

# BIO - BIOLOGY

## **BIO 1001 Human Biology and Bioethics (GE) (3 Units)**

An exploration of assorted topics in human biology as they intersect with bioethical and sustainability issues of current interest in society. Topics include human physiology, health, reproduction, genetics, cell biology/biochemistry, evolution and ecology. Course examines the underlying scientific basis of specific examples and how they relate to everyday life. Course approach emphasizes the process of science, critical thinking, active learning, social relevancy, and building connections between case studies and general concepts of biology.

Letter grade.

**Corequisite(s):** BIO 1001L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.  
(GELO1D)

## **BIO 1001L Human Biology and Bioethics Lab (GE) (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 1001. Letter grade.

**Corequisite(s):** BIO 1001  
(GELO1D)

## **BIO 1002 Environment and People (GE) (4 Units)**

A systematic overview of major topics in global ecology as experienced by people in the developing world, both the problems they face and the successful actions of communities to solve those problems. Introduces creation care and sustainable development as key concepts needed to overcome the challenges and build hope for the future. Includes such topics as population growth, food and agriculture, land degradation, urbanization, sanitation, health care, biodiversity, climate change, consumerism, and the implications for wise resource management, green economics, and governmental policy. Course approach emphasizes the process of science, critical thinking, active learning, social relevancy, and building connections between case studies and general concepts. Students engage in weekly readings, film discussions, and a term paper project.

Letter grade.

(GELO1A)

## **BIO 1003 Introduction to Biology (GE) (3 Units)**

Designed to meet the requirements for the California Multiple Subject Teaching Credential for teaching grades K-8 (but open to all students). The subject areas include zoology, botany, physiology, cell structure, ecology, genetics, and evolution. Course explores major themes in these subject areas as they relate to everyday life, ethical concerns, conservation issues, and common misunderstandings. Course approach emphasizes the process of science, critical thinking, active learning, social relevancy, and building connections between case studies and general concepts of biology.

Letter grade.

**Corequisite(s):** BIO 1003L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.  
(GELO1D)

## **BIO 1003L Introduction to Biology Lab (GE) (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 1003. Letter grade.

**Corequisite(s):** BIO 1003  
(GELO1D)

## **BIO 1004 Biotechnology and Society (GE) (4 Units)**

An examination of current topics in biotechnology as they impact society, bioethics, and sustainable living. Course addresses the questions "What is biotechnology?", "How does it work?", and "How does it affect our lives?" Topics may include genetic engineering, gene amplification, genome projects, gene therapy, DNA fingerprinting, cloning, assisted reproductive technology, genetic screening, recombinant DNA, knock-outs, AIDS research, and GM foods. Course approach emphasizes the process of science, critical thinking, active learning, social relevancy, and building connections between case studies and general concepts of biology.

Letter grade.

(GELO1C)

## **BIO 1005 Ecology and Conservation (GE) (3 Units)**

A wide-ranging exploration of major topics in ecological science relating to current issues in conservation biology. Drawing from academic and applied fields, the course examines major concepts in conservation biology and their impact on society, public policy, wise management of natural resources, consumerism and ethical choices encountered in everyday life. Focus topics include biodiversity, habitat destruction, exotic species introductions, human harvesting, protected areas, and climate change. Course approach emphasizes the process of science, critical thinking, active learning, social relevancy, and building connections between case studies and general concepts.

Letter grade.

**Corequisite(s):** BIO 1005L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.  
(GELO1D)

## **BIO 1005L Ecology and Conservation Lab (GE) (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 1005. Letter grade.

**Corequisite(s):** BIO 1005  
(GELO1D)

## **BIO 1006 Global Health and Pathogens (GE) (4 Units)**

An examination of current topics in global health as they impact society, bioethics, and creation care. The course addresses the topics of the major pathogens that threaten global health, the basic immune response to a pathogen, how vaccines work, and challenges to fighting pathogens on a global level. The course approach emphasizes critical thinking, active learning, social relevancy, and building connections between case studies and general concepts of biology.

Online.

(GELO1D)

## **BIO 1030 Human Anatomy and Physiology I (GE) (3 Units)**

The first course of a two-semester sequence which examines the human body from an integrated perspective. Topics include an introduction to chemistry and cell function, tissue types, skeletal system, muscular system, and nervous system.

Does not count for credit in the Biology major. Letter grade.

**Pre or Corequisite(s):** CHE 1003 or CHE 1052

**Corequisite(s):** BIO 1030L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.  
(GELO1D)

## **BIO 1030L Human Anatomy and Physiology I Lab (GE) (1 Unit)**

An anatomy and physiology laboratory that is a co-requisite for BIO 1030. Letter grade.

**Corequisite(s):** BIO 1030  
(GELO1D)

**BIO 1040 Human Anatomy and Physiology II (3 Units)**

The second semester of a sequence which examines the human body from an integrated perspective emphasizing the interrelationship of structure and function. Topics include sensory and autonomic nervous system, endocrine system and reproduction, cardiovascular system, immune system, respiratory system, digestive system, and urinary system.

Does not count for credit toward the Biology major. Letter grade.

**Prerequisite(s):** BIO 1030 and CHE 1003 or CHE 1052

**Corequisite(s):** BIO 1040L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 1040L Human Anatomy and Physiology II Lab (1 Unit)**

An anatomy and physiology laboratory that is a co-requisite for BIO 1040. Letter grade.

**Corequisite(s):** BIO 1040

**BIO 2010 Cell Biology and Biochemistry (GE) (3 Units)**

An introduction to the principles of cell biology, molecular biology, and biochemistry. Topics include the chemical basis of life, basic membrane functions and membrane transport, basic metabolic pathways including cellular respiration and photosynthesis, cell division, and expression of the genetic material.

Letter grade.

**Corequisite(s):** BIO 2010L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

(GELO1D)

**BIO 2010L Cell Biology and Biochemistry Lab (GE) (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 2010. Letter grade.

**Corequisite(s):** BIO 2010

(GELO1D)

**BIO 2011 Ecological and Evolutionary Systems (GE) (3 Units)**

An introduction to the principles of ecology, evolutionary biology and sustainability.

Letter grade.

**Corequisite(s):** BIO 2011L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

(GELO1D)

**BIO 2011L Ecological and Evolutionary Systems Lab (GE) (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 2011. Letter grade.

**Corequisite(s):** BIO 2011

(GELO1D)

**BIO 2012 Organismal Biology (3 Units)**

Principles of animal and plant structure, function, and diversity. Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 2012L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 2012L Organismal Biology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 2012. Letter grade.

**Corequisite(s):** BIO 2012

**BIO 2020 Microbiology of Infectious Diseases (3 Units)**

A study of microbial physiology, the diseases associated with infections by certain pathogenic microbes and the vertebrate response to microbial infections.

Letter grade.

**Prerequisite(s):** CHE 1003 or CHE 1052; BIO 1040 (may be taken concurrently).

**Corequisite(s):** BIO 2020L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 2020L Microbiology of Infectious Diseases Lab (1 Unit)**

A laboratory that is a co-requisite for BIO 2020.

Letter grade.

**Corequisite(s):** BIO 2020

**BIO 3012 Applied Plant Biology (2 Units)**

A study of plant structure, function and phytochemistry through an examination of economically and culturally important plants, including plants for medicine, food, energy, fiber and building materials. Topics include environmental plant physiology, biotechnology, plant propagation, medicinal botany, and sustainable land use.

Letter grade.

**Prerequisite(s):** BIO 2012

**Recommended:** MTH 2003 or MTH 3063

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3015 Microbiology (3 Units)**

An in-depth exploration of the world of microscopic organisms, including their diversity, physiology, biochemistry and ecology. Emphasis is on prokaryotes, but also some discussion of microscopic eukaryotes and viruses.

Letter grade.

**Prerequisite(s):** BIO 3045

**Corequisite(s):** BIO 3015L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3015L Microbiology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 3015.

Letter grade.

**Corequisite(s):** BIO 3015

**BIO 3023 Introduction to Oceanography (3 Units)**

An introduction to the interdisciplinary study of the oceans, including survey of geological, chemical, physical and biological oceanography. Includes consideration of current research methods and exploration of marine systems.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 3023L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3023L Introduction to Oceanography Lab (1 Unit)**

A field work-based laboratory that is a co-requisite for BIO 3023.

Letter grade.

**Corequisite(s):** BIO 3023

**BIO 3033 Marine Biology (3 Units)**

The study of life in the oceans, including the ecology, structure, function and adaptations of marine organisms to their environment.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 3033L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3033L Marine Biology Lab (1 Unit)**

A field work-based laboratory that is a co-requisite for BIO 3033.

Letter grade.

**Corequisite(s):** BIO 3033

**BIO 3040 Field Biology: Neotropical Ecology (2 Units)**

A field-oriented course that introduces students to the ecology and conservation biology of the New World Tropics. The course begins during Quad II of the spring semester, and continues with a 10-day field immersion trip to Costa Rica in early May. We visit some of the most intense biodiversity hotspots in Central America. Through readings, lectures, student presentations, and field trips, we explore the plants and animals of the tropics and investigate the ecological and cultural complexities of conserving them. Relevant issues of culture, language, public policy, and stewardship are also covered. Students complete a project paper or presentation based on their independent research.

Letter grade.

**Prerequisite(s):** BIO 2011

**BIO 3045 Genetics (3 Units)**

The study of the inheritance, organization, expression and variability of genes.

Letter grade.

**Prerequisite(s):** BIO 2010 with a grade of "C" or better or consent of instructor.

**Corequisite(s):** BIO 3045L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3045L Genetics Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 3045.

Letter grade.

**Corequisite(s):** BIO 3045

**BIO 3050 Advanced Cell Biology (3 Units)**

An in-depth study of the structure and function of eukaryotic cells. Topics include various aspects of subcellular structure, cytoskeleton dynamics and regulation, the mechanism of cell motility and intracellular transport cell adhesion, cellular signal transduction mechanisms, regulation of cell division and cancer. The laboratory provides exposure to important current methodologies.

Letter grade.

**Prerequisite(s):** BIO 3045

**Corequisite(s):** BIO 3050L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3050L Advanced Cell Biology Lab (1 Unit)**

A laboratory that is a co-requisite for BIO 3050.

Letter grade.

**Corequisite(s):** BIO 3050

**BIO 3052 Research Methodology (3 Units)**

This course builds upon the basis of the scientific method that students are exposed to as freshmen. It focuses on teaching students how to develop biological questions, search databases to obtain background information, design scientific experiments, and analyze data. The course will focus more specifically on how research data is obtained, how experimental knowledge and data are dispersed amongst the scientific community, and how these data are used as a base for correlating new data and upon which new experimentation is based.

Letter grade.

**Prerequisite(s):** BIO 3045

**BIO 3063 Conservation Ecology (3 Units)**

An examination of the key concepts and issues at the intersection of conservation biology and ecology, starting with environmental ethics and the valuation of nature and moving to sustainable development and creation care. Students read journal articles and discuss the medical value of biodiversity, zoonotic disease and public health, trophic cascades, toxicology, endocrine disruption, conservation genetics and extinction vortices, de-extinction and species resurrection, shifting baselines, physiological ecology, road ecology, conservation behavior, and community-based conservation. We also explore innovative technology driving advances in conservation such as biologgers, camera traps, and fecal genetic and hormonal analysis. Students complete a team field research project on (or near) the Point Loma campus to apply the concepts of conservation ecology to the local environment.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 3063L

**Recommended:** BIO 2012

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3063L Conservation Ecology Lab (1 Unit)**

A field work-based laboratory that is a co-requisite for BIO 3063.

Letter grade.

**Corequisite(s):** BIO 3063

**BIO 3080 Molecular Biology (3 Units)**

A study of the regulatory mechanisms that govern gene expression in eukaryotic and prokaryotic cells and their viruses. Alterations of normal eukaryotic genetic regulatory mechanisms resulting from the transformed (cancerous) state also are discussed. Laboratory includes practical experience with the methodologies of modern genetic engineering.

Letter grade.

**Prerequisite(s):** BIO 3045 and CHE 1052

**Corequisite(s):** BIO 3080L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3080L Molecular Biology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 3080.

Letter grade.

**Corequisite(s):** BIO 3080

**BIO 3090 Immunology (3 Units)**

Introduction to the immune system with an emphasis on mammalian models. The course focuses on the cellular and molecular regulation of the immune system in health and disease. Topics include recognition of antigen, development of lymphocyte repertoires, and innate and adaptive immune responses. Also included are discussions of the immune system's responses to cancer cells, tissue transplants, and allergenic substances.

Letter grade.

**Prerequisite(s):** BIO 3045

**Corequisite(s):** BIO 3090L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 3090L Immunology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 3090.

Letter grade.

**Corequisite(s):** BIO 3090

**BIO 4000 Developmental Biology (3 Units)**

An analysis of mechanisms of early development of invertebrates and vertebrates. Includes a study of the cellular, molecular, and genetic factors that influence cell differentiation and the determination of the body plan, as well as a study of the morphogenesis of selected organ systems. The implications of development on our understanding of the mechanisms of evolution (evo-devo) are discussed.

Letter grade.

**Prerequisite(s):** BIO 3045

**Corequisite(s):** BIO 4000L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4000L Developmental Biology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 4000 and uses a variety of model organisms to study normal and abnormal development.

Letter grade.

**Corequisite(s):** BIO 4000

**BIO 4010 Vertebrate Biology (3 Units)**

An exploration of the evolution of morphology, physiology, and behavior of the vertebrate lineage from hagfish to humans. Appropriate emphasis is given to the major evolutionary approaches of form and function, phylogenetic systematics, taxonomy, natural selection, evo-devo, and the study of fossils and molecular genetics. The course works its way from fish to tetrapods, surveying the distinguishing morphology, physiology, ecology, and lifestyle adaptations of each group. Conservation status and current threats from human impacts are covered. Students learn through readings, group activities and discussions, films, and a research project tracing the evolution of a currently threatened vertebrate species or group.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 4010L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4010L Vertebrate Biology Lab (1 Unit)**

A laboratory that is a co-requisite for BIO 4010. Lab activities provide hands-on learning through exploration and dissection of specimen vertebrates and field trips to the zoo and aquarium.

Letter grade.

**Corequisite(s):** BIO 4010

**BIO 4023 Advanced Human Physiology (3 Units)**

This course examines how different organ systems work and interact with each other to maintain homeostasis in the human body. The course specifically examines metabolism, the digestion, the nervous system, endocrinology, the muscular system, respiration, the cardiovascular system, and the urinary system.

Letter grade.

**Prerequisite(s):** BIO 2012 and CHE 2094 or consent of instructor (Cell and Molecular Biology or Organismal minors).

**Recommended:** MTH 2003 or MTH 3063

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4023L Advanced Human Physiology Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 4023.

Letter grade.

**Corequisite(s):** BIO 4023

**BIO 4030 Animal Behavior (3 Units)**

An exploration of the behavioral biology of animals, building on the foundation of Tinbergen's Four Problems and incorporating the insights of ethology, psychology, behavioral ecology, and cognitive ethology. Topics include proximate and ultimate mechanisms, behavioral genetics, developmental ethology, neurophysiology, learning, communication, reproduction, sexual selection, parasite and predator defense, mating systems, parental behavior, and sociality. The evolutionary basis of behavior is emphasized, including natural selection, developmental genetics, and domestication. Guest lectures and films expand on the reading and lecture content, and conservation issues are explored.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 4030L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4030L Animal Behavior Lab (1 Unit)**

A laboratory that is a co-requisite for BIO 4030 in which students complete a semester-long team research project at the San Diego Zoo.

Letter grade.

**Corequisite(s):** BIO 4030

**BIO 4050 Advanced Biochemistry (3 Units)**

Detailed analysis of protein and membrane structure. Includes quantitative approaches to the study of enzymes, catalytic mechanisms of enzymes, and a survey of the major metabolic pathways of carbohydrates, lipids, amino acids and nucleic acids.

Letter grade.

Also offered as CHE 4050.

**Prerequisite(s):** BIO 2010 and CHE 2094

**Corequisite(s):** BIO 4050L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4050L Advanced Biochemistry Lab (1 Unit)**

An inquiry-based laboratory that is a co-requisite for BIO 4050.

Letter grade.

Also offered as CHE 4050L.

**Corequisite(s):** BIO 4050

**BIO 4063 Learning and Teaching in Science (3 Units)**

Students study learning theories within the context of science. Students engage in meaningful reflections of their own learning experiences, while considering future opportunities they may have in helping others learn. While dimensions of effective science teaching practices are studied, the course is designed to appeal to all students of science, regardless of their specific career interests. 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. Research on modifications for diverse learners and learners with exceptionalities is included. [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. Letter grade.

**Prerequisite(s):** BIO 2010 or GE-BIO and at least Sophomore standing.

**BIO 4070 Neuroscience (3 Units)**

Neuroscience is a study of the nervous system at the molecular, cellular, intercellular, and gross anatomy levels. Topics include neuroanatomy, nervous system development, neurons and glia, physiology of neurons, neural networks, and learning and memory. Diseases and conditions corresponding to the topics covered will also be discussed. Additional topics include intelligence, language, and ethics.

Some laboratory work is included during class meeting times. Letter grade.

**Prerequisite(s):** BIO 1040 or BIO 2012 or BIO 4023, or PSY 3001, or consent of instructor.

**BIO 4073 Experimental Marine Ecology (3 Units)**

A field-oriented course that explores aspects of marine ecology within the context of coastal communities, including ecological relationships within the marine environment, factors influencing community structure, and biogeography. A central component of the course will be an independent project with experimental design.

Letter grade.

**Prerequisite(s):** BIO 2011

**Corequisite(s):** BIO 4073L

**Fee:** Course fee applies. See "Special Fees" in Financing a PLNU Education.

**BIO 4073L Experimental Marine Ecology Lab (1 Unit)**

A field work-based laboratory that is a co-requisite for BIO 4073. Letter grade.

**Corequisite(s):** BIO 4073

**BIO 4083 Introduction to Geographic Information Systems (GIS) (3 Units)**

Geographic Information Systems (GIS) involves the analysis and management of geographic information. This course is designed to introduce the basic principles and techniques of GIS (including spatial data sources, data structures, projections and coordinate systems), the essential skills of operating a functional GIS (including data creation, data editing and geospatial analysis), and the different applications of GIS technology.

Letter grade.

**BIO 4090 Internship in Biology (1-3 Units)**

Authentic work experience in jobs that are oriented to the field of biology and that include responsibility for decision making, problem solving, and the use of techniques, skills, and knowledge acquired in the classroom. May be repeated up to total of six (6) units. Credit/No Credit.

**Prerequisite(s):** Junior or Senior standing; consent of department chair and faculty advisor.

"C" Designation is for California Internships. "E" Designation is for Out of State Internships.

**BIO 4095 Special Studies in Biology (1-6 Units)**

Individual study in depth of a selected biology topic under the direct supervision of a member of the faculty.

May be repeated for up to six (6) units as long as the content is different. Letter grade.

**Prerequisite(s):** Consent of instructor and department chair.

**BIO 4097 Biology Seminar (1 Unit)**

Examination and discussion of selected biological issues with an emphasis on the relationship between Christian faith and scientific study. Course is to be taken by Biology, Biology-Chemistry and Environmental Science majors during their last semester prior to graduation. Letter grade.

**Prerequisite(s):** Senior standing as a Biology, Biology-Chemistry, or Environmental Science major.

**BIO 4099 Research in Biology (1-3 Units)**

Independent investigation, under the supervision of a member of the biology faculty.

May be repeated for a total of six (6) units, but no more than three (3) units may count toward upper-division requirements for graduation. Letter grade.

**Prerequisite(s):** Junior or Senior standing and consent of instructor.