

BIOLOGICAL SCIENCES

Biological Sciences Department (<http://www.csuchico.edu/biol/>)
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Insight

The Department of Biological Sciences is committed to becoming Northern California's premier facility for the education of students, the creation of insightful researchers, skilled professionals, and knowledgeable citizens who will have the capacity to meet biological challenges of the future and will continue contributing towards our understanding of life. We introduce our majors to current research and techniques in biological sciences and prepare them for employment opportunities, graduate education, or professional programs of study.

Experience

Students are strongly encouraged to become involved in faculty research projects in the laboratory and the field.

The faculty represent diverse academic backgrounds and are vitally interested in their students. In addition to teaching and advising, faculty are actively involved in research and scientific publication and encourage undergraduates to be involved in their research programs. Natural research sites such as Big Chico Creek Ecological Reserve provide year-round research opportunities to undergraduates and graduate students.

The department has many well-equipped teaching and research facilities including scanning electron, confocal, and fluorescence microscopy. Other resources include the natural history museum, herbarium, and several greenhouses.

The objectives of the graduate program are to develop research and analytical skills so that students are equipped to conduct independent research and teach as professional biologists upon graduation. The MS in biological sciences combines coursework and satisfactory completion of an original thesis.

Outlook

The organizational, data-gathering, and written communication skills acquired by biology majors prepare students for a wide variety of careers. Students may prepare themselves for employment in laboratories, business, or teaching. Laboratory positions are available in university and governmental research centers, pharmaceutical and biological product manufacturers, biotechnology firms, and agricultural/food processing companies. The teacher shortage in the United States is critical, so a teaching career, especially in the sciences, has a bright outlook.

Students who emphasize field studies may prepare themselves for positions in private companies as well as state and federal agencies. Participation in internships or cooperative education programs enhances employability in these areas.

Programs

Undergraduate

Bachelor's

- Biological Sciences BA (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/biological-sciences-ba/>)
- Biological Sciences BS (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/biological-sciences-bs/>)
- Microbiology BS (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/microbiology-bs/>)

Minors

- Biological Sciences Minor (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/biological-sciences-minor/>)

Credentials

- Science with a Concentration in Biological Science Single Subject Matter Preparation Program (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/science-concentration-biological-science-single-subject-matter-preparation-program/>)

Pre-Professional

- Biology Pre-Professional Programs (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/biology-pre-professional-programs/>)

Graduate

Master's

- Biological Sciences MS (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/biological-sciences-ms/>)
- Botany MS (<https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/biological-sciences/botany-ms/>)

Biological Sciences

BIOL 102 Introduction to Living Systems

3 Units GE

Typically Offered: Fall and spring

An integrated study of the nature and interactions of living things and their environments. This course is an introduction to the processes of evolution and speciation, ecology and ecosystem processes, cellular biology and organismal physiology. The course is primarily for students without a strong background in high school biology or chemistry. The course includes online content delivery, in-class discussion, and a hands-on activity session. 2 hours activity, 2 hours discussion. (020372)

General Education: Laboratory Activity (B3); Life Science (B2)

Cross listing(s): SCED 102

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

- BIOL 103 Human Anatomy** 4 Units GE
Typically Offered: Spring, summer, fall
 Study of the structure of the human body, to include muscles, bones, heart, brain, ear, eye, and other systems, as well as a short look at development of the fetus. Lab work entails dissection of the cat and study of the human skeleton. 2 hours activity, 3 hours lecture. (001110)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division
- BIOL 104 Human Physiology** 4 Units GE
Typically Offered: Fall and spring
 Basic functioning of the organ systems of the human body, including the brain and nervous system; vision and hearing; heart and circulation; blood and immunity; respiration, digestion and metabolism; muscles; excretory, endocrine, and reproductive systems. 2 hours activity, 3 hours lecture. (001114)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division
- BIOL 105 Food, Fiber, and Drugs** 3 Units GE
Typically Offered: Fall and spring
 Designed specifically for non-majors. Emphasis on broad biological principles, as illustrated by plants, and the economic importance and role of plants in human ecology. 2 hours activity, 2 hours lecture. (001119)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division
- BIOL 109 The Biological University Experience** 1 Unit
Typically Offered: Fall and spring
 A university success course for biology majors new to California State University, Chico. Appropriate for all incoming freshmen and transfer students. The course explores academic and social opportunities in addition to resources available to promote successful completion of the student's educational goals. Meets twice a week for the first half of the semester. 1 hour lecture. (021133)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division
- BIOL 161 Principles of Ecological, Evolutionary, and Organismal Biology** 4 Units GE
Typically Offered: Fall and spring
 Introduction to evolutionary history and biological diversity, microbes and protists, invertebrates, vertebrates, and plants. Form and function of plants and animals. Ecological principles. 3 hours laboratory, 3 hours lecture. (001123)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division; Sustainable Course
- BIOL 162 Principles of Cellular and Molecular Biology** 4 Units GE
Prerequisite: CHEM 107 or CHEM 111; or department permission.
Typically Offered: Fall and spring
 Introduction to biological molecules, bioenergetics, cellular structure and function, elements of molecular biology and genetics, and mechanisms of macroevolution and systematics. 3 hours laboratory, 3 hours lecture. (001122)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division; Sustainable Course
- BIOL 163 Principles of Physiology and Development** 4 Units GE
Prerequisite: BIOL 162 or department permission.
Typically Offered: Fall and spring
 Introduction to plant and animal physiology and development. Laboratory consists of small group independent investigations of biological questions that include student-devised experiments; application of biological techniques, data analysis, and peer reviewed presentation of results. 3 hours laboratory, 3 hours lecture. (020284)
General Education: Laboratory Activity (B3); Life Science (B2)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division
- BIOL 198 Special Topics** 1-3 Units
Typically Offered: Fall and spring
 This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours discussion. (001135)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division
- BIOL 211 Allied Health Microbiology** 4 Units
Prerequisite: BIOL 103, BIOL 104, BIOL 162, or SCED 102; CHEM 107, CHEM 108, or CHEM 111.
Typically Offered: Fall and spring
 Introduction to structure/function, metabolism, genetics, ecological interactions and pathogenic mechanisms of microorganisms. In addition, the roles of microorganisms in sanitation and in the food and biotechnology industries will be discussed. 3 hours laboratory, 3 hours lecture. (001132)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division
- BIOL 302 Evolution** 3 Units GE
Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.
Typically Offered: Fall and spring
 Analysis of the evidence for evolution and the nature of the process. Darwinism, neo-Darwinism, sociobiology, conflicts and misconceptions regarding evolution, creationism, and evolution of the human body and mind are considered. 3 hours discussion. (001139)
General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Race, Ethnicity, and Sovereignty Pathway; Science, Technology, and Society Pathway
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

BIOL 302W Evolution (W) 3 Units GE, W

Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

Analysis of the evidence for evolution and the nature of the process. Darwinism, neo-Darwinism, sociobiology, conflicts and misconceptions regarding evolution, creationism, and evolution of the human body and mind are considered. 1 hour discussion, 2 hours lecture. (021355)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Race, Ethnicity, and Sovereignty Pathway; Science, Technology, and Society Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division; Writing Course

BIOL 303 Human Genetics 3 Units GE

Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

The inheritance, expression, and evolution of the genetic material in humans. Topics include genetic engineering, gene therapy, prenatal diagnosis, cancer, the human genome project, genetic influences on human behavior, such as homosexuality and mental illness, and the social and ethical consequences of the new technologies. 3 hours discussion. (001140)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Equity, Ethics, and Policy Pathway; Science, Technology, and Society Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 311 Pandemics, Germs, and Society 3 Units GE

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Life Sciences (B2); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

This course provides students with a general overview of microbes (bacteria, fungi, viruses) before introducing concepts related to 1) how novel pathogens emerge to cause pandemics, 2) the science of vaccines and information literacy related to making wise decisions about vaccination, and 3) how public health measures are implemented to restrict the spread of pathogens. In addition, students become familiar with the beneficial uses of microbes and their metabolites in agriculture, nutrition, and sustainable energy. 3 hours lecture. (022232)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Health and Wellness Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 318 Biology of Childhood 3 Units GE

Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

Basic biological principles, including the scientific method, reproduction, development, physiology, and anatomy. The biological basis of childhood diseases, immunity, nutrition, issues of health and well-being, and the relevance of biological information in social, political, and ethical decision making regarding children. 3 hours discussion. (001151)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Health and Wellness Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 322W Science and Human Values (W) 3 Units GE, W

Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

Critically examines scientific and humanistic world views and sensibilities, directly applying these approaches to contemporary social and personal problems. 3 hours lecture. (021254)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Equity, Ethics, and Policy Pathway; Sustainability and Climate Change Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division; Sustainable Course; Writing Course

BIOL 323 Biology of Sex 3 Units GE

Prerequisite: One biological sciences course, GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

This course explores sex, gender, sexual expression, and mating behavior in humans and non-humans from an evolutionary biological perspective. Why does sex exist? Why do genders exist? What are the alternatives? Why is sex expression so variable in nature? What explains the diversity of courtship and mating behaviors? The course emphasizes lessons gleaned from applying the principles of scientific inquiry toward the study of these and related questions. 3 hours lecture. (021160)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Gender and Sexuality Pathway; Race, Ethnicity, and Sovereignty Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 330 California Ethnobotany **3 Units GE**

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

California Ethnobotany explores people/plant relationships through California history. We investigate the complex politics, economics, and diverse cultural traditions associated with plants in California. The course emphasizes: 1) traditional Native American gathering practices and uses, 2) introduced plants and traditions of immigrants, 3) the cross-cultural conversation of sharing plant knowledge, and 4) the emerging practices of people seeking to reconnect with using wild plants as food and "botanicals". Students discuss relevant literature and participate in hands-on exercises in plant identification, cultivation, ethical collecting, and representative preparation techniques. Special focus on Northern California, including the Mechoopda Maidu Indian Tribe of Chico Rancheria. 2 hours activity, 2 hours lecture. (022230)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); California Studies Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 334 Conservation Ecology **3 Units GE**

Prerequisite: One biological sciences course; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

An examination of ecological principles and the impact of increasing population and technology upon the environment. 3 hours discussion. (001156)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); California Studies Pathway; Sustainability and Climate Change Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division; Sustainable Course

BIOL 345 Health and Lifestyle Diseases **3 Units GE**

Prerequisite: One lower-division course in Biological Sciences; GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

An evaluation of the most common major diseases that affect our society and the lifestyle choices that contributes to them. A major theme is that the risk of acquiring many diseases can be reduced through lifestyle changes. 3 hours discussion. (001165)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Health and Wellness Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 350W Fundamentals of Ecology (W) **3 Units W, GW**

Prerequisite: GE Written Communication (A2) requirement; BIOL 161 or faculty permission.

Typically Offered: Fall and spring

Some taxonomic background is recommended. Interrelationships among living organisms, field observations of such phenomena. Application of quantitative and qualitative methods to the interpretation of ecological phenomena. 2 hours discussion, 3 hours laboratory. (001206)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division; Sustainable Course; Writing Course; Graduation Writing Assessment

BIOL 360 Genetics **4 Units**

Prerequisite: BIOL 163 or faculty permission.

Typically Offered: Fall and spring

A detailed study of the principles of classical, molecular, and population/evolutionary genetics. Activities will include computer simulations of segregation, linkage, and population genetics, internet-based database searches for genetic diseases and cloned genes, and searches of the current genetic literature. 1 hour discussion, 3 hours lecture. (001173)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 4 units

Course Attributes: Upper Division

BIOL 369 Advanced Plant Biology **3 Units**

Prerequisite: BIOL 161, BIOL 162, and BIOL 163, or faculty permission.

Typically Offered: Fall only

Advanced study of plant anatomy, morphology, physiology, ecology, and evolution. 3 hours laboratory, 2 hours lecture. (020280)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 370 Advanced Zoology **3 Units**

Prerequisite: BIOL 161, BIOL 162, and BIOL 163, or faculty permission.

Typically Offered: Spring only

Advanced study of animal anatomy, morphology, physiology, ecology, and evolution. 3 hours laboratory, 2 hours lecture. (020281)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

BIOL 371W Microbiology (W) **4 Units W, GW**

Prerequisite: GE Written Communication (A2) requirement; BIOL 161, BIOL 162, BIOL 163, or faculty permission.

Typically Offered: Fall and spring

Introduction to the biology of prokaryotic and eukaryotic microorganisms, as well as viruses. Topics include cell structure, metabolism, genetics; ecological interactions; pathogenic mechanisms; and the roles of microorganisms in sanitation, food production, and biotechnology. The lab focuses on methods for growing and studying diverse microbes. 6 hours laboratory, 2 hours lecture. (020279)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 4 units

Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

<p>BIOL 389 Clin Laboratory Observation 1 Unit Prerequisite: Microbiology/Clinical Laboratory Science majors with no previous clinical laboratory experience and who have completed BIOL 470W; faculty permission. Typically Offered: Fall and spring Students observe in a clinical hospital laboratory and in a private clinical laboratory. 1 hour discussion. (001161) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 15 units Course Attributes: Upper Division</p>	<p>BIOL 409 Molecular Biology 4 Units Prerequisite: BIOL 163, BIOL 360. Typically Offered: Spring only Detailed analysis of structure and related functions of cells with an emphasis on the molecular mechanisms of gene expression and gene regulation. Lectures and laboratory sessions focus on current theories and methodologies associated with cloning, nucleic acid analysis, gene expression, bioinformatics, and genomics. 6 hours laboratory, 2 hours lecture. (020282) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 398 Special Topics 1-3 Units Typically Offered: Fall and spring This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours discussion. (001166) Grade Basis: Graded Repeatability: You may take this course more than once Course Attributes: Upper Division</p>	<p>BIOL 411 Cell Biology 4 Units Prerequisite: BIOL 163, BIOL 360. Typically Offered: Fall only Detailed study of cellular function with an emphasis on intracellular and intercellular communication. Topics include protein structure and function, properties of biological membranes, signal transduction, protein trafficking pathways, vesicular transport, cell cycle, apoptosis and cancer. 3 hours discussion, 3 hours laboratory. (001169) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 399 Special Problems 1-3 Units Typically Offered: Fall and spring This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Research in biology under direct supervision of faculty member. For majors only. This course counts toward the upper-division biology units required for the BS. 9 hours supervision. (001167) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>	<p>BIOL 412W Bacterial Physiology (W) 4 Units W, GW Prerequisite: GE Written Communication (A2) requirement; BIOL 360, BIOL 371W, CHEM 370. Typically Offered: Spring only Study of bacterial structure and function, modes of metabolism, regulatory responses to environmental change and stress, and microbial aspects of nutrition and growth. 2 hours discussion, 6 hours laboratory. (001222) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment</p>
<p>BIOL 402 Microbial Ecology 4 Units Prerequisite: BIOL 161. Recommended: BIOL 371W. Typically Offered: Fall only The roles and interactions of viruses, bacteria, algae, protozoa, and fungi in the natural and human environment, stressing fundamental principles of ecology and evolution. 3 hours laboratory, 3 hours lecture. (001225) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 414 Plant Physiology 4 Units Prerequisite: BIOL 163 or SCED 102; CHEM 108 or CHEM 270; or faculty permission. Typically Offered: Spring only Functions in higher plants; water and soil relations, photosynthesis, respiration, enzyme action, and growth. 3 hours discussion, 3 hours laboratory. (001181) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 404 Aquatic Ecology  4 Units Prerequisite: BIOL 161, CHEM 112. Typically Offered: Fall only even years Physical, chemical, and biological factors influencing the ecology of inland waters. 3 hours laboratory, 3 hours lecture. (001207) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division; Sustainable Course</p>	<p>BIOL 416 Vertebrate Physiology 4 Units Prerequisite: BIOL 162, BIOL 163; CHEM 108 or CHEM 270. Typically Offered: Fall and spring General features of vertebrate physiology. Function of muscular, nervous, respiratory, circulatory, excretory, and endocrine systems. 2 hours discussion, 6 hours laboratory. (001180) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 408 Principles of Evolution 3 Units Prerequisite: BIOL 360. Typically Offered: Fall only A detailed study of the evolutionary process, including history, natural selection, population genetics, molecular evolution, speciation, coevolution, and macroevolution. 3 hours discussion. (001201) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	

<p>BIOL 418 Neurophysiology 4 Units Prerequisite: BIOL 161, BIOL 163; CHEM 108 or CHEM 270. Typically Offered: Spring only This course provides students with background and fundamental information necessary to pursue neuroscience at the graduate or professional level. Cellular and molecular mechanisms within mammalian central nervous system are emphasized. 3 hours laboratory, 3 hours lecture. (001219) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 433 Herpetology 4 Units Prerequisite: BIOL 161. Typically Offered: Spring only even years The morphology, evolution, physiology, behavior, ecology, and taxonomy of amphibians and reptiles. California amphibians and reptiles are emphasized, including field studies of local species. 3 hours laboratory, 3 hours lecture. (001212) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 422 General Entomology 4 Units Prerequisite: BIOL 161 or faculty permission. Recommended: BIOL 163. Typically Offered: Spring only The morphology, ecology, and physiology of insects. Economic entomology and medical entomology, and taxonomy. 2 hours discussion, 6 hours laboratory. (001210) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 434 Ornithology 4 Units Prerequisite: BIOL 161, BIOL 163. Typically Offered: Spring only even years The morphology, evolution, ecology, physiology, taxonomy, and behavior of birds, including field studies of local species. 2 hours discussion, 6 hours laboratory. (001213) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 426 Developmental Biology 4 Units Prerequisite: BIOL 161, BIOL 163, or faculty permission. Typically Offered: Fall only Principles and theories of animal development, emphasizing the vertebrate. 3 hours discussion, 3 hours laboratory. (001188) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 435 Mammalogy 3 Units Prerequisite: BIOL 161. Typically Offered: Fall only Study of evolution, anatomy, physiology, ecology, and behavior of mammals. California mammals will be emphasized in lab. 2 hours discussion, 3 hours laboratory. (001215) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>BIOL 428 Animal Behavior 3 Units Prerequisite: BIOL 163. Typically Offered: Fall only odd years Consideration of the basic problems in animal behavior, including orientation, social behavior, and the nature and organization of animal societies. 2 hours discussion, 3 hours laboratory. (001205) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>BIOL 436 Waterfowl Biology 3 Units Typically Offered: Fall only This lecture, lab, and field course exposes students to the evolution, ecology, morphology, classification, and identification of North American waterfowl. Additionally, this course has a strong hands-on wetland management component, as well as extensive exposure to the primary literature. 3 hours laboratory, 2 hours lecture. (021105) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>BIOL 430 Comparative Anatomy of the Vertebrates 4 Units Prerequisite: BIOL 161, BIOL 163. Typically Offered: Fall only odd years Explanation of the anatomical similarities and differences of selected vertebrates. The evolution and adaptive significance of various systems are considered. 2 hours discussion, 6 hours laboratory. (001171) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 442 Plant Morphology 4 Units Prerequisite: BIOL 163. Typically Offered: Fall only odd years Comparative morphology of plant types, emphasizing evolution of structures and methods of reproduction. 3 hours discussion, 3 hours laboratory. (001191) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 432 Biology of Fishes 4 Units Prerequisite: BIOL 161. Typically Offered: Fall only odd years Morphology, ecology, behavior, and systematics of California fishes, with an introduction to fisheries biology. 3 hours discussion, 3 hours laboratory. (001208) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 446 Plant Pathology 4 Units Prerequisite: BIOL 163 or PSSC 101 or faculty permission. Typically Offered: Fall only Study of plant pathology encompassing parasitism and disease in plants, pathogen attack strategies, diseased plant physiology, plant defense mechanisms, environmental effects on disease and descriptions of diseases and treatments. 3 hours laboratory, 3 hours lecture. (001194) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>

<p>BIOL 448 Plant Diversity and Identification 4 Units Prerequisite: BIOL 161 or faculty permission. Typically Offered: Spring only Principles of plant classification with field study of local flora, emphasizing the higher plants and their phylogenetic relationships. 2 hours discussion, 6 hours laboratory. (001198) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 472 Microbial Genetics 4 Units Prerequisite: BIOL 162. Recommended: BIOL 360 and BIOL 371W. Typically Offered: Fall only The molecular basis of mutation and recombination, mechanisms of gene transfer, transcription in bacteria and bacteriophages, genetics and biochemistry of regulation of bacterial operons, and bacteriophage development, and recombinant DNA application to genetic engineering. 3 hours discussion, 3 hours laboratory. (001224) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 451 Plant Geography 3 Units Prerequisite: BIOL 161, BIOL 369. Typically Offered: Fall only even years The composition and distribution of plant communities, emphasizing the ecological, environmental, and evolutionary processes that affect them. 3 hours laboratory, 2 hours lecture. (020283) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>BIOL 476 General Virology 4 Units Prerequisite: BIOL 162, BIOL 371W. Recommended: BIOL 360. Typically Offered: Spring only The physical, chemical, and biological properties of bacteria and animal viruses, and their interactions with the host at cellular and organismic levels. 3 hours discussion, 3 hours laboratory. (001185) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 460 Histology 4 Units Prerequisite: BIOL 161, BIOL 163. Typically Offered: Spring only odd years Microscopic analysis of tissues, organs, and organ systems of vertebrates emphasizing mammalian histophysiology. 3 hours discussion, 3 hours laboratory. (001170) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 482 Bioinformatics for Biologists 4 Units Prerequisite: BIOL 360, MATH 315. Typically Offered: Spring only This is an introduction to some of the bioinformatics techniques and programs commonly used by biologists to analyze large datasets such as the human genome, microbiomes, proteomic datasets, etc. While not requiring any programming experience, this course includes writing simple queries using SQL and basic programming using Perl scripts. 3 hours laboratory, 3 hours lecture. (021658) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>
<p>BIOL 462 Hematology 3 Units Prerequisite: BIOL 163. Recommended: CHEM 270. Typically Offered: Fall and spring The study of blood in normal and abnormal conditions. 2 hours discussion, 3 hours laboratory. (001174) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>BIOL 484W Field Ecology (W) 3 Units W, GW Prerequisite: GE Written Communication (A2) requirement, BIOL 161, BIOL 350W. Typically Offered: Spring only Principles of ecology illustrated in the context of biotic communities. Field studies using quantitative and qualitative approaches. Laboratory segment offered at local field sites. 1 hour discussion, 6 hours laboratory. (001203) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Sustainable Course; Writing Course; Graduation Writing Assessment</p>
<p>BIOL 466 Immunology 4 Units Prerequisite: BIOL 163. Typically Offered: Spring only The development and expression of the immune response, the basic principles of antigen-antibody reactions and their relevance to medicine, genetics, taxonomy, and evolution. 3 hours discussion, 3 hours laboratory. (001220) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 489 Internship in Biology 1-3 Units Prerequisite: Necessary background for the specific internship. Typically Offered: Fall and spring This internship course is offered for 1.0-3.0 units. You must register with a supervising faculty member. The internship program is designed to provide students with direct field or laboratory research experience in occupational settings. 9 hours supervision. (001228) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 15 units Course Attributes: Upper Division</p>
<p>BIOL 470W Medical Bacteriology (W) 5 Units W, GW Prerequisite: GE Written Communication (A2) requirement; BIOL 371W, CHEM 270. Typically Offered: Fall only Immunization against tetanus and diphtheria required. Biological characteristics of medically important bacteria. Mechanisms of pathogenicity and host-resistance. Laboratory procedures for isolation and identification. 3 hours discussion, 6 hours laboratory. (001182) Grade Basis: Graded Repeatability: You may take this course for a maximum of 5 units Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment</p>	

<p>BIOL 490 Peer Mentoring in the Biological Sciences 2 Units Prerequisite: Faculty permission. Typically Offered: Fall and spring Lecture/discussions to train peer mentors for the biology majors' introductory courses laboratory sections. Peer mentors' laboratories are scheduled to coincide with a lab section for the course in which they are mentoring. Peer mentors assist the laboratory instructor in all phases of lab planning, set-up, and tear-down. In addition peer mentors become involved in laboratory instruction including explaining procedures, providing demonstrations, answering questions, and student evaluation. Peer mentors are encouraged to offer help during the scheduled lab period when first-year mentees inquire about class choices, studying, and other student issues. The peer mentoring program is a rewarding way to help first-year students become part of the university and community. 3 hours independent study, 1 hour lecture. (021033) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division</p>	<p>BIOL 499H Honors Research in Biological Sciences 3-6 Units Prerequisite: Faculty permission. Typically Offered: Inquire at department An intensive 6-unit, one-year course in biological research. See department office for details. (Open only to students with at least a 3.0 GPA in the major.) The course will consist of participation in a team research effort. 9 hours supervision. (001244) Grade Basis: Graded Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>
<p>BIOL 492 Seminars in Biological Science 1 Unit Prerequisite: Junior or senior standing or faculty permission. Typically Offered: Fall and spring Analysis of seminars on various topics in the biological sciences. 1 hour seminar. (001232) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>	<p>BIOL 600 Research in Biological Sciences 3 Units Prerequisite: Admission into the graduate program in biology or botany. Typically Offered: Fall only Orientation to literature review and thesis research. Strategies and techniques used in molecular, cellular, organismic, and ecological research. Required of all biology/botany graduate students during their first fall semester and will include sign-up for the Graduate Qualifying Examination to be given the next semester. 3 hours seminar. (001245) Grade Basis: Graduate Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Graduate Division</p>
<p>BIOL 494 Senior Seminar in Biology 1 Unit Prerequisite: Senior standing. Typically Offered: Fall and spring Presentation and discussion of scientific reports based on current literature. 1 hour seminar. (001230) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>BIOL 601 Scientific Presentations 2 Units Prerequisite: BIOL 399, BIOL 499H, BIOL 697, or BIOL 699T. Typically Offered: Spring only Students will learn, develop, and practice the skills required to make effective oral presentations of scientific data. Presentation formats to be discussed will include the "elevator speech," chalk talk, poster presentation, and formal research presentations often given at scientific conferences. 2 hours lecture. (022157) Grade Basis: Graduate Graded Repeatability: You may take this course for a maximum of 2 units Course Attributes: Graduate Division</p>
<p>BIOL 495 Science Teaching Experience 1 Unit Typically Offered: Fall and spring Science teaching experience for undergraduate students with K-12 students from local schools. 3 hours laboratory. (021975) Grade Basis: Graded Repeatability: You may take this course for a maximum of 2 units Course Attributes: Upper Division</p>	<p>BIOL 602 Scientific Writing 2 Units Prerequisite: Candidacy for MS in Biological Sciences. Typically Offered: Spring only Students will learn, discuss, and practice the characteristics and elements of effective scientific writing. Emphasis will be placed on completing a written research proposal or graduate thesis. 2 hours lecture. (022158) Grade Basis: Graduate Graded Repeatability: You may take this course for a maximum of 2 units Course Attributes: Graduate Division</p>
<p>BIOL 498 Special Topics 1-4 Units Typically Offered: Fall and spring This course is for special topics offered for 1.0-4.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 0 hours seminar. (001242) Grade Basis: Graded Repeatability: You may take this course more than once Course Attributes: Upper Division</p>	<p>BIOL 605 Biological Seminar 1 Unit Typically Offered: Fall and spring Presentation and discussion of reports based on current biological literature and special studies by graduate students. 1 hour seminar. (001249) Grade Basis: Graduate Graded Repeatability: You may take this course for a maximum of 6 units Course Attributes: Graduate Division</p>
<p>BIOL 499 Special Topics 1-3 Units Prerequisite: Faculty permission. Typically Offered: Fall and spring This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 9 hours supervision. (001243) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>	<p>BIOL 609 Advanced Cellular/Molecular Biology 4 Units Prerequisite: BIOL 409 or CHEM 451. Typically Offered: Fall only even years Theory and strategies used in prokaryotic and eukaryotic molecular biology. DNA manipulations, cloning systems, immunological assays, and protein purification and analytical techniques. 3 hours laboratory, 3 hours seminar. (001279) Grade Basis: Graduate Graded Repeatability: You may take this course for a maximum of 4 units Course Attributes: Graduate Division</p>

- BIOL 610 Topics in Cell/Molecular Biology** 1-3 Units
Prerequisite: BIOL 609.
Typically Offered: Inquire at department
 This course is a special topic offered for 1.0-3.0 units. Detailed discussion of selected topics in molecular and cellular biology. Extensive survey of current literature and analysis of research strategies. Topics are selected and advertised by instructor. Past topics have included molecular actions between plants and microbes; pathogenesis of disease; oncogenes and signal transduction. 1 hour discussion. (001281)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 9 units
Course Attributes: Graduate Division
- BIOL 611 Advanced Physiology/Cell Biology** 4 Units
Prerequisite: BIOL 411 or BIOL 414 or BIOL 416.
Typically Offered: Fall only odd years
 Examination of the underlying molecular and bio-chemical mechanisms which allow physiological adaptations, establishment of pattern formation and differentiation of eucaryotic organisms. 3 hours laboratory, 3 hours seminar. (001280)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division
- BIOL 612 Topics in Physiological/Developmental Biology** 1-3 Units
Prerequisite: BIOL 611.
Typically Offered: Inquire at department
 This course is a special topic offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Detailed discussion of selected contemporary topics in physiological and developmental biology. Topic will be selected and advertised by the instructor. 1 hour discussion. (001285)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 9 units
Course Attributes: Graduate Division
- BIOL 613 Population Ecology** 🌱 4 Units
Prerequisite: BIOL 350W.
Typically Offered: Spring only odd years
 Study and lecture/discussion of population ecology, with an emphasis on field methods used on local populations. 6 hours laboratory, 2 hours seminar. (001303)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Sustainable Course
- BIOL 614 Topics in Ecology and Systematics** 🌱 1-3 Units
Prerequisite: BIOL 350W.
Typically Offered: Fall only even years
 This course is a special topic offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Detailed investigation of selected special topics in ecology, systematics, or evolutionary biology. Extensive survey of current literature. Topics will be selected and advertised by the instructor. 0 hours seminar. (001291)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Sustainable Course
- BIOL 616 Foundations of Ecology** 3 Units
Typically Offered: Fall only
 Course provides a historical overview of the development of the fields of ecology through study of foundational works and contemporary literature with applications of modern analytical tools and experimental design. 3 hours lecture. (022159)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- BIOL 617 Foundations of Evolutionary Biology** 3 Units
Typically Offered: Spring only
 This course provides a historical overview of the development of the field of evolutionary biology through study of foundational works and contemporary literature with applications of modern analytical tools and experimental design. 3 hours lecture. (022160)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division
- BIOL 660 Landscape Ecology** 🌱 3 Units
Prerequisite: BIOL 350W or GEOG 444; MATH 314 or MATH 350 or GEOG 315.
Typically Offered: Fall only
 This course emphasizes spatial patterning in the landscape its causes, development, and importance for ecological and environmental processes. The course includes the study of ecological and anthropologic aspects of landscape pattern and change. The laboratory includes hands-on experience with tools used in landscape ecology. 3 hours laboratory, 2 hours lecture. (020295)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division; Sustainable Course
- BIOL 668 Community and Ecosystem Ecology** 🌱 3 Units
Prerequisite: BIOL 350W and a statistics course.
Typically Offered: Spring only even years
 The analysis, modeling, and computer simulation of the structure and function of communities and ecosystems, with emphasis on patterns of competition, predation, energy and nutrient flow and succession. 3 hours laboratory, 2 hours seminar. (001305)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division; Sustainable Course
- BIOL 672 Plant Ecology** 🌱 4 Units
Prerequisite: BIOL 350W, BIOL 448, graduate standing.
Typically Offered: Spring only odd years
 Autecology, emphasizing California vascular plants, with focus on current topics in behavioral and reproductive ecology. Field project work and detailed literature survey. 6 hours laboratory, 2 hours seminar. (001299)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Sustainable Course
- BIOL 692 Advanced Biology Seminar Series** 1 Unit
Typically Offered: Fall and spring
 Experts in various fields of Biology present their research each week. Following each presentation students are required to write a paper that summarizes and critiques the presentation. 1 hour lecture. (021960)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division

BIOL 697 Independent Study**1-4 Units****Typically Offered:** Fall and spring

This course is a graduate-level independent study. You must register directly with a supervising faculty member. Survey and careful study of literature, experimentation, observation, and collection of data in field and laboratory. 9 hours supervision. (001319)

Grade Basis: Report in Progress: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division**BIOL 699T Master's Thesis****1-6 Units****Typically Offered:** Fall and spring

This course is a master's study offered for 1.0-6.0 units. You must register directly with a supervising faculty member. 3 hours supervision. (001320)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division

Environmental Literacy

ENVL 105 Environmental Literacy**3 Units GE****Typically Offered:** Fall and spring

This course introduces students to the issue and practices of environmental literacy. Environmental literacy is the capacity to perceive and interpret the relative health of environmental systems and to connect the environment to human physical, mental, and social health. Students are encouraged to recognize that their lives depend upon the environment, and that their personal decisions affect the environment. 3 hours lecture. (003723)

General Education: Lifelong Learning and Self-Development (E)**Grade Basis:** Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division; Sustainable Course**ENVL 105W Environmental Literacy (W)****3 Units GE, W****Typically Offered:** Fall and spring

This course introduces students to the issue and practices of environmental literacy. Environmental literacy is the capacity to perceive and interpret the relative health of environmental systems and to connect the environment to human physical, mental, and social health. Students are encouraged to recognize that their lives depend upon the environment, and that their personal decisions affect the environment. 3 hours lecture. (021259)

General Education: Lifelong Learning and Self-Development (E)**Grade Basis:** Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division; Sustainable Course; Writing Course**ENVL 389 Internship****1-3 Units****Typically Offered:** Fall and spring

This course is an internship offered for 1.0-3.0 units. You must register with a supervising faculty member. 0 hours supervision. (021061)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 15 units**Course Attributes:** Upper Division

Biological Sciences Department

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