallino, Joseph J.

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Bowen, Jennifer

Karasack, Becky

Kwiatkowski, Bonnie

Graham, Leslie

Micks, Pat

Washbourne, Ian

ADMINISTRATIVE ASSISTANT

Berthel, Dixie

Johnson-Horman, Frances

STUDENTS

Alexander-Ozinskas, Marselle O., Bates College

Bernhardt, Beth A., Lawrence University

Bowie, Jacqueline J., Bates College

Chiota, Nicole A., Furman University

Crosby, Gareth W., Mount Holyoke College

Fichman, Michael A., Haverford College



Science Journalism Program

FELLOWS

Del Guercio, Gino, Documentary Filmmaker

DeVita, Elizabeth, Freelance

Jones, Nicola, Reporter, *New Scientist Magazine*, UK

Jordan, Andrew, Freelance Producer

Kumar, Sanjay, Freelance Foreign Correspondent, India

Levy, Sharon, Freelance

Lubick, Naomil, Freelance

Mellgren, Erik, Reporter, *Ny Teknik*, Sweden

Onion, Amanda, Science Editor, ABCNEWS.com

Ortega, Jordi, Freelance TV News Reporter-Producer

Perlman, David, Science Editor, *San Francisco Chronicle*

Ryan, John, Freelance

Setziol, Ilsa, Environment Reporter, Southern California
Public Radio

Singer, Natasha, Correspondent, *Outside Magazine*

Wolfson, Wendy, Freelance

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Bloom, Kerry, University of North Carolina,
Chapel Hill

Clarkson, Melissa, Rensselaer Polytechnic Institute

Palazzo, Robert, Rensselaer Polytechnic Institute

Pearson, Chad, University of North Carolina, Chapel Hill

Schnackenberg, Brad, University of North Carolina,
Chapel Hill

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Neill, Christopher, Marine Biological Laboratory

Kelsey, Sam, Marine Biological Laboratory

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Fellowships, Massachusetts Institute of Technology

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Kleese, Katherine R., Grinnell College

Korth, Jennifer A., Dickinson College

Kramer, Jordan M., Vassar College

Myers, Kendra J., Middlebury College

O'Reilly, Lindsay, Bard College

Sue, Marissa C., Wellesley College

Treat, Claire C., Mount Holyoke College

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Hiemenz, Matthew, University of Texas Southwestern Medical Center

AMERICAN SOCIETY FOR CELL BIOLOGY

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Green, Melissa, Morehouse School of Medicine
Icenhour, Crystal, Mayo Clinic
Johnson, Ervin, University of California, Davis
Moustakas, Jacqueline, University of California, Berkeley
Onyewuu, Chiatogu, Duke University Medical Center
Rowland, Chris, Emory University
Winbush, Ari, University of Oregon

AMERICAN SOCIETY FOR REPRODUCTIVE MEDICINE

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Costello, Elizabeth, University of Colorado, Boulder

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Boschetti, Chiara, University degli Studi di Milano
Ericsson, Rolf, Uppsala University
Ingman, Wendy, University of Adelaide

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Ellis, Louise, University of Cambridge
Prickett, Sara, University of London

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Buzio, Oscar, University of Illinois, Chicago
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Hastings, Julie, University of Illinois, Chicago
Jones, Rebecca, Prince Henry's Institute of Medical Research
Langat, Daudi, University of Kansas Medical Center
Perry, Melissa, Harvard School of Public Health
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Icenhour, Crystal, Mayo Clinic
Liao, Wei-Li, Georgetown University
Marra, Robert, Duke University Medical Center
Missall, Tricia, St. Louis University Medical Center
Mylonakis, Eleftherios, Massachusetts General Hospital
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Ramsdale, Mark, University of Aberdeen
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Figureido, Juliana, Instituto Biofisica, Brazil
Wang, Qian, New York University Medical Center



Conti, Lisa, University of California, Santa Barbara
Ebrahim, Shamsha, Massachusetts Institute of Technology
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Wilms, Christian, Max Planck Institute for Brain Research

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Jones, Raymond, University of Texas at El Paso
Kumar, Vimlesh, Tata Institute of Fundamental
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Cruz, Georgina, University of Miami School of Medicine
French, Wendy, University of Texas Southwestern
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Helms, Rebecca, University of California, San Diego
Kitt, Khameeka, University of Arizona
Nakachi, Mia, Keio University
Nally, Kenneth, Cork University Hospital
Prodon, Francois, Laboratoire de Biologie du
Developement
Sergeant, Kate, University of Newcastle upon Tyne
Sigl, Reinhard, University of Innsbruck Medical School
Tai, Lung-Hao, SUNY, Stony Brook
Ungvari, Zoltan, New York Medical College
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Wilms, Christian, Max Planck Institute for Brain Research
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Ungvari, Zoltan, New York Medical College
Zhong, Xiaoli, Johns Hopkins University School of Medicine

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Dunn, Cory, Johns Hopkins University School of Medicine
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Grimm, Andrew, Washington University
Herbst, Allen, University of Wisconsin
Irvine, Gareth, Queen's University Belfast
Lee, Seung-Jae, Johns Hopkins University School of Medicine
Mair, William, University College London
Martinez, Sara, Washington University School of Medicine
Melk, Anette, University of Alberta
Muffat, Julien, California Institute of Technology
Pekanovic, Ana, University of Tubingen
Pregueiro, Antonio, Dartmouth Medical School
Ravid, Katya, Boston University School of Medicine
Riabowol, Karl, University of Calgary
Sage, Brian, Carnegie Mellon University
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Steinert, Susanne, University of Texas Southwestern Medical Center
Zhang, Jian, Texas Tech Health Sciences Center

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Jaumotte, Juliann, University of Pittsburgh
Jones, Raymond, University of Texas at El Paso
Kitt, Khameeka, University of Arizona
Phillips, Kelli, West Virginia University School of Medicine

HOWARD HUGHES MEDICAL INSTITUTE-BIOLOGY OF PARASITISM COURSE

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Evans, Krystal, Walter & Eliza Hall Institute for Medical Research
Van Doren, Giel, University of Melbourne

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Brubacher, John, University of Manitoba
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Evers, Jan Felix, Freie Universität Berlin
Gescher, Johannes, Universität Freiburg
Goel, Pranay, Ohio State University
Martens-Habbena, Willm, University of Oldenburg
Narayanan, Rishikesh, Tata Institute of Fundamental Research, India
Omosun, Yusuf, University of Ibadan
Petersen, Dorothe, Göteborg University
Sigl, Reinhard, University of Innsbruck Medical School
Sudek, Sebastian, Scripps Institute of Oceanography
Tiso, Natascia, Università di Padova
Tobler, Nicole, Swiss Federal Institute for Environmental Science & Technology
Tronosco, Xoana, University College London

Uthaman, Smitha, University of Massachusetts
Zhou, Yi, Boston University
Zitzmann, Sybille, Max Planck Institute for Marine Microbiology

INTERNATIONAL BRAIN RESEARCH ORGANIZATION

Frenkel, Lia, University of Buenos Aires
Li, Cheng-Yu, Institute for Neuroscience
Mora, Emanuel, Universidad de la Habana
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Li, Wei, University of Iowa College of Medicine

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Post-Course Research Awards

PHYSIOLOGY
Csiszar, Anna, New York Medical College
Ungvari, Zoltan, New York Medical College
Zhong, Xiaoli, The Johns Hopkins University School of Medicine

EMBRYOLOGY
Boschetti, Chiara, Università degli Studi di Milano

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 Maryland, University of, School of Medicine
 Massachusetts College of Pharmacy & Health Sciences
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 Massachusetts Institute of Technology
 Massachusetts, University of
 Massachusetts, University of, Medical Center
 Max Planck Institute for Brain Research, Germany
 Max Planck Institute for Molecular Genetics, Germany
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 Milano, Università degli Studi di, Italy
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 Minnesota, University of
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 Mount Sinai School of Medicine
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 National Institute of Parasitology, Argentina
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 New Mexico State University
 New Mexico State University
 New Mexico, University of
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 New York City Department of Health & Mental Hygiene
 New York Medical College
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 New York, State University of, Downstate Medical Center
 New York, State University of, School of Nursing, Buffalo
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 North Carolina, University of, Chapel Hill
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 Oldenburg, University of, Germany
 Oregon Health and Science University
 Oregon Neurology, PC
 Oregon State University
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 Oslo, University of, Norway

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 Panum Institute The, Denmark
 Pennsylvania State University
 Pennsylvania, University of
 Pennsylvania, University of, School of Medicine



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Rice University
 Rochester, University of
 Rockefeller University
 Rush University Medical Center
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 SARS International Centre for Marine Molecular Biology,
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 Savannah State University
 Science & Technology, University of, China
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 Spirit Healthcare of Louisiana, Inc.
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Tata Institute of Fundamental Research, India
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 Texas, University of, Dallas
 Texas, University of, El Paso
 Texas, University of, Health Science Center
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 and Center Research
 Iowa, University of, College of Medicine

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 Liverpool University, United Kingdom
 London, University of, United Kingdom
 Louisiana State University

M.D. Anderson Cancer Center
 Madonna University
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 Manchester, University of, United Kingdom
 Manitoba, University of, Canada

Countries Represented (students)

Argentina
 Australia
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 Belarus
 Belgium
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 Chile
 China
 Colombia
 Croatia
 Cuba
 Denmark
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 Germany
 Greece
 Hong Kong
 Hungary
 India
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 Japan
 Mexico
 Netherlands
 Nigeria
 Norway
 Peru
 Philippines
 Poland
 Portugal
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 Russia
 South Africa
 South Korea
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Vanderbilt University
Vermont, University of
Vienna, University of, Austria
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Australia
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Washington University School of Medicine
Weill Medical College of the Cornell University
West Virginia University School of Medicine
Wisconsin, University of
Women and Infants' Hospital
Woods Hole Oceanographic Institution
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Pennsylvania, University of, School of Medicine
Pittsburgh, University of
Pittsburgh, University of, School of Medicine
Pomona College
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Rockefeller University, The
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Stowers Institute for Medical Research
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Texas A&M University
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Texas, University of, Southwestern Medical Center
The Institute for Genomic Research
The J. Craig Venter Science Foundation
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The Walter and Eliza Hall Institute, Australia
Toronto, University of
Tufts University
Tufts University School of Medicine
Tufts University School of Veterinary Medicine

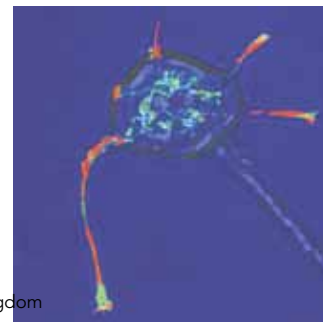
Ulm, University of, Germany
Universitat Autònoma de Barcelona
University College London
Utah, University of

Vanderbilt Medical Center
Vanderbilt University
Vermont, University of
Victoria, University of
Virginia, University of
Volen Center, Brandeis University

Washington University
Washington, University of
Washington University School of Medicine
Weill Medical College/Cornell University
Wellcome Trust Sanger Institute
Wellesley College
Wesleyan University
Wheaton College
Whitehead Institute/MIT
Williams College
Wisconsin, University of, Madison
Woods Hole Oceanographic Institute

Yale University
Yale University School of Medicine

Zebrafish Institute of Neuroscience



Countries Represented (faculty)

Argentina
Australia
Belgium
Canada
China
Denmark
France
Germany
Greece
India
Indonesia
Ireland
Israel
Italy
Japan
Mexico
New Zealand
Poland
Portugal
Romania
Spain
Sweden
Switzerland
Taiwan
The Netherlands
Turkey
United Kingdom
USA

Institutions Represented (faculty)

Missouri, University of, Columbia
Missouri, University of, Kansas City
Monell Chemical Senses Center
Montana State University
MPI for Marine Microbiology
MPI for Medical Research
MRC Centre, United Kingdom
MRC Laboratory for Molecular Biology, United Kingdom
Mt. Sinai School of Medicine
MusWorks, Inc.

National Cancer Institute
National Institute for Medical Research
National Institute of Mental Health
National Institutes of Health
National Library of Medicine
New England Medical Center/Tufts Medical School
New Jersey Institute of Technology
New York State Department of Health
New York, State University of, Buffalo
New York, State University of, Stony Brook
New York University
New York University School of Medicine
North Carolina, University of, Chapel Hill
North Carolina, University of, Wilmington
North Shore-LIJ Research Institute
Northwestern University
Notre Dame, University of
Nottingham, University of, United Kingdom
NTT Communication Science Labs

Ohio State University
Oklahoma Medical Research Foundation
Oregon Health & Science University
Oregon, University of
Ottawa, University of
Oxford University, United Kingdom

Alabama, University of, Birmingham
 Albany, University at
 Albert Einstein College of Medicine
 American Psychological Association
 Anatomy, University College London
 Arizona State University
 Arizona, University of
 Auburn University
 Axon Instruments

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 Beth Israel Deaconess Medical Center
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 Boston College
 Boston University
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 California, University of, Davis
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 Carl Zeiss MicroImaging, Inc.
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 Carnegie Mellon University
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 Children's National Medical Center
 Cincinnati, University of
 City College of New York
 Cleveland Clinic
 Cold Spring Harbor Laboratory
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 Columbia University
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 Cordoba National University, Spain
 Cornell University
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 Dartmouth College
 Dartmouth Medical School
 Duke University
 Duke University Medical Center
 Dundee, University of, United Kingdom

Edinburgh, University of, United Kingdom
 Emory University

FC Donders Center of Cognitive Neuroimaging
 Florida Atlantic University
 Florida State University
 Florida, University of
 Fred Hutchinson Cancer Research Center
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Georgetown Medical School
 Georgetown University
 Georgia Institute of Technology
 Georgia, University of



Glasgow, University of
 Guelph, University of, Canada

Harbor-UCLA Medical Center
 Harvard Medical School
 Harvard School of Public Health
 Harvard University
 Hawaii, University of
 Hebrew University
 HHMI/Children's Hospital
 HHMI/Washington University School of Medicine
 House Ear Institute

Idaho, University of
 Illinois at Chicago, University of
 Illinois, Urbana-Champaign, University of
 Indiana University
 Institute for Biological Data Processing, Germany
 Institut Pasteur, France
 Institute for Cell Biology, Bern University, Switzerland
 Iowa State University
 Iowa, University of
 Institute of Stem Cell Research, University of Edinburgh,
 United Kingdom

Johns Hopkins Medical School
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 Johns Hopkins University

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Lethbridge, University of
 London School of Hygiene & Tropical Medicine,
 United Kingdom

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 Michigan State University
 Michigan, University of
 Minnesota, University of
 Minnesota, University of, Medical School

mblwhoilibrary

REPORT OF THE LIBRARY DIRECTOR

The library has focused its efforts on supporting the core programs in science in Woods Hole and continues to be a place of opportunity, interaction, and serendipity, with strong collections that remain central to the knowledge-building process. Major efforts have been mounted in the area of creating a “commons” that delivers scientific information as well as a place for information on technology needs. The library is partnering with researchers to help organize instructional materials, resources for learning and co-creating digital knowledge repositories.

The library also faces challenges in terms of physical space, technological infrastructure, and people skills. The evolving library is omnipresent at each scientist’s desktop with more than 70% of peer-reviewed scientific information being received in electronic format. The need for additional 24/7 outreach services accompanies these electronic successes.

To accommodate these changes, a new library web site (www.mblwhoilibrary.org) was inaugurated in December following a web usability study. A web presence is crucial to any library’s success because it is a portal to information needed by scientists who now use library services in different ways and at different times. Electronic journal publication has contributed to new service and economic models that libraries deal with daily. For example, electronic journals are, for the most part, now licensed and not owned.

The rapid evolution of scholarly communication has led to major operating changes in our library systems. The traditional publishing model in prestigious journals that requires the

transfer of copyright from author to publisher is being challenged by the major open access initiatives. Institutional members of the MBLWHOI Library are participating in two open

archive initiatives: the Public Library of Science and BioMed Central. The economic model that keeps these journals freely available online requires a one-time publication fee from the authors. The library currently pays these fees through its institutional memberships. After conducting a major online users survey and working with the Joint Users Committee, the library cancelled 151 journal titles and added 15 titles to support current research. The library continues to work on its strategic plan, which will involve new use of space, technology, and support services. WHOI has appointed a committee of scientists from its major scientific departments and centers to look at how library services will be used over the next 10 years.

The Digital library projects—the Herbarium, uBio, and the electronic archive for WHOI technical reports—are beginning to reach critical mass, and the first two have recently been incorporated in national and international initiatives at the National Center for Biotechnology and Information (NCBI) and Global Biodiversity Information Facility (GBIF). Electronic access and change are ever present in the science library of today.

— Catherine N. Norton



Library Researchers

- Abbott, Jayne, Marine Research, Inc.
 Ahmadjian, Vernon, Clark University
 Allen, Nina, North Carolina State University
 Allen, Garland, Washington University
 Allnut, Tom, Advanced BioNutrition Corporation
 Anderson, Everett, Harvard University
 Applegate, Andy, New England Fishery Management Council
- Baccetti, Baccio, University of Siena
 Barratt, Ruth, Advanced BioNutrition Corporation
 Benjamin, Thomas, Harvard Medical School
 Blake, Charles, University of South Carolina
 Boelke, Deirdre, New England Fishery Mgmt. Council
 Borgese, Thomas, Lehman College
 Born, Richard T., Harvard University
 Boyer, John, Union College
 Bradley, David, Harvard University
 Broussard, Christine, University of La Verne
 Browne, Carole, Wake Forest University
 Bullis, Robert, Advanced BioNutritional Corporation
 Burke, Don, Johns Hopkins
 Burr, Arthur, Simon Fraser University
- Candelas, Graciela, University of Puerto Rico
 Carbonetto, Sal, McGill University
 Caruso, Paul, Massachusetts Division of Marine Fisheries
 Chase, Brad, Annisquam River Marine Fisheries Station
 Child, Frank, Trinity College
 Chisholm, John, Massachusetts Division of Marine Fisheries
 Clark, John, UMASS Amherst
 Clarkson, Kenneth, Bell Labs, Lucent Technologies
 Clusin, William, Stanford Medical Center
 Cobb, Jewel, California State University
 Cohen, Bruce N., California Technological Institute
 Cohen, Seymour, American Cancer Society
 Colinvaux, Paul, MBL
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 Collier, R., Harvard Medical School
 Copeland, Donald, MBLWHOI Library
 Correia, Steve, Massachusetts Division of Marine Fisheries
 Corwin, Jeffrey, University of Virginia
 Couch, Ernest, Texas Christian University
- D'Alessio, Giuseppe, Universita di Napoli Federico
 deToledo-Morrell, Leyla, Rush University
 Duncan, Thomas, Nichols College
- Epstein, Herman, Brandeis University
 Estrella, Bruce, Massachusetts Division of Marine Fisheries
- Finkelstein, Alan, Albert Einstein College of Medicine
 Fischbach, Gerald, Columbia University
 Fraenkel, Dan, Harvard Medical School
 Frenkel, Krystyna, NYU School of Medicine
- Galatzer-Levy, Robert, University of Chicago
- German, James, Cornell University
 Goldstein, Moise, The Johns Hopkins University
 Groden, Joanna, University of Cincinnati
 Grossman, Albert, NYU Medical School
- Halvorson, Harlyn, MBLWHOI Library
 Halvorson, Lisa, University of Texas Southwestern Medical Center
 Harel, Moti, Advanced BioNutrition Corporation
 Haring, Phil, New England Fishery Management Council
 Haubrich, Robert, Denizen University
 Hernandez-Nicaise, Mari-Luz, University of Nice
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 Hickey, Michael, Massachusetts Division of Marine Fisheries
 Hochschild, Ann, Harvard Medical School
 Hoskins, Sally, CCNY
- Inoué, Sadayuki, McGill University
 Iribane, Oscar, Universidad Nacional de Mar del Plata
- Jacobson, Allan, UMass Medical School
 Jaye, Robert, Solomon Schechter Day School
 Johnston, Daniel, Baylor College of Medicine
 Josephson, Robert, University of California
- Karlin, Arthur, Columbia University
 Kellogg, Chris, New England Fishery Mgmt. Council
 Kelly, Robert, Northwestern University
 Keynan, Alexander, Israel Academy of Sciences and Humanities
 Khanna, Rita, Advanced BioNutrition Corporation
 King, Kenneth, MBLWHOI Library
 Krane, Stephen, Mass General Hospital-East
 Kyle, David, Advanced BioNutrition Corporation
- Laderman, Aimlee, Yale University School of Forestry and Environmental Studies
 Lee, John, City College of CUNY
 Lipper, Evelyn, New York Presbyterian Hospital
 Lisman, John, Brandeis University
 Loewenstein, Werner, *Journal of Membrane Biology*
 Logan, George, University of Virginia
 Luckenbill-Edds, Louise, Ohio University
- Mayo, Charles, Coastal Studies Org.
 Meinertzhagen, Ian, Dalhousie University
 Mendelsohn, Michael, Molecular Cardiology Research Institute
 Menini, Anna, SISSA
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 Metz, Vanessa, California Coastal Commission
 Milkman, Roger, MBLWHOI Library
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 Mizel, Merle, Tulane University
 Moore, Greg, Coastal Studies Organization
 Mooseker, Mark, Yale University
 Moth-Poulsen, Thomas, Massachusetts Division of Marine Fisheries
- Nagel, Ronald, Albert Einstein College of Medicine
- Narahashi, Toshio, Northwestern University Medical School
 Naugle, John, National Aeronautics & Space Administration
 Nelson, Gary, Annisquam River Marine Fisheries Station, New England Fishery Management Council
 Nichols, Owen, Coastal Studies Organization
 Nies, Tom, New England Fishery Management Council
- Pickering, James, MIMPC-International Marine Consultants
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- Rabinowitz, Michael, Harvard Medical School
 Rafferty, Nancy, Falmouth, MA
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 Reznikoff, William, University of Wisconsin
 Robbins, Jooke, Center for Coastal Studies
 Rome, Lawrence, University of Pennsylvania
- Schippers, Jay, MBLWHOI Library
 Schwartz, James, MBLWHOI Library
 Senese, Angie, Bowdoin College
 Shephard, Frank, Eppler Lung Research Foundation (Woods Hole Database, Inc)
 Shepro, David, Boston University
 Sherman, Irwin, University of California
 Shimomura, Osamu, MBLWHOI Library
 Silvoni, Gabriela, INIDEP
 Siwicki, Kathleen, Swarthmore College
 Smith, Tim, NOAA
 Spector, Abraham, Columbia University
 Spotte, Stephen, Mote Marine Lab
 Steele, Lori, New England Fishery Mgmt. Council
 Steinberg, Martin, Boston University Medical Center
 Stracher, Alfred, SUNY, Downstate Medical Center
 Stuart, Ann, University of North Carolina
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 Sundquist, Eric, United States Geological Survey
- Tilney, Lewis, University of Pennsylvania
 Tweedell, Kenyon, University of Notre Dame
 Tykocinski, Mark, University of Pennsylvania
 Tytell, Michael, Wake Forest University School of Medicine
- Valentine, Deirdre, New England Fishery Management Council
 Valles, James, Brown University
 Van Holde, Kensal, Oregon State University
- Walton, Alan, Cavendish Lab
 Warren, Leonard, University of Pennsylvania Medical School
 Weiss, Nathaniel, MBLWHOI Library
 Weissmann, Gerald, New York University School of Medicine
 Wilson, Linda, University of Manitoba
 Wirth, Dyann, Harvard School of Public Health
- Yevick, George, Stevens Institute of Technology

financials

REPORT OF THE TREASURER

Financial results for the Laboratory's 115th year of operation demonstrated a strong rebound from a challenging year in 2002. Strong investment returns, dramatic growth in contributions, and more effective control of expenses enabled the institution to return to positive growth in Net Assets.

Operating Support grew by \$3.1 million, led by a 63% increase in Contributions and an 8.5% increase in Government Grants. Foundations provided 80% of the Contributions and the annual fund raised a record \$611 thousand for unrestricted purposes. For the second year in a row, the laboratory applied for over 100 Government Grants. The MBL also experienced a dramatic \$1.5 million increase in National Institutes of Health grant revenues. All other sources of Operating Support basically remained stable.

Operating Expenses were well controlled increasing only 2.3% from the previous year and well below the historical trend of increasing approximately 10% each year. The laboratory continued its investment in the future adding to the scientific staff with salary and fringe expenses increasing 9.4% but this was offset by double digit declines in expenses for professional services, subcontracts, equipment, and utilities. As a result, the MBL had a slight positive change in Net Assets before non-operating activities.

Strong Non-Operating results were due to \$6.2 million in Investment Income and Earnings, which resulted from a 15.2% gain in our long-term investment portfolio. This was the first positive return since 1999 and enabled the MBL to reinvest \$4.2 million in investment gains after transferring \$2 million to temporarily restricted accounts.

These factors combined to result in a

\$3.6 million increase in Net Assets, a welcome improvement over the decline experienced in 2002.

The Balance Sheet also reflected these improvements in performance. The \$2 million increase in Pledges and Other receivables reflect the growth in Contributions. On February 27, 2003, the Massachusetts Development Finance Agency issued on behalf of the MBL, \$5 million in Commercial Paper Revenue Notes. This increased the Long-Term Debt, and after some capital improvements, left \$3.5 million in Assets Held by the Bond Trustee as of the year end. The Endowment and Similar Investments increased by \$5.3 million as we chose only to draw \$900 thousand in cash for operations. Property Plant and Equipment increased by approximately \$1 million as our purchases of property and equipment exceeded the laboratory's depreciation for the fifth consecutive year.

The laboratory's Temporary Net Assets increased by \$4.6 million, due primarily to the increase in multi-year pledges from foundations. Unrestricted Net Assets declined by \$1.2 million and this remains an area of concern. Our development efforts going forward will focus on expanded unrestricted giving to improve this situation.

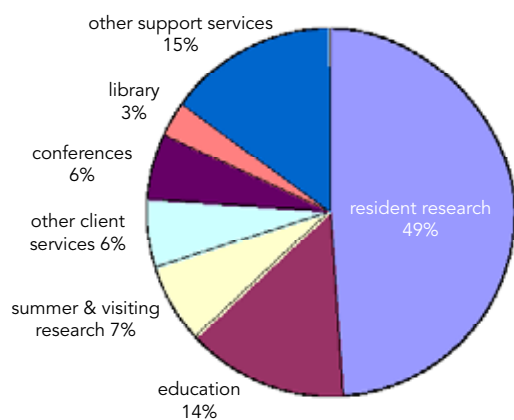
From a financial perspective, our return on average Net Assets was a healthy 5% and MBL's Leverage Ratio (Unrestricted & Temporarily Restricted Net Assets/Debt) remains acceptable at 3.22X. In summary, it was a good opening year for the implementation of the laboratory's Strategic Plan.

— Mary B. Conrad

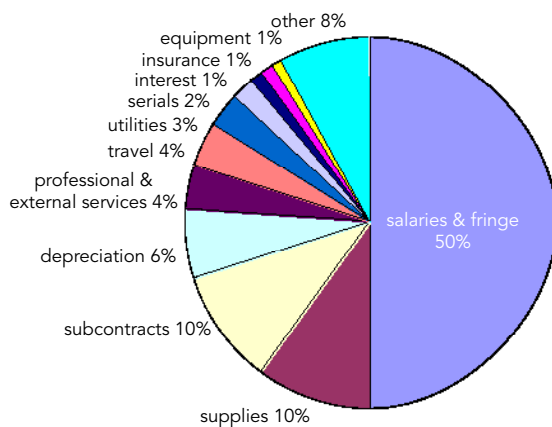


Financial Statements

SOURCES OF \$35.8 MILLION IN OPERATING SUPPORT



USES OF \$35.6 MILLION IN EXPENSES



The financial statements of the Marine Biological Laboratory for the fiscal year ending December 31, 2003, were audited by PricewaterhouseCoopers, LLP.

Complete financial statements are available upon request from:

Mr. Homer Lane
Chief Financial Officer
Marine Biological Laboratory
7 MBL Street
Woods Hole, MA 02543

Operating History and Balance Sheet as of December 31, 2003 and 2002

BALANCE SHEET (In Thousands)	2003	2002
ASSETS:		
Cash and Short-Term Investments	\$1,286	\$4,357
Pledges and Other Receivables	10,851	8,794
Assets Held by Bond Trustee	3,536	-
Other Assets	778	631
Endowment and Similar Investments	47,627	42,290
Property Plant and Equipment (Net)	<u>32,671</u>	<u>31,729</u>
TOTAL ASSETS:	<u>96,749</u>	<u>87,801</u>
LIABILITIES:		
Accounts Payable	2,769	2,637
Annuities and Unitrusts Payable	471	535
Deferred Revenue and Other Liabilities	2,943	2,717
Long-Term Debt	<u>15,200</u>	<u>10,200</u>
Total Liabilities:	<u>21,383</u>	<u>16,089</u>
NET ASSETS:		
Unrestricted	19,184	20,381
Temporarily Restricted	29,901	25,278
Permanently Restricted	<u>26,281</u>	<u>26,053</u>
Total Net Assets:	<u>75,366</u>	<u>71,712</u>
TOTAL LIABILITIES AND NET ASSETS:	<u>\$96,749</u>	<u>\$87,801</u>

OPERATING HISTORY (In Thousands)

OPERATING SUPPORT:		
Government Grants	\$17,190	\$15,849
Contracts	1,503	1,495
Plant and Net Tuition	2,260	2,188
Conferences and Services	5,126	5,333
Donations	7,357	4,522
Plant and Other Revenues	<u>2,395</u>	<u>3,321</u>
Operating Support:	<u>35,831</u>	<u>32,708</u>
EXPENSES:		
Salaries and Fringe	23,750	22,371
Subcontracts	6,244	5,998
Supplies and Services	2,126	1,460
Other Programs	<u>3,526</u>	<u>5,027</u>
Expenses:	<u>35,646</u>	<u>34,856</u>
CHANGE IN NET ASSETS BEFORE NON-OPERATING ACTIVITY:	185	(2,148)
Non-Operating Activities:		
Contributions to Plant and Other Expenses, Net	(758)	(149)
Total Investment Income and Earnings	6,201	(1,994)
Less Investment Earnings Used for Operations	<u>(1,974)</u>	<u>(1,901)</u>
Reinvested (Utilized) Investment Earning:	<u>4,227</u>	<u>(3,895)</u>
TOTAL CHANGE IN NET ASSETS:	<u>\$3,654</u>	<u>\$(6,192)</u>

gifts

REPORT OF THE DEVELOPMENT COMMITTEE



Development efforts at the MBL in 2003 focused on maintaining our solid base of support from foundations, increasing the Annual Fund, nurturing relationships with donors, and defining strategies to identify and cultivate new supporters.

The MBL raised \$6,871,782 in 2003 with the largest gift being \$2.2 million from the Howard Hughes Medical Institute (HHMI) in support of the summer courses. This is the fourth gift of this magnitude from Hughes in the last 15 years and reflects this noted foundation's confidence in our educational program. As William R. Galey, HHMI director of graduate science education stated in his award letter, "...the Laboratory has been a key center for research and teaching in basic biology for over one hundred years. We note the continuing outstanding quality and relevance of the courses and are pleased that the courses' value remains so high for the international biomedical research community."

Another highlight is a gift from the Grass Foundation to establish the Grass Faculty Grant Program, which supports collaborative research in neuroscience by teams of investigators and is renewable for up to three years.

This generous grant enabled the MBL to attract four excellent scientists in 2003 to complement our existing neurobiology research and courses.

As always, annual unrestricted giving played a crucial role in the financial health of the Laboratory in 2003, bridging the gap between income from endowment, grants, and fees, and the actual costs of our research and education programs. I am pleased to report that the Annual Fund increased 10.4% over last year bringing in \$611,047. I wish to acknowledge the service of long-time summer investigator Dr. Peter B. Armstrong, who finished out his term as Annual Fund chairman with these fine results.

The development team coordinated numerous recognition events for our donors in 2003, from the annual Whitman Society reception to intimate lunches with scholarship recipients. They also hosted a Day of Science on campus for potential donors, and the annual Council of Visitors meeting, both events designed to inform and educate guests about science at the MBL.

Finally, it was a year of transition as we said good-bye to Frank Carotenuto who had served as director of external affairs for 11 years, and to Wendy Faxon who, as associate director of development for foundations, had served the MBL for 13 years. They were both instrumental in professionalizing the development effort at the MBL to the point where we raised \$41 million in the Discovery Campaign and can now think about new and higher goals. Those goals are now the responsibility of Carol Pooser, hired in August as the new director of external affairs. We welcome Carol and look forward to taking the MBL to the next level.

On behalf of the Board of Trustees, and the students and researchers who were able to pursue their dreams of discovery at the MBL, I extend my sincerest thanks to those whose names appear on the following pages as well as those who requested anonymity. Your support made all the difference.

— *Christopher M. Weld, Chairman*

HIGHLIGHTS

We gratefully acknowledge the important support provided by the following foundations and individuals for our research and education programs.

Major Gifts (over \$100,000)

[Howard Hughes Medical Institute](#) awarded \$2,200,000 to support the MBL's educational programs for the years 2004 through 2007; \$48,000 to support the Semester in Environmental Science; and \$5,000 to support the Science Journalism Program.

[Burroughs Wellcome Fund](#) awarded \$424,101 to support the course, *Frontiers in Reproduction: Molecular and Cellular Approaches*, for three years beginning 2004; and \$400,000 to support the course *Biology of Parasitism: Modern Approaches* for the years 2003 through 2006.

[The Grass Foundation](#) provided \$450,000 to fund neuroscientists participating in the Albert and Ellen Grass Faculty Grant Program; \$45,000 to fund the Neural Development and Genetics of Zebrafish course for the years 2003 through 2005; and \$5,000 to support the Neural Systems and Behavior Scholarship Fund.

[The Andrew W. Mellon Foundation](#) awarded \$500,000 to support the Semester in Environmental Science for undergraduate students from liberal arts colleges and universities.

[G. Unger Vetlesen Foundation](#) provided \$150,000 for the Josephine Bay Paul Center in Comparative Molecular Biology and Evolution; \$100,000 to help develop marine models for biomedical research; and \$100,000 to underwrite veterinary services in Marine Resources.

[The Ellison Medical Foundation](#) provided a grant of \$300,000 to support the course *Biology of Parasitism: Modern Approaches*, for the years 2004 through 2007.

[The Starr Foundation](#) awarded \$250,000 for

laboratory equipment and a computer classroom for students in the Semester in Environmental Science that takes place in the C. V. Starr Environmental Sciences Building.

[George Frederick Jewett Foundation](#) awarded \$150,000 to support capital improvements to the Marine Biological Laboratory/Woods Hole Oceanographic Institution (MBLWHOII) Library, and for upgrading the air conditioning in Lillie Auditorium.

[The Friendship Fund and the Crane Family](#) made a gift of \$1,000 to support the Tay Hayashi Lectureship in Cell Physiology, and \$100,000 for programs to be determined.

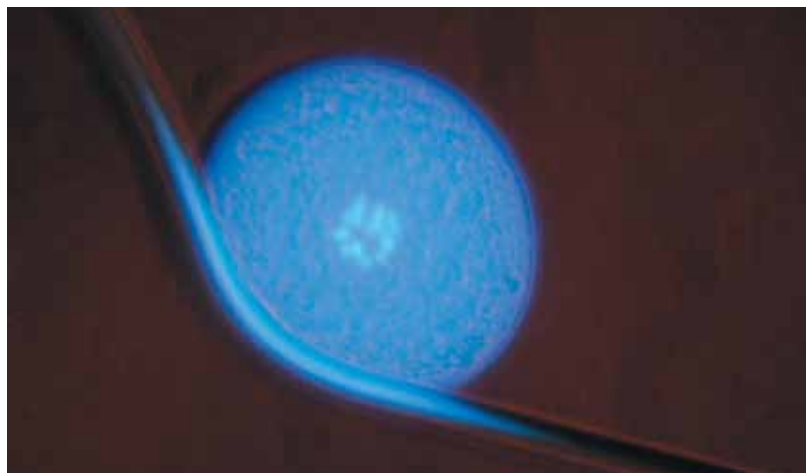


Major Gifts (\$10,000 to \$99,000)

Anonymous (1)
The American Society for Cell Biology
Dr. Porter W. Anderson, Jr.
The Baker Foundation
Cox Foundation, Inc.
W. A. Dart Foundation
Mr. and Mrs. Richard B. DeWolfe
Audrey and Martin Gruss Foundation
Mr. and Mrs. David Hibbitt
Horizon Foundation, Inc.
Mr. and Mrs. William Huyett
Dr. and Mrs. Shinya Inoué
Dr. and Mrs. Kurt J. Isselbacher
Dr. and Mrs. Hans Jannasch
Drs. Darcy B. Kelley and Richard S. Bockman
The Gruss Lipper Foundation
Mr. and Mrs. George W. Logan
Merck Research Laboratories
The Honorable and Mrs. G. William Miller
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Mr. Robert S. Shifman
Alfred P. Sloan Foundation
Society for Neuroscience
Drs. William Speck and Evelyn Lipper
The Seth Sprague Education and
Charitable Foundation
The Sprague Foundation
Mr. Jeffrey A. Stuckey
Drs. Albert Stunkard and Margaret Maurin
Mrs. Madeleine Trinkaus
Mr. Sidney J. Weinberg, Jr.
Mr. and Mrs. Christopher M. Weld
World Precision Instruments

Matching Gifts

Aetna Inc.
Bristol-Myers Squibb Corporation
The Commonwealth Fund
ExxonMobil Foundation, Inc.
Johnson & Johnson
Oracle Corporation
The David and Lucile Packard
Foundation
Saint-Gobain Corporation
Foundation



Special Gifts (up to \$9,999)

Anonymous (2)
Ms. Ruth B. Altschul
American Society for Biochemistry
& Molecular Biology
The American Society for Cell Biology
Drs. James and Helene Anderson
Aquatic Eco-Systems, Inc.
Mr. and Mrs. Spencer L. Baird
Mr. and Mrs. John M. Baitzell
Ms. Susan M. Barnes
Ms. Elia Ben-Ari
Mr. Mitchell R. Berger
Mr. and Mrs. John Bloomberg
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Ms. Susan A. Huettner
Mr. and Mrs. Herbert Isbin
Mr. Daniel Isenberg
Mr. David Isenberg and Ms. Paula Blumenthal
Ms. Sara Isenberg
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Dr. and Mrs. Benjamin Kaminer

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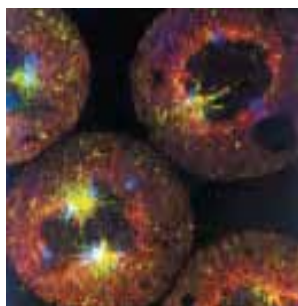
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The first All Alumni Weekend was held on the MBL campus June 6-8, 2003. Alumni, as well as current and former faculty, attended from 10 states, representing 12 different MBL courses and every decade since the 1940s! Guests took good advantage of the opportunity to meet with fellow students, reconnect with teachers and mentors, and visit familiar Woods Hole haunts.

One couple had spent their honeymoon in the 1955 Marine Botany course and celebrated their wedding anniversary on campus. Another alum, from the University of Belgrade, was able to show his son, a recent U.S. high school graduate, where he spent the summer of 1992 studying Neurobiology. The program featured lectures from distinguished

alumni Joan Ruderman and Marc Kirschner of Harvard Medical School, and from former faculty member Doug Melton of Harvard's Center for Genomic Research. Tours of the campus highlighted new facilities and resident research, and collecting trips on the R/V *Gemma* afforded a close look at the rich benthic community of Vineyard Sound.

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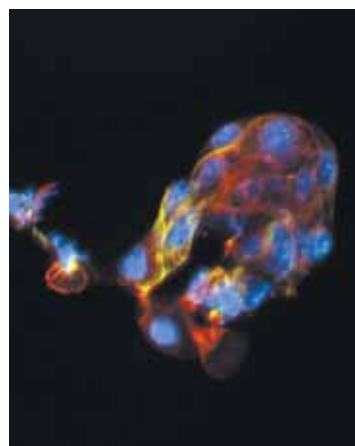
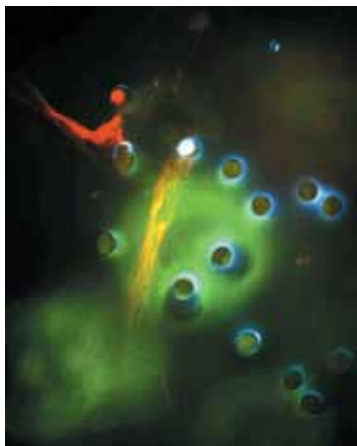
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Johns Hopkins University School of Public Health

"In Vivo Imaging of the Nervous System in Health and Disease"
Dr. Jeff W. Lichtman, Moderator
Washington University School of Medicine

"In Vivo Imaging of Synapses in Normal Muscles and in a Model of ALS"
Dr. Jeff Lichtman

"Synaptic Plasticity in the Cerebral Cortex of Adults"
Dr. Wenbiao Gan
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"In Vivo Imaging of Spinal Cord Regeneration"
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