Biology

Bachelor of Science degree with a major in Biology —

Concentrations in:
- Cellular/Molecular Biology
- Ecology
- General Biology
- Marine Biology
- Microbiology
- Science Education

Minor in Biology

Science Teaching Credential

Master of Science degree in Biology

Department Chair
Amy Sprowles, Ph.D.

Department of Biological Sciences
Science Complex B 221
707-826-3245
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 techni- cian, 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. 87-82., and “The Master’s Degree” pp. 83-84.

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 [33-34 units]

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 105</td>
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<td>BOT 105</td>
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<td>CHEM 109</td>
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<td>CHEM 110</td>
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<td>MATH 109</td>
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<td>PHYX 106</td>
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<td>STAT 109</td>
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<td>ZOOL 110</td>
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Upper Division [8 units]

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 340</td>
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<tr>
<td>BIOL 340L</td>
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Select one of the following concentrations:

Cellular/Molecular Biology Concentration

Core courses plus:

Lower Division

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>PHYX 107</td>
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<td>PHYX 118</td>
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<tr>
<td>CHEM 228</td>
<td>4</td>
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<tr>
<td>CHEM 324</td>
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<tr>
<td>CHEM 324L</td>
<td>2</td>
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<td>CHEM 325</td>
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<tr>
<td>CHEM 325L</td>
<td>2</td>
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Upper Division

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tr>
<td>BIOL 350</td>
<td>3</td>
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<tr>
<td>BOT 310</td>
<td>4</td>
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<tr>
<td>ZOOL 310</td>
<td>4</td>
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<td>ZOOL 312</td>
<td>4</td>
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</tbody>
</table>
BIOL 440  (2) Molecular Genetics Lab, or
BIOL 450  (2) Cell Biology Laboratory

Upper Division Restricted Electives

Choose 12 units from the courses below.

Note: No more than two units of BIOL 490 or BIOL 499 may be used to fulfill this requirement.

BIOL 412  (4) General Microbiology
BIOL 440  (2) Molecular Genetics Lab [if not already taken]
BIOL 450  (2) Cell Biology Lab [if not already taken]
BIOL 544  (2) Stem Cell Biology
BIOL 544L  (2) Stem Cell Biology Lab
BIOL 564  (4) Transmission & Scanning Electron Microscopy
BIOL 490 (1-2) Senior Thesis, or
BIOL 499 (1-2) Directed Study
CHEM 438  (4) Introductory Biochemistry
CHEM 434  (3) Biochemistry I
CHEM 434L  (2) Biochemistry I Lab
CHEM 353  (3) Biochemistry II
CHEM 353L  (2) Biochemistry II Lab
ZOOL 476  (4) Principles of Animal Development

or upper division statistics courses with the approval of your advisor.

Ecology Concentration

Core courses plus:

Lower Division

CHEM 228  (4) Brief Organic Chemistry
PHYX 107  (4) College Physics: Electromagnetism & Modern Physics, or
PHYX 118  (1) College Physics: Biological Applications

One course from the following:

GEOG 106  (3) Physical Geography
GEOI 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 412  (4) General Microbiology, or
BIOL 433  (3) Microbial Ecology and
BIOL 433D  (1) Microbial Ecology Discussion

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 12 additional units of upper division courses in biological sciences, chosen in consultation with an academic advisor.

General Biology Concentration

Core courses plus:

Lower Division

PHYX 107  (4) College Physics: Electromagnetism & Modern Physics, or
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 Microbiology, or
BIOL 433  (3) Microbial Ecology and
BIOL 433D  (1) Microbial Ecology Discussion

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 12 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 107  (4) College Physics: Electromagnetism & Modern Physics, or
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 350  (3) Cell Biology, or
FISH 310  (4) Ichthyology
ZOOL 314  (5) Invertebrate Zoology

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

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

BIOL 418  (3) Marine Microbiology
BIOT 553  (3) Marine Phytoplankton Ecology
FISH 375  (3) Marine Mollusks
FISH 435  (4) Biology of Marine Fishes
OCN 410  (3) Zooplankton Ecology
ZOO 530  (3) Benthic Ecology
ZOO 552  (3) Advanced Invertebrate Zoology
ZOO 556  (4) Marine Mammalogy

Microbiology Concentration

Core courses plus:

Lower Division

PHYX 107  (4) College Physics: Electromagnetism & Modern Physics, or
PHYX 118  (1) College Physics: Biological Applications

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
Take all lower division courses before beginning upper division work.

Upper Division
BIOL 330 (4) Principles of Ecology
BIOL 412 (4) General Microbiology
BIOL 418 (3) Marine Microbiology, or
BIOL 433 (3) Microbial Ecology and
BIOL 433D (1) Microbial Ecology Discussion
BIOL 440 (2) Molecular Genetics Laboratory, or
BIOL 490 (1-2) Senior Thesis, or
BIOL 499 (1-2) Directed Study

Upper Division Restricted Electives
Six units from the courses listed below.
BIOL 350 (3) Cell Biology
BIOL 440 (2) Molecular Genetics Lab (if not already taken)
BIOL 450 (2) Cell Biology Lab
BIOL 564 (4) Transmission & Scanning Electron Microscopy
BOT 358 (2) Biology of the Microfungi
BOT 356 (4) Phycology
CHEM 438 (4) Introductory Biochemistry
Or upper division statistics course with the approval of your advisor.

Science Education Concentration
Core courses plus:
Lower Division (12 units)
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 (19 units)
BIOL 330 (4) Principles of Ecology
BIOL 350 (3) Cell Biology
BIOL 448 (3) Biogeography
BIOL 499 (1) Directed Study
BOT 350 (4) Plant Taxonomy
ZOO 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
Lower Division (12 units)
BIOL 105 (4) Principles of Biology
BOT 105 (4) General Botany
ZOO 110 (4) Introductory Zoology
Upper Division (11-12 units)
One of the following courses.
BIOL 350 (3) Cell Biology
BOT 310 (4) General Plant Physiology
ZOO 310 (4) Animal Physiology
ZOO 312 (4) Human Physiology
Plus an additional eight units of upper division courses [approved by minor advisor] in at least two of these three areas: biology (BIOL), botany (BOT) and zoology (ZOO). Of these eight units, a minimum of six units must be courses NOT used to satisfy major requirements.

Note: BIOL 307 Evolution is the only upper division GE Area B course that can be used to satisfy requirements for the Biology minor.

Requirements for the Master's Degree
Program Learning Outcomes
Graduate students will:
- apply a rich body of relevant biological sciences knowledge and information to solve complex scientific problems and challenges
- present a proposal for biological research or project of their own design
- conduct a unique and independent biological investigation or an independent project according to the rigors and conventions of the field
- communicate the results of their scientific investigation or project in an oral format according to conventions of the discipline
- communicate the results of their scientific investigation or project in writing according to the conventions of the discipline

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 Master of Science degree in Biology
Required Courses
BIOL 683 [1] Introduction to Graduate Studies
BIOL 684 [1] Introduction to Graduate Research
BIOL 685 [1] Seminar in Biology [take two seminars]

Upper division or graduate units in biological sciences or supporting courses approved by the graduate committee to bring total to 30 units. A minimum of 18 units must be at the graduate level.
While in residence, enrollment in a minimum of two units * per semester of:
BIOL 690 [1-4] Thesis or

*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.

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