

BIOLOGY (BIO)

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BIO Courses

BIO 111. General Biology. 4 units

Term Typically Offered: F,W,SP,SPSU

2020-21 or later catalog: GE Area B2

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B2

2019-20 or earlier catalog: GE Area B4

Overview of fundamental concepts in biology and of scientific inquiry.

Principles of cellular life and energetics, inheritance and genetic mechanisms, evolution and ecology. Emphasis on the relationship between biology and human affairs. Not open for major credit in Biological Sciences, Microbiology or Marine Sciences. Not open to students who have completed BIO 161. Course offered in hybrid format with classroom-based and online learning. 3 lectures, 1 laboratory. Fulfills GE Areas B2 and B3 (GE Areas B2 and B4 for students on the 2019-20 or earlier catalogs).

BIO 114. Plant Diversity and Ecology. 4 units

Term Typically Offered: W, SP

2020-21 or later catalog: GE Area B2

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B2

2019-20 or earlier catalog: GE Area B4

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 Indigenous People, and human impacts on native plant communities. Field trip required. 2 lectures, 2 laboratories. Fulfills GE Areas B2 and B3 (GE Areas B2 and B4 for students on the 2019-20 or earlier catalogs).

BIO 123. Biology of Sex. 4 units

Term Typically Offered: W

2020-21 or later catalog: GE Area B2

2019-20 or earlier catalog: GE Area B2

Fundamental principles of biology related to sexual reproduction: genetics, physiology, behavior, ecology and evolution of sex in a broad range of organisms. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE Area B2.

BIO 150. Diversity and History of Life. 4 units

Term Typically Offered: F, W

2020-21 or later catalog: GE Area B2

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B2

2019-20 or earlier catalog: GE Area B4

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. Fulfills GE Areas B2 and B3 (GE Areas B2 and B4 for students on the 2019-20 or earlier catalogs).

BIO 161. Introduction to Cell and Molecular Biology. 4 units

Term Typically Offered: F,W,SP,SPSU

2020-21 or later catalog: GE Area B2

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B2

2019-20 or earlier catalog: GE Area B4

Recommended: CHEM 110 or CHEM 124 or CHEM 127.

Fundamentals of cellular biology with an emphasis on the molecular perspective of life: biomolecules, cellular energetics, cell structure and reproduction, molecular mechanisms of genetics and gene expression. 3 lectures, 1 laboratory. Fulfills GE Areas B2 and B3 (GE Areas B2 and B4 for students on the 2019-20 or earlier catalogs).

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

Term Typically Offered: F,W,SP,SPSU

CR/NC

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: SP

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

Term Typically Offered: F, W, SP

2020-21 or later catalog: GE Area B2

2019-20 or earlier catalog: GE Area B2

Corequisite: BMED/BRAE 213. Recommended: CHEM 124.

Fundamentals of life sciences: energetics, cell biology, genetics, microbiology, organismal biology, and ecology. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. 2 lectures. Fulfills GE B2.

BIO 222. Biodiversity of California. 4 units

Term Typically Offered: F, W, SP
 2020-21 or later catalog: GE Area B2
 2019-20 or earlier catalog: GE Area B2
 Recommended: Completion of GE Area A.

Foundations and importance of California's biological diversity from historical and modern contexts. Overview of California's diverse habitats, wildlife and their adaptations. Current challenges to preserving California's biodiversity. Concepts in quantification, conservation and appreciation for California's biodiversity. 4 lectures. Fulfills GE Area B2.

BIO 227. Wildlife Conservation Biology. 4 units

Term Typically Offered: F, W, SP
 2020-21 or later catalog: GE Area B2
 2019-20 or earlier catalog: GE Area B2
 Sustainability Focused
 Recommended: Completion of GE Area A2.

Wildlife biology and philosophies of conservation. Basic principles of ecology and evolution. Practices applied to wildlife management. Current problems involving people-wildlife interactions with special reference to world biodiversity. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Not open to students with credit in BIO 363. 4 lectures. Fulfills GE Area B2.

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 intended for Biological Sciences majors. May be taken after BIO 232. 4 lectures, 1 laboratory.

BIO 232. Human Anatomy and Physiology II. 5 units

Term Typically Offered: F,W,SPSU
 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 intended for Biological Sciences majors. May be taken before BIO 231. 4 lectures, 1 laboratory.

BIO 253. Health Professions Shadowing. 1 unit

Term Typically Offered: F
 CR/NC
 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 150 or 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 Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

BIO 300. Research Experience for Undergraduates. 1-2 units

Term Typically Offered: F,W,SPSU
 CR/NC
 Prerequisite: Consent of instructor. Recommended: STAT 218.

Laboratory, field, or biology education research experience. Development of research skills and techniques. Interested students consult with a faculty member prior to enrolling to clarify expectations and deliverables. Total major credit limited to 6 units, with a maximum of 2 units per quarter. Total credit limited to 12 units. Credit/No Credit grading only.

BIO 301. Service Learning in the Health Professions. 3 units

Term Typically Offered: W
 Prerequisite: BIO 161 or MCRO 221 or MCRO 224; completion of GE Area A with a grade of C- or better; one course in GE Area D2 (or in GE Area D3 for students on the 2019-20 or earlier catalogs); and consent of instructor.

Framework for understanding the implications of service in different health-related settings through discussion and participation in a local service project. Social determinants of health, cultural competency and unconscious bias, identity/intersectionality, and health needs of different populations. 2 lectures, 1 laboratory.

BIO 302. Human Genetics. 4 units

Term Typically Offered: F, W, SP
 2020-21 or later: Upper-Div GE Area B
 2019-20 or earlier catalog: GE Area B5, B6, or B7
 Prerequisite: Junior standing; completion of GE Area A with grades of C- or better; one course in GE Area B4 with a grade of C- or better (GE Area B1 for students on the 2019-20 or earlier catalogs); and one of the following courses: ASCI 112, BIO 111, BIO 123, BIO 161, BIO 213, or BOT 121. Recommended: STAT 217, STAT 218, STAT 251, STAT 305, STAT 312, STAT 321, or STAT 350.

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 Area Upper-Division B (GE Areas B5, B6, or B7 for students on the 2019-20 catalog).

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 to Biological Sciences, Microbiology, or Marine Sciences majors. 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

Term Typically Offered: F

2020-21 or later: Upper-Div GE Area B

2019-20 or earlier catalog: GE Area B5, B6, or B7

Prerequisite: Junior standing; completion of GE Area A with grades of C- or better; one BIO or MCRO course in GE Area B2; completion of GE Area B4 with a grade of C- or better (GE Area B1 for students on the 2019-20 or earlier catalogs).

Introduction to the causes, characteristics and treatment of human cancer. 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 Area Upper-Division B (GE Areas B5, B6, or B7 for students on the 2019-20 catalog).

BIO 308. Genetic Engineering Technology. 4 units

Term Typically Offered: W

2020-21 or later: Upper-Div GE Area B

2019-20 or earlier catalog: GE Area B5, B6, or B7

Prerequisite: Junior standing; completion of GE Area A with grades of C- or better; and completion of GE Areas B1 through B4, with a grade of C- or better in one course in GE Area B4 (GE Area B1 for students on the 2019-20 or earlier catalogs); and one of the following courses: CHEM 110, CHEM 124, or CHEM 127.

Introduction to the biology, methodology, and techniques used in genetic engineering. Potential benefits and problems in application within agriculture, nutrition, medicine and environmental context, 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/CHEM 308. Fulfills GE Area Upper-Division B (GE Areas B5, B6, or B7 for students on the 2019-20 catalog).

BIO 321. Mammalogy. 4 units

Term Typically Offered: F

Prerequisite: one of the following: BIO 162, BIO 263, NR 306 or ASCI 239.

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

BIO 322. Ichthyology. 4 units

Term Typically Offered: SP

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. Field trip required. 3 lectures, 1 laboratory.

BIO 323. Ornithology. 4 units

Term Typically Offered: SP

Prerequisite: BIO 162 or BIO 263 or BIO 427 or ASCI 239.

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.

BIO 324. Herpetology. 4 units

Term Typically Offered: SP

Prerequisite: BIO 150 or BIO 160 and BIO 162.

Living and extinct reptiles and amphibians; an adaptive approach to their diversity, biology, and classification. 2 lectures, 2 laboratories.

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: TBD

Prerequisite: Junior standing; BIO 162 or BIO 263 or BIO 427 or ASCI 239.

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.

BIO 330. Extended Field Biology Activity. 1-3 units

Term Typically Offered: TBD

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 Class Schedule will list the topic 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 to 3 activities.

BIO 335. General Entomology. 4 units

Term Typically Offered: TBD

Prerequisite: BIO 150, BIO 160, BIO 211, or PLSC 313. 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.

BIO 336. Invertebrate Zoology. 4 units

Term Typically Offered: W

Prerequisite: BIO 150 or BIO 160 and BIO 162.

Invertebrate groups of animals with emphasis on taxonomy, morphology, distribution, and economic importance. 2 lectures, 2 laboratories, and fieldwork.

BIO 351. Principles of Genetics. 5 units

Term Typically Offered: F, W, SP

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 including humans. Membrane transport, fluid/salt balance, excitable cells, metabolic rate, temperature, gas exchange and circulation. 3 lectures, 1 laboratory.

BIO 363. Principles of Conservation Biology. 4 units

Term Typically Offered: F, W, SP

Sustainability Focused

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. Formerly BIO 401.

BIO 400. Special Problems for Advanced Undergraduates. 1-2 units

Term Typically Offered: F,W,SP,SU

Prerequisite: Consent of instructor. Recommended: STAT 218.

Investigation, research, studies, or surveys of biological problems by students working with faculty. Interested students should consult with a faculty member prior to enrolling to clarify expectations and deliverables. Total major credit limited to 6 units, with a maximum of 2 units per quarter. Total credit limited to 12 units.

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

Prerequisite: BIO 361; CHEM 331 or STAT 218; PHYS 123 or PHYS 133 or PHYS 143; or graduate standing in Biological Sciences.

Anatomy and physiology of nervous systems, including electrophysiology, molecular and cellular mechanisms of neurotransmission, and interactions between the nervous system and other body systems, including integumentary and digestive, with an emphasis on humans and other vertebrates. Includes human cadaver study. 3 lectures, 1 laboratory.

BIO 407. Advanced Anatomy and Physiology: Endocrinology. 4 units

Term Typically Offered: F, SP, SU

Prerequisite: BIO 361; CHEM 331 or STAT 218; or graduate standing in Biological Sciences.

Anatomy and physiology of the endocrine system and hormones, and interactions with body systems including digestive and reproductive systems, with an emphasis on humans and other vertebrates. Course may be offered in classroom-based or online format. 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. Includes human cadaver study. 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. Includes human cadaver study. 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 411. Advanced Human Gross Anatomy. 2 units

Term Typically Offered: SU

Prerequisite: One of the following courses with a grade of C- or better: BIO 231, BIO 232, or BIO 361; and consent of instructor.

Human gross anatomy using human cadaver dissection from a regional perspective. Dissection of the musculo-skeletal and nervous tissues, vasculature, and viscera of body regions including: head, neck, torso, extremities, and body cavities. 2 laboratories.

BIO 412. Gastrointestinal Physiology and Microbiology. 4 units

Term Typically Offered: SP

Prerequisite: BIO 231 or BIO 361; and MCRO 221 or MCRO 224.

Anatomy and physiology of the digestive system in humans and other vertebrates. Emphasis on structure and function of the gastrointestinal tract and interactions with the immune system and the microbiome. 4 lectures.

BIO 413. Evolutionary Medicine. 4 units

Term Typically Offered: TBD

Prerequisite: BIO 263; and BIO 303 or BIO 351. Recommended: MCRO 224.

Principles and mechanisms of biological evolution in the context of human health. Microevolutionary and macroevolutionary processes, adaptation, phenotypic plasticity, biogeographic patterns of allele frequencies, tradeoffs. Focus on human health including host-pathogen coevolution, cancer, mental health, obesity, drug metabolism, evolutionary history. 4 lectures. Not open to students with credit in BIO 414.

BIO 414. Evolution. 4 units

Term Typically Offered: F,W,SP,SS

Prerequisite: BIO 263; and BIO 303 or BIO 351. Recommended: BIO 327, BOT 326, or MSCI 300.

Principles, theories and mechanisms of biological evolution of plants, animals and microorganisms. Core principles include microevolutionary and macroevolutionary processes, adaptation, phenotypic plasticity, biogeographic patterns of allele frequencies, tradeoffs. Not open to students with credit in BIO 413. 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 terrestrial and aquatic systems in relation to past and present physical and biotic factors. Methods to determine local and global distribution patterns of biota. Role of humans in past, present and future distributions of organisms. 4 lectures.

BIO 416. Climate Change Biology. 4 units

Term Typically Offered: SP

Prerequisite: BIO 150 or BIO 160; BIO 162; and BIO 263.

Biological consequences of climate change. Effects on cellular and organismal physiology and geographic distribution of organisms. Biodiversity, community and ecosystem impacts. Introduction to atmospheric chemistry, climate dynamics, and consequences for human populations. Possible biological mitigation strategies to reduce CO₂ emissions. Field trip required. 3 lectures, 1 laboratory.

BIO 421. Wetlands. 4 units

Term Typically Offered: TBD

Prerequisite: BOT 121 or BIO 162; CHEM 127; and SS 120 or SS 130. Recommended: one of the following: BIO 327, BOT 313, BOT 326, MSCI 300, NR 304, NR 305, or NR 306.

The formation, characteristics, and functions of wetlands. Genesis of hydric soils. Plant adaptations to saturated soils. Wetlands as wildlife habitat. Policies and social issues associated with wetlands. The procedures of wetland delineations. 3 lectures, 1 laboratory. Crosslisted as BIO/NR/SS 421.

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

CR/NC

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, CHEM 314, CHEM 369, 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

Prerequisite: One of the following upper-division ecology courses: BIO 327, BIO 363, BIO 401, BIO 444, BOT 326, MSCI 300, 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

Prerequisite: one of the following: BIO 351, BIO 302, BIO 303, CHEM 373, or graduate standing in Biological Sciences. Recommended: BIO 361 or ZOO 332 or BMED 460; and CHEM 313, CHEM 314, CHEM 369, 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.

BIO 429. Parasitology. 4 units

Term Typically Offered: F, W

Prerequisite: BIO 150 or 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.

BIO 434. Environmental Physiology. 4 units

Term Typically Offered: F

Sustainability Focused

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: SP

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: BIO 302, BIO 303, 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: W

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: TBD

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: TBD

Prerequisite: BIO 150 or BIO 160, BIO 162, BIO 263, and STAT 218; or graduate standing in Biological Sciences. Recommended: BIO 327, BIO 363, BIO 401, BOT 326, or MSCI 300.

Principles of ecology at the community level including the mechanisms 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: SP

Sustainability Focused

Prerequisite: BIO 263, BOT 326, or NR 306; and STAT 218, or Graduate standing in Biological Sciences. Recommended: BIO 327, BIO 363, BIO 401, MSCI 300, SS 120, 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 447. Spatial Ecology. 4 units

Term Typically Offered: W

Prerequisite: BIO 263; and GEOG 218 or GEOG 318 or NR/LA 218; and STAT 218; or graduate standing in Biological Sciences. Recommended: BIO 327, BOT 326, or MSCI 300; and STAT 313 or STAT 513.

Effect of geographical space on distribution and abundance of organisms. Analysis of movement, home ranges, connectivity, range limits, and factors that shape these processes. Survey of available tools and data to answer questions in the discipline. 3 lectures, 1 lab.

BIO 448. Geoeology. 4 units

Term Typically Offered: TBD

Prerequisite: BIO 114, BIO 162, BIO 211, or BOT 121; and BIO 227, BIO 263, NR 305, NR 306, or SS 321. Recommended: GEOL 102 or SS 120.

Exploration of the role of landforms and lithology in shaping species and community diversity, and ecological and evolutionary processes. Plant-microbe-soil relations, heavy metal tolerance, conservation of rock outcrop plants and associated biota. Green technologies such as phytoremediation and agromining. Field trip required. 3 lectures, 1 laboratory.

BIO 450. Undergraduate Laboratory Assistantship. 1-4 units

Term Typically Offered: F, W, SP

CR/NC

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, SP

Prerequisite: BIO 351 or CHEM 373; and CHEM 216, CHEM 312 or CHEM 316. Recommended: CHEM 313, CHEM 314, CHEM 369, 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: Completion of GWR; STAT 218; and junior standing.

Guided course with group meetings, leading to completion of a written research proposal. Review of scientific literature and analysis of existing experimental results from published peer-reviewed articles in biology. Includes oral presentations. Course may be offered in classroom-based, online, or hybrid format. 2 activities.

BIO 462. Senior Project Research Experience. 2 units

Term Typically Offered: F,W,SP,SU

Prerequisite: Completion of GWR; STAT 218; junior standing; and consent of instructor. Recommended: BIO 400.

Completion of research, data analysis, or other substantial project as a capstone for the major. Student identifies faculty mentor before enrolling to develop project proposal and clarify deliverables. Typically a continuation of BIO 400. Written project report and/or presentation required.

BIO 463. Honors Research. 2 units

Term Typically Offered: F,W,SP,SU

Prerequisite: BIO 461 or BIO 462; and consent of instructor.

Continuation of research experience leading to completion of advanced research in the biological sciences. Topic selected and conducted in consultation with a faculty mentor. 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. The 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: W

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The 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: SP

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 Class Schedule 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 with a grade of C- or better or consent of instructor; CHEM 313 or CHEM 314 or CHEM 369 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

Term Typically Offered: F,W,SP,SU

CR/NC

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

Term Typically Offered: F,W,SP,SU

CR/NC

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: F,W,SP,SU

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: 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: F

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: SP

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. 2 units

Term Typically Offered: TBD

Prerequisite: BIO 442 or graduate standing.

Function and evolution of behavioral traits as they relate to ecological phenomena. Behaviors include habitat selection, migration, spacing mechanisms, mating strategies, foraging, aggression, parasitism, altruism, communication, and comparative social systems. Examples from the primary literature. Includes oral presentations. 2 seminars.

BIO 560. Graduate Professional Seminar. 2 units

Term Typically Offered: F

Prerequisite: Graduate standing in Biological Sciences.

Preparation for a successful career in biology within or outside of academia through skills development in professional communication and presentation, the peer-review process, mentorship, scientific ethics. 2 seminar.

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 562. Data Management and Visualization in Biology. 3 units

Term Typically Offered: TBD

Prerequisite: STAT 218 and graduate standing in Biological Sciences; or consent of instructor. Recommended: Experience with Excel and R.

Data management and visualization tools for research. Introduction to data management in menu driven applications. Extensive work with data management in code-driven applications. Advanced visualization techniques for data presentation and publication. 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. The 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 Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

BIO 574. Teaching Strategies for College Biology Laboratories. 1 unit

Term Typically Offered: F

CR/NC

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

Term Typically Offered: F, W, SP

CR/NC

Prerequisite: Graduate standing; Department Chair and Graduate Coordinator approval required.

Supervised teaching-related activities associated with undergraduate classes in the Biological Sciences Department including assessment, curriculum development, implementing novel teaching approaches. Total credit limited to 2 units. Credit/No Credit grading only.

BIO 583. Research Experience for Regenerative Medicine Students. 2 units

Term Typically Offered: SP

Prerequisite: Graduate standing in the Specialization in Regenerative Medicine for the MS in Biological Sciences; or Specialization in Regenerative Medicine for the MS in Biomedical Engineering; or the Animal Science Specialization for the MS in Agriculture.

Independent research experience in biological or biomedical research. Proposal writing and literature review; experimental design, implementation and troubleshooting; oral and poster presentations. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 583. Formerly ASCI/BIO/BMED 594.

BIO 585. Cooperative Education Experience. 6 units

Term Typically Offered: F,W,SP,SU

CR/NC

Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

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. 1-2 units

Term Typically Offered: F, W, SP

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Critical evaluation of primary literature on a specific topic in biology. Includes oral and/or written presentation of critiques. The Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 2 seminars.

BIO 591. Biology Colloquium. 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 4 units. 1 activity.

BIO 593. Regenerative Medicine Internship. 3-5 units

Term Typically Offered: F, W, SP

Prerequisite: Graduate standing in the Specialization in Regenerative Medicine for the MS in Biological Sciences; or the Specialization in Regenerative Medicine for the MS in Biomedical Engineering; or the Specialization in Animal Science for 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 595. Cooperative Education Experience. 12 units

Term Typically Offered: F,W,SP,SU

CR/NC

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.

BIO 5532. Advances in Organismal Physiology. 1-3 units

Term Typically Offered: SP

Prerequisite: Graduate standing in Biological Sciences. Recommended: One of the following: BIO 434, BIO 502, BIO 4422, or BIO 5502.

Critical evaluation of physiological mechanisms by which organisms sense, respond and adapt to changing environmental conditions including temperature, oxygen, and pH. Focus on literature-based advances at the frontier of scientific understanding. 1 to 3 seminars.