

## Faculty

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Biologists seek to understand the complexity of the living world through observation and experiment. By offering course work and laboratory experience concerning microorganisms, plants, animals (including humans), and the interrelationships among these living things, the *Biology Department* encourages the student to consider the study of life an exciting and continuing challenge, whether at the level of molecules, cells, organisms, populations, or ecosystems.

The biology major prepares students for careers in the practice or teaching of the life sciences, for graduate study, or for entering professional schools in dentistry, medicine, veterinary medicine, and pharmacy.

The biology curriculum may be enriched by research (BIOL 412) either on or off campus.

## Major in Biology, B.S.

*A minimum of 100.5 hours (49.5 upper-division hours)*

### ► Required Core Courses (40.5 hours):

BIOL 121+122+123	Biological Foundations I, II, III	5+5+5
BIOL 221+222	Intro to Research Methods I, II	2+2
BIOL 233	Ecology	4
BIOL 320	Cellular and Molecular Biology	4
BIOL 348	Systems Physiology	5
BIOL 354	Genetics	4
BIOL 397	Biology Seminar	0.5
BIOL 450	Philosophy of Origins	3
SCIE 290	Sophomore Seminar	1

### ► Required Core Electives (21 hours):

*At least 21 hours from the following:* 21  
In consultation with the advisor, select additional upper-division BIOL courses (please note that service courses do not count toward the major). BIOT 345, BIOT 345L, CHEM 481, ENVR 360, and ENVR 360L may also apply.

### ► Required Cognate Courses (39 hours):

CHEM 111+12+13+L	General Chemistry I, II, III+Lab	5+5+5
CHEM 371+72+73+L	Organic Chemistry I, II, III+Lab	4+4+4
PHYS 111+112+113	General Physics I, II, III	4+4+4

### Recommended Cognate Courses:

CHEM 481	Biochemistry I (4)
MATH 131	Calculus I (4)

### Pre-medical and pre-dental students:

The B.S. degree curriculum, including recommended cognates, exceeds all undergraduate science requirements for pre-medical and pre-dental students applying to Loma Linda University and many other schools.

## Biology

### Major in Biology, B.A.

A minimum of 88.5 hours (37.5 upper-division hours)

Required core courses and cognate courses are the same as those for the B.S. degree. Core electives: Select 9 hours in biology from the core electives listed above for the B.S. degree. BIOL 412 is not applicable toward the B.A. degree.

### Major in Conservation Technology, B.S.

A minimum of 93 hours (28-38 upper-division hours)

#### ► Required Core Courses (64 hours):

BIOL 121+122+123	Biological Foundations I, II, III	5+5+5
BIOL 221+222	Intro to Research Methods I, II	2+2
BIOL 412	Research in Biology	2
CNTC 201	Principles of Conservation Tech	3
CNTC 240	Introduction to GIS	2
CNTC 301	Applications of Conservation Tech	2
CNTC 301L	Applied Conservation Tech Lab	2
CNTC 340	Intermediate GIS	2
CNTC 490	Conservation Tech Capstone	1
CNTC 494	Internship	4
DTSC 101	Introduction to Data Science	4
DTSC 201	Fundamentals of Data Science	4
DTSC 215	Frmworks & Libs for Data Science	4
DTSC 323L	Statistical Methods in Data Sci Lab	1
DTSC 420	Machine Learning	3
ENVR 360+360L	Conservation Biology (+Lab)	4
INFS 115	Introduction to Programming	4
SCIE 290	Sophomore Seminar	1
STAT 322	Statistical Methods	3

#### ► Required Core Electives (13-16 hours):

At least four classes from the following list:

BIOL 233	Ecology	4
BIOL 323	Vertebrate Biology	4
BIOL 325	Flowering Plants	3
BIOL 331	Marine Biology	4
BIOL 338	Field Biology	3
ENVR 361+361L	Energy & Climate Change (+Lab)	4
ENVR 362+362L	Pollution & Environ. Quality (+Lab)	4
DTSC 425	Legal & Ethical Aspects of Data	3
MATH 131	Calculus I	4

#### ► Required Cognate Courses (15 hours):

CHEM 111+12+13+L	General Chemistry I, II, III+Lab	5+5+5
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### Major in Environmental Studies, B.S.

A minimum of 91.5 hours (19.5 upper-division hours)

#### ► Required Core Courses (61.5 hours):

BIOL 121+122+123	Biological Foundations I, II, III	5+5+5
BIOL 221	Intro to Research Methods I	2
BIOL 222	Intro to Research Methods II	2
BIOL 233	Ecology	4
BIOL 450	Philosophy of Origins	3
CHEM 111+12+13+L	General Chemistry I, II, III+Lab	5+5+5
ENVR 360+360L	Conservation Biology+Lab	4
ENVR 361+361L	Energy & Climate Change+Lab	4
ENVR 362+362L	Pollution & Environmental Quality + Lab	4
ENVR 397	Environmental Studies Seminar	0.5
ENVR 494	Internship	4
RELT 240	Eco-theology	3
SCIE 290	Sophomore Seminar	1

#### ► Required Core Electives (30 hours):

At least 30 hours from the following: 30

AGRI 212	Home Greenhouse Gardening (2)
AGRI 213	Home Vegetable Gardening (2)
BIOL 227+L	Natural Hist of California & Lab (3+1)
BIOL 323	Vertebrate Biology (4)
BIOL 325	Flowering Plants (3)
BIOL 328	Animal Behavior (4)
BIOL 331	Marine Biology (4)
BIOL 338	Field Biology (3)
BIOL 366	Medical Microbiology (5)
CHEM 324+324L	Analytical Chemistry I+Lab (2+1)
CHEM 325	Analytical Chemistry II (2)
CHEM 371+72+73+L	Organic Chemistry I, II, III+Lab 4+4+4
CHEM 451+452	Thermodynamics+Kinetics (3+3)
ENVR 412	Research in Environmental Studies (1-2)
GEOL 233	Geology (4)
INFS 240	Intro to Geographic Info Systems (2)
MATH 131+132	Calculus I, II (4+4)
PHYS 111+112+113	General Physics I, II, III (4+4+4)

#### Recommended courses for students interested in specific areas:

The following courses are recommended to help students become better prepared for a job or for graduate school in more specialized areas. These courses are not intended to provide students with the specific skills required for a job.

*Air Quality:* CHEM 324+324L, 371+372+373, 451+452, INFS 240, MATH 131+132, PHYS 111+112+113

*Conservation Biology:* BIOL 227, 323, 325, 328, 338, CNTC 201, DTSC 101, INFS 240

*Energy:* CHEM 324+324L, 325, 371+372+373, 451+452, GEOL 233, INFS 240, MATH 131+132, PHYS 111+112+113

*Environmental Economics:* ACCT 121+122+123, ECON 261, 265, MATH 131+132

*Environmental Policy:* PLSC 124, 274, RELT 355, SOWK 232

*Marine Resources:* BIOL 331, GEOL 233, INFS 240

*Solid Waste Management:* CHEM 324+324L, 325, 371+372+373, 451+452, INFS 240, PHYS 111+112+113

*Water Management:* BIOL 366, CHEM 324+324L, 325, 371+372+373, 451+452+453, INFS 240, MATH 131+132, MICR 134, PHYS 111+112+113

*Wildlife Management:* BIOL 227, 323, 328, 338, DTSC 101, INFS 240

**Global Health Combined Major  
4+1 Bachelors & Master's Degree  
PUC B.S. or B.A. & LLU M.P.H.**

*If you wish to extend your strong interest and bachelor's degree to a career in public health with an emphasis in global health, this combined undergraduate and master's program may be ideal for you. You can earn your degree in just five years of full-time study instead of six years to earn the dual degree of Bachelor of Art or Bachelor of Science in Global Health through Pacific Union College and Loma Linda University's Master of Public Health with emphasis in Global Health.*

*This program is available for graduates of the B.A. or B.S in Global Health with a strong academic record. Interested students with a 3.0 GPA or higher will be eligible to apply during winter quarter of their senior year at PUC by following Loma Linda University's admission process.*

**Major in Global Health, B.S.**

*A minimum of 111 hours in the major and cognates*

**► Required Core Courses (35-38 hours):**

GLBH 201	Introduction to Global Health	2
GLBH 310	Population Health	4
GLBH 410	Epidemiology for Public Health	4
GLBH 418	Ethics for Global Health	4
GLBH 422	Metrics Literacy	4
GLBH 460	Health Systems of the World	4
GLBH 465	Issues in Global Health	4
GLBH 470	Project Implementation	4
GLBH 476	GH Field Experience	4
GLBH 495	Independent Study in GH	1-4

**► Required Cognate Courses (76 hours):**

ANTH 124	Cultural Anthropology	4
BIOL 101	Human Anatomy	5
BIOL 102	Human Physiology	5
COMM 105	Communication & Public Speaking	4
COMM 220	Health Communication	4
COMM 223	Interpersonal Communication	3
COMM 330	Intercultural Communication	3
ECON 270	Healthcare Economics	3
ENVR 360	Conservation Biology	3
ENVR 361	Energy & Climate Change	3
ENVR 362	Pollution & Environmental Quality	3
FDNT 235	Nutrition	3
HLED 166	Health Education	2
MICR 134	Microbiology	5
PSYC 234	Human Development	4
SOCI 355	Cultural Diversity	3
STAT 222	Intro to Statistics	4

*Loma Linda University courses, 4th Year* 15

PCOR 501	Public Health for Community Resilience (5)	
PCOR 502	Public Health for Community Health (5)	
PCOR 503	Public Health and Health Systems (5)	

**Recommended Electives**

STAT 322	Statistical Methods	3
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## Biology

### Major in Global Health, B.A.

A minimum of 111 hours (at least 32 upper-division hours)

#### ► Required Core Courses (45 hours):

GLBH 201	Intro to Global Health	2
GLBH 310	Population Health	4
GLBH 410	Epidemiology for Public Health	4
GLBH 418	Ethics for Global Health	4
GLBH 422	Metrics Literacy	4
GLBH 460	Health Systems of the World	4
GLBH 465	Issues in Global Health	4
GLBH 470	Project Implementation	4
GLBH 476	GH Field Experience	5
GLBH 490	GH Capstone Seminar I	5
GLBH 491	GH Capstone Seminar II	5
GLBH 495	Independent Study in GH	1-4

#### ► Required Cognate Courses (61 hours):

Choose at least 15 hours from this group, with at least 1 PLSC course and 1 SOCI course:

PLSC 274	Intro to Political Thought	3
PLSC 328	Critical World Issues	3
PLSC 485	Foreign Relations/US	3
PSYC 390	Gender Issues	3
RELH 314	World Religions	3
SOCI 121	Intro to Sociology	4
SOCI 214	The Family	4

#### Additional Cognate Courses:

ANTH 124	Cultural Anthropology	4
COMM 105	Communication and Public Sp.	4
COMM 220	Health Communication	4
COMM 223	Interpersonal Communication	3
COMM 330	Intercultural Communication	3
ECON 270	Healthcare Economics	3
ENVR 360	Conservation Biology	3
ENVR 361	Energy & Climate Change	3
ENVR 362	Pollution & Environmental Quality	3
FDNT 235	Nutrition	3
HLED 166	Health Education	2
PSYC 234	Human Development	4
SOCI 355	Cultural Diversity	3
STAT 222	Intro to Statistics	4

#### Recommended:

STAT 322	Statistical Methods	3
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### Major in Global Health, A.S.

A minimum of 42 hours

#### ► Required Core Courses (26 hours):

GLBH 201	Intro to Global Health	2
GLBH 310	Population Health	4
GLBH 410	Epidemiology for Public Health	4
GLBH 418	Ethics for Global Health	4
GLBH 422	Metrics Literacy	4
GLBH 460	Health Systems of the World	4
GLBH 465	Issues in Global Health	4

#### ► Required Cognate Courses (7 hours):

FDNT 235	Nutrition	3
STAT 222	Intro to Statistics	4

#### Choose two Cognate Courses (6-8 hours):

ENVR 360	Conservation Biology	3
ENVR 361	Energy & Climate Change	3
ENVR 362	Pollution & Environmental Quality	3
COMM 330	Intercultural Communication	3
ECON 270	Healthcare Economics	3
EMER 225	Public Health for EMS	3

#### Choose one Cognate Course (3-4 hours):

ANTH 124	Cultural Anthropology	4
COMM 220	Health Communication	4
COMM 223	Interpersonal Communication	3
HLED 166	Health Education	2
MICR 134	Microbiology	5
PSYC 234	Human Development	4
PLSC 274	Intro to Political Thought	3
PLSC 328	Critical World Issues	3
PLSC 485	Foreign Relations/US	3
PSYC 390	Gender Issues	3
SOCI 121	Intro to Sociology	3
SOCI 214	The Family	3
SOCI 355	Cultural Diversity	3

## Teaching Credential

Students desiring to enter a program of studies leading to a California teaching credential in science with a concentration in biology should take the B.A. or B.S. degree in Biology. Students will need to pass the science (biology concentration) portion of the CSET exam one quarter prior to doing full-time student teaching. Students are invited to discuss the program with their major advisor in the Biology Department.

Those who plan to teach on the secondary level should consult with the credential analyst in the Education Department and should become acquainted with the specific requirements for admission to and successful completion of the Teacher Education Program as outlined in the section entitled "Education" in this catalog.

## Minor in Biology

*A minimum of 30 hours (12 upper-division hours)*

### ► Required Courses (18 hours):

BIOL 121+122+123	Biological Foundations I, II, III	5+5+5
BIOL 450	Philosophy of Origins	3

### ► Required Electives (12 hours):

*At least 12 hours from the following (9 upper-division):* 12  
Additional non-service BIOL courses

## Minor in Environmental Studies

*A minimum of 30 hours (11 upper-division hours)*

### ► Required Courses (30 hours):

BIOL 233	Ecology	4
ENVR 360	Conservation Biology	3
ENVR 361	Energy & Climate Change	3
ENVR 362	Pollution & Environmental Quality	3

*At least two of the following labs:* 1+1

ENVR 360L	Conservation Biology Lab (1)
ENVR 361L	Energy & Climate Change Lab (1)
ENVR 362L	Pollution & Envr Quality Lab (1)

*At least one of the following sequences:* 15

BIOL 121+122+123	Biological Foundations I, II, III (5+5+5)
CHEM 111+112+113	General Chemistry I, II, III (5+5+5)

## Minor in Global Health

*A minimum of 24 hours*

### ► Required Courses (6 hours)

GLBH 201	Intro to Global Health	2
GLBH 310	Population Health	4

### ► Choose between these courses (8 hours)

GLBH 410	Epidemiology for Public Health	4
GLBH 422	Metrics Literacy	4
GLBH 460	Health Systems of the World	4
GLBH 465	Issues in Global Health	4

### ► Required Cognate Courses (10 hours)

FDNT 235	Nutrition	3
STAT 222	Statistics	4

### ► Choose between one of these courses

ENVR 360	Conservation Biology	3
ENVR 361	Energy and Climate Change	3
ENVR 362	Pollution Environmental Quality	3

## Biology

### Agriculture

#### LOWER-DIVISION COURSES:

#### **AGRI 212** **2 W** **Home Greenhouse Gardening**

The home greenhouse space used to grow plants for food, indoor and outdoor uses. One lecture and one laboratory per week. Odd years.

#### **AGRI 213** **2 S** **Organic Vegetable Gardening**

The indoor and outdoor spaces used to grow, maintain, and harvest vegetable crops using organic methods. One lecture and one laboratory per week. Even years.

### Biology

#### SERVICE COURSES:

*(Not applicable to a major or minor in this department)*

#### **BIOL 100** **4 F** **Introduction to Human Biology**

Basic concepts of human anatomy (including terms, structure, cell, and organs), human physiology (including basic chemistry, homeostasis, and genetics) and microbiology (including microorganisms, prokaryotes, and human immune system). Designed to prepare students for BIOL 101, BIOL 102, and MICR 134.

#### **BIOL 101** **5 F, W** **Human Anatomy**

Human structure as the expression of basic principles of morphology. Each functional system considered in terms of its cell, tissue, and organ types. Four lectures and one laboratory per week. Prerequisite: One of the following options:  
- Minimum ACT score of 22  
- Minimum SAT score of 1100 (new

scoring system) or 1500 (old scoring system)

- Minimum college-level GPA of 3.0
- Completion of BIOL 100 with minimum grade C-

#### **BIOL 102** **5 W, S** **Human Physiology**

The function of human body systems, emphasizing the relationships among these systems; the role of each system in normal body function and health. Four lectures and one laboratory per week. Prerequisite: BIOL 101 with minimum grade C-. Recommended prerequisite: Secondary-school chemistry or CHEM 101 with minimum grade C-.

#### **BIOL 105** **4 S** **Introduction to Biology**

The organization and complexity of living organisms. The central questions of biology: the relationship between form and function, acquisition and use of energy, continuity between generations, and biodiversity. Enrollment limited to non-science majors; not available to students who have had a college biology course.

#### **BIOL 105L** **1 S** **Introduction to Biology Lab**

Hands-on experience and practical understanding of fundamental biological concepts. Corequisite or prerequisite: BIOL 105.

#### **BIOL 223** **2 F, S** **Medical Terminology**

The terminology of science and medicine.

#### **BIOL 227** **3 F** **Natural History of California**

Plants and animals of California as they relate to its diverse topography and geology.

#### **BIOL 227L** **1 F** **Natural History of California Laboratory**

Laboratory activities coordinated with BIOL 227. Coerequisite: BIOL 227.

*Note: A minimum grade of C- is required for all listed biology prerequisite courses.*

#### LOWER-DIVISION COURSES:

#### **BIOL 121+122+123** **5+5+5 F+W+S** **Biological Foundations I, II, III**

An integrated foundation in life science principles for biology majors and preprofessional students in the biomedical sciences. Prerequisite to most biology courses with higher numbers. Four lectures and one laboratory per week. Prerequisite: BIOL 105 or equivalent.

*BIOL 121:* Mendelian genetics, biodiversity, ecology, and evolution.

*BIOL 122:* The cell as the structural and functional unit of life; organelles and their functions; structure and function of essential biomolecules; and an introduction to molecular genetics. Prerequisite: CHEM 101 or equivalent.

*BIOL 123:* The form and function of plants and animals.

#### **BIOL 221** **2 F, W** **Introduction to Research Methods I**

Study of descriptive and inferential statistical methods frequently used to analyze biological data, including experimental design, graphical presentation of data, analysis of frequency data, parametric vs nonparametric tests, analysis of two or more means, correlation and regression. One lecture and one laboratory per week. Prerequisites: BIOL 121+122+123. Prerequisite or corequisite: STAT 222.

**BIOL 222 2 W, S**

**Introduction to Research Methods II**

The gathering of resource material from the peer-reviewed scientific literature and the design of a research project that incorporates the choice of a model system, statistical tests, data recording and analysis, and interpretation of results. The primary focus is the writing and oral presentation of a well-designed research proposal. One lecture and one laboratory per week. Prerequisite: BIOL 221 (or STAT 322 for Biomathematics majors).

**BIOL 233 4 F**

**Ecology**

The interaction of physical and biological factors in maintaining balance within the ecosystem. Survey of world biomes and aquatic ecosystems. Laboratories examine and compare biotic communities and their structure. Three lectures and one laboratory per week. Prerequisite: BIOL 121+122+123.

UPPER-DIVISION COURSES:

**BIOL 320 4 W**

**Cellular and Molecular Biology**

Composition, structure, and function of the cell and its organelles; emphasis on intracellular and intercellular communication and control principles. Three lectures and one laboratory per week. Prerequisites: BIOL 121+122+123; CHEM 371.

**BIOL 323 4 W**

**Vertebrate Biology**

Biology of the vertebrates, including their relationship to the physical environment and to other species and their social and reproductive patterns. The laboratory emphasizes the vertebrates in northern California. Three lectures and one laboratory per week. Prerequisite: BIOL 121+122+123. Even years.

**BIOL 325 3 S**

**Flowering Plants**

Study of flowering plant biology; structure and physiology, practical human uses, and methods of collecting, identifying, and curating plant specimens. Two lectures and one laboratory per week. Prerequisite: BIOL 123 or BIOL 227. Odd years.

**BIOL 328 4 S**

**Animal Behavior**

Diversity of animal behavior including instinct, learning, communication, sociobiology, and the genetic, physiological, and ecological aspects of behavior. Three lectures and one laboratory per week. Prerequisite: BIOL 121+122+123. Odd years.

**BIOL 331 4 S**

**Marine Biology**

Introduction to oceanography, marine life, and humanity's impact on the marine environment. Three lectures and one laboratory per week. Prerequisites: BIOL 121+122+123. Even years.

**BIOL 338 3 Arr**

**Field Biology**

Study of the diversity of organisms in marine, freshwater, and terrestrial ecosystems of a selected region. Offered under different subtitles and at different locations. Includes classroom lectures, laboratory, and extensive field exercises as part of a study tour during an academic break. Requires additional cost for study tour and includes travel during an academic break. Qualifies for IP grading. Odd years.

**BIOL 348 5 F**

**Systems Physiology**

Functions of the nervous, muscular, endocrine, cardiovascular, respiratory, renal, and reproductive systems with emphasis on regulatory mechanisms and

integration. Examines processes used by animals in adjusting to their external environment and controlling their internal environment. Laboratories involve firsthand analysis of selected aspects of the major functional systems. Four lectures and one laboratory per week. Prerequisites: BIOL 121+122+123 or BIOL 101+102.

**BIOL 354 4 S**

**Genetics**

Genetics of bacteria, plants, and animals. Chromosome mapping, population and evolutionary genetics, prokaryotic and eukaryotic genetic control, and molecular genetics. Emphasis on the study of modern molecular genetic techniques and concepts. Three lectures and one laboratory per week. Prerequisites: BIOL 121+122+123, 320.

**BIOL 366 5 W**

**Medical Microbiology**

Major groups of bacteria, viruses, and fungi that are pathogens or normal flora of humans. Laboratory work emphasizes the culture, characterization, and identification of unknown bacteria of medical importance. Four lectures and one laboratory per week. Prerequisite: BIOL 121+122+123 or MICR 134.

**BIOL 395 1-3 Arr**

**Special Topics in Biology**

Additional laboratory or library studies correlated with biology courses. Repeatable for credit under different subtitles.

**BIOL 397 0.5 W**

**Biology Seminar**

(See also BIOL 397 & ENVR 397.)

Topics of current interest in the biological and environmental sciences are presented and discussed. Prerequisites: BIOL 121+122+123, SCIE 290. Graded S/U.

## Biology

### **BIOL 412** 1-4 F, W, S, Su **Research in Biology**

Original investigation in selected areas of biology. The research topic is selected and the work done under direction of a faculty advisor. Scholarly presentation of research results is encouraged. Prerequisites: BIOL 121+122+123, 222 and permission of the instructor. Repeatable to a maximum of 4 credits. A maximum of 2 credits applied to the Biology major. Graded S/U. Qualifies for IP grading.

### **BIOL 419** 3 F **Developmental Biology**

Principles of animal development and its molecular basis in selected model organisms. Cell communication and differentiation, embryonic induction, pattern formation, morphogenesis, and the genetic control of development. Prerequisites: BIOL 121+122+123, 320, 354. Even years.

### **BIOL 422** 4 S **Advanced Human Anatomy**

Intensive study of the structure of the human body. The laboratory requires extensive cadaver dissection. Two lectures and two laboratories per week. Prerequisite: BIOL 121+122+123 or BIOL 101 with a grade of B or better.

### **BIOL 426** 5 W **Histology**

Microscopic structure of the fundamental tissues and organs of humans and other mammals with functional correlations. Three lectures and two laboratories per week. Prerequisite: BIOL 121+122+123. Recommended: BIOL 320.

### **BIOL 430** 4 F **Neuroscience**

The neural basis of behavior with emphasis on the human nervous system. Includes cellular approaches to neural function, neuroanatomy, development

of neurons and circuits, and neuroendocrine mechanisms. Three lectures and one laboratory per week. Prerequisite: BIOL 121+122+123. Recommended prerequisite: BIOL 348.

### **BIOL 445** 2 F **Biotechnology I**

An overview of the basic goals and methods of biotechnology with an emphasis on DNA biotechnology. Topics covered include DNA and RNA analysis and manipulation, gene and DNA cloning, DNA amplification, DNA sequencing and genetic modification of organisms. Applications of biotechnology, along with political and ethical considerations, will be discussed. Two lectures per week. Prerequisites: BIOL 121+122+123. Corequisite: BIOT 345L.

### **BIOL 445L** 1 F **Biotechnology I Lab**

Focus on critical thinking, analytical reasoning, and lab skills practiced in the fields of biomedical science, genetic engineering, agriculture, and forensics. Techniques include cultures of cell lines, bacteria and worms, and protein analyses of ELISA, immunocytochemistry and Western blotting in addition to preparation of media and solution. One laboratory per week.

### **BIOL 450** 4 F **Philosophy of Origins**

Historical and current issues relating to special creation and evolution models of origins. Biological, geological, and paleontological evidence and potential explanations along with the theological and scientific implications of various interpretations. Limited to students with senior standing majoring in biology and environmental studies who will graduate in the current calendar year. Prerequisite: BIOL 121+122+123, 354.

### **BIOL 469** 4 S **Immunology**

The lymphoid system and its response to foreign substances by humoral or cellular mechanisms that may protect or injure the host. Immunogens, immunoglobulins, complement, antigen-antibody reactions, phagocytosis, inflammation, immediate and delayed allergy, autoimmunity, and the immunology of transplantation, cancer and tolerance. Prerequisites: BIOL 121+122+123, 320

### **BIOL 495** 1-3 Arr **Independent Study**

Properly qualified students in biology whose scholarship is of outstanding quality may undertake a limited amount of individual investigation. Repeatable to a maximum of 6 credits.

## Conservation Technology

### LOWER-DIVISION COURSES:

### **CNTC 201** 3 F **Conservation Technology**

This course will introduce students to an array of current and emerging technologies in the conservation/environmental field, include remote sensing, geographic information systems (GIS), geographic positioning systems (GPS), coding/programming, Internet of Things (IoT), camera trapping, environmental sensors, artificial intelligence (including machine and deep learning), digital twins, conservation genetics (e.g., eDNA, scat dogs), and mobile app development and usage. Students will be learn to critically read and evaluate peer-reviewed scientific literature. Two lectures and one laboratory per week.

**CNTC 240** **2 F**  
**Introduction to GIS**  
*(See INFS 240.)*

UPPER-DIVISION COURSES:

**CNTC 301** **2 W**  
**Applications of Conservation Technology**

Study of the development and use of conservation technologies in environmental and other professional fields, with experience in understanding how this field is evolving and what professional job prospects may exist now and in the future. Experience applying conservation technologies – including camera trapping, eDNA, coding/programming, geographic information systems (GIS), and mobile apps – in field and laboratory situations. Prerequisite: CNTC 201

**CNTC 301L** **2 S**  
**Applied Conservation Technology Lab**

Application of conservation technologies – including geographic information systems (GIS), remote sensing, coding/programming, and camera trapping – to forest and fire management questions within the PUC forest. Students will become proficient in experimental design, data collection, data analysis, and scientific communication. Prerequisite: DTSC 101, INFS 115, INFS 240, and CNTC 301.

**CNTC 340** **2 S**  
**Intermediate GIS**

Study of the spatial data structures and the display, manipulation, and analysis of geographic information, both through lecture and laboratory settings. Hands-on application of GIS skills and experience with GIS software will occur in the laboratory. Prerequisite: INFS/CNTC 240.

**CNTC 490** **1 S**  
**Conservation Technology Capstone**

A project-based course in which students develop proposals for conservation technology-based projects that could be implemented at PUC or to evaluate data and make recommendations based on conservation-technology-based projects that are already occurring at PUC. Prerequisite: CNTC 301, 301L.

**CNTC 494** **1-4 F, W, S, Su**  
**Internship**

Placement in a professional internship position where students will apply their conservation technology skills to a job. Each student will produce a final report and presentation based on the outcomes of their internship. Prerequisite: Permission of the instructor. Repeatable to a maximum of 4 credits.

## Environmental Studies

UPPER-DIVISION COURSES:

**ENVR 360** **3 F**  
**Conservation Biology**

Conservation ethics, population biology, biodiversity, threats to biodiversity, conserving biodiversity, and the interplay of human populations, economics, and politics. Required corequisite for biology and environmental studies majors and minors: ENVR 360L.

**ENVR 360L** **1 F**  
**Conservation Biology Laboratory**

Laboratory activities coordinated with ENVR 360. Prerequisite: BIOL 121+122+123.

**ENVR 361** **3 W**  
**Energy and Climate Change**

Fossil fuels, alternative energy sources, energy conservation, energy politics, atmosphere and climate, natural climate

changes, and global warming. Required corequisite for environmental studies majors and minors: ENVR 361L.

**ENVR 361L** **1 W**  
**Energy and Climate Change Laboratory**

Laboratory activities coordinated with ENVR 361

**ENVR 362** **3 S**  
**Pollution and Environmental Quality**

Air pollution, ozone depletion, acid rain, water quality, water pollution, wastewater treatment, solid waste management, food production, pest control, and various environmental hazards. Required corequisite for environmental studies majors and minors: ENVR 362L.

**ENVR 362L** **1 S**  
**Pollution and Environmental Quality Laboratory**

Laboratory activities coordinated with ENVR 362.

**ENVR 397** **.5 W**  
**Environmental Studies Seminar**  
*(See also BIOL 397.)*

Topics of current interest in the biological and environmental sciences are presented and discussed. Prerequisites: BIOL 121+122+123, SCIE 290. Graded S/U.

**ENVR 412** **1-4 F, W, S, Su**  
**Research in Environmental Studies**

Original investigation in selected areas of environmental studies. The research topic is selected and the work done under direction of a faculty advisor. Scholarly presentation of research results is encouraged. Prerequisites: BIOL 222 and permission of the instructor. Repeatable to a maximum of 4 credits. A maximum of 2 credits applied to the Environmental Studies major. Graded S/U. Qualifies for IP grading.

**ENVR 494** **1-4 F, W, S, Su**  
**Internship**

Volunteer service or employment with an environmental government agency or non-government organization to provide students with experience relevant to future employment or graduate studies. A report must be submitted summarizing duties performed and skills learned. Prerequisite: Permission of instructor. Repeatable to a maximum of 4 credits. Graded S/U. Qualifies for IP grading.

## Geology

LOWER-DIVISION COURSES:

**GEOL 233** **3 F**  
**Geology**

A comprehensive introduction to the fundamental principles and concepts of Earth science.

**GEOL 233L** **1 F**  
**Geology Lab**

Hands-on experience and practical understanding of fundamental geological concepts. Corequisite or prerequisite: GEOL 233.

## Global Health

**GLBH 201** **2 F, S**  
**Introduction to Global Health**

An introduction to key global health topics. Looks at links between poverty and health; relationships among health, equity, and health disparities; connections between health and social and economic development; and the relationship between gender and ethnicity to health.

**GLBH 310** **4 F**  
**Population Health**

Focuses on interrelated conditions that influence health outcomes of individuals

within populations. Considers health as influenced by cultural, social, economic, and physical environments. Examines patterns of health practices, human biology, early childhood development, and health services on the health outcomes of various groups of individuals.

**GLBH 410** **4 F**  
**Epidemiology for Public Health**

Expands on prior knowledge to provide solid foundation in key areas of methodology, causality, and the complex issues that surround chronic and infectious disease investigation. Examines descriptive epidemiology, including data sources, study designs, measures of effect, data interpretation, and screening. Also focuses on four content areas: infectious diseases, occupational and environmental health, molecular and genetic epidemiology, and psychosocial epidemiology.

**GLBH 418** **4 W**  
**Ethics for Global Health**

Exploration of how values influence one's perspective on identifying global wrongs related to health and seeking to find solutions. For example, where do the rights of people to enjoy health intersect with the idea that other people may not feel obligated to provide charity? If one group believes in a particular systematic approach to health, what happens when they fail to respect national boundaries in offering solutions to a health issue?

**GLBH 422** **4 S**  
**Metrics Literacy**

Health indicators, calculated as rates, ratios, and percentages, serve as a common numerical language to make order out of chaos. These numbers represent (in aggregate) real people's lives. What do health indicators really tell us? How do they work, what do they reveal, what do they conceal? This class explores why it matters.

**GLBH 460** **4 W**  
**Health Systems of the World**

Health systems in all countries reflect disparities in wealth. The demand for health services always outstrips the financial resources available to supply them. Differences in income translate to both personal and societal wealth and have a profound and continuing effect on the opportunities, lifestyles, and health of the people. Even low-income countries now experience wealthy-nation diseases, such as heart disease and cancer.

**GLBH 465** **4 F**  
**Issues in Global Health**

Many health issues surface to the public domain in the form of controversies. To get to the root of the controversy, and to gain insight into what must be done to promote health, learners must dissect root causes before proposing strategies for progress. This course covers a variety of health-related topics that affect the U.S. and many other countries.

**GLBH 470** **4 S**  
**Project Implementation**

This course is intended to help students understand not only competent health program planning and evaluating but also to become savvy consumers of evaluation reports. The distinction between individual patient health and population health is a prerequisite for the thinking and planning stages. Implementation varies depending on which level of a population is targeted, different determinants of a health problem, and the selected strategies and interventions to address a health problem. Quality improvement methodologies are presented since they complement traditional program evaluations.

**GLBH 476** **4 Arr**  
**Global Health Field Experience**

The field experience focuses on issues relevant to global health, including health

care, health education, environmental effects on health, infectious disease, mental health, health disparities, medical sequelae of natural disasters or political violence, indigenous healing practices, nutrition and reproductive health. Prerequisite: Department permission.

## Microbiology

SERVICE COURSE:

*(Not applicable to a major or minor in this department)*

### MICR 134

5 F, S

#### General Microbiology

An introduction to microorganisms—the bacteria, viruses, and fungi; the usefulness of microorganisms in nature and manufacturing; pathogenesis and immunity. Consideration of each major infectious disease with respect to its causative agent, characteristics, diagnosis, transmission, and prevention. Four lectures and one laboratory per week.

Prerequisites: Demonstrated algebra proficiency of MATH 096 or equivalent *plus*

One of the following options:

- BIOL 101, 102 (*strongly recommended*)
- Minimum ACT score of 22
- Minimum SAT score of 1100 (new scoring system) or 1500 (old scoring system)
- Minimum college-level GPA of 3.0
- Completion of BIOL 100 with minimum grade C-.

## Science

SERVICE COURSE:

*(Not applicable to a major or minor in this department)*

### SCIE 100

1 Su

#### STEM I

A week-long program intensive with course work, projects, and focused academic study in STEM subjects for college early students (grades 6-8). Prerequisite: Admission to PacificQuest summer program. Repeatable for Credit. Graded S/U.

### SCIE 101

1 Su

#### STEM II

A week-long program intensive with course work, projects, and focused academic study in STEM subjects for college early students (grades 9-11). Prerequisite: Admission to PacificQuest summer program. Repeatable for Credit. Graded S/U.

LOWER-DIVISION COURSE:

### SCIE 290

1 W

#### Sophomore Seminar

Preparation of math and science students for successful pursuit of internship/research, graduate school, and career opportunities. Discussions of discipline-specific career options and skills needed for obtaining a job or success at the next level of education. Includes resume writing and portfolio preparation. Relevant topics of interest presented by guest speakers. 1 credit S/F.

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