

**HSU Academic Department Reports – Biological Sciences  
October 10, 2008 - Program Prioritization**

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I. Departmental Mission, Goals and History

MISSION STATEMENT

The Department of Biological Sciences at Humboldt State University is one of the premier campuses in the CSU system for teaching and conducting research in the life sciences. In an era when rapid advances in biology are changing all facets of the human experience, future citizens must increasingly be environmentally, economically and socially responsible to build viable and sustainable communities. Clearly, biology-oriented teaching that promotes hands-on learning and environmental conservation must therefore be a major focus on our campus.

Teaching and training in the biological sciences are especially challenging and exciting because fundamental knowledge of biological processes is expanding at an ever-accelerating rate, creating a constant need for course revision and curricular re-invention. This explosion of information requires us to place more and more emphasis on critical thinking and problem solving in our curriculum, rather than on the dissemination of facts.

In addition, an unusually large portion of this new, fundamental knowledge is directly relevant to the public in an era in which environmental concerns have become truly global in scope. Developing our students' essential analytical skills requires intensive teaching, involving a combination of "hands-on" field work, laboratory work, problem-solving, writing and oral presentation skills. These activities are inherently more costly than traditional lecture format courses, yet are an integral component of adequate preparation for careers in the life sciences. With rapid increases in everything from DNA databases to coral reef bleaching around the globe, careers in the life sciences will continue to expand and diversify, placing high enrollment pressure on our courses.

Biological Sciences faculty are also heavily involved with their undergraduate and graduate students as they investigate an extraordinary array of research problems, ranging from the diversity of genes and genomes to the organization of communities and ecosystems, and from the evolution of life forms to the diversity of the biosphere. These activities, along with the extraordinarily beautiful and diverse local habitats that are readily available for research, give our students outstanding opportunities to truly "make a positive difference" in the world around them.

Faculty within the Department of Biological Sciences embrace the importance of our teaching mission at three academic levels: teaching undergraduates preparing for life sciences careers, training the next generation of biological scientists at the graduate level, and helping to engender a scientifically literate public.

## GOALS

Our strategic goals for these teaching missions are briefly outlined below. We recognize two kinds of goals in our programs: (1) universal goals, which are not restricted to any one course or group of courses, and (2) course specific goals, which vary in specific detail from course to course.

### *Universal Goals*

- Foster an understanding and appreciation of the diversity and complexity of the natural world and encourage its preservation.
- Teach our students how to acquire and synthesize knowledge of the living world and how to communicate it effectively and accurately in both written and oral formats.
- Demonstrate to our students that education in the biological sciences extends beyond the classroom.
- Ensure that our students are scientifically and technically aware and possess the skills needed for life-long inquiry.

We also recognize goals that are course specific. These goals include an understanding of basic concepts and the mastery of technical skills used in the discipline.

### *Course Specific Goals*

- Ensure that students develop an understanding of the scientific process by teaching them to ask meaningful questions, formulate alternate, testable, hypotheses, and employ the methods of science to gather and interpret data in testing those hypotheses.
- Ensure that students are literate in the language of science, which includes the use of mathematical equations, quantitative data, analytical procedures, and the representation of data in graphs, tables, diagrams, and in written expression.
- Ensure that students understand that all life forms possess mechanisms to extract, transform, and use energy from their environment in ways that allow for their maintenance, growth, and reproduction.

- Ensure that students are aware of the interconnectedness of life on Earth and that all biological processes occur within both a genealogical (evolutionary) and organizational (molecules, cells, organisms, populations, communities, ecosystems, and the biosphere) framework.
- Ensure that students understand that biological evolution offers the only logical, scientific explanation for the simultaneous unity and diversity of life on earth.

## RECENT HISTORY OF THE DEPARTMENT

The Department of Biological Sciences has undergone many changes this past decade plus. In 1990 there were more than 30 permanent faculty in the Department; today we have just over 20, with only 3 in our largest emphasis: Marine Biology. The Department has gone through nearly a complete turnover of faculty. As a whole, the previous cohort was not nearly as active in research as their replacements. This has added demands on time, space, and workload for all faculty, but has led to unprecedented opportunities for our undergrad and grad students to become involved in creative endeavors. Additionally, we have experienced significant growth in enrollment, and with recent declines in faculty most advisors carry loads of nearly 50 students.

The Department of Biological Sciences offers three B.S. degree programs: Biology (eight different options), Botany, and Zoology. Additionally, we provide three Minors (Biology, Botany, Zoology), and six pre-professional programs (Pre-medical, Pre-veterinary, Pre-dental, Pre-optometry and Pre-pharmacy, and Science Teaching).

Our graduate program (Biology Masters) has approximately 50 active students per year. Grad students not only enroll in courses and are involved in original thesis research projects, but they also provide a significant fraction of our teaching, especially in lower-division lab courses.

In addition to the excellent success of our teaching mission, the Department has an exemplary record of scholarship and outreach efforts, highlighted in our four program reports. These efforts provide comprehensive support for students, faculty and regional communities and are integrated across departments in all three colleges, as well as across other university campuses. Faculty in the Department have been largely responsible for bringing in over \$8 million in grant funds during the last five years. Furthermore, most of these extracurricular initiatives have funds in the pipelines. Here we briefly describe several major initiatives.

The **Howard Hughes Medical Institute at HSU**, founded more than 15 years ago and directed by Dr. Jacob Varkey, has brought major support for undergrad education and educational outreach. This series of grants from HHMI represent one of the longest periods of continuous support to any university for funding undergrad education. Funds have supported summer internships, supplementary instruction classes in CNRS, workshops for high school students as well as summer research opportunities. Undergraduate summer internships provided stipends, research funds, and training in oral/written communication skills. Many of the student participants have presented at scientific meetings or in peer-reviewed journal publications.

The **Marine Mammal Education and Research Program (MMERP)**, founded in 1997 and directed by Dr. Dawn Goley, is one of only five university-based programs in the country involving undergraduates in marine mammal research. MMERP fosters an understanding of the biology of local marine mammals through research and education. Undergraduates gain research experience in marine mammal science through active engagement in on-going gray whale, Steller Sea Lion and Harbor Seal research projects to advance our understanding of the behavior and ecology of these marine mammals along the northern California coast. This highly popular program has trained over 250 students during the last 10 years and continues to grow.

The **Redwood Science Project (RSP)**, founded in 2000 and directed by Dr. Jeffrey White, is a significant regional player supporting education with funding from grants totaling \$3.7 million. RSP projects include outreach to K-12 schools, teacher professional development, future teacher programs for undergraduates and credential program students, research and program evaluation, and media development.

Over 400 teachers and future teachers from 13 counties participated in RSP programs in the last three years leading to enrollment with over seven departments in our three colleges. Formal partnerships include sixteen K-12 school districts in six counties, four CSUs, two UCs, two federal agencies, three state agencies, three science museums, and a number of non-profits.

The **Research Experience for Undergraduates (REU) Program**, directed by Drs. Sean Craig and Matt Johnson since 2004, is targeted at groups under-represented in science, and provides funds for mentored summer research focused on a wide array of topics in Ecology and Evolutionary biology. Students receive a generous stipend (>\$4,000), housing, meals and research supplies needed for individually designed projects that are completed during the 10-week program. Students work closely with one or more of the 16 participating faculty from 9 departments at HSU. Our REU students have co-authored papers, given talks at regional and national meetings, received academic awards for the quality of their research, and initiated scientific clubs for minority students on our campus. Many previous REU participants are now in prestigious Medical or Graduate programs around the country.

The **Bioacoustics Projects**, begun in 2004 in the laboratory of Dr. Joseph Szewczak, receive support from federal sources and several states (\$1.6 million) to develop hardware and software to automatically monitor and recognize bat and bird species from their vocalizations. This initiative has sent students to 35 states and supports grads and undergrads with stipends.

The **Central and Northern California Ocean Observing System** (formerly CICORE) at HSU, directed by Dr. Frank Shaughnessy since its inception in 2002, provides for placement of infrastructure as well as a website for real-time monitoring of coastal marine ecosystem processes from Point Conception to the CA-OR border. The data generated are used in CNRS classes, undergrad and grad student research, and by state agencies and mariculture companies.

The **Research at Undergraduate Institution (RUI) Program**, directed by Dr. Patricia Siering and co-directed by Dr. Mark Wilson is a 5-year \$1.2 million collaborative project involving students and researchers at HSU, Portland State University and CSU-Chico. With funding from the National Science Foundation beginning in 2008, this project seeks to understand the biodiversity, microbial activities, and interactions among microorganisms and their viruses in a hydrothermal ecosystem sited at the largest hot spring in North America, Boiling Springs Lake in Lassen Volcanic National Park. It will directly impact ca. 800 undergraduate students in classroom and research activities, and will also contribute to graduate and high school student training.

## II. Departmental Faculty and Staff

<b>Biological Sciences Dept Instructors -- AY Average Count of Appointments</b> facpos_BIOL report generated: 22-FEB-08						
<b>Appt Category</b>	<b>AY 02/03</b>	<b>AY 03/04</b>	<b>AY 04/05</b>	<b>AY 05/06</b>	<b>AY 06/07</b>	<b>AY 07/08</b>
Lecturer	10	8	9	8	9	6
Assist Prof	6	7	7	7	7	6
Assoc Prof	9	7	8	9	11	7
Professor	8	6	6	4	6	8
Teach Assoc	23	26	21	24	22	20
Volunteer	4	5	4	3	1	1
<b>Total</b>	<b>59</b>	<b>57</b>	<b>54</b>	<b>55</b>	<b>55</b>	<b>47</b>

<b>Biological Sciences AY average FTEF (time base totals)</b> facpos_BIOL report generated: 22-FEB-08						
<b>Appt Category</b>	<b>AY 02/03</b>	<b>AY 03/04</b>	<b>AY 04/05</b>	<b>AY 05/06</b>	<b>AY 06/07</b>	<b>AY 07/08</b>
Lecturer	4.08	3.81	4.60	4.49	3.83	3.02
Assist Prof	6.00	6.50	7.00	6.50	6.84	5.50
Assoc Prof	8.50	6.38	7.84	8.88	11.00	7.00
Professor	7.45	5.21	5.21	4.00	5.50	7.39
Teach Assoc	5.50	5.70	5.05	5.36	4.41	4.83
Volunteer	.24	.42	.48	.36	.03	.03
<b>Total</b>	<b>31.76</b>	<b>28.00</b>	<b>30.16</b>	<b>29.59</b>	<b>31.60</b>	<b>27.76</b>

<b>Biological Sciences department release/assigned time</b>						
<b>facpos_BIOL report generated: 22-FEB-08</b>						
<b>Assignment Description</b>	<b>AY 02/03</b>	<b>AY 03/04</b>	<b>AY 04/05</b>	<b>AY 05/06</b>	<b>AY 06/07</b>	<b>AY 07/08</b>
Excess Enrollment (=>75)	.70	.80	.83	.68	.68	.35
New Preparations	.07	.10	.00	.20	.10	.00
Non-Traditional Instruction	.03	.00	.00	.00	.00	.00
Special Instr Programs	.89	.76	.71	.76	.73	.50
Instr Experimt Innov/Research	.90	1.03	1.48	.00	.23	.33
Instr-Related Services	.20	.16	.16	.13	.07	.07
Advising Responsibilities	.20	.20	.23	.20	.20	.20
Instr-Related Comm Assignmts	.18	.00	.24	.15	.00	.00
Curricular Planning or Studies	.00	.00	.00	.10	.00	.00
Calif Faculty Assoc Activities	.00	.00	.00	.00	.10	.10
Dept Chair AY, Leaders/Dir.	.43	.43	.43	.43	.43	.43
Dept Chair – 12mo	.50	.50	.50	.52	.50	.50
Proj/Prog Leaders, Dir., Coord	.07	.00	.00	.00	.00	.00
Other State Funds	.00	.00	.00	1.13	1.74	.43
Grant: Redwood Projects	.00	.00	.00	.00	.00	.20
Grant: Academic	.00	.00	.00	.00	.80	.13
External non-State Funds	.00	.00	.00	.00	.05	.95
<b>Total</b>	<b>4.15</b>	<b>3.97</b>	<b>4.57</b>	<b>4.28</b>	<b>5.63</b>	<b>4.18</b>

*Personnel (At least .5 FTE)*

Name	Position	Description of Specialty and Key Contributions (no more than 100 words per person)
Mr. Anthony Baker	IST III (1.0)	<b>Stockroom Manager</b> Manages biology stockroom including molecular biology core facility.
Ms. Robin Bencie	IST II (0.5) and Lecturer (0.27)	<b>HSU Collections Manager, Vascular Plant Herbarium Lecturer-Botany</b> Manages HSU Herbarium and teaches labs for Plant Taxonomy.
Ms. Andrea Bartles	IST I (0.75)	<b>Lab Technician-grant funded</b> Technician for the NSF-RUI Project, Microbial Observatory.
Dr. Milton Boyd	FERP Professor	<b>Marine Ecology</b> Teaches Principles of Biology, advises, and serves as CFA faculty representative.
Dr. Michael Camann	Professor	<b>Insect Community Structure</b> Teaches Entomology, General Ecology, Principles of Biology. Active research faculty in insect ecology at community and ecosystem scales: insect assemblage structure, how external forces influence insect community structure, especially anthropogenic land use and disturbance, and how insect community structure influences ecosystem processes such as organic detritus processing and nutrient mobilization. He approaches these questions on several fronts, including forest canopy insect ecology, forest soil microarthropods, and freshwater macroarthropod ecology. Also developing site-specific biomonitoring protocols in Northern California.
Dr. Sean Craig	Associate Professor	<b>Marine Ecology &amp; Evolution;</b> Teaches General Zoology, Invertebrate Zoology, and Intertidal Ecology. Active research faculty in 2 areas of marine biology: 1) self-nonsel recognition and the evolution of cooperation in colonial marine animals, and (2) rocky intertidal and subtidal community ecology, with a particular focus on interactions between native and introduced species. He is Director of HSU's Research Experiences for Undergraduates (REU) Program.

Name	Position	Description of Specialty and Key Contributions (no more than 100 words per person)
Dr. Dawn Goley	Associate Professor	<p><b>Marine Mammalogist</b> Teaches Mammalogy, Marine Mammalogy, and Animal Behavior. Active research faculty in distribution of marine mammals along the Pacific coast of western North America; Ecology and behavior of cetaceans, pinnipeds, and other marine mammals; Director, Marine Mammals Education and Research Program (HSU).</p>
Dr. Terry Henkel	Associate Professor	<p><b>Mycologist-Ecology and Systematics of Fungi</b> Teaches General Botany, Mycology (3 courses), and Plants and Civilization. Active research faculty in neotropical macrofungal surveys and alpha-taxonomic description of basidiomycetes and ascomycetes; development of local myco-florulas, and comparison of the structure and functional roles of fungal communities in forests of the Guiana Shield. Also investigates the roles ectomycorrhizal associations have in structuring tree communities in tropical rain forests; uses of fungi by indigenous peoples of northeastern Amazon region, including Guyana and Brazil; investigating the effects of land management practices on macrofungal communities in coastal forests of Northern California.</p>
Dr. Thorvald Holmes	IST II (0.5) & Lecturer (0.13)	<p><b>Vertebrate Museum Manager/Lecturer-Mammalogy</b> Manages HSU Vertebrate Museum and teaches Mammalogy.</p>
Dr. Bryan Jennings	Assistant Professor	<p><b>Howard Hughes Medical Institute Assistant Professor of Molecular Biology and Bioinformatics</b> Funded by HHMI grant for first four years at HSU, then position will transition to faculty line at HSU. Teaches courses in molecular biology, genomics, bioinformatics. Active research faculty in the ecological and evolutionary basis of species radiations. His research focuses on diversification of birds and non-avian reptiles at multiple hierarchical levels.</p>
Mr. Terry Jones	IST III (1.0)	<p><b>Microbiology Laboratory Supervisor</b> Maintains microbial cultures, prepares organisms and materials for many courses and individuals in the Department as well as the community.</p>

Name	Position	Description of Specialty and Key Contributions (no more than 100 words per person)
Dr. Erik Jules	Associate Professor	<p><b>Plant Population &amp; Community Ecology</b> Teaches Principles of Ecology, Population &amp; Community Ecology, and Plant Ecology. Active research faculty in plant demography and invasion ecology. Recent studies concern the spread of a non-native pathogen on a cedar endemic to Northwest California and Southwest Oregon, the effects of logging practices on plant population extinction risk, and the evolution of tolerance to serpentine habitats in non-native plants. He also has a passion for environmental history. Most of his work is conducted in the Klamath Region of California and Oregon.</p>
Mr. Michael King	Instructor (~0.93)	<p><b>Lecturer-Human Anatomy &amp; Physiology</b> Teaches a variety of course in human anatomy, physiology, introductory biology, etc.</p>
Dr. Casey Lu	Professor and Chair	<p><b>Plant Physiologist/Secondary Science Education</b> When not chair, teaches Principles of Biology, Plant Physiology, Electron Microscopy, and Plant Tissue Culture. Active research faculty studying how plants respond to heavy metal stress with a focus on plants grown in lead-contaminated conditions. Results of this research may apply to improving phytoremediation techniques for contaminated sites in California and the US. Re-established the grant-funded Redwood Science Project (promoting improvements in science education) in 2000 along with Drs. White and DeMartini.</p>
Dr. Sharyn Marks	Professor	<p><b>Herpetology, Conservation Biology, and Evolutionary Developmental Biology</b> Teaches General Zoology, Animal Development, and Herpetology. Active research faculty in a program that investigates the ecology of several amphibian species. She addresses basic biological questions such as (1) What are the environment factors that regulate amphibian activities? (2) How do we predict the distribution of species on a landscape scale? and, (3) How do the habitat requirements of an individual species vary over its life cycle? By integrating knowledge of amphibian ecology with information on the mechanisms of amphibian declines, land managers can develop effective plans for maintaining biodiversity.</p>

<b>Name</b>	<b>Position</b>	<b>Description of Specialty and Key Contributions (no more than 100 words per person)</b>
Dr. Michael Mesler	Professor	<b>Plant Systematics, Pollination Ecology, Pteridology</b> Teaches Plant Taxonomy, Plant Animal Interactions, and Pollination Biology. Active research faculty studying mating biology of ferns; evolutionary consequences of hybridization; and pollination ecology. Most of his work is centered on the interactions between flowers and pollinators.
Dr. Edward Metz	Associate Professor	<b>Evolutionary Genetics</b> Teaches Genetics, Evolution, and Invertebrate Zoology. Active research faculty studying the genetics of sperm-egg interaction during fertilization in marine invertebrates, including sea urchins and abalone. Specific interests include studies of adaptive evolution with aspects of both organismal and molecular biology. He is especially interested in (1) mate choice and sexual selection and (2) "arms races" between hosts and pathogens.
Ms. Crystal Miller	ISA I (0.5)	<b>Interim Greenhouse Assistant</b> Manages living collection in HSU Greenhouse.
Ms. Shannon Morago	Project Coordinator (.15), and Lecturer (.35)	<b>Secondary &amp; Elementary Science Education</b> Coordinates programs with the Redwood Science Project including advising and teaching methods in science.
Dr. Bruce O'Gara	Associate Professor	<b>Neurobiology and Animal Physiology</b> Teaches Human Physiology and Animal Physiology. Active research faculty studying the effects of copper on the behavior and neural function of the aquatic oligochaete worm <i>Lumbriculus variegatus</i> . Copper exposure negatively affects several locomotory behaviors as well as the electrophysiological properties of specific identified neurons. Dr. O'Gara's lab has developed several treatments that protect the animals from copper toxicity.
Ms. Country Otto	Lecturer (.67)	<b>Introductory Biology and Science Education</b> Teaching assignments include Introduction to Botany Laboratory, Freshman Interest Group seminars, and the Nature and Practice of Science.
Mr. Marty Reed	ET III (0.5)	<b>Equipment Technician</b> Takes care of everything! Works 0.5 for Biological Sciences and 0.5 for the rest of CNRS.

Name	Position	Description of Specialty and Key Contributions (no more than 100 words per person)
Dr. John Reiss	Professor	<p><b>Evolutionary and Developmental Morphology, Herpetology</b>  Teaches Human Anatomy, Animal Development, and Comparative Vertebrate Anatomy.  Active research faculty studying morphology of amphibian metamorphosis from an evolutionary perspective. He is particularly interested in the origins and diversification of the metamorphic patterns seen in living amphibians.</p>
Ms. Cheryl Satter	AA/S I (1.0)	<p><b>Department of Biological Sciences  Administrative Analyst/Specialist</b>  She runs the Department office, capable of doing just about anything.</p>
Dr. Frank Shaughnessy	Professor	<p><b>Seaweed and Seagrass Ecology</b>  Teaches General Botany, Phycology, Marine Macrophyte Ecology.  Active research faculty studying population and community ecology of marine algae and seagrasses. He is also involved in a CSU collaborative effort to set up an integrated ocean observation platform to monitor near shore marine water quality.</p>
Dr. Patricia Siering	Professor	<p><b>Microbial Physiology and Ecology</b>  Teaches Principles of Biology, Bacteriology, and Microbial Ecology.  Active research faculty studying the following: (1) role of bacteria in biogeochemical cycling in natural habitats; (2) diversity, physiology and genetic processes underlying microbial life in high temperature, low pH environments; (3) assessment and quantification of microbial biodiversity within natural communities, especially pertaining to the effects of environmental and anthropogenic perturbations; and (4) detection of microorganisms, their genes and associated activities in field and laboratory systems.</p>

<b>Name</b>	<b>Position</b>	<b>Description of Specialty and Key Contributions (no more than 100 words per person)</b>
Dr. Joseph (Joe) Szewczak	Associate Professor	<b>Comparative physiology and physiological ecology —especially of bats</b> Teaches Human Physiology and Animal Physiology. Active research faculty has investigated processes that involve gas exchange such as acid-base state, the control of ventilation, and how animals use that gas (i.e. metabolism). He has explored bats' physiological functioning from the cold depths of torpor, to how they acclimatize and fly at high altitudes. He is currently developing hardware and software for automated bioacoustical monitoring of bats and birds, and deterrent technology to prevent bat mortality at wind turbines.
Dr. Alexandru (Mihai) Tomescu	Assistant Professor	<b>Plant Morphology, Anatomy, and Paleobotany</b> Teaches General Botany, Developmental Plant Anatomy, Evolutionary Plant Morphology, and Paleobotany. Active research faculty studying the origin and early evolution of complex eukaryotic life on land; early land plants; plant evolutionary developmental biology (with emphasis on the evolution of the endodermis and leaves); the application of morphology in plant phylogeny reconstruction.
Ms. Leslie VanderMolen	Lecturer (~0.90)	<b>General Biology and Human Biology</b> Teaches General Biology lecture and laboratories. Has expertise in Human health and genetics.
Ms. Julie Van Sickle	Co-Director, Redwood Science Project (0.6)	<b>Science Education, Elementary; Academic Literacy.</b>
Dr. Jacob Varkey	Professor	<b>Cellular and Molecular Genetics</b> Teaches Genetics, Cell Biology, and Biotechnology. Active research faculty in Genetic and phenotypic analysis of genes involved in spermatogenesis by the nematode worm <i>C. elegans</i> . Dr. Varkey also directs the Alliance for Minority Participation (AMP) program at HSU and is the Program Coordinator of the Howard Hughes Medical Institute Undergraduate Biological Sciences Education Program at HSU.
Ms. Elizabeth Weaver	ASC I	<b>Department of Biological Sciences ASC/Graduate Secretary/Receptionist</b> She assists AA/S and Chair run the office, graduate secretary, co-webmaster.

Name	Position	Description of Specialty and Key Contributions (no more than 100 words per person)
Ms. Deborah Weigle	IST III (0.5)	<b>Interim Greenhouse Manager.</b> Manages living collection in HSU Greenhouse.
Dr. Jeffrey White	Associate Professor and Executive Director, Redwood Science Project (RSP)	<b>Plant Biogeography &amp; Systematics; Science Education</b> Teaches Biogeography, Biology of Rarity, Nature and Practice of Science, and a variety of course offering associated with the RSP. Active research studying plant biogeography and ecology, educational research on academic literacy in high school, and attitudes about science teaching. He is also the Director of the Humboldt Science and Mathematics Center, home of the Redwood Science Project, and is co-founder of the California Environmental Legacy Project.
Dr. Mark Wilson	Associate Professor	<b>Microbiology and Genetics</b> Teaches Principles of Biology, Genetics, and Bacteriology. Active research faculty studying the use of molecular genetics to address environmental questions, particularly questions concerning microbial ecology and diversity. This includes gene biogeography, gene expression, enzyme activity, microscale localization, physiological analyses, and genetic characterization of individual cells and populations in field sites. He is also interested in the characterization of interesting microbial isolates.
Dr. Jianmin Zhong	Assistant Professor	<b>Microbiology and molecular evolution</b> Teaches Bacteriology and Medical Microbiology. Active research faculty investigating bacterial endosymbionts in tick vectors of human and animal diseases. His long-term goal is to study bacterial gene expressions that are essential for maintenance and survival strategies of the symbionts in ticks by high throughput approaches, such as microarray and proteomic arrays. The overall research aim is to improve detection of tick-borne pathogens and control tick-borne diseases in the future.

### III. Recruitment and Retention

We have produced a new Departmental brochure; provided highlight points for University recruiters; and developed promotional videos and still images with members of the Graphics Department for placement on the University website and in other recruitment materials. Additionally, we assist in training HSU Tour Guides about our programs (at least once per year), and we regularly give tours to prospective students and their families. The chair estimates that around 100 families visited and toured the Department this past year.

In addition, department initiatives including the HHMI program, summer NSF-REU program, and LS-AMP programs, along with programs offered by RSP have assisted in retention of minority students and those underrepresented in the sciences by offering paid research opportunities year-round for both HSU students as well as minority students attracted from outside our institution (e.g. students from Stanford, Harvard and UC Berkeley working in summer in our REU program). We hope to continue to expand these programs in the future with an NSF-UMEB grant (Undergraduate Mentoring in Environmental Biology) submitted by Dr. Bruce O’Gara.

We have seen an increase in the number of our majors over the last three years. Our courses have strong enrollment, yet we have lost several faculty over the past five years. It does not appear that we need to do anything more than what is currently being done to generate as many students as we can handle. We clearly need to add more faculty in order to grow further and fully utilize some of our superb facilities.

### IV. Learning, Curriculum, and Assessment.

The learning outcomes for the Biology Department align closely with the specific learning goals from section I of this report. The five outcomes include:

- 1) Students should develop an understanding of the scientific process that allows them to ask meaningful questions, formulate alternate, testable, hypotheses, and employ the methods of science to gather and interpret data in testing those hypotheses.
- 2) Students should be literate in the language of science, which includes the use of mathematical equations, quantitative data, analytical procedures, and the representation of data in graphs, tables, diagrams, and in written expression.

- 3) Students should understand that all life forms possess mechanisms to extract, transform, and use energy from their environment in ways that allow for their maintenance, growth, and reproduction.
- 4) Students should be aware of the interconnectedness of life on earth and that all biological processes occur within both a genealogical (evolutionary) and organizational (molecules, cells, organisms, populations, communities, ecosystems, and the biosphere) framework.
- 5) Students should understand that biological evolution offers the only logical, scientific explanation for the simultaneous unity and diversity of life on earth.

As part of a study on student achievement among majors in our department, we have completed assessments on four of our five learning outcomes during the period from Fall 2006 to Spring 2008. ***Our methodology*** used an embedded assessment approach to address specific questions pertaining to each learning outcome. In each case, three to five multiple-choice or essay questions were included on final exams administered in three or four core courses central to departmental programs. Assessment questions were developed by faculty involved in the assessment efforts and in the target course offerings. Questions were reviewed and approved by the Biology Department's Curriculum Committee prior to final use. Only Biology, Botany, and Zoology majors were include in this study.

In total 522 student assessments in 13 different classes were completed. Approximately half of our faculty, nine all together, participated in the development and administration of the assessments. Below we provide brief summaries of our findings

### ***Learning Outcome 1 (Assessed Spring 2008)***

Assessment questions focused on developing hypotheses that related to provided observations, or distinguishing scientific reasoning from other types of thought. We assessed 102 students enrolled in the following courses: BIOL 340 Genetics (Metz); BIOL 412 General Bacteriology (Siering); and BIOL 430 Intertidal Ecology (Craig).

As assessed, the ability of our students to formulate hypotheses was not as advanced as we would like. Only about 50% of our students earned 67% or more of available points. To some extent, this may indicate that we have not been focusing on this specific skill consistently enough. At the faculty retreat in August 2008, we discussed this result, and some faculty thought that the over-emphasis in our core lower division curriculum of factual content, as opposed to

specific skill sets, was at least partially to blame. There were inconsistencies concerning how much time was devoted to developing this skill among different teachers teaching the same course. We agreed that a renewed focus and increased emphasis on developing hypotheses needed to take place in all of our lower division core courses, and that in upper division courses this should include time developing and evaluating experimental systems to distinguish competing hypotheses.

### ***Learning Outcome 2 (Assessed Fall 2007)***

Assessment questions focused specifically on the representation of data in graphs, tables, and diagrams. Most questions asked students to interpret data that was presented in a graph, table or diagram. We assessed 114 students enrolled in the following courses: BIOL 330 Ecology (Donahue); BIOL 340 Genetics (Varkey); and ZOOL 356 Mammalogy (Arbogast).

The assessment of students in the upper-division classes indicated a relatively strong ability to interpret information in graphs, tables and diagrams, with ~72% of the students earning 67% or more of available points. To some extent this might reflect ongoing curricular changes that the department has been engaged in for several years targeted at increasing active learning approaches in several courses, including BIO105 Principles of Biology and BIO330 Principles of Ecology which are taken by all of our majors (the only exception being students with an emphasis in Cell/Molecular Biology, who are not required to take BIO330). Several active learning activities focused on interpretation of data have been incorporated into these courses. Assuming that such strategies have in fact helped our majors develop these skills, the department would like to focus on similar skills in our largest GE course as well, BIO104. We recently proposed changing the structure of this course from 2 hours of lecture plus 3 hours of lab to 3 hours of lecture plus 3 hours of lab. The primary goal of this change was to introduce more active learning strategies; the content of the course was not increased. However, this curricular change has not yet been approved by the Vice-Provost.

### ***Learning Outcome 3 (Assessed Fall 2006)***

We assessed a total of 224 students in the following courses: BIOL 105 Introduction to Biology (Siering), BIOL 105 Introduction to Biology (Wilson), BIOL 330 Ecology (Donahue), BIOL 412 General Bacteriology (Zhong).

The results of this assessment were mixed, with students in the lower division courses not doing as well as we would hope (~60% of students earned 67% or more of available points) while upper division students did better (~73% earned 67% or more of available points). Some methodological issues reduced our confidence in the accuracy of the results. Some of these methodological issues included the types of questions that were used, for example, and the grading of some questions was difficult or ambiguous. Other questions were application-type questions that in retrospect we realized were somewhat more advanced than we thought was appropriate for assessment purposes in a lower division course.

***Learning Outcome 5 (Assessed Spring 2007)***

We assessed 82 students in the following courses: BIOL 340 Genetics (Wilson), BOT 350 Plant Taxonomy (Mesler), ZOOL 314 Invertebrate Zoology (Metz). Assessment questions addressed a variety of aspects of evolution, natural selection, and population genetics.

Students appeared to perform quite well; approximately 75% of the students earned 75% or more of available points.