

UNDERGRADUATE RESEARCH OPPORTUNITIES IN THE DEPARTMENT OF BIOLOGICAL SCIENCES

Most faculty members in the biology department mentor undergraduate research. Usually the student gets credit for this work by enrolling in BIOL 496 (individual study) with their faculty mentor. BIOL496 paperwork must be completed by the end of the schedule change period of the quarter. For each hour of credit, the student invests a minimum of three hours per week on their research project. Details are established with the particular faculty mentor. A brief introduction to faculty members' research interests and possible student research projects is given below. Contact individual faculty members for additional information.

Dan Beck - terrestrial ecology; ecophysiology; reptiles

My students and I conduct field and laboratory studies on the ecology and physiology of vertebrates, primarily lizards and snakes. Some projects include monitoring rattlesnake dens in Kittitas County, garter snake physiology, and snake thermoregulation. Students can also participate each winter quarter/spring break in a broader array of field research projects in the Sonoran desert and tropical dry forest biomes of Arizona and Mexico (through BIOL/GEOL 377).

Lucinda Carnell - behavior genetics in *C. elegans*; molecular neurobiology

My research involves using the free-living soil nematode, *Caenorhabditis elegans* to study neural pathways involved in controlling behavior. In particular, I am studying the pathways controlled by the neurotransmitters, dopamine and serotonin. These neurotransmitters are important for modulating behavior in animals from invertebrates to humans. I have performed genetic screens to identify mutants defective in response to dopamine and serotonin using well characterized behaviors modulated by these neurotransmitters such as rates of locomotion and egg laying. One current project involves genetic screening for mutants defective in their response to long-term exposure to serotonin on egg laying and characterizing these mutants by identifying the genes responsible for these altered responses to serotonin.

Tom Cottrell - plant ecology; response of vegetation to disturbance

My current work involves characterization of vegetation community changes that occur after fire. I hope to link these changes to factors such as fire intensity, frequency, and season of disturbance. Opportunities include becoming involved in the seed identification, or participation in a small greenhouse study this fall, in conjunction with this study. Summer opportunities may exist for field vegetation sampling for students who have a suitable coursework background (General Ecology and Plant Taxonomy). In addition to my own research topics I will consider working with students interested in diverse topics from rare plant communities to community dynamics of weed species.

Kris Ernest - terrestrial community ecology; herbivory

My research currently focuses on levels of herbivory in forest canopies. Opportunities for students include: collecting field data at the Wind River Canopy Crane site, laboratory or field studies testing whether our leaf marking techniques affect herbivory rates, quantifying elk herbivory in the understory, and literature searches for canopy herbivory. I am also interested in research on dwarf mistletoe in the more immediate vicinity of Ellensburg (or at least Kittitas County). I might be willing to direct UG research on other topics in terrestrial ecology.

Jason Irwin – environmental physiology; cold tolerance; insects, amphibians

My research interests focus on cold tolerance, especially insects and amphibians that freeze solid to survive northern winters. Potential undergraduate projects range from field studies of geographic distribution and the micro environmental conditions experienced by animals during the winter to laboratory studies of metabolic and other physiological responses to freezing and thawing. Although I often have potential projects in mind, I am open to new research ideas generated by students.

Paul W. James - aquatic ecology; fish biology

My research interests include stream ecology and fish biology. I have ongoing projects involving studies of the population dynamics and spawning behavior of trout and salmon. I am also interested in having students work with me on field studies that involve the habitat preference and home range size of stream fishes. In addition to projects on fishes, I am interested in the ecology of aquatic invertebrates such as insects and zooplankton that inhabit local streams and lakes.

Jim Johnson - mycology; molecular systematics; molecular ecology

My research interests include the systematics, evolutionary biology, biodiversity, and ecology of the mushrooms. My main focus has been using DNA sequences to understand the evolutionary relationships between species of fungi and then using the phylogenies to answer basic questions about the evolution of certain characteristics or the ecology of the organisms. Current areas of interest include: 1) the evolution of self-fertilization among the inky-cap mushrooms; 2) the diversity of ectomycorrhizal fungi along precipitation gradients; 3) the diversity and ecology of fungi associated with various mammalian herbivores; and 4) the molecular systematics of the mushroom forming fungi (Order Agaricales).

Holly Pinkart - microbiology; microbial ecology

My research focuses on microbial ecology and biogeochemistry. Currently, I am involved in a project that examines the diversity and activities of microorganisms in Soap Lake, a lake that is both saline and alkaline. Because the lake supports no life forms larger than zooplankton, it is an ideal setting in which to examine a closed, microbially dominated ecosystem. Students involved in this project will learn a variety of techniques for culturing and characterization of unusual microorganisms, and will have the opportunity to discover new species. Additionally, students can learn and apply molecular techniques to study diversity and phylogeny of these organisms.

Mary Poulson - plant physiology; photosynthesis; stress response

The major goal of research in my laboratory is to elucidate the mechanisms that plants use to alter their photosynthetic machinery in response to environmental stress. I am particularly interested in the study of photosynthesis. I welcome students who are interested in plant physiology at the whole plant or subcellular-level and will mentor students wishing to work in the laboratory or the field. Examples of research questions that students may pose in my laboratory are: how do conifers respond to drought in conjunction with high light? Or, how do plants alter their photosynthetic reactions when exposed to ultraviolet-B radiation?

Ian Quitadamo - science education; assessment of critical thinking

My primary research focuses on quantitative assessment of critical thinking skills and investigation of factors that produce measurable changes in CT. Students who participate in this research can expect to learn what critical thinking is, why it is relevant to undergraduate education, and how it relates to scientific literacy. Practical skills that students learn in this research include research design, assessment, measurement, and statistical analysis.

Linda Raubeson - plant evolutionary genetics; phylogenetics

We use molecular techniques to address a variety of questions in plant evolutionary biology. Areas of focus include: conifer phylogenetics, chloroplast genome evolution and studies of individual plant species of the region. Undergraduates could undertake projects such as: study the evolutionary relationships of a group of plants based on DNA sequence data, characterize a mutation of the chloroplast genome, finish and annotate a chloroplast genome, measure amounts or patterns of genetic diversity in a local species.

Dan Selski - vertebrate brain development

The vertebrate brain is a complex biological system of cellular interactions. The developmental mechanisms controlling the formation of correct synaptic connections in the brain are a further level of complex cell biology. With the relatively simple system of the avian visual system, these developmental processes can be studied *in vivo* at the cellular level. I use molecular biological tools to identify gene products that might control the development of the chick brain. I also use molecular biological methods *in vivo* to specifically test whether a particular gene product has a developmental function. Typically the expression of a gene is altered, and brains are later assayed for correct axon outgrowth and synapse formation. Student project involvement can range from: 1) DNA-database (gene) searches and analyses on the computer; to 2) anatomical analyses of brains; to 3) synthesis of molecular biological reagents in a DNA lab. The cell biological mechanisms identified by these methods should be relevant to brain development in a wide range of vertebrates.

Lixing Sun - animal behavior

My current research areas are: 1.) Ecology and evolution of communication systems, especially chemical communication in amphibians; 2.) Behavioral ecology in relation to population dynamics in rodents (field and lab work in China) and, 3) Social and cultural evolution, i.e., hypothesis-testing using human historical data. I especially welcome interdisciplinary, innovative approaches between biology and anthropology, psychology or sociology.

Steve Wagner - conservation genetics; biology of amphibians.

We are using molecular genetic tools to answer a variety of ecological, evolutionary, and conservation questions related to amphibians of the Pacific Northwest. Projects include: regional phylogeography of amphibians, adaptive genetic variation and their response to stress (i.e. heat shock, pollutants, oxygen concentration), and Project CROAK. Project CROAK is a research based curriculum integrated into math and science courses at Zillah High School.