# BIO - BIOLOGY

**BIO 6001 Graduate Internship in Biology (1-6 Units)**
This course is an elective option allowing students to gain research/lab experience through internships at a variety of local businesses/organizations.
May be repeated up to a total of six (6) units. Credit/No Credit.

**BIO 6011 Learning in Science (3 Units)**
This course involves discussion and integration of seminal papers in the area of learning theory, with applications in a variety of scientific research, business, and educational settings.
Predominantly online course delivery.

**BIO 6021 Readings in Biology (1 Unit)**
This course focuses on the reading and discussion of research articles and other sources of material on a particular topic in biology. Topics vary. May be repeated up to four (4) units as long as the content is different. Credit/No Credit.

**BIO 6033 History/Philosophy of Science (3 Units)**
This course involves discussion of seminal works in the history and philosophy of science as a way of thinking. From this perspective, the course explores current interest in the nature of science as an integral part of the study of science.
Predominantly online course delivery.

**BIO 6043 Research Design in Science Education (3 Units)**
This course promotes understanding of both qualitative and quantitative research design in science education, with a focus on current trends in the field.
Predominantly online course delivery.

**BIO 6060 Microbiology and Immunology (3 Units)**
Concepts in microbiology, including the diversity and ecology of microscopic organisms, and in immunology, focusing on cellular and molecular regulation of the immune system in health and disease, are addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6061 Ecology of Plants and Animals (3 Units)**
Concepts related to complex ecological systems with special emphasis on the interactions between plants and animals are addressed from the perspective of teaching for conceptual understanding.
Lecture and field-oriented lab.

**BIO 6062 Genetics and Molecular Biology (3 Units)**
Concepts in genetics and molecular biology, including inheritance, organization, variability and expression of genes, with emphasis on the regulatory mechanisms that govern gene expression in eukaryotic and prokaryotic cells, are addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6063 Cell Biology (3 Units)**
Concepts in cell biology, including the chemical basis of life, the structure and function of organelles, basic metabolic pathways, models for the origin of cells are addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6064 Developmental Biology (3 Units)**
Concepts emerging from the union of the two disciplines of evolution and development that help us better understand both the process of development and of the diversity of life forms are central to this course. Emphasis will be placed on the concepts of modularity, developmental master control genes (toolkit genes) and genetic switches that are the keys to explaining how the diversity within the body plans of animals develop. These topics will be addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6065 Physiology of Plants and Animals (3 Units)**
Concepts related to the physiological mechanisms that contribute to homeostasis in both plants and animals are addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6067 Marine Biology (3 Units)**
Concepts in marine biology, including the ecology, function, and adaptations of marine organisms, are addressed from the perspective of teaching for conceptual understanding.
Lecture and field-oriented lab.

**BIO 6068 Evolutionary Biology (3 Units)**
The concept of evolution is viewed as the central theme unifying all of biology. In this course evolutionary processes will be discussed in their genetic, historical, religious, and ecological contexts. Topics covered include the agents of evolution, speciation, population genetics, and macroevolutionary trends in evolution. These topics will be addressed from the perspective of teaching for conceptual understanding.
Lecture and lab.

**BIO 6082 Research Proposal and Pilot Study (1 Unit)**
Students identify a biology or biology education-related research problem, then prepare a brief literature review and research design, followed by carrying out a pilot study with abbreviated analysis.
Predominantly online course delivery.

**BIO 6083 (A,B,C,D,E,F) Thesis (1-6 Units)**
Students write a thorough literature review and bibliography related to their chosen biology education problem, then design, carry out, and analyze the results of their original research, draw conclusions, and propose implications of their findings. This process culminates with the completion of the student's written thesis, as well as a public presentation of the research. Students register for each thesis unit (6083 A through F) in sequence (A through F) corresponding to the 6 units necessary to complete the thesis requirement. Students may register for as many as three thesis units in a single semester (i.e., 6083A, 6083B, and 6083C) or as few as one unit. At the end of each semester a grade of Credit/No Credit is issued reflecting the student's satisfactory progress toward thesis completion. If in the final semester (BIO 6083F) of thesis enrollment the student has not completed all requirements for the thesis, the student is automatically enrolled in thesis extension status for each subsequent semester until the thesis is completed.
Credit/No Credit.
**Fee:** A thesis extension fee is charged (see fee schedule) for each semester of thesis extension.

**BIO 6084 Comprehensive Examination in General Biology (0 Units)**
This exam is required for general biology students to complete their graduation requirements if the thesis option is not chosen.
Credit/No Credit.

**BIO 6090 Special Studies in Biology (1-3 Units)**
Selected studies in the area of biology as determined by the Department of Biology.
May be repeated for credit up to a maximum of eight (8) units as long as the content is different.
**Prerequisite(s):** Permission is required from the Chair of the Department of Biology and the course faculty. The student must be in good academic standing.

**BIO 6092 Perspectives on Science (1 Unit)**
Perspectives on Science is a monthly seminar series with speakers from research institutions and universities which address current research in their fields, including chemistry, biology, physics, astronomy, and geology. Following the seminar, students discuss research articles by the speaker. May be repeated for a total of six (6) units. Credit/No Credit.

**BIO 6123 Leadership in Science (3 Units)**
This course explores the development of a theoretical basis of the intrinsic and extrinsic motivations for exceptional performance. Students analyze the ways leadership and culture shape an organization's environment and history. Different leadership styles, personal leadership effectiveness, and both historical and contemporary leadership literature will be examined. Case studies relevant to academic biology departments, life science research labs, biotechnology companies, and biology-related non-profit organizations will be included.

**BIO 6163 Methods of Teaching Secondary Science (3 Units)**
This methodology course is designed to prepare students to teach secondary-level (Grades 7-12) and college-level science. This course includes lesson planning, intentional practice of classroom management, micro-teaching, classroom observation, group and self-evaluation, active and equitable participation for culturally, ethnically, linguistically, and academically diverse learners, and formative assessment to differentiate instruction for all learners. Topics include the following: pedagogical content knowledge, curriculum selection and design, methods and modalities of science teaching, assessment, classroom application of various forms of technology, safe laboratory management and operation, integration of language arts and mathematics in the science curriculum, and professional organizations. Instruction is aligned to the state-adopted Science Common Core Standards (7-12) and the Next Generation English Language Development Standards, and relevance to college course teaching is incorporated. Modifications for diverse learners and learners with exceptionalities are researched. [AC1] Equivalent to EDU 4034 (undergraduate level) or EDU 6024 (graduate level). PLNU students who complete BIO 4063 are exempt from taking EDU 4034 or EDU 6024 for their preliminary single subject credential.
Undergraduate students that are eligible may take this course as BIO 4063. Students with credit for BIO 4063, EDU 4034, or EDU 6024 are not eligible for this course.