

BIOLOGICAL SCIENCES

<http://www.pacific.edu/college/biology>

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Location: Biology Building, South Campus

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Programs Offered

Master of Science in Biological Sciences

For a graduate degree in the Department of Biological Sciences, the candidate may take a broadly based program in biology or may specialize in areas such as molecular and cellular biology, physiology or ecology.

Candidates for the master of science degree in biological sciences must hold a bachelor's degree that includes the equivalent of the baccalaureate program in biology at University of the Pacific. Candidates holding the bachelor's degree with a major in fields other than biology may be accepted provided deficiencies in biology are made up.

Knowledge

Demonstrate knowledge of research methods and skill to design and implement research studies in the biological sciences.

Communication

Demonstrate written, oral and interpersonal communication skills as needed for advanced study, teaching and research.

Teamwork

Develop collaboration, leadership, and intercultural skills as needed to participate in research studies, work productively with colleagues, and/or teach.

Breadth

Demonstrate broad knowledge of the biological sciences and deep knowledge of one or more areas of concentration, including molecular and cellular biology, physiology, microbiology, ecology, paleontology, and plant and animal systematics.

Ethics

Develop ethical reasoning as needed to design and carry out research and function successfully within the broad field of the biological sciences.

Professionalism

Demonstrate oral and written communication skills necessary for entry into the profession or further study.

Master of Science in Biological Sciences

Students must complete a minimum of 32 units with a Pacific cumulative grade point average of 3.0 in order to earn the master of science degree in biological sciences.

I. Required Graduate Courses

Select one of the following Techniques/Methods Course: 4

BIOL 259	Molecular Biological Techniques	
BIOL 271	Methods in Field Biology	
BIOL 295	Graduate Seminar	4

Note: 1) Students who have received credit for BIOL 159 or BIOL 171 with a grade of B or better prior to entering the graduate

program cannot take BIOL 259 or BIOL 271, respectively. With program director consent, these students must take either the alternative Techniques/Methods class (i.e., students with credit for BIOL 159 can take BIOL 271, and vice versa), or an additional 4 unit BIOL elective numbered 200 or above (see "Electives" below). **2)** All biology graduate students must take two semesters of BIOL 295.

II. Thesis/Research

Minimum of 8 units

BIOL 297	Graduate Research	4-6
BIOL 299	Thesis	2 or 4

III. Electives

BIOL Electives (3 courses numbered 200 or above excluding BIOL 291, BIOL 295, BIOL 297, and BIOL 299) 12

Note: 1) With program director permission, students may substitute BIOL 291 for one BIOL elective. **2)** With program director permission, students may substitute one 100-level BIOL course (excluding BIOL 191 and BIOL 197) for one graduate-level BIOL elective. **3)** Students may count a maximum of six (6) units of BIOL 297 toward their degree. **4)** Students are encouraged, where appropriate, to select courses offered by other departments or units of the University, such as Chemistry or the Thomas J. Long School of Pharmacy and Health Sciences.

Biological Sciences Courses

BIOL 101. Genetics. 5 Units.

Emphasis of study is heritable variations and their relation to structure, behavior and function of genetic material. This basic course is for students concentrating on biological sciences, medical sciences and liberal arts. In addition to lecture, one-three hour laboratory per week is required. Prerequisites: BIOL 051 and BIOL 061. Recommended: Sophomore standing.

BIOL 111. Anatomy and Physiology. 4 Units.

This lecture and laboratory course covers the structure and function of the major physiological systems of the human body, and it is intended primarily for students in the Dental Hygiene program. Students taking BIOL 111 do not receive credit for either BIOL 071 or BIOL 081. Prerequisites: BIOL 051 and BIOL 061.

BIOL 122. Principles of Immunology. 4 Units.

The fundamental properties of antigens and antibodies are covered with an emphasis on the theories of antibody production, tolerance, transplantation immunity, autoimmunity and tumor immunology. Prerequisites: BIOL 101 and CHEM 121.

BIOL 124. Cancer Biology. 4 Units.

The course examines the morphological and molecular events that accompany the changes of a normal mammalian cell into a cancer cell, with an emphasis on the major pathways that affect cell growth and division, cell communication, cell death and metastasis. Prerequisite: BIOL 101.

BIOL 126. Neurobiology. 4 Units.

This course focuses on the molecular and cell biology of neuronal function and development, and how neurons work together to retrieve and process information and respond accordingly, with thorough discussions of sensory and motor systems and a brief review of more complex brain functions, such as emotions, speech and language, and memory. Prerequisites: BIOL 051 and BIOL 061.

BIOL 128. Histology. 4 Units.

A study of the tissues which comprise the organs of the body is the focus. This course is limited to human tissues. Thin sections of organs will be studied and their structure related to function. Credit only given once for BIOL 128 or BIOL 129. Prerequisites: BIOL 051 and BIOL 061.

BIOL 129. Histology Online. 3 Units.

This is a non-lab, online version of BIOL 128. Credit is only given once for BIOL 128 or BIOL 129. Prerequisites: BIOL 051 and BIOL 061. Recommended: BIOL 101.

BIOL 130. Plant Kingdom. 4 Units.

Through lectures, laboratories and field trips, students are introduced to the morphology, reproduction biology and environmental requirements of all major groups of plants. Included are material bearing on the evolutionary relationships within and between each major group. Individual projects are required. Prerequisites: BIOL 051 and BIOL 061. (ENST)

BIOL 134. Comparative Physiology. 4 Units.

This course is a detailed review of organ function in diverse groups of organisms. Emphasis is on physiological adaptation to the environment. Prerequisites: BIOL 051 and BIOL 061.

BIOL 145. Microbiology. 5 Units.

The biology of microorganisms is studied with emphasis on viruses, bacteria, fungi and protozoa. In addition to lecture, one three-hour laboratory per week is required. Prerequisites: BIOL 051, BIOL 061; CHEM 025, CHEM 027.

BIOL 146. Industrial Microbiology. 4 Units.

An in-depth knowledge of the industrial applications of microorganisms. The course uses an understanding of microbial physiology and genetics to illustrate how these organisms are utilized to create commercial products ranging from medicines to food products. Prerequisite: BIOL 145.

BIOL 147. Medical Microbiology. 4 Units.

Medical microbiology covers a survey of microorganisms implicated in human disease; emphasis on characteristics and properties of microorganisms, chiefly bacteria and fungi which are responsible for pathogenesis. Laboratory includes methods of isolation, characterization, and identification of bacteria and fungi responsible for human disease. Prerequisites: BIOL 145 and CHEM 121 with a C- or higher or permission of instructor.

BIOL 151. Parasitology. 4 Units.

Principles of parasitism as well as biology of animal parasites with special emphasis on the protozoa, platyhelminths, nematodes, acanthocephala and arthropods are studied. Techniques of recovery of parasites from various vertebrate hosts are introduced including staining, mounting and identification. Prerequisites: BIOL 051, BIOL 061, BIOL 101. (ENST)

BIOL 153. Cell Biology. 4 Units.

Cell Biology studies cell structure and function with emphasis on the dynamic nature of the cellular environment and the methodologies of cell biology. The experimental basis of our present understanding of the cell is also stressed. Prerequisites: BIOL 051, BIOL 061, BIOL 101, CHEM 025 and CHEM 027. Recommended: Organic chemistry.

BIOL 155. Biological Electron Microscopy. 4 Units.

The process and techniques involved in examining biological specimens with the transmission electron microscope will be covered in detail. When competence in specimen processing is achieved, each student performs an original experiment as a term project. Prerequisites: BIOL 051, BIOL 061, CHEM 025, CHEM 027. Recommended: BIOL 101.

BIOL 157. Topics in Biomedical Research. 4 Units.

Basic research in the areas of cell biology, biochemistry, molecular biology and physiology are examined in their applications to current problems in medicine. Topics covered include genetic engineering, gene therapy, transplants and cloning. Prerequisites: BIOL 051, BIOL 061, BIOL 101; CHEM 121.

BIOL 159. Molecular Biological Techniques. 4 Units.

This advanced laboratory course in the methods of molecular biology, has an emphasis on modern techniques and their application in the laboratory. Topics covered include gene cloning, protein expression systems, nucleic acid isolation and purification, and basic methods of bioinformatics. Prerequisites: BIOL 101 and CHEM 121 with a "C-" or higher.

BIOL 162. Comparative Vertebrate Anatomy. 5 Units.

The evolution of vertebrate organ systems as revealed by comparative morphology are emphasized. Prerequisites: BIOL 051 and BIOL 061. Recommended: BIOL 101.

BIOL 165. Embryology and Development. 4 Units.

This laboratory course focuses on the events that occur as a single-celled embryo develops into an adult organism. Developmental processes are studied at the descriptive and mechanistic levels, leading to an understanding of how and why complex structures are produced. Major emphases is placed on animal embryology (both vertebrate and invertebrate) leading to the production to tissues, organs and organ systems. Later developmental processes also are studied, as well as sex determination. Additional topics include cancer and evolution as seen in the context of development. Prerequisites: BIOL 051, BIOL 061, BIOL 101.

BIOL 169. Elements of Biochemistry. 4 Units.

The field of biochemistry is the focus in this non-lab course that is designed as a preparation for students who will attend a Pharmacy or Dental School. Topics include nucleic acid and protein structure and synthesis, intermediary metabolism, enzyme action, and synthesis and degradation of important biological molecules. The relationship of biochemistry, nutrition, and human disease is discussed. This course does not count for the Biochemistry major. Prerequisites: BIOL 051, BIOL 061, BIOL 101, CHEM 123 with a "C-" or higher.

BIOL 170. Human Anatomy. 5 Units.

This course is a study of the structure of the organ systems of humans. In addition to lecture, one three-hour laboratory per week is required. Credit will not be given if a student has taken BIOL 111. Prerequisites: BIOL 051 and BIOL 061.

BIOL 171. Methods in Field Biology. 4 Units.

A course focused on methods of biological investigation with emphasis on modern field sampling techniques and instrumentation. Students are trained in experimental design and quantitative data analysis used to address a range of biological questions. Prerequisites: BIOL 051 and BIOL 061 with a "D" or better. (ENST)

BIOL 175. Ecology. 5 Units.

The structure and dynamics of populations, biotic communities and ecosystems, is emphasized with particular focus upon relationships of organisms to their environments. Prerequisites: BIOL 051 and BIOL 061. (ENST)

BIOL 176. Ecology and Conservation Biology. 4 Units.

The principles of ecology are introduced with attention to consider threats and disruptions to ecological systems from the level of local populations through ecosystems, landscapes, and global processes. Ecological principles are used to help understand these systems, to make predictions for the future or for other systems, and to evaluate possible solutions. The class considers the importance of economic and demographic forces in causing conservation problems and in shaping conservation strategies, and students practice planning conservation areas. Prerequisite: BIOL 051. (ENST)

BIOL 177. Natural Medicines. 4 Units.

A lab course that surveys drugs found in nature, in particular their history, uses, and mode of action, and is designed as a preparation for students who will attend a Pharmacy or Dental School. Topics include history of medicine, survey of natural compounds relevant to pharmacology, and survey of naturally-derived drugs used to treat cancer, heart disease, and neurological disorders. Prerequisites: BIOL 051, BIOL 061, BIOL 101, CHEM 123 with a "C-" or higher.

BIOL 179. Evolution. 4 Units.

Lectures and readings on the mechanisms of evolutionary change in organisms are the focus. Prerequisites: BIOL 051 and BIOL 061. Recommended: BIOL 101.

BIOL 180. Human Physiology. 5 Units.

This course is a lecture- and laboratory-based review of the functions of the major organ systems of vertebrates with emphasis on the human body. Lab exercises demonstrate basic physiological processes in the human body and emphasize techniques of instrumental data acquisition and data presentation. Credit will not be given if a student has taken BIOL 111. Prerequisites: BIOL 061; CHEM 023, CHEM 025. Recommended: one semester of genetics.

BIOL 182. Medical Endocrinology. 4 Units.

This lecture/lab course presents the fundamentals and current topics in human endocrinology from a medical and clinical perspective. Lectures cover normal endocrine physiology, endocrine diseases, diagnostic rubrics for patient assessment/disease evaluation, and current treatment recommendations. Lab is divided into two units: (1) Histology of healthy endocrine glands and histopathology of diseased endocrine glands; and (2) Developing patient assessment/diagnosis skills using computer "virtual patients." Prerequisites: BIOL 051, BIOL 061, CHEM 025 and CHEM 027. Recommended: BIOL 71 or 81 or BIOL 128.

BIOL 185. Comparative Animal Behavior. 4 Units.

The ecology and evolution of animal behavior are discussed. Laboratory involves a quantitative study of animal behavior at Micke Grove Zoo. Prerequisites: BIOL 051 and BIOL 061. Junior standing in Biological Sciences or Psychology.

BIOL 186. Hormones and Behavior. 4 Units.

An on-line reading/discussion/writing course focusing on the bidirectional interactions between an animal's behaviors and its endocrine system. Topics include: overview of the vertebrate endocrine system, biological sex and gender issues, courtship and sex behaviors, parenting behavior, pheromonal communication, aggression and other social behaviors, learning and memory, hunger, stress, and biological rhythms. Discussions also analyze current research publications, research methodologies, and results. Students practice scientific writing and prepare a 10-12 page research paper. This course counts as an upper division elective in the Biology major and as an elective in the Gender Studies degree. Prerequisites: BIOL 051 and BIOL 061. (GEND)

BIOL 191. Independent Study. 2-4 Units.**BIOL 197. Undergraduate Research. 1-4 Units.****BIOL 222. Immunology. 4 Units.**

Students study immunoglobulin structure, function, and expression in animals. Molecular and cellular mechanisms of humoral immune response, cell-mediated immunity, complement system, autoimmune diseases, tolerance induction, transplantations, cancer immunity, vaccines, and cytokine actions are also emphasized. Graduate standing.

BIOL 224. Cancer Biology. 4 Units.

The course examines the morphological and molecular events that accompany the change of a normal mammalian cell into a cancer cell, with an emphasis on the major pathways that affect cell growth and division, cell communication, cell death and metastasis.

BIOL 226. Neurobiology. 4 Units.

The course focuses on the molecular and cell biology of neuronal function and development, and how neurons work together to retrieve and process information and respond accordingly. It involves thorough discussions of sensory and motor systems and a brief review of more complex brain functions, such as emotions, speech and language, and memory.

BIOL 234. Comparative Physiology. 4 Units.

This course offers a detailed review of organ function in diverse groups of organisms. Emphasis is on physiological adaptation to the environment. Graduate standing.

BIOL 244. Developmental Biology. 4 Units.

Students examine the genetic control of development and the physiological mechanisms involved in fertilization and differentiation. Graduate standing.

BIOL 246. Industrial Microbiology. 4 Units.

An in-depth knowledge of the industrial applications of microorganisms. The course uses an understanding of microbial physiology and genetics to illustrate how these organisms are utilized to create commercial products ranging from medicines to food products. Prerequisite: BIOL 145.

BIOL 247. Medical Microbiology. 4 Units.

This course content is the same as BIOL 147 with three additional hours per week of seminar and/or special project. Graduate standing.

BIOL 251. Parasitology. 4 Units.

This course content is the same as BIOL 151. Principles of parasitism, biology of animal parasites with special emphasis on the protozoa, nematodes, helminths, acanthocephala, and arthropods are covered with three additional hours per week of seminar and/or special project. Graduate standing.

BIOL 253. Cell Biology. 4 Units.

This course content is the same as BIOL 153. Students take an in-depth look at the structure and function of a cell with an emphasis on the methodologies of Cell Biology. Research-based current understanding of the topics is stressed and a special project is required. Graduate standing.

BIOL 255. Biological Electron Microscopy. 4 Units.

This course content is the same as BIOL 155. The processes and techniques involved in examining biological specimens with the transmission electron microscope are covered in detail. When competence in specimen processing is achieved, each student performs an original experiment as a term project. Graduate standing.

BIOL 259. Molecular Biological Techniques. 4 Units.

This is an advanced laboratory course in the methods of molecular biology, with emphasis on modern techniques and their application in the laboratory. Topics covered include gene cloning, protein expression systems, nucleic acid isolation and purification, and basic methods of bioinformatics. Graduate standing.

BIOL 271. Methods in Field Biology. 4 Units.

This is a course focused on methods of biological investigation with emphasis on modern field sampling techniques and instrumentation. Students are trained in experimental design and quantitative data analysis used to address a range of biological questions. Graduate standing.

BIOL 274. Biology of Insects. 4 Units.

A lecture and laboratory introduce a broad study of the structure and function of insects, the most diverse terrestrial organisms with over 1 million described species. The course includes a study of their anatomy, physiology, ecology, evolution, reproduction, behavior, and relation to humans. The laboratory work includes field trips in addition to the preparation of 50 classified insects. Project assignments include but are not limited to identification of taxa of interest, and analysis of insect data related to student interests.

BIOL 279. Evolution. 4 Units.

This course content is the same as BIOL 179 and a special project is required. Graduate standing.

BIOL 282. Medical Endocrinology. 4 Units.

This lecture/lab course presents the fundamentals and current topics in human endocrinology from a medical and clinical perspective. Lectures cover normal endocrine physiology, endocrine diseases, diagnostic rubrics for patient assessment/disease evaluation, and current treatment recommendations. Lab is divided into two units: (1) histology of healthy endocrine glands and histopathology of diseased endocrine glands; and (2) developing patient assessment/diagnosis skills using computer "virtual patients." Prerequisites: Graduate Standing.

BIOL 291. Independent Study. 2 or 4 Units.

BIOL 295. Graduate Seminar. 4 Units.

BIOL 297. Graduate Research. 1-6 Units.

BIOL 299. Thesis. 2 or 4 Units.