Courses and Research Apprenticeships

FHL offers educational opportunities for students in spring, summer and autumn. Students earn credits through the University of Washington but do not need be currently enrolled at UW to attend. Courses and apprenticeships are taught by faculty of the University of Washington as well as other universities and research institutions.

Research Apprenticeships are intense, full-time research training experiences offered to qualified undergraduates and post-baccalaureates in spring and autumn (10-11 weeks). Small groups (6-12 students) work on a focused research study guided by faculty and graduate student mentors.

The instructional program in summer is intended primarily for graduate students with the exception of Marine Invertebrate Zoology. Well-qualified undergraduates may be admitted to graduate-level courses with the consent of the director and the faculty of the courses. Summer courses (5 weeks) may be taken sequentially, but not concurrently.

Additional information and FHL’s online application form can be found at http://depts.washington.edu/fhl/stu_stu_index.html.

http://depts.washington.edu/fhl
(206) 543-1484 or (360) 378-2165

Scientific Facilities

Laboratories and Equipment The teaching and research laboratories consist of twelve buildings with running sea water. Walk-in cold rooms, microtechnique room, flume and shop are available. Analytical equipment for general use includes centrifuges, computers, scintillation counter, an HPLC, a LC-Mass spectrometer, PCR thermocyclers and other equipment for molecular biology, spectrophotometers, culture chambers, fluorescence microscope, video equipment, scanning laser confocal microscopes and electrophysiological equipment. A scanning electron microscope and transmission electron microscope may be used by investigators who have or can obtain appropriate training.

Stockroom The FHL stockroom provides reagents, labware, photographic materials, and small items of equipment at cost to students and investigators. Persons needing unusual materials, large quantities, radioisotopes or special equipment should make arrangements in advance.

Marine Equipment A 58-foot steel research vessel, the R/V Centennial, equipped for dredging, trawling, net hauling, and water sampling is available for classroom and research. The services of an R.O.V. submersible capable of working to 1,000 foot depths are also available. Rowboats and outboard powered boats can also be used.

Facilities for Scuba Diving Divers certified by the University of Washington (AAUS) may use FHL’s four boats and a limited number of tanks and weights for specific projects approved by the Diving Officer (DO). Study site information as well as check-out dives are provided by the Diving Officer.

Library The Friday Harbor Laboratories library provides a core collection of books, journals and electronic resources with a focus on the marine sciences. Areas of emphasis include developmental biology, cellular biology, oceanography, fish biology and marine ecology. Access is available to the UW libraries catalog, journal indexes, electronic references, news sources and journals.

Synoptic Collection A collection of preserved marine animals and plants is available as an aid to identification and location. In addition, files of collecting and study-site surveys and color transparencies of local marine life and habitats are maintained for reference.

Importation of Species Most imports of marine species into Washington State for research are illegal without a permit from the Washington State Department of Fish and Wildlife. Permits, when granted, will require strict quarantine of non-native organisms with no contact with the FHL seawater system.

Vertebrate Research Persons intending to work with fish at Friday Harbor Laboratories, including field collecting must have University of Washington Animal Care Committee approval before holding fish in laboratory aquaria for experimental purposes.
THE ZOOBOT QUARTER

March 29 - June 4, 2010
16 credits total for three integrated courses:

MARINE ZOOLOGY
5 credits - Biology 430
Dr. Megan Dethier

MARINE BOTANY
5 credits - Biology 445
Dr. Charles O’Kelly & Dr. Robin Kodner

MARINE BENTHIC ECOLOGY
Research Apprenticeship
6 credits - Biology 479
Dr. Robin Kodner & Dr. Michael O’Donnell

This trio of courses surveys the groups of marine invertebrates and plants represented in the San Juan Archipelago; natural history, adaptations, evolution and taxonomy. Considerable field work and detailed laboratory study of organisms is included. A field trip to the exposed outer coast allows contrasts of the organisms and ecology there.

The linked research apprenticeship will focus on the effects of climate change on marine organisms and their communities. Each student will select a phyla and research topic to perform in the field, laboratory or both; example projects include the effects of ocean acidification on algae/herbivore interactions or temperature induced shifts in phytoplankton communities. All students also perform organized outreach activities with local schools. Enrollment limited to 18.

The Marine Benthic Ecology research apprenticeship will be integrated with the Marine Zoology and Marine Botany courses; students must register for all three.

For additional information contact:
mdethier@uw.edu, okelly@gmail.com,
kodner@uw.edu, mooseo@uw.edu

Online application can be found at http://depts.washington.edu/fhl/stu_index.html

GENOMIC BIOLOGY AND PHYSIOLOGY OF BASAL METAZOAANS & DEUTEROSTOMES

March 29 - June 4, 2010
15 credits - Biology 479
Dr. Billie Swalla & Dr. Leonid Moroz

This apprenticeship will integrate genomic and physiology data throughout development to study less explored invertebrate groups such as basal metazoans and basal deuterostomes. We will combine molecular and functional approaches to understand the origin and evolution of main animal lineages, focusing on evolution of signaling pathways. Specifically, we will take advantage of the recently sequenced genomes and deep transcriptome analysis from representatives of these groups (i) to validate animal phylogeny and explore novel hypotheses related to evolution of nervous, hormonal and immune systems at the genomic level; (ii) to explore expression of genes essential for development and neuronal organization in these animals and identify homologous cellular lineages and signal transduction components across phyla; (iii) to characterize the distribution and functional role of selected signaling molecules in evolution and development of major animal innovations. Enrollment limited to 12.

For additional information contact: bjswalla@uw.edu or moroz@whitney.ufl.edu

Full research descriptions are available by year on our Web site at http://depts.washington.edu/fhl/res_index.html. You can find a list of research publications by year: http://depts.washington.edu/fhl/resBibliography08s.html.
Summer Quarter

MARINE INVERTEBRATE ZOOLOGY

Session A June 14 - July 16, 2010
9 credits - Biology 432
Dr. Marjorie Wonham & Dr. Noa Shenkar

Comparative biology of marine invertebrate animals, focusing on morphology, natural history, functional biology, life history, and evolutionary relationships. Two daily lectures provide overviews of the major and many smaller phyla, but the heart of the course comprises study of living animals in the laboratory and fieldwork in the diverse marine habitats surrounding San Juan Island. Applications are welcome from undergraduate students, post-baccalaureates and graduate students. Prior coursework in invertebrate biology or animal diversity is advisable but not essential. Enrollment limited to 20. For additional information contact: marwonham@yahoo.com or nshenkar@uw.edu

MARINE ALGAE

Session A June 14 - July 16, 2010
9 credits - Biology 539
Dr. Bob Waaland & Dr. Tom Mumford

The marine algae course will explore seaweed biodiversity with emphasis on their role in marine ecosystems. There will be four key components: 1. Seaweeds from diverse habitats will be investigated by practicing the methods essential for their identification. 2. The functional role of seaweeds as primary producers in marine ecosystems will include their interactions with other community components. 3. Methods for quantitative analysis of the distributions and abundances in marine communities will be applied to accessible seaweed dominated communities. 4. Methods for cultivation of seaweeds for purposes such as algal life history studies, growth rates and development patterns, physiological responses, ecosystem mesocosm experiments, and production of food, will be investigated. This course will provide a foundation for effective management of benthic primary producers in coastal ecosystems in relation to biodiversity assessment, ecosystem function and resiliency. Enrollment limited to 15. For additional information contact: jrw@uw.edu or Thomas.Mumford@dnr.wa.gov

BIOMECHANICS

Session A June 14 - July 16, 2010
9 credits - Biology 533
Dr. Emily Carrington & Dr. John Gosline

This course uses an engineering perspective to evaluate the mechanical design of organisms. We will develop an understanding of the diversity of ways organisms construct materials, organize body plans, and interact with their physical environment. We will explore the basic principles of both solid and fluid mechanics and apply these principles to specific biological examples. The emphasis will be on marine organisms (especially invertebrates and seaweeds), but terrestrial examples will be drawn upon as well. Topics covered will include: basic laws of fluid motion, life in boundary layers, turbulence and mixing, mechanical properties of biological materials, static and dynamic beam theory, mechanical design for the surf zone, phenotypic plasticity in mechanical design and biomechanical techniques. This course is quantitative; a basic understanding of calculus and physics is assumed. Enrollment limited to 15. For additional information contact: ecarring@uw.edu or gosline@zoology.ubc.ca

COMPARATIVE INVERTEBRATE EMBRYOLOGY

Session A June 14 - July 16, 2010
9 credits - Biology 536
Dr. Billie Swalla & Dr. Alexandra Eaves

This course will focus on the development of invertebrate phyla with an evolutionary perspective. We will provide extensive hands-on laboratory experience with the fertilization and development of most invertebrate phyla including: Cnidaria, Ctenophora, Platyhelminthes, Nemertea, Brachiopoda, Phoronida, Bryozoa, Mollusca, Polychaeta, Chaetognatha, Echinodermata, Hemichordata and Tunicata. Lectures will focus on cellular and molecular analysis of evolutionary changes in development as well as reproduction and gamegenesis. We will emphasize morphological processes and discuss similarities and differences in embryos and how they develop. Several field trips will acquaint students with the rich invertebrate fauna of the San Juan Islands. Enrollment limited to 15. For additional information contact: bjswalla@uw.edu or alex.eaves@cahs-bc.ca

BLINKS SUMMER RESEARCH INTERNSHIPS

The Blinks Program offers a full immersion research experience for motivated undergraduates, post-baccalaureates and graduate students. In keeping with the University of Washington’s policy of encouraging diversity and including underrepresented groups, the program seeks 6-8 students of diverse backgrounds and interests to participate in 8-12 week summer research projects in the marine sciences. To apply: http://depts.washington.edu/fhl/studentBlinkschol.html.
**NEUROETHOLOGY**

Session B  
July 19 - August 20, 2010  
9 credits - Biology 533  
Dr. Richard Strathmann & Dr. Shaun Cain

This course will focus on learning techniques in neuroethical research such as behavioral recording and analysis, electrophysiology of intact and reduced preparations, voltage clamp and pharmacology, immunohistochemistry and confocal microscopy of neural structures. Each pair of students will explore a project that helps them learn the techniques they need in their own research. Research will focus on the nudibranch (sea slug) *Tritonia diomedea* because it is most amenable to neuroethological analysis. Enrollment limited to 15. For additional information contact: james.murray@csueastbay.edu or shaun.cain@eou.edu

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**LARVAL BIOLOGY**

Session B  
July 19 - August 20, 2010  
9 credits - Biology 533 or Ocean 590  
Dr. Richard Strathmann &  
Dr. Danny Grunbaum

The emphasis of this course will be on functional requirements and constraints for embryos, larvae, and juveniles of marine animals. Topics include parental investment per ovum, fertilization, parental protection and retention of embryos, extraembryonic nutrition, larval feeding and swimming, functional morphology of embryos and larvae, dispersal, settling, mortality, recruitment, effects of larval nutrition on performance of juveniles, juvenile ecology, and evolutionary transitions between modes of development. The course includes short research projects by groups of two or more students with a short written paper from each project. Enrollment limited to 15. For additional information contact: rrstrath@uw.edu or grunbaum@ocean.washington.edu.

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**ECOLOGY OF INFECTIOUS MARINE DISEASE**

Session B  
July 19 - August 20, 2010  
9 credits - Biology 533  
Dr. Drew Harvell, Dr. Carolyn Friedman &  
Dr. Steven Roberts

This course will be a training program in invertebrate-pathogen ecology that will bring together and train the future leaders in the rapidly emerging, multidisciplinary field. The course will 1) survey host-pathogen interaction in the Friday Harbor region; 2) teach diagnostic tools for identifying viral, bacterial, protozoan and fungal infections of invertebrates; 3) teach approaches to examine the invertebrate innate immune response to different pathogens. Enrollment limited to 15. For additional information contact: cdh5@cornell.edu, carolynf@uw.edu, sr320@uw.edu

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**FUNCTIONAL MORPHOLOGY AND ECOLOGY OF MARINE FISHES**

Session B  
July 19 - August 20, 2010  
9 credits - Fish 565  
Dr. Adam Summers &  
Dr. Lara Ferry-Graham

The course will use the diverse marine fish community of the San Juan Islands as a tool to explore the relationship between functional morphology and ecology. Students in the course will learn: 1) the evolutionary history and relationships of the major radiations of bony and cartilaginous fishes; 2) basic ecological principles as they relate to fish biology; 3) tools and techniques for collecting fishes; 4) basic morphology of cartilaginous and bony fishes; 5) tools and techniques of functional morphology. Enrollment limited to 15. For additional information contact: fishguy@uw.edu or lfgraham@mlml.calstate.edu

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**Marine Biology Quarter**

September 27 - December 10, 2010  
Students will enroll in three of the following four course options available for the Marine Biology Quarter, which together constitute a full-time enrollment of either 15 or 16 credits for each student:

1) **SOCIAL CHANGE AND THE MARINE ENVIRONMENT**  
5 credits - Sociology 401 or Program on the Environment (PoE) Envir 450  
Dr. Susan Thistle

While providing a hands-on look at key problems facing the marine environment, this course focuses on the different social groups shaping such problems and their solutions. Looking at efforts to restore salmon and protect orcas, for example, we examine tribal and other views of habitat degradation and marine protected areas. This course meets the Environmental Perspectives and Experiences requirement in PoE at UW. Enrollment limited to 20.

2) **SCIENTIFIC DIVING**  
5 credits - Biology 479  
Dr. Kevin Britton-Simmons & Pema Kitaeff

The scientific diving course will focus on diving skills/specialties and research techniques commonly used in subtidal ecology. The course will include lectures on marine ecology, local flora and fauna and dive planning and safety. Students must have basic open water SCUBA certification, but will become AAUS certified in class. Enrollment limited to 8.

3) **MARINE BIOLOGY**  
5 credits - Biology 250, Ocean 250 or Fish 250  
Dr. Emily Carrington & Dr. Michael O’Donnell

This lecture/lab course focuses on the diversity of organisms inhabiting the marine environment, taking a broad tour through the plants and animals of the marine realm (plankton, seaweeds, invertebrates, fish, birds, and mammals) and exploring how these organisms have adapted to life underwater. Numerous field and lab exercises will expose students to common marine biological techniques and to the diverse marine communities common to the San Juan Islands. (This course fulfills a core requirement of the UW Marine Biology minor.) Prerequisite: at least one quarter of introductory biology (more is preferred). Enrollment limited to 20.

4) **MARINE ENVIRONMENT RESEARCH APPRENTICESHIP**  
6 credits - Biology 479, Fish 479, Ocean 479, Sociology 499 or Envir 499 (the Envir 499 course meets the UW Program on the Environment Capstone requirements (Envir 491) with permission. Dr. Susan Thistle & Dr. Emily Carrington

This course guides students in independent research from a natural or social science perspective. Research projects to be determined by student and faculty. Enrollment limited to 20. For additional information contact: s-thistle@northwestern.edu, aquaman@uw.edu, pema@uw.edu, carring@uw.edu or mooseo@uw.edu
The Helen Riaboff Whiteley Center provides a retreat for established scholars and artists to study, write, create and interact with collaborators in a peaceful and stimulating environment. Scholars of any discipline may work at the Center for stays of several days to three months, undisturbed by the conflicting demands of their academic and artistic careers.

Whiteley Study Center (A. Whiteley)

The Center building provides four study rooms, a meeting room, access to the internet and AV equipment. Seven cottages located adjacent to the Study Center provide housing for scholars. Arthur and Helen Whiteley established this Center as a place of collegial interaction, a tribute to the faculty of the UW, and a gift to scholars of all nations. For additional information visit http://depts.washington.edu/fhl/Whiteley.

Scholarships & Fellowships

Scholarship and fellowship support is available to qualified students in need. This funding derives from generous donations from FHL alumni and friends of the Laboratories. Financial aid is awarded on the basis of need and merit; admission decisions are not influenced by financial aid requirements. Support is available to both undergraduate and graduate students. For additional information regarding scholarships and fellowships please visit http://depts.washington.edu/fhl/studentFellowships.html.

Post-Doctoral Fellowships

FHL will support a post-doctoral scientist for a two-year appointment to establish an active research program and assist the Director and Resident Associate Director in facilitating the efforts of visiting scientists and students. Applications are welcome from scientists with qualifications in any area of marine research readily supportable by FHL. For additional information regarding post-doctoral fellowships, please visit http://depts.washington.edu/fhl/resPdocFellowInfo.html.

Mellon Faculty Support

Mellon Foundation support is available for qualified visiting faculty and researchers who bring cultural or ethnic diversity to FHL. It is intended for independent researchers and faculty who serve as research mentors at any time of the year. Interested persons should contact the FHL director at sebens@u.washington.edu.

The Center for Cell Dynamics (CCD) conducts innovative research that combines experimental cell and developmental biology with computer modeling. Funded by a NIH-NIGMS Center of Excellence award promoting the emerging field of computational biology, the Center is led by Dr. Garrett Odell. The Center’s mandate is to cross-train scientists in bench biology and mathematics/computational modeling techniques while working on complex problems that require both approaches. Research focuses on understanding the mechanisms of morphogenesis, cell division, cell polarization and contractility, and the function and evolution of regulatory gene networks. For additional information on opportunities for collaborative student, post-doctoral and visiting faculty research, please visit the CCD Web site at www.celldynamics.org.

The Whiteley Center

Dr. Kenneth P. Sebens assumed the directorship of FHL in September 2005. His areas of research are rocky subtidal community ecology, suspension feeding, hydrodynamic effects on benthos and coral reef ecology. Dr. Sebens is a Professor in the Biology Department at the University of Washington.

The Anne Hof Blinks Research Fellowship Program

The Blinks Fellowship Program offers hands-on, full-immersion summer research internships to 6-8 motivated seniors, post-baccalaureates and graduate students. The program seeks students of diverse cultural backgrounds and interests. By linking fellows with marine scientists, fellows learn both the process and the substance of scientific research. The experience exposes fellows to life and work in a marine science research laboratory. For additional information and project options, please visit depts.washington.edu/fhl/studentBlinkschol.html. This program is funded by the Anne Hof Blinks Fellowship and generous support of the Andrew W. Mellon Foundation, ASCB and FASEB and other sources.

The University of Washington reaffirms its policy of equal opportunity regardless of race, color, creed, religion, national origin, sex, sexual orientation, age, marital status, disability, or status as a disabled veteran or Vietnam era veteran in accordance with University policy and applicable federal and state statutes and regulations. The University of Washington is committed to providing access, equal opportunity and reasonable accommodation in its services, programs, activities, education and employment for individuals with disabilities. To request disability accommodation in the application process, contact Friday Harbor Laboratories at fhlfac@u.washington.edu.

Dr. Kenneth P. Sebens, Director

Dr. Kenneth P. Sebens
Resident Associate Director: Dr. Adam Summers
Administrator: Scott Schwinge
Fiscal Specialist: Aimee Urata
Student Coordinator: Stacy Markman
Facilities Coordinator: Vikky Daucianas
Whiteley Coordinator: Kathy Cowell
Marine Supervisor: Dr. David Duggins
Diving & Boating Safety Officer: Pema Kitaeff
Sr. Computer Specialist & R/V Skipper: Dr. Craig Staude
Director of Development: Rachel Anderson
K-12 Education: Jenny Roberts & Margo Thorp

Center for Cell Dynamics

Dr. Garrett Odell
Associate Director: Dr. Victoria Foe

Personnel