BIOLOGY (BIOL)

BIOL 100 Human Biology (Units: 3)
Not intended for biology majors.

Course Attributes:
• E1: Lifelong Learning Develop
• B2: Life Science
• Social Justice

BIOL 101 Human Biology Laboratory (Unit: 1)
Prerequisite: BIOL 100.

Laboratory exercises demonstrating scientific processes, including the scientific method, analysis of data, and drawing appropriate conclusions. Extra fee required.

Course Attributes:
• B3: Lab Science

BIOL 150 The World of Plants (Units: 3)
Intended for non-biology majors.
World of plants, their place in nature, and the relation to humans. Growing plants, field observations, and studies of the economic uses of plants. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required.

Course Attributes:
• B2: Life Science
• B3: Lab Science
• Environmental Sustainability

BIOL 160 Marine Biology (Units: 3)
Introduction to the marine environment including oceanic, intertidal, and near shore communities of plants, animals, and microbes. Emphasis is on marine biological and chemical processes and environmental issues both locally and globally.

Course Attributes:
• B2: Life Science
• B3: Lab Science
• Environmental Sustainability

BIOL 170 Animal Diversity (Units: 3)
Intended for non-biology majors.
Describes the diversity of animal life and provides an overview of basic concepts of evolution, the fossil record, physiology, behavior, ecology, geographical distribution, and issues in the conservation of biodiversity.

Course Attributes:
• B2: Life Science
• Environmental Sustainability

BIOL 171 Animal Diversity Laboratory (Unit: 1)
Prerequisite: BIOL 170 (may be taken concurrently).

Examination of photographic specimens of animal species, their habits, and their anatomy. Computer exercises to illustrate evolutionary, ecological, and physiological principles. Extra fee required.

BIOL 176 Science and Politics of Stem Cell Biology (Units: 3)
Not open to biology majors.
Foundation for understanding concepts in stem cell biology, social, and political issues in stem cell research and regenerative medicine.

Course Attributes:
• B2: Life Science
• Am. Ethnic & Racial Minorities
• Social Justice

BIOL 210 General Microbiology and Public Health (Units: 3)
Intended for non-biology majors.
Basic concepts of microbiology; practical applications to medicine, public health, and the environment.

BIOL 211 General Microbiology and Public Health Laboratory (Unit: 1)
Prerequisite: BIOL 210 (may be taken concurrently). Intended for non-biology majors.

Laboratory techniques in isolation, enumeration, and identification of microorganisms. Extra fee required.

BIOL 212 Principles of Human Physiology (Units: 3)
Prerequisites: CHEM 101 or CHEM 115, BIOL 100 and BIOL 101 or BIOL 210, with grades of C or better. Intended for non-majors.

Study of the gross anatomy of the human body; body systems involving gross structure and history; computerized virtual anatomy lab experience supplemented with enhanced skeletal and specimen study and cadaver visits. (Plus-minus letter grade only)

BIOL 230 Introductory Biology I (Units: 5)
Prerequisites: Restricted to majors and minors in biology and biochemistry, majors in kinesiology, and majors in environmental studies under the natural resources management and conservation concentration B.S. program.

Fundamentals of biology: chemical basis of life, cell structure, bioenergetics, plant and animal physiology, and genetics. Classwork, 3 units; laboratory, 2 units. Extra fee required.

BIOL 240 Introductory Biology II (Units: 5)
Prerequisite: BIOL 230 with a grade of C- or better.

Fundamentals of biology: gene expression, development, evolution, ecology, and the diversity of microbes, plants, and animals. Classwork, 4 units; laboratory, 1 unit. Extra fee required.
BIOL 300 Nature Study (Units: 3)
Prerequisite: One course in college biology. Intended for non-biology majors.

Identification, structure, adaptation, life history, habits, habitat, economic status, conservation of common plants and animals. Two all-day field trips scheduled on two separate weekends. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required.

Course Attributes:
- UD-B: Physical Life Science
- Environmental Sustainability

BIOL 310 Biology for Today's World (Units: 3)
Prerequisite: College course in biology.


Course Attributes:
- UD-B: Physical Life Science
- Environmental Sustainability

BIOL 313 Principles of Ecology (Units: 3)
Prerequisite: One course in college biology or an environmentally-oriented subject. Intended for non-majors.

Ecological principles and methods. Introduction to population, community, and ecosystem ecology. Trips to various habitats. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required.

BIOL 315 Fungi of Siera Nevada (Unit: 1)
A survey of the spring fungus flora of the northern Sierra Nevada. Focus on fleshy fungi, lichens and wood rotting fungi. Registration must be sent to the SNFC Director.

BIOL 317 Ecology of California (Units: 3)
Prerequisite: College course in biology.

Examines ecology, natural history of California, and impact humans have on the environment in a perceptual and scientific content. Focus on principal processes underlying the evolution/diversity of California's terrestrial/aquatic flora/fauna.

BIOL 318 Our Endangered Planet (Units: 3)
Prerequisite: One course in college biology. Intended for non-majors.

The effect of humans on the ecology of our environment. Species extinctions, the role of genetics, nature reserves, biology of small populations, and restoration ecology.

Course Attributes:
- E1: Lifelong Learning Develop
- UD-B: Physical Life Science
- Am. Ethnic & Racial Minorities
- Environmental Sustainability
- Global Perspectives

BIOL 322 Human Sexuality: Integrative Science (Units: 3)
Prerequisite: BIOL 100 or equivalent or consent of instructor.

Presents basic scientific foundations of human sexuality. Explores the symbiotic relationships between biology and society throughout the life cycle. Discusses the challenges associated with human sexuality and the tools for dealing with them.

BIOL 326 Disease! (Units: 3)
Prerequisite: BIOL 100 or equivalent or consent of instructor. Intended for non-majors.

Origin and natural history of selected infectious and non-infectious human diseases including causal agents, mechanisms, and historical impact. Factors involved in the incidence and distribution of disease.

Course Attributes:
- UD-B: Physical Life Science
- Global Perspectives
- Social Justice

BIOL 327 AIDS: Biology of the Modern Epidemic (Units: 3)
Prerequisite: One course in college biology. Intended for biology majors and non-majors.

Modern epidemic of AIDS is viewed from biological and social perspectives: virology, epidemiology, the immune system, disease states, diagnosis, treatment, prevention, public health issues, sexuality, response of the scientific community, comparison with other historical epidemics.

Course Attributes:
- UD-B: Physical Life Science
- Global Perspectives

BIOL 328 Human Anatomy (Units: 4)
Prerequisites: Restricted to sophomore standing or above with a major in biology, biochemistry, chemistry, clinical science, or kinesiology, BIOL 230 with a grade of C- or better, or consent of instructor.

Gross structures of the human body. Classwork, 3 units; laboratory, 1 unit. Extra fee required.

BIOL 330 Human Sexuality (Units: 3)
Prerequisite: One course in college biology or consent of instructor. Intended for B.A. in General Biology majors and non-majors.

Development, structure, function, and dysfunction of reproductive and sexual systems in humans, physiology of sexual response, variations in sexual expression, law, birth control and abortion, sexual health, sexual motivation, love, and sexual values.

Course Attributes:
- E1: Lifelong Learning Develop
- UD-B: Physical Life Science
Biology (BIOL)

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BIOL 332 Health Disparities in Cancer (Units: 3)
Prerequisite for BIOL 832: Graduate standing or consent of instructor. Prerequisites for BIOL 332: Restricted to upper division standing; BIOL 230, BIOL 240, BIOL 355.

Major determinants of health disparities in cancer including ethnic differences in biology and prevention and treatment of cancer. Strategies to overcome these disparities through research, health education, outreach, advocacy, and policy changes. (BIOL 832/BIOL 332 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
- BIOL 332/832
- Am. Ethnic & Racial Minorities
- Global Perspectives
- Social Justice

BIOL 337 Evolution (Units: 3)
Prerequisites: BIOL 230, BIOL 240, BIOL 355. Intended for biology majors and non-majors.

The principles of evolutionary biology, concentrating on basic population genetic mechanisms and methods of analysis.

BIOL 344GW Research Skills - GWAR (Units: 3)
Prerequisite for BIOL 844: Graduate standing or consent of instructor. Prerequisites for BIOL 344GW: ENG 214 or equivalent with a grade of credit or C- or better, BIOL 230, BIOL 240, and consent of instructor.

Practical skills for successfully conducting undergraduate research. Focus on experimental design, critical review of literature, effective oral and written scientific presentation, and development of research plan. (BIOL 844/BIOL 344GW is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
- Graduation Writing Assessment
- BIOL 344GW/844

BIOL 349 Bioethics (Units: 3)
Prerequisite: Restricted to upper-division standing.

Human experiments, genetic engineering, in-vitro fertilization, human enhancement, cloning, reproductive technology, animal testing, euthanasia and assisted dying. Emphasis on respectful and reflective discussion.

Course Attributes:
- UD-B: Physical Life Science
- Social Justice

BIOL 350 Cell Biology (Units: 3)
Prerequisites: Restricted to upper-division standing; Biology and Biochemistry majors; BIOL 230, BIOL 240, CHEM 115 with a grade of C- or better.

Cell structure and function, extracellular matrix interactions, signal transduction, and regulatory mechanisms in cell growth and differentiation.

BIOL 351GW Experiments in Cell and Molecular Biology - GWAR (Units: 4)
Prerequisites: Upper division standing; restricted to Biology and Biochemistry majors; ENG 214 or equivalent with a grade of CR or C- or better, BIOL 350, BIOL 355.

Experiments introducing laboratory techniques: microscopy, cytochemistry, spectrophotometric quantitation of macro-molecules, organelle isolation, animal cell culture, gene expression, protein analysis, recombinant DNA techniques. Classwork, 2 units; laboratory, 2 units. Extra fee required. (Plus-minus ABC/NC)

Course Attributes:
- Graduation Writing Assessment

BIOL 355 Genetics (Units: 3)
Prerequisites: Restricted to upper division standing; Biology and Biochemistry majors; BIOL 230, BIOL 240, CHEM 130 with a grade of C- or better.

Viral, prokaryotic, and eukaryotic genetics. Population, human, and molecular genetics.

BIOL 356 Honors Genetics (Units: 2)
Prerequisite: BIOL 355 with a grade of B or better. Intended for biology majors.

Advanced topics, new ideas, unsolved problems, reading of original research, and review of articles in genetics: Mendelian, molecular, and population. (Plus-minus letter grade only)

BIOL 357 Molecular Genetics (Units: 3)
Prerequisite: BIOL 355 or equivalent with a grade of C- or better. Intended for Biology majors.

Current ideas in molecular biology including the transfer and expression of genetic information, interaction and hybridization of genes, molecular mutagens, and molecular evolution. Ethical questions.

BIOL 358 Forensic Genetics: Math Matters (Units: 4)
Prerequisites: Restricted to sophomore, junior, or senior students in Biology, Chemistry, Mathematics, and Computer Science programs; BIOL 230 with a grade of C- or better, MATH 199, or consent of instructor.

Statistical forensic genetics with a focus on social impact; statistical exploration and analyses in R programming language; original scientific research project; critical analysis of forensics in the media; forensic genetics policy proposal project. Classwork, 3 units; laboratory, 1 unit. (Plus-minus letter only)

BIOL 380 Evolutionary Developmental Biology (Units: 3)
Prerequisites: BIOL 337 is highly recommended. Intended for Biology majors.

Examines the evolution of animal diversity by evaluating co-option of developmental mechanisms and comparative embryology from representative taxa spanning ancestral multicellular animals through vertebrates. (Plus-minus letter grade only)
BIOL 382 Developmental Biology (Units: 3)
Prerequisites for BIOL 782: Graduate standing; BIOL 350, BIOL 355 or equivalents with grades of C- or better; or consent of instructor. Prerequisites for BIOL 382: BIOL 350, BIOL 355 with grades of C- or better. Intended for Biology and Biochemistry majors.

Early embryonic development: exploration of the molecular genetic basis for tissue differentiation. Gene regulation, chromatin, sex determination, oncogenesis, aging, and pattern formation. Extra fee required. (BIOL 782/BIOL 382 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
- BIOL 382/782

BIOL 391 Microscopy and Photomicrography (Units: 2)
Prerequisite: One course in college physics or consent of instructor. Intended for upper division Biology majors.

The use of the microscope with brightfield, darkfield, phase contrast, and fluorescent optics. Principles of photomicrography. Classwork, 1 unit; laboratory, 1 unit. Extra fee required.

BIOL 401 General Microbiology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, CHEM 233 with a grade of C- or better. Intended for Biology and Biochemistry majors.

Morphology, physiology, genetics, molecular biology, evolution, and taxonomy of microorganisms; bacteria and viruses; importance of microbes in biotechnology, ecology, and public health.

BIOL 402GW General Microbiology Laboratory - GWAR (Units: 3)
Prerequisites: Restricted to Biology majors; ENG 214 with a grade of C- or better, BIOL 401 (may be taken concurrently).

Laboratory techniques in the isolation, cultivation, and identification of microbes, especially bacteria; microbial properties including nutrition, gene transfer, enzyme induction, and viral replication. Lecture, 1 unit; laboratory, 2 units. Extra fee required. (Plus-minus letter grade only)

Course Attributes:
- Graduation Writing Assessment

BIOL 411 Environmental Microbiology (Units: 3)
Prerequisites: BIOL 401, BIOL 402GW, BIOL 355, CHEM 340 or CHEM 349. Intended for Biology majors.

Study of microbes and microbial communities using molecular and genomic approaches; primary research data includes novel microbial genomes and metagenomes. (Plus-minus letter grade only)

BIOL 420 General Virology (Units: 3)
Prerequisites: BIOL 401, BIOL 402GW with a grade of C- or better, or consent of instructor. Intended for biology majors.

Molecular aspects of virus structure, genetics, reproduction, and infection. Bacterial, animal, and plant viruses. (Plus-minus letter grade only)

BIOL 425 Emerging Diseases (Units: 3)
Prerequisites: BIOL 230, BIOL 240, BIOL 355 or BIOL 401 or BIOL 350, CHEM 130.

Biology of the emerging diseases that threaten humans and wildlife. The molecular biology, genetics, epidemiology, ecology, and economic impact of emerging viruses.
BIOL 454 Parasitology Laboratory (Unit: 1)
Prerequisite: BIOL 453 (may be taken concurrently).

Methods and techniques in the examination, preparation, recognition, and identification of protozoan and metazoan parasites of animal hosts; human parasites with orientation toward clinical science. Extra fee required.

BIOL 458 Biometry (Units: 4)
Prerequisite: One course in college biology. Intended for Biology majors.

Biological measurements, experimental design, data analysis, statistical methods as applied to biological problems, methods of data resolution and presentation. Classwork, 3 units; laboratory, 1 unit. Extra fee required.

BIOL 460 General Entomology (Units: 4)
Prerequisites: BIOL 230, BIOL 240, or consent of instructor. Intended for Biology majors.

The insects and their close relatives; physiology, external and internal structures; life cycles; classification of insects to order; ecology in desert, field, forest, and aquatic habitats; economic and medical importance of orders. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. Extra fee required.

BIOL 461 Insect Taxonomy (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Classification of insects and their close relatives to family; taxonomic categories and procedures. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. Extra fee required.

BIOL 464 Medical Entomology (Units: 3)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Terrestrial arthropods and how they relate to human health. Arthropod-human interactions: entomophobia, allergy, venoms, parasitism, body infestations, disease vectors, epidemiology; major arthropod borne diseases and their impact on humans and society.

BIOL 470 Natural History of Vertebrates (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Structure, behavior, and distribution of amphibians, reptiles, birds and mammals, especially those of Central California. One all-day field trip required. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. Extra fee required.

BIOL 475GW Herpetology - GWAR (Units: 3)
Prerequisites: ENG 214 or equivalent with a grade of C- or better, BIOL 230, BIOL 240, or consent of instructor. Intended for Biology majors.

Evolution, classification, and distribution of amphibians and reptiles. The ecology and behavior of California species. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required. (Plus-minus ABC/NC)

Course Attributes:

- Graduation Writing Assessment

BIOL 478GW Ornithology - GWAR (Units: 4)
Prerequisites: ENG 214 with a grade of C- or better, BIOL 230, BIOL 240. Intended for Biology majors.

Anatomy, physiology, behavior, distribution, classification, and evolution of birds; visits to the San Francisco Zoo, private aviarries and museums. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. One weekend field trip required. Extra fee required. (Plus-minus ABC/NC)

Course Attributes:

- Graduation Writing Assessment

BIOL 482 Ecology (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Interrelationships between organisms and their environment, studied at the individual, population, community, and ecosystem levels. Field trips to various environments. Classwork, 3 units; laboratory and fieldwork, 1 unit. Extra fee required.

BIOL 490 Ecology of Infectious Diseases (Units: 4)
Prerequisites: BIOL 230, BIOL 240, with grades of C- or better.

Examination of ecological and evolutionary processes that govern the transmission of pathogens in animal and plant systems including factors that lead to disease emergence, the impact of diseases on host populations, and theoretical foundations of disease ecology. Classwork, 3 units; activity, 1 unit.

BIOL 492 Comparative Anatomy of Vertebrates (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Organ systems of selected vertebrate types. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 500 Evolution and Diversity of Plants (Units: 4)
Prerequisites: BIOL 230, BIOL 240.

Comparative biology and phylogeny of the major lineages of plants. Evolution and diversification of vegetative and reproductive structures, life histories, and ecological adaptations. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 502 Biology of the Algae (Units: 3)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Collection, preservation, identification, and culturing of marine and freshwater algae. Comparative studies of morphology, life history, and ecology. Field trips. Classwork, 2 units; laboratory, 1 unit. Extra fee required.

(BIOL 702/BIOL 502 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:

- BIOL 502/702

BIOL 504 Biology of the Fungi (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Groups of fungi including their classification, life cycles, morphology and development, and economic significance. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. Extra fee required.
BIOL 505 Comparative Anatomy of Vascular Plants (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Plant cells and tissues, their structure, development, and organization into vegetative and reproductive structures; evolutionary and ecological interpretation of tissues of vascular plants. Classwork, 2 units; laboratory; 2 units. Extra fee required.

BIOL 508 Plants and Human Affairs (Units: 3)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Plants useful or harmful to humans; origins and history, botanical relationships, chemical constituents that make them economically important, and their roles in literate and preliterate cultures. Classwork, 2 units; laboratory, 1 unit.

BIOL 514 Plant Taxonomy (Units: 5)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Principles of plant taxonomy including classification systems and phylogenetic relationships within the flowering plants; practice in identification and collecting. Classwork, 2 units; laboratory and fieldwork, 3 units. (Plus-minus letter grade only)
(BIOL 814/BIOL 514 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)
Course Attributes:
  • BIOL 514/814

BIOL 525 Plant Physiology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, CHEM 130. Intended for Biology majors.

Plant physiology: photosynthesis, water and mineral uptake and distribution, translocation of organic materials; environmental and internal plant regulatory factors, and their effect on growth and metabolism.

BIOL 526 Plant Molecular Physiology Laboratory (Units: 2)
Prerequisites: Restricted to Biology majors; BIOL 230, BIOL 240, CHEM 130.

Molecular, physiological, and biochemical understanding of plant growth and development. Focus on plant development, plant-plant and plant-environment interactions, photosynthesis, water balance, mineral nutrition, gene expression, cell imaging, data analyses and presentations. Extra fee required.

BIOL 529GW Plant Ecology - GWAR (Units: 4)
Prerequisites: ENG 214 or equivalent with a grade of CR or C- or better, BIOL 230, BIOL 240. Intended for Biology majors.

Principles of ecology through the study of plants and plant associations. Ecological concepts, biotic-environmental dynamics and relationships, and levels of ecological integration. Biotic provinces and plant associations in California. Classwork, 2 units; laboratory, 1 unit; fieldwork, 1 unit. Extra fee required. (Plus-minus ABC/NC)
Course Attributes:
  • Graduation Writing Assessment

BIOL 530 Conservation Biology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, or consent of instructor. Intended for Biology majors.

Principles of nature conservation, preservation, and management. Theory, laws, and practice of conservation science.

BIOL 532 Restoration Ecology (Units: 3)
Prerequisites: BIOL 230, BIOL 240.

Focuses on restoration of degraded habitats, with emphasis on the application of ecological theory to restoration practice. A variety of habitats will be covered, especially those common to the Bay Area.

BIOL 534 Wetland Ecology (Units: 4)
Prerequisites: BIOL 230, BIOL 240, or consent of instructor.

Ecology of a variety of wetland types; biotic and abiotic characteristics and processes; conservation, restoration and management. Field trips to wetland habitats and participation in field and/or greenhouse experiments. Classwork, 3 units; laboratory, 1 unit. Extra fee required.

BIOL 550 Plant and Animal Interactions (Units: 4)
Prerequisites: BIOL 230, BIOL 240, an upper division course in ecology. Intended for Biology majors.

Interactions between animals and plants, including such general topics as herbivory, seed dispersal and predation, mycorrhizae, mimicry, myrmecochory, and the co-evolutionary processes that lead to such interactions. Classwork, 3 units; laboratory, 1 unit. Extra fee required. (Plus-minus letter grade only)

BIOL 555 Marine Invertebrate Zoology (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Comparative laboratory and field study of local marine invertebrate animals; evolution and functional morphology. Classwork, 2 units; laboratory and fieldwork, 2 units. Extra fee required.

BIOL 556 Natural History of Marine Invertebrates (Units: 4)
Prerequisites: BIOL 230, BIOL 240; BIOL 555 recommended.

Investigation of concept of biodiversity using California coastal communities in local intertidal and nearshore habitats as a field laboratory. Field trips required. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 570GW Biology of Fishes - GWAR (Units: 4)
Prerequisites: ENG 214 or equivalent with a grade of CR or C- or better, BIOL 230, BIOL 240, or consent of instructor. Intended for Biology majors.

Morphology, physiology, behavior, ecology, distribution, classification, and evolution of marine and freshwater fishes; California species. Classwork, 2 units; laboratory and fieldwork, 2 units. Two weekend field trips. Extra fee required. (Plus-minus ABC/NC)
Course Attributes:
  • Graduation Writing Assessment

BIOL 572 Colloquium in Ecology, Evolution, and Conservation (Units: 2)
Prerequisite for BIOL 572: Graduate standing. Prerequisite for BIOL 572: Upper division standing or consent of instructor.

Presentation of student and faculty research, recent journal articles, and presentations by outside speakers. Student speakers receive graduate seminar credit. May be repeated for a total of 8 units. (BIOL 872/BIOL 572 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)
Course Attributes:
  • BIOL 572/872
BIOL 575 Fisheries Biology (Units: 3)
Prerequisite: BIOL 570GW or a course in ecology. Intended for Biology majors.

Principles and practices in fish ecology and population dynamics, fishing methods and economics, and fisheries management. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required.

BIOL 577 Ecological and Environmental Modeling (Units: 4)
Prerequisites: BIOL 230, BIOL 240, or a course in ecology, MATH 199, or consent of instructor. Intended for Biology majors.

Theory and practice of mathematical and computer modeling of organisms, ecosystems, and their environment. Classwork, 3 units; laboratory, 1 unit. (Plus-minus letter grade only)

BIOL 580 Limnology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, CHEM 215, CHEM 216. A course in ecology is recommended. Intended for Biology majors.

Physical, chemical, and biological characteristics of inland waters. Individual field projects. Field trips conducted during class time. Classwork, 2 units; laboratory and fieldwork, 1 unit. Extra fee required.

BIOL 582 Biological Oceanography (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Physical characteristics of oceans; biology of plankton and benthos, emphasizing production and food webs. Identification, sampling, and productivity measurements of marine organisms. Classwork, 3 units; laboratory and fieldwork, 1 unit. Extra fee required.

BIOL 584 Marine Microbial Ecology Laboratory (Unit: 1)
Prerequisite: CHEM 115.

Laboratory section covers methods of measuring microbial rate processes (growth, nutrient uptake, etc.) and assessment of cell concentration in situ; isolation and culture of microbes. Extra fee required. (Plus-minus letter grade only)

BIOL 585 Marine Ecology (Units: 3)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Plant and animal relationships in near-shore marine communities; temperate zone communities of the central California coast.

BIOL 586 Marine Ecology Laboratory (Units: 2)
Prerequisites: BIOL 585 (may be taken concurrently).

Laboratory and fieldwork in marine ecology introducing students to sampling methods, laboratory techniques, data collection, and analysis. Fieldwork in a variety of marine field environments. Includes use of primary literature and oral and written presentations. Extra fee required.

BIOL 600 Animal Behavior (Units: 3)
Prerequisites: BIOL 230, BIOL 240.

General introduction to animal behavior. Mechanisms of behavior including development, hormones, neural processes, and cognition. Evolutionary approaches including foraging, habitat selection, communication, sexual selection, mating systems, parental care, and social behavior. Extra fee required. (Plus-minus letter grade only)

BIOL 607 Conservation and Management of Marine Mammals (Units: 3)
Prerequisites: BIOL 230, BIOL 240, BIOL 355.

Biology and scientific principles involved in the conservation and management of marine mammals. Current regulations and methodologies are critically reviewed and evaluated. Controversies concerning conservation, ecological balance, and specific governmental constraints in the face of a changing environment will be discussed.

BIOL 609 Physics in Medicine (Units: 3)
Prerequisites: PHYS 121, BIOL 230, or equivalents, or consent of instructor.

Mechanics, thermodynamics, and electricity applied to mechanical properties of tissues, metabolism, membrane transport, control and regulation of physical parameters. Sonography, electromagnetism and quantum physics applied to medical diagnostic technology and imaging.

BIOL 612 Human Physiology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, CHEM 130, PHYS 121. Intended for Biology majors.

Integrative mechanisms; control systems in cardiovascular and respiratory physiology. Circulation; distribution and regulation of body fluids; digestive systems; metabolism.

BIOL 613GW Human Physiology Laboratory - GWAR (Units: 3)
Prerequisites: ENG 214 with a grade of C- or better, BIOL 612 or BIOL 630 (may be taken concurrently). Intended for Biology majors.

Experiments in preparation, recording, and analysis of the functioning of human and other vertebrate organ systems and tissues. Classwork, 1 unit; laboratory, 2 units. Extra fee required. (Plus-minus ABC/NC)

Course Attributes:
- Graduation Writing Assessment

BIOL 614 Vertebrate Histology (Units: 4)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Microscopic anatomy of tissues and organ systems of vertebrates. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 615 Molecular Pathophysiology (Units: 3)
Prerequisites: BIOL 350, BIOL 355, BIOL 612. Intended for Biology majors.

Globally important diseases caused by genetic errors, environmental factors, or parasites. Each disease is studied at the molecular, cellular, and physiological levels.

BIOL 616 Cardiorespiratory Physiology (Units: 3)
Prerequisites: BIOL 230, BIOL 240, BIOL 612 or BIOL 630, PHYS 121, or consent of instructor. Intended for Biology majors.

The physiology of the cardiovascular and respiratory systems, and their interrelationship. Organ function in health and disease. (Plus-minus letter grade only)

BIOL 617 Environmental Physiology (Units: 3)
Prerequisite: BIOL 612 or BIOL 630. Intended for Biology majors.

The physiological and biochemical mechanisms underlying adaptation of animals to diverse environments. (Plus-minus letter grade only)
**BIOL 618 Biology of Aging (Units: 3)**  
Prerequisites: Biology majors and minors only; BIOL 350, BIOL 355, BIOL 212 or BIOL 612.  
Biological processes underlying aging. Focus on the molecular mechanisms of aging, including specific animal models of aging, age-related changes in the major physiological systems in humans. (Plus-minus letter grade only)

**BIOL 619 Pathophysiology (Units: 3)**  
Prerequisites: Biology majors and minors only; BIOL 212 or BIOL 612.  
The processes underlying disease in the major physiological systems. Focus on understanding the relationship between changes at the molecular, cellular and tissue levels and their physiological manifestations at the organ and system levels. (Plus-minus letter grade only)

**BIOL 620 Endocrinology (Units: 3)**  
Prerequisites: Restricted to Biology majors and Pre-health certificate students; BIOL 230, BIOL 240.  

**BIOL 621 Reproductive Physiology (Units: 3)**  
Prerequisites: BIOL 230, BIOL 240, BIOL 330, CHEM 130. BIOL 492 or another course in vertebrate anatomy is recommended. Intended for Biology majors.  
Reproductive morphology and physiology of vertebrates.

**BIOL 622 Hormones and Behavior (Units: 3)**  
Prerequisites: BIOL 230, BIOL 240, or consent of instructor, a course in physiology or endocrinology strongly recommended. Intended for Biology majors.  
Effects that hormones exert on behavior. Hormonal activation and organization of behavior and the nervous system. Actions of hormones compared in humans and in non-human species.

**BIOL 623 Pharmacology (Units: 3)**  
Prerequisites: BIOL 230, BIOL 240 with grades of C- or better, BIOL 612, CHEM 130.  
Pharmacology principles, including pharmacokinetics of drug absorption and elimination. Mechanisms of drug action on the body. Commonly used pharmaceutical drugs. (BIOL 723/BIOL 623 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

**Course Attributes:**  
- Graduation Writing Assessment  
- BIOL 631GW/731

**BIOL 627 Biophysics (Units: 3)**  
Prerequisites: PHYS 121, CHEM 115, BIOL 230, or equivalents, or consent of instructor.  
Physical description of free energies and driving forces, energetic and timescales of biological processes, interactions of biomolecules, diffusion transport and signaling, protein DNA and membrane structure, molecular motors, cooperative binding, membrane potentials and excitability, regulation of gene expression.

**BIOL 630 Animal Physiology (Units: 3)**  
Prerequisites: BIOL 230, BIOL 240, CHEM 130. Intended for Biology majors.  
The physiology of animals, including structure, function, and regulation of organ systems. Unifying principles and natural adjustments to stress.

**BIOL 631GW Animal Physiology Laboratory - GWAR (Units: 4)**  
Prerequisite for BIOL 731: BIOL 630 or BIOL 612.  
Prerequisites for BIOL 631GW: ENG 214 with a grade of C- or better, BIOL 612 or BIOL 630. Intended for Biology majors.  
Approaches to scientific research on the environmental physiology of marine and estuarine organisms, with a focus on metabolic processes. Emphasis on scientific writing and communication. Classwork, 2 units; laboratory 2 units. Extra fee required. (Plus-minus ABC/NC) (BIOL 731/BIOL 631GW is an undergraduate/graduate level paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

**Course Attributes:**  
- Graduation Writing Assessment  
- BIOL 631GW/731

**BIOL 638 Bioinformatics & Genome Annotation (Units: 4)**  
Prerequisite for BIOL 738: BIOL 357 or consent of instructor. Prerequisite for BIOL 638: BIOL 230 or consent of instructor.  
Analyze and annotate a different chunk of genomic DNA. Results from this course will be incorporated into peer-reviewed publications, students listed as an author. (Plus-minus letter grade only) (BIOL 738/BIOL 638 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

**Course Attributes:**  
- BIOL 638/738

**BIOL 640 Cellular Neurosciences (Units: 3)**  
Prerequisites: BIOL 230, BIOL 240, CHEM 130, PHYS 121. BIOL 350 and BIOL 612 are recommended. Intended for Biology majors.  
Cellular and molecular analysis of neurons. Cellular, synaptic, and retinal neurophysiology. Electrical and chemical mechanisms underlying intraneuronal and inter-neuronal signaling.

**BIOL 642 Neural Systems Physiology (Units: 3)**  
Prerequisites: BIOL 328 or BIOL 612.  
Communication between neural centers controlling sensory and motor systems, homeostasis, learning, thought, and affect. Connectivity, neurophysiological regulation, and neuropathology. (Plus-minus letter grade only)
Biol 652 Science Education Partners in Biology (Units: 4)
Prerequisites: BIOL 230, BIOL 240, or one upper division biology course and consent of instructor.

Introduction to biology teaching and learning; engage in K-12 classroom teaching; examine understanding of biology, discuss science education literature, and analyze biology lessons and student learning. Classwork, 2 units; fieldwork, 2 units. Extra fee required.

Biol 694 Cooperative Internship in Biology (Units: 2-4)
Prerequisites: Sophomore standing and above and consent of Biology faculty adviser.

Written and oral report of work performed with an outside agency; requested written report from agency supervisor. Evaluation of work by biology adviser and/or faculty committee. Open to Biology majors. May be repeated for a total of 16 units.

Biol 699 Independent Study in Biology (Units: 1-3)
Prerequisites: Restricted to senior biology majors and consent of the department and instructor.

Special study in the laboratory, field, or library under the direction of a member of the department. The student must present a written detailed report of the work accomplished to the staff of the department. May be repeated for credit.

Biol 702 Biology of the Algae (Units: 3)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Collection, preservation, identification, and culturing of marine and freshwater algae. Comparative studies of morphology, life history, and ecology. Field trips. Classwork, 2 units; laboratory, 1 unit. Extra fee required. (BIOL 702/BIOL 502 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 502/702

Biol 708 Scientific Methods for Professional Aquatic Scientists (Units: 3)
Prerequisite: Graduate standing or consent of instructor.

Introduction to research tools and approaches used by scientists including: software for data analysis and presentation, using scientific literature, experimental design, writing scientific papers and proposals, professional communication (oral, poster, letter), time and stress management. (Plus-minus letter grade only)

Biol 710 Advanced Biometry (Units: 3)
Prerequisite: BIOL 458.

Use of computers for critical data evaluation and decision-making. Accessing and using available statistical packages, database management, construction of phylogenetic tree models, and advanced statistical analyses. No prior computer experience required. Classwork, 2 units; laboratory, 1 unit. Extra fee required.

Biol 711 Immunassays (Units: 3)
Prerequisites: CHEM 349, BIOL 435 or equivalent (may be taken concurrently).

Principles and applications of antigen-antibody interactions, immunassay design, and detection systems. Enzyme, luminescent and fluorescent assays, and their successful application in laboratory medicine or biological research are emphasized.

Biol 714 Biomedical Enzymology (Units: 3)
Prerequisite: CHEM 349 or equivalent.

Fundamental knowledge of enzymes, cofactors, and enzyme kinetics. Laboratory and computer exercises focus on action and kinetics of enzymes commonly used in medical diagnosis and/or biotechnology research. Classwork, 2 units; laboratory, 1 unit. Extra fee required. (Plus-minus letter grade only)

Biol 716 Skills for Scientific Proposal Writing (Units: 3)
Prerequisites: Graduate standing and consent of instructor.

Development of technical writing skills through the process of writing and editing research proposals based on students' own research projects.

Biol 723 Pharmacology (Units: 3)
Prerequisites: BIOL 230, BIOL 240 with grades of C- or better, BIOL 612, CHEM 130.

Pharmacology principles, including pharmacokinetics of drug absorption and elimination. Mechanisms of drug action on the body. Commonly used pharmaceutical drugs. (BIOL 723/Biol 623 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 623/723

Biol 731 Animal Physiology Laboratory - GWAR (Units: 4)
Prerequisite for BIOL 731: BIOL 630 or BIOL 612. Prerequisites for BIOL 631GW: ENG 214 with a grade of C- or better, BIOL 612 or BIOL 630. Intended for Biology majors.

Approaches to scientific research on the environmental physiology of marine and estuarine organisms, with a focus on metabolic processes. Emphasis on scientific writing and communication. Classwork, 2 units; laboratory 2 units. Extra fee required. (Plus-minus ABC/NC) (BIOL 731/BIOL 631 is an undergraduate/graduate level paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 631GW/731
• Graduation Writing Assessment

Biol 732 Biology and Chemistry of Signaling Pathways (Units: 3)
Prerequisite: Classified graduate status or consent of instructor.

An interdisciplinary presentation of the mechanisms by which extracellular stimuli trigger intracellular biochemical reactions that lead to alterations in cellular function. (Plus-minus letter grade) (This course is offered as BIOL 732 and CHEM 846. Students may not repeat the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 732/CHEM 846

Biol 737 Plant Metabolism (Units: 3)
Prerequisite: BIOL 525 or CHEM 340 or CHEM 349. Intended for Biology and Chemistry majors.

Plant metabolism: photosynthesis, cell wall biosynthesis, nitrogen, and sulfur metabolism, secondary plant products. Common metabolic pathways with an emphasis on functioning and regulation of these pathways in plants.
BIOL 738 Bioinformatics & Genome Annotation (Units: 4)
Prerequisite for BIOL 738: BIOL 357 or consent of instructor.
Prerequisite for BIOL 638: BIOL 230 or consent of instructor.

Analyze and annotate a different chunk of genomic DNA. Results from this course will be incorporated into peer-reviewed publications, students listed as an author. (Plus-minus letter grade only)
(BIOL 738/BIOL 638 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)
Course Attributes:

- BIOL 638/738

BIOL 741 Electron Microscopy (Units: 4)
Prerequisite: Graduate or senior standing, or consent of instructor.

Preparation of biological and inorganic materials for scanning and transmission electron microscopy, x-ray microanalysis, EBSD, CL, operation of the electron microscope(s), and data interpretation. Classwork, 1 unit; laboratory, 3 units. Extra fee required.
(This course is offered as BIOL 741, CHEM 741, and ERTH 741. Students may not repeat the course under an alternate prefix.)
Course Attributes:

- BIOL 741/CHEM 741/ERTH 741

BIOL 743 Cell and Molecular Techniques (Units: 3)
Prerequisites: Graduate standing, BIOL 357 (may be taken concurrently), CHEM 340, CHEM 341.

Lecture and discussion of modern techniques and design of strategies used in cell and molecular biology research. Includes discussion of societal issues.

BIOL 750 Science Teaching for Scientists I (Units: 2)
Prerequisite: Graduate standing or consent of instructor.

Introduction to practical teaching strategies, science education theory and research, and scientific teaching to SF State graduate student scientists who are teaching science in a variety of contexts. May be repeated for a total of 4 units. (Plus-minus letter grade only)
(This course is offered as SCI 750 and BIOL 750. Students may not repeat the course under an alternate prefix.)
Course Attributes:

- SCI 750/BIOl 750

BIOL 756 Principles of Human Genetics (Units: 3)
Prerequisite: Upper division genetics course and consent of instructor.

Intended for graduate students in Biology and Genetic Counseling.

Inheritance, molecular genetics, cytogenetics, variation, mutation, family history, pedigree analysis, genetic risk calculation, quantitative traits, evolution and population genetics. (Plus-minus letter grade only)

BIOL 760 Cancer Biology (Units: 3)
Prerequisites: Classified graduate standing; CHEM 340 or CHEM 349, BIOL 350 or BIOL 401, BIOL 357, or consent of instructor.

Molecular and cellular basis of cancer. Emphasis on potential therapeutic targets, including cell cycle regulators, signal transduction mechanisms, cellular differentiation factors, oncogenes, tumor suppressors. (Plus-minus letter grade only)

BIOL 763 Molecular Biology of Cancer (Units: 2)
Prerequisites: Graduate standing, a course in biochemistry.

The biology, diagnosis, and treatment of cancer focuses on how recent advances have been achieved by application of molecular biology principles and techniques. Topics include metastasis, angiogenesis, carcinogenesis, genetics, therapeutics, and potential future advances. (Plus-minus letter grade only)

BIOL 765 Biomedical Immunology Advanced Topics (Units: 2)
Prerequisite: Graduate standing or consent of instructor.

Faculty direct and evaluate student presentations of seminars on selected advanced topics in clinical immunology.

BIOL 772 Molecular Methods in Medical Microbiology (Units: 4)
Prerequisites: Graduate standing; biochemistry and microbiology courses with laboratory, or consent of instructor.

Overview of clinically significant microorganisms, emphasizing functional roles of biological macromolecules in pathogenesis and genetic applications. Lab covers basic principles and current molecular techniques used in model microbes. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 773 Advances in Biomedical Microbiology: Molecular Microbiology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.

Overview of molecular and genetic approaches that are used to study microbial physiology. May be repeated for a total of 4 units in consultation with departmental adviser, as topics may vary.

BIOL 774 Nucleic Acid Probe Methods: Biotechnology Applications (Units: 3)
Prerequisite: Graduate standing in biology or consent of instructor.

Basic concepts and applications of modern nucleic acid technologies in diagnosis, therapeutics, and biotechnology. Classwork, 1 unit; laboratory, 2 units. (Plus-minus letter grade only)

BIOL 775 Biomedical Microbiology Advanced Topics (Units: 2)
Prerequisite: Graduate standing or consent of instructor.

Primary scientific articles on important human microbial diseases and a centenary perspective of scientific discovery in microbiology are emphasized. Students are required to participate in article presentations and discussion.

BIOL 776 Molecular Biology of Cancer (Units: 2)
Prerequisites: Graduate standing, a course in biochemistry.

The biology, diagnosis, and treatment of cancer focuses on how recent advances have been achieved by application of molecular biology principles and techniques. Topics include metastasis, angiogenesis, carcinogenesis, genetics, therapeutics, and potential future advances. (Plus-minus letter grade only)

BIOL 777 Molecular Biology of Cancer (Units: 2)
Prerequisites: Graduate standing, a course in biochemistry.

The biology, diagnosis, and treatment of cancer focuses on how recent advances have been achieved by application of molecular biology principles and techniques. Topics include metastasis, angiogenesis, carcinogenesis, genetics, therapeutics, and potential future advances. (Plus-minus letter grade only)
BIOL 782 Developmental Biology (Units: 3)
Prerequisites for BIOL 782: Graduate standing; BIOL 350, BIOL 355 or equivalents with grades of C- or better, or consent of instructor.
Prerequisites for BIOL 382: BIOL 350, BIOL 355 with grades of C- or better. Intended for Biology and Biochemistry majors.

Early embryonic development: exploration of the molecular genetic basis for tissue differentiation. Gene regulation, chromatin, sex determination, oncogenesis, aging, and pattern formation. Extra fee required. (BIOL 782/BIOL 382 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 382/782

BIOL 784 Biomedical Virology Applications (Units: 3)
Prerequisite: Graduate standing or consent of instructor.

Topic to be specified in Class Schedule. Lecture, 1 unit; laboratory, 2 units. May be repeated when topics vary.

Course Attributes:
• Generic Course

BIOL 792 Molecular Virology (Units: 4)
Prerequisite: Graduate standing or consent of instructor.

Virology laboratory covering the growth and detection of viruses. Techniques include the propagation and titration of viruses in cell culture as well as the detection of viral infections by immunochemical and nucleic acid-based techniques. Classwork, 2 units; laboratory, 2 units.

BIOL 793 Advances in Biomedical Hematology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.

Topic to be specified in Class Schedule. May be repeated as topics vary.

Course Attributes:
• Generic Course

BIOL 800 Mushroom Taxonomy (Units: 3)
Prerequisites: Graduate or senior standing; BIOL 504 or equivalent; or consent of instructor.

Morphology, microscopic anatomy, taxonomy; biochemical and cytological aspects, ecology and artificial cultivation of the macroscopic fungi. Lecture, 2 units; laboratory, 1 unit. Extra fee required.

BIOL 801 Population Genetics (Units: 3)
Prerequisite: Restricted to graduate biology students or consent of instructor.

Genetic basis of evolution. Effects of mating system, drift, migration, selection on genetic variation. Quantitative genetics, applications of molecular techniques in evolutionary biology. Lecture, 2 units; laboratory, 1 unit. Extra fee required. (Plus-minus letter grade only)

BIOL 802 Advanced Topics in Biotechnology (Units: 2)
Prerequisite: Restricted to graduate Biology students and consent of instructor.

Examination of the current topics in biotechnology, pharmaceutical, and clinical research industry. May be repeated when topics vary.

Course Attributes:
• Generic Course

BIOL 803 Core Concepts of Biotechnology (Units: 3)
Prerequisite: CHEM 340 or BIOL 355 or BIOL 357, or equivalent background with consent of instructor.

Introductory course for students interested in careers in biotechnology. Core concepts of biotechnology to keep abreast of current trends, biomedical applications, and historical foundations. (Plus-minus letter grade only)

BIOL 804 Life Science Careers (Units: 2)
Prerequisites: Restricted to graduate Biology students and consent of instructor.

Introduction to career opportunities for biology life science students after graduation, choosing a career, and necessary tools to pursue a chosen field.

BIOL 805 Evolutionary Genetics (Units: 4)
Prerequisites: Graduate or senior standing; BIOL 355; or consent of instructor.

Principles of evolutionary genetics, including an emphasis on evolutionary quantitative genetics, molecular population genetics, molecular evolution and genomics. Classwork, 2 units; laboratory, 2 units. Extra fee required.

BIOL 814 Plant Taxonomy (Units: 5)
Prerequisites: BIOL 230, BIOL 240. Intended for Biology majors.

Principles of plant taxonomy including classification systems and phylogenetic relationships within the flowering plants; practice in identification and collecting. Classwork, 2 units; laboratory and fieldwork, 3 units. (Plus-minus letter grade only)

(BIOL 814/BIOL 514 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
• BIOL 514/814

BIOL 815 Advanced Phylogenetic Analysis (Units: 4)
Prerequisite: Graduate standing or consent of instructor.

Methods and techniques of phylogenetic inference. Parsimony, maximum likelihood, quantitative phylogenetic analysis, and comparative methods. Molecular data in evolution. Classwork, 3 units; laboratory, 1 unit. Extra fee required. (Plus-minus letter grade only)

BIOL 818 Molecular Techniques in Evolution and Ecology (Units: 4)
Prerequisite: BIOL 355 or equivalent and consent of instructor.

Molecular techniques commonly used in the fields of evolutionary biology and ecology. PCR and direct DNA sequencing. Classwork, 2 units; laboratory, 2 units. Extra fee required. (Plus-minus letter grade)

BIOL 821 Fire Ecology (Units: 3)
Prerequisites: Graduate or senior standing; BIOL 529GW; or consent of instructor.

Role of fire as an environmental factor in the life histories and succession of plants and/or animals. Classwork, 2 units; laboratory, 1 unit. Extra fee required.
BIOL 830 Advanced Conservation Biology (Units: 3)
Prerequisites: Graduate standing; BIOL 530; or consent of instructor.
Theory and practice of nature conservation; traditional resource management; new theory of the conservation of small populations. Classwork, 2 units; laboratory, 1 unit. Extra fee required. (Plus-minus letter grade only)

BIOL 832 Health Disparities in Cancer (Units: 3)
Prerequisite for BIOL 832: Graduate standing or consent of instructor.
Prerequisites for BIOL 332: Restricted to upper division standing; BIOL 230, BIOL 240, BIOL 355.
Major determinants of health disparities in cancer including ethnic differences in biology and prevention and treatment of cancer. Strategies to overcome these disparities through research, health education, outreach, advocacy, and policy changes.
(BIOL 832/BIOL 332 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
- BIOL 332/832
- Am. Ethnic & Racial Minorities
- Global Perspectives
- Social Justice

BIOL 840 Community Ecology (Units: 3)
Prerequisites: Graduate or senior standing in Biology, a course in ecology.
Modern concepts and approaches to natural community structure, organization, and dynamics. Historical and current theoretical models, forces structuring communities, interactions among communities, role of exotic species. (Plus-minus letter grade only)

BIOL 843 Population Biology (Units: 3)
Prerequisites: Graduate or senior standing, a course in genetics, ecology, biometry.
Modern concepts of structure, organization, and evolution of plant and animal populations. Genetical, ecological, evolutionary, and theoretical approaches to the study of populations.

BIOL 844 Research Skills - GWAR (Units: 3)
Prerequisite for BIOL 844: Graduate standing or consent of instructor.
Prerequisites for BIOL 344GW: ENG 214 or equivalent with a grade of credit or C- or better, BIOL 230, BIOL 240, and consent of instructor.
Practical skills for successfully conducting undergraduate research. Focus on experimental design, critical review of literature, effective oral and written scientific presentation, and development of research plan.
(Plus-minus ABC/NC)
(BIOL 844/BIOL 344GW is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Attributes:
- Graduation Writing Assessment
- BIOL 344GW/844

BIOL 848 Behavioral Ecology (Units: 3)
Prerequisite: Graduate standing or consent of instructor.
Evolution of behavior: optimal foraging, predation, sexual selection, social organization, habitat selection, and communication. (Plus-minus letter grade only)

BIOL 849 Responsible Conduct of Research (Units: 3)
Prerequisite: Restricted to Graduate standing or consent of the instructor.
Research integrity, working with human subjects, research with animals, drug testing and clinical trials, data management, reproducibility, peer review, authorship, conflicts of interest.

BIOL 860 Advances in Biology Education Research (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Students will read and present primary research articles, facilitate discussions, write article analyses, and develop a mini-grant proposal on a biology education research question. May be repeated for a total of 4 units.

BIOL 861 Advances in Cell and Molecular Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Topic to be specified in Class Schedule. May be repeated as topics vary.
Course Attributes:
- Generic Course

BIOL 862 Advances in Ecology and Systematic Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Topic to be specified in Class Schedule. May be repeated as topics vary.
Course Attributes:
- Generic Course

BIOL 863 Advances in Marine Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Topic to be specified in Class Schedule. May be repeated as topics vary.
Course Attributes:
- Generic Course

BIOL 864 Advances in Microbiology (Units: 2)
Prerequisites: Graduate standing and consent of instructor.
Topic to be specified in Class Schedule. May be repeated as topics vary.
Course Attributes:
- Generic Course

BIOL 865 Advances in Physiology and Behavioral Biology (Units: 2)
Prerequisite: Restricted to graduate students in Biology or consent of instructor.
Topic to be specified in Class Schedule. May be repeated as topics vary.
Course Attributes:
- Generic Course

BIOL 871 Colloquium in Microbiology, Cell and Molecular Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Presentation of student and faculty research, recent journal articles, and presentations by outside speakers. Does not fulfill graduate seminar requirement. May be repeated for a total of 4 units. (Plus-minus letter grade only)
BIOL 872 Colloquium in Ecology, Evolution, and Conservation (Units: 2)
Prerequisite for BIOL 872: Graduate standing.
Prerequisite for BIOL 572: Upper division standing or consent of instructor.
Presentation of student and faculty research, recent journal articles, and presentations by outside speakers. Student speakers receive graduate seminar credit. May be repeated for a total of 8 units. (BIOL 872/BIOL 572 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)
Course Attributes:
- BIOL 572/872

BIOL 881 Seminar: Cell and Molecular Biology (Unit: 1)
Prerequisites: Graduate standing and consent of instructor.
Topic to be specified in Class Schedule. May be repeated for a total of 4 units when topics vary.
Course Attributes:
- Generic Course

BIOL 883 Seminar in Marine Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Seminar on topics in marine biology. Topic to be specified in Class Schedule.
Course Attributes:
- Generic Course

BIOL 890 Cooperative Internship (Units: 2-3)
Prerequisite: Graduate standing.
For students who are conducting cooperative internship and work-related research experience. May be repeated for a total of 6 units.

BIOL 891 Biomedical Research Design (Units: 2)
Prerequisite: Must have fulfilled the GET requirement and have a specific research topic approved by a mentor.
Exercises encompass the elements of biomedical laboratory science research proposals: needs assessment, literature review, clinical significance, feasibility, controls, materials and methods, budget, data presentation, human/animal aspects, record keeping, reference notation, and statistical significance. (Plus-minus letter grade only)

BIOL 895 Research Project (Units: 4)
Prerequisite: BIOL 896, consent of instructor, approval of Advancement to Candidacy (ATC) and Culminating Experience (CE) forms by Graduate Studies.
Supervised independent and original laboratory or field investigation. Guidelines available at the biology department office. Advancement to Candidacy and Proposal for Culminating Experience Requirement forms must be approved by Graduate Studies before registration. (CR/NC grading only)

BIOL 896 Directed Reading (Unit: 1)
Prerequisites: Approval of department; permission is required for concurrent enrollment in BIOL 897 or BIOL 895.
Supervised preparation of the research proposal for a research project or thesis research, and completion of the preliminary oral examination. May not be repeated. (Plus-minus letter grade, RP)

BIOL 897 Research (Units: 1-6)
Prerequisites: Completed undergraduate major in biology and classified status.
Independent and original laboratory or field investigation under supervision of a faculty member. May be repeated. (Plus-minus letter grade, CR/NC, RP)

BIOL 898 Master's Thesis (Units: 4)
Prerequisites: Consent of instructor and approval of Advancement to Candidacy (ATC) for the Master of Arts in Biology and Culminating Experience (CE) forms by Graduate Studies.
Advancement to Candidacy and Proposal for Culminating Experience Requirement forms must be approved by the Graduate Division before registration. (CR/NC, RP)

BIOL 8003 Introduction to Marine Science (Unit: 0)
This course will provide an introduction to marine sciences for the general public and high school students participating in SF State's Sea Lion Bowl Diversity Program. Coursework and guest speakers will expose students to academic programs, scholarships, internships and opportunities for marine-related careers.
The course will include brief lectures, field trips and guest speakers on the following topics:
- Marine biology
- Marine geology
- Physical, chemical & biological oceanography
- Marine technology and navigation
- Marine history and economics
- Marine Policy
- Current research in marine science
- Undergraduate marine science programs
- Careers in marine science and technology

BIOL 8010 Geology of Haskell Peak and Lakes Basin (Unit: 0)
We will view pillow lavas, peperites, and turbidites-- all of them metamorphosed, and discover that the tuffs on Haskell Peak are filling an Oligocene paleovalley that stretches from a caldera cluster in central Nevada all the way to California's Great Valley. All instruction will take place where the rocks are-- in the field.

BIOL 8011 Moths of California (Unit: 0)
An informal introduction for studying and observing moths. Emphasis will be on collecting and processing adult moths and recording observations based on the techniques described in our book, Moths of Western North America. The workshop is recommended for persons interested in moths or those studying insect/plant relationships, or managing biodiversity conservation.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 8420 Ethnobotany of the Sierra Nevada (Unit: 0)
Explore the wild edible and healing plants of the Sierras and learn how to identify and use them. We will visit beautiful trails, ethically gather wild plants and prepare a celebratory wild food feast. Dive into the stunning beauty of Sierra Nevada wild flowers and acquire the necessary botanical skills to identify and classify plants. Join us for a fun-filled botanical adventure, deepen your connection to nature, build your herbal medicine chest and feast on the delicious bounty the Sierra Mountains.
Course Attributes:
- Sierra Nevada Field Campus
BIOL 8421 Introduction to Wildlife Tracking (Unit: 0)
In this introductory level course we will explore the tracks and sign left by wildlife in the Sierra Nevada. The primary focus of the course will be to learn and practice a process-based approach to interpret these tracks and sign. Through discussion and fieldwork we will cover the fundamentals of tracking such as tracking terminology, foot morphology, clear print identification, gait interpretation, track aging, sign interpretation, trailing, and journaling. In the field around Sierra Nevada Field Campus and in nearby Sierra Valley we will track as a group and with guided individual practice. Though we will concentrate on mammals and birds, we may look at other tracks and sign as we explore.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 8422 Mammals of the Sierra Nevada (Unit: 0)
The workshop will cover the classification and diagnostic features of the 6 orders and families of Sierra Nevada mammals, excluding bats, which are treated in a separate course. It will focus on comparative natural history and the adaptations that make survival possible in the climatic extremes of the Sierra Nevada. It will also address environmental change in the Sierra Nevada due to human influence, including extinctions and species recovery.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 8423 The Way of Water in Your Nature Journal- Sketching, Watercolor Painting, Notes and Prose (Unit: 0)
Water moves through the Lakes Basin as streams, waterfalls, marshes and lakes - an ever-present undercurrent to the landscape surrounding the Sierra Buttes. The movement of water - its life-giving and mesmerizing effects - sets the stage for deep reflection. In this class, we will explore techniques for capturing all this in our nature journals. Attending closely to what we see in nature deepens our experience, curiosity, and love of the natural world. Easy daily hikes will take us to locations where we'll mix watercolors and learn to sketch and paint close-ups as well as thumbnail waterscapes. Each day's leisurely pace will allow us to record our impressions of the surrounding area through painting, notes and prose. We will also pay attention to the composition of our pages as they evolve richly with the day.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9001 Wetland Delineation (Units: 4)
This 40-hour training focuses on procedures used to delineate wetland boundaries using the 1987 Corps Wetland Delineation and Interim Regional Supplement: Arid West Region (2006). The main objective is to provide participants with a hands-on introduction to delineation of jurisdictional wetlands in California. Field demonstrations of procedures to identify wetland vegetation, hydric soils, and wetland hydrology indicators will be covered. During field trips to many types of wetland ecosystems throughout the San Francisco Bay Area, including tidal salt marshes, freshwater marshes, riparian habitats, vernal pools and wet meadows, participants will work with instructors in groups to delineate extent of jurisdictional wetlands.
Class format: 50% lecture and discussion, 50% field work
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9007 Ecology of Invasive Species in Tidal Marshes of the San Francisco Estuary (Units: 1.6)
San Francisco Estuary has the greatest number of invasive exotic species of all estuaries in the continental US. In this course we will focus on those species that have invaded the tidal marsh habitats and adjacent channels and mudflats in the estuary. We will examine mechanisms of invasion and identify taxa of greatest concern in current and future invasions. We will explore effects of invaders on the ecology of the estuary's marshes, including modifications to habitat, changes to community structure, and influences on ecosystem processes. We will discuss current efforts to prevent further introductions, and methods for monitoring the distribution and abundance of invaders, assessing impacts, and control. Finally, we will explore implications of current and future invasions for conservation and restoration of native species and habitats in the estuary. Basic, non-specialized familiarity with ecology and Bay Area wetlands is assumed.
Class format: 60% lecture/lab and 40% field.

BIOL 9008 Seasonal Wetlands/Vernal Pools (Units: 1.6)
This course introduces the physical, biological, and biogeochemical processes that drive the ecological dynamics of seasonal wetland systems, with a focus on specific North Bay Area wetlands. Specific objectives are to examine (1) the hydrologic and geomorphic landscape features in which wetlands develop; (2) the linkages between hydrology, geomorphology, and wetland soil properties; (3) the relationship between soil properties and plant community structure and function and; (4) wetland creation, restoration, regulation and management. In addition, some time will be allocated to basic wetland identification principles, basic wetland plant identification and rare seasonal wetland species issues. Class Format: 25% Lecture, 75% Field.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9009 Wetland Hydrology (Units: 1.6)
This class introduces the dominant hydrologic processes active in tidal and freshwater wetland systems that serve as the engineer and earth sciences foundation of applied wetland restoration and natural resource management practice. Using examples throughout California, it provides a description of hydrologic processes, their watershed and geomorphic context, and how they influence the ecological health of tidal wetlands. The influences of tidal cycles, tidal inlets, channel/marsh plain morphology and control structures on flow and circulation in salt and brackish marshes will be examined. Freshwater wetlands and the riparian corridor will be addressed. Through lecture, discussion and case study, the class focuses on linkages between hydrologic and biological processes in wetland systems. Class format: 50% lecture and discussion; 50% field demonstration and discussion.
Course Attributes:
- Sierra Nevada Field Campus
BIOL 9016 Advanced Wetland Delineation (Units: 2)
This course will expand upon the wetland delineation principles discussed in the basic wetland delineation course. The course will focus on implementing the delineation procedures described in the Arid West and Western Mountains, Valleys and Coast Supplemental Delineation Manuals. Students will learn how to document vegetation, soil, and hydrology using Comprehensive Wetland Delineation techniques. Upon completion of the course students will be able to develop a wetland hydrology monitoring program, determine plant species composition and percent cover using transect sampling/direct sampling techniques, and analyze soil characteristics useful in wetland delineation using field and laboratory techniques. In addition, the course will discuss the new wetland delineation submittal requirements established by the Army Corps of Engineers to determine if identified wetlands and waters are federally-regulated according to the SWANCC and the Rapanos/Carabell Supreme Court decisions. This course will not cover how to evaluate a "significant nexus" according to the June 5, 2007 guidance issued by the Corps. At this time, it appears that the Army Corps and EPA have determined that every drainingway has a "significant nexus" no matter how small or far away from the traditional navigable water. Rather, the course will describe methods and procedures for collecting and presenting the data requested by the Army Corps. Such information will include how to determine stream order, relevant reach, ascertain if a drainage is a relatively permanent water, and how to document physical, chemical, and biological conditions of the relevant reach. Any recent changes to the Army Corps wetland delineation verification procedures that arise due to public review and comment will also be discussed. Class Format: 50% Lecture 50% Field demonstration.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9018 Science in the Park (2.5CEU) (Units: 2.5)
This five day workshop is co-sponsored by the San Francisco Botanical Garden Society, California Academy of Sciences, with the participation of the San Francisco Conservatory of Flowers and the DeYoung Museum. The workshop will focus on the forest habitats that are readily accessible to Bay Area students and educators. With the tools and techniques covered in this week-long workshop, teachers will be able to get their students actively engaged with the natural world. Teachers will learn to observe, record, and understand forest features from an individual tree outside the school, to the expansive natural areas, gardens and exhibits found in Golden Gate Park. This standards-aligned workshop will explore life cycles, plant and animal adaptations, plant and animal interactions, climate, and soil. All of these topics will be covered under the canopy of the five types of forests in Golden Gate Park: oak woodlands, tropical rainforests, cloud forests, redwood forests, and urban forests. The target audience for this year’s teacher workshop will be teachers of grades K through 5.

BIOL 9019 Primary Care (CPR) and Secondary Care (First Aid) (.6CEU) (Units: 0.6)
Primary Care CPR teaches participants how to respond to life-threatening emergencies. This course focuses on primary care through a combination of knowledge development, skill development and scenario practice to give participants the confidence in their ability to provide care when emergency situations arise. Secondary Care First Aid covers injuries or illnesses that are not immediately life threatening. Primary and Secondary Care courses must be taken together.

BIOL 9020 Divers Alert Network Oxygen First Aid for Scuba Diving Injuries (.4CEU) (Units: 0.4)
This course is designed to train and educate the general diving public in the techniques of using oxygen as first aid for a suspected dive injury. In addition, this course will introduce the fundamentals of recognizing diving injury warning signs, response and management.

BIOL 9021 Greatest Hits in the Evolution of Land Plants (.6CEU) (Units: 0.6)

BIOL 9100 GIS for Wetlands (Units: 1.6)
This course offers an intensive, hands-on introduction to Geographic Information Systems (GIS) and Global Positioning Systems (GPS) technology and their application to wetland science. Students will learn basic GIS concepts, terminology, and techniques exploring the industry standard GIS software, ArcGIS 9.3. Day 1 will emphasize managing and displaying data using ArcGIS and Google Earth, as well as collecting, uploading and displaying GPS field data using Trimble GPS devices. Day 2 will emphasize editing shapefiles and fundamental geoprocessing skills, including using aerial and satellite imagery in conjunction with National Wetlands Inventory data and topographic maps to delineate wetland areas and identify change over time. In the process students will learn about wetlands classification schemes, how online resources and GIS can be used to support wetland delineation processes, and fundamentals of cartographic design and data handling. Class Format: 25% lecture and 75% computer exercises.

BIOL 9350 Identifying Wetland Plant Indicator Species (Units: 1.6)
Common wetland plant species provide important indicators of wetland habitat conditions and are a key component to wetland habitat mapping. Through a combination of field, lab, and lecture, this course will provide resources and methods designed to enable students to identify common wetland plant indicator species. The focus will be on Bay Area wetland plant species but the emphasis will be on learning techniques that are designed to solve identification problems and that can be applied in a broader geographic context. Class Format: 25% Lecture, 50% Field, 25% Lab.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9395 Wetlands Restoration Ecology (Units: 1.6)
This course will address current topics in ecology and their application to restoration of wetland habitats. We will discuss how ecological concepts and experimentation can guide wetland restoration projects, from establishing goals, to monitoring and assessing success, to adaptively managing wetland restoration sites. This course will be primarily lecture and discussion, with a field trip held the afternoon of the second day. Class Format: 75% Lecture and 25% Field.
Course Attributes:
- Sierra Nevada Field Campus

BIOL 9396 Wetlands Restoration Monitoring Techniques (Units: 0.8)
A one day course focusing on field based tools and techniques to properly monitor wetland restorations. This course will provide resources and methods for monitoring and assessing restoration success. In addition we will address restoration management all with an emphasis on salt marshes around the SF bay area. Class Format: 25% lecture and 75% field demonstration.
BIOL 9400 Explorations in Science Education (1CEU) (Unit: 1)
BIOL 9401 Our Changing Ocean and Estuaries (Units: 0.8)
BIOL 9851 Personalized Medical World Conference (Unit: 1)
BIOL 9852 Personalized Medical World Conference (Units: 2)