**Biological Sciences**

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**Academic Programs**

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The department offers several undergraduate programs leading to Bachelor of Science degrees in Biological Sciences, Marine Sciences and Microbiology, and minors in Biology and Microbiology. For qualified students, a graduate program is available leading to a Master of Science or a Master of Arts degree. In addition, courses are offered to satisfy biology requirements in academic majors across campus.

The Biological Sciences department teaches courses with the following prefixes: BIO (Biology), BOT (Botany), MCR0 (Microbiology), MSC1 (Marine Science), and ZOO (Zoology).

The department is housed in modern facilities equipped with up-to-date instrumentation. Cal Poly's geographical setting offers unusual opportunities for studying representative plants and animals of both Northern and Southern California. Graduates of the various programs enter fields in teaching; laboratory technology; public health; biotechnology research and manufacturing; wildlife management; consulting; agriculture; industry; and private, state, and national park and forest services. A significant number of graduates enter graduate or professional schools for advanced study of botany, ecology, entomology, microbiology, plant pathology, zoology, marine sciences, veterinary science, cell and molecular biology, medicine, and dentistry. The department offers courses required for preprofessional training in medicine and paramedical fields.

Students majoring in Biological Sciences, Marine Sciences, or Microbiology may take advantage of opportunities to participate in research projects. Special opportunities are available through the Center for Applications in Biotechnology (CAB) that is developing biological tools to address environmental concerns through collaborative interdisciplinary research and education; the Center for Coastal Marine Science (CCMS) that promotes and facilitates basic and applied studies of coastal marine systems for the purposes of addressing environmental concerns and fostering hands-on learning through discovery and outreach; and the Undergraduate Biotechnology Laboratory (UBL), which is co-funded by Cal Poly and the National Science Foundation to provide undergraduates with hands-on experience with biotechnology. In addition, there are a large number of opportunities to work in the laboratory of individual faculty members in areas such as conservation, genetics and genomics, botany, ecology, endangered species, infectious disease mechanisms, developmental biology, anatomy, and physiology.

The department supports the concept of international education and encourages students to investigate opportunities for overseas study. For further information, see Cal Poly International Center (http://catalog.calpoly.edu/academicsupportandcampuslife/academicservicesandprograms/calpolyinternationalcenter).

**Undergraduate Programs**

**BS Biological Sciences**

The degree offers students a broad education in biology from molecules to ecosystems, with an emphasis on hands-on training in the laboratory and the field. Biology majors can gain preprofessional preparation in the biomedical fields, coursework toward a teaching credential, progress toward professional certification, and/or preparation for graduate training in a field of interest. In addition to the core coursework for the biology major, students may choose a concentration in order to gain a deep, focused understanding of a specific subfield within biology, or may follow the general curriculum in biology for broader exposure to a variety of topics. Students are encouraged to consult with a faculty advisor and the College of Science and Mathematics Advising Center to help them learn about their chosen degree program, concentration choices, career options, study skills, and departmental opportunities. Students interested in teaching may choose any concentration and should contact the single subject credential advisor for information about teaching opportunities and recommended coursework.

**Concentrations**

**Anatomy and Physiology**

Students in this concentration study biological sciences with an emphasis on the structure and function of humans and other animals. This concentration is ideal for students preparing for careers in the health professions.

**Ecology**

The study of ecology spans a wide breadth of habitats, from terrestrial to marine, and multiple scales of organization, from microbial interactions to global processes. As such, the ecology concentration allows flexibility for students to design a program to fit their interests and career goals within this broad discipline. The concentration emphasizes collection and analysis of data to better understand the factors that affect the distribution and abundance of organisms. In many contexts, these results are used to identify and solve environmental problems. Graduates may pursue careers in education, ecological consulting, planning or coordination, habitat restoration, or environmental law. A graduate may be academically qualified for professional certification as an Associate Ecologist by the Ecological Society of America.

**Marine Biology and Conservation**

Prepares students for advanced training or professional employment in public or private agencies concerned with marine sciences, freshwater ecology, fisheries biology, fisheries management, or related fields. By judicious selection of electives, the student is academically prepared to apply for professional certification as a Fisheries Biologist by the American Fisheries Society.

**Molecular and Cellular Biology**

Designed for students who are interested in how genes and their products work to create and maintain cells, tissues and organisms. This concentration augments the diverse biological sciences curriculum with laboratory courses in nucleic acid and protein techniques, along with cell biology, biochemistry, and electives such as bioinformatics, microbial biotechnology, immunology, developmental biology and virology. This concentration is ideal for
students interested in biotechnology or biomedical research, and is also an excellent option for students planning future studies in the health professions. Students selecting this concentration are not eligible for the Biotechnology Minor.

**Wildlife and Biodiversity Conservation**

The purpose is to prepare students in the skills necessary to participate in the conservation of wildlife, plants, and other wild species and their habitats. Professions in this arena include N.G.O., state and federal resource management agencies, private consulting firms, and research. These professions require a solid foundation in the identification of wild species, the principles of ecology, and the tools, policies and social context of conservation. This area of concentration may help students meet the requirements for professional certification established by off-campus entities such as The Wildlife Society and the Ecological Society of America; students interested in such certification programs should consult with their faculty advisor for specific programmatic guidance.

**General Curriculum in Biology**

A General Curriculum in Biology is also an option. It is not a concentration but can be used to fulfill the unit requirements of a concentration. Students are encouraged to select from one of the concentrations listed above but those who do not declare a concentration will default to the General Curriculum.

**BS Marine Sciences**

*New program, effective Fall 2016*

The degree is an integrative program designed to prepare students for advanced training or professional employment in public or private agencies concerned with marine-related issues. While this degree is based in Biological Sciences, the program includes faculty from other disciplines including chemistry, physics, mathematics, engineering, and computer science. The degree instills students with critical thinking and analytical skills in areas such as marine organism physiology, conservation, fisheries, oceanographic sampling and data networks. Through the use of experience-based learning including faculty-led research projects, students will develop essential knowledge as well as a solid foundation in community-oriented education in the interdisciplinary field of marine sciences.

**BS Microbiology**

Microbiology is the study of bacteria, viruses, fungi, and protists. Microorganisms are ubiquitous in the environment as important contributors to nutrient cycling, and many have symbiotic relationships with other organisms. Species of medical importance impact human and animal health as pathogens associated with infectious diseases. Additionally, microorganisms are critical research tools in fields such as molecular biology and genetics, and are used for large-scale production of many foods, pharmaceuticals, and industrial chemicals. Cal Poly is one of the few public universities in California offering a laboratory-intensive Bachelor of Science degree in Microbiology.

In the junior and senior years, majors take specialized courses in medical microbiology, immunology, microbial physiology, genetics, virology, and cell biology. Students also choose elective courses related to student interests and career goals in close consultation with their faculty advisor. Such goals may include graduate school or professional studies with further training through Clinical Laboratory Scientist (CLS) or Public Health Microbiologist certification programs. Graduates may also pursue post-baccalaureate employment in applied areas such as industrial microbiology, food and dairy microbiology, biotechnology, public health, epidemiology, or medical laboratory technology.

**Biology Minor**

The purpose of the minor is to help students from other disciplines acquire increased factual and conceptual knowledge in biology, an increased understanding of scientific methods and techniques used to study biology, and an increased ability to analyze biological topics in the news or in various jobs. Biological issues are important throughout modern life and particularly relevant in many careers, including those in health-related businesses, agriculture, several engineering disciplines, city planning, teaching K-12 students, journalism, political science, psychology, and statistics. Students in more closely related majors such as biochemistry or kinesiology may also be interested in strengthening their biology background. In addition, an enhanced biology background helps students become better educated citizens regarding a variety of controversial issues in modern society (e.g., genetically-modified organisms in agriculture, human cloning, genetic discrimination, the pressures of population growth).

**Biotechnology Minor**

For information regarding the Biotechnology Minor, please see College of Science and Mathematics (http://catalog.calpoly.edu/collegesandprograms/collegeofsciencemathematics) section.

**Microbiology Minor**

This minor is designed to give students, from majors in which microbiology may be an important component, increased exposure to factual information, concepts, and skills and to provide those students a more complete understanding of the roles of microorganisms as they pertain to their major. Students in the allied health and related fields may expand their breadth of knowledge in microbial diseases, transmission and prevention, and immunologic responses. Students in applied fields of study such as Food and Dairy Sciences and various aspects of agriculture can gain additional information in pertinent topics such as the presence and role of microorganisms in water and wastewater treatment, in recycling of nutrients and soil fertility, in food processing, spoilage, and production, and in disease transmission.

**Graduate Programs**

**Master of Arts Degree in Biological Sciences**

**General Characteristics**

This degree offers a broad background in the biological sciences. The program is designed to offer sufficient breadth and depth to strengthen the student’s academic understanding and improve competence for:

1. many types of biological work that require advanced training beyond the bachelor’s degree;
2. careers in industry and/or civil service;
3. teaching biological sciences at the elementary, secondary, and community college levels.

This degree differs from the MS in Biological Sciences in that a research thesis is not required.

Last updated: 01/29/16
Prerequisites

Admission to this program requires a minimum grade point average of 3.0 in the last 90 quarter units attempted, submission of satisfactory scores on the Graduate Record Examination (GRE), and two letters of recommendation from persons knowing your academic potential.

Advancement to candidacy requires a satisfactory background in biology, and completion of 12 units of courses specified in an informal study plan with a minimum grade point average of 3.0. Information pertaining to specific departmental requirements for admission classified or conditionally classified may be obtained from the Director of the Graduate and Research Committee (Graduate Coordinator) of the Biological Sciences Department.

Program of Study

The formal program of study for the degree must include 45 units of committee-approved graduate work, at least 30 units of which must be at the 500 level. A grade point average of 3.0 or better is required from the combination of all courses included in the Formal Study Plan. Coursework must include 32 units within the Biological Sciences Department at Cal Poly. Only 4 units of BIO 575 College Teaching Practicum can be used; a maximum of 3 units of BIO 590 Seminar in Biology can be used in the Formal Study Plan. To complete the degree the GRE Advanced Biology exam must be passed with a score of 650 or higher. The culminating experience is a comprehensive written exam covering three areas of biology.

Master of Science Degree in Biological Sciences

General Characteristics

This degree offers a broad background in the biological sciences. The program is designed to offer sufficient breadth and depth to strengthen the student's academic understanding and improve competence for:

1. many types of biological work that require advanced training beyond the bachelor's degree;
2. careers in industry and/or civil service;
3. teaching biological sciences at the elementary, secondary, and community college levels;
4. independent research in the field of specialization;
5. continued graduate work at other institutions.

Prerequisites

Admission to this program requires a minimum grade point average of 3.0 in the last 90 quarter units attempted, submission of satisfactory Graduate Record Examination (GRE) scores, and two letters of recommendation from persons knowing your academic potential.

Information pertaining to specific departmental requirements for admission classified or conditionally classified may be obtained from the Director of the Graduate and Research Committee (Graduate Coordinator) of the Biological Sciences Department.

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The formal program of study for the degree must include 45 units of committee-approved graduate work, at least 30 units of which must be at the 500 level. Coursework must include 32 units taken within the Biological Sciences Department at Cal Poly. A grade point average of 3.0 or better is required from the combination of all courses included in the Formal Study Plan. A maximum of 3 units of BIO 590 Seminar in Biology, and a maximum of 3 units of BIO 500 Individual Study may be used as credit towards the degree. The culminating experience is a written and publicly presented independent and novel body of research, and nine units of BIO 599 Thesis. To complete the degree the GRE Advanced Biology exam must be passed with a score of 650 or better.

MS Biological Sciences, Specialization in Regenerative Medicine

Characteristics. Prepares students for careers in regenerative medicine and related fields. Specifically, our graduates are prepared for immediate employment in regenerative medicine, biotechnology or medical technology companies, or as research specialists/laboratory managers at universities and research institutes. Program graduates are also well-prepared to matriculate into biological sciences doctoral programs or graduate programs in the health professions.

Culminating Experience. Students who obtain a degree in the Master of Science in Biological Sciences with a specialization in Regenerative Medicine are not required to complete the GRE Advanced Biology exam or BIO 599. In place of the thesis as a culminating experience, students are required to complete a non-traditional Comprehensive Exam. This non-traditional Comprehensive Exam includes a 9-month internship at a company or academic research laboratory (BIO 593), a quarter-long project course at Cal Poly (BIO 594), a written report and oral presentation of the internship project, and a written report and oral presentation of the final quarter-long project. Through the completion of these components, students demonstrate their ability to integrate the knowledge of the area, show critical and independent thinking, and demonstrate mastery of the subject matter.