Intertidal Tidings

Newsletter for the Friday Harbor Laboratories • University of Washington • Autumn 2008 • Volume 13

Ten Years of RAP at FHL

This year (2008-2009) is the tenth anniversary of **FHL's Research Apprenticeship Program (FHL RAP)**. The Research Apprenticeship Program was created because of a crucial need to draw more and better students into the research enterprise at the University of Washington. We recognized, as have others, that there is a national problem: undergraduates are avoiding scientific research in droves.

With the support of the UW Provost in 1999, FHL sought to invest in a fundamentally different approach. The methods tried in the past, here and elsewhere, usually involved faculty teaching background/methods followed by project assignments, or students working individually, episodically (usually a few hours to a few days a week) in lab projects, often with supervision by postdocs and graduate students. These experiences have not always worked out well for undergraduates.

A problem seems to arise from the perception by faculty that we must teach students how to do research, instead of letting them explore by doing hands-on research. It turns out that students react differently if they have ownership of genuine research questions and project design from the beginning, if they work in an intense and focused way, and are part of a team with graduate students and faculty working together full time. These four features – ownership, intensity, focus and teamwork seem to be the keys to the garden. So, that is how the FHL Research Apprenticeship Teams (FHLab RATs) were envisioned.

The Research Apprenticeships at FHL integrate research and education by involving small numbers of advanced undergraduates in a directed research experience with two or more faculty and two graduate students supervising. Common procedures are initial orientation to the research topic by lectures, demonstrations and practice exercises, discussion of relevant research papers, suggested research questions and approaches to answering them. The students divide into smaller research groups which write proposals that are reviewed, then proceed with their research.

As the research progresses, lectures and formal instruction decrease; advising specific to the ongoing research and exchange of information in lab meetings increases. Students learn scientific writing skills and also give oral presentations of their results

Research Apprenticeship (Autumn 2008): Pelagic Ecosystem Function in the San Juan Archipelago

at a meeting open to the scientific community at FHL. Students attend weekly seminars at FHL and become part of a research community whose size and informality encourages interaction. Some of the research leads to papers submitted for publication; students can then become co-authors of published papers.

Over the past ten years, we have offered more than 50 apprenticeships, and have had over 400 students engaged in this experience. Topics have ranged from molecular and cellular biology, to neurobiology, evolutionary developmental biology, oceanography, marine ecology, marine chemistry, and many more. In 2002, the Research Apprenticeship Program received the Brotman Award for "Outstanding Collaborative Achievement in Teaching and Fostering Excellent Learning." The Apprenticeships also have an outreach component. For example, for the Problems in Marine Conservation Apprenticeship, students presented their results to the Marine Resource Committee (MRC) of San Juan County. Thus, these students' results and presentations can immediately make a difference in actions by local government in marine conservation.

The apprenticeships, including financial support for the students, have been funded by the UW Provost and FHL, several foundations (Mellon, Dickinson, Mary Gates, Packard, Washington Research), HHMI, ARCS, NSF (Verdugo research grant), NIH (through CCD) and numerous and generous individual donors. Some of these sources have ended, and a few new ones have started up (two NSF faculty research grants). At our peak of funding, we were able to run eight Research Apprenticeships per year; for the next few years we envision three to four. Hosting apprenticeships with the optimum numbers of students (about 70 per year) will thus require additional funding sources every two to five years. We at FHL are determined to continue this successful and important program. Additional funding will be sought to support the program in its second decade.

Friday Harbor Laboratories hosted core research for 2008 Nobel Prize in Chemistry

by Claudia Mills

When the 2008 Nobel Prize in Chemistry was announced October 8, it went to a set of discoveries anchored in the waters of Friday Harbor in the San Juan Islands. Osamu Shimomura of the Marine Biological Laboratory in Woods Hole, Massachusetts, shares the prize with Martin Chalfie of Columbia University and Roger Tsien of University of California, San Diego. Shimomura was a visiting scientist at the University of Washington Friday Harbor Labs for about 20 summers between 1961 and 1988, where he studied photoproteins in *Aequorea victoria*, one of the jellyfish common in the waters around Friday Harbor. Chalfie and Tsien also did portions of their work using *Aequorea* at the Friday Harbor Laboratories. All three scientists were present during the 2004 Centennial celebrations at the UW Friday Harbor Laboratories, as participants in a special symposium on Calcium-Regulated Photoproteins and Green-Fluorescent Proteins.

Shimomura and his post-doctoral advisor Frank Johnson were interested in the proteins responsible for the flash of light produced by some jellyfish. *Aequorea* was present in enormous numbers in Friday Harbor in the 1960s, and so became the focus of their studies. Thousands of jellyfish were collected by Dr. Shimomura and his family, assisted each year by teenagers from Lab families and from town. For many years, the going rate was a penny per jellyfish and the Friday Harbor town dock was the favored location for collecting.

In a 1995 paper, Shimomura recalled that he spent hours floating and dozing in a lab rowboat in the (not very busy) harbor that first summer of 1961, trying to figure out just how to extract the initially-elusive bio-luminescent proteins from the jellyfish. Collecting jellyfishes was followed by the initial steps in the protein extraction, and then at the end of each summer, partly-purified material was carried back to Princeton University where Shimomura continued his studies.

Aequorea is one of many jellyfish that bioluminesce in response to being prodded; although how the animals use this capability in the wild is still not well understood. The light is localized around the rim of the jellyfish and is produced by a pair of proteins, called *aequorin and green fluorescent protein* (GFP), that work together. It is for research on GFP that the Nobel Prize was awarded.

Green fluorescent protein, unlike aequorin, emits light without adding any other components to the mix besides ultraviolet light. It was cloned about 1990, and after that, the jellyfish were no longer needed. Chalfie and Tsien, who shared the Nobel Prize, were among a diverse group of scientists who realized the potential of GFP as a genetic marker protein, making it possible to insert fluorescence-tagged foreign proteins into cells, producing cells or entire organisms that fluoresce under UV illumination. GFP and its analogues have now become ubiquitous tools in biological and medical science.

In the paper describing the history of his studies of these proteins, Shimomura recalled that when *Aequorea* jellyfish were most abundant, he could collect 5-10 per minute, and that 3000-4000 jellyfish could be processed on a good day. *Aequorea*, along with most of the other 75 species of jellyfish in the San Juan Archipelago, is now present only in very low numbers, due to unidentified problems with the ecology of Puget Sound (the other species were never collected in substantial numbers, thus the scientists' collections are not implicated in the general drop in all jellies). Shimomura's ground-breaking work could never have been accomplished in our now-depauperate waters, and thus serves as a reminder of the value of biodiversity in our everyday lives, and that remarkable discoveries can be made from humble materials.

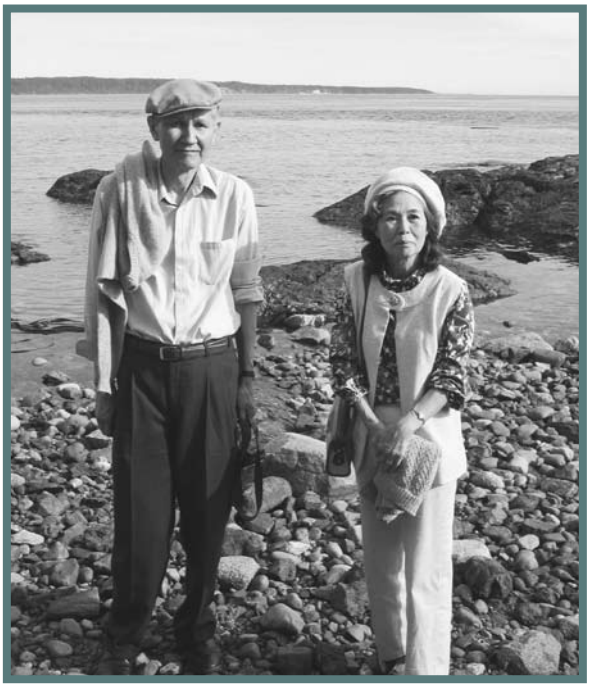

Photo by Claudia Mills, UW Friday Harbor Laboratories

Dr. Osamu Shimomura and wife Akemi (who worked as his research assistant) at a beach barbecue on San Juan Island in 2004 during a symposium on photoproteins in celebration of the centennial of the UW Friday Harbor Labs.

Shimomura is the second scientist who has worked summers at the Friday Harbor Labs to receive the Nobel Prize. George Hitchings, who was an undergraduate research assistant at FHL in 1927, shared in the Nobel Prize for Physiology or Medicine in 1988.

The Whiteley Center

The Helen Riaboff Whiteley Center at Friday Harbor Labs provides a refuge for established scholars, not only scientists but scholars in the humanities, arts, and music and just about every field from anthropology to zoology. Scholars may study, write, create and interact with collaborators in a peaceful and quiet environment. They can work in quiet isolation if they choose or they can take advantage of opportunities to mingle with other Whiteley Center scholars or students and marine scientists at FHL.

In 2008 the Whiteley Center will have hosted over 200 Whiteley Scholars, some for multiple visits. For more information on the Whiteley Center visit the web site on the FHL home page at http://depts.washington.edu/fhl.

Some examples of the broad topics of work by scholars at the Whiteley Center include:

Deborah Brosnan, Sustainable Ecosystems Institute: Scientific, policy and climate change challenges of restoring coastal ecosystems.

John Delaney, University of Washington: Wrote a paper on "Boiling Submarine Hydrothermal Systems."

Casey Dunn, Brown University: Worked on a book on educating scientists and biologists about computing and programming approaches to processing their data.

Douglas Eernisse, California State University at Fullerton: Worked on completing a manuscript on the morphological and molecular taxonomy of the seastar genus Henricia, with Megumi Strathmann.

Charles H. Greene, Cornell University: Completed a manuscript on the "Responses of NW Atlantic Shelf Ecosystems to Remote Climate Forcing."

Lee Gulyas, Western Washington University: Worked on a collection of essays about working and living in the Middle East.

Merna Ann Hecht: Preparing a project related to her work as a writer and storyteller with children who are dealing with significant losses.

Suzanne Holland, University of Puget Sound: Worked on writing a book "Genetics in Translation: Ethics and Justice."

Michael Honey, University of Washington, Tacoma: Was writing a book "John Handcox, the African-American tradition and the Southern Tenant Farmers Union."

Vik Iyengar, Villanova University: Was investigating the evolution of exaggerated male trait and female mating preferences in the rattlebox moth.

Joel Kingsolver, University of NC, Chapel Hill: Prepared an address on "Evolution without Darwin" for the American Society of Naturalists.

Gretchen Lambert, Cal State University, Fullerton: Worked on the indigenous and non-indigenous acidians of the Pacific NW and Guam.

Bill Phillips, University of Washington: Examined the role of the primary care physician in integrating the understanding of health and illness through naturalistic observation.

Donald Rogers, Prof. Emeritus, Long Island University: Investigated interrelationships among the Weibul equation and equations for dispersion in an ecological contest (seed, eggs or larvae).

Hedrick Smith, Pulitzer Prize winner: worked on developing a new video for the PBS Frontline series dealing with the issues of pollution of Puget Sound and of Chesapeake Bay.

GK-12 Program

NSF GK-12 Grant Partners
UW Graduate Students with K-12 Teachers to Enhance Marine Science Instruction

To energize and enhance public school instruction about local marine ecosystems, the National Science Foundation (NSF) has awarded $578,569 to the UW to send eight Biology, Oceanography and Fisheries Science graduate students into the community to partner with Seattle-area and San Juan County high schools in developing hands-on instruction, projects, field trips, and more. This is the first year of a five-year program, with a total expected award of $2,892,577.

The Program is led by Dr. Ken Sebens (PI), Director of the University's Friday Harbor Laboratories on San Juan Island and Professor in the Department of Biology, in collaboration with Co-PIs, Dr. Daniel Grünbaum, Associate Professor, School of Oceanography and Dr. David Armstrong, Director and Professor, School of Aquatic and Fishery Sciences (SAFS). Dr. Megan Dethier (Biology) and Dr. Loveday Conquest (SAFS) are the faculty coordinators for the San Juan County and Seattle-area high schools, respectively, and Dr. Tansy Clay (Oceanography) is the Program Manager.

The project, "GK-12: Ocean and Coastal Interdisciplinary Science" will apply biology, physics and chemistry to studying ocean and coastal processes in the Puget Sound Region. The graduate students will work with 8 to 12 high school teachers in five Seattle and two San Juan County public high schools. For 2008-2009 these include Friday Harbor High School on San Juan Island, Orcas High School on Orcas Island, and Garfield High School, West Seattle High School, Ingraham High School and Ballard High School in Seattle.

The program aims to help high schools benefit from the cutting-edge research that UW graduate students and their advisors conduct. The graduate students will receive a fellowship of $30,000 annually to work jointly with high school teachers to craft basic science lessons and projects that promote understanding of the interdisciplinary science of oceanography and marine research. Through innovative, research-linked workshops and field trips, high school students will acquire knowledge of marine science and an appreciation for delicate coastal ecosystems, and be inspired to pursue higher education that leads to careers in science. Teachers will also attend workshops designed to expose them to the latest in marine science topics. Graduate student participants will benefit from working with experienced teachers by acquiring a broad new array of teaching skills while they complete their degrees.

The FHL OACIS GK-12 Graduate Student Fellows for the 2008-2009 Academic year are: Alexandra Hart and Robin Elahi, both graduate students in the University of Washington's Department of Biology. Six other Fellows are in Seattle schools: Kevin Turner and Christina Maranto, (Department of Biology), Colleen Kellogg, Elizabeth Tobin and Jonathan Kellogg (School of Oceanography), and Amanda Bruner (School of Aquatic and Fisheries Sciences).

Research Grants at FHL

New Research Grants at FHL

Collaborative Research: Systematics and Evolution of Hemichordates

FHL researchers, Billie Swalla (Associate Professor of Biology atthe University of Washington) and Ken Halanych (Associate Professorof Biological Sciences at Auburn University) were recently funded by NSF to examine the diversity and evolution of marine hemichordate wormsfound in the Pacific Northwest and worldwide. This collaborative grant will investigate the number and type of species of hemichordates that currently exist; they are especially interesting to evolutionary biologists because they are similar to our invertebrate ancestors. Studies will be conducted to understand how these species relate to each other and to chordate ancestors using sophisticated genomic techniques. Embryonic development in these worms will also be examined to determine shared developmental mechanisms with chordates. Hemichordates are related to echinoderms and can regenerate whole body parts, just as sea stars can. Thus, they may serve as an excellent model for regeneration of the nervous system in humans. This project will include participation of undergraduate and graduate students from both universities. This award is from the NSF DIvision of Environmental Biology, Phylogenetic Systematics Program, 2008-2011.

From Molecular Mechanics to the Dynamics of Cell Shape Change and Tissue Morphogenesis

FHL researcher Ed Munro (UW Department of Biology, FHL Center for Cell Dynamics), in collaboration with colleagues Thomas Lecuit and Pierre-Francois Lenne of the Developmental Biology Institute of Marseilles (IBDM), was recently awarded a 3-year grant from the Human Frontiers Science Program to study germband elongation in Drosophila embryos. The goal of their research is to combine molecular genetics and quantitative imaging (Lecuit), physical and optical perturbations (Lenne) and computer simulations (Munro) to explore how the cell rearrangements that drive germband elongation emerge through the interplay between polarized contractility, and the dynamics of cell-cell adhesion. The funds will support ongoing work at FHL and IBDM, and an exchange of visiting scientists between institutions. The award is for 2008-2011.

Effects of Temperature on Ecological Processes in a Rocky Intertidal Community

FHL researchers Emily Carrington (UW Department of Biology) and Sarah Gilman (former FHL postdoc) have initiated a new project funded by the National Science Foundation, Biological Oceanography Program that examines in detail the biophysical, physiological, and ecological effects of temperature on a rocky intertidal community, a marine ecosystem that has emerged as a model system for studying the ecological consequences of temperature. It will focus on three major species common to the FHL shoreline: the barnacle, *Balanus glandula*, its predator *Nucella ostrina*, and the rockweed *Fucus gardneri*, which provides shelter for both species. The research is centered around three major goals: to develop biophysical models to explicitly link local climate to organismal body temperatures; to develop energy budget models to relate organismal body temperature to individual performance; and to identify the effect of temperature on interactions among the three species through a series of laboratory and field experiments. When linked, these studies will provide a mechanistic basis for exploring the role of temperature in structuring communities and will contribute to our understanding of the ecological consequences of future climate changes. Collaborators on the project include Michael O'Donnell (current FHL postdoc) and Deborah Donovan (WWU). The grant is for 2008-2012.

Other Grants to Faculty at FHL during 2008

The following list illustrates the broad range of externally funded research being carried out at FHL during the past year, by UW faculty working at FHL. This is only a partial list of FHL research, since there are many visiting researchers funded by grants through their own universities.

Dethier, M., PI. Nature Conservancy. Subtidal Survey of the Wasp Islands. 2007–2008.

Dethier, M., PI. Department of Natural Resources. Long-term monitoring and focus studies in shoreline biota in Puget Sound. 2007-2009.

Dethier, M., PI. King County. Intertidal biota surveys at Point Wells. 2006-2010.

Grunbaum, Danny, PI, Quantifying in situ Zooplankton Movement and Trophic Impacts in Thin Layers in East Sound, WA 2004-08, ONR.

Hanson, B. Duggins, D.O., PI. NOAA. Marine Mammal Research: R.V. Centennial. 2008-2009.

Newton, J., Sebens, K.P., PI. Washington Department of Ecology. Joint Effort to Monitor the Straits. 2007-2009.

Odell, G.M., P.I. NIH-NIGMS. Gene Networks: From molecules to mechanistic models. 2007-2009.

Sebens, K.P., PI. NSF-Field Stations and Marine Labs Program. FSML Student Researcher Housing. 2007-2008.

Strathmann, R.R., PI. NSF-OCE. Predator-induced morphological defenses of marine zooplankton. 2006-2009.

Strathmann, R.R., PI. NSF-OCE. Swimming and Vulnerability in Pelagic Development. 2002-2008.

Willows, A.O.D., PI. NSF. Geomagnetic sensing system. 2004-2008.

Wyllie-Echeverria, S., PI. Thatcher Bay Restoration. Skagit Fisheries Enhancement Group. 2006-2008.

Wyllie-Echeverria, S., PI. Washington State Parks. Recovery of Zostera marina following anchor and mooring buoy disturbances: A case study in Echo Bay, Sucia Island, WA. 2007-2008.

Wyllie-Echeverria, S., PI. Island County Cornet Bay Restoration Project – Eelgrass Assessment. 2008.

Please see our website for a full listing of researchers at FHL each year: http://depts.washington.edu/fhl/ResInts2008.html

and for a list of research publications by year: http://depts.washington.edu/fhl/resBibliography00s.html

FHL Postdocs

Michael (Moose) O'Donnell is thrilled to have the opportunity to work at the Friday Harbor Laboratories as a postdoctoral scholar. Thanks to the intimate connection between the lab and the environment, the Labs offer a unique opportunity for experimental studies to understand how aspects of the physical environment (such as temperature or water chemistry) set limits to where organisms can live.

Throughout Moose's professional career he has nearly always found himself only one degree removed from the laboratories. His first experience with marine research came – while studying English literature at UC Berkeley – in the form of a summer internship with Dr. Robert Steneck of the University of Maine (and a former visiting professor at FHL). During that summer he realized the pleasure of research diving, literally immersing himself in data collection to see the factors driving where organisms live. Following graduation and a brief stint in the business world, Moose returned to UC Berkeley, this time as a secretary working for Dr. Mimi Koehl (herself a former FHL postdoc). Watching Mimi and her graduate students and postdocs work reinforced the desire to continue a career of marine research. By taking a few classes and asking questions around the lab, Moose picked up enough basic biology knowledge to overcome his non-science degree.

Moose subsequently began graduate school in the biomechanics lab of Dr. Mark Denny at Stanford University. Early on, graduate school led to Moose's first experience at FHL, taking a summer course on Chemosensory Ecology in 1999. He spent part of his graduate school studying fluid mechanics in the civil engineering department. Through the connection between biology and engineering, Moose undertook his thesis research on the ways in which breaking waves structure intertidal habitats. For instance, his work documented the extent to which mussel beds provide protection from wave forces to organisms living nearby, something that ecologists had long postulated must be the case. Additionally, his thesis showed that, by splashing water high up in the intertidal zone, breaking waves may be as important at protecting intertidal organisms from thermal stress at low tide as they are a danger from physical dislodgement.

Following completion of his PhD in 2005, Moose did a postdoc in the physiological ecology laboratory of Dr. Gretchen Hofmann at UC Santa Barbara. Extracting RNA from larval samples to assess gene expression patterns was a huge shift from being bashed by waves, but it provided opportunities to ask organisms the extent to which certain environmental conditions affected their physiology. This work included biogeography of intertidal mussels as well as growing sea urchin larvae under conditions to simulate acidification of surface oceans by increasing CO2 levels in the atmosphere.

At FHL, Moose is excited to expand on his previous interests to learn how ecological interactions between organisms are influenced by the physical environment. This will include temperature effects in the intertidal as well as continuing looking at ecological effects of ocean acidification.

Robin Kodner received her bachelors degree in 2000 in Paleobiology and History from the University of Wisconsin – Madison and her PhD in Biology from Harvard University in 2007. Her research focuses on interpreting ancient organic matter. She is using modern organisms and ecosystems to define taxonomic specificity of biosignatures found in the geologic record.

Robin was first introduced to the labs in 2006, while she was a graduate student at Harvard University. She came to the labs to collect a marine green alga, that blooms in the San Juans in winter. This elusive phytoplankton is rarely studied though it likely has a global distribution, and the only consistent and reliable population to collect is here at the Friday Harbor Labs. Robin spent 5 month in the last year of her PhD work as a visiting researcher at FHL studying this organism, and is excited to be back here as an official member of the University of Washington. In her postdoc work at FHL, she is conducting a field survey of phytoplankton biomarkers from surface waters in the San Juans and following organic signatures from phytoplankton blooms in to sediments.

Robin is also teaming up with the Center for Environmental Genomics (CEG) in the School of Oceanography on main campus to develop genomic and metagenomic techniques to investigate the biosynthesis of these biosignatures, and will apply these method to her field site in the San Juans. At the CEG, she is working with Dr. Ginger Armbrust. Robin's work is helping to build more bridges between FHL and the School of Oceanography and bringing some exciting new research in microbial ecology, genomics and geobiology to FHL.

Associate Director

Richard Strathmann to Retire

After more than 35 years, Richard Strathmann will retire as Associate Director of the UW's Friday Harbor Laboratories in December of 2008.

The good news about Richard's retiring as Associate Director is that it will give him more time to devote to his research and will also enable him to continue teaching at FHL.

During his distinguished career, Richard has made many contributions to the field of marine invertebrate larval functional biology, larval ecology, and invertebrate development and evolution. He has also deeply influenced many generations of students in courses at Friday Harbor and at the UW in Seattle. He has mentored innumerable students who have been lucky enough to seek his company and advice. Not least of all, he has been an inspiration to his colleagues, who have benefited from his papers, his creativity, and countless discussions that always left them amazed at his intellectual breadth, courage and imagination.

The University of Washington and Friday Harbor Laboratories has decided to honor Richard and his wife Megumi with the establishment of an endowment fund that follows Richard's and Megumi's suggestion to support the education and research of graduate students working on problems relating to the Pacific Northwest and environs. This is a broad mandate that honors his love of natural history and organismal biology and allows the use of the funds to support anything from course expenses to graduate research.

Richard's contributions to the field of biology are many. His many years of teaching and research have made a profound impact. He has produced over 90 publications, has been a PhD advisor to 14 students (2 still in progress), has advised and has sponsored numerous masters students and postdocs.

On behalf of the students, staff and colleagues, Thank you, Richard and Megumi, for all you have done for FHL and countless students. You are both greatly appreciated.

Photo by Kathleen Ballard

Finding Adam

In September 2009, Adam Summers will become the Resident Associate Director of the University of Washington Friday Harbor Laboratories. Adam will have a joint faculty appointment with the Department of Biology and the School of Aquatic and Fisheries Sciences. He will reside at FHL, and will teach courses at FHL and in Seattle. Adam has been a regular member of the FHL summer faculty, and we are very pleased he will be joining us permanently next year.

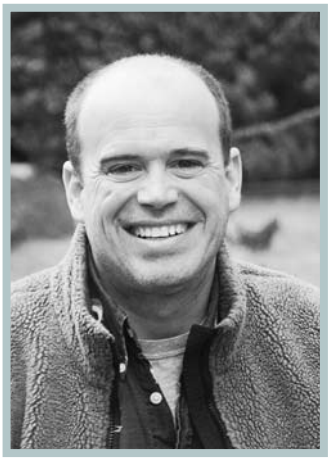

Photo by Kathleen Ballard

Adam was raised in New York City and in the north woods of Canada. At Swarthmore College he earned de-grees in mathematics and engineering, but was not interested in pursuing either as a career. While teaching SCUBA in Australia on the Great Barrier Reef he met his first professional biologists. He returned to New York to get a Masters degree in Biology at New York University then went to the University of Massachusetts for his Ph.D. From the beginning of his research career he capitalized on previous training as an engineer to understand the evolution of the mechanical systems of animals.

At the University of California Berkeley (UCB) he was a Miller Research Fellow working on the mechanics of salamander walking and the jaws of a particularly unusual group of limbless amphibians called caecilians. While at UCB he was approached by Pixar Studios to help them with the movie **"Finding Nemo."** He spent three years advising on animal movements and biological aspects of the film.

Seven years ago Adam founded the Biomechanics Laboratory at the University of California Irvine, and while there he won the Bartholomew Prize for physiology research and the UC Academic Senate prize for undergraduate teaching. With students and collaborators he has published prolifically on abstruse subjects including the heads of hammerhead sharks, the properties of skeletons and the difficulties of eating hard prey. He also enjoys sharing his enthusiasm for the field of biomechanics with a monthly column in *Natural History Magazine*.

Adam's involvement with the Friday Harbor Labs began when he was a graduate student taking the fish biomechanics course taught by Karel Liem and Bruce Miller. He returned twice as a teaching fellow in the course, then he took over the teaching duties. Adam has been involved in mentoring Blink's Fellows and has two graduates of the program as PhD students in his lab. During 2008-2009, Adam is serving as a Program Director at the National Science Foundation in Washington, D.C., in the Physiological and Structural Systems Cluster, Directorate for Biological Sciences.

The FHL Marine Life Endowment

The FHL Marine Life Endowment (MLE) has reached its goal to assure the future and the quality of the Inverts, Algae, Fish, and Embryology Courses.

by Dennis Willows

In the summer of 1964, fresh out of an undergraduate degree in Physics, my graduate advisor, Graham Hoyle, nudged me into the FHL course in Marine Invertebrates. Arthur Fontaine and Lem Fraser taught that summer, and our TAs were Meg Strathmann, and Jack Boykin. That experience really 'lit my fire'…. and ignited my graduate thesis and then four decades of career research in neuroscience.

While Director of FHL during 1972-2005 I had the good fortune to meet hundreds of other students who told me that their lives, both personal and professional, were profoundly shaped by the FHL courses in Marine Invertebrates, Algae, Fish, and/or Comparative Embryology. These foundational courses have been offered almost every year since the founding of FHL in 1904.

So when it became evident that financial pressures on universities were reducing the quality and even eliminating entirely many of these kinds of courses nationally, Betsy Gladfelter (Inverts, '68) and I decided to prevent that from happening here.

It was a gratifying experience. In under two years, we heard from 25 people who made bequests (total > $7M) and 45 more who made cash gifts (total > $40K), to "vest" the Marine Life Endowment. Their names are listed here. Next time you see one of them, be sure to give that person a hug, or at least a pat on the back. **They have done it!** These courses will be sustained with internationally eminent faculty, fine students and graduate TAs for the indefinite future. Although the endowment won't be paying for all the courses immediately (that will have to wait for our Wills to "mature"!), even now the MLE has begun to help to pay for the foundational courses. It also provides immediate leverage on UW-FHL to do the right thing, since the bequests and future income generated by the MLE are absolutely contingent even now, upon the continuing health of these courses.

There were many more people who indicated a strong interest in making bequests to the MLE but chose not to do so now. For those people, and for others, there is a second option, that in my opinion is at least, as crucial to future students and to the quality of FHL training. I would urge all FHL friends and alums to please consider the newly established Marine Research Vessel (MRV) Endowment, organized by Gordon Robilliard and George Von Gehr. The Marine Research Vessel Endowment assures students' access to research vessels and SCUBA to launch and sustain their field work.

Donors to the Marine Life Endowment Include:

Bequests:

Anonymous • Elizabeth Brainerd • Joan Ferraris and Jon Norenburg • Lara Ferry-Graham • Paul Gabrielson • Katherine Graubard and Bill Calvin • Betsy Gladfelter • Brian Helmuth • Laurinda Jaffe • Alan Kohn • Bob Lundeen • Sam and Laura Long • Lloyd and Terri Matsumoto • Bruce Miller • Trish Morse • Don Peek • Mary Rice • Pamela Roe • Ken Sebens and Emily Carrington • Adam Summers • Jim Truman and Lynn Riddiford • Arthur Whiteley • Dennis Willows

Donations:

Aimee Bakken • Doug Allen • David Bentley • Maria Byrne • Bill Calvin and Katherine Graubard • Bruce Crawford • Carla D'Antonio • Paul Dayton • Jeffrey Felix • David and Ina Gotelli • John Howieson • Akiko and Mineo Iwata • David Jamison • Nancy Knowlton • Charles Laird and Judith Shepherd • Gretchen and Charlie Lambert • L.H. (Hank) and Linda Livingston • Jane Lubchenco • Lloyd and Terri Matsumoto • Ellen Mehan • Rachel Ann Merz • David Meyer • Claudia Mills • Jay Mittenthal • Phyllis Mumaw • Gene and Martha Nester • Joann Otto • Leonard M. Passano • Lynn Riddiford and Jim Truman • Mary Rice • Brian Rivest • Pamela Roe • Paula Shadle and Robert Miller • Karen E. Spaulding • John Spady • Richard and Megumi Strathmann • Stephen Stricker • Richard Vance • Steve Vogel • Robert and Susan Waaland • Jason Wolfe • Larry Wolf • Sally Woodin • Russel Zimmer

Save the Date

Friday Harbor Laboratories presents
The 9th Annual

Jazz at the Labs

at Friday Harbor Laboratories

Saturday, June 6, 2009

Featuring Dennis Willows and
The San Juan Jazz Quintet + 1
And returning by request
Jay Thomas and Seattle's
Fabulous Jazz Coalescence
With Chris Amemiya

Jazz at the Labs supports the Friday Harbor Laboratories K-12 Science Outreach Program in the San Juan Schools

For information call Bob Schwartzberg
at 360-378-2165, ext.2

See an excerpt from Jazz 2008,
at www.sanjuanislandstv.com and click on events.

Scholarship / Fellowship Funds

Ellie Dorsey Memorial Fund:
Generates an annual gift presented to a student in memory of Ellie Dorsey

Patricia Dudley Endowment
Supports the study of systematics and structure of organisms and marine ecology

Fernald Fellowship Endowment:
Supports graduate students for studies of marine invertebrate development

FHL Discretionary Fund for Excellence:
Provides funds for student aid and encourages diverse initiatives that benefit FHL

FHL Research and Graduate Fellowship Endowment:
Supports graduate students and postdocs for marine science studies

Anne Hof Blinks Fellowship Endowment:
Supports students of diverse backgrounds in marine science studies

Illg Distinguished Lectureship Endowment:
Brings specialists to present lectures on invertebrate biology and to meet FHL students and researchers

Kohn Fellowship Endowment:
Supports graduate study of invertebrate biology research and course work

Marine Life Endowment:
Preserves FHL "core" courses in Marine Algae / Botany, Comparative Invertebrate Embryology, Marine Invertebrate Biology and Marine Fish Biology

Marine Science Fund:
A current use fund to provide student aid for courses the following year

Larry McEdward Memorial Fund:
Provides annual support for a graduate student in memory of Larry McEdward

Mellon Mentor Endowment for Excellence in Research Training:
Provides faculty salary in support of internship in marine science, matched 1:1 by the Mellon Foundation

Reed Undergraduate Endowment:
Scholarships to undergraduates for study of marine sciences

Richard and Megumi Strathmannn Endowed Fellowship:
Supports graduate students focusing on problems in the Pacific Northwest

Stephen & Ruth Wainwright Fellowship Endowment:
Fellowships for graduate students studying form and function of organisms

Dennis Willows Director's Endowment:
Provides future FHL directors with discretionary funds for unbudgeted needs including student assistance

2009 FHL Courses

Spring Quarter (March 30 - June 5)

The ZooBot Quarter:

- Marine Zoology
- Marine Botany
- Marine Benthic Ecology (Research Apprenticeship)

- Dynamics of Cellular Morphogenesis: Experiments and computer simulation (Research Apprenticeship)

Summer Term A (June 15 - July 17)

- Marine Invertebrate Zoology
- Fish Swimming
- Comparative Invertebrate Embryology
- Marine Algae

Summer Term B (July 20 - Aug. 21)

- Marine Bioaccoustics
- Larval Biology
- Estuarine and Coastal Fluid Dynamics

Autumn Quarter (Sept. 28 - Dec. 11)

Marine Biology Quarter:

- Society and the Marine Environment
- Scientific Diving
- Marine Biology
- Marine Environmental Research Apprenticeship

- Pelagic Ecosystem Function in the San Juan Archipelago (Research Apprenticeship)

Application and information available at:
http://depts.washington.edu/fhl/

People

FHL sponsored a "Meet the Author" reception for **Fu-Shiang Chia**. Fu-Shiang introduced his latest book "Airs of the States" from the Shi Jing, a new trilingual translation of the world's oldest collection of lyric poetry with parts dating back 3000 years. Fu-Shiang translated these poems from Classical into modern Chinese and then English. Fu-Shiang completed the first draft of the book at Friday Harbor Labs. Dr. Chia has a long history with the UW FHL having been a research assistant, researcher and instructor at the Labs. He is currently a member of the FHL Development Advisory Board.

Dan Hoffman, former student at FHL, authored "That Summer of 1964 on the Island; Stories from the Log of a Marine Biologist." This book of memories is a record of summers he spent as a zoology graduate student at the Labs in the summer of 1964, and memories of his experiences at other laboratories. The book is available on Amazon.com.

Terrie Klinger, University of Washington Associate Profesor of Marine Affairs. The Western Society of Naturalists has named Terrie Klinger as the 2008 Naturalist of the Year. She was selected because of her strong teaching record in marine biology, glowing praise from her students, her extensive knowledge of marine algae and benthic ecology and her research on environmental stressors and their impact on near shore systems.

David Montgomery, a University of Washington professor of Earth and Space Sciences, has been named a MacArthur Fellow. Montgomery was honored for fundamental contributions to understanding forces that shape our world. He has utilized the Whiteley Center at FHL many times to do his writing and acknowledged this in his book "Dirt." He states, "I am also grateful to the Whiteley Center at the UW's Friday Harbor Laboratory for providing the perfect environment to finish the manuscript."

Fernanda Oyarzun, a graduate student working on her PhD with FHL Associate Director Richard Strathmann and a teaching assistant at FHL, has been recognized by the UW with the Outstanding Teaching Award for creating new curricula to enable underrepresented minorities and students from disadvantaged backgrounds to achieve success in Biology 180, the undergraduate gateway course for life sciences.

FHL Contributors

We want to thank our many contributors for their kind and generous support of students and programs at FHL. Their interest in, and concerns for marine science are greatly appreciated.

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You can make a difference

If you wish to make a bequest, please discuss it carefully with your attorney. Our suggested bequest language is: I give, devise, and bequeath to the Board of Regents of the University of Washington, Seattle, Washington, (specific amount, percentage of estate, or property description) for Friday Harbor Laboratories.

As the old saying goes ... "Where there's a Will, there's a way."

For more information contact:
Office of Gift Planning:
Phone: 206-685-1001 or toll-free at 1-800-284-3679

E-mail: giftplan@u.washington.edu
Website: http://supportuw.washington.edu/giftplanning

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With a charitable gift annuity, you can direct the gift to the UW Friday Harbor Laboratories or to an FHL program of your choosing.

- **Support for the Research Apprenticeship Program**
- **Operational Support of the R/V Centennial**
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Single Beneficiary Gift Annuity Rate Table

AGE	RATE
55	5.3%
60	5.5%
65	5.7%
70	6.1%
75	6.7%
80	7.6%
85	8.9%

For more information, contact Bob Schwartzberg, Director of Development, UW Friday Harbor Laboratories at 360-378-2165 ext.2 or by e-mail at rsberg@u.washington.edu

Or visit the UW Website at www.uwfoundation.org/giftplanning

From the Director's Office...

Today's ecologists, marine biologists, and fellow travelers face a difficult challenge – how to conduct their research in an environment that is certainly changing, often in unpredictable ways. Do the interactions we find today represent long-standing, possibly co-evolved, relationships or are they fairly recent developments that might not last very long? Should we even expect to see the same biological communities in the intertidal or subtidal zone, that were here when FHL was founded? Maybe the differences over the past century are not so great, but what about the next one, where atmospheric and sea surface temperatures will increase substantially, and the oceans will become even more acidic. Could Osamu Shimomura have done his Nobel Prize research on GFP if almost all the *Aequorea* jellyfish had disappeared?; that's the situation right now. Disturbing as these scenarios are, many researchers are drawn to ecology and environmental science for just that reason – no matter how bad it is, they want to know, and maybe do something about it. FHL has always been a site for important ecological research, and a great place to compare to the very different exposed coasts of Washington state and Vancouver Island. I can only see more such research happening here in the future.

One of the most amazing resources we have at FHL is a network of biological preserves, totaling over 1500 acres on San Juan and Shaw Islands. These preserves include much forested land, some open grassland areas, many rocky outcrops, and miles of protected intertidal rock, mud and sand. On Shaw Island, we have the Cedar Rock Preserve, with a resident caretaker and several buildings, and the Fred and Marilyn Ellis Preserve, consisting of four parcels, three with waterfront, including Pt. George. This has been a very popular site for intertidal and subtidal research; it is the point of land you can see directly across from Cantilever Pt. at FHL. These preserves total almost a thousand acres, which means that a large part of Shaw is protected from development and will stay in its natural state. The terrestrial habitats on Shaw and San Juan Islands have attracted researchers studying beetles, butterflies, bluebirds, trees, native plants on rocky outcrops, prairie grasses, small mammals, and classes have visited Shaw Island specifically to examine the terrestrial plant communities almost every year. Over the past two years, we have improved the facilities and renovated some of the buildings to make use of the Shaw preserves easier.

On San Juan Island, everyone knows about the Pt. Caution / FHL biological preserve, almost 500 acres of forest and rocky habitat with some of the most beautiful intertidal and coastal habitats on the island (ever been to Shady Cove? Collins Cove? Heaven?), as well as some of the largest and oldest trees on the island, visible along the Fire Trail. The subtidal zone adjacent to this preserve has been a favorite site for diving research, but only recently have my students and I begun to quantify the whole biological community (long-term studies initiated in 2006). By a stroke of luck, I found out that Chuck Birkeland had done about four years of photographic quadrat studies at the same site during the 1960s-1970s, when he was a grad student here. He donated the photographic slides, so we can make some important comparisons to see how the rocky subtidal benthos has changed over four decades. Also on San Juan Island, we have False Bay, the iconic study site for soft bottom types, and Argyle Lagoon and its tidal creek, a favorite collecting site for some very strange creatures in the lesser known phyla. In a foresighted move, the university purchased both of these properties when the opportunity came up, to our everlasting benefit.

Adjacent to the terrestrial and intertidal habitats in the biological preserves are four marine preserves, or marine protected areas (MPAs), managed jointly by the Washington Department of Fish and Wildlife, and the university, through FHL. One additional marine preserve surrounds Yellow and Low Islands, owned by The Nature Conservancy. For the past three years, Megan Dethier, Pema Kitaeff and their assistants have conducted surveys of the subtidal zone off Yellow Island, which represents the first information on the composition of those subtidal marine communities. Last year, this MPA received protection from all forms of fishing. The other preserves exclude bottom-fishing, but allow trolling for salmon, which still results in some bottom fish catch.

The MPAs have already had one major effect – lingcod have made a sharp recovery, in numbers and size, and several species of rockfish are more abundant in the preserves than in control areas. This effect has not been seen generally, despite catch limits of only one rockfish per day, nor have they been seen in the voluntary bottom fish recovery zones established by San Juan County. Rockfish are very slow growing, and reproduce late compared to other fish, so they need a lot of protection to make a comeback. Our (mandatory) preserves show this is possible; now it is time to do something on a larger scale. Australia, for example, decided it had to make about a third of the Great Barrier Reef into MPAs to ensure survival of their reef fish and other biota.

The University of Washington has just established a new "College of the Environment", and I expect FHL will have a strong linkage with that college. I hope this new emphasis brings additional researchers to FHL who will use our amazing network of biological preserves to help understand the ecology of this region, the ways in which it is changing, and what we might do to prevent the worst scenarios. There is plenty of room for terrestrial ecologists to work at these sites, staying at FHL or at Cedar Rock on Shaw Island, along with our traditional marine researchers. And yes, we will continue to investigate the evolution of marine creatures, the workings of cells and embryos, and the mechanics of fish locomotion, among many other fascinating endeavors at FHL. Once in a while, some of those researchers will look out the window and wonder what those of us in boats and dive gear are finding, and whether the creatures they work on will still be here when their students need them.

Young Investigator Prize

University of Washington Friday Harbor Laboratories

The UW / FHL Young Investigator's Prize is awarded every year to the high school junior or senior showing the greatest promise in the fields of science and mathematics. Regional students submit high school transcripts, two Letters of Recommendation (from teachers or scientists with whom the applicant has previously worked), and an essay describing their background and career goals. The winner is picked by a committee of three University of Washington professors and is awarded a cash prize ($4000 in 2008). In addition, the winner is expected to spend the summer as a full-time research assistant in a UW FHL laboratory.

For more information about the Young Investigator Prize, or to contribute to the Prize, contact David Duggins at dduggins@u.washington.edu.

For Labbies Only...

Here's an easy way to help the U.W. Friday Harbor Laboratories -- no cost, just a bit of your time:

If you are a Labbie (that means you've have spent any time at all at FHL, as a student, instructor or researcher), please take a few minutes and take a special Friday Harbor Laboratories survey. The results will help improve FHL, and will be used to make a case for increased funding of our apprenticeships, classes and facilities.

So please go to:
http://depts.washington.edu/fhl/survey.html

Your help with this survey is greatly appreciated.

Photo by Robert Waaland

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