BIOLOGY (BIO)

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BIO Courses

BIO 1111 General Biology (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2020-26 catalogs: GE Area B2

Overview of fundamental concepts in biology and of scientific inquiry. Principles of cellular life and energetics, inheritance and genetic mechanisms, evolution and ecology. Relationship between biology and human affairs. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Course may be offered in classroom-based, online, or hybrid format. 3 lectures. Fulfills GE Area 5B (GE Area B2 for students on the 2020-26 catalogs).

BIO 1112 Biology Laboratory for Non-Majors (1 unit)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B3
Corequisite: One of the following: BIO 123, BIO 222, BIO 227, BIO 1111, BIO 1113, BIO 2215, BIO 2217, MSCI 111, or MSCI 1111.

Laboratory investigation of fundamental concepts in biology and scientific inquiry. Principles of life (cells, reproduction, diversity, and energetics), inheritance and genetic mechanisms, evolution and ecology. Emphasis on local ecosystems and the relationship between biology and human affairs. Not open for major credit in Biological Sciences, Marine Sciences, or Microbiology. 1 laboratory. Fulfills GE Area 5C (GE Area B3 for students on the 2020-26 catalogs).

BIO 1113 Biology of Sex (3 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5B
2020-26 catalogs: 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, Marine Sciences, or Microbiology. Course may be offered in classroom-based or online format. 3 lectures. Fulfills GE Area 5B (GE Area B2 for students on the 2020-26 catalogs). Formerly BIO 123.

BIO 1114 Plant Diversity and Ecology (4 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B2
2020-26 catalogs: GE Area B3

Plant diversity and ecology in 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. 3 lectures, 1 laboratory. Fulfills GE Areas 5B and 5C (GE Areas B2 and B3 for students on the 2020-26 catalogs). Formerly BIO 114.

BIO 1150 Life: History and Diversity (4 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B2
2020-26 catalogs: GE Area B3

Overview of the history, diversity, and genetic relatedness of life on Earth. Broad-scale evolutionary framework for understanding the form and function of life's diversity with emphasis on plants and animals. 3 lectures, 1 laboratory. Fulfills GE Areas 5B and 5C (GE Areas B2 and B3 for students on the 2020-26 catalogs). Formerly BIO 150.

BIO 1151 Life: Molecules and Cells (4 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B2
2020-26 catalogs: GE Area B3
Recommended: Concurrent enrollment in college chemistry.

Fundamentals of biology from the molecular and cellular perspective. Biomolecules, cellular energetics, cell structure and reproduction, molecular mechanisms of genetics and gene expression. Connections to animal and plant physiology. 3 lectures, 1 laboratory. Fulfills GE Areas 5B and 5C (GE Areas B2 and B3 for students on the 2020-26 catalogs). Formerly BIO 161.

BIO 2200 Special Problems for Undergraduates (1-2 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Intended for lower division students in the Biological Sciences Department. Repeatable up to 8 units. Credit/No Credit grading only. Formerly BIO 200.

BIO 2213 Life Science for Engineers (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2020-26 catalogs: GE Area B2

Fundamentals of life sciences: integrative study of biological mechanisms and their evolutionary basis at levels including energetics, cell biology, genetics, microbiology, organismal biology, and/or ecology. Emphasis on scientific method and contrasts between engineered and natural systems. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Course may be offered in classroom-based, online, or hybrid format. 3 lectures. Fulfills GE Area 5B (GE Area B2 for students on the 2020-26 catalogs). Formerly satisfied the GE B2 requirement as BMED/BIO 213.

BIO 2215 Biodiversity of California (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2020-26 catalogs: GE Area B2
Recommended: Completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs).

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. 3 lectures. Fulfills GE Area 5B (GE Area B2 for students on the 2020-26 catalogs). Formerly BIO 222.

BIO 2217 Wildlife Conservation Biology (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5B
2020-26 catalogs: GE Area B2
Sustainability Focused
Recommended: Completion of GE Area 1A with a grade of C- or better (GE Area A2 for the 2020-26 catalogs).

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, Marine Sciences, or Microbiology. Not open to students with credit in BIO 263, BIO 363, BIO 2253, or BIO 3343. 3 lectures. Fulfills GE Area 5B (GE Area B2 for students on the 2020-26 catalogs). Formerly BIO 227.

BIO 2231 Human Anatomy and Physiology I (4 units)
Term Typically Offered: F, SP, SU
Prerequisite: One of the following: BIO 111, BIO 161, BIO 1111, or BIO 1151; and one of the following: CHEM 110, CHEM 124, CHEM 125, CHEM 1110, CHEM 1120, CHEM 1122, PSC 101, or PSC 1101.

Structure and function of the skeletal, muscular, nervous, endocrine, and integumentary systems. Molecular, cellular, and organ system levels of organization. Laboratory includes study of prosected human cadavers. Not open for major credit in Biological Sciences. Not open to students with credit in BIO 4431. May be taken after BIO 232 or BIO 2232. 3 lectures, 1 laboratory. Formerly BIO 231.

BIO 2232 Human Anatomy and Physiology II (4 units)
Term Typically Offered: F, SP, SU
Prerequisite: One of the following: BIO 111, BIO 161, BIO 1111, or BIO 1151; and one of the following: CHEM 110, CHEM 124, CHEM 125, CHEM 1110, CHEM 1120, CHEM 1122,PSC 101, or PSC 1101.

Structure and function of the circulatory, immune, respiratory, digestive, urinary, and reproductive systems. Molecular, cellular, and organ system levels of organization. Laboratory includes study of prosected human cadavers. Not open for major credit in Biological Sciences. Not open to students with credit in BIO 4432. May be taken before BIO 232 or BIO 2231. 3 lectures, 1 laboratory. Formerly BIO 232.

BIO 2252 Orientation to Biotechnology (2 units)
Term Typically Offered: TBD
Prerequisite: Completion of one course with a BIO, BOT, or MCRO prefix; and completion of one course with a CHEM prefix.

Introduction to the diversity of fields in biotechnology. Applications of biotechnology methods to agricultural, pharmaceutical, nutritional, medicinal, and environmental problems and systems. Course may be offered in classroom-based or hybrid format. 2 lectures. Crosslisted as BIO/CHEM 2252. Formerly BIO/CHEM 202.

BIO 2253 Principles of Ecology and Evolution (4 units)
Term Typically Offered: F, SP
Prerequisite: BIO 150 or BIO 1150; and BIO 161 or BIO 1151.

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. Formerly BIO 263.

BIO 2255 Molecular and Cellular Biology Lab Skills (1 unit)
Term Typically Offered: F
Prerequisite: BIO 161 or BIO 1151.

Laboratory skills for Biological Sciences majors concentrating in molecular and cellular biology. Introduction to techniques used in this discipline, including aseptic technique, basic molecular biology, microscopy, and cell propagation, manipulation, and analysis. 1 laboratory.

BIO 2270 Special Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly BIO 270.

BIO 3210 Biology of Plants and Animals for Future Teachers (4 units)
Term Typically Offered: SP
Prerequisite: Completion of GE Area 5 (GE Areas B1 to B3 for the 2020-26 catalogs); PSC 103 or PSC 1102; and Liberal Studies major. Recommended: STAT 130, STAT 217, STAT 1000, or STAT 1110.

Life science for future teachers. Cell biology, ecology, and evolution including, structure, function, and diversity of plants and animals. Living and nonliving components in environments and energy transfer. Life cycles, reproduction, adaptation, and evolution. Hands-on activities and model organisms for elementary classrooms. Field trip may be required. Not open for major credit in Biological Sciences, Microbiology, or Marine Sciences. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Replaced BIO 211.

BIO 3300 Research Experience for Undergraduates (1-2 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Consent of instructor. Recommended: STAT 218 or STAT 1110.

Laboratory, field, theoretical, 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. Repeatable up to 8 units. Credit/No Credit grading only. Formerly BIO 300.

BIO 3312 Human Genetics (3 units)
Term Typically Offered: F, SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); and one of the following courses: ASCI 112, ASCI 1112, BIO 111, BIO 123, BIO 161, BIO 213, BIO 1111, BIO 1113, BIO 1151, BIO 2213, BOT 121, or BOT 1121. Recommended: STAT 217, STAT 218, STAT 251, STAT 305, STAT 312, STAT 321, STAT 350, STAT 1110, STAT 1210, STAT 2610, STAT 3210, or STAT 3310.

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, Marine Sciences, or Microbiology. Not open to students with credit in BIO 303, BIO 351, BIO 3351, or MCRO 3351. Course may be offered in classroom-based, online, or hybrid format. 3 lectures. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly BIO 302.

BIO 3315 Biology of Cancer (3 units)
Term Typically Offered: F
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); and one of the following: BIO 111, BIO 161, BIO 1111, or BIO 1151.

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 Biochemistry, Biological Sciences, Marine Sciences, or Microbiology. Course may be offered in classroom-based or hybrid format. 3 lectures. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly BIO 305.

BIO 3318 Genetic Engineering Technology (3 units)
Term Typically Offered: F
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); completion of GE Area 5 (GE Areas B1 to B3 for the 2020-26 catalogs); and one of the following courses: CHEM 110, CHEM 124, CHEM 127, CHEM 1110, CHEM 1112, CHEM 1120, or CHEM 1122.

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 CHEM 3356, or to Biological Sciences major or Microbiology major. 3 lectures. Crosslisted as BIO/CHEM 3318. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly BIO/CHEM 308.

BIO 3321 Mammalogy (4 units)
Term Typically Offered: F
Prerequisite: One of the following: ASCI 229, ASCI 2229, BIO 162, BIO 263, BIO 361, BIO 2253, BIO 3352, NR 306, or NR 3306.

Evolution, physiology, ecology, and functional morphology of mammals. Taxonomic classification and identification of mammals, with emphasis on California species. Field trip required. Course may be offered in classroom-based or hybrid format. 2 lectures, 2 laboratories. Formerly BIO 321.

BIO 3322 Ichthyology (4 units)
Term Typically Offered: SP
Prerequisite: BIO 150 or BIO 1150; and BIO 161 or BIO 1151.

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. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Formerly BIO 322.

BIO 3323 Ornithology (4 units)
Term Typically Offered: SP
Prerequisite: One of the following: BIO 150, BIO 162, BIO 222, BIO 227, BIO 263, BIO 1150, BIO 2215, BIO 2217, BIO 2253, NR 306, or NR 3306.

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. Field trip required. 2 lectures, 2 laboratories. Formerly BIO 323.

BIO 3324 Herpetology (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: BIO 150, BIO 162, or BIO 1150.

Living and extinct reptiles and amphibians; an adaptive approach to their diversity, biology, and classification. Field trip required. 2 lectures, 1 laboratory. Formerly BIO 324.

BIO 3325 General Entomology (4 units)
Term Typically Offered: F
Prerequisite: One of the following: BIO 150, BIO 211, BIO 1150, BIO 3210, PLSC 313, or PLSC 3313.

Introduction to the study of insects. Structure, major orders and families of insects, life histories, medical, and economic importance. Insect collection required. Field trip required. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Formerly BIO 335.

BIO 3326 Invertebrate Zoology (4 units)
Term Typically Offered: F
Prerequisite: BIO 150 or BIO 1150; and BIO 161 or BIO 1151.

Invertebrate groups of animals with emphasis on taxonomy, morphology, distribution, and economic importance. Field trip required. 3 lectures, 1 laboratory. Formerly BIO 336.

BIO 3327 Wildlife Ecology (3 units)
Term Typically Offered: F
Prerequisite: One of the following: BIO 263, BIO 2253, NR 304, NR 305, NR 306, NR 3304, NR 3305, or NR 3306. Recommended: STAT 217, STAT 218, or STAT 1110.

Principles of ecology as applied to the study of wild vertebrates and their habitats; diet and nutrition, home range and habitat use, dispersal, community interactions, macroecology, population estimation, and modeling. Emphasis on relationship between theory and practice. 2 lectures, 1 laboratory. Formerly BIO 327.

BIO 3331 Service Learning in the Health Professions (3 units)
Term Typically Offered: TBD
Prerequisite: Completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 4B (GE Area D2 for the 2020-26 catalogs); one of the following: BIO 161, BIO 1151, MCRO 221, MCRO 224, MCRO 2221, or MCRO 2224; 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 and structural humility, unconscious bias, identity/intersectionality, and health needs of vulnerable populations. 2 lectures, 1 laboratory. Formerly BIO 301.

BIO 3333 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, BIO 361, BIO 2231, BIO 2232, or BIO 3352; 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 activities. Formerly BIO 411.

BIO 3338 Plant Physiology (4 units)
Term Typically Offered: TBD
Prerequisite: BIO 150 and BIO 161, or BIO 1150 and BIO 1151, or BOT 121 or BOT 1121; and CHEM 124 or CHEM 1120. Recommended: STAT 218 or STAT 1110.

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. Formerly BIO 435.

BIO 3343 Principles of Conservation Biology (3 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: BIO 263, BIO 2253, NR 304, NR 305, NR 306, NR 3304, NR 3305, or NR 3306.

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. 3 lectures. Formerly BIO 363.

BIO 3351 Principles of Genetics (3 units)
Term Typically Offered: F, SP
Prerequisite: BIO 161 or BIO 1151; CHEM 124 or CHEM 1120; and CHEM 125 or CHEM 1122. Recommended: One of the following: CHEM 312, CHEM 2240, CHEM 216, or CHEM 2242; and one of the following: STAT 217, STAT 218, or STAT 1110.

Principles of genetics and genetic analysis, including underlying molecular mechanisms. Gene structure and function, inheritance patterns, regulation of gene expression, mutation, recombination, recombinant DNA technology, and an introduction to population genetics. Not open to students with credit in MCRO 3351. Course may be offered in classroom-based or online format. 3 lectures. Formerly BIO 351.

BIO 3352 Principles of Animal Physiology (4 units)
Term Typically Offered: F, SP
Prerequisite: BIO 161 or BIO 1151; CHEM 124 or CHEM 1120; and CHEM 125 or CHEM 1122. Recommended: One of the following: CHEM 216, CHEM 312, CHEM 2240, or CHEM 2242; and STAT 218 or STAT 1110.

Fundamental principles of animal physiology, including cellular mechanisms and integration to whole animals, membrane transport, fluid/salt balance, excitable cells, chemical signaling, metabolic rate, temperature, gas exchange, circulation, digestion, and immune function. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Formerly BIO 361.

BIO 3360 Cellular Immunotherapy (3 units)
Term Typically Offered: F
Prerequisite: BIO 161 or BIO 1151; and one of the following: BMED 420, BMED 2420, MCRO 224, MCRO 2224, CHEM 312, or CHEM 2240.

Current cell and gene therapies that affect immune function. Fundamental aspects of immune responses and immune tolerance in cancer. Biological principles blended with medical advances, following evolution of cell therapy from hematopoietic stem cell transplantation to latest treatments. 2 lectures, 1 laboratory. Crosslisted as BIO/BMED 3360.

BIO 3362 Regenerative Medicine Therapies (3 units)
Term Typically Offered: TBD
Prerequisite: BMED/BIO 3360.

Emerging use of cell and gene therapy and tissue engineering to treat degenerative diseases and chronic injuries. Metabolic diseases, cardiovascular disease, neurodegenerative disease, musculoskeletal diseases and injuries. 2 lectures, 1 laboratory. Crosslisted as BIO/BMED 3362.

BIO 4400 Special Problems for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP, SU
Prerequisite: Consent of instructor. Recommended: STAT 218 or STAT 1110.

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. Repeatable up to 8 units. Formerly BIO 400.

BIO 4413 Evolutionary Medicine (4 units)
Term Typically Offered: SP
Prerequisite: BIO 263 or BIO 2253; and one of the following: BIO 302, BIO 351, BIO 3312, BIO 3351, CHEM 373, CHEM 3356, or MCRO 3351. Recommended: MCRO 224 or MCRO 2224.

Principles of microevolutionary and macroevolutionary processes in the context of human health. Adaptation, phenotypic plasticity, tradeoffs, host-microbe coevolution, cancer, mental health, obesity, and drug metabolism. Not open to students with credit in BIO 414 or BIO 4414. 4 lectures. Formerly BIO 413.

BIO 4414 Evolution (4 units)
Term Typically Offered: F, SP
Prerequisite: BIO 263 or BIO 2253; and one of the following: BIO 302, BIO 351, BIO 3312, BIO 3351, or MCRO 3351.

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, and tradeoffs. Not open to students with credit in BIO 413 or BIO 4413. 4 lectures. Formerly BIO 414.

BIO 4422 Environmental Physiology (4 units)
Term Typically Offered: TBD
Prerequisite: BIO 150 or BIO 1150; BIO 161 or BIO 1151; BIO 361 or BIO 3352; CHEM 124 or CHEM 1120; and CHEM 125 or CHEM 1122; or graduate standing in Biological Sciences.

Effect of environmental change on physiology, morphology, and behavior in animals over multiple time scales. Emphasis will be placed on physiological responses and evolutionary adaptations to changes in temperature, water and ion balance, oxygen levels, and pH. Field trip required. 3 lectures, 1 laboratory. Formerly BIO 434.

BIO 4424 Teaching Science in Secondary Schools (4 units)
Term Typically Offered: F
Prerequisite: Admission into Cal Poly's Single-Subject Credential Program or Liberal Studies Science concentration.

Research-based methods of teaching life and physical sciences in secondary schools, with an emphasis on planning instruction and designing learning experiences for all students using inclusive instructional strategies. 4 lectures. Crosslisted as BIO/PSC 4424. Formerly BIO/PSC 424.

BIO 4425 Science Teaching Clinical Experience Seminar (2 units)
Term Typically Offered: SP
CR/NC
Prerequisite: Admission into Cal Poly's Single Subject Credential Program in Science. Corequisite: EDUC 469 or EDUC 4469.

Principles and practices in effective teaching of science at the middle and high school level, learning theories, curriculum structure, classroom issues, and the teaching profession. 2 seminars. Credit/No Credit grading only. Crosslisted as BIO/PSC 4425. Formerly BIO/PSC 425.

BIO 4427 Wildlife Management (4 units)
Term Typically Offered: TBD
Prerequisite: One of the following: ASCI 239, ASCI 2239, BIO 263, BIO 2253, MSCI 300, MSCI 3300, NR 304, NR 305, NR 306, NR 3304, NR 3305, or NR 3306; or graduate standing in Biological Sciences.

Principles and applications of manipulating the distribution and abundance of wild species, especially terrestrial vertebrate species and their habitats. Application of ecological theory to managing endangered, game, and over-abundant species. Emphasis on the role and limitation of science in wildlife management. Field trip required. 3 lectures, 1 laboratory. Formerly BIO 427.

BIO 4429 Parasitology (4 units)
Term Typically Offered: TBD
Prerequisite: BIO 150 and BIO 161 or BIO 1150 and 1151; or BIO 161 or BIO 1151 and MCRO 221 or MCRO 2221; or MCRO 224 or MCRO 2224; or graduate standing in Animal Sciences or Biological Sciences.

Biology, morphology, and life histories of external and internal parasites of humans and other animals. Parasite-host relationships, pathogenesis, disease epidemiology, and impact of parasites on global public health. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Formerly BIO 429.

BIO 4431 Advanced Anatomy and Physiology I (4 units)
Term Typically Offered: F, SP
Prerequisite: BIO 361 or BIO 3352.

Advanced studies of the structure and function of the integumentary, endocrine, nervous, and musculoskeletal systems in humans and other vertebrates. Lab includes study of prosected human cadavers. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory.

BIO 4432 Advanced Anatomy and Physiology II (4 units)
Term Typically Offered: F, SP
Prerequisite: BIO 361 or BIO 3352.

Advanced studies of the structure and function of the cardiovascular, respiratory, renal, digestive, reproductive, and immune systems in humans and other vertebrates. Lab includes study of prosected human cadavers. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory.

BIO 4433 Neuroscience (3 units)
Term Typically Offered: F
Prerequisite: BIO 361 or BIO 3352; or graduate standing in Biological Sciences.

Advanced studies of the nervous system, including electrophysiology, molecular and cellular mechanisms of neurotransmission, sensory systems and motor control, complex brain functions, and disease states. Course may be offered in classroom-based or online format. 3 lectures. Formerly BIO 406.

BIO 4434 Endocrinology (3 units)
Term Typically Offered: F, SU
Prerequisite: BIO 361 or BIO 3352; 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. 3 lectures. Formerly BIO 407.

BIO 4436 Functional Histology (4 units)
Term Typically Offered: TBD
Prerequisite: One of the following: ASCI 229, ASCI 2229, BIO 231, BIO 232, BIO 361, BIO 2231, BIO 2232, or BIO 3352; or graduate standing in Animal Science, Biological Sciences, or Biomedical Engineering.

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. 3 lectures, 1 laboratory. Formerly BIO 410.

BIO 4437 Gastrointestinal Physiology and Microbiology (3 units)
Term Typically Offered: TBD
Prerequisite: One of the following: BIO 231, BIO 361, BIO 2231, BIO 3352, or BIO 4431; and one of the following: MCRO 221, MCRO 224, MCRO 2221, or MCRO 2224.

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. Course may be offered in classroom-based, online, or hybrid format. 3 lectures. Formerly BIO 412.

BIO 4442 Behavioral Ecology (4 units)
Term Typically Offered: F
Prerequisite: BIO 263 or BIO 2253; or graduate standing in Biological Sciences.

Principles of behavioral ecology including interactions of animals with each other and with the environment, and the evolution of behavioral adaptations that impact individual reproductive success. 3 lectures, 1 laboratory. Formerly BIO 442.

BIO 4443 Climate Change Biology (4 units)
Term Typically Offered: TBD
GWR
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); one of the following: BIO 263, BIO 2253, MSCI 300, or MSCI 3300; and BIO 361 or BIO 3352. Recommended: BIO 445 or BIO 4444.

Physiological responses to environmental stressors. Biological effects on organismal abundance, phenology and distribution. Consequences for biodiversity, community and ecosystems. Biogeochemical cycles. Biological adaptation and mitigation strategies. Introduction to atmospheric chemistry, past and future climates. Field trip required. 3 lectures, 1 laboratory. Fulfills GWR.

BIO 4444 Population and Community Ecology (4 units)
Term Typically Offered: TBD
Prerequisite: BIO 263 or BIO 2253; and STAT 218 or STAT 1110; or graduate standing in Biological Sciences.

Principles of population and community ecology including the mechanisms that structure populations and communities, and the quantitative methods used to study population distributions and trajectories, and community diversity and interactions. Field trip required. 3 lectures, 1 laboratory.

BIO 4446 Ecosystem Ecology (4 units)
Term Typically Offered: SP
Prerequisite: One of the following: BIO 263, BIO 2253, MSCI 300, MSCI 3300, NR 306, or NR 3306; and MATH 141 or MATH 1261; or graduate standing in Biological Sciences. Recommended: One of the following: STAT 218, STAT 251, STAT 305, STAT 312, STAT 350, STAT 1110, STAT 1210, STAT 2610, STAT 3210, or STAT 3310.

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 and inorganic nutrients. 4 lectures. Formerly BIO 446.

BIO 4447 Spatial Ecology (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: BIO 263, BIO 2253, NR 305, NR 306, NR 3305, or NR 3306; one of the following: GEOG 218, GEOG 2218, LA/NR 218, or LA/NR 2218; and STAT 218 or STAT 1110; or graduate standing in Biological Sciences. Recommended: One of the following: BIO 327, BIO 336, BIO 3326, BIO 3327, MSCI 300, or MSCI 3300; and one of the following: STAT 302, STAT 513, STAT 3520 or STAT 5120.

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. 2 lectures, 1 laboratory. Formerly BIO 447.

BIO 4448 Geoecology (4 units)
Term Typically Offered: TBD
Prerequisite: One of the following: BIO 114, BIO 435, BIO 1114, BIO 3338, BOT 121, BOT 313, BOT 1121, or BOT 3313; and one of the following: BIO 227, BIO 263, BIO 2217, BIO 2253, NR 305, NR 306, NR 3305, NR 3306, SS 321, or SS 3321. Recommended: One of the following: GEOL 201, GEOL 203, GEOL 2203, GEOL 2240, SS 120, or SS 1120.

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. Formerly BIO 448.

BIO 4449 Biogeography (3 units)
Term Typically Offered: SP
Prerequisite: BIO 263 or BIO 2253; 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. 3 lectures. Formerly BIO 415.

BIO 4450 Undergraduate Laboratory Assistantship (1-3 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Consent of instructor.

Assisting the instructor in teaching and supervising undergraduate laboratories in the Biological Sciences Department. Repeatable up to 6 units. Credit/No Credit grading only. Formerly BIO 450.

BIO 4451 Bioinformatics Applications (4 units)
Term Typically Offered: F
Prerequisite: One of the following: BIO 302, BIO 351, BIO 3312, BIO 3351, CHEM 373, CHEM 3356, or MCRO 3351; or graduate standing in Biological Sciences.

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, and ethical and societal concerns. Course may be offered in classroom-based, online, or hybrid format. 4 lectures. Crosslisted as BIO/CHEM 4451. Formerly BIO/CHEM 441.

BIO 4452 Cell Biology (3 units)
Term Typically Offered: F, SP
GWR
Prerequisite: Junior standing; and one of the following: BIO 351, BIO 3351, CHEM 373, CHEM 3356, or MCRO 3351. Recommended: One of the following: CHEM 314, CHEM 369, CHEM 3350, or CHEM 3352.

Introduction to cell structure and function, energy conversions, protein sorting, signaling, cytoskeleton, cell adhesion, and the cell cycle. Course may be offered in classroom-based or hybrid format. 2 lectures, 1 activity. Fulfills GWR.

BIO 4455 Developmental Biology (3 units)
Term Typically Offered: SP
Prerequisite: BIO 161 or BIO 1151; and one of the following: BIO 351, BIO 3351, CHEM 373, or CHEM 3356; or graduate standing in Biological Sciences.

Principles and processes of embryonic development, including fertilization, morphogenesis, cell specification and differentiation, axis determination, and organogenesis. 2 lectures, 1 laboratory. Formerly BIO 405.

BIO 4456 Immunology (4 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: BIO 351, BIO 3351, CHEM 373, CHEM 3356, or MCRO 3351; or graduate standing in Biological Sciences. Recommended: One of the following: CHEM 314, CHEM 369, CHEM 3350, or CHEM 3352.

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. Formerly BIO 426.

BIO 4457 Molecular Biology Laboratory (3 units)
Term Typically Offered: F, SP
Prerequisite: Grade of C- or better in one of the following: BIO 351, BIO 3351 or MCRO 3351, or consent of instructor; or graduate standing in Biological Sciences.

Introduction to techniques used in molecular biology and biotechnology; RNA/DNA purification and characterization, reverse transcription, polymerase chain reaction, plasmid construction, gene expression, and protein purification. Not open to students with credit in CHEM 4453. Course may be offered in classroom-based or hybrid format. 1 lecture, 2 laboratories. Formerly BIO/CHEM 475.

BIO 4458 Hematology (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: BIO 302, BIO 351, BIO 3312, BIO 3351, CHEM 373, CHEM 3356, or MCRO 3351; or graduate standing in Biological Sciences. Recommended: One of the following: BIO 232, BIO 361, BIO 2232, BIO 3352, BMED 460, or BMED 4460; and one of the following: CHEM 314, CHEM 369, CHEM 3350, or CHEM 3352.

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. 2 lectures, 1 laboratory. Formerly BIO 428.

BIO 4461 Senior Project - Research Proposal (2 units)
Term Typically Offered: F, SP, SU
GWR
Prerequisite: Senior standing; and STAT 218 or STAT 1110.

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

BIO 4462 Senior Project - Research Experience (2 units)
Term Typically Offered: F, SP, SU
Prerequisite: Senior standing; STAT 218 or STAT 1110; completion of GWR; and consent of instructor. Recommended: BIO 400 or BIO 4400.

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. Written project report and/or presentation required. Formerly BIO 462.

BIO 4463 Senior Project - Meta-analysis in Biology (2 units)
Term Typically Offered: SP
GWR
Prerequisite: Senior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); and STAT 218 or STAT 1110.

Group meta-analysis leading to scientific manuscript on the topic of the group's choice. Tools for meta-analysis in biology: study design, systematic literature review, statistical techniques, and publication bias. 1 lecture, 1 laboratory. Fulfills GWR.

BIO 4466 Honors Research (2 units)
Term Typically Offered: F, SP, SU
Prerequisite: One of the following: BIO 461, BIO 462, BIO 4461, BIO 4462, or BIO 4463; 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. Formerly BIO 463.

BIO 4470 Special Advanced Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly BIO 470.

BIO 4471 Special Advanced Laboratory (1-2 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 2 laboratories. Formerly BIO 471.

BIO 4472 Current Topics in Biological Research (1-3 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 public policy. The Class Schedule will list the topic selected. Repeatable up to 6 units. 1 to 3 seminars. Formerly BIO 472.

BIO 4485 Cooperative Education Experience (1-6 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Sophomore standing and consent of instructor.

Work experience in business, industry, government, and other areas of student career interest. Positions are paid and may require relocation and registration in course for two consecutive semesters. Formal report and evaluation by work supervisor required. Repeatable up to 12 units. Credit/No Credit grading only. Formerly BIO 485.

BIO 4495 Cooperative Education Experience (12 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Sophomore standing and consent of instructor.

Work experience in business, industry, government, and other areas of student career interest. Positions are paid and may require relocation and registration in course for two consecutive semesters. Formal report and evaluation by work supervisor required. Repeatable up to 24 units. Credit/No Credit grading only. Formerly BIO 495.

BIO 5500 Individual Study (1-4 units)
Term Typically Offered: F, SP, SU
Prerequisite: Graduate standing and consent of instructor.

Advanced independent study in biological sciences planned and completed with the approval of and under the direction of a member of the department faculty. Repeatable up to 12 units. Formerly BIO 500.

BIO 5501 Molecular and Cellular Biology (4 units)
Term Typically Offered: F
Prerequisite: Graduate standing in Biological Sciences.

Principles of molecular and cellular biology including gene function and regulation, energetics, protein trafficking, cytoskeleton, signaling, adhesion, and the cell cycle. Course may be offered in classroom-based or hybrid format. 3 lectures, 1 laboratory. Formerly BIO 501.

BIO 5502 Evolution, Ecology, and Organismal Biology (4 units)
Term Typically Offered: TBD
Prerequisite: Graduate standing in Biological Sciences.

Evolution, ecology and organismal biology, including physiological and behavioral responses to environmental change. Experimental and quantitative approaches to study populations, community structure, and interactions among species. 3 lectures, 1 laboratory. Formerly BIO 502.

BIO 5504 Research Career and Proposal Development (3 units)
Term Typically Offered: F
Prerequisite: Graduate standing in Biological Sciences.

Skills development for a career in biology, including academic and research expectations, time management, presentations, curriculum vitae, scientific ethics, and writing. Apply skills in experimental design, scientific reasoning, and literature review to produce a polished graduate thesis proposal draft. 3 seminars. Formerly BIO 560.

BIO 5505 Scientific Writing and Communication (1 unit)
Term Typically Offered: TBD
CR/NC
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Written and oral presentations of a specialized research topic in biology focused on the justification, design, and predicted findings of a research project. Credit/No Credit grading only.

BIO 5506 Data Management and Visualization in Biology (2 units)
Term Typically Offered: TBD
Prerequisite: STAT 218 or STAT 1110; or graduate standing in Biological Sciences. 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. Course may be offered in classroom-based or hybrid format. 2 seminars. Formerly BIO 562.

BIO 5509 Communicating Biology to Various Audiences (1 unit)
Term Typically Offered: F
Prerequisite: Graduate standing.

Key issues for scientists communicating with the general public and other professionals. Introduction to principles, examination of case studies, and practical application in writing, presentations, and social media. Intended for graduate students in biology and related disciplines. 1 activity. Formerly BIO 509.

BIO 5511 Advanced Cell Culture Techniques (1 unit)
Term Typically Offered: SP
Prerequisite: Specialization in Regenerative Medicine for the MS in Biological Sciences; Specialization in Regenerative Medicine for the MS in Biomedical Engineering; or the Animal Science Specialization for the MS in Agriculture.

Process development of unit operations involved in cell production. Donor-to-donor variability, manual vs automated isolations, activation and proliferation, and scale-up culture conditions. 1 laboratory. Crosslisted as BIO/BMED 5511.

BIO 5528 Principles of Stem Cell Biology (2 units)
Term Typically Offered: F
Prerequisite: Graduate standing in Agriculture, Biological Sciences, or Biomedical Engineering. Recommended: One of the following: ASCI 406, ASCI 4406, BIO 452, or BIO 4452.

Principles of stem cell biology including characteristics, types, developmental roles, therapeutic uses, historical perspectives, and introduction to ethical issues. Emphasis on primary literature and student presentations. 2 seminars. Crosslisted as ASCI/BIO 5528. Formerly BIO 534.

BIO 5531 Advanced Behavioral Ecology (2 units)
Term Typically Offered: TBD
Prerequisite: BIO 442 or BIO 4442; or graduate standing.

Evolution of behavioral traits as they relate to ecological phenomena. Behaviors include mating, foraging, aggression, parasitism, predation, altruism, communication, territoriality, social interactions, and habitat selection. Examples from the primary literature. Includes oral presentations. 2 seminars. Formerly BIO 537.

BIO 5532 Advances in Organismal Physiology (1-3 units)
Term Typically Offered: TBD
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.

BIO 5570 Special Advanced Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Directed group study of special topics for graduate students. The Class Schedule will list topic selected. Repeatable up to 12 units. 1 to 3 seminars. Formerly BIO 570.

BIO 5571 Special Advanced Laboratory (1-2 units)
Term Typically Offered: TBD
Prerequisite: Graduate standing and consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 8 units. 1 to 2 laboratories. Formerly BIO 571.

BIO 5574 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 college biology laboratory classes. Introduction to teaching strategies, managing a classroom, writing and grading assessments, and science education research for the laboratory class setting. Credit/No Credit grading only. Course may be offered in classroom-based, online, or hybrid format. 1 activity. Formerly BIO 574.

BIO 5575 College Biology Teaching Practicum (1-2 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Graduate standing; and approval of Department Chair and Graduate Coordinator.

Supervised teaching-related activities associated with undergraduate classes in the Biological Sciences Department including assessment, curriculum development, implementing novel teaching approaches. Repeatable up to 2 units. Credit/No Credit grading only. Formerly BIO 575.

BIO 5583 Research and Professional Development 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 and professional development in biological or biomedical research. Proposal writing and literature review, experimental design, implementation and troubleshooting, data visualization and analysis, oral and poster presentations, and workplace issues. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 5583. Formerly ASCI/BIO/BMED 583.

BIO 5585 Cooperative Education Experience (6 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study, analysis, and work experience in student's career field. Current innovations, practices, and problems in administration, supervision, and organization of business, industry, or government actions in biological study. Must have demonstrated ability to do independent work and research in career field. Repeatable up to 6 units. Credit/No Credit grading only. Formerly BIO 585.

BIO 5590 Seminar in Biology (1-2 units)
Term Typically Offered: F, 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 subtitle selected. Repeatable up to 12 units. 1 to 2 seminars. Formerly BIO 590.

BIO 5591 Biology Colloquium (1 unit)
Term Typically Offered: F, SP
CR/NC
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. Repeatable up to 4 units. Credit/No Credit grading only. 1 activity. Formerly BIO 591.

BIO 5595 Cooperative Education Experience (12 units)
Term Typically Offered: F, SP, SU
CR/NC
Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Extended advanced study, analysis, and work experience in student's career field. Current innovations, practices, and problems in administration, supervision, and organization of business, industry, or government action in biological study. Must have demonstrated ability to do independent work and research in career field. Repeatable up to 12 units. Credit/No Credit grading only. Formerly BIO 595.

BIO 5598 Project (1-3 units)
Term Typically Offered: F, SP, SU
Prerequisite: Graduate standing and consent of instructor.

Individual or group, research or design experience, with faculty approval and guidance, generally with additional guidance from external project sponsor. Deliverables include a report and presentation that satisfy the culminating experience for a master's degree. Repeatable up to 6 units. Crosslisted as ASCI/BIO/BMED 5598. Formerly ASCI/BIO/BMED 593.

BIO 5599 Thesis (1-3 units)
Term Typically Offered: F, 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. Repeatable up to 6 units. Formerly BIO 599.