BIOLOGY (BIO)

BIO Courses

BIO 111. General Biology. 4 units
GE Area B2; GE Area B4
Term Typically Offered: F, W, SP, SU
Principles of cellular biology, heredity, ecology, biological diversity, and evolution, with emphasis on their relationships to human affairs. Not open for major credit in Biological Sciences, Microbiology or Marine Sciences. Not open to students who have completed BIO 115 or BIO 161. 3 lectures, 1 laboratory. Fulfills GE B2 & B4.

BIO 112. Environmental Biology and Conservation. 4 units
GE Area B5
Term Typically Offered: F, W, SP
A biologically centered exploration of our planet focusing on natural resource conservation and contemporary environmental issues. Interactions between components of the biosphere and impacts of human society on interrelationships within ecosystems. Trends in natural resource conservation and biodiversity preservation. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. 4 lectures. Fulfills GE B5.

BIO 114. Plant Diversity and Ecology. 4 units
GE Area B2; GE Area B4
Term Typically Offered: W, SP
Plant diversity and ecology in aquatic and terrestrial plant communities including adaptations of plants to their environment. Identification of common, local native plants and plant communities, uses of native plants by Native Americans, and human impacts on native plant communities. 2 lectures, 2 laboratories. Fulfills GE B2 & B4.

BIO 123. Biology of Sex. 4 units
GE Area B2
Term Typically Offered: W
Fundamental principles of biology related to sexual reproduction: genetics, physiology, behavior, ecology and evolution of sex in a broad range of organisms. 4 lectures. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Fulfills GE B2.

BIO 160. Diversity and History of Life. 4 units
Term Typically Offered: F, W
Overview of the history, diversity and genetic relatedness of life on Earth; broad-scale evolutionary framework of the organization and expansion of life on Earth. 3 lectures, 1 laboratory.

BIO 161. Introduction to Cell and Molecular Biology. 4 units
GE Area B2; GE Area B4
Term Typically Offered: F, W, SP, SU
Recommended: CHEM 110 or CHEM 111 or CHEM 124 or CHEM 127.

BIO 162. Introduction to Organismal Form and Function. 4 units
Term Typically Offered: W, SP
Prerequisite: BIO 161. Recommended: CHEM 110 or CHEM 111 or CHEM 124 or CHEM 127.
Fundamentals of the structure and physiology of tissues and organs of plants and animals: energy acquisition and food distribution, gas exchange and fluid transport, and sensing and responding to the environment. 3 lectures, 1 laboratory.

BIO 200. Special Problems for Undergraduates. 1-2 units
CR/NC
Term Typically Offered: F, W, SP, SU
Prerequisite: Consent of department chair.
Individual investigation, research, studies or surveys of selected problems. Intended for lower division students in the Biological Sciences Department. Total credit limited to 12 units, with a maximum of 2 units per quarter. Credit/No Credit grading only.

BIO 202. Orientation to Biotechnology. 2 units
Term Typically Offered: F, W
Prerequisite: Completion of a course with a BIO, BOT or MCRO prefix and a course with a CHEM prefix.
Introduction to the diversity of fields in biotechnology. Applications in agriculture, nutrition, medicine and environmental problems. 1 lecture, 1 activity. Crosslisted as BIO/CHEM 202.

BIO 211. Biology of Plants and Animals. 4 units
Term Typically Offered: W, SP
Prerequisite: BIO 111; for Liberal Studies majors only. Recommended: STAT 130 or STAT 217.
Plant and animal anatomy, physiology, diversity and life cycles. How plants and animals acquire nutrients, reproduce, and adapt to environments. Emphasis on hands-on activities and model organisms suited for the elementary classroom. 3 lectures, 1 laboratory. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences.

BIO 213. Life Science for Engineers. 2 units
GE Area B2
Term Typically Offered: F, W
Prerequisite: MATH 142; for engineering students only. Corequisite: BMED/BRAE 213. Recommended: CHEM 124.

BIO 227. Wildlife Conservation Biology. 4 units
GE Area B2
Term Typically Offered: F, W, SP
BIO 231. Human Anatomy and Physiology I. 5 units
Term Typically Offered: F, W, SP
Prerequisite: BIO 111 or BIO 161; CHEM 110, CHEM 111, CHEM 124, CHEM 127, or PSC 102.

Structure and function of the skeletal, muscular, nervous, endocrine, and integumentary systems. Molecular, cellular, and organ system levels of organization. Lab includes study of prosected human cadavers. Not open for major credit to Biological Sciences majors. Not open to students with credit in BIO 432 or ZOO 331. 4 lectures, 1 laboratory.

BIO 232. Human Anatomy and Physiology II. 5 units
Term Typically Offered: F, W, SP
Prerequisite: BIO 111 or BIO 161; CHEM 110, CHEM 111, CHEM 124, CHEM 127, or PSC 102.

Structure and function of the circulatory, immune, respiratory, digestive, urinary, and reproductive systems. Molecular, cellular, and organ system levels of organization. Lab includes study of prosected human cadavers. Not open for major credit to Biological Sciences majors. Not open to students with credit in BIO 433 or ZOO 332. 4 lectures, 1 laboratory.

BIO 253. Health Professions Shadowing. 1 unit
CR/NC
Term Typically Offered: F, W, SP
Prerequisite: Consent of instructor.

Observation in a healthcare setting. Students will shadow healthcare practitioners on campus or in a community setting. Specific placement depend on practitioner availability. Total credit limited to 2 units with a maximum of 1 unit per quarter. Credit/No Credit grading only. 1 activity. Priority to BIO and MCRO majors.

BIO 263. Introductory Ecology and Evolution. 4 units
Term Typically Offered: F, SP
Prerequisite: BIO 160 or BIO 161.

Basic concepts in ecology and evolution. Relationships among organisms in populations, communities and ecosystems, structures and dynamics of populations, communities and ecosystems, ecosystem inputs and energy flows, nutrient cycling, biogeography, population genetics, evolution, patterns of biodiversity and issues in conservation biology. 3 lectures, 1 laboratory.

BIO 270. Selected Topics. 1-4 units
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

BIO 302. Human Genetics. 4 units
GE Area B5
Term Typically Offered: F,W,SP,SU
Prerequisite: ASCI 112, BIO 111, BIO 123, BIO 161, BIO 213, or BOT 121. Recommended: STAT 217 or STAT 218.

Basic principles of human inheritance, including the transmission of genetic traits, chromosomal abnormalities and their effects, gene structure and function, mutations and mutagenic agents, cancer genetics, population genetics, and principles of genetic counseling. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Not open to students with credit in BIO 303 or BIO 351. 4 lectures. Fulfills GE B5.

BIO 303. Survey of Genetics. 4 units
Term Typically Offered: F, W, SP
Prerequisite: BIO 111 or BIO 161 or BOT 121. Recommended: STAT 218.

Principles of heredity and variation. Transmission genetics; molecular mechanisms of inheritance and gene expression. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Not open to students with credit in BIO 351. Credit will be granted in only one of the following courses: BIO 302 or BIO 303. 4 lectures.

BIO 305. Biology of Cancer. 4 units
GE Area B5
Term Typically Offered: F
Prerequisite: Completion of GE Area B2.

Introduction to the causes, characteristics and treatment of human cancer. Topics include effects of carcinogens and radiation; the genetics of cancer; molecular, cellular and physiological changes in common cancers; conventional chemotherapy and new treatments. Not open for major credit in Biological Sciences, Microbiology, Marine Sciences, or Biochemistry. 4 lectures. Fulfills GE B5.

BIO 308. Genetic Engineering Technology. 4 units
GE Area F
Term Typically Offered: F, W
Prerequisite: Junior standing; completion of GE Area B2, and one of the following: CHEM 110, 111, 124 or 127.

Introduction to the methodology and techniques used in genetic engineering. Applications in agriculture, nutrition, medicine and environmental problems. Potential benefits and problems, including the underlying ethical questions. Not open to students with credit in CHEM 373, or to Biological Sciences, Marine Sciences, or Microbiology majors. 4 lectures. Crosslisted as BIO/CHM 308. Fulfills GE Area F.

BIO 321. Mammalogy. 4 units
Term Typically Offered: F
Prerequisite: BIO 162 or BIO 263 or BIO 427 or ASCI 329.

Ecology, behavior, physiology, functional morphology, and evolution of mammals. Classification and identification of mammals, with emphasis on California species. 2 lectures, 2 laboratories. Formerly ZOO 321.

BIO 322. Ichthyology. 4 units
Term Typically Offered: F
Prerequisite: BIO 162.

Phylogeny, anatomy, functional morphology, physiology, and ecology of marine and freshwater fishes. Special reference to local and economically important species. Laboratory emphasis on taxonomy of California species, especially marine groups. 2 lectures, 2 laboratories. Formerly ZOO 322.

BIO 323. Ornithology. 4 units
Term Typically Offered: F
Prerequisite: BIO 162 or BIO 263 or BIO 427 or ASCI 329.

Classification and identification of birds, with emphasis on California species. Functional morphology, physiology, ecology, behavior and census methods. Field trips may require meeting in the morning before scheduled lab time. 2 lectures, 2 laboratories. Formerly ZOO 323.
BIO 324. Herpetology. 4 units  
Term Typically Offered: SP, SU  
Prerequisite: BIO 160 and BIO 162.  
Living and extinct reptiles and amphibians; an adaptive approach to their diversity, biology, and classification. 2 lectures, 2 laboratories. Formerly ZOO 341.

BIO 327. Wildlife Ecology. 4 units  
Term Typically Offered: SP  
Prerequisite: BIO 263 or NR 306. Recommended: STAT 217 or STAT 218.  
Principles of ecology as applied to the study of wild vertebrates and their habitats. Emphasis on techniques for collecting and analyzing field data and how these data apply to the study and management of wildlife. Use of the literature, inventory of plants and animal populations, use of maps and databases, quantifying diet and habitat use, determining sex and age and nutritional condition, capture and marking techniques, non-invasive sampling methods. 3 lectures, 1 laboratory.

BIO 329. Vertebrate Field Zoology. 4 units  
Term Typically Offered: SU  
Prerequisite: Junior standing; BIO 162 or BIO 263 or BIO 427 or ASCI 329.  
Identification and natural history of terrestrial vertebrates, with emphasis on field studies and local species. Field trips may require meeting in the morning before scheduled lab time. 2 lectures, 2 laboratories. Formerly ZOO 329.

BIO 330. Extended Field Biology Activity. 1-3 units  
Term Typically Offered: F, W, SU  
Corequisite: Enrollment in corresponding field biology course.  
Minimum of two days of field instruction in places with significant biological diversity, and an individual or group project. Focus on field notebooks, field identification, survey methods, experimental design, and significant habitat types for various groups of organisms. The Schedule of Classes will list the title of the associated field biology course. Total credit limited to 6 units, each associated with a different field biology course, with no more than 4 units applied as advisor approved electives. Field trip required. 1-3 activities.

BIO 335. General Entomology. 4 units  
Term Typically Offered: W  
Prerequisite: AEPS 313, BIO 160, or BIO 211. Recommended: BIO 162.  
Introduction to the study of insects. Structure, major orders and families of insects, life histories, medical, and economic importance. Insect collection required. 2 lectures, 2 laboratories. Formerly ZOO 335.

BIO 336. Invertebrate Zoology. 4 units  
Term Typically Offered: W  
Prerequisite: BIO 160 and BIO 162.  
Invertebrate groups of animals with emphasis on taxonomy, morphology, distribution, and economic importance. 2 lectures, 2 laboratories, and fieldwork. Formerly ZOO 336.

BIO 351. Principles of Genetics. 5 units  
Term Typically Offered: F,W,SP,SU  
Prerequisite: BIO 161; CHEM 216, CHEM 312, or CHEM 316. Recommended: BIO 263; STAT 217 or STAT 218.  
Principles of genetics and genetic analysis, including underlying molecular mechanisms. Subjects include gene structure and function, inheritance patterns, regulation of gene expression, mutation, recombination, recombinant DNA technology, and an introduction to population genetics. 5 lectures.

BIO 361. Principles of Animal Physiology. 4 units  
Term Typically Offered: F, W, SP  
Prerequisite: BIO 162; and CHEM 216, CHEM 312 or CHEM 316.  
Fundamental principles of animal physiology, including cellular mechanisms and integration to whole animals. Membrane transport, fluid/salt balance, excitatory cells, metabolic rate, temperature, gas exchange and circulation. 3 lectures, 1 laboratory.

BIO 400. Special Problems for Advanced Undergraduates. 1-2 units  
Term Typically Offered: F,W,SP,SU  
Prerequisite: Consent of instructor.  
Individual investigation, research, studies, or surveys of selected problems. Total major credit limited to 6 units, with a maximum of 2 units per quarter. Total credit limited to 12 units.

BIO 401. Principles of Conservation Biology. 4 units  
Term Typically Offered: F, W  
Prerequisite: BIO 263 or NR 306, or graduate standing in Biological Sciences.  
Foundational concepts in the conservation of wild organisms and their habitats. Quantification and valuation of biological diversity, current threats to diversity, and approaches to better understand and address these threats, across terrestrial, freshwater, and marine environments. 4 lectures.

BIO 405. Developmental Biology. 4 units  
Term Typically Offered: SP  
Prerequisite: BIO 161, BIO 162, and BIO 303 or BIO 351 or CHEM 373.  
Events and mechanisms of embryonic development, including fertilization, morphogenesis, cell differentiation, and organogenesis, with emphasis on differential gene expression in model organisms. 3 lectures, 1 laboratory.

BIO 406. Advanced Anatomy and Physiology: Neuroscience. 4 units  
Term Typically Offered: F, SP  
Prerequisite: BIO 361; CHEM 331 or STAT 218; PHYS 123 or PHYS 133; or graduate standing in Biological Sciences.  
Anatomy and physiology of nervous systems including electrophysiology, molecular and cellular mechanisms of neurotransmission, interactions between the nervous system and other body systems, and comparative anatomy of vertebrate nervous systems, especially humans. 3 lectures, 1 laboratory.
BIO 407. Advanced Anatomy and Physiology: Endocrinology. 4 units  
Term Typically Offered: F, SP  
Prerequisite: BIO 361; CHEM 331 or STAT 218; or graduate standing in Biological Sciences.  
Anatomy and physiology of the endocrine system and hormones, with an emphasis on humans and other vertebrates. 4 lectures.

BIO 408. Advanced Anatomy and Physiology: Cardiorespiratory and Renal. 4 units  
Term Typically Offered: F, W  
Prerequisite: BIO 361; CHEM 331 or STAT 218; or graduate standing in Biological Sciences.  
Anatomy and physiology of the cardiovascular, respiratory, and renal systems, with an emphasis on humans and other vertebrates. Discussion of health and disease states and responses to exercise and environmental factors. 3 lectures, 1 laboratory.

BIO 409. Advanced Anatomy and Physiology: Muscle and Locomotion. 4 units  
Term Typically Offered: W, SP  
Prerequisite: BIO 361; CHEM 331 or STAT 218; PHYS 121 or PHYS 141; or graduate standing in Biological Sciences.  
Anatomy and physiology of musculoskeletal systems, including energetics and biomechanics of locomotion. Discussion of invertebrates and vertebrates with emphasis on humans. 3 lectures, 1 laboratory.

BIO 410. Functional Histology. 4 units  
Term Typically Offered: SP  
Prerequisite: ASCI 229 or BIO 231 or BIO 232 or BIO 361 or graduate standing in Biological Sciences.  
Functional microscopic anatomy of principal tissues and organs of vertebrates, including humans. Structural studies to determine mechanisms underlying physiological processes and their clinical applications in medicine. 2 lectures, 2 laboratories.

BIO 414. Evolution. 4 units  
Term Typically Offered: F, W, SP, SU  
Prerequisite: BIO 263; and BIO 303 or BIO 351. Recommended: BIO 327 or BOT 326 or MSCI 328.  
Scientific evaluation of the theories, mechanism, and patterns of biological evolution. 4 lectures.

BIO 415. Biogeography. 4 units  
Term Typically Offered: TBD  
Prerequisite: BIO 263, or graduate standing in Biological Sciences.  
Plant and animal distribution patterns in relation to past and present physical and biotic factors; survey of major biomes with major emphasis on North and South America. 4 lectures.

BIO 419. Analytical Methods in Ecology. 4 units  
Term Typically Offered: TBD  
Prerequisite: STAT 218 or graduate standing in Biological Sciences. Recommended: one of the following: BIO 263, BIO 327, BOT 326, MSCI 328 or NR 306.  
Introduction to quantitative methods used in ecology with an emphasis on the design and analysis of field studies. Population estimates, sampling design and analysis, and the determination of community structure. 3 seminars, 1 activity.

BIO 421. Wetlands. 4 units  
Term Typically Offered: TBD  
Prerequisite: BOT 121 or BIO 162, CHEM 111 or CHEM 127, and SS 121 or SS 131. Recommended: one of the following: BIO 327, BOT 313, BOT 326, MSCI 328 or NR 306.  

BIO 424. Organizing and Teaching Science. 4 units  
Term Typically Offered: TBD  
Prerequisite: Admission to the Single Subject Credential Program.  
Techniques, aims and objectives in the teaching of physical and life sciences at the secondary level. Selection and organization of teaching material, including strategies for English language learners (ELL) and special needs students. Evaluation of results. 3 lectures, 1 activity. Crosslisted as BIO/PSC 424.

BIO 425. Clinical Experience in Teaching Science Seminar. 2 units  
Term Typically Offered: TBD  
Prerequisite: Acceptance into the Single Subject Credential Program in Science. Concurrent: EDUC 469 or EDUC 479.  
Principles and practices in effective teaching of science at the middle and high school level, learning theories, curriculum content and structure, classroom issues, and the teaching profession. Credit/No Credit grading only. Total credit limited to 4 units. 2 seminars. Crosslisted as BIO/PSC 425.

BIO 426. Immunology. 4 units  
Term Typically Offered: W, SP  
Prerequisite: BIO 351 or CHEM 373. Recommended: CHEM 313 or CHEM 371.  
Principles of molecular and cellular immunology. Emphasis on molecular regulation of immune cell development, including generation of unique receptors, lymphocyte signal transduction and selection, programmed cell death and regulation of immune responses. Discussion and demonstration of roles of immunology in disease and as diagnostic tools. 3 lectures, 1 laboratory.

BIO 427. Wildlife Management. 4 units  
Term Typically Offered: F, W  
Prerequisite: One of the following upper-division ecology courses: BIO 327, BIO 401, BIO 444, BOT 326, MSCI 328, or NR 306, or graduate standing in Biological Sciences.  
Important habitats, such as riparian, wetlands, and habitat features important to wildlife, such as vegetation types and snags. Basic concepts of wildlife management. Emphasis on planning and designing habitats to meet the needs of wildlife. 3 lectures, 1 laboratory.
BIO 428. Hematology. 4 units
Term Typically Offered: W, SU
Prerequisite: BIO 351 or BIO 302 or BIO 303 or CHEM 373, or graduate standing in Biological Sciences. Recommended: BIO 361 or ZOO 332 or BMED 460; CHEM 313 or CHEM 371.

Development and function of blood as a tissue. Composition, function, and mechanisms of formation and destruction of blood components in health and disease. Methods for examination of blood. 3 lectures, 1 laboratory. Formerly ZOO 428.

BIO 429. Parasitology. 4 units
Term Typically Offered: F
Prerequisite: BIO 160 and BIO 161, or MCRO 221, or MCRO 224, or graduate standing in Biological Sciences.

External and internal parasites of man and animals. Life history. Parasite-host relationships. Control and recognition of species of clinical importance. 2 lectures, 2 laboratories. Formerly ZOO 425.

BIO 434. Environmental Physiology. 4 units
Term Typically Offered: F
Prerequisite: BIO 162, or graduate standing in Biological Sciences. Recommended: BIO 263.

Comparative physiological mechanisms involved in the regulation of oxygen uptake, water and ion balance, and temperature regulation in animals. Emphasis is placed on physiological adaptations which maintain or restore homeostasis in animals which are subjected to environmental changes. 3 lectures, 1 laboratory.

BIO 435. Plant Physiology. 4 units
Term Typically Offered: W
Prerequisite: BOT 121 or BIO 162. Recommended: BIO 161 or BIO 303; CHEM 312 or CHEM 216.

Consideration of the principal physiological and biochemical processes of plants with emphasis on water relations, mineral nutrition, photosynthesis, and the physiology of plant development. 3 lectures, 1 laboratory.

BIO 441. Bioinformatics Applications. 4 units
Term Typically Offered: F, SP
Prerequisite: Junior standing; BIO 161 or BIO 303. Recommended: BIO 302 or BIO 303 or BIO 351 or CHEM 373.

Introduction to new problems in molecular biology and current computer applications for genetic database analyses. Use of software for: nucleic acid, genome and protein sequence analysis; genetic databases, database tools; industrial applications in bioinformatics; ethical and societal concerns. 3 lectures, 1 laboratory. Crosslisted as BIO/CHEM 441.

BIO 442. Behavioral Ecology. 4 units
Term Typically Offered: SP
Prerequisite: BIO 263, or graduate standing in Biological Sciences.

Behavioral adaptations of animals to their environment and way of life. Analysis of behavior patterns, use of patterns in clarifying evolutionary and ecological relationships. 3 lectures, 1 laboratory.

BIO 444. Population Ecology. 4 units
Term Typically Offered: F
Prerequisite: BIO 263 or NR 306.

Growth, fluctuations, balance, and natural mechanisms controlling wild populations, and methods for assessing their interconnectedness. Field trip may be required. 3 lectures, 1 laboratory.

BIO 445. Community Ecology. 4 units
Term Typically Offered: W
Prerequisite: BIO 160, BIO 162, BIO 263, and STAT 218 or Graduate standing in Biological Sciences. Recommended: BIO 327, BIO 401, BOT 326, or MSCI 328.

Principles of ecology at the community level including the mechanism that structure ecological communities, and the quantitative methods used to study community ecology such as diversity metrics, community composition analyses, interaction strengths and the application of statistics to field and experimental studies. 3 lectures, 1 laboratory.

BIO 446. Ecosystem Ecology. 4 units
Term Typically Offered: W
Prerequisite: BIO 263, BOT 326, or NR 306; and STAT 218, or Graduate standing in Biological Sciences. Recommended: BIO 327, BIO 401, MSCI 328 or SS 121.

Advanced ecosystem ecology and biology, and the interactions of biological communities with the abiotic environment. Emphasis on climate change, ecosystem services, and major fluxes and pools of organic elements. 4 lectures.

BIO 450. Undergraduate Laboratory Assistantship. 1-4 units
CR/NC
Term Typically Offered: F, W, SP
Prerequisite: Consent of instructor and department chair.

Assisting the instructor in teaching and supervising undergraduate laboratories in the Biological Sciences Department. Total credit limited to 8 units, with a maximum of 4 units per quarter. Credit/No Credit grading only.

BIO 452. Cell Biology. 4 units
Term Typically Offered: F, W, SP
Prerequisite: BIO 351 or CHEM 373; and CHEM 216, CHEM 312 or CHEM 316. Recommended: CHEM 313 or CHEM 371.

Introduction to cell structure and function, energy conversions, protein sorting, signaling, cytoskeleton, cell adhesion, and the cell cycle. 3 lectures, 1 laboratory.

BIO 461. Senior Project - Research Proposal. 2 units
Term Typically Offered: F,W,SP,SU
Prerequisite: fulfillment of GWR, STAT 218, and junior standing.

Completion of a research proposal and literature review, including analysis of experimental results from published peer-reviewed articles in biology. Written and oral presentations. 2 activities.
**BIO 462. Senior Project - Research. 2 units**
Term Typically Offered: F,W,SP,SU
Prerequisite: fulfillment of GWR, STAT 218, junior standing, and consent of instructor. Recommended: BIO 400.

Completion of a research project or equivalent in the biological sciences, selected and conducted in consultation with an instructor. Results are presented in written reports.

**BIO 463. Honors Research. 2 units**
Term Typically Offered: F,W,SP,SU
Prerequisite: BIO 462 and consent of instructor.

Completion of advanced research in the biological sciences, selected and conducted in consultation with an instructor. Results presented as a written report and/or oral presentation in a public forum.

**BIO 470. Selected Advanced Topics. 1-4 units**
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**BIO 471. Selected Advanced Laboratory. 1-4 units**
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topics selected. Total credit limited to 8 units. 1 to 4 laboratories.

**BIO 472. Current Topics in Biological Research. 1-4 units**
Term Typically Offered: TBD
Prerequisite: Junior standing.

Applications of biological research topics. Discussions of how selected discoveries in biological research formed the basis for, and were developed into, practical applications, currently accepted theories, generally utilized techniques or decisions affecting society and political policies. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 seminars.

**BIO 475. Molecular Biology Laboratory. 3 units**
Term Typically Offered: F, W, SP
Prerequisite: BIO 161, and grade of C- or better in BIO 351 or CHEM 373 or consent of instructor.

Introduction to techniques used in molecular biology and biotechnology: DNA extraction, characterization, cloning, Southern blotting, reverse transcription, polymerase chain reaction, and sequencing analysis. 1 lecture, 2 laboratories. Crosslisted as BIO/CHEM 475.

**BIO 476. Gene Expression Laboratory. 3 units**
Term Typically Offered: SP
Prerequisite: BIO/CHEM 475; CHEM 313 or CHEM 371, or graduate standing in Biological Sciences.

Heterologous gene expression of a recombinant protein in a microbial system: gene cloning, construction of expression plasmid, DNA sequence analysis, transformation of microbial host, selection and analysis of transformed host cells, expression and purification of recombinant protein. 1 lecture, 2 laboratories. Crosslisted as BIO/CHEM 476.

**BIO 485. Cooperative Education Experience. 6 units**
CR/NC
Term Typically Offered: F,W,SP,SU
Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BIO 495. Cooperative Education Experience. 12 units**
CR/NC
Term Typically Offered: F,W,SP,SU
Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BIO 500. Individual Study. 1-4 units**
Term Typically Offered: TBD
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study planned and completed with the approval of and under the direction of a member of the department faculty. A written scholarly presentation of the results of each BIO 500 project must be included in the graduate student’s departmental file. Total degree credit limited to 3 units. Total credit limited to 12 units.

**BIO 501. Molecular & Cellular Biology. 4 units**
Term Typically Offered: F
Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Principles of molecular and cellular biology including gene function and regulation, energetics, protein trafficking, cytoskeleton, signaling, adhesion, and the cell cycle. 3 lectures, 1 laboratory.

**BIO 502. Biology of Organisms. 4 units**
Term Typically Offered: W
Prerequisite: BIO 501 and graduate standing in Biological Sciences, or consent of instructor.

Principles of and current topics in organismal biology, with an emphasis on physiology (including organ systems), behavior, and responses to the environment. 3 lectures, 1 laboratory.

**BIO 503. Population Biology. 4 units**
Term Typically Offered: SP
Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Considerations of theory and practice in population ecology, evolutionary biology, and biosystematics. 3 lectures, 1 laboratory.
**BIO 509. Communicating Biology to General Audiences. 1 unit**  
Term Typically Offered: W  
Prerequisite: Graduate standing.

Key issues for scientists communicating with the general public. Introduction to principles, examination of case studies, and practical application in outreach projects. Intended for graduate students in biology and related disciplines. 1 activity.

**BIO 524. Developmental Biology Seminar. 2 units**  
Term Typically Offered: TBD  
Prerequisite: Graduate standing in Biological Sciences or consent of instructor. Recommended: BIO 501.

Principles and selected topics in developmental biology. Issues of differentiation, morphogenesis, and pattern formation; specific topics chosen by participants. 2 seminars.

**BIO 534. Principles of Stem Cell Biology. 2 units**  
Term Typically Offered: F  
Prerequisite: Graduate standing in Biological Sciences, Biomedical Engineering, or Agriculture, or consent of instructor. Recommended: BIO 452 or BIO 501.

Principles of stem cell biology including characteristics, types, roles in development, therapeutic uses, historical perspectives and ethical issues. 2 seminars.

**BIO 537. Advanced Behavioral Ecology. 1 unit**  
Term Typically Offered: TBD  
Prerequisite: BIO 442, or graduate standing.

Function and evolution of behavioral traits as they relate to ecological phenomena. Habitat selection, migration, spacing mechanisms, reproductive strategies, feeding strategies, agonistic, parasitic, altruistic behavior, communication, and comparative social systems. 1 activity.

**BIO 561. Proposal Writing for Biological Research. 3 units**  
Term Typically Offered: W  
Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Written and oral presentations of a proposal for research in biology including a literature review. 3 seminars.

**BIO 570. Selected Topics in Biology. 1-4 units**  
Term Typically Offered: TBD  
Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Directed group study of selected topics for graduate students. Class Schedule will list topics for selection. Total credit limited to 12 units. 1 to 4 seminars.

**BIO 571. Selected Advanced Laboratory. 1-4 units**  
Term Typically Offered: TBD  
Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**BIO 574. Teaching Strategies for College Biology Laboratories. 1 unit**  
CR/NC  
Term Typically Offered: F  
Prerequisite: Graduate standing in Biological Sciences.

Concepts of teaching and learning related to instructor performance in college biology laboratory classes. Introduction to teaching strategies, managing a classroom, writing exam questions, and science education research for the laboratory class setting. Credit/No Credit grading only. 1 activity.

**BIO 575. College Biology Teaching Practicum. 1-2 units**  
CR/NC  
Term Typically Offered: F, W, SP  
Prerequisite: Graduate standing and evidence of satisfactory preparation in biology; Department chair and graduate coordinator's approval required.

Part-time teaching assignment in an undergraduate college classroom. Includes teaching and related activities under the supervision of a professor in Biological Science. Total credit limited to 2 units. Credit/No Credit grading only. 1-2 activities.

**BIO 585. Cooperative Education Experience. 6 units**  
CR/NC  
Term Typically Offered: F, W, SP, SU  
Prerequisite: Graduate standing in Biological Sciences.

Advanced study, analysis and part-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 6 units. Credit/No Credit grading only.

**BIO 590. Seminar in Biology. 1 unit**  
Term Typically Offered: F, W, SP  
Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Problems and topics in advanced biology selected according to the interest and needs of the students enrolled. Total credit limited to 6 units. 1 activity.

**BIO 591. Trends in Biology. 1 unit**  
Term Typically Offered: F, W, SP  
Prerequisite: Graduate standing in Biological Sciences.

Recent trends in the field of biology for graduate students in the Biological Sciences master's degree program. Overview of current research with presentations from visiting scholars and Cal Poly faculty. Total credit limited to 3 units. 1 activity.
BIO 593. Regenerative Medicine Internship. 3-5 units
Term Typically Offered: TBD
Prerequisite: Graduate standing in the Specialization in Regenerative Medicine for the MS in Biological Sciences, or the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture.

Supervised graduate research and/or development in stem cell science or regenerative medicine and engineering. Provides students with an off-campus industrial or university internship. Total credit limited to 10 units. Crosslisted as ASCI/BIO/BMED 593.

BIO 594. Applications in Regenerative Medicine. 2 units
Term Typically Offered: TBD
Prerequisite: Graduate standing in the Specialization in Regenerative Medicine for the MS in Biological Sciences, or the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture.

Transfer of skills and knowledge gained through coursework, in an applied setting at Cal Poly. Demonstration of technical, problem solving, and presentation skills, and familiarity with current research. Part of the culminating experience for the Specialization in Regenerative Medicine in the MS in Biological Sciences, or the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 594.

BIO 595. Cooperative Education Experience. 12 units
CR/NC
Term Typically Offered: F,W,SP,SU
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study, analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 12 units. Credit/No Credit grading only.

BIO 599. Thesis. 1-3 units
Term Typically Offered: F,W,SP,SU
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Individual research under the general supervision of the faculty, leading to a graduate thesis of suitable quality. Total credit limited to 9 units.