DIVISION OF MARINE BIOLOGY HOPKINS MARINE STATION

Emeritus: (Professor) John H. Phillips, Jr.; (*Professor-Research*) R. Paul Levine
Acting Director: George N. Somero
Professors: Mark W. Denny, David Epel, William F. Gilly, Dennis A. Powers, George N. Somero, Stuart H. Thompson
Associate Professor: Barbara A. Block
Assistant Professor: Fiorenza Micheli
Courtesy Professor: Irving L. Weissman
Lecturer: James M. Watanabe

The Hopkins Marine Station is at Pacific Grove, on the south side of Monterey Bay, 90 miles from the main University campus. The 11-acre grounds, on the main portion of Cabrillo Point, include a sheltered landing place and storage for small boats. Buildings include the Lawrence Blinks Laboratory, Alexander Agassiz Laboratory, Jacques Loeb Laboratory, Harold A. Miller Library, Monterey Boat Works, Walter K. Fisher Laboratory, Tuna Research and Conservation Center, and De Nault Family Research Building. The 15,000 volume library subscribes to approximately 450 journals, and its collections are particularly strong in embryology, marine biology, microbiology, and oceanography.

The station is open during the entire year and maintains a permanent staff of resident investigators and technical assistants. The staff is supplemented by visiting faculty members, especially during the summer. There are facilities for visiting investigators and for elementary and advanced instruction in biology. For further information, write Hopkins Marine Station, Pacific Grove, CA 93950.

COURSES

56H. Seminar: History and Philosophy of Science—The nature of scientific inquiry, its logic, historical patterns, and sociology. Emphasis is on the unique aspects of the biological sciences.
2 units (Somero) alternate years, given 2001-02

160H/260H. Cell Physiology—(Graduate students register for 260H.) The structures and processes that control life at the cellular level. Topics: membrane structure and function, signal transduction, the cytoskeleton, transport processes, cell division, cell-cell interactions, and motility. Similar to Bio. 121 but using marine examples. Prerequisite: Biological Sciences core or consent of instructor.
4 units, Win (Epel)

161H/261H. Invertebrate Zoology—(Graduate students register for 261H.) Survey of invertebrate diversity emphasizing form and function in a phylogenetic framework. Morphological diversity, life histories, physiology, and ecology of the major invertebrate groups, concentrating on local marine form examples. Current views on the phylogenetic relationships and evolution of the invertebrates. Lectures, lab, plus field trips. Prerequisite: Biological Sciences core or consent of instructor.
5 units, Win (Watanabe)

162H/262H. Comparative Animal Physiology—(Graduate students register for 262H.) Physiological principles are examined using the diversity of solutions apparent in vertebrates and invertebrates, and focusing on how animals work. Topics: physiology of respiration, circulation, energy metabolism, thermoregulation, osmotic regulation, muscle physiology, and locomotion. Labs introduce physiological measurements with animals, discussion sections emphasize current topics in evolutionary and ecological physiology. Prerequisite: Biological Sciences core.
5 units, Spr (Block) alternate years, not given 2001-02

163H/263H. Principles of Oceanic Biology—(Graduate students register for 263H.) How the physics and chemistry of the oceanic environment affect marine plants and animals. Topics: seawater and ocean circulation, separation of light and nutrients in the two-layered ocean, oceanic food webs and trophic interactions, oceanic environments, biogeography, and global change. Lectures, discussion, and field trips. Recommended: Physics 21 or 51, Chemistry 31, Biological Sciences core, or consent of instructor.
4 units, Win (Denny, Somero)

164H/264H. Marine Botany—(Graduate students register for 264H.) Introduction to plants in the sea. Phytoplankton and oceanic productivity; macrophytes and nearshore ecology; marine angiosperms from taxonomical, physiological, and ecological perspectives. Lectures, lab. Prerequisite: Biological Sciences core or consent of instructor.
4 units, Win (Staff) alternate years, not given 2001-02

165H/265H. Air and Water—(Graduate students register for 265H.) Introduction to environmental physics. The physical properties of life's fluids compared and contrasted. How and why life has evolved differently on land than in water. Topics: density, viscosity, diffusion, thermal properties, sound, light, evaporation, and surface tension. Recommended: Physics 21, 23, or 51, 53; calculus; Biological Sciences core; or consent of instructor.
3 units, Spr (Denny) alternate years, not given 2001-02

166H/266H. Locomotion—(Graduate students register for 266H.) How animals and plants swim, crawl, run, and fly. The principles of fluid and solid mechanics determine the possibilities and limitations of organismal motion. Recommended: Physics 21 or 51, Biological Sciences core, or consent of instructor.
3 units (Denny) alternate years, given 2001-02

167H/267H. Nerve, Muscle, and Synapse—(Graduate students register for 267H.) Fundamental aspects of membrane excitability and conduction, synaptic transmission, and excitation-contraction coupling. Emphasis is on biophysical, molecular, and cellular level analyses of these processes in vertebrate and invertebrate systems. Labs on intra- and extracellular recording and patch clamp techniques. Lectures, discussions, and labs. Prerequisites: Physics 23, 28, 43, or equivalent; Chemistry 31, 135; calculus; or consent of instructor.
5 units, Win (Gilly)

168H/268H. Seminar: Cellular Signal Transduction—(Graduate students register for 268H.) Lecture/seminar, group discussions. Focus is on the physiology, biochemistry, and molecular biology of signaling cascades, from basic principles to advanced and current topics. Prerequisite: consent of instructor. (AU)
1 unit, Spr (Thompson)

169H/269H. Neurobiology and Behavior—(Graduate students register for 269H.) The neural mechanism responsible for generating animal behavior. Topics: neronal excitability, synaptic plasticity, signal transduction, and neural circuits. Lectures, discussions, demonstrations, and lab. Prerequisite: Biological Sciences core or consent of instructor.
5 units, Win (Thompson)

170H/270H. Seminar: Topics in Marine Biology—(Graduate students register for 270H.) A specific topic of current interest to marine science is explored through discussion of the primary literature. Prerequisite: Biological Sciences core or consent of instructor.
1 unit, Win (Staff)

171H/271H. Ecological and Evolutionary Physiology—(Graduate students register for 271H.) The interplay between environmental factors (e.g., temperature, light, nutrient supply, salinity, and oxygen availability) and adaptive change at the physiological level. Emphasis is on marine species and the roles played by physiological adaptations in establishing their distribution and performance. Prerequisite: Biological Sciences core or consent of instructor.
4 units, Win (Somero)

172H/272H. Marine Ecology—(Graduate students register for 272H.) Introduction to the principles of ecology as applied to life in the sea. Population dynamics, community ecology, and the effects of man on the oceans. Lectures, lab. Prerequisite: Biological Sciences core or consent of instructor.

5 units, Spr (Micheli)

173H/273H. Marine Conservation Biology—(Graduate students register for 273H.) Offered with the support of the Pew Conservation Trust. The science of preserving marine diversity and the major conservation issues associated with marine ecosystems. Topics: the decline of open fisheries, salmon conservation, bycatch issues in fisheries, the use of marine reserves, marine invasions and pollution, and global warming. Guest lecturers from other universities who specialize in marine conservation.

3 units (Block) alternate years, given 2001-02

174H/274H. Experimental Design and Probability—(Graduate students register for 274H.) Variability is an integral part of biology. Introduction to probability and its use in designing experiments to address biological problems. Focus is on analysis of variance, when and how to use it, why it works, and how to interpret the results. Design of complex, but practical, asymmetrical experiments and environmental impact studies, and regression and analysis of covariance. Computer-based data analysis. Prerequisite: Biological Sciences core or consent of instructor.

3 units, Spr (Watanabe)

175H. Problems in Marine Ecology and Ecophysiology—Field-based, emphasizing individual and small-group research for advanced undergraduates. Students learn field and laboratory techniques to address ecological, ecophysiological, and biomechanical problems faced by marine organisms. Original research projects may be integrated with ongoing research programs in the Hopkins Marine Life refuge. Prerequisites: Biological Sciences core, consent of instructors.

8 units, Spr (Watanabe, Denny, Micheli, Somero, Epel, Block)

176H. Experimental Neurobiology—Lab, emphasizing methods in the neurosciences, including electrophysiological, biochemical, molecular, behavioral, and histological techniques. Students work on individual original research projects under guidance of the faculty. Prerequisites: strong interest in neurobiology and previous relevant course work, consent of instructors.

8 units, Spr (Gilly, Thompson)

177H/277H. Seminar: Cell Physiology of Stress—(Graduate students register for 277H.) Organisms are constantly exposed to environmental stresses and potential cell damage. The nature of these stresses, adaptive defense mechanisms, and repair responses when these defenses break down. Emphasis is on stress responses to toxins, DNA damage, oxidative stress, and the signal transduction pathways involved in stress responses. Prerequisites: Biological Sciences core, consent of instructor.

2 units, Spr (Epel) alternate years, not given 2001-02

178H/278H. Seminar: Deep-Sea Biology—(Graduate students register for 278H.) The deep sea is the largest, but least understood, fraction of the biosphere. Organisms living in this huge space possess diverse adaptations to allow life under high pressure. Recent discoveries in deep-sea biology, including the biology of the hydrothermal vents, and the technology that makes these advances possible. Prerequisites: Biological Sciences core, consent of instructor.

2 units, Spr (Somero) alternate years, not given 2001-02

198H. Directed Instruction/Reading—May be taken as a prelude to research and may also involve participation in a lab or research group seminar and/or library research. Credit for work arranged with out-of-department instructors restricted to Biological Sciences majors and requires department approval.

Aut, Win, Spr, Sum—both terms (Staff)

199H. Undergraduate Research—For experience in biological research, qualified undergraduate students may undertake individual work in the fields listed under 300H. Arrangements must be made by consultation or correspondence.

Aut, Win, Spr, Sum—both terms (Staff)

290H. Teaching of Biological Science—Open to upper-division undergraduates and graduate students. Practical experience in teaching lab biology or serving as an assistant in a lecture course. Prerequisite: consent of instructor.

1-5 units, Win, Spr, Sum (Staff)

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated:

B. Block: Comparative Vertebrate Physiology—biomechanics, metabolic physiology and phylogeny of pelagic fishes, evolution of endothemy.

M. Denny: Biomechanics—the mechanical properties of biological materials and their consequences for animal size, shape, and performance.

D. Epel: Developmental Biology—physiology and regulation of early embryonic development. Embryonic adaptation to environmental stress.

W. Gilly: Neurobiology—analysis of giant axon systems in marine invertebrates from molecular to behavioral levels.

R. P. Levine: Molecular Biology and Biochemistry of Biomineralization.

F. Micheli: Marine Ecology—species interactions and community ecology, scale-dependent aspects of community organization, marine conservation and design of multi-species marine protected areas, behavioral ecology.

D. Powers: Adaptational Biochemistry—molecular mechanisms of evolution, mechanisms of gene expression in relation to environmental variables, molecular ecology, physiological ecology, population biology, biodiversity, and marine biotechnology.

G. Somero: Ecological and Evolutionary Physiology—adaptations of marine organisms to the environment: temperature, pressure, desication, and oxygen availability.

S. Thompson: Neurophysiology—neuronal control of behavior and mechanisms of ion permeation, signal transduction, calcium homeostasis, and neutrotransmission.

J. Watanabe: Marine Ecology—kelp forest ecology and invertebrate zoology.

SUMMER PROGRAM

The summer program is open to all advanced undergraduate, graduate, and postdoctoral students, and to teachers whose biological backgrounds, teaching, or research activities can benefit from a summer's study of marine life. Application blanks and further information may be obtained by writing to Hopkins Marine Station, Pacific Grove, CA 93950. Completed applications should be submitted by March 31. Applications received later are considered if space is still available.

The Summer Quarter is divided into two terms. It is possible to register for either term, or for the full quarter. Registration is possible for only one course during each term.

FIRST TERM

179H. Subtidal Communities—Lectures, lab, and field trips treating shallow water marine communities. Emphasis is on local habitats and the introduction of physical environmental parameters, community composition, aspects of the biology of constituent species, and methods for subtidal studies. Prerequisites: SCUBA certification, SCUBA equipment, ocean diving experience, and some background in biology.

6 units (Watanabe)

277H. Biomechanics and Ecological Physiology of Intertidal Communitites—Introduction to the mechanical and physiological design of wave-swept organisms. How different abiotic stresses (wave exposure, wind speed, temperature, light) influence marine animals and plants, and adaptive responses to these stresses. Lab introduces methods for measur-

ing environmental stress and organismal responses. Recommended: background in algology, intertidal ecology, or invertebrate zoology; basic physics and calculus.

4 units (Denny, Somero) alternate years, not given 2001-02

SECOND TERM

180H/280H. Problems in Subtidal Ecology—(Graduate students register for 280H.) Group and individual research projects focus on shallow water marine communities, emphasizing the importance of identifying a relevant problem through review of the scientific literature, formulating an adequate research plan, and collecting data in the field. Lectures/discussions focus on proper experimental design, data analysis, and critiques of selected papers from the scientific literature. Prerequisites: 179H or consent of instructor; SCUBA certification, SCUBA equipment, and ocean diving experience.

6 units (Watanabe)