



# The Department of **BIOLOGY**

"Now in the twenty-first century, we have the rolling Pacific hillside of Point Loma in San Diego—the most beautiful of all our California locations. Thank you Lord for making this possible. We are blessed!"

~ Beryl R. Dillman, Professor Emeritus of Education

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## **OBJECTIVES**

- To prepare students for graduate study in science, medicine, and various allied health professions;
- To provide training in preparation for teaching at the elementary or secondary level;
- To provide training for entry into industrial positions utilizing life science technology;
- To provide research experience in biology to interested students;
- To serve allied science departments with focused courses in necessary aspects of biology;
- To introduce the liberal arts student to fundamental biological concepts that are relevant to life, values, and culture;
- To examine with students the interaction of biology with Christian faith.

## **TRADITION OF EXCELLENCE...**

The Department of Biology is dedicated to the success of the students, and offers a wealth of opportunities for students who are interested in pursuing work in science related fields. For students whose interests and academic needs lie in both biology and chemistry, an interdepartmental major in Biology-Chemistry has been designed to prepare students for biochemistry, immunology, molecular biology, pharmacology, physiology, medicine and dentistry. Biology students have the opportunity to work side-by-side with their professors doing faculty-assisted research projects, and may become co-authors on scholarly papers in national and international scientific journals. Many students present research at various science conferences. Students also have sophisticated instrumentation and computational resources at their fingertips for use in science courses and research labs. Advanced technology resources and applications within the department and University accessible to students include: the campus computer facility, centrifugation, tissue preparation, computerized spectroscopy, physiology, DNA sequencing, recombinant DNA technology, and computational bioinformatics.

All of these opportunities have been given to students through the help of numerous grants from governmental agencies such as the National Institutes of Health and the National Science Foundation, various private organizations, steady cooperation from university administration, and strong financial backing by biology and chemistry alumni. Since 1977, alumni of the Department of Biology have contributed an average of more than \$12,000 per year in support of the science instruction and research programs.

## **STEP INTO YOUR FUTURE...**

Students who graduate with a degree from the Department of Biology leave PLNU prepared for graduate schools or careers in industry. Over the last 25 years, approximately 80% of PLNU's applicants have gained acceptance into medical schools (roughly twice the national average), and the acceptance rate for biology and chemistry students applying to graduate (M.A., M.S., and Ph.D) and dental school programs is approximately 95 percent.

## **FACULTY**

David Brown, Ph.D.

*University of Oklahoma*

Darrel Falk, Ph.D.

*University of Alberta*

Rebecca Fliestra, Ph.D.

*University of Kansas Medical Center*

Kerry Fulcher, Ph.D.

*University of Idaho*

David Kerk, Ph.D.

*University of California, Los Angeles*

Michael McConnell, Ph.D.

*Tufts University School of Medicine*

Michael Mooring, Ph.D.

*University of California, Davis*

Dawne Page, Ph.D.

*University of California, San Francisco*

# Biology MAJOR

## LOWER-DIVISION REQUIREMENTS

COURSE #	TITLE	UNITS
BIO 110*	Cell Biology and Biochemistry	4
BIO 120*	Animal Biology	4
BIO 240*	Genetics	4
CHE 152*	General Chemistry I	4
CHE 153*	General Chemistry II	4
CHE 295*	Organic Chemistry I	5
MTH 123*	Elementary Functions	3
MTH 145*	Calculus I with Applications	5
<b>TOTAL</b>		<b>33</b>

## UPPER-DIVISION REQUIREMENTS

COURSE #	TITLE	UNITS
BIO 300*	Biomathematics and Bioinformatics	3
BIO 310	General Botany	4
BIO 350	Advanced Cell Biology	3
BIO 360*	Ecology	3
BIO 380	Molecular Biology	3
BIO 420	Vertebrate Physiology	3
BIO 497*	Biology Seminar	1
Additional Track I Courses to a total of		12
Additional Track II Courses to a total of		9
Additional Track I, Track II or upper-division level courses outside Biology approved by department chair**		5
<b>TOTAL</b>		<b>47</b>

### TRACK I

COURSE #	TITLE	UNITS
BIO 310*	General Botany	4
BIO 320	Marine Zoology	3
BIO 330	Marine Invertebrate Zoology	2
BIO 340	Ornithology	2
BIO 360*	Ecology	3
BIO 370	Marine Plant and Microbial Life	2
BIO 410*	Vertebrate Biology	3
BIO 420*	Vertebrate Physiology	3
BIO 430	Animal Behavior	3

### TRACK II

COURSE #	TITLE	UNITS
BIO 350*	Advanced Cell Biology	3
BIO 380*	Molecular Biology	3
BIO 390	Microbiology and Immunology	3
BIO 400	Developmental Biology	3
BIO 450	Advanced Biochemistry	4
BIO 470	Neuroscience	3

## TEACHER EDUCATION REQUIREMENTS

One of the following:

COURSE #	TITLE	UNITS
BIO 390	Microbiology and Immunology	3
BIO 400	Developmental Biology	3
BIO 450	Advanced Biochemistry	4

\* Are required by the state for the Teacher Education Concentration in Life Sciences)

\*\*Biology 302 may substitute for part of this requirement.

## RECOMMENDATION

Biology majors planning to pursue graduate or professional studies should also take either:

COURSE #	TITLE	UNITS
PHY 141	General Physics I	4
PHY 142	General Physics II <b>OR</b>	
PHY 241	University Physics I	4
PHY 242	University Physics II	4

## Biology-Chemistry (BS)

MAJOR

The interdepartmental major in Biology-Chemistry has been designed for those students whose academic needs and interests lie in both biology and chemistry. The major was instituted because a large segment of contemporary scientific interest can best be served by such a major. Areas well served by this preparation include medicine, dentistry, and several graduate disciplines, including biochemistry, physiology, and molecular biology. This major earns a Bachelor of Science degree.

## LOWER-DIVISION REQUIREMENTS

COURSE #	TITLE	UNITS
BIO 110	Cell Biology and Biochemistry	4
BIO 120	Animal Biology	4
BIO 240	Genetics	4
CHE 152	General Chemistry I	4
CHE 153	General Chemistry II	4
CHE 211	Analytical Chemistry	2
CHE 295	Organic Chemistry I	5
PHY 141	General Physics I	4
PHY 142	General Physics II <b>OR</b>	
PHY 241	University Physics I	4
PHY 242	University Physics II	4
MTH 145	Calculus I with Applications	5
<b>TOTAL</b>		<b>44</b>

## UPPER-DIVISION REQUIREMENTS

COURSE #	TITLE	UNITS
BIO 380	Molecular Biology	3
BIO 497	Biology Seminar	1
CHE 300	Organic Chemistry II	2
CHE 325	Physical Chemistry I	5
CHE 351	Organic Qualitative Analysis	2
CHE 466	Advanced Inorganic Chemistry	2
CHE 326	Physical Chemistry II <b>OR</b>	
CHE 370	Instrumental Analysis <b>OR</b>	
CHE 453	Advanced Organic Chemistry	2
BIO 450	Advanced Biochemistry <b>OR</b>	
CHE 450	Advanced Biochemistry	4
<b>Three courses from:</b>		
BIO 350	Advanced Cell Biology	3
BIO 390	Microbiology and Immunology	3
BIO 400	Developmental Biology	3
BIO 420	Vertebrate Physiology	3
<b>TOTAL</b>		<b>39</b>

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Biology

# Biology COURSES

## BIO 101 (4) HUMAN BIOLOGY AND BIOETHICS - GE

A systematic examination of the operation of the human body as well as a discussion of current issues in which biological knowledge impacts society. Lecture and laboratory.

## BIO 102 (4) ENVIRONMENTAL BIOLOGY - GE

A study of natural resource waste, pollution, and overpopulation with possible solutions through effective earth stewardship in conservation, recycling, birth control and other means. Lecture.

## BIO 110 (4) CELL BIOLOGY AND BIOCHEMISTRY - GE

An introduction to the principles of cell biology and biochemistry. Topics to be discussed include the chemical basis of life, the structure and function of cellular organelles, basic metabolic pathways, the expression of the genetic material, recombinant DNA technology and models for the origin of cells. Lecture and laboratory.

*Prerequisite: Must have a previous course in high school or university-level chemistry.*

## BIO 120 (4) ANIMAL BIOLOGY

Principles of animal structure, function, and diversity. Lecture and laboratory.

*Prerequisite: Biology 110.*

## BIO 130 (4) HUMAN ANATOMY AND PHYSIOLOGY I- GE

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 toward a Biology major. Lecture and laboratory.

*Prerequisite or Corequisite: Chemistry 103 or Chemistry 152.*

## BIO 140 (4) HUMAN ANATOMY AND PHYSIOLOGY II

The second semester of a sequence which examines the human body from an integrated perspective emphasizing the interrelationship of structure and function. Topics include endocrine system and reproduction, cardiovascular system, immune system, respiratory system, digestive system, and urinary system. Does not count for credit toward a Biology major. Lecture and laboratory.

*Prerequisite: Biology 130.*

## BIO 220 (5) MICROBIOLOGY OF INFECTIOUS DISEASES

A study of microbial physiology, the diseases associated with infections by certain pathogenic microbes and the vertebrate response to microbial infections. Does not apply toward the Biology major. Lecture and laboratory.

*Prerequisites: Biology 140 and Chemistry 103.*

## BIO 240 (4) GENETICS

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

*Prerequisite: Biology 120.*

## BIO 300 (3) BIOMATHEMATICS AND BIOINFORMATICS

An examination of the importance of mathematical concepts, techniques and computer applications to contemporary biology. Lecture and lab topics include

statistics, mathematical modeling, computer analysis of biological molecules, and the use of the Internet.

*Prerequisites: Biology 110 and Mathematics 145.*

## BIO 302 (4) SCIENTIFIC ISSUES AND SOCIETY

Historical and current analysis of the progress of the biological and physical sciences and the impact of that progress on society. Alt.\*

*Prerequisites: Biology 240; and one of the following - Physics 103, Physics 141, Physics 241.*

## BIO 310 (4) GENERAL BOTANY

Principles of plant structure, function and diversity. Lecture and laboratory.

*Prerequisite: Biology 110.*

## BIO 320 (3) MARINE ZOOLOGY

A study of marine animals and their habitats, with an emphasis on marine vertebrates. Lecture, laboratory, and field work.

*Prerequisite: Biology 120.*

## BIO 330 (2) MARINE INVERTEBRATE ZOOLOGY

A study of invertebrate adaptive biology, including anatomy, locomotion, nutrition, respiration, excretion, reproduction, and behavior. An emphasis will be placed on marine invertebrates and other invertebrate representatives of importance to the Southern California ecosystems. Includes lecture and laboratory. Alt.\*

*Prerequisite: Biology 120.*

## BIO 340 (2) ORNITHOLOGY

A study of the physiology, morphology and systematics of birds with emphasis on identification of Southern California species. The course includes a field component that includes bird identification through sight, sound, and habitat.

*Prerequisite: Biology 120.*

## BIO 350 (3) ADVANCED CELL BIOLOGY

A study of the structure and function of eukaryotic cells. Topics include various aspects of subcellular structure, the extracellular matrix, cellular signal transduction mechanisms, regulation of cell division and cancer. The laboratory will provide exposure to important current methodologies.

*Prerequisites: Biology 120 and Biology 240.*

## BIO 360 (3) ECOLOGY

A study of current ecological theory with environmental applications. Lecture, laboratory, and field work.

*Prerequisite: Biology 120.*

## BIO 370 (2) MARINE PLANT AND MICROBIAL LIFE

An analysis of shoreline, tidal and floating marine plants, and associated microbial life of the Southern California coastline. Ecological and habitat characteristics will be studied. Lecture, laboratory, and field work. Alt.+

*Prerequisites: Biology 102 or 110 and consent of instructor.*

## BIO 380 (3) MOLECULAR BIOLOGY

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 will also be discussed. Laboratory includes practical experience with the methodologies of modern genetic engineering. Lecture and laboratory.

*Prerequisite: Biology 240.*

### **BIO 390 (3) MICROBIOLOGY AND IMMUNOLOGY**

A descriptive survey of selected bacteria and viruses that are problematic to humans and an analysis of the human body's humoral and cell-mediated immune responses to such foreign agents. Also included are discussions of the immune system's responses to cancer cells, tissue transplants, and allergenic substances. Lecture and laboratory.

*Prerequisites: Biology 240 and Chemistry 295.*

*Biology 450 is recommended.*

### **BIO 400 (3) DEVELOPMENTAL BIOLOGY**

An analysis of mechanisms of early development of invertebrates and vertebrates. Includes a study of the cellular, molecular, and genetic factors which influence the determination of the body plan as well as a study of the morphogenesis of selected organ systems. Lecture and laboratory.

*Prerequisites: Biology 240 and Biology 380.*

### **BIO 410 (3) VERTEBRATE BIOLOGY**

Taxonomy, behavior, distribution, and ecology of the vertebrates and a comparative study of their morphologies. Lecture and laboratory. Alt.+

*Prerequisite: Biology 120.*

### **BIO 420 (3) VERTEBRATE PHYSIOLOGY**

A physiochemical analysis of life processes, as studied by a systemic approach. Lecture and laboratory.

*Prerequisites: Biology 120 and Chemistry 295.*

### **BIO 430 (3) ANIMAL BEHAVIOR**

An exploration of the behavioral biology of animals, including behavior genetics, physiological mechanisms, development, learning, neuro-physiology, ecology, reproduction, and social behavior; insights from ethology, psychology, behavioral ecology, and sociobiology will be studied. Labs will emphasize various aspects of behavioral research in field settings and students will conduct their own research projects. Lecture and laboratory. Alt.\*

*Prerequisite: Biology 360 or consent of instructor.*

### **BIO 450 (4) ADVANCED BIOCHEMISTRY**

A detailed analysis of protein and membrane structure, quantitative approaches to the study of enzymes, catalytic mechanisms of enzymes, and a survey of the major metabolic pathways, including those of carbohydrates, lipids, amino acids, and nucleic acids. Lecture and laboratory.

*Prerequisites: Biology 110 and Chemistry 295.*

### **BIO 470 (3) NEUROSCIENCE**

A study of the nervous system at the molecular, cellular and intercellular levels with the goal of understanding the generation and control of thoughts and behavior. Laboratory exercises will examine sensory transduction, CNS function, synaptic physiology, behavior and neuroanatomy. The relationship of brain and mind will be examined in discussions of nervous system development, intelligence, memory, patho-physiology, sexuality

and gender identity, and religious faith and ethics. Lecture and laboratory. Alt.+

*Prerequisites: Biology 420, or Psychology 301 or Biology 140, or consent of instructor.*

### **BIO 490 (1-3) INTERNSHIPS IN BIOLOGY**

Authentic work experience in jobs that are biologically oriented and which include some responsibility for decision making, problem solving, and the use of techniques, skills, and knowledge acquired in the classroom. May be repeated to a maximum of three units. Graded Credit/No Credit.

*Prerequisites: Junior or senior standing. Consent of department chair and faculty advisor is required.*

### **BIO 495 (1-3) SPECIAL STUDIES IN BIOLOGY**

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

*Prerequisites: Consent of instructor and department chair.*

### **BIO 497 (1) BIOLOGY SEMINAR**

Examination and discussion of selected biological issues with an emphasis on the relationship between Christian faith and scientific study. This course is to be taken by Biology and Biology-Chemistry majors during their last spring semester prior to graduation.

*Prerequisite: Senior standing as a Biology or Biochemistry major.*

### **BIO 499 (1-3) RESEARCH IN BIOLOGY**

Independent investigation, under the supervision of a member of the biology faculty. May be repeated for a total of six units, but no more than three units may count toward upper-division requirements for graduation.

*Prerequisites: Junior or senior standing and consent of instructor is required.*

## **AU SABLE ENVIRONMENTAL FIELD STUDIES PROGRAM**

Summer field courses in environmental biology are offered by the Au Sable Institute of Environmental Studies, a Christian organization offering course work and field experiences in the context of Christian environmental stewardship. Courses are offered during two 5-week summer sessions at three North American campuses (Great Lakes, Pacific Rim, Chesapeake Bay) and two international venues (India, Kenya). Courses are at the 300/400 upper-division level, and provide students with academic content, field experience, and practical tools for stewardship of creation resources. Academic credit for all Au Sable courses is granted through PLNU. Courses are 4 units each, and a two-course load is typical. Course credit counts for graduation electives. Qualified students are awarded the Au Sable Fellowship of up to \$1200, and grants-in-aid of at least \$400 are also available. Interested students should contact PLNU's Au Sable Institute Representative.