

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

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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. 66-81., and "The Master's Degree" pp. 82-84.

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, or
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
CHEM 228	(4) Brief Organic Chemistry, or
CHEM 324	(3) Organic Chemistry I, and
CHEM 324L	(2) Organic Chemistry I Lab, &
CHEM 325	(3) Organic Chemistry II, and
CHEM 325L	(2) Organic Chemistry II Lab

Upper Division

BIOL 410	(4) Cell Biology
BIOL 412	(4) General Bacteriology
BIOL 440	(2) Genetics Lab
BOT 310	(4) Gen. Plant Physiology, or
ZOOL 310	(4) Animal Physiology, or
ZOOL 312	(4) Human Physiology

- CHEM 438 (4) Introductory Biochemistry, **or**
 CHEM 434 (3) Biochemistry I, **and**
 CHEM 434L (2) Biochemistry I Lab **and**
 CHEM 435 (3) Biochemistry II, **and**
 CHEM 435L (2) Biochemistry II Lab
- BIOL 490 (1-2) Senior Thesis, **or**
 BIOL 499 (1-2) Directed Study

Ecology & Biodiversity Concentration

Core courses plus:

Lower Division

- CHEM 228 (4) Brief Organic Chemistry
 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

- 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
 ZOO 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
 ZOO 314 (5) Invertebrate Zoology
 ZOO 316 (3) Freshwater Aquatic Invertebrates
- ZOO 354 (4) Herpetology
 ZOO 356 (3) Mammalogy
 ZOO 358 (4) General Entomology
 ZOO 556 (4) Marine Mammalogy

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

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 228 (4) Brief Organic Chemistry, **or**

- ZOO 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
 ZOO 314 (5) Invertebrate Zoology
 ZOO 316 (3) Freshwater Aquatic Invertebrates

- ZOO 354 (4) Herpetology
 ZOO 356 (3) Mammalogy
 ZOO 358 (4) General Entomology
 ZOO 556 (4) Marine Mammalogy

One anatomy/morphology course from:

- BOT 322 (4) Developmental Plant Anatomy
 BOT 372 (4) Evolutionary Morphology of Plants
- ZOO 270 (4) Human Anatomy
 ZOO 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
 ZOO 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**
 ZOO 310 (4) Animal Physiology, **or**
 ZOO 312 (4) Human Physiology

One chemistry option:

- CHEM 228 (4) Brief Organic Chemistry, **or**
 CHEM 324 (3) Organic Chemistry I **and**
 CHEM 324L (2) Organic Chemistry I Lab, **and**

- CHEM 325 (3) Organic Chemistry II **and**
 CHEM 325L (2) Organic Chemistry II Lab

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

Marine Biology Concentration

Core courses plus:

Lower Division

- BIOL 255 (3) Marine Biology
 CHEM 228 (4) Brief Organic Chemistry
 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
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

CHEM 228	(4) Brief Organic Chemistry
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 434	(3) Biochemistry I, and
CHEM 434L	(2) Biochemistry I Laboratory, and
CHEM 435	(3) Biochemistry II, and
CHEM 435L	(2) Biochemistry II Laboratory

OR

CHEM 438	(4) Introductory Biochemistry
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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

CHEM 228	(4) Brief Organic Chemistry
GEOL 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
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.

