Molecular Environmental Biology

Bachelor of Science (BS)

The Molecular Environmental Biology (MEB) major is designed to expose students to the organization and function of biological organisms. Molecular approaches are expected to play an increasing role in environmental problem-solving in the near future, and their success will depend upon a sound understanding of biological principles from molecular through ecological levels. The program trains students in the organization and function of biological organisms and their integration into the environment.

Declaring the Major

Advice on admission for freshmen and transfer students can be found on the CNR Admissions Guide (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/admissionstext) page or the CNR Prospective Student website (https://nature.berkeley.edu/prospective-students). Freshman students may apply directly to the major, or they may select the College of Natural Resources’s undeclared option and declare the major by the end of their fourth semester. Transfer students may apply directly to the major through the UC application.

Information for current Berkeley students who would like to declare the major after admission, including information on a change of major or change of college, please see chapter 6 of the College of Natural Resources Undergraduate Student Handbook (https://nature.berkeley.edu/handbook). (https://nature.berkeley.edu/handbook) Students can meet with peer advisors or academic advisors for full guidance.

- There is a 3.0 GPA requirement to transfer into the College of Natural Resources from other colleges on campus.
- Required pre-requisite courses to declare the Molecular Environmental Biology are: Chemistry 1A/L and 3A/L, one semester of Biology (1A/L or 1B), R1A and R1B, Math 1A/1B or 16A/B or 10A/B
  - It is recommended to complete the ESPM lower-division core courses.
- Undeclared students must declare a major by the end of their fourth semester. Failure to declare a major by junior standing will result in a registration block, and you will not be able to enroll in any courses until you are declared.
- Current UC Berkeley students who entered as freshmen are expected to be able to graduate in a total of 8 semesters (summers excluded). Exceptions are rarely granted. Students should be progressing in major requirements each semester.
- All major requirements must be taken for a letter grade.
- Both halves of the Reading and Composition requirement must be completed by the end of the fourth semester.

Honors Program

Students with a grade point average (GPA) of 3.6 or higher may enroll in the College of Natural Resources Honors Program (H196) once they have reached upper division standing. To fulfill the program requirements, students design, conduct, and report on an individual research project working with a faculty sponsor. For further information on registering for the Honors Symposium and on Honors requirements, please see the College of Natural Resources website (http://nature.berkeley.edu/site/honors_program.php).

Minor Program

There is no minor program in Molecular Environmental Biology.

Other Majors and Minors Offered by the Department of Environmental Science, Policy, and Management

Conservation and Resource Studies (http://guide.berkeley.edu/undergraduate/degree-programs/conservation-resource-studies) (Major and Minor)
Environmental Sciences (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-sciences) (Major only)
Forestry and Natural Resources (http://guide.berkeley.edu/undergraduate/degree-programs/forestry-natural-resources) (Major and Minor)
Society and Environment (http://guide.berkeley.edu/undergraduate/degree-programs/society-environment) (Major only)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

Structure of the MEB Major

The lower division coursework provides a strong foundation in biological principles, and the upper division areas introduce students to the organization and function of biological organisms at the molecular, cellular, organismal, and ecological levels. The major also offers specialization through six Areas of Concentration: (1) animal health and behavior, (2) biodiversity, (3) ecology, (4) environmental and human health, (5) insect biology, and (6) global change biology.

**The curriculum has been revised effective Fall 2016. Students admitted prior to Fall 16 and following the previous curriculum should refer to the 15-16 (http://guide.berkeley.edu/archive/2015-16/undergraduate/degree-programs/molecular-environmental-biology/#majorrequirementstext) Guide.

Lower Division Requirements

Breadth Requirement

Select courses from L&S “7 Breadth” Categories (https://ls.berkeley.edu/seven-course-breadth-requirement)

# One course (3-4 units) in Arts & Literature, Historical Studies, or Philosophy & Values
# One course (3-4 units) in Social & Behavioral Sciences or International Studies

Reading & Composition Requirement

Students must complete Reading & Composition (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/reading-composition-requirement) by the end of sophomore year.

ESPM Environmental Science Core

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<tr>
<th>Select one of the following:</th>
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<tr>
<td>ENV SCI 10</td>
<td>Course Not Available [3]</td>
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<td>ESPM 2</td>
<td>The Biosphere [3]</td>
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**Upper division Requirements**

Select two courses from Area A and two courses from Area B. No more than one course from each category. Also complete the Senior Seminar (ESPM 192) and 12 units in Area of Concentration.

**Area A**

**Biochemistry**
- MCELLBI 102 Survey of the Principles of Biochemistry and Molecular Biology 4
- CHEM 135 Chemical Biology 3

**Molecular Biology/Genetics**
- ESPM 108B Environmental Change Genetics 3
- PLANTBI 160 Plant Molecular Genetics 3
- MCELLBI 104 Genetics, Genomics, and Cell Biology 4
- INTEGBI 141 Human Genetics 3
- INTEGBI 161 Population and Evolutionary Genetics 4
- INTEGBI 162 Ecological Genetics 4
- INTEGBI 164 Human Genetics and Genomics (lab included) 4
- MCELLBI 140 General Genetics 4

**Cell & Developmental Biology**
- MCELLBI 130 Cell and Systems Biology 4
- MCELLBI 133L Physiology and Cell Biology Laboratory 4
- MCELLBI 141 Developmental Biology 4
- MCELLBI 137L Physical Biology of the Cell 3
- PLANTBI C112 General Microbiology 4
- PLANTBI C109 Evolution and Ecology of Development 3
- PLANTBI C112L General Microbiology Laboratory 2

**ESPM Social Science Core**

Select one of the following:

- ESPM C11 Americans and the Global Forest 4
- ESPM C12/ Introduction to Environmental Studies 4
- ENGLISH C77 Environmental Policy, Administration, and Law
- CHEM 102 and General Chemistry Laboratory
- CHEM 3A Chemical Structure and Reactivity 5
- & 3AL and Organic Chemistry Laboratory
- CHEM 3B Chemical Structure and Reactivity 6
- & 3B and Chemical Structure and Reactivity
- BIOLOGY 1A General Biology Lecture 5
- & 1AL and General Biology Laboratory
- BIOLOGY 1B General Biology Lecture and Laboratory 4
- MATH 16A Analytic Geometry and Calculus 1 3
- MATH 16B Analytic Geometry and Calculus 1 3
- PHYSICS 8A Introductory Physics 2 4

2 For pre-health students, PHYSICS 8B is required in addition to PHYSICS 8A.

**Area B**

**Organismal Physiology**
- ESPM 144 Insect Physiology 3
- INTEGBI 132 Survey of Human Physiology 4
- INTEGBI 140 Biology of Human Reproduction 4
- INTEGBI 148 Comparative Animal Physiology 3
- INTEGBI 150 Evolutionary Environmental Physiology 3
- INTEGBI 151 Plant Physiological Ecology 4
- INTEGBI 151L Plant Physiological Ecology Laboratory 2
- MCELLBI 136 Physiology 4
- NUSCTX 103 Nutrient Function and Metabolism 3
- PLANTBI/ MCELLBI C116 Microbial Diversity 3
- PLANTBI 135 Physiology and Biochemistry of Plants 3

**Organismal Diversity**
- ESPM 106 American Wildlife: Management and Policy in the 21st Century (lab included) 3
- ESPM C105 Natural History Museums and Biodiversity Science 3
- ESPM 108A Trees: Taxonomy, Growth, and Structures (lab included) 3
- ESPM 115B Biology of Fungi with Laboratory (lab included) 4
- EBSP C125 Biogeography 4
- ESPM 132 Spider Biology (lab included) 4
- ESPM C138/ PLANTBI C114/ MCELLBI C114 Introduction to Comparative Virology 4
- MCELLBI 114 PLANTBI C120 Plant Cell Biology 4
- & 120L Plant Cell Biology and Laboratory for Biology of Algae 4

- PLANTBI 111 Introduction to California Plant Life with Laboratory 4
- MCELLBI 103LF Invertebrate Zoology with Laboratory 5
- INTEGBI 104LF Natural History of the Vertebrates with Laboratory 5
- INTEGBI 168 & 168L Systems of Vascular Plants and Systematics of Vascular Plants with Laboratory 5
- PLANTBI 113 California Mushrooms (lab included) 3
- PLANTBI C110L Plant Life and Laboratory for Biology of Algae 4
- PLANTBI/ MCELLBI C116 C110L Plant Life with Laboratory (lab included) 4
- MCELLBI 116 Microbial Diversity 3

**Ecology**
- ESPM 102A Course Not Available (lab included) 4
- ESPM 111 Ecosystem Ecology 4
- ESPM 112 Microbial Ecology 3
- ESPM 112L Microbial Metagenomic Data Analysis Lab 1
- ESPM 113 Insect Ecology 3
- ESPM 114 Wildlife Ecology 3
- ESPM 115C Fish Ecology (lab included) 3
- ESPM 116B Rangeland Ecology 3
- ESPM 116C Tropical Forest Ecology 3
- ESPM C125 Biogeography 4
### Lab Requirement

Select two upper division courses which include a lab, as part of the Areas A or B or Area of Concentration requirements. Additionally, this requirement many be fulfilled by: (1) One 3-4 unit independent study lab (course numbered H196 or 199); Summer Forestry Field Camp; or the Moorea Field Study course.

### Area of Concentration Requirement

Select 12 units from one concentration below. Up to four independent study units (e.g., ESPM 199, ESPM H196) may be applied to the concentration.

#### 1. Animal Health & Behavior

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<th>Course Code</th>
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<td>ESPM 103</td>
<td>Principles of Conservation Biology</td>
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<td>ESPM 106</td>
<td>American Wildlife: Management and Policy in the 21st Century (lab included)</td>
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<td>ESPM 110</td>
<td>Primate Ecology</td>
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<td>ESPM 114</td>
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<tr>
<td>ESPM C126</td>
<td>Animal Behavior</td>
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<td>ESPM 142</td>
<td>Insect Behavior</td>
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<tr>
<td>ESPM 146L</td>
<td>Medical and Veterinary Entomology Laboratory</td>
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<td>ESPM 186</td>
<td>Management and Conservation of Rangeland Ecosystems</td>
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<td>ESPM 188</td>
<td>Case Histories in Wildlife Management</td>
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<tr>
<td>INTEGBI 104LF</td>
<td>Natural History of the Vertebrates with Laboratory</td>
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<td>INTEGBI C143A/PSYCH C113</td>
<td>Biological Clocks: Physiology and Behavior</td>
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<td>INTEGBI C143B/PSYCH C116</td>
<td>Hormones and Behavior</td>
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<tr>
<td>INTEGBI 146LF</td>
<td>Behavioral Ecology with Laboratory</td>
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<tr>
<td>INTEGBI 148</td>
<td>Comparative Animal Physiology</td>
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<tr>
<td>INTEGBI 184L</td>
<td>Morphology of the Vertebrate Skeleton with Laboratory</td>
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<td>PSYCH 121</td>
<td>Animal Cognition</td>
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#### 2. Biodiversity

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<td>Principles of Conservation Biology</td>
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<tr>
<td>ESPM C105</td>
<td>Natural History Museums and Biodiversity Science</td>
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<td>ESPM 106</td>
<td>American Wildlife: Management and Policy in the 21st Century (lab included)</td>
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<td>ESPM 108A</td>
<td>Trees: Taxonomy, Growth, and Structures (lab included)</td>
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<td>ESPM 115B</td>
<td>Biology of Aquatic Insects</td>
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<td>ESPM C125</td>
<td>Biogeography</td>
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<tr>
<td>ESPM 132</td>
<td>Spider Biology (lab included)</td>
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<td>ESPM 140</td>
<td>General Entomology (lab included)</td>
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<tr>
<td>ESPM 147</td>
<td>Field Entomology (&quot;Ants,&quot; &quot;Beetles,&quot; and &quot;Spiders&quot; (1 unit each) SP. All three courses must be completed to equal one “lab course”)</td>
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<td>INTEGBI 102LF</td>
<td>Introduction to California Plant Life with Laboratory</td>
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<td>INTEGBI 103LF</td>
<td>Invertebrate Zoology with Laboratory</td>
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<td>Natural History of the Vertebrates with Laboratory</td>
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<tr>
<td>INTEGBI 160</td>
<td>Evolution</td>
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<td>INTEGBI 168 &amp; 168L</td>
<td>Systematics of Vascular Plants and Systematics of Vascular Plants with Laboratory</td>
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<td>INTEGBI 173LF</td>
<td>Mammalogy with Laboratory</td>
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<td>INTEGBI 174LF</td>
<td>Ornithology with Laboratory</td>
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<tr>
<td>INTEGBI 175LF</td>
<td>Herpetology with Laboratory</td>
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<td>INTEGBI 183L</td>
<td>Evolution of the Vertebrates with Laboratory</td>
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<tr>
<td>PLANTBI C110L</td>
<td>Biology of Fungi with Laboratory</td>
<td>4</td>
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<tr>
<td>PLANTBI 113</td>
<td>California Mushrooms</td>
<td>3</td>
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<tr>
<td>PLANTBI/ MCCELLBI C116</td>
<td>Microbial Diversity</td>
<td>3</td>
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<tr>
<td>PLANTBI 120 &amp; 120L</td>
<td>Biology of Algae and Laboratory for Biology of Algae</td>
<td>4</td>
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#### 3. Ecology

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<th>Course Title</th>
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<tr>
<td>ESPM 105A</td>
<td>Sierra Nevada Ecology</td>
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<td>ESPM 102A</td>
<td>Course Not Available</td>
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<tr>
<td>ESPM C103/INTEGBI C156</td>
<td>Principles of Conservation Biology</td>
<td>4</td>
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<tr>
<td>ESPM 110</td>
<td>Primate Ecology</td>
<td>4</td>
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<tr>
<td>ESPM C104/ENVECON C115</td>
<td>Modeling and Management of Biological Resources</td>
<td>4</td>
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<tr>
<td>ESPM 111</td>
<td>Ecosystem Ecology</td>
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<td>ESPM 112</td>
<td>Microbial Ecology</td>
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<td>ESPM 113</td>
<td>Insect Ecology</td>
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<tr>
<td>ESPM 114</td>
<td>Wildlife Ecology</td>
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<tr>
<td>ESPM 115B</td>
<td>Biology of Aquatic Insects</td>
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<td>ESPM 115C</td>
<td>Fish Ecology</td>
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<tr>
<td>ESPM 116B</td>
<td>Rangeland Ecology</td>
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<td>ESPM 116C</td>
<td>Tropical Forest Ecology</td>
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<td>ESPM 117</td>
<td>Urban Garden Ecosystems</td>
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<td>ESPM 118</td>
<td>Agricultural Ecology</td>
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<tr>
<td>ESPM 119</td>
<td>Chemical Ecology</td>
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<tr>
<td>ESPM C130/GEOG C136</td>
<td>Terrestrial Hydrology</td>
<td>4</td>
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4. Environment & Human Health

ANTHRO 135 Paleoenvironmental Archaeology 4
ESPM C126/ ESPM C144 Animal Behavior 4
INTREGI C138/ INTREGI C144 Introduction to Comparative Virology 4
PLANTBI C114/ MCELLBI C114 Pesticide Chemistry and Toxicology 3
PLANTBI C114/ NUSCTX C114 Medical Ethnobotany 4
PLANTBI C114/ NUSCTX C114 Medical Ethnobotany Laboratory 2
INTREGI C131 General Human Anatomy 3
INTREGI C131 General Human Anatomy Laboratory 2
INTREGI C137 Human Endocrinology 4
INTREGI C140 Biology of Human Reproduction 4
INTREGI C143A/ PSYCH C113 Biological Clocks: Physiology and Behavior 3
INTREGI C143A/ PSYCH C113 Hormones and Behavior 3
MCELLBI C135A Topics in Cell and Developmental Biology: Molecular Endocrinology 3
MCELLBI C150 Molecular Immunology 4
MCELLBI C165 Neurobiology of Disease 3
NUSCTX C03 Nutrient Function and Metabolism 3
NUSCTX C108A Introduction and Application of Food Science 3
NUSCTX C110 Toxicology 4
NUSCTX C160 Metabolic Bases of Human Health and Diseases 4
NUSCTX C166 Nutrition in the Community 3
PLANTBI/ MCELLBI C103 Bacterial Pathogenesis 3
PLANTBI C180 Environmental Plant Biology 2
PB HLTH 103 Course Not Available 2
PB HLTH 104A Health Promotion in a College Setting 2
PB HLTH 105 Course Not Available 2
PB HLTH 116 Seminar on Social, Political, and Ethical Issues in Health and Medicine 3
PB HLTH 150B Introduction to Environmental Health Sciences 3
PSYCH 110 Introduction to Biological Psychology 3

5. Insect Biology/Arthropod Science

ESPM C140 General Entomology (ESPM C140 required for Insect Biology concentration.) 4
ESPM C105 Natural History Museums and Biodiversity Science 3
ESPM C113 Insect Ecology 3
ESPM C132 Spider Biology 4
ESPM C134 Fire, Insects, and Diseases in Forest Ecosystems 3
ESPM C142 Insect Behavior 3
ESPM C144 Insect Physiology 3
ESPM C147 Field Entomology 1
ESPM C148 Pesticide Chemistry and Toxicology 3
ESPM C172 Photogrammetry and Remote Sensing 3

6. Global Change Biology

CIV ENG 107 Climate Change Mitigation 3
ECON C102 Natural Resource Economics 4
ENE,RES 101 Ecology and Society 3
ENE,RES 102 Quantitative Aspects of Global Environmental Problems 4
ENVECON C175 The Economics of Climate Change 4
EPS 102 History and Evolution of Planet Earth 4
EPS 115 Stratigraphy and Earth History 4
ESPM C105 Environmental Change Genetics 3
ESPM C152 Global Change Biology 3
ESPM C167 Environmental Health and Development 4
ESPM C170 Carbon Cycle Dynamics 3
GEOG 142 Climate Dynamics 4
GEOG 143 Global Change Biogeochemistry 3
GEOG C139 Atmospheric Physics and Dynamics 3
INTREGI C154 Plant Ecology 3
INTREGI C154L Plant Ecology Laboratory 2
INTREGI C159 The Living Planet: Impact of the Biosphere on the Earth System 3
LD ARCH 110 Ecological Analysis 3
LD ARCH 110L Ecological Analysis Laboratory 2
LD ARCH C188 Geographic Information Systems 4
PLANTBI C122 Bioenergy 2
PLANTBI C180 Environmental Plant Biology 2
varied educational experience outside of their major program and many undergraduate breadth provide Berkeley students with a rich and varied educational experience outside of their major program and many students complete their breadth courses in their first two years. Breadth courses are built into CNR major requirements and each major requires a different number of breadth courses and categories. The EEP major is the only CNR major that requires the entire 7 course breadth. Refer to the major snapshots on each CNR major page (https://nature.berkeley.edu/advising/majors-minors) for additional information.

General Guidelines
1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a Pass/No Pass basis only. Other exceptions to this requirement are noted as applicable.
2. A minimum cumulative grade point average (GPA) of 2.0 is required.
3. A minimum GPA of 2.0 in upper division major requirements is required.
4. At least 15 of the 36 required upper division units must be taken in the College of Natural Resources (except for students majoring in Environmental Economics and Policy; please see the EEP major adviser for further information).
5. A maximum of 16 units of Independent Study (courses numbered 97, 98, 99, 197, 198, and 199) may count toward graduation, with a maximum of 4 units of Independent Study per semester.
6. No more than 1/3 of the total units attempted at UC Berkeley may be taken Pass/No Pass. This includes units in the Education Abroad Program and UC Intercampus Visitor or Exchange Programs.
7. A maximum of 4 units of Physical Education courses will count toward graduation.
8. A maximum of 4 units of Independent Study per semester.
9. A maximum of 4 units of Independent Study per seminar.
10. A maximum of 4 units of Independent Study per term.
11. A maximum of 4 units of Independent Study per session.
12. A maximum of 4 units of Independent Study per off-campus study.
13. A maximum of 4 units of Independent Study per UC Extension.
14. A maximum of 4 units of Independent Study per non-UC study abroad programs.
15. A maximum of 4 units of Independent Study per concurrent degree.
16. A maximum of 4 units of Independent Study per simultaneous degree.
17. A maximum of 4 units of Independent Study per concurrent major.
18. A maximum of 4 units of Independent Study per simultaneous major.
19. A maximum of 4 units of Independent Study per overlap major.
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96. A maximum of 4 units of Independent Study per UC Berkeley.
97. A maximum of 4 units of Independent Study per UC Berkeley.
98. A maximum of 4 units of Independent Study per UC Berkeley.
99. A maximum of 4 units of Independent Study per UC Berkeley.
100. A maximum of 4 units of Independent Study per UC Berkeley.

High School Exam Credit

Units Requirements
Students must complete at least 120 semester units of courses subject to certain guidelines:

- At least 36 units must be upper division courses, including a minimum of 15 units of upper division courses in the College of Natural Resources.
- A maximum of 16 units of Special Studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed towards the 120 units; a maximum of four is allowed in a given semester.
- A maximum of 4 units of Physical Education from any school attended will count towards the 120 units.
- Students may receive unit credit for courses graded P (including P/NP units taken through EAP) up to a limit of one-third of the total units taken and passed on the Berkeley campus at the time of graduation.

Semester Unit Minimum
All CNR students must enroll in at least 13 units each fall and spring semester.

Semester Unit Maximum
To request permission to take more than 19.5 units in a semester, please see the major adviser.

Semester Limit
Students admitted as freshmen must graduate within 8 fall/spring semesters at UC Berkeley. Students admitted as transfer students must graduate within 4 fall/spring semesters at UC Berkeley. Students who go on EAP and UCDC can petition for additional semesters. Summer session, UC Extension and non-UC study abroad programs do not count towards this semester limit. Students approved for double majors or simultaneous degrees in two colleges may be granted an additional semester. CNR does not limit the number of total units a student can accrue.

Senior Residence Requirement
After the term in which you achieve and exceed 90 units (senior status), you must complete at least 24 of the remaining 30 units in residence at the College of Natural Resources over at least 2 semesters. To count as residence, a semester must consist of at least 6 passed units taken and passed on the Berkeley campus at the time of graduation.

Undergraduate Breadth
Undergraduate breadth provide Berkeley students with a rich and varied educational experience outside of their major program and many
Learning Goals for the Major

1. Holistic interdisciplinary thinking, that understanding the "big picture"
   a. Interdisciplinarity: The ability to understand and work across different disciplines
   b. Multiple processes: Recognition that biology and the environment involve multiple processes as do solutions to modern problems
   c. Interconnectedness: Understanding that biology and the environment are interconnected at many spatial, temporal, and hierarchical levels
   d. Global and international approaches: Appreciating that the environment is necessarily global in nature and solutions to problems require international approaches

2. Training in the hierarchy of biology
   a. Fundamentals of Science: Training in the cores areas of physics, chemistry, biology, and mathematics

b. Quantitative skills: Necessary tools for addressing biological problems
c. Biochemistry: An understanding of the fundamentals of biological chemistry including the properties of intermediary metabolites, the structure and function of biological macromolecules, and the logic of basis of genetics and gene expression
d. Molecular biology/Genetics: The molecular biology of bacterial, archaeal and eukaryotic cells and their viruses, mechanisms of DNA replication, transcription, translation, nuclear and organellar genome structure and function and regulation of gene expression heritability, measures of selection, etc.
e. Cell and developmental biology: Cell structure and function, embryonic and post-embryonic development and growth, and gene expression
f. Organismal physiology: Understanding of physiological function whether microbial, animal or plant, or comparison between different systems
g. Organismal diversity: Emphasis on the nature of diversity whether plant, animal, fungus, protist, bacteria, or virus, the history of the lineages and life itself, and how diversity is distributed, global threats, etc.
h. Ecology: The nature of interactions, biotic or abiotic, that dictate organismal distributions in space and time
i. Laboratory experiences: Laboratory experiences allow students to gain hands-on experience in scientific approaches and methods
j. Capstone seminar: The major ends with a senior seminar in Molecular Approaches to Environmental Problem-Solving. This course is highly interdisciplinary and is specifically intended to illustrate how all of the levels and approaches to biology are complementary and applicable to assessing or solving real-world problems especially as it relates to environmental issues

3. Analysis and application for students that choose the Animal Health & Behavior area of concentration
   a. Interaction of health and environment: Understanding how the environment, whether internal or external, affects organism health and behavior
   b. Expertise in health: Examination of the health of organisms from either physiological or environmental perspectives
   c. Epizootics: An appreciation of the potential for diseases in animal populations to spill over into humans as is the case in avian influenza or even the origins of HIV

4. Analysis and application for students that choose the Biodiversity area of concentration
   a. Biodiversity science: Detailed understanding of morphological and ecological diversity of a given organismic lineage
   b. Origins and evolution of life: Basic understanding of systematics and phylogenetics
   c. Quantifying biology: Knowledge of various sampling and species identification techniques to collect data
   d. Informatics: Proficiency in database development and management

5. Analysis and application for students that choose the Ecology area of concentration
   a. Principles of Ecology: Detailed understanding of ecological principles including energy flow, hydrologic, and mineral cycles, factors limiting species distribution and population size, and characteristics of species, populations, and communities
b. Ecological interactions: Interactions relevant to different organismic groups.

6. Analysis and application for students that choose the Environment & Human Health area of concentration.
b. Disease: Environmental epidemiology and the impacts of disease.

7. Analysis and application for students who choose the Insect Biology area of concentration.
a. Insects and biodiversity science: Understanding of major insects groups, relationships, and diversity.
b. Insects and environmental science: Knowledge of the impacts of insects (positive and negative) in the environment.

8. Analysis and application for students who choose the Microbiology area of concentration.
a. Microbiology expertise: Expertise and competence in processes, patterns in microbiology, and the role of microbes in ecosystem function.
c. Microbiology and the environment: Microbiology in environmental science, including impacts on human health & well-being.

9. Basic skills in research, analysis, communication.
a. Reading carefully: Ability to read for detail and comprehension.
b. Writing accurately: Ability to write succinctly, clearly, with coherence.
c. Thinking critically: Critical thinking through the exposure and synthesis of biological knowledge from courses and lab work.
d. Using theoretical and empirical knowledge: Ability to synthesize and apply information obtained through theory and observations.
e. Quantitative skills: Obtaining the quantitative skills necessary for the subdisciplines.
f. Analysis: Ability to perceive, tackle, and solve problems in environmental science.
g. Research experience: Research experience to practice scientific approaches and methods. Work with a faculty mentor while participating in an undergraduate research program or designing an individual research project. Share research results or work in progress in the form of a paper, report, research poster, or public presentation.
h. Communication: Strong communication skills, both written and verbal, to prepare for independent research work or team projects.

10. Lifetime skills.
a. Continuing appreciation for biological systems: To develop a passion for biology and its interconnections with the environment.
b. Representing science: To become an advocate for the training and knowledge of science, particularly the biological disciplines.

In the College of Natural Resources, we provide holistic, individual advising services to prospective and current students who are pursuing major and minors in our college. We assist with a range of topics including course selection, academic decision-making, achieving personal and academic goals, and maximizing the Berkeley experience.

If you are looking to explore your options, or you are ready to declare a major, double major, or minor, contact the undergraduate adviser for your intended major. Visit our website (https://nature.berkeley.edu/advising/meet-cnr-advisors) to explore all of our advising services.

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