

Department of Biology

Biological Sciences Building, Room 302

(909) 537-5305 Department of Biology website (<http://biology.csusb.edu/>)

The major in biology emphasizes the relationship between structure and function in living systems and the concept that biological processes can be studied at different levels of organization. The program provides a balanced blend of traditional and modern biology, incorporating the important generalizations of traditional biology and the more recent advances essential to the successful biologist or medical practitioner of the future.

The excellent facilities and equipment of the department are readily available to all students enrolled in biology courses. Seniors are encouraged to engage in research projects through the independent study program. Field trips are a normal and required part of a number of courses.

Many career opportunities are available to the student majoring in biology. The undergraduate program provides an excellent background for further work in medicine, dentistry, veterinary medicine and graduate programs. It can also serve for entry into a career in education, industry and governmental organizations.

Preprofessional students of medicine, dentistry or other science-based fields seeking a major in biology should consult with a departmental advisor or with the Health Professions Advising Center (<https://cns.csusb.edu/hpac/>).

The B.S. in Bioinformatics is essentially the interdisciplinary study of biology and biochemical systems using mathematics and computer science. Bioinformatics is a growing area, with many definitions and descriptions. Bioinformatics is the use of computers and statistics to make sense out of the huge mounds of data that are accumulating from high-throughput biological and chemical experiments, such as sequencing of whole genomes, DNA microarray chips, two-hybrid experiments, and tandem mass spectrometry.

There are three different approaches to bioinformatics:

Tool building. Creating new programs and methods for analyzing and organizing data.

Tool using. Using existing programs and data to answer biologically interesting questions.

Tool maintenance. Setting up databases, translating biologists' questions into ones that programs can answer, keeping the tools working and the databases up to date.

The main goal of the degree is to prepare the students for graduate studies in bioinformatics. A secondary goal is to provide the students with very relevant bioinformatics skills that will be useful for Research and Development in the growing biotechnology industries.

The degree is jointly administered by the Department of Biology, the Department of Chemistry and Biochemistry, and the School of Computer Science and Engineering. The program is housed in the School of Computer Science and Engineering.

Departmental Honors

Candidacy for departmental honors in biology is voluntary. To be eligible a student must fulfill the following requirements:

1. Achieve a minimum grade point average of 3.5 for all courses satisfying the requirements for the major (as defined above);
2. Take at least five courses in the major at this university;
3. Satisfactorily complete Biology Independent Research.

Application for candidacy must be made at the beginning of the senior year. Approval of candidacy and of the project and project advisor rests with the department. The project advisor will have sole responsibility for acceptance of the completed project.

The department may grant honors to exceptional students who fail to meet the above requirements, but who have in the judgment of the department brought distinction upon themselves and the department in some other appropriate manner.

Emerita

Kimberlyn Williams, Professor
B.A. 1979, University of California, Davis
Ph.D. 1987, Stanford University

Current Faculty

Nicole Bournias-Vardiabasis, Professor
B.S. 1975, University of California, Irvine
Ph.D. 1978, University of Essex, United Kingdom

Michael Y. Chao, Professor, Chair
B.S. 1993, National Taiwan University
Ph.D. 2001, University of Texas Southwestern Medical Center

Jeremy Dodsworth, Associate Professor
B.S. 2000, University of Wisconsin, Madison
Ph.D. 2006, University of Washington

Angela Horner, Associate Professor
B.S. 2000, Centre College
M.S. 2005, University of Cincinnati
Ph.D., 2010, Ohio University - Main Campus

Anthony E. Metcalf, Professor
B.A. 1977, Simon Fraser University
B.S. 1988, Ph.D. 1998, University of California, Riverside

Laura Newcomb, Professor
B.S. 1995, University of Wisconsin, Milwaukee
Ph.D. 2001, University of Wisconsin, Madison

Daniel Nickerson, Associate Professor
B.S. 2000, Kenyon College
Ph.D. 2008, University Of Colorado at Boulder

Paul M. Orwin, Professor
B.S. 1991 Harvey Mudd College
Ph.D. 2001, University of Minnesota

Tomasz Owerkowicz, Associate Professor
B.A. 1994, Ph.D. 2003, Harvard University, 2003

Breanna Putman, Assistant Professor
B.S. 2010, California Polytechnic State University San Luis Obispo
Ph.D. 2016, San Diego State

David Rhoads, Associate Professor
B.S. 1994, Pennsylvania State University

Ph.D., 1992, Michigan State University

John Skillman, Professor
B.S. 1988, Oregon State University
Ph.D. 1994, Duke University

David Smith, Assistant Professor
B.S. 2001, Texas State University
Ph. D, 2012 Northern Arizona University

Stuart S. Sumida, Professor
B.A. 1981, M.A. 1983, Ph.D. 1987, University of California, Los Angeles

Emeriti

Klaus Brasch, Professor

James A. Ferrari, Professor
B.A. 1975, Queens College, City University of New York
M.S. 1979, Ph.D. 1985, University of California, Riverside

Sarojram Mankau, Professor

David Polcyn, Professor, Associate Chair
B.A. 1981, California State University, Fullerton
M.A. 1983, Ph.D. 1988, University of California, Riverside

Jeffrey M. Thompson, Professor

Ruth Wilson, Professor

Undergraduate Degrees

Bachelor of Science

Bioinformatics (<https://catalog.csusb.edu/colleges-schools-departments/natural-sciences/computer-science-engineering/bioinformatics-bs/>)

Biology (<https://catalog.csusb.edu/colleges-schools-departments/natural-sciences/biology/biology-bs/>)

Graduate Degree

Master of Science

Biology (<https://catalog.csusb.edu/colleges-schools-departments/natural-sciences/biology/biology-ms/>)

Minor

Biology (<https://catalog.csusb.edu/colleges-schools-departments/natural-sciences/biology/biology-minor/>)

Certificate

- Biotechnology (<https://catalog.csusb.edu/colleges-schools-departments/natural-sciences/biology/biotechnology-certificate/>)

Courses

BIOL 1000. Introduction to Biology. Units: 3

Provides a broad introduction of biology, including our molecular-organismic-ecological heritage and the role of humans within the biosphere. Not intended for biology or biochemistry majors. When combined with BIOL 1000L, this course is equivalent to the previously offered BIOL 100. Students may not receive credit for both. Satisfies GE Category B2. This course will be offered in person and online each semester.

BIOL 1000L. Introduction to Biology Lab. Unit: 1

Semester Corequisite: BIOL 1000 or instructor consent
Introductory level hands-on observation and experimentation on biological specimens, materials, and models. Not intended for biology and biochemistry majors. Materials fee required. When combined with BIOL 1000, this course is equivalent to the previously offered BIOL 100. Students may not receive credit for both. Satisfies GE Category B3.

BIOL 1010. Biology for Teachers. Units: 4

Survey of major areas of biology including cell biology, genetics, evolution, plant and animal anatomy and physiology, ecology, and behavior. Course content and practices are aligned with the Next Generation Science Standards (NGSS). Specially designed for students interested in teaching grades K-8. Three hours lecture and three hours lab. Materials fee required. Satisfies GE Category B2; B3.

BIOL 1020. Science, Culture, & Life. Units: 3

An exploration of the connection between science and culture. Employs literature focused on how culture influences science knowledge and the scientific process, such as "Braiding Sweetgrass" by the Native American author Robin Wall Kimmerer. The format of the course will be discussion of the readings based on instructor prompts, reflection essays, and collected descriptions that combine scientific knowledge of plants and their cultural meaning. In the process, the traditional societal definition of what it means to be a scientist will be challenged. Satisfies GE category E.

BIOL 2010. Principles of Biology I. Units: 5

Semester Prerequisite: CHEM 2100 with a grade of C or higher. Quarter Prerequisite: CHEM 215 with a grade of C (2) or better, or consent of department

Provides a foundational understanding of 1) the process of life and the universality of life processes at the molecular and cellular level and 2) the principles of Mendelian genetics. Four hours lecture and three hours laboratory. Materials fee required. When combined with BIOL 2020, this course is equivalent to the previously offered BIOL 200, 201, and 202. Satisfies GE category B2 and B3; this course is not recommended as a GE course for non-STEM majors.

BIOL 2020. Principles of Biology II. Units: 5

Semester Prerequisite: BIOL 2010 with a grade of C (2) or better. Quarter Prerequisite: BIOL 200 and BIOL 201 with a grade of C or better
Introduces diversity, structure and function of all Kingdoms of life. Provides a foundational understanding of the principles of population genetics, evolution and ecology of organisms, populations, and communities. Four hours lecture and three hours laboratory. Materials fee required. When combined with BIOL 2010, this course is equivalent to the previously offered BIOL 200, 201, and 202.

BIOL 2160. Genetics and Society. Units: 3

Technological advances in genetics and their impact on society. Biological and ethical perspectives of the application of genetic research. Previously offered as BIOL 216. Satisfies GE category B2.

BIOL 2170. Biology of Diseases. Units: 3

The biology, pathogenicity, epidemiology, diagnosis, and treatment of prominent and emerging infectious diseases. Impact of current biotechnology in relation to vaccine development, experimental treatments, and improved diagnostics and screening. Previously offered as BIOL 217. Satisfies GE Category B2.

BIOL 2180. Sustainable Agriculture. Units: 3

Evidence-based comparison of traditional, modern, and sustainable agricultural practices, including plant health, pests and diseases, crop types and yields, food distribution, and food insecurity. Examination of food-related choices in a scientific, ethical, and social context. Satisfies GE category B2.

BIOL 2200. Microbiology for Allied Health Majors. Units: 4

Semester Prerequisite: BIOL 1000 strongly recommended. Quarter Prerequisite: one lower-division biology course
Structure, physiology, and classification of bacteria, microbial eukaryotes, and viruses. Rudiments of infection and immunity, and overview of pathogenic microbes. Laboratory training in microscopy, cultivation, and identification of microorganisms. Three hours lecture and three hours laboratory. Materials fee required. Students enrolling in this course for a third time may do so only with the consent of instructor. Formerly BIOL 220; students may not receive credit for both.

BIOL 2230. Human Anatomy and Physiology I for Allied Health Majors. Units: 4

Quarter Prerequisite: BIOL 100 and be declared in one of the following degree options: BS in Nursing, or BS in Health Science, or BS in Nutrition and Food Science, or BS in Kinesiology, or Minor in Kinesiology; or consent of instructor
Covers living chemistry, cells, tissues, integumentary, skeletal, muscular, and nervous systems. Three hours lecture and three hours laboratory. Materials fee required. Previously offered as BIOL 223. Students may not receive credit for both courses. Students enrolling in this course for a third time may do so only with the consent of instructor. This course only satisfies allied health pre-professional requirements and does not fulfill any requirements for the Biology BS degree.

BIOL 2240. Human Anatomy and Physiology II for Allied Health Majors. Units: 4

Semester Prerequisite: BIOL 2230
Covers digestive, nervous, respiratory, cardiovascular, urinary, endocrine, and reproductive systems. Three hours lectures and three hours laboratory. Materials fee required. Previously offered as BIOL 224. Students may not receive credit for both courses. Satisfies GE category B2 and B3. This course only satisfies allied health pre-professional requirements and does not fulfill any requirements for the Biology BS degree.

BIOL 3010. Human Ecology. Units: 3

Semester Prerequisite: Junior or senior standing. Quarter Prerequisite: junior or senior standing
Environmental and ecological impacts of the growing human population, taking into consideration the effects of science, technology, and our societal attitudes. Satisfies GE Category B5. Formerly offered as NSCI 310. Students may not receive credit for both courses. Satisfies Environmental Sustainability Pathway.

BIOL 3030. History of Life on Earth. Units: 3

Semester Prerequisite: Junior or senior standing. Quarter Prerequisite: Junior or senior standing
History of life on earth and the processes that govern its genesis, evolution, extinction, ecology, and preservation. Offered as BIOL 3030 and GEOL 3030. Satisfies GE Category B5. Formerly offered as NSCI 360. Students may only receive credit for one of these courses.

BIOL 3091. Special Studies in Biology. Unit: 1

Investigation, research, or study of a selected topic, the topic title to be specified in advance. May repeat for credit as topics change for a total of 2 units. Instructor consent required. This course does not satisfy any requirements for the undergraduate major in Biology. Formerly BIOL 295A.

BIOL 3092. Special Studies in Biology. Units: 2

Investigation, research, or study of a selected topic, the topic title to be specified in advance. May repeat for credit as topics change, for a total of 4 units. Instructor consent required. This course does not satisfy any requirements for the undergraduate major in Biology. Formerly BIOL 295B.

BIOL 3100. Cell Biology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better, and one of CHEM 2300 with a C (2.0) or better, CHEM 2400 with a C (2.0), or better or CHEM 3400 with a C (2.0) or better. Quarter Prerequisite: BIOL 200, BIOL 201 and BIOL 202 with grades of C (2.0) or better; CHEM 215 and CHEM 216
Structure and function of eukaryotic cells and organelles, and their physiological processes at the molecular level, including metabolism, signal transduction, gene regulation, and cell cycle control. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 300; students may not earn credit for both courses. Satisfies GE designation WI.

BIOL 3120. Molecular Biology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; and one of the following: CHEM 2300, CHEM 2400 or CHEM 3400 with a C (2.0) or better. Quarter Prerequisite: BIOL 300 with a grade of C or better and CHEM 223 or CHEM 323
Informational macromolecules, and how they direct molecular processes in both eukaryotic and bacterial cells. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 400; students may not receive credit for both courses.

BIOL 3200. Microbiology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

The structure and function, metabolism, and genetics of microorganisms with an introduction to bacterial, viral, fungal, and protozoan pathogens. Two hours lecture and six hours laboratory. Materials fee required. Formerly offered as BIOL 320; students may not receive credit for both courses. Satisfies GE designation WI.

BIOL 3300. Genetics. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400
Principles of heredity and genetic analysis, including underlying molecular mechanisms. Includes current concepts of the organization, function, and regulation of genes. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 423; students may not receive credit for both courses.

BIOL 3400. Comparative Embryology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400

Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400
Descriptive survey of developmental patterns of tissue and organ formation to include studies of insects, echinoderms, and amphibian, avian, reptilian, marsupial plus placental mammalian vertebrate embryology. Two hours lecture and three hours laboratory. Materials fee required. BIOL 3420 strongly recommended. Formerly offered as BIOL 340; students may not receive credit for both courses.

BIOL 3410. Biology of Invertebrates. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

Survey of the major groups of invertebrates, with emphasis on taxonomy, structure, function, reproduction, and evolution. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 331; students may not receive credit for both courses.

BIOL 3420. Comparative Biology of the Vertebrates. Units: 5

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

Structural, developmental and ecological changes in the evolution of the chordates and their ancestors, with an emphasis on comparative vertebrate anatomy. Three hours lecture and six hours laboratory. Materials fee required. Formerly offered as BIOL 342; students may not receive credit for both courses.

BIOL 3430. Mammalogy. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with grade C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

Systematics, evolution, morphology, physiology, ecology and behavior of mammals. Two hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 343; students may not receive credit for both courses.

BIOL 3440. Herpetology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with grad of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

Diversity, evolution, morphology, physiology, behavior and ecology of amphibians and reptiles. Two hours lecture and six hours laboratory. Materials fee required. Formerly offered as BIOL 344; students may not receive credit for both courses.

BIOL 3450. Ornithology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with grade C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

Introduction to the biology of birds. Course includes study of the functional morphology, ecology and behavior, and the evolutionary relationships among extant taxa. Laboratory exercises will focus on identification and museum studies, coupled with field observations of avian species diversity and associated habitats with an emphasis on resident and migratory species of southern California. Two hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 345; students may not receive credit for both courses.

BIOL 3460. Entomology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better
Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

A survey of the anatomy, classification, physiology, ecology, and evolution of the insects. Two hours lecture and three hours laboratory/field studies. Materials fee required. Formerly offered as BIOL 335; students may not receive credit for both courses.

BIOL 3470. Ichthyology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400

This course will provide students with an overview and a broad understanding of the biodiversity found within fishes. It will cover topics such as aquaculture, behavior, conservation, ecology, evolutionary relationships and physiology. For the lab component, students will have an opportunity for hands-on studies of morphology, meristics (quantifying features of a fish), species identification, and behavior. They will also address topics related to conservation and policy, and participate in a field trip to the Southern California Marine Institute, where students will observe fishes caught (and released) during a trawl. Overall, this course will provide a unique opportunity for students to learn more about organismal biology using current, real-world approaches. Two hours lecture and three hours laboratory. Materials fee required.

BIOL 3480. Vertebrate Paleontology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400

Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

Survey of the origins, evolution, and diversity of major lineages of fossil vertebrates, with emphasis on the use of fossil examples to elucidate patterns of form and function, origins of major groups, development of key structural innovations, and patterns of change and extinction over time.

Two hours lecture and three hours laboratory. Formerly offered as BIOL 305; students may not receive credit for both courses.

BIOL 3520. Local Flora. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better or consent of instructor

Identification of the flora and ecological communities of southern California with a consideration of taxonomic principles. One hour lecture, one hour discussion, and three hours laboratory including field collections. Materials fee required. Formerly offered as BIOL 319; students may not receive credit for both courses.

BIOL 3540. Plant Biology and Diversity. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better

Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

Comparative plant morphology, anatomy, and development, with emphasis on ecological consequences of variation in anatomical traits.

Three hours lecture and three hours laboratory. Materials fee required. 2000-level physics course (or equivalent) recommended. Formerly offered as BIOL 354; students may not receive credit for both courses.

BIOL 3560. Plant Physiology. Units: 5

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better, and one of the following with a grade of C (2.0) or better: CHEM 2300, CHEM 2400, or CHEM 3400

Comparative analysis of physiological activity in plants at the various levels of cells, tissues, organs and organisms. Three hours lecture and six hours laboratory. Materials fee required. Formerly offered as BIOL 431 and BIOL 4510; students may not receive credit for both courses.

BIOL 3630. Comparative Animal Physiology I. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C or better. Quarter Prerequisite: BIOL 300 with a grade of C or better

A comparative analysis of the physiologic mechanisms and performance in animals, with emphasis on evolutionary trends in neuronal and musculoskeletal functions. Three hours lecture and three hours laboratory. Materials fee required. 2000-level physics course (or equivalent) recommended. Together BIOL 3630 and BIOL 3640 are equivalent to BIOL 424; students may not earn credit for both BIOL 424 and BIOL 3630. Satisfies GE designation WI.

BIOL 3640. Comparative Animal Physiology II. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C or better.

Prerequisite: BIOL 300 with a grade of C or better

A comparative analysis of the physiologic mechanisms and performance in animals, with emphasis on evolutionary trends in cardiorespiratory, osmotic and thermoregulatory functions. Three hours lecture and three hours laboratory. Materials fee required. 2000-level physics course (or equivalent) recommended. Together BIOL 3630 and BIOL 3640 are equivalent to BIOL 424, students may not earn credit for both BIOL 424 and BIOL 3640. Satisfies GE designation WI.

BIOL 3700. Evolution. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better

Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

A broad survey of evolutionary biology. Topics include natural selection and adaptation, population genetics, speciation, and the historical patterns in the diversity of life that arise from the evolutionary process. Three hours lecture and one hour of discussion. Formerly offered as BIOL 321; students may not receive credit for both courses.

BIOL 3800. Ecology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better, MATH 2210 with a grade of C (2.0) or better, and Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better; and MATH 120, MATH 192 or MATH 211; or consent of instructor

Semester Corequisite: Completion of or concurrent enrollment in CHEM 2300, CHEM 2400 or CHEM 3400

Analysis of the interrelationships of organisms and their physical and biotic environment with a consideration of the role of the environment in natural selection. Three hours lecture and three hours laboratory/field studies. Materials fee required. Formerly offered as BIOL 450; students may not receive credit for both courses.

BIOL 3820. Microbial Ecology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2) or better. Quarter Prerequisite: BIOL 202 with a grade of C (2) or better; completion of CHEM 221 or CHEM 321

Semester Corequisite: CHEM 2300, CHEM 2400, or CHEM 3400

An overview of interactions between microorganisms and their environments, and classical and modern methods used to study microbial communities and their ecology. Particular focus will be placed on important roles that microbes play in carbon and nitrogen cycling, and human-microbe interactions. Three hours lecture and three hours lab. Materials fee required.

BIOL 3880. Invasion Biology. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Prerequisite: BIOL 300 with a grade of C (2.0) or better

Semester Corequisite: Completion of or concurrent enrollment in CHEM 2300, CHEM 2400, or CHEM 3400

The study of how exotic species are introduced into a new environment and the impact that they have on that new environment. More specifically, it involves the exploration of the ecology and evolution of invasive species. Through a combination of lectures, discussion and hands-on, research-based approaches, students will: 1) understand how invasive species are being introduced; 2) evaluate and predict under which ecological and evolutionary conditions a species might become invasive; 3) diagnose the impact of invasive species on the surrounding biotic and abiotic environment; 4) collect and analyze data and create a visual representation of species spread; and 5) design a plan for prevention, control and/or eradication of targeted invasive species. Two hours lecture and three hours laboratory/ field studies. Materials fee required.

BIOL 3900. Conservation Biology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; completion of or concurrent enrollment in CHEM 2300 or CHEM 2400 or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of "C" (2.0) or better, and BIOL 321 or 450

Semester Corequisite: CHEM 2300 or CHEM 2400 or CHEM 3400

An examination of factors influencing biological diversity including habitat loss and fragmentation, global climate change, and species extinction. The science of conservation biology is interdisciplinary and has a focus that ranges from genes and populations through ecosystems and global levels of biodiversity. The maintenance and restoration of biodiversity necessarily overlaps with other disciplines including wildlife and resource management, law, economics, and ethics. Formerly offered as BIOL 514 or BIOL 5840; students may not earn credit for both courses. Three hours lecture, one hour discussion.

BIOL 3950. Marine Biology. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400, or CHEM 3400; or consent of instructor. Prerequisite: BIOL 300 with a grade of C (2.0) or better; or consent of instructor

Semester Corequisite: Completion of or concurrent enrollment in CHEM 2300, CHEM 2400, or CHEM 3400

This course provides students with comprehensive knowledge in marine biology. This course covers taxonomy, ecology, evolution and conservation of marine fauna and flora. During this course, students will obtain training in taxonomical identification, field ecology and management of marine resources. Three hours lecture and three hours laboratory/ field studies. Materials fee required.

BIOL 3961. Directed Study. Unit: 1

Reading and library research in an area of biology conducted under the direction of a faculty member in the Department of Biology. Consent of instructor and departmental approval of a written proposal submitted on a standard application form filed in advance of the semester in which the course is to be taken. May be taken two time for four unit, but no more than two units of BIOL 3961 or BIOL 3962 may be applied toward a biology elective for graduation. Graded credit/no credit. Formerly BIOL 396A.

BIOL 3962. Directed Study. Units: 2

Reading and library research in an area of biology conducted under the direction of a faculty member in the Department of Biology. Consent of instructor and departmental approval of a written proposal submitted on a standard application form filed in advance of the semester in which the course is to be taken. May be taken two time for four units, but no more than two units of BIOL 3961 or BIOL 3962 may be applied toward a biology elective for graduation. Graded credit/no credit. Formerly BIOL 396B.

BIOL 4130. Biology of Stem Cells. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; Pre- or Co-requisite one of the following: CHEM 2300, CHEM 2400 or CHEM 3400

Semester Corequisite: CHEM 2300, CHEM 2400 or CHEM 3400

Examination of fundamental concepts and themes in stem cell-based regenerative medicine: pluripotency and reprogramming, cell types, organ systems, stem cells and therapeutics an ethics. Experimental approaches and emerging areas in stem cell research addressed in seminars from visiting scholars/scientists and with readings from the primary literature. Formerly offered as BIOL 413 and BIOL 3130; students may not receive credit for both courses.

BIOL 4140. Biology of Cancer. Units: 2

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better and one of the following: CHEM 2300, CHEM 2400 or CHEM 3400. BIOL 3100, 3120, or BIOL 3300 recommended

Semester Corequisite: One of the following: CHEM 2300, CHEM 2400 or CHEM 3400

A comprehensive survey of the biological principles formulated over time that have established current mechanistic understandings leading to a varied approach to cancer treatment. Topics include the molecular genetics of cancer, factors affecting tumor growth, host defense against cancer cells, environmental and lifestyle carcinogens and modern therapeutic protocols. Formerly offered as BIOL 3140; students may not receive credit for both courses.

BIOL 4200. Medical Microbiology. Units: 5

Semester Prerequisite: BIOL 3200. Quarter Prerequisite: BIOL 300 with a grade of C or better, and BIOL 320 or consent of instructor

An overview of topics and lab techniques in medial microbiology, emphasizing the biology of medically relevant bacteria, viruses, fungi and protozoa. The course will focus on the host-pathogen interaction, including the actions of the pathogenic microorganism and the immune response, as well as the overall host microbiome as an ecosystem perturbed by infection. Three hours of lecture, one hour of discussion, and three hours laboratory. Materials fee required. Formerly offered as BIOL 420; students may not receive credit for both courses.

BIOL 4270. Functional Microbial Genomics. Units: 5

Semester Prerequisite: BIOL 3100 with a grade of C or better, or BIOL 3200 with a grade of C or better

Training in microbiology and molecular biology laboratory skills, biotechnology research, and the broader concepts of genomics and genome database/bioinformatics/cyber infrastructure applications. Students will participate in authentic/original research- attempting to duplicate that in faculty labs but in a classroom setting. Mastering the process of science will be stressed. This will include an emphasis on experimental design, research material preparation, critical thinking, data analysis, real-life research problem solving, and iterative learning. BIOL 3120 recommended. Three hours lecture and six hours laboratory. Materials fee required. Formerly offered as BIOL 427; students may not receive credit for both courses.

BIOL 4400. Developmental Biology. Units: 4

Semester Prerequisite: BIOL 3100 or BIOL 3120 or BIOL 3200 or BIOL 3300. Quarter Prerequisite: BIOL 300 with a grade of C or better, and CHEM 223 or 323

Comparative analysis of patterns and processes of development of organisms, with emphasis on the role of genetic and biochemical mechanisms. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 440; students may not receive credit for both courses.

BIOL 4580. Medical and Economic Botany. Units: 3

Semester Prerequisite: One of the following: BIOL 3700, BIOL 3800, or BIOL 3900; and one of the following: CHEM 2300, CHEM 2400, or CHEM 3400. Quarter Prerequisite: BIOL 300 with a grade of C (2.0) or better. Survey of medically and economically important plant species and families. Includes plants harmful and beneficial to humans, with emphasis on vascular species. Formerly offered as BIOL 380; students may not earn credit for both courses.

BIOL 4630. Human Anatomy and Physiology I. Units: 5

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better. Quarter Prerequisite: BIOL 300 with a grade of C or better. Semester Corequisite: One of the following: CHEM 2300, CHEM 2400, or CHEM 3400

Comprehensive study of the human form and function in the broader context of vertebrate animals, and select case studies of human pathologies. Course covers early development and the anatomy and physiology of the integumentary, skeletal, muscular, and nervous systems, and the special senses. Four hours lecture and three hours laboratory. Materials fee required. When combined with BIOL 4640, this course is equivalent to the previously offered BIOL 323 and BIOL 324. Students may not receive credit for both this course and either BIOL 323 or BIOL 324.

BIOL 4640. Human Anatomy and Physiology II. Units: 5

Semester Prerequisite: BIOL 4630 with a grade of C or better; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better. Comprehensive study of the human form and function in the broader context of vertebrate animals, and select case studies of human pathologies. Course covers early development and the anatomy and physiology of the digestive, respiratory, cardiovascular, excretory, reproductive, and endocrine systems. Four hours lecture and three hours laboratory. Materials fee required. When combined with BIOL 4630, this course is equivalent to the previously offered BIOL 323 and 324. Students may not receive credit for both this course and either BIOL 323 or BIOL 324.

BIOL 4650. Human Anatomy for Biology Majors. Units: 5

Semester Prerequisite: Completion of either PHYS 2000 or PHYS 2500 with a 'C' (2.0) or better, and completion of BIOL 2020 with a 'B' (3.0) or better or completion of any 3000 level Biology course with a 'C' (2.0) or better

Comprehensive study of the human form in the broader context of vertebrate animals. Topics include the anatomy of early development and the following systems: integumentary, skeletal, muscular, nervous, digestive, respiratory, cardiovascular, excretory, reproductive, endocrine and special senses. Four hours lecture and three hours laboratory. Students that have taken either BIOL 323 or BIOL 4630 and BIOL 4640 may not take this course as an elective in the BIOL major. Materials fee required.

BIOL 4901. Special Topics. Unit: 1

Semester Prerequisite: BIOL 2020 with a grade of C (2) or better. Quarter Prerequisite: BIOL 300 with a grade of C (2) or better. Semester Corequisite: CHEM 2300 or CHEM 2400 or CHEM 3400. Group study of a selected topic, the title to be specified in advance. Can be taken a maximum of four times for a total of four units as topics change. Formerly 490A.

BIOL 4902. Special Topics. Units: 2

Semester Prerequisite: BIOL 2020 with a grade of C or better. Quarter Prerequisite: BIOL 300 with a grade of C or better. Semester Corequisite: CHEM 2300 or CHEM 2400 or CHEM 3400. Group study of a selected topic, the title to be specified in advance. May be repeated up to four times for credit as topics change. Can be taken a maximum of four times for a total of eight units. Formerly BIOL 490B.

BIOL 4903. Special Topics. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C or better; completion of or concurrent enrollment in CHEM 2300 or CHEM 2400. Quarter Prerequisite: BIOL 300 with a grade of C or better. Group study of a selected topic, the title to be specified in advance. May be repeated up to four times for credit as topics change. Formerly BIOL 490C.

BIOL 4911. Special Laboratory Topics. Unit: 1

Semester Prerequisite: BIOL 2020 with a grade of C (2.0) or better; completion of or concurrent enrollment in CHEM 2300 or CHEM 2400 or CHEM 3400. Semester Corequisite: CHEM 2300 or CHEM 2400 or CHEM 3400. Group laboratory study of a selected topic, the title to be specified in advance. Materials fee required. Can be taken a maximum of four times for a total of four units as topics change. Formerly BIOL 491A.

BIOL 4912. Special Laboratory Topics. Units: 2

Semester Prerequisite: BIOL 2020 with a grade of C or better. Quarter Prerequisite: BIOL 300 with a grade of C or better and 15 units of upper-division biology course work

Semester Corequisite: CHEM 2300 or CHEM 2400 or CHEM 3400
Group laboratory study of a selected topic, the title to be specified in advance. May be repeated up to four times for credit as topics change. Materials fee required. Can be taken a maximum of four times for a total of eight units. Formerly BIOL 491B.

BIOL 4990. Readings in Biology. Unit: 1

Semester Prerequisite: BIOL 2020 with a grade of C or better. Quarter Prerequisite: BIOL 200, 201, 202 and 300
Group study of topics of current biological interest, involving analysis of the primary literature and presentations by students. May be taken up to four times but students may only earn credit toward the major once. Instructor consent required. Graded credit/no credit. Formerly BIOL 391.

BIOL 5000. Biology Seminar. Unit: 1

Semester Prerequisite: BIOL 2020 with a grade of C or better, or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better

Topics of current biological interest, presented by students, faculty, and guest speakers. Discussion of primary research associated with presentation topics, including how the research relates to broader topics in Biology. May be taken once for credit toward the B.S. in Biology; may be taken twice for credit toward the elective requirement of the Master of Science in Biology. Formerly offered as BIOL 390 or BIOL 591; students may not earn credit for either of these previous courses and this course. Graded credit/no credit.

BIOL 5010. Ethics in Biological Research. Unit: 1

Quarter Prerequisite: Graduate or senior standing in Biology
Ethical issues related to biological research. Covers use of animals and humans as research subjects, conservation and cultural issues, intellectual property, authorship, and research misconduct. It includes basic Research Ethics, also known as Responsible Conduct of Research, and meets the Responsible Conduct of Research training requirements for NIH and NSF grants.

BIOL 5050. Biostatistics and Experimental Design. Units: 4

Semester Prerequisite: MATH 2210, BIOL 2020 with a grade of C or better, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of "C" or better, MATH 192 or 211, and consent of instructor
Provides an understanding of the design of biological experiments and analysis of data. Topics will include experimental design and sampling protocols, techniques for displaying and describing data, probability, and hypothesis testing. The course surveys statistical approaches to the analysis of proportions and frequencies, comparisons of means among numerical variables, regression, correlation, analysis of variance, as well as non-parametric approaches. Three hours lecture and three hours laboratory. Formerly offered as BIOL 505, students may not receive credit for both.

BIOL 5100. Experimental Cellular Analysis. Units: 4

Semester Prerequisite: BIOL 3100 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better; or graduate standing in Biology; or consent of instructor

Laboratory techniques for examining and manipulating cells, including genetic, biochemical, imaging, and viability assays. This course will integrate core principles of cell biology and biochemistry with an emphasis on experimental design, execution, interpretation, and presentation. Two hours lecture and six hours laboratory. Materials fee required.

BIOL 5130. Animal Tissue Culture. Units: 3

Semester Prerequisite: BIOL 3100 with a grade of C or better, or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better

Theory and concepts of animal tissue culture including fundamentals of tissue culture techniques, sub-culturing and maintenance of cell lines. Strong emphasis on stem cell technology. One hour lecture and four hours laboratory. Materials fee required. Formerly offered as BIOL 513; students may not earn credit for both courses.

BIOL 5150. Neurobiology. Units: 3

Semester Prerequisite: One of the following courses with a grade of C or better: BIOL 3100, BIOL 3120, BIOL 3200, or BIOL 3300; or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better

Study of the structure, physiology, and pharmacology of the nervous system. Mechanisms of cellular communication, perception of sensory information, endocrine function, motor control, development, and learning and memory in the nervous system will be examined. Formerly offered as BIOL 580; students may not receive credit for both courses.

BIOL 5160. Introduction to Regulatory Affairs in the Life Sciences. Units: 2

Semester Prerequisite: BIOL 5130. Quarter Prerequisite: BIOL 300 with a grade of "C" or better and consent of the instructor
Introduces the pharmaceutical, biotechnology, and biologics industries and the laws and regulations related to these products. Discussion of company organization, product development, and commercialization-associated activities. Consent of Instructor required. Formerly offered as BIOL 516; students may not earn credit for both courses.

BIOL 5170. Human Embryonic Stem Cell Culture Methods. Units: 2

Semester Prerequisite: BIOL 5130. Quarter Prerequisite: BIOL 300 with a grade of "C" or better and consent of instructor
Advanced laboratory training in plating and passaging of human embryonic stem cells and human induced pluripotent stem cells. Mastery of a variety of cell culture techniques including isolation and culturing techniques including isolation and culturing of mouse embryonic fibroblasts, PCR and flow cytometry and immunohistochemistry on human embryonic stem cells and embryoid bodies. One hour of lecture and three hours of lab. Consent of Instructor required. Materials fee required. Formerly offered as BIOL 517; students may not earn credit for both courses.

BIOL 5200. Tropical Biology. Units: 4

Semester Prerequisite: One of the following: BIOL 3430, 3440, 3450, 3460, 3700, BIOL 3800, or BIOL 3900; and one of the following: CHEM 2300, CHEM 2400, or CHEM 3400

Study of terrestrial tropical ecosystems, focusing on animal diversity, the relationships between organisms and environment, and comparisons with temperate ecosystems. Students engage in field methodology to address an ecological research question. A field trip to Costa Rica required during the term at student expense. Three hours lecture and three hours laboratory. Materials fee required.

BIOL 5260. Genomics. Units: 4

Semester Prerequisite: Graduate standing in Biology, or one of the following courses with a grade of C or better: BIOL 3100, BIOL 3120, BIOL 3200, or BIOL 3300. Quarter Prerequisite: BIOL 300 with a grade of C or better

Overview of the history of genomics and its current applications. Topics covered will include genome sequencing, assembly, annotation, and analysis; transcriptomics and proteomics. Three hours lecture and three hours lab. Materials fee required.

BIOL 5280. Advanced Molecular Genetics. Units: 3

Semester Prerequisite: One of the following courses with a grade of C or better: BIOL 3100, BIOL 3120, BIOL 3200, or BIOL 3300; or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better, BIOL 400, 423, and CHEM 223 or 323

Examination of modern molecular techniques applied to genetics research in common model organisms, including transgenesis, gene targeting/replacement, temporal-spatial control of gene expression, and in situ and genome-wide expression analysis. Formerly offered as BIOL 528; students may not receive credit for both courses.

BIOL 5300. Microscopy. Units: 3

Semester Prerequisite: senior standing or consent of instructor. Quarter Prerequisite: senior standing and consent of instructor

Theory and techniques of modern microscopy. Lectures on theory of optics and imaging for several types of microscopes (Light microscope, fluorescence microscope, confocal microscope, scanning probe microscope, and electron microscope). Laboratory includes hands-on training in the technical aspects of specimen preparation and microscope use. Two hours lecture and three hours laboratory. Formerly offered as BIOL/GEOL 530, students may not receive credit for both courses. Offered as GEOL 5300 and BIOL 5300. Students may not receive credit for both. Materials fee required.

BIOL 5310. Advanced Molecular Techniques. Units: 4

Semester Prerequisite: BIOL 3120 with a grade of C or better, or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better and BIOL 400

Techniques utilized in molecular research and biotechnology. Methods for isolating and analyzing molecules of life, including DNA, RNA, and protein will be carried out in the context of an advanced molecular research project. A final research report will be required from the student. Two hours lecture and six hours laboratory. Materials fee required. This course incorporates portions of BIOL 502 and BIOL 592; students may not receive credit both BIOL 592 and BIOL 5310.

BIOL 5320. Virology. Units: 4

Semester Prerequisite: One of the following courses with a grade of C (2.0) or better: BIOL 3100, BIOL 3120, BIOL 3200, or BIOL 3300. Quarter Prerequisite: BIOL 400 with a grade of "C" (2.0) or better

Examination of the structure, genetics and modes of replication of viruses, viroids, and other related sub-cellular entities; their implications in medicine; and their use in scientific research. Virological methods such as infection and plaque assays will be carried out in the context of an advanced virology research project. Three hours lecture and three hours laboratory. Formerly offered as BIOL 572; students may not receive credit for both courses. Materials fee required.

BIOL 5330. Biotechnology Practicum. Units: 5

Semester Prerequisite: BIOL 3100 with a grade of C (2.0) or better and either BIOL 3120, BIOL 3200 with grades of C (2.0) or better; or CHEM 4100/4100L; or graduate standing; or permission of instructor.

Prerequisite: BIOL 300 with grade of C (2.0) or better, plus 15 additional units of upper-division Biology; or permission of instructor
Laboratory principles and procedures useful to students interested in a research or industry career. Laboratory exercises will emphasize preparation of useful biotechnological products, including cells and purified enzymes. Students will take an active role in planning experiments, including preparing required solutions, reagents, and materials. Students will evaluate and report the quality of products they produce, measuring abundance, purity, and potency. Three hours lecture and six hours laboratory. Materials fee required.

BIOL 5370. Immunology. Units: 5

Semester Prerequisite: BIOL 3120 and either BIOL 3100 or BIOL 3200; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 400 with a grade of "C" or better

Foundations of immunology and current advances in the study of the immunological response. Laboratory examination of immunological assays applied in both research and clinical diagnostics. Three hours lecture, one hour discussion, and three hours laboratory. Materials fee required. Formerly offered as BIOL 573; students may not receive credit for both courses.

BIOL 5420. Advanced Vertebrate Morphology. Units: 3

Semester Prerequisite: BIOL 3420 with a grade of C or better, or graduate standing in Biology. Quarter Prerequisite: BIOL 342, BIOL 424 and consent of instructor

Advanced techniques in the study of vertebrates, including dissection and specimen preparation. Lecture sessions on advanced topics in vertebrate anatomy and recent research advances. Lab activities include construction of animal skeletal materials, detailed study and dissection of vertebrate organ systems, and individual student designed projects. Projects consist of both laboratory projects under the guidance of instructor and problem-based learning activities that are conducted both in the laboratory and in open activity time with small student groups. (Highly recommended to students planning on applying to PBL veterinary professional programs.) Two hours lecture and three hours laboratory. Materials fee required. BIOL 3630 or BIOL 3640 recommended. Formerly offered as BIOL 524; students may not receive credit for both courses.

BIOL 5550. Comparative Biomechanics.**Units: 4**

Semester Prerequisite: Completion of either PHYS 2000 or PHYS 2500 with a 'C' (2.0) or better AND at least ONE of the following with a 'C' (2.0) or better: BIOL 3400, BIOL 3410, BIOL 3420, BIOL 3430, BIOL 3440, BIOL 3450, BIOL 3460, BIOL 3480, BIOL 3630, BIOL 3700, BIOL 3800, BIOL 3950; or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with grade of C or better, PHYS 121, PHYS 122, or consent of instructor

Examination and quantitative analysis of structure and function of animals and plants using physical principles. Application of fluid and solid mechanics in the study of biologic materials. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 555; students may not receive credit for both courses.

BIOL 5670. Endocrinology. Units: 3

Semester Prerequisite: BIOL 3100 with a grade of C or better; or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better

Endocrine systems with emphasis on mechanisms for regulating the biosynthesis, secretion, transport, and actions of hormones. Formerly offered as BIOL 576; students may not receive credit for both courses.

BIOL 5720. Population Genetics. Units: 4

Semester Prerequisite: Math 2110 with a grade of C or better and either BIOL 3700 with a grade of C or better or BIOL 3800 with a grade of C or better; or graduate standing in Biology. Quarter Prerequisite: BIOL 423 and MATH 192 or 211

Focuses on evolution at the genetic level including the description of genetic variation within and among populations and the evolutionary forces that can act on this variation over time. Three hours lecture, one hour discussion. Formerly offered as BIOL 522; students may not earn credit for both courses.

BIOL 5752. Internship in Biology. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575A.

BIOL 5752B. Internship in Biology: Pre-Health. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575B.

BIOL 5752C. Internship in Biology: Biotechnology. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575C.

BIOL 5752D. Internship in Biology: Wildlife Biology. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575D.

BIOL 5752E. Internship in Biology: Botany. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575E.

BIOL 5752F. Internship in Biology: Science Education. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575F.

BIOL 5752G. Internship in Biology: Museum Science. Units: 2

Supervised work and study in work situations involving biological research and technical skills. May be repeated for a total of six units. Only two units of internship courses (BIOL 5752-5752G) may be applied towards the biology major requirements. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 575G.

BIOL 5820. Vertebrate Field Biology. Units: 3

Semester Prerequisite: BIOL 3700 with a grade of C or better, or BIOL 3800 with a grade of C or better, or graduate standing in Biology, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, BIOL 450

Field study of the ecology and natural history of the vertebrate fauna of southern California. One hour lecture and six hours laboratory/field work. Materials fee required. Formerly offered as BIOL 525; students may not receive credit for both courses.

BIOL 5850. Global Change Biology. Units: 3

Semester Prerequisite: BIOL 3800 with a grade of C or better, or graduate standing in Biology, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of "C" or better, and an upper-division lab course in ecology (BIOL 349, BIOL 450, or BIOL 455) or consent of instructor. An examination of changing ecological and biogeochemical processes at selected times in the earth's history including, but not limited to, the modern era. Exploration of causes and consequences of contemporary global change for biological systems including displaced populations, disrupted ecological interactions, and altered epidemiological patterns. Formerly offered as BIOL 515; students may not earn credit for both courses.

BIOL 5860. Physiological Ecology. Units: 4

Semester Prerequisite: One of the following with a grade of C or better: BIOL 3630, BIOL 3640, or BIOL 4510; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 354 and 424; or 431 and either 331 or 342; and 450

Study of physiological, morphological, and behavioral responses of organisms to physical environmental factors such as temperature, light, salinity, and altitude. Three hours lecture and three hours laboratory. Materials fee required. Formerly offered as BIOL 565; students may not receive credit for both courses.

BIOL 5901. Senior Seminar: Molecular Biology. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3120 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in molecular biology. Formerly BIOL 590A.

BIOL 5902. Senior Seminar: Biosystematics. Units: 2

Semester Prerequisite: At least 90 semester units and either BIOL 3300 with a C or better or BIOL 3700 with a C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in biosystematics. Formerly BIOL 590B.

BIOL 5903. Senior Seminar: Cell Biology. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3100 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in cell biology. Formerly BIOL 590C.

BIOL 5904. Senior Seminar: Physiology. Units: 2

Semester Prerequisite: At least 90 semester units or graduate standing in Biology, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in physiology. Formerly BIOL 590D.

BIOL 5905. Senior Seminar: Ecology. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3800 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in ecology. Formerly BIOL 590E.

BIOL 5906. Senior Seminar: Genetics. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3300 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in genetics. Formerly BIOL 590G.

BIOL 5907. Senior Seminar: Evolution. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3700 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in evolution. Formerly BIOL 590H.

BIOL 5908. Senior Seminar: Microbiology. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 3200 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in microbiology. Formerly BIOL 590I.

BIOL 5909. Senior Seminar: Zoology. Units: 2

Semester Prerequisite: At least 90 semester units or graduate standing in Biology, or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in zoology. Formerly BIOL 590J.

BIOL 5910. Senior Seminar: Botany. Units: 2

Semester Prerequisite: At least 90 semester units and one of the following courses with a grade of C or better: BIOL 3520, BIOL 3540, BIOL 4510, or BIOL 4580; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Survey of current literature, methods and ethics of scientific inquiry in botany. Formerly BIOL 590K.

BIOL 5911. Senior Seminar: History of Biology. Units: 2

Semester Prerequisite: At least 90 semester units and BIOL 2020 with a grade of C or better; or graduate standing in Biology. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units

Investigation into the history of different branches of biology. Formerly BIOL 590L.

BIOL 5912. Senior Seminar: Conservation Biology. Units: 2

Semester Prerequisite: At least 90 semester units and either BIOL 3700 with a grade of C or better or BIOL 3800 with a grade of C or better; or graduate standing in Biology; or consent of instructor. Quarter Prerequisite: BIOL 300 with a grade of C or better, and a minimum of 15 upper-division units in biology courses and at least 135 quarter units Survey of current literature, methods and ethics of scientific inquiry in conservation biology. Formerly BIOL 590M.

BIOL 5951. Independent Research. Unit: 1

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of 3 or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of 3 or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the major requirements of the B.S. in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596A.

BIOL 5952. Independent Research. Units: 2

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of B or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of B or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the major requirements of the B.S. in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596B.

BIOL 5953. Independent Research. Units: 3

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of B or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of B or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the major requirements of the B.S. in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596C.

BIOL 5954. Independent Research. Units: 4

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of B or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of B or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the major requirements of the B.S. in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596D.

BIOL 5955. Independent Research. Units: 5

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of 3 or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of 3 or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the undergraduate degree in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596E.

BIOL 5956. Independent Research. Units: 6

Semester Prerequisite: BIOL 2020 with a grade of C or better and a minimum overall GPA of 3 or better. Quarter Prerequisite: BIOL 202 with a grade of C or better and a minimum overall GPA of 3 or better Laboratory and/or field research in selected areas in biology conducted under the direction of a faculty member. A total of four units of Independent Research (BIOL 5951-5956) may be applied toward the undergraduate degree in Biology. Students must present research findings at least once per academic year at the Biology Department colloquium, and must attend the Biology Department colloquium every semester until their projects are complete. Department approval of a written project proposal submitted on a standard application is required. The project proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Materials fee required. Consent of Instructor required. Graded credit/no credit. Formerly BIOL 596F.

BIOL 5970. Directed Study in Science Education. Unit: 1

Readings and library research on pedagogical content knowledge of specific content areas in biology. This course should be taken concurrently with or shortly after taking an upper division course in the relevant area of biology. Graded credit/no credit. May be repeated up to four times for credit. No more than two units may be applied toward degree requirements for the BS in Biology. Department approval of a written proposal submitted on a standard application is required. The proposal must be submitted for Departmental review in advance of the semester in which the course is to be taken. Consent of Instructor required. Formerly BIOL 597.

BIOL 6010. Effective Teaching Strategies for Graduate TAs. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: Graduate standing in Biology
Course explores multiple perspectives and strategies for effective teaching. Covers the diversity of students and learning needs, effective presentations, professional behaviors, assessment of student progress and learning, and how to adapt class content or teaching approach as needed. Includes classroom visitations and peer observations. This course is required of all graduate students prior to or concurrent with their first assignment as a teaching assistant. Formerly offered as BIOL 601; students may not receive credit for both courses.

BIOL 6020. Professional Writing in the Biological Sciences. Units: 2

Semester Prerequisite: Graduate standing in Biology
Writing skills appropriate to scientific works (journal articles, meeting abstracts, proposals, technical writing for general audiences, etc.). Includes formatting conventions, peer review, and ethical issues in scientific writing. Graduate students should take this course early in their program.

BIOL 6030. Presentation in Biological Sciences. Unit: 1

Semester Prerequisite: Graduate standing in Biology
Methods of effective presentation in biological research. Covers structure of oral presentations, effective data presentation, and audience engagement. Completion of course requires presentation of original laboratory and/or field research. Students will work closely with their thesis mentor to develop, carry out, analyze, prepare, and present their first research talk at the Biology Department Student Research Colloquium or other venue approved by the student's thesis committee. Graded credit/no credit.

BIOL 6050L. Graduate Biostatistics and Experimental Design Laboratory. Unit: 1

Semester Prerequisite: BIOL 5050 and consent of instructor
Provides experience in using various computer programs and techniques to address problems in statistical analysis and presentation of data related to a student's thesis project, including analysis of proportions and frequencies, comparisons of means among numerical variables, regression, correlation, analysis of variance, as well as non-parametric approaches. Graded credit/no credit.

BIOL 6100. Primary Literature in Biology. Unit: 1

Semester Prerequisite: Graduate standing in Biology
Faculty supervised discussion in journal club format. Students will learn how to interpret, evaluate, present, and critique published research articles in various subfields of biology. Formerly BIOL 691. May be repeated up to three times for credit. Graded credit/no credit.

BIOL 6300. Advanced Topics in Molecular Biology. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
An in-depth consideration of selected research areas in molecular biology. May be repeated for credit as topics change. Formerly BIOL 600.

BIOL 6310. Advanced Topics in Cell Biology. Units: 2

Quarter Prerequisite: consent of instructor
An in-depth consideration of selected research areas in cell biology. May be repeated for credit as topics change. Formerly BIOL 605.

BIOL 6320. Advanced Topics in Plant Biology. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
An in-depth consideration of selected areas of current study in plant biology. May be repeated for credit as topics change. Formerly BIOL 620.

BIOL 6330. Advanced Topics in Zoology. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
An in-depth consideration of selected research areas in zoology. May be repeated for credit as topics change. Formerly BIOL 622.

BIOL 6340. Advanced Topics in Physiology. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
An in-depth consideration of selected research areas in physiology. May be repeated for credit as topics change. Formerly BIOL 624.

BIOL 6350. Advanced Topics in Immunology. Units: 2

Quarter Prerequisite: BIOL 573
An in-depth examination of current research in cellular and molecular immunology. May be repeated for credit as topics change. Formerly BIOL 677.

BIOL 6360. Advanced Topics in Microbiology. Units: 2

Semester Prerequisite: BIOL 2200 or BIOL 3200 and graduate standing in Biology. Quarter Prerequisite: BIOL 220 or BIOL 320
An in-depth examination of current research in microbiology. May be repeated for credit as topics change. Formerly BIOL 678.

BIOL 6370. Advanced Topics in Ecology. Units: 2

Semester Prerequisite: BIOL 3800 or equivalent, and graduate standing in Biology. Quarter Prerequisite: BIOL 450 or equivalent
Literature survey of specific topics related to community or ecosystem dynamics. May be repeated for credit as topics change. Formerly BIOL 670.

BIOL 6380. Advanced Topics in Evolution. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
Topics of current research interest in plant or animal evolution. May be repeated for credit as topics change. Formerly BIOL 680.

BIOL 6390. Advanced Topics in Genetics. Units: 2

Semester Prerequisite: Graduate standing in Biology. Quarter Prerequisite: consent of instructor
An in-depth consideration of selected research areas in genetics. May be repeated for credit as topics change. Formerly BIOL 650.

BIOL 6400. Advanced Topics in Biosystematics. Units: 2

Semester Prerequisite: Graduate standing in Biology, BIOL 3300, and one taxonomy-based course; eg BIOL 3520, 3410, 3460, 3420, or 3540.
Quarter Prerequisite: BIOL 423 and one taxonomy-based course; eg BIOL 319, 331, 335, 342, 353, or 354
Fundamental concepts of classification systems, biometric and experimental taxonomic procedures, nomenclature and systematic literature, both plant and animal materials used. Formerly BIOL 664.

BIOL 6490. Advanced Topics in Biology. Units: 2

Semester Prerequisite: Graduate standing in Biology
Selected topics and reviews of current investigations in the fields of biology. May be repeated for credit as topics change. Formerly BIOL 690.

BIOL 6930. Supervised Graduate Research in Biology. Unit: 1

Semester Prerequisite: Classified graduate standing in Biology. Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor
Laboratory and/or field research methods in biology. Instruction in methods and techniques in the student's subfield of biology, focusing on developing methods and direction for the thesis research. Students should take this course early in their graduate program. Formerly BIOL 692; students may not receive credit for both. Consent of instructor required. Graded credit/no credit.

BIOL 6940. Thesis proposal. Units: 3

Semester Prerequisite: BIOL 6020, BIOL 6930, and completion of at least 6 additional units toward the graduate degree
Research proposal development conducted under direction of the student's thesis mentor. To complete the course, students must successfully defend their thesis proposal. The written thesis proposal should explicitly state the research objectives, review the body of literature that motivates and justifies the research, describe appropriate research methods, and present preliminary data. The student will defend the thesis proposal with an oral presentation open to the public, followed by a private question and answer period with the thesis committee. Successful completion allows student to advance to candidacy. Consent of instructor required. Graded credit/no credit.

BIOL 6951. Independent Graduate Research in Biology. Unit: 1

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor
Original individual research in biology to be conducted under the supervision of a faculty member. Consent of instructor required. Formerly BIOL 696A. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit.

BIOL 6952. Independent Graduate Research in Biology. Units: 2

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor
Original individual research in biology to be conducted under the supervision of a faculty member. Consent of instructor required. Formerly BIOL 696B. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit.

BIOL 6953. Independent Graduate Research in Biology. Units: 3

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor
Original individual research in biology to be conducted under the supervision of a faculty member. Consent of instructor required. Formerly BIOL 696C. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit.

BIOL 6954. Independent Graduate Research in Biology. Units: 4

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor
Original individual research in biology to be conducted under the supervision of a faculty member. Formerly BIOL 696D. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit. Consent of instructor required.

BIOL 6955. Independent Graduate Research in Biology. Units: 5

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor

Original individual research in biology to be conducted under the supervision of a faculty member. Formerly BIOL 696E. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit. Consent of instructor required.

BIOL 6956. Independent Graduate Research in Biology. Units: 6

Quarter Prerequisite: classified standing in Masters Degree Program and consent of instructor

Original individual research in biology to be conducted under the supervision of a faculty member. Formerly BIOL 696F. May be repeated twice for credit. No more than six units of Independent Graduate Research (BIOL 6951-6956) may be applied toward degree requirements. Graded credit/no credit. Consent of instructor required.

BIOL 6970. Graduate Thesis. Units: 3

Semester Prerequisite: BIOL 6940

Preparation of the thesis for the Master of Science in Biology under the direction of a faculty member from the student's committee. Requirements: successful completion and defense of the thesis. Formerly offered as the combination of BIOL 699A, BIOL 699B and BIOL 699C. Consent of instructor required. Graded credit/no credit.

BIOL 6990. Continuous Enrollment for Graduate Candidacy Standing. Units: 0

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6991. Continuous Enrollment for Graduate Candidacy Standing. Unit: 1

Quarter Prerequisite: Advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6992. Continuous Enrollment for Graduate Candidacy Standing. Units: 2

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6993. Continuous Enrollment for Graduate Candidacy Standing. Units: 3

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6994. Continuous Enrollment for Graduate Candidacy Standing. Units: 4

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6995. Continuous Enrollment for Graduate Candidacy Standing. Units: 5

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.

BIOL 6996. Continuous Enrollment for Graduate Candidacy Standing. Units: 6

Quarter Prerequisite: advancement to candidacy and approval of program graduate coordinator or, if an interdisciplinary studies major, consent of the Dean of Graduate Studies

Independent study leading to completion of requirements (other than course work) for the master's degree. To retain classified standing in the master's program, a student must enroll in a Continuous Enrollment for Graduate Candidacy Standing course each quarter until the project or thesis is accepted or the comprehensive examination passed. Students who enroll through the university have full use of all university facilities. See Culminating Experience: Exam, Thesis, or Project in Graduate Degree and Program Requirements section of the Bulletin of Courses. Continuous Enrollment for Graduate Candidacy Standing is a variable unit course, see fee schedule in the Financial Information section of the Bulletin of Courses. Earned units are not degree-applicable nor will they qualify for financial aid.