CURRICULUM VITAE
April, 2001

Joseph Ayers

ADDRESS:
Department of Biology and
Marine Science Center,
Northeastern University,
East Point, Nahant, MA 01908
(617) 581-7370, FAX: 581-6076
Internet: lobster@neu.edu
http://www.dac.neu.edu/msc/ayers.html

PERSONAL: **Born:** Long Beach, California, November 14, 1947
Married: Nancy Jean Ayers, **Son:** Geoffrey Bert Ayers

EDUCATION:

BA 1970	Biology	University of California, Riverside
Ph. D 1975	Biology	University of California, Santa Cruz,
Postdoctoral 1975-1976	Neurophysiology	Centre National de la Recherche Scientifique, Marseilles, France
Postdoctoral 1976-1978	Neurophysiology	University of California, San Diego,

PROFESSIONAL EXPERIENCE:

Assistant and Associate Professor of Biology, Department of Biology and Marine Science Center, Northeastern University, Boston and East Point, Nahant, Massachusetts, 1978 - present. Tenure July, 1984.

Director, Marine Science Center, Northeastern University, June, 1995 to June, 2001. *Interim Director,* December, 1991- June, 1995. *Acting Director,* July 1984 - October, 1984, January, 1988-March, 1988, January, 1989-March, 1989, November 1990-January, 1991. In this capacity I oversaw the operations and programs of the Marine Science Center, the associated research vessels and the East/West Marine Biology Program.

Alfred E. Sloan Foundation Fellow. Department of Biology, Northeastern University, 1980-1982

NINCDS Postdoctoral Fellow in the laboratory of Prof. Allen I. Selverston, Department of Biology, University of California, San Diego, La Jolla, California, August, 1976 - July, 1978.

NSF-CNRS, U. S.-France Exchange of Scientists Postdoctoral Fellow in the laboratory of Dr. Francois Clarac, Institut de Neurophysiologie et Psychophysiologie, Centre National de la Recherche Scientifique, Marseilles, France, August, 1975 - July, 1976.

NIH Research Assistant in the laboratory of Prof. William J. Davis, The Thimann Laboratories, University of California, Santa Cruz, California. September, 1972 - July, 1975.

Teaching Assistant, Department of Biology, University of California, Santa Cruz, Sept., 1970 - Aug., 1972.

PROFESSIONAL ORGANIZATIONS:
Society for Neuroscience.
International Union of Physiologists.
International Society for Neuroethology
American Association for the Advancement of Science.
American Academy of Underwater Sciences

Scholarship

RESEARCH INTERESTS:

My research focuses on the neuroethology of motor systems in invertebrates and lower vertebrates. A developmental approach is directed toward establishing the adaptive mechanisms of simple action patterns and innate behavior. We have focused on the development of technology that allows recording from motor pattern generators and the behavior they control to directly address the mechanisms of behavior. We have performed these studies on the walking and feeding systems of lobster and the undulatory behavior of the lamprey. These studies have led to the biomimesis of ambulatory lobster-based and undulatory lamprey-based underwater robots. The robots are based on neurotechnology for myomorphic actuators, neuromorphic sensors and biomimetic controllers based on neuronal circuits. We are focusing on the achievement of reactive autonomy through the development of a process that allows the derivation of robotic behavioral libraries through reverse engineering the command sequences that underlie the behavior of the model species. An ongoing program of software development in digital neuronal signal processing biotelemetry, correlated motion and sensor based analysis from video and computational neuroethology supports all projects.

PUBLICATIONS:

Reish, D.J. and J. Ayers (1968) Studies on the Mytilus edulis community in Alamitos Bay, California. III. The effects of reduced dissolved oxygen and chlorinity concentrations on survival and byssus thread formation. **Veliger 10:** 384-388

Davis, W.J. and J. Ayers (1972) Locomotion: Control by positive feedback optokinetic responses. **Science 177**: 183-185

Ayers, J. and W.J. Davis (1977) Neuronal control of locomotion in the lobster. I. Motor programs for forward and backward walking. **J. Comp. Physiol. 115:** 1-24

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Ayers, J. and A. I. Selverston (1977) Synaptic control of an endogenous pacemaker network. **J. Physiol. (Paris) 73:** 453-461.

Clarac, F. and J. Ayers (1977) La marche chez les crustaces: Activite motrice programmee et regulation peripherique. **J. Physiol. (Paris) 73:** 523-544

Ayers, J. L. and W.J. Davis (1978) Neuronal control of locomotion in the lobster III. Dynamic organization of walking leg reflexes. **J. Comp. Physiol. 123:** 289-298

Ayers, J. and F. Clarac (1978) Neuromuscular strategies underlying different behavioral acts in a multi-functional crustacean leg joint. **J. Comp. Physiol., 128**: 81-94.

Ayers, J. and A.I. Selverston (1979) Monosynaptic entrainment of an endogenous pacemaker network: A cellular mechanism for von Holst's magnet effect. **J. Comp. Physiol. 129:** 5-17.

Ayers, J. (1980) Do different behaviors require different central pattern generators? **The Behavioral and Brain Sciences. 3:** 541.

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Pinsker, H. M. and Ayers, J. (1983) Neuronal Oscillators. Chapter 9 in: **The Clinical Neurosciences**. Section Five. Neurobiology. W. D. Willis [ed]. Churchill Livingstone Publishers. Pp. 203-266.

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Currie, S., and Ayers, J. (1983) Regeneration of Locomotor Command Systems in the lamprey. **Brain Research 279**: 238-240.

Ayers, J. L. and A. I. Selverston (1984) Synaptic perturbation and entrainment of the gastric mill rhythm in the spiny lobster. **Journal of Neurophysiology 51**: 129 - 141.

Prosser, C. L., Ayers, J., Green, E. and Nelson, D. (1985) Evolution of temperature regulation and constancy of function (Homeokinesis) at different temperatures. In: **Evolutionary Biology of Primitive Fishes**. R. E. Forman, A. Gorbman, J.M. Dodd and R. Olsson [eds.] Plenum Press.

Currie, S., and Ayers, J. (1987) Plasticity of fin command system function following spinal cord transection in larval sea lampreys, Petromyzon marinus, ***Brain Research 415:*** 337-341.

Clairborne, B. and J. Ayers (1987) Functional anatomy and Behavior. In: **The Crustacean Stomatogastric System.** A. Selverston and M. Moulins [eds.]. Springer-Verlag, Pp. 9-29.

Ayers, J. and Kushner, P. (1987) Contingent effects of synaptic input to the lobster stomatogastric pyloric system In: **The Crustacean Stomatogastric System**. A. Selverston and M. Moulins [eds.]. Springer-Verlag, Pp. 257-261

Bratton, B. and Ayers, J. (1988) Observations on the Electric Organ Discharge of two skate species and its relationship to behavior. ***Environ. Biology. Fishes 20:*** 241-254.

Ayers, J. (1989) Recovery of oscillator function following spinal regeneration in the sea lamprey. In: **Cellular and Neuronal Oscillators**. J. Jacklet, [ed]. Marcel Dekker, New York, Pp. 349-383.

Davis, B. M, J. Ayers, L. Koran, J, Carlson, M. Anderson and S. B. Simpson (1990) Time course of regeneration of the salamander spinal cord and the recovery of swimming: HRP retrograde tracing and kinematic analysis. ***Experimental Neurology 108:*** **1-16**

Maney, E.J., Ayers, J., Sebens, K.P, and Witman, J. (1990) Quantitative Techniques for Underwater Video Photography. In: **Diving For Science**. Am. Acad. Underwater Sci., St. Petersburgh. Pp. 255-265

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Ayers, J. and Crisman. J. (1992) The Lobster as a Model for an Omnidirectional Robotic Ambulation Control Architecture. In: **Biological Neural Networks in Invertebrate Neuroethology and Robots.**, R. Beer., R. Ritzmann and T. McKenna [eds], 287-316.

Ayers, J. and Crisman, J. and Massa, D. (1992) A Biologically-based Controller for a Shallow Water Walking Machine, ***IEEE Proc. on Oceanic Systems*** (1992) 837-842.

Massa, D., Ayers, J. and Crisman, J. (1992) Acoustic Communication, Navigation and Sensing Systems for a Biologically-based Controller for a Shallow Water Walking Machine, ***IEEE Proc. on Oceanic Systems***, (1992) 590-595.

Ayers, J. (1992) Desktop Motion Video for Scientific Image Analysis. ***Advanced Imaging 7:*** 52-55.

Swain, G.P., Snedeker, J.A., Ayers, J. & Selzer, M.E. (1993) The Cytoarchitectue of spinal-projecting neurons in the brain of the larval sea lamprey, ***J. Comp. Neurol, 336:*** 194-210

Ayers, J., Crisman, J. D. and Massa, D. (1993) A Biologically-based Controller for an Underwater Ambulatory Robot. **Proc. Int. Symp. Unmanned Untethered Submersible Technology**. Autonomous Undersea Systems Institute, Portsmouth, N.H., Pp. 60-68

Ayers, J., Kashin, S., Blidberg, D. R. and Massa, D. (1994) Biologically-Based Underwater Robots. ***Unmanned Systems 12:*** 30-36. .

Ayers, J. (1994) A Behavior-Based Controller Architecture for Reactive Underwater Robots. Proceedings of ZIF Conferences on **Prerational Intelligence and Robotics**, Beilefeld, Pp. 5-16.

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Breithaupt, T. and Ayers, J. (1995) Visualization and quantative analysis of underwater biological flow fields using suspended particles. ***Marine Behavior and Physiology,*** in press

Ayers, J. (1995) A Reactive Ambulatory Robot Architecture for Operation in Current and Surge. In: **Proc. of the Autonomous Vehicles in Mine Countermeasures Symposium**. Naval Postgraduate School. Pp. 15-31

Jalbert, J. Kashin, S. Ayers, J. (1995) A Biologically-based Undulatory Lamprey-like AUV. In: Proc. of the Autonomous Vehicles in Mine Countermeasures Symposium. Naval Postgraduate School. Pp. 39-52

Chappell, S and Ayers, J. (1995) Innate and Modulated Autonomous Underwater Vehicle Behavior. In: Proc. Int. Symp. **Unmanned Untethered Submersible Technology**. Autonomous Undersea Systems Institute, Portsmouth, N.H., Pp. 376-387.

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Ayers, J, Zavracky, P., McGruer, N., Massa. D., Vorus, W., Mukherjee, R. and Currie, S. (1998) A Modular Behavioral-Based Architecture for Biomimetic Autonomous Underwater Robots. In: **Proc. of the 3rd International Conference on Technology and the Mine Problem**. Naval Postgraduate School. *CDRom.*

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Rudolph, A., J. Ayers, J. Davis, M. V. Srinivasan, M. Willis, R. Cartledge, R. Potember, R, Triendl, V. Payne, (1999) Multidisciplinary Bioscience & Technology In Japan. **DARPA/DSO Technical Repor**t.

Ayers, J., J. Witting, C. Wilbur P. Zavracky, N. McGruer and D. Massa (2000) Biomimetic Robots for Shallow Water Mine Countermeasures. In **Proceedings of the 4th International Conference on Technology and the Mine Problem**. 16 Pages,*CD Rom.*

Ayers, J. (2000) A Conservative Biomimetic Control Architecture for Autonomous Underwater Robots. In: **Neurotechnology for Biomimetic Robots**,. J. Ayers, J. Davis and A. Rudolph [eds]. MIT Press, In press.

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Ayers, J., Witting, J., McGruer, N., Olcott, C., Massa, D. (2000) Lobster Robots. In: **Proceedings of the International Symposium on Aqua Biomechanism**s. T. Wu and N, Kato, [eds]. Tokai University.

Ayers, J., Wilbur, C., Olcott, C. (2000) Lamprey Robots. In: **Proceedings of the International Symposium on Aqua Biomechanism**s. T. Wu and N, Kato, [eds]. Tokai University.

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Ayers, J. and A. I. Selverston (1977) Monosynaptic control of inter- and intra-oscillator coordination of an endogenous pacemaker network. **Soc. Neurosci. Abstr. 4**: 267

Ayers, J. (1978) Synaptic perturbation and entrainment of the gastric mill rhythm of the spiny lobster. **Soc. Neurosci. Abstr. 5:** 379.

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Ayers, J., Currie, S., Kinch, J. and Pereira, W. (1982) Adult lampreys can recover from complete spinal cord transection. **Soc. Neurosci. Abstr. 8**: 868.

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Kaufman, D., Margolin, L and J. Ayers (1985) Behavioral analysis of the recovery of command system function following spinal transection in larval and adult sea lampreys. **Soc. Neurosci. Abstr. 11:** 589.

Swain, G. P. and Ayers, (1986) Development of descending reticulospinal systems during transformation in the Sea Lamprey. **Soc. Neurosci. Abstr. 12:** 318

Ayers, J. and Wilbur, C. (1986) Recovery of swimming following spinal transection is enhanced at lower temperatures in larval sea lamprey.. **Soc. Neurosci. Abstr. 12:** 1574

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Jordan, S. and Ayers, J. (1991) Recruitment of Reticulospinal Neurons during Swimming Command Microstimulation in Lamprey. **Soc. Neurosci. Abstr. 17:** 944.

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Joseph Ayers, Lars Schlichting & Cricket Wilbur, (1998) Reverse Engineering Behavior In The Lobster By Finite State Analysis. Abs Soc Neuroscience, in press

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Joseph Ayers (2000) A Biomimetic Architecture For Sensing, Modulation, And Sequencing Autonomous Behavior,. Abs. Soc Neuroscience 26: 805

Joseph Ayers (2001) A Biomimetic Architecture For Sensing, Modulation, And Sequencing Autonomous Behavior, Proc. Int. Cong on Neuroethology, Bonn, 6: 329

INVITED LECTURES 1990-present

The Lobster: Biological Intelligence as a Model for a Robotic Control Architecture. ONR Conference of Locomotion Control in Legged Invertebrates, National Academy Study Center. Woods Hole, MA Sept 13, 1991.

Correlation of Behavior with Unit Electrophysiology . Scientific Computing and Automation Conference. Philadelphia. PA Sept 11, 1991 Session Chair: Scientific Imaging on the Macintosh.

In Vivo Recording During Behavior. Williams College, November 1, 1991

Correlation of Kinematic and Electrophysiological Analysis on the Macintosh II. SEAM92 Conference of MacSciTech, MacWorld Expo, San Francisco, CA. January 19, 1992. Session Chair: Scientific Image Processing and Analysis

In Vivo recording from Regenerating Reticulospinal Neurons In the Lamprey, Bowdin College, February 20, 1992

Marine Research: The Atlantic Lobster. Presentation to the National Science Teachers Association, Boston, March 27, 1992

Recruitment of Reticulospinal Neurons During Swimming Command Microstimulation in Lamprey. East Coast Nerve Net - Eighteenth Annual Meeting, March 28, 1992. with Sarah Jordan

Effects of Eyestalk Manipulation on Gastric Mill Rhythms in Homarus Americanus. East Coast Nerve Net - Eighteenth Annual Meeting, March 28, 1992. with Alicia Morris

Sonar Biotelemetry from the Lobster Feeding and Stomatogastric Systems, Laboratory de Neurophysiologie Comparee, CNRS, University de Bordeaux, Archecon, France. May 22, 1992

Lecturer in the Neurobiology Course, Isle of Shoals Marine Laboratory, Cornell University, June 1992

Scientific Image Analysis on the Macintosh II. Education Conference, MacWorld Expo, Boston MA. August 6, 1992.

Lobster Neuronal Network-Based Controllers for Ambulatory Robots, DARPA Undersea Warfare Program, Arlington Virginia, September 14, 1992.

The Laboratory Toolbox. Hypercard Conference, MacWorld Expo, San Francisco, CA. January 6, 1993.

Correlated Motion and Sensor Analysis on the Macintosh. MacWorld Expo, San Francisco, CA. January 7, 1993. Session Chair: Enabling Technologies in Scientific Research and Education

The Lobster as a Model for an Underwater Ambulatory Robot, MIT Sea Grant, February 9, 1993.

Lecturer in the Mariculture Course, Marine Biological Laboratory, Woods Hole. June, 1993

Sonar Telemetry of Physiological Data from Freely Behaving Lobsters. SEAM93 Conference of MacSciTech, MacWorld Expo, Boston, MA. August 2, 1993.

Reverse-Engineering Lobster Control Systems for Robot Controllers. SEAM93 Conference of MacSciTech, MacWorld Expo, Boston, MA. August 2, 1993.

The Laboratory Toolbox. Hypercard Conference, MacWorld Expo, Boston, MA. August 3, 1993.

The Mac as a Spatial Spectrophotometer. MacWorld Expo, Boston, MA. August 4, 1993. Session Chair: Cutting Edge Technologies in Scientific Research and Education

Lobster Locomotion Control. Sept. 9, 1993. ONR Symposium on Aquatic Locomotion, National Academy of Sciences Study Center, Woods Hole

A Biologically-Based Controller for an Underwater Ambulatory Robot. Sept, 27, 1993. Eighth International Symposium on Unmanned Untethered Submersible Technology. University of New Hampshire

Development and Behavior the Lobster Feeding and Stomatogastric Motor Systems. November 9, 1993. Stomatogastric Mini-Symposium, Society for Neuroscience Annual Meeting, Washington, DC.

Adaptive Control of an Ambulatory Underwater Robot. November 10, 1993, Expeditionary Warfare Office (OPNAV85), Department of Defense, The Pentagon.

Computational Neuroethology of the Lobster Walking System. December 9, 1993, Institute of Zöology, University of Hamburg, Germany

Computational Neuroethology of the Lobster Walking System. December 13, 1993, Institute of Zöology, University of Köln., Germany..

Computational Neuroethology of the Lobster Walking System. December 15, 1993, Institute of Zöology, University of Bonn, Germany.

Biologically-Based Robots, December, 1993, Department of Physics, Northeastern University

Lobster Biotechnology, March, 28, 1994, National Council, Northeastern University

Lobster Based Robots. East Coast Nerve Net - Twentieth Annual Meeting, April 4, 1994.

A Lobster Based Ambulatory Robot Controller, May 16, 1994, Zentrum für interdisziplinäre Forschung Conference: "Prerational Intelligence in Robotics: From Sensorimotor Intelligence to Collective Behavior. Universität Bielefeld. Germany

A Behavior-Based Controller Architecture for Underwater Ambulatory Robots, Advanced Research Projects Agency, Undersea Warfare Program, Arlington, VA. December 12, 1994

Biologically-Based Robots in Surf-Zone Mine Countermeasures. Carl Menneken Lecture in Mine Warfare. Naval Postgraduate School, Monterey, CA, January 19, 1995.

Biologically Based Underwater Robot Controllers, Review meeting on **Bio-Locomotion and Rotational Flow over Compliant Surfaces**, Sponsored by ARPA and ONR, Johns Hopkins University, March 20-22 1995. Baltimore

Development of Stomatogastric Mediated Motor Programs In The American Lobster. Boston Area Neuroscience Group, Northeastern University, March 27, 1995 (Poster with Kari Lavalli)

A Lobster-based Underwater Robot Controller, Boston Area Neuroscience Group, Northeastern University, March 27, 1995 (Poster with Lars Schlichting)

A Reactive Walking Robot Architecture for Operation in Current and Surge, Environmental Session, *A Biologically-Based Undulatory AUV*. Contributed Papers Session. *A Generic Biologically-Based Control Architecture*, Vehicles Session. Panel Member, Environments Session. Chair: Contributed papers session. **Symposium On Autonomous Vehicles in Mine Countermeasures.** Naval Postgraduate School, April 4-7, Monterey, CA.

Biologically Based Underwater Robots. Electro / 95 International, Boston, MA June 23, 1995

Computational Neuroethology of Undulatory and Ambulatory Locomotion. MacWorld Expo. Macs in Science / Technology, Boston MA, August 9, 1995.

Biologically Based Underwater Robots. Boston University Marine Program, Boston, MA November 16, 1995

Computational Neuroethology of Underwater Locomotion. Department of Zoölogy, University of Victoria, Victoria, BC. Feb. 16, 1996

Opportunities in Marine Biotechnology. Swampscott High School, May 21, 1995.

How to be a Marine Biologist. Lynn Classical High School, Career Day, Lynn Classical High School,. June 11, 1996.

Neurotechnology for Biologically-Based Underwater Robots, Marine Biological Laboratory, Woods Hole, MA , December 11, 1996.

Reverse Engineering Marine Animals to Design Underwater Robots. Member of the Faculty of MacWorld Expo in San Francisco. Participant in the Science and Engineering Conference, January 10, 1997.

Neurotechnology for Biologically-Based Underwater Robots, Institute of Marine Sciences of the University of California, Santa Cruz, January 14, 1997.

"Mennekin Lecture on Mine Warfare" titled *Biologically-Based Robots for Littoral Zone Remote Sensing*, Naval Postgraduate School in Monterrey, California. January 16, 1997

Neurotechnology for Biologically Based Underwater Robots. DARPA, Defense Sciences Office May 17, 1997.

Career Opportunities in Marine Biology. Lynn Classical High School, Career Day , Lynn Classical High School,. June 11, 1997.

Neurotechnology for Biologically Based Underwater Robots. MIT Department of Ocean Engineering,, July 13, 1997.

Biomimetic Underwater Robots. Controlled Biological Systems Workshop, DARPA, Herndon VA. Oct 21, 1997.

Biomimetic Underwater Robots. Mine Warfare Technology Program, Naval Undersea Warfare Center, Newport, RI. December 10 , 1997.

Neurotechnology for Biomimetic Underwater Robots. Neurotechnology for Autonomy in Aeronotics and Space Exploration, NASA Ames Research Center, January 14, 1997

A Modular Behavioral-Based Architecture for Biomimetic Autonomous Underwater Robots, Naval Postgraduate School, April 7, 1998

Biomimetic Underwater Robots: DARPA: Controlled Biological Systems Kickoff Meeting. San Diego CA August 4, 1998.

Neurotechnology for Biomimetic Underwater Robots. German National Research Center for Information Technology , Sankt Augustin, Germany. October 23, 1998

Finite State Analysis of Behavior. Artificial Ethology Conference, Lanzarote, Canary Islands, July 2, 1998.

Neurotechnology for Biomimetic Underwater Robots. AAIA Robotic Forum, Draper Laboratories, July 16, 1998.

Biomimetic Underwater Robots: DARPA: Controlled Biological Systems Kickoff Meeting. San Diego CA August 4, 1998.

Neurotechnology for Biomimetic Underwater Robots. German National Research Center for Information Technology, Sankt Augustin, Germany. October 23, 1998

MEMs Sensors for Underwater Robots. DARPA Controlled Biological Systems Program Review, Tucson, AZ. January 4, 1999

Neurotechnology for Biomimetic Underwater Robots. Department of Biology. Northeastern University, February 10, 1999.

Demonstration of Biomimetic Robots. US. Marine Corps, Sea Expo. USS Hornet, Alameda Naval Station. March 19-21, 1999.

Neurotechnology for Biomimetic Underwater Robots. Department of Psychology, Smith College, March, 24, 1999.

Autonomous Underwater Vehicles, IEEE Robotics and Automation Society, Wellesley, MA June 8, 1999

Biomimetic Underwater Robots, Autonomous Systems Laboratory, Peripheral Systems Laboratories, Fujitsu Laboratories, Tokyo, Japan, May 17, 1999.

Behavior-based Underwater Robots, Mini-Brain Program, Hokkaido University. Hokkaido, Japan, May 18, 1999.

Biomimetic Underwater Robots, School of Marine Science and Technology, Tokai University, Shimizu City, Japan, May 19, 1999.

Biomimetic Underwater Robots, Department of Mechanical Engineering, Tokyo Institute of Technology. Tokyo, Japan, May 20, 1999.

Biomimetic Underwater Robots, Underwater Technology Research Center, Institute of Industrial Science, University of Tokyo, , May 20, 1999.

Biomimetic Underwater Robots, Electronics R&D Division, Mitsubishi Heavy Industries, Yokohama, Japan, May 21, 1999.

How to Become a Marine Biologist, Careers Day, Lynn Classical High School, June 8, 2000.

*Autonomous Underwater Vehicle*s, IEEE Robotics and Automation Society, Wellesley, MA June 8, 1999
Lobster Robots, 2nd, International Symposium in Frontiers in Crustacean Neuroscience. Hamburg, Germany, July 12, 1999

Biomimetic Underwater Robots, Marine Corps Future Laboratory, Quantico, VA August 17, 2000.

Behavior-based Underwater Robots. 1st Gordon Conference on Neuroethology and Behavior, Queens College, Oxford University. September 2, 1999.

Biomimetic Robots for Shallow Water Mine Countermeasures, Plenary Lecture 4th International Conference on Technology and the Mine Problem, Naval Postgraduate School, Pacific Grove, CA. Session Leader: Autonomous Underwater Vehicles. March 15-16, 2000.

Biomimetic Ambulatory and Undulatory Underwater Vehicles (Lecture and Technical Demonstration). Controlled Biological Systems PI Meeting, San Antonio, Texas. April 11, 2000.

Crustacean Gait Control: Biomimetic Implementation. & Undulating Locomotion: Biomimetic Implementation (2 talks) NASA Workshop on Invertebrate Sensory Information Processing: Implications for Biologically Inspired Autonomous Systems. Jonsson Center of the National Academy of Sciences, April 16, 2000.

Biomimetic Ambulatory and Undulatory Underwater Vehicles (Lecture and Technical Demonstration). Controlled Biological Systems PI Meeting, San Antonio, Texas. April 11, 2000.

A Conservative Biomimetic Control Architecture for Autonomous Underwater Robots. International Conference on Neurotechnology for Biomimetic Robots, Nahant, MA.

Lobster Robots. Keynote Speech. 1st International Symposium on Aqua Bio-Mechanisms, Tokai University Pacific Center, Honolulu, HI August 27, 2000.

Biomimetic Underwater Vehicles (Lecture and Technical Demonstration). Controlled Biological Systems PI Meeting, Breckenridge, CO. March 22-23, 2000.

SOFTWARE SYSTEMS DEVELOPED

(1) Graphics utilities which support general parametric graph editing (*MacGraph*), phase response curve and entrainment analysis (*MacPRC*) and use of the Farallon MacRecorder as a digital oscilloscope (*MacScope*).

(2) Ongoing development of *MacLamprey*, a Macintosh based program for the analysis of undulatory locomotion which supports, curvature analysis, and and graphical display for timed based analysis of electrophysiological and kinematic data. This program is fundamental to our work on the analysis of undulatory locomotion and received data acquired from video-tape by the program ColorImage

(3) Ongoing development of *SpikeTrain* Macintosh based signal processing application which resolves multi-unit nerve recordings into the activity patterns of individual neurons. The programs interface with ColorImage to acquire *in vivo* recordings from the lamprey CNS and direct correlation with kinematic behavioral analysis Over the past year I have made a major enhancement of this program by completely rewriting it in Pascal and porting it the the Macintosh. This program is fundamental both to my collaboration with Prof. Georg Heinzel (University of Bonn) and my proposed program with David Brady and Don Massa on Real-Time sonar telemetry of electrophysiological data. I expect to distribute this via the National Institutes of Health Bulletin Board when completed. (1991-present)

(4) General purpose programs for data entry and analysis of frog kinematics and jump trajectories (1988-1989)

(5) Ongoing development of *ColorImage* a true color image analysis program which supports the segmentation and quantification of objects from true (24bit) color images of natural scenes and motion analysis from digital movies. We have recently upgraded this program to support the Functionality of NIH Image V1.51, the RasterOps 24STV frame grabber and the Cambridge Research Instruments *Varispec Tunable Filter*. This latter instrument supports real-time digital spectroscopy using the Macintosh. ColorImage is the basis for our current reverse kinematic analyses of lobster locomotion for our ONR Lobster Robot program and lamprey locomotion for our ARPA Undulatory Robot program.. It has been distributed nationally though electronic bulletin boards at National Institutes of Health and MacSciTech for over five years and on the MacSciTech CD-ROM. With Garth Fletcher (1990-present)

(6). Development of *Laboratory Toolbox*, a multimedia Hypercard stack which supports acquisition, analysis and data-base management of image, table and sensor data. This stack originated as a project for my course Biological Laboratory Computing and has attracted interest from several local software and hardware vendors who have donated equipment to be supported. I am distributing the *Laboratory Toolbox* Hypercard Stack nationally through the NIMH, MacSciTech and Stanford InfoMac electronic bulletin boards. I am using variants of this program as the basis of a K-12 outreach program (The Johnson School Hypercard Club) to the Nahant School District. (1991-present)

(7) Development of *SonarRecorder* and *SonarViewer* which are two utilities for long term sonar biotelemetry using the Massa Products E-326T and E-326R telemetry systems. These programs allow the continuous acquisition of telemetry data from both pool hydrophones as well as a radio sonobuoy *(SonarRecorder)* and graphical visualization and statistical analysis of the results *(SonoView).*

(8) Development of *MotorProgram*, a simulation program for demonstration of stomatogastric, walking, gait and metachronal rhythm pattern generation mechanisms by invertebrate motor pattern generators.

(9) Ongoing Development of *Ambulator II*, which implements a finite state machine for the control of omnidirectional ambulation. This program is the basis of our research program for the development of a lobster-based autonomous robot. Over the past year we have added behavioral sequencing and sensor models to this development platform. (1992-present).

(10) Ongoing Development of *Undlator I*, which implements a finite state machine for the control of undulatory locomotion. This program is the basis of our research program for the development of a lamprey-based autonomous robot. This program generates control signals for a 5 segment unduator which can generate lamprey, carp, shark and trout motor patterns. (1994-present).

RESEARCH SUPPORT:

Research Grants and Fellowships

National Science Foundation Training Grant, Department of Biochemistry, University of California, Riverside, Summer, 1968.

U. S. Public Health Service Training Grant, Department of Biology, University of California, Riverside, 1968-1969.

NSF-CNRS, U. S.-France Exchange of Scientists Postdoctoral Fellowship, Centre National de la Recherche Scientifique, Marseilles, 1975-1976.

NINCDS Postdoctoral Fellowship, Department of Biology, University of California, San Diego, 1976-1978, competitive renewal also awarded for 1978-1979.

Analysis of Lamprey Behaviors. Funded by Northeastern University College of Arts and Sciences Research Grant Program

Alfred E. Sloan Research Fellowship. Department of Biology, Northeastern University, 1980-1982

Behavioral and Physiological Analysis of Spinal Cord Regeneration in the Sea Lamprey. (1982) Northeastern University RSDF, J. Ayers.$4,990

Analysis of Neural Circuit Variability. funded by Biomedical Research Support Grant # RR07143.

Regeneration in the Lamprey Spinal Cord. funded by Biomedical Research Support Grant RR07143.

Analysis of behavior with a Digital Camera funded by Biomedical Research Support Grant RR07143.

Development of Interdisciplinary Neurosciences Courses at Northeastern University . With Norman Boisse and Alex Skavenski. Funded by the Northeastern University Instructional Development Fund.

Regeneration of Locomotor Command Systems. Funded by National Science Foundation Developmental Neuroscience and Science and Technology to Aid the Handicapped Programs, BNS 8406880.1984-1987

Functional Anatomy of Frog Tecto-Motor Systems. With David Ingle. Funded by National Science Foundation, Integrative Neural Sciences Program. January 1, 1988, Dec. 31, 1990

Development of True Color Picture Processing Algorithms. Funded by Apple Computer. June, 1988

Acquisition of an Electronic Still Video System for Color Image Analysis. Funded by the NIH BSRG Support Grant, January, 1989

Development of A Biological Image Processing Facility.(1990) With Kenneth Sebens, Jon Witman., David Ingle, and M.P. Morse, Funded by the National Science Foundation Instrument and Instrument Development Program. (DIR-8917532)

Improvement of Research Facilities at Marine Science Center (1990) K.P.Sebens, P.I. J. Ayers, MP.Morse, J. Witman co-investigators. Funded by the NSF Marine Facilities Program (DIR-9013164) 7/90-6/92, $161,000

Neuroethological Analysis of Lobster Feeding Using Sonar Biotelemetry (1991) J. Ayers, P.I. Funded by the NSF Neural Mechanisms of Behavior Program, 1991-1992, $14,000 BNS 9021278

Development of Multi-Channel Sonar Biotelemetry Systems for Analysis of Motor Pattern Modulation (1991) J. Ayers, P.I. Donald Massa, Co-investigator. Funded by the Office of Naval Research, Biological Intelligence Program. 1991-1992, $40,000 Grant # N00014-91-J-1822

Comparative Analysis of Lobster Feeding and Stomatogastric Motor Programs (1991-1994) J. Ayers, P,I. , Georg Heinzel (University of Bonn) co-investigator Funded by the Human Frontiers Research Program. 1991-1993. $56,000

Development of a College of Arts and Sciences Multi-Media Laboratory (1992) with Gerald Herman. Funded by the College of Arts and Sciences, Northeastern University, $65.000.

Development of Lobster Feeding and Stomatogastric Motor Programs. (1992) J. Ayers, P.I. Funded by the NSF Neural Mechanisms of Behavior Program, IBN-9121224, 1992-1994, $79,000

Biological Based Control of Omnidirectional Robot Walking (1992) with Jill Crisman. Funded by the Northeastern University Research and Scholarship Development Fund. 1992-1993,. $9,200.

D. R. Blidberg, PI., Joseph Ayers, Sergei Kashin coPIs. *Development of a Biologically-based Undulatory Autonomous Submersible Robot.* Advanced Research Project Agency Start Date May 1, 1994, Duration: 18 Months. Direct Costs: $308,048, Indirect Costs: $155,467.

Massa Products, Corporation, SBIR Grant. With D. Massa, J. Ayers, D.R. Blidberg and J.D. Crisman. (1994) *Legged Vehicle for Underwater Mobile Operations.* ONR SBIR Phase 1 Proposal Topic # N93-139, Start Date Feb 26, 1994; Duration 18 months. Total Costs $75,000, Direct Costs to NU $9,366, Indirect Costs: $5,432.

Joseph Ayers (1998) Summer Marine Biology Institute. GE Fund, $25,000.

Joseph Ayers and Donald Massa Integration of an Ambulatory Robotic System with an Acoustic Lane Marking System for Littoral Zone Mine Countermeasures. DOD 1997 STTR Topic N97T002, $99,880.

Joseph Ayers (PI), Donald Massa, William Vorus, Paul Zavracky, Nicol McGruer, Ranjan Mukherjee, Scott Currie Development of Biomimetic Undulatory and Ambulatory Underwater Robots, DARPA-DSO Biomimetic Systems Program. ONR Grant N00014-98-1-0381. $3,160,233. March 1, 1998-February 28, 2001

Joseph Ayers (1998) Summer Marine Biology Institute. GE Fund, $23,500.

Donald Massa, David Brady and Joseph Ayers (1998) Development Acoustic Lane Marking and Navigation System for Littoral Zone Mine Countermeasures. DOD 1998 Phase 2 STTR Topic N97T002, $749,204

INDUSTRIAL COLLABORATIONS

Massa Products, Inc, Hingham, MA Donald Massa (President of MPI) has collaborated as a co-investigator on the Lobster Sonar Biotelemetry and the Biomimetic Projects.

Fletcher Applied Sciences, Mason NH. Garth Fletcher has collaborated with me from the inception of ColorImage. He developed the color quantization algorithms fundamental to color image segmentation. We have enhanced ColorImage to support color based motion analysis using the Sequence Grabber, providing the only NIH Implementation that supports the video technology in modern Macintoshes.

Abbate Video Consultants, Norfolk, MA . I have been collaborating with Mark Abbate on the development of both ColorImage and the Laboratory Toolbox. Abbate Video Consultants developed the serial interface between Macintosh and Sony VCR's and CamCorders which has enabled the motion analysis capabilities of these two projects.

Dynamic Structures and Materials, LLT. We collaborate with DSM in the development of training algorithms for artificial muscle.

East Coast Seafood, Lynn, MA. I have collaborated with Michael Tourkistas (President, East Coast Seafood) on a project to develop holding conditions to optimize shell hardening in soft shell lobsters. East Coast Seafood is the largest shipper of lobsters in the world.

GW Instruments, Somerville, MA. I supported the GW instruments MacAdios technology in the Laboratory Toolbox Hypercard project. I was portrayed in their advertisements in Science, Journal of Neuroscience and Journal of Neurophysiology.

POPULAR PRESS and TV COVERAGE:

Lampreys aid paralytics? In **Science Digest 90:** 94. 1984

D. Herold Lamprey Man. In: **North Shore Sunday 11:** 1-5, 1988

They're building a Fish? **Lynn Daily Evening Item**, June 9, 1994

Biological-Based Robots **Popular Mechanics Magazine Show**, Discovery Channel, November 16, 1995 (Nationally Broadcast) Rebroadcast on several occasions.

Macintosh takes a big bite of the education apple. By David Liscio, Mass High Tech 14: 13. August 19, 1996

Remote Reality Robots, By Glennda Chui, **San Jose Mercury News,** May 28, 1998

Sea Robots to prowl Nahant's Shorelines. By Chris Iacono. **Lynn Daily Evening Item** March 20, 1998

Here's the catch: cleaner water has meant disappearing lobsters. By Peter J. Howe, **Boston Globe** 4/16/98.

Ideas: The Bionic Lobster By John Yemma, Boston Globe Magazine, June 14, 1998

Simple Nematode may Give Navy a New Way to Find Mines. By Louis Jacobson. **The Washington Post**: Science: Robotics. August 24, 1998

Wiggling Through the Waves. By Amy Adams. **New Scientist** Vol160: 32-35. October 10. 1998

Pentagon Recruiting Bees, Cockroaches and Wasps by Jeff Nesmith .1999 **Cox News Service**

Marine Camp has no drills: Ocean Lures Kids to Nahant Program. **Lynn Daily Evening Item**, August 14, 1999.

Frankensteins Lobster? By Marie Lingblom. **North Shore Sunday**, June, 20, 1999. Pp 12-14.

Pentagon Recruits insects to find land mines. **Riverside Press Enterprise**, July 25, 1999.

Natural Born Robots, **Scientific American Frontiers**, Public Broadcasting System, November 2, 1999

Le.top.des.réseaux / nvtechno **Le Monde Interactif** du mercredi 28 avril 1999, Stéphane Mandard

Robotic Lobsters, Fox 2000, Broadcast in May Fox TV

Spy Fly: Tiny, winged robot to mimic nature's fighter jets. By Chuck Squatriglia, **San Francisco Chronicle** , November 2, 1999

PHOTO ESSAY: Robots. By Peter Menzel **Business Week**, Dec. 13, 1999

Notebook: Don't Tell the Chinese, By Harriet Barovick, Michelle Derrow, Tam Gray, Daniel Levy, Lina Lofaro, David Spitz, Flora Tartakovsky And Chris Taylor, **Time Magazine**. June 21, 1999

Lego Mindstorms Website: The BURP Program was featured in the ROBOTNEWS section during the months of Dec, 1999-Jan, 2000.

BBC, Nature. *Robocritters*, Shown in Britain March 2000, To be aired on the Learning Channel in the US

Biologists and Engineers Create a New Generation of Robots That Imitate. Life. By Gary Taubes **Science** 2000 Apr 7;288(5463):80-3

Building a Perfect Lobster Robot. By Gary Taubes **Science** 2000 Apr 7;288(5463):82

Biobots By Peter Menzel and Faith D'Aluisio **Discover** Vol. 21 No. 9 (September 2000)

RoboSapiens. By Peter Menzel and Faith D'Aluisio, MIT Press, 2000

Robots mimic living creatures by Yvonne Carts-Powell **SPIE OE Reports** Number 201 September 2000

Pentagon sends robo-lobster on ocean patrol. By Will Iredale **London Sunday Times**, April 1, 2001.

Teaching

COURSES DESIGNED AND IMPLEMENTED:

General Neurophysiology	
Graduate Neurophysiology Laboratory	
Advanced Cell Biology	
Human Anatomy and Physiology I.	With Laboratory
Human Anatomy and Physiology II	With Laboratory
Human Physiology I.	With Laboratory
Comparative Neurobiology	With Laboratory
Vertebrate Physiology I.	With Laboratory
Foundations of Neural Science	
Special Topics in Neural Science	
Neuroethology	With Laboratory
Biological Laboratory Computing	With Lab / Demonstration
Senior Seminar	

Graduate Seminars:
Neural Mechanisms Underlying Behavior
Synaptic Transmission
Behavioral Neurobiology
Spinal Cord Regeneration
Lamprey Neurobiology
Problem Solving in Biological Laboratory Computing

GRADUATE and POSTDOCTORAL STUDENTS:

Bradford Bratton, MS, 1980, Thesis Title: *Electric Organ Discharge Patterns in Raja erinacea and their Relation to Behavior*. Currently: Visiting Asst Prof. Colby College

Scott Currie, MS, 1981, Thesis Title: *Recovery from Spinal Cord Transection in Larval and Adult Lampreys.* Currently: Associate Professor, University of California, Riverside

Galen Eaholtz, MS, 1986, Thesis Title: *Recovery of Locomotion following Spinal Cord Transection in the larval sea lamprey, Petromyzon marinus: A Functional Determination. Currently*: Postdoctoral Associate: University of Washington.

Dean Kaufman, MS, 1988, Thesis Title: *Brainstem control of Undulatory Behavior in the Sea Lamprey*. Currently: Senior Scientist, Siemens Corporation

James Kinch, MS, 1988, Thesis Title: *Quantitative Analysis of Undulatory Behavior in Normal and Recovered Spinally Transected Sea Lamprey*. Currently: Vice President, Toxicon Corporation.

Gary Swain, Ph.D. 1989, Project Title: *Correlation of Anatomical Regeneration with Behavioral Recovery of Swimming in the Sea Lamprey*. Currently: Laboratory Director, Department of Neurology, University of Pennsylvania Hospital.

Lee Margolin, Ph.D. 1989, Project Title: *Behavioral and Electro-physiological Analysis of Recovery from Spinal Cord Transection in Adult Sea Lamprey, Petromyzon marinus.* . Currently: Senior Scientist, Frederick Haer Associates, Portland.

Karen Lee, Ph.D, 1993. Dissertation Title: *Interactions between Stomatogastric and Feeding Motor Programs in the American Lobster, Homarus americanus*. Currently an Assistant Professor, University of Pittsburgh at Johnstown

Sarah Jordan, M.S. 1993. Project Title: *What neurons underly the initiation and modulation of electrically evoked swimming in normal and recovered spinal transected Lamprey*. Currently: Education Coordinator, Shoals Marine Laboratory.

Traci Garofalo, Project Title: *Neuroethological analysis of Arousal and Behavioral Switching in Recovered Spinally Transected Lamprey* MS Granted, 1996. Currently: Veterinary Assistant, Salem MA.

Jan Witting, Ph.D. 1999. Project Title: *Prey capture by Corals. Currently: Postdoc MSC*
.

Kari Lavalli, Ph. D., NSF Postdoctoral Associate. Project Title: *Development of Lobster Feeding and Stomatogastric Motor Programs, 1992-1994.*

Jan Witting. Postdoctoral Associate on the DARPA Biomimetic Robot Project, 1999 to present

Service

NATIONAL PEER REVIEW ACTIVITIES:

Proposal Reviewer, National Science Foundation, Neurobiology Program, Developmental Neurobiology Program, Integrative Neural Sciences Program, Spinal Cord Research Foundation

Manuscript Reviewer, Science, The Journal of Neurophysiology, Neuroscience, Journal of Experimental Biology, The Journal of Neurobiology, Experimental Brain Research

Departmental, College and University Committees

Member, State of the Biology Department Ad-Hoc Committee, 1979.

Chairman, University Academic Computer Policy Committee. 1978-1980 Chairman, 1980-1981,1981-1982, 1984-1985. Reappointed for 1987-1989.

Member, Special Advisory Committee to the Provost for Computer Affairs, Northeastern University, 1984-1986. Member of acquisition committee which specified the University Ethernet Network, 1984-85 and Central VAX8650 System, 1985-1986.

Chairman, Biology Colloquium Committee Northeastern University, 1979-1980, 1984-1985

Member, Committee on Research and Scholarship, College of Arts and Sciences, Northeastern University, 1981-1982

Member, Steering Committee, Center for Marine Science and Maritime Studies College of Arts and Sciences, Northeastern University, 1982 - 1983.

Member, Physiology Search Committee, Department of Biology, Northeastern University, 1982.

Member, Graduate Committee, Department of Biology, Northeastern University, 1980-1985.

Member, Honors Committee,College of Arts and Sciences, Northeastern University, 1983-1984.

Member, Director Search Committee, Marine Science and Maritime Studies Center, Northeastern University, 1984.

Member, Physiology Search Committee, Department of Biology, Northeastern University, 1984.

Member, Physiology Search Committee, Department of Biology, Northeastern University, 1986-1987

Member, University Microcomputer Committee, Northeastern University, 1986-1987.

Chairman, Word Processing Committee, Department of Biology, 1987-1988

Member, University Council on Research and Scholarship, Northeastern University 1988-1991.

Member, Information Services Strategic Planning Committee, Office of the Provost, Northeastern University, 1992-1993.

Member, Experiential Education Strategic Planning Committee, College of Arts and Sciences, Northeastern University, 1992-1993.

Member, Urban Education Strategic Planning Committee, College of Arts and Sciences, Northeastern University, 1992-1993.

Member, Academic Computing Advisory Committee, Northeastern University, 1991-1993.

Chairman, Research Computing Subcommittee, University Council on Research and Scholarship, Northeastern University 1990-1991.

Member, Distinguished Professor Selection Committee, Northeastern University 1989

Member, Electrical and Computer Engineering Graduate Program Review Committee, Northeastern University, 1989

Member, Faculty Senate, Northeastern University, 1993-1995.

Member, College Council, College of Arts and Sciences, Northeastern University, 1979-1981., 1992-Present

Service as Interim Director and Director, Marine Science Center

Facilities Development

NSF Facilities Progam Laboratory Addition

During the summer and fall of 1992, I oversaw the new addition to the MSC main building, This addition provides office/laboratory space to up to 8 visiting scientists.

Bunker 104

With a gift of $30,000 from Y.T. Li and Associates I oversaw the renovation of the south Gunport and main gallery of Bunker 104. This project achieved:

(1) Extension of a 4 inch passive seawater supply and return line from the Edwards laboratory to the south gunport of Bunker 104.
(2) Installation of a 200 amp electrical service to the south gunport
(3) Installation of a dehumidification system in the south gunport and an exhaust system in the north gunport to prevent condensation in the bunker.
(4) Installation of a roll top door and crashbar emergency exit in the south gunport
(5) Sealing and painting the south gunport
(6) Installation of a halogen lighting system in the south gunport.
(7) Installation of emergency lighting and exit signs.

Marine Systems Engineering Laboratory

A gift to MSC from Massa Products Corporation supported the renovation of the Generator Room of Bunker 104 area as the physical facilities for the Marine Systems Engineering This adds ~4000 sq. ft. of habitable laboratory space to MSC. This space is currently used as a Lecture Hall and houses the robot program.

Mariculture Laboratory

Through support of R.V. Trappist (Gloucester, MA) we established a mariculture laboratory in Bunker 104 that has been augmented by state funds and is currently used for the K-12 outreach program.

Robotics Laboratory

During 1998, we have renovated the muffler gallery in the Frank Massa Marine Systems Engineering Laboratory to house the DARPA Biomimetic Robot Project.

Biological Imaging Laboratory

The Biological Imaging Laboratory contains 5 Macintosh-based workstations including:
(1) A Videotape-based motion analysis system
(2) A Video microscope with color acquisition and segmentation capability.
(3) A Macrophotography system
(4) A slide scanner system
(5) A color flatbed scanner system

Microbiology Laboratories

This provided laboratory facilities for Slava Epstein in addition to a Radiation Laboratory

Running Seawater/Preparation Area

This shared facility is available to all MSC staff and students.

CAS Multimedia Laboratory

Gerry Herman and I established a Multimedia Laboratory in Richards Hall.

New Boats

We received gifts of a 23 ft Steiger Craft from Charles Labron and a 25 ft Allman Cruiser from Richard Andersen. The Steiger craft has been in operation since we received it. We recently restored the Allman.

MSC Programs

K-12 Outreach

Since 1993, we have continued an extensive K-12 outreach program involving primarily the Lynn and Minuteman (Lincoln, Concord, Acton) Regional School Districts. We have maintained a formal Junior and Senior High School Outreach program with the Lynn School District in collaboration with the Lynn Business and Educational Foundation that provides financial support.

GE Foundation Marine Biology Experience

Through 1997-1998 we received a grants from the GE Fund to conduct the Summer Marine Biology Institute. 16 students and 8 faculty from 8 College Bound highschools were housed in Northeastern Dorms and bussed to the Marine Science Center for the one week program. The Institute resulted in a web page which can be found at:
http://www.dac.neu.edu/msc/collegebound/
This program was featured in GE's Annual Report to Stockholders.

Marine Biology Concentration/Minor

I established the Marine Biology Concentration and Marine Biology Majors. The programs were initially proposed in 1995 and eventually approved in 1998.

East/Weat Marine Biology Program

The East/West Program is now entering its 16th year as eminent source of leading marine biologists.

Personnel Recruitment:

As Interim Director and Director, I personally recruited the following scientists and staff to MSC

Scientists

Slava Epstein, Senior Research Scientist, Currently Asst. Prof. Department of Biology

Dennis Bazylinski,Adjunct Research Associate

Sergei Kashin, Senior Research Scientist

Dick Blidberg, Director Marine Systems Engineering Laboratory

Jim Jalbert, Senior Projects Engineer, MSEL

Steven Chappel, Senior Software Engineer, MSEL

Dr. PoKay Ma, Senior Scientist

Dr. Jan Newton, Adjunct Research Associate

Dr. Roy Turner, Senior Scientist, Marin Systems Engineering Laboratory

Dr. Frank Kirchner, Senior Scientist

Dirk Spennenburg Research Assistant

Dr. Geoff Trussel, Research Associate

Lowell Gray, Adjunct Research Associate

Senior Intern

Al Badger: Senior Intern

Staff

Sarah Jordan, MS. : Education Coordinator.

Captain Douglas O'leary: Maintenance Supervisor/Skipper

Joshua Mahoney Maintenance Assistant/Mate

Cricket Wilbur, MS. Senior research technician

Chris Olcott, Technical Assistant

Dr. Sal Genovese,: Education Coordinator

Elizabeth Clinton, CPA: Administrative Officer

John McDonough: Maintenance Assistant / Mate

COMMUNITY SERVICE:

Member, Computer Curriculum Committee. Nahant School District. Nahant, Massachusetts 1981-1982.

Chairman, Valley Road School Study Committee. Nahant, Massachusetts, 1986-1988.

Chairman, Conservation Commission, Town of Nahant, 1997-2001. Reappointed for 1990-1992, 1993- 2001.

Member, Open Space Committee, Town of Nahant, 1988-1995.

Member, Board of Directors. Nahant Education Foundation, 1994-Present

Member, Board of Directors. Safer Water In Massachusetts (SWIM)

Member, Technical Advisory Committee, Nahant, School District, 1994-1995

Project Leader, Mariculture and Hypercard Clubs and 6th grade science projects, Johnson School, Nahant, MA 1994-1998

Member, Swampscott School District PALMS Leadership Team 1996-1997

Member, Greater Lynn Region School-to-Work Council