DEPARTMENT OF BIOLOGICAL SCIENCES

CENTRAL WASHINGTON UNIVERSITY

STUDENT HANDBOOK

2008 - 2009

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I MISSION STATEMENT

The Department of Biological Sciences provides the biological component of the liberal arts education at Central Washington University. We promote student understanding of biological concepts relevant to the individual and society, and foster an appreciation of scientific inquiry. Evolution is the unifying theme of our curriculum. Our students obtain a broad education, covering a wide variety of biological disciplines. We focus on the student; classes are small, facilitating hands-on experience, interactions with faculty, and opportunities for both undergraduate and graduate research. We offer a full complement of competitive pre-professional programs, strong programs in regional field biology, and a quality program for secondary biology educators.

II MAJORS

The Department of Biological Sciences offers two basic degree options:

BACHELOR OF SCIENCE: The Bachelor of Science major offers the opportunity to specialize in a field of biology or work toward becoming a high school teacher. The degree can be designed to prepare the student for immediate entrance into a chosen profession or for preparation for graduate work. The specific program is to be designed by the student and the appropriate departmental advisor.

Areas of specialization within the Bachelor of Science program include:

- Cell & Molecular Biology
- Ecology
- Organismal Biology
- Biology Teaching
- General Biology (no specialization)

BACHELOR OF ARTS: The Bachelor of Arts degree is designed to develop breadth in the sciences generally. Students completing the Bachelor of Arts major will find that their strong general background will allow them flexibility in career choices. The Bachelor of Arts degree meets the requirements for admission to most graduate schools and health professions programs.

The Bachelor of Arts program is well designed for:

- Preparation for entering health professions (e.g. Pre-Medicine, Pre-Dentistry, Pre-Physical Therapy, etc.)
- Preparation for graduate school.
- General biology

III ADMISSION TO MAJOR

In order to gain admission to and successfully complete the Biology Major, students must:

A. Meet with an Advisor

Advisors are normally assigned by the Biology Department upon admission to the major. However, it is highly recommended that a student talk with an advisor well before being admitted to the major. Any Biology Department faculty member may serve as an advisor. The list of faculty advisors in this handbook will help you determine the most appropriate person for your area of interest. Please meet with your advisor as early in your academic career as possible to begin planning your program!

B. Meet the Entry-to-Major Qualifications Listed Below.

1. Pass CHEM 181, 181 Lab and CHEM 182, 182 Lab (or be currently enrolled in CHEM 182)
2. Pass BIOL 181, 182, and 183 (or equivalent)
3. Qualify for MATH 170
4. Register with the department and be advised by departmental faculty

C. Complete and File an Application to the Major by the Beginning of the Junior Year.

A formal application to the Biology Major www.cwu.edu/~biology/forms/index.html must be submitted with your advisor's approval. The entry-to-major qualifications must be met and application should be made by the beginning of the junior year. Application forms can also be obtained from the advisor or department office.

D. Complete and File a Program of Study by the End of the Junior Year.

In order to graduate, each student must have on file, in the Biology Department and in the Registrar's Office, an official Course of Study www.cwu.edu/~biology/forms/index.html. This program (a list of courses) is prepared by the student in conjunction with his/her advisor. It must be approved by the student, advisor, and department chair one year prior to graduation, however, completion and approval at the time of admission to the major is strongly recommended. Program of Study forms can also be obtained from the advisor or the department office. Each student's program is individually designed. Students should meet with their advisor at least once each quarter to discuss their progress.

IV STUDENT SCHOLARLY ACTIVITIES

The department is student oriented and provides a diversity of laboratory and field experiences. Students are encouraged to participate in a wide variety of activities.

RESEARCH ACTIVITIES: Students are encouraged to seek out a faculty member who is engaged in an active research that compliments the student's career goals (see attached list of faculty and their research interests). Students who begin research early and continue it through their career in the department gain a better understanding of their profession and are more competitive in the job market or in graduate school admissions.

FIELD PROGRAM: The department believes in the importance of exposing students to biological field experiences. In addition to those provided by regular courses, the department offers summer field courses and trips to biologically interesting areas during breaks between quarters.

V STUDENT ORGANIZATIONS

Biology Club: All biology students are encouraged to join the Biology Club. This student-run organization meets regularly to discuss academic planning and career opportunities in biology. The club co-sponsors the bi-weekly Natural Science Seminar Series, performs service activities, and plans recreational outings.
http://www.cwu.edu/~biology/biologyClub/biologyClub.html

Beta Beta Beta: *BBB* is the undergraduate National Biological Sciences Honorary Society. Students maintaining a high grade point average (3.0 or higher) are encouraged to apply.

Various organizations for students interested in health professions (medicine, dentistry, etc.) are available to provide information, support, and opportunities for service.

VI GRADUATION REQUIREMENTS

- You must earn at least 180 credits.
- You must have completed at least 60 credits of upper-division (300 and above) study.
- At least 45 credits must have been earned at CWU over a period of at least 3 quarters.
- Transfer students must earn at least 10 credits in the major and 10 in the minor at CWU.
- You must have a cumulative GPA of at least 2.0 in courses taken at CWU.
- You must have a cumulative GPA of at least 2.25 in your major.

- End-of-major assessment must be completed, usually in conjunction with BIOL 499S. This requirement helps to assess whether the Department has fulfilled its instructional objectives and provides us with information that will enable us to continuously improve our programs and courses.

- Application for the Bachelor's degree must be filed early during the quarter preceding planned graduation. See class schedule booklet for exact deadline date.

VII DEGREE OPTIONS

Bachelor of Arts Degree

The Bachelor of Arts degree is designed to develop breadth in the sciences generally. Students completing the Bachelor of Arts major will find that their strong general background will allow them flexibility in career choices. The Bachelor of Arts degree meets the requirements for admission to most graduate schools and health profession programs. Each student's program must be approved by the Department of Biological Sciences at least one academic year preceding graduation. Students seeking the B.A. in Biology must complete one year of college/university study of a single foreign language or two years high school study of a single foreign language. CHEM 181 has a prerequisite of high school chemistry and qualification for MATH 153. BIOL 181, 182, & 183 have pre or co-requisites of CHEM 181, 182, 18, respectively.

Required Course	Credits
BIOL 181: General Biology I	5
BIOL 182: General Biology II	5
BIOL 183: General biology iii	5
BIOL 213: Quantitative methods in Biology	5
BIOL 321: Genetics	5
BIOL 470: Mechanisms of Evolution	3
BIOL 499.1: Senior Seminar **or** 497: Honors Thesis	1
CHEM 181: 181.1: 182: 182.1: 183: 183.1 General Chemistry	15
CHEM 361: 361.1: 362: Organic Chemistry	8
Select one of the following:	**10**
PHYS 111: 111.1: 112: 112.1: 113: 113.1 Intro. Physics **or**	10
PHYS 181: 181.1: 182: 182.1: General Physics	10
Select one of the following:	**5-10**
BIOL 441: Plant Physiology **or**	5
BIOL 455: Zoophysiology **or**	5
BIOL 355 and 356: Human Anatomy & Physiology	10
Select one of the following:	**5**
BIOL 360: General Ecology	5
BIOL 420: Environmental Microbiology	5
Total:	**71-76**

Bachelor of Science Degrees

The B.S. major offers undergraduate students a degree program with depth of training in the biological sciences and supporting fields. This program prepares students for immediate entrance into careers in biological sciences, graduate work, or teaching biology.

Students may choose one of the following B.S. degrees: (For details see www.cwu.edu/~biology/ugrad/bs/indexnewbsfall04.html)

- B.S. Biology - General Biology (no specialization)
- B.S. Biology - Cell and Molecular Biology specialization
- B.S. Biology - Ecology specialization
- B.S. Biology - Organismal Biology specialization
- B.S. Biology - Teaching

The specialization will be indicated on the student's transcripts.

Students must consult with the appropriate Biology advisor for approval of their B.S. program and electives. The approved program must be submitted for approval to the Department of Biological Sciences at least one academic year preceding graduation.

All students in the B.S. Biology Major must complete all B.S. Core requirements, plus additional specific requirements. A maximum of 15 credits in BIOL 490 and BIOL 496 may be included in the major. CHEM 181 has a prerequisite of high school chemistry and qualification for MATH 153. BIOL 181, 182, & 183 have pre or co-requisites of CHEM 181, 182, 183, respectively BIOL 181, 182, & 183 have pre or co-requisites of CHEM 181, 182, 183, respectively..

B.S. Core Requirements	Credits
BIOL 181: General Biology I	5
BIOL 182 General Biology II	5
BIOL 183: General Biology III	5
BIOL 213: Quantitative Methods in Biology	4
CHEM 181, 181LAB, 182, 182LAB, 183, 183LAB General Chemistry	15
BIOL 321: Genetics	5
BIOL 360: General Ecology OR BIOL 420: Environmental Microbiology	5
BIOL 441: Plant Physiology OR BIOL 455: Zoophysiology	5
BIOL 470: Mechanisms of Evolution	3
BIOL 499S: Senior Seminar OR 497: Honors Thesis	1
CHEM 361, 361 LAB, 362 Organic Chemistry	8
Core Total:	**61**
B.S. Total with Specialization	**100**

Organismal diversity requirement: All students in the Biology B.S. program must take at least one advanced (300 or 400 level) animal course, one advanced plant course, and one advanced course covering other organisms (fungi, protists, bacteria, viruses). These courses may be

contained within the Core or taken as electives. See department for list of approved courses in each category.

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.

Blaise Dondji - Immunology of infectious diseases

My research focuses on the immunology of infectious diseases with special interest on parasite infections. Currently, my work in the lab involves the characterization of the host immune responses to infection and the identification of mechanisms by which infectious agents overcome the human immune system. Since co-infections are frequently reported in human populations, the research questions will be answered in mono- and co-infection models. My laboratory models are

Leishmania, a protozoan parasite causing cutaneous and visceral diseases in more the 88 countries around the world; and hookworm, an intestinal parasite affecting about a billion people worldwide. Our understanding of the immune interactions between the host and the infectious agent is one of the basic requirements for the development of improved and/or new control tools such as vaccines and drugs.

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 surveying local streams to assess restoration projects. 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.

Gabrielle Stryker - the vaccine potential of the paraflagellar rod proteins of *Trypanosoma cruzi*, the etiologic agent of Chagas' disease. The paraflagellar rod (PFR) is a unique structure which lies alongside the axoneme found in the flagella of most kinetoplastids. The PFR is a network of cytoskeletal filaments that is attached to axonemal microtubule doublets 4 through 7. This complex structure is critical for cell motility and has been demonstrated to be immunogenic in *T. cruzi*.

A second line of research currently ongoing is a collaborative mathematical modeling project, studying the dynamics of Chagas' disease with insecticide spraying of endemic villages. In this work we have developed a mathematical model, in the form of four coupled nonlinear differential equations. Our main interest is to study the effects of cessation of insecticide spraying in a hypothetical community. This model allows us to study the effects of various spraying scenarios on the growth and maintenance of the populations, including outcomes when spraying is stopped.

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.

DEPARTMENT OFFICE & STAFF

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