

# BIOLOGY

## **Bachelor of Science degree with a major in Biology —**

Concentrations in:

Cellular/Molecular Biology  
Ecology & Biodiversity  
Environmental Biology  
General Biology  
Marine Biology  
Microbiology  
Science Education

## **Minor in Biology**

## **Science Teaching Credential**

## **Master of Science degree in Biology**

### **Department Chair**

Bruce O'Gara, Ph.D.

### **Department of Biological Sciences**

Science Complex B 221

707-826-3245

[www.humboldt.edu/biosci](http://www.humboldt.edu/biosci)

### **The Program**

Students completing this program will have demonstrated the ability to:

- apply the scientific method to questions in biology by formulating testable hypotheses, gathering data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses
- present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists
- access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works
- apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations
- identify the major groups of organisms and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of organisms that differentiate the various domains and kingdoms from one another
- use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped organismal morphology, physiology, life history, and behavior

- explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life

- explicate the ecological interconnectedness of life on earth by tracing energy and nutrient flows through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems

- demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

Humboldt's program emphasizes hands-on learning. Our diverse facilities include the largest greenhouse in the California State University system, a vertebrate museum containing mammals, reptiles, and amphibians from around the world, and a vascular plant herbarium with almost 100,000 specimens. Near the campus are many parks, forests, and undisturbed habitats for studying plants and animals in their natural surroundings.

Humboldt's marine laboratory, located on the coast in the nearby town of Trinidad, gives students outstanding opportunities for marine biology projects. The research vessel, the Coral Sea, is used for seagoing field trips. Several smaller boats are used in nearshore waters, coastal lagoons, and Humboldt Bay.

Our well-equipped biotechnology laboratory, cell culture facility, and College Core facility allow modern work in molecular and cellular biology. Scanning and transmission electron microscopes are also available for student use.

Humboldt biology graduates have many job opportunities: teacher, field biologist, marine biologist, museum curator, science librarian, clinical lab technologist, laboratory technician, environmental consultant, microbiologist, and biotechnology research technician. Graduates may also pursue advanced study in biology or a professional degree.

### **Preparation**

In high school take biology, chemistry, and physics (with labs, if possible); beginning and intermediate algebra; geometry; and trigonometry.

## **REQUIREMENTS FOR THE MAJOR**

*For a description of degree requirements to be fulfilled in addition to those listed below for the major, please see "The Bachelor's Degree" section of the catalog, pp. 66-80., and "The Master's Degree" section of the catalog, pp. 81-83.*

*Students who receive a grade below a C- in any prerequisite course will require instructor approval for enrollment.*

### **Core Courses (for all concentrations)**

*Take all lower division courses before beginning upper division work.*

#### **Lower Division**

BIOL 105	(4)	Principles of Biology
BOT 105	(4)	General Botany
CHEM 109	(5)	General Chemistry I
CHEM 110	(5)	General Chemistry II
MATH 105	(3)	Calculus for the Biological Sciences & Natural Resources, <b>or</b>
MATH 109	(4)	Calculus I
PHYX 106	(4)	College Physics: Mechanics & Heat
STAT 109	(4)	Introductory Biostatistics
ZOOL 110	(4)	Introductory Zoology

#### **Upper Division**

BIOL 307	(4)	Evolution
BIOL 340	(4)	Genetics

*Select one of the following concentrations:*

#### **Cellular/Molecular Biology Concentration**

*Core courses plus:*

#### **Lower Division**

PHYX 107	(4)	College Physics: Electromagnetism & Modern Physics
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#### **Upper Division**

BIOL 410	(4)	Cell Biology
BIOL 412	(4)	General Bacteriology
BIOL 440	(2)	Genetics Lab
BOT 310	(4)	Gen. Plant Physiology, <b>or</b>
ZOOL 310	(4)	Animal Physiology, <b>or</b>
ZOOL 312	(4)	Human Physiology
CHEM 328	(4)	Brief Organic Chemistry, <b>or</b>
CHEM 321	(5)	Organic Chemistry, <b>&amp;</b>
CHEM 322	(5)	Organic Chemistry
CHEM 438	(4)	Introductory Biochemistry, <b>or</b>
CHEM 431	(5)	Biochemistry, <b>&amp;</b>
CHEM 432	(5)	Biochemistry

BIOL 490 (1-2) Senior Thesis, **or**  
BIOL 499 (1-2) Directed Study

### Ecology & Biodiversity Concentration

*Core courses plus:*

#### Lower Division

PHYX 118 (1) College Physics:  
Biological Applications

One course from the following:

GEOG 106 (3) Physical Geography

GEOL 109 (4) General Geology

OCN 109/109L (3/1) General  
Oceanography/Lab

SOIL 260 (3) Intro to Soil Science

FISH 320 (3) Limnology

#### Upper Division

CHEM 328 (4) Brief Organic Chemistry

BIOL 330 (4) Principles of Ecology

BIOL 434 (4) Population & Community  
Ecology

BIOL 438 (4) Field Ecology, **or**

BIOL 490 (1-2) Senior Thesis, **or**

BIOL 499 (1-2) Directed Study

One course from the following:

BIOL 410 (4) Cell Biology

BIOL 412 (4) General Bacteriology

BOT 310 (4) General Plant Physiology

ZOOL 310 (4) Animal Physiology

At least six units of additional courses from  
the following:

BIOL 412 (4) General Bacteriology

BOT 350 (4) Plant Taxonomy

BOT 354 (4) Agrostology

BOT 355 (4) Lichens and Bryophytes

BOT 356 (4) Phycology

BOT 358 (2) Biology of Microfungi

BOT 359 (2) Biology of Ascomycetes  
and Basidiomycetes

FISH 310 (4) Ichthyology

WLDF 365 (3) Ornithology I

ZOOL 314 (5) Invertebrate Zoology

ZOOL 316 (3) Freshwater Aquatic  
Invertebrates

ZOOL 354 (4) Herpetology

ZOOL 356 (3) Mammalogy

ZOOL 358 (4) General Entomology

ZOOL 556 (4) Marine Mammalogy

One upper division statistics course (e.g.,  
STAT 333, STAT 406, STAT 409)

At least **three** additional upper division  
courses in the biological sciences to be  
chosen in consultation with advisor.

### Environmental Biology Concentration

*Core courses plus:*

#### Lower Division

PHYX 118 (1) College Physics:  
Biological Applications

*Take all lower division courses before  
beginning upper division work.*

#### Upper Division

BIOL 330 (4) Principles of Ecology

One course from the following:

BIOL 410 (4) Cell Biology, **or**

BOT 310 (4) Gen. Plant Physiology, **or**

CHEM 328 (4) Brief Organic Chemistry,  
**or**

ZOOL 310 (4) Animal Physiology

Two courses in plant groups from:

BOT 350 (4) Plant Taxonomy

BOT 354 (4) Agrostology

BOT 355 (4) Lichens & Bryophytes

BOT 356 (4) Phycology

BOT 359 (2) Biology of Ascomycetes  
& Basidiomycetes

BOT 360/BOT 360L (2/2) Biology of the  
Fleshy Fungi/Lab

Two courses in animal groups from:

FISH 310 (4) Ichthyology

WLDF 365 (3) Ornithology I

ZOOL 314 (5) Invertebrate Zoology

ZOOL 316 (3) Freshwater Aquatic  
Invertebrates

ZOOL 354 (4) Herpetology

ZOOL 356 (3) Mammalogy

ZOOL 358 (4) General Entomology

ZOOL 556 (4) Marine Mammalogy

One anatomy/morphology course from:

BOT 322 (4) Developmental Plant  
Anatomy

BOT 372 (4) Evolutionary Morphology  
of Plants

ZOOL 270 (4) Human Anatomy

ZOOL 370 (4) Comparative Anatomy  
of the Vertebrates

Two practical applications courses from:

BIOL 412 (4) General Bacteriology

BIOL 433 (3) Microbial Ecology **and**

BIOL 433D (1) Microbial Ecology  
Discussion

BOT 394 (3) Forest Pathology

BOT 458 (3) Pollination Biology

BOT 553 (3) Marine Macrophyte  
Ecology

ESM 360 (3) Intro to Environmental  
Planning Methods

REC 330 (3) Adventure Theory &  
Practice

SOC 320 (4) Environmental Sociology

SOIL 260 (3) Intro to Soil Science

WLDF 460 (3) Conservation Biology

ZOOL 430 (4) Comparative Animal  
Behavior

Or other courses selected in consultation  
with an advisor

One unit from:

BIOL 490 (1-2) Senior Thesis, **or**

BIOL 499 (1-2) Directed Study

### General Biology Concentration

*Core courses plus:*

#### Lower Division

PHYX 118 (1) College Physics:  
Biological Applications

*Take all lower division courses before  
beginning upper division work.*

#### Upper Division

BIOL 330 (4) Principles of Ecology

BIOL 412 (4) General Bacteriology, **or**

BIOL 433 (3) Microbial Ecology **and**

BIOL 433D (1) Microbial Ecology  
Discussion

One course from the following:

BIOL 410 (4) Cell Biology, **or**

BOT 310 (4) Gen. Plant Physiology, **or**

ZOOL 310 (4) Animal Physiology, **or**

ZOOL 312 (4) Human Physiology

CHEM 321 (5) Organic Chemistry **and**

CHEM 322 (5) Organic Chemistry, **or**

CHEM 328 (4) Brief Organic Chemistry

At least **15 additional units of upper divi-  
sion courses** in biological sciences, chosen  
in consultation with an academic advisor.

### Marine Biology Concentration

*Core courses plus:*

#### Lower Division

BIOL 255 (3) Marine Biology

OCN 109/109L (3/1) General  
Oceanography/Lab

PHYX 118 (1) College Physics:  
Biological Applications

*Take all lower division courses before  
beginning upper division work.*

#### Upper Division

BIOL 330 (4) Principles of Ecology

BOT 356 (4) Phycology

CHEM 328 (4) Brief Organic Chemistry

FISH 310 (4) Ichthyology

ZOOL 314 (5) Invertebrate Zoology

BIOL 430 (3) Intertidal Ecology, **or**

OCN 310 (4) Biological Oceanography

- BIOL 410 (4) Cell Biology, **or**  
 BOT 310 (4) Gen. Plant Physiology, **or**  
 ZOOL 310 (4) Animal Physiology

One of the following:

- BIOL 490 (1-2) Senior Thesis, **or**  
 BIOL 498 (2) Marine Biology Capstone  
 Research, **or**  
 BIOL 499 (1-2) Directed Study

Choose **at least one advanced marine biology elective** from the following list, or from any optional course NOT taken above.

- BIOL 418 (3) Marine Microbiology  
 BOT 553 (3) Marine Macrophyte  
 Ecology  
 FISH 375 (3) Mariculture  
 FISH 435 (4) Biology of Marine Fishes  
 OCN 410 (3) Zooplankton Ecology  
 ZOOL 530 (3) Benthic Ecology  
 ZOOL 552 (3) Advanced Invertebrate  
 Zoology  
 ZOOL 556 (4) Marine Mammalogy

### Microbiology Concentration

Core courses plus:

#### Lower Division

- PHYX 118 (1) College Physics:  
 Biological Applications

*Take all lower division courses before beginning upper division work.*

#### Upper Division

- BIOL 330 (4) Principles of Ecology  
 BIOL 412 (4) General Bacteriology  
 BIOL 418 (3) Marine Microbiology, **or**  
 BIOL 433 (3) Microbial Ecology **and**  
 BIOL 433D (1) Microbial Ecology  
 Discussion  
 BIOL 440 (2) Genetics Laboratory  
 BOT 358 (2) Biology of the Microfungi  
 CHEM 328 (4) Brief Organic Chemistry  
 CHEM 431/CHEM 432 (5/5)  
 Biochemistry, **or**  
 CHEM 438 (4) Introductory Biochemistry

One course from the following:

- BIOL 410 (4) Cell Biology, **or**  
 BOT 310 (4) Gen. Plant Physiology, **or**  
 ZOOL 310 (4) Animal Physiology, **or**  
 ZOOL 312 (4) Human Physiology  
 BIOL 490 (1-2) Senior Thesis, **or**  
 BIOL 499 (1-2) Directed Study

### Science Education Concentration

*Core courses plus:*

#### Lower Division

- GEO 109 (4) General Geology  
 PHYX 107 (4) College Physics:  
 Electromagnetism &  
 Modern Physics

*Take all lower division courses before beginning upper division work.*

#### Upper Division

- BIOL 330 (4) Principles of Ecology  
 BIOL 412 (4) General Bacteriology, **or**  
 BIOL 433 (3) Microbial Ecology **and**  
 BIOL 433D (1) Microbial Ecology  
 Discussion  
 BIOL 440 (2) Genetics Laboratory  
 BOT 350 (4) Plant Taxonomy  
 CHEM 328 (4) Brief Organic Chemistry  
 ZOOL 312 (4) Human Physiology

Before applying to the secondary education credential program, students must meet the prerequisite of 45 hours early field experience or enroll in SED 210/SED 410. In addition, they must take EDUC 285 or equivalent.

### REQUIREMENTS FOR THE MINOR

- BIOL 105 (4) Principles of Biology  
 BOT 105 (4) General Botany  
 ZOOL 110 (4) Introductory Zoology

One of the following:

- BIOL 410 (4) Cell Biology, **or**  
 BOT 310 (4) Gen. Plant Physiology, **or**  
 ZOOL 310 (4) Animal Physiology

An additional eight upper division units (approved by the minor advisor) in at least two of these three areas: biology, botany, zoology.

### REQUIREMENTS FOR THE MASTER'S DEGREE

Students completing this program will have demonstrated the ability to:

- demonstrate a thorough understanding of fundamental knowledge in biology and the essential literature in their specific research or project area
- propose, design, and conduct research or a project in biological sciences and demonstrate proficiency in the techniques and methods of analysis appropriate for their research or project area
- present the results of their research or project to an appropriate forum in both oral and written format.

#### Requirements For Admission

Bachelor's degree in biology, botany, zoology, or a related subject area approved by the Department of Biological Sciences.

Undergraduate GPA at least 2.5 overall or 3.0 for the last 60 semester units of credit.

Submitted results of the aptitude portion of the Graduate Record Examination (GRE).

#### Requirements For The Degree

30 upper division or graduate units in biological sciences or supporting courses approved by the graduate committee, including BIOL 683 and BIOL 684 (normally taken at the first opportunity) and two seminars (BIOL 685). A minimum of 18 units must be at the graduate level.

Combined total of not less than four nor more than eight units of BIOL 690 and/or BIOL 699 (with a maximum of six units in BIOL 690) and a thesis or project approved by the graduate committee.

While in residence, enrollment in a minimum of two units per semester of BIOL 690 or BIOL 699.

Oral presentation of the thesis or project work and defense of the thesis or project before the graduate committee.

