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 Rausser College Admissions Guide (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/#admissiontext) page or the Rausser College Prospective Student page (https://nature.berkeley.edu/prospective-students/). Freshman students may apply directly to the major, or they may select the Rausser College of Natural Resource's undeclared option and declare the major by the end of their fourth semester. Transfer students apply directly to the major, or they may select the Rausser College of Natural Resources website (http://guide.berkeley.edu/undergraduate/degree-programs/natural-resources/#admissionstext) page for full guidance.

Information for current Berkeley students who would like to declare the major after admission, including information on change of major or change of college, please see chapter 6 of the Rausser College of Natural Resources Undergraduate Student 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 Rausser 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 or 16A or 10A, and a second quantitative course in either Math 1B, 16B, 10B) or Statistics (STAT 2, C8, 20, 25, 131A, PB HLTH 141, 142A).
  - It is recommended that students complete the ESPM lower-division core courses prior to declaring.
- 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 (including breadth).
  - 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 Rausser 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 Rausser 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 and Minor)
Food Systems (https://nature.berkeley.edu/advising/minors/food-systems/) (Minor only)
Ecosystem Management and Forestry (http://guide.berkeley.edu/undergraduate/degree-programs/ecosystem-management-forestry/) (Major and Minor)
Geospatial Information Science and Technology (https://nature.berkeley.edu/advising/minors/gist/) (Minor only)
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) global change biology, and (6) insect 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.

Core Requirement
ESPIM Environmental Science Core
Select one of the following:
- ESPIM 2 The Biosphere [3]
- ESPIM 6 Environmental Biology [3]
- ESPIM C10 Environmental Issues [4]
- ESPIM 15 Introduction to Environmental Sciences [3]
- ESPIM C46 Climate Change and the Future of California [4]

ESPIM Social Science Core
Select one of the following:
- ESPIM 5 FROM FARM TO TABLE: FOOD SYSTEMS IN A CHANGING WORLD [4]
- ESPIM C11 Americans and the Global Forest [4]
- ESPIM C22AC Fire: Past, Present and Future Interactions with the People and Ecosystems of California [4]
- ESPIM 50AC Introduction to Culture and Natural Resource Management [4]
- ESPIM 60 Environmental Policy, Administration, and Law [4]

Science Core
Complete all of the following:
- CHEM 1A & 1AL General Chemistry and General Chemistry Laboratory
- CHEM 3A & 3AL Chemical Structure and Reactivity and Organic Chemistry Laboratory
- CHEM 3B & 3BL Chemical Structure and Reactivity and Organic Chemistry Laboratory
- BIOLOGY 1A & 1AL General Biology Lecture and General Biology Laboratory
- BIOLOGY 1B General Biology Lecture and Laboratory [4]
- PHYSICS 8A Introductory Physics [4]

Quantitative Core (2 courses)
Select one of the following:
- MATH 1A Calculus [4]
- MATH 16A Analytic Geometry and Calculus [3]
Select one of the following:
- MATH 1B Calculus [4]
- MATH 16B Analytic Geometry and Calculus [3]
- STAT 2 Introduction to Statistics [4]
- STAT C8 Foundations of Data Science [4]
- PB HLTH 141 Introduction to Biostatistics [5]

Upper division Requirements
Select two courses from Area A and two courses from Area B. Also complete 12 units in Area of Concentration and two lab courses.

Area A: Genetics, Molecular, Cell, and Developmental Biology
- CHEM 135 Chemical Biology [3]
- ESPIM 108B Environmental Change Genetics (lab included) [3]
- 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 102 Survey of the Principles of Biochemistry and Molecular Biology [4]
- MCELLBI 104 Genetics, Genomics, and Cell Biology [4]
- MCELLBI 130 Cell and Systems Biology [4]
- MCELLBI 133L Physiology and Cell Biology Laboratory (lab included) [4]
- MCELLBI 137L Physical Biology of the Cell (lab included) [4]
- MCELLBI 140 General Genetics [4]
- PLANTBI C112 General Microbiology and General Microbiology Laboratory (lab course optional) [4]
- PLANTBI 135 Physiology and Biochemistry of Plants [3]
- PLANTBI 150 Plant Cell Biology [3]
- PLANTBI 160 Plant Molecular Genetics [3]
- PB HLTH 162A Public Health Microbiology [3]
- PB HLTH 162L Public Health Microbiology Laboratory (lab course optional) [2]

Area B: Ecology, Evolution, and Organismal Biology
- ESPIM C105 Natural History Museums and Biodiversity Science (lab included) [3]
- ESPIM 108A Trees: Taxonomy, Growth, and Structures (lab included) [3]
- ESPIM 111 Ecosystem Ecology [4]
- ESPIM 112 Microbial Ecology [3]
- ESPIM 112L and Microbial Metagenomic Data Analysis Lab (lab course optional) [1]
- ESPIM 113 Insect Ecology [3]

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

Select 12 units from one concentration below. Up to four independent study units (research units numbered 192C, H196, or 199) may be applied to the concentration.

Animal Health & Behavior

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ESPM C103</td>
<td>Principles of Conservation Biology</td>
<td>4</td>
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<tr>
<td>ESPM 106</td>
<td>American Wildlife: Management and Policy in the</td>
<td>3</td>
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<td>21st Century</td>
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<td>ESPM 114</td>
<td>Wildlife Ecology</td>
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<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 C156</td>
<td>Animal Communication</td>
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<tr>
<td>ESPM 157</td>
<td>Data Science in Global Change Ecology (lab included)</td>
<td>4</td>
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<tr>
<td>ESPM 158</td>
<td>Biodiversity Conservation in Working Landscapes</td>
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<td>(lab included)</td>
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<tr>
<td>ESPM 186</td>
<td>Management and Conservation of Rangeland Ecosystems</td>
<td>4</td>
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<tr>
<td>ESPM C192</td>
<td>Molecular Approaches to Environmental Problem</td>
<td>2</td>
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<td>Solving</td>
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<tr>
<td>INTEGBI 104LF</td>
<td>Natural History of the Vertebrates with Laboratory</td>
<td>5</td>
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<tr>
<td>INTEGBI 135</td>
<td>The Mechanics of Organisms</td>
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<td>INTEGBI C135L/</td>
<td>Laboratory in the Mechanics of Organisms</td>
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<td>BIO ENG 136L/</td>
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Biodiversity

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<td>Principles of Conservation Biology</td>
<td>4</td>
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<tr>
<td>ESPM C105</td>
<td>Natural History Museums and Biodiversity Science</td>
<td>3</td>
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<td>(lab included)</td>
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<tr>
<td>ESPM 106</td>
<td>American Wildlife: Management and Policy in the</td>
<td>3</td>
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<td>21st Century</td>
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<td>ESPM 108A</td>
<td>Trees: Taxonomy, Growth, and Structures (lab</td>
<td>3</td>
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<td>ESPM C125</td>
<td>Biogeography</td>
<td>4</td>
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<tr>
<td>ESPM C126</td>
<td>Animal Behavior</td>
<td>4</td>
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<td>ESPM 132</td>
<td>Spider Biology (lab included)</td>
<td>4</td>
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<tr>
<td>ESPM 140</td>
<td>General Entomology (lab included)</td>
<td>4</td>
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<td>ESPM 142</td>
<td>Insect Behavior</td>
<td>3</td>
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<td>ESPM 147</td>
<td>Field Entomology (“Ants,” “Beetles,” and “Spiders”</td>
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<td>(1 unit each) SP. All three courses must be</td>
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<td>completed to equal one “lab course”)</td>
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Molecular Environmental Biology

ESPM C156 Animal Communication 3
ESPM 157 Data Science in Global Change Ecology (lab included) 4
ESPM C192 Molecular Approaches to Environmental Problem Solving 2
INTEGBI 102LF Introduction to California Plant Life with Laboratory 4
INTEGBI 103LF Invertebrate Zoology with Laboratory 5
INTEGBI 104LF Natural History of the Vertebrates with Laboratory 5
INTEGBI 160 Evolution 4
INTEGBI 168L Systematics of Vascular Plants with Laboratory 4
INTEGBI 173LF Mammalogy with Laboratory 5
INTEGBI 174LF Ornithology with Laboratory 4
INTEGBI 175LF Herpetology with Laboratory 4
INTEGBI 183L Evolution of the Vertebrates with Laboratory 4
INTEGBI 184L Morphology of the Vertebrate Skeleton with Laboratory 4
PLANTBI C110L Biology of Fungi with Laboratory 4
PLANTBI 113 California Mushrooms (lab included) 3
PLANTBI C116 Microbial Diversity 3
PLANTBI 120 Biology of Algae 2
PLANTBI 120L Laboratory for Biology of Algae 2

Ecology

ESPM C103 Principles of Conservation Biology 4
ESPM C104/ Modeling and Management of Biological Resources 4
ENVECON C115

ESP 105A Sierra Nevada Ecology (Summer Forestry Camp) 4
ESP 111 Ecosystem Ecology 4
ESP 112 Microbial Ecology 3
ESP 112L Microbial Metagenomic Data Analysis Lab 1
ESP 113 Insect Ecology 3
ESP 114 Wildlife Ecology 3
ESP 115A Freshwater Ecology 3
ESP 115C Fish Ecology (lab included) 3
ESP 116B Grassland and Woodland Ecology (lab included) 4
ESP 117 Urban Garden Ecosystems (lab included) 4
ESP 118 Agricultural Ecology 4
ESP C130 Terrestrial Hydrology 4
ESP 131 Soil Microbiology and Biogeochemistry 3
ESP 134 Fire, Insects, and Diseases in Forest Ecosystems 3
ESP 137 Landscape Ecology (lab included) 3
ESP 147 Field Entomology (“Ants,” “Beetles,” and “Spiders” (1 unit each) SP. All three courses must be completed to equal one “lab course”) 1
ESP 152 Global Change Biology 3
ESP 157 Data Science in Global Change Ecology (lab included) 4
ESP 158 Biodiversity Conservation in Working Landscapes (lab included) 4
ESP 173 Introduction to Ecological Data Analysis (lab included) 3
ESP 174 Design and Analysis of Ecological Research (lab included) 4
ESP 181A Fire Ecology (lab included) 3
ESP 192 Molecular Approaches to Environmental Problem Solving 2
INTEGBI 102LF Introduction to California Plant Life with Laboratory 4
INTEGBI 120 Introduction to Quantitative Methods in Biology 4
INTEGBI 151 Plant Physiological Ecology 4
INTEGBI 151L Plant Physiological Ecology Laboratory 2
INTEGBI 153 Ecology 3
INTEGBI 154 Plant Ecology 3
INTEGBI 154L Plant Ecology Laboratory 2
INTEGBI 160 Evolution 4
PLANTBI 180 Environmental Plant Biology 2

Environment & Human Health

ANTHRO 135 Paleoenvironment: Archaeological Methods and Laboratory Techniques 4
ESPM C126/ Animal Behavior 4
INTEGBI C144

ESP 105A Sierra Nevada Ecology (Summer Forestry Camp) 4
ESP 111 Ecosystem Ecology 4
ESP 112 Microbial Ecology 3
ESP 112L Microbial Metagenomic Data Analysis Lab 1
ESP 113 Insect Ecology 3
ESP 114 Wildlife Ecology 3
ESP 115A Freshwater Ecology 3
ESP 115C Fish Ecology (lab included) 3
ESP 116B Grassland and Woodland Ecology (lab included) 4
ESP 117 Urban Garden Ecosystems (lab included) 4
ESP 118 Agricultural Ecology 4
ESP C130 Terrestrial Hydrology 4
ESP 131 Soil Microbiology and Biogeochemistry 3
ESP 134 Fire, Insects, and Diseases in Forest Ecosystems 3
ESP 137 Landscape Ecology (lab included) 3
ESP 147 Field Entomology (“Ants,” “Beetles,” and “Spiders” (1 unit each) SP. All three courses must be completed to equal one “lab course”) 1
ESP 152 Global Change Biology 3
ESP 157 Data Science in Global Change Ecology (lab included) 4
ESP 158 Biodiversity Conservation in Working Landscapes (lab included) 4
ESPM/NUSCTX C159 Human Diet 4
ESPM 162/ Animal Behavior 4
INTEGBI C144

INTEGBI 116L Medical Parasitology (lab included) 4
INTEGBI 117 Medical Ethnobotany 2
INTEGBI 117LF Medical Ethnobotany Laboratory 2
INTEGBI 120 Introduction to Quantitative Methods in Biology 4
INTEGBI 131 General Human Anatomy 3
INTEGBI 131L General Human Anatomy Laboratory 2
INTEGBI 137 Human Endocrinology 4
INTEGBI 140 Biology of Human Reproduction 4
INTEGBI C143A/ PSYCH C113 Biological Clocks: Physiology and Behavior 3
INTEGBI C143B/ PSYCH C116 Hormones and Behavior 3
MCELLBI 135A Topics in Cell and Developmental Biology: Molecular Endocrinology 3
MCELLBI 150 Molecular Immunology 4
MCELLBI 160 Cellular and Molecular Neurobiology 4
MCELLBI 165 Neurobiology of Disease 3
NUSCTX 103 Nutrient Function and Metabolism 3
NUSCTX 108A Introduction to the Study of Food Science 3
NUSCTX 110 Toxicology 4
NUSCTX 160 Metabolic Bases of Human Health and Diseases 4
Global Change Biology

CIV ENG 107  Climate Change Mitigation  3
ENE,RES 101  Ecology and Society  3
ENE,RES 102  Quantitative Aspects of Global Environmental Problems  4
ENVECON C102  Natural Resource Economics  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
EPS C181/ C167  Atmospheric Physics and Dynamics  3
EPSM 108B  Environmental Change Genetics (lab included)  3
EPSM 137  Landscape Ecology (lab included)  3
EPSM 152  Global Change Biology  3
EPSM 157  Data Science in Global Change Ecology (lab included)  4
EPSM C167  Environmental Health and Development  4
EPSM C170  Carbon Cycle Dynamics  3
EPSM C192  Molecular Approaches to Environmental Problem Solving  2
GEOG C188  Geographic Information Systems  4
GEOG 140A  Physical Landscapes: Process and Form  4
GEOG 142  Climate Dynamics  4
GEOG 143  Global Change Biogeochemistry  3
GEOG 149B  Climate Impacts and Risk Analysis  3
GEOG/LD ARCH 188  Geographic Information Systems  4
INTEGBI 154  Plant Ecology  3
INTEGBI 154L  Plant Ecology Laboratory  2
INTEGBI 159  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
PLANTBI 122  Bioenergy  2
PLANTBI 180  Environmental Plant Biology  2

Insect Biology/Arthropod Science

ESPM 140  General Entomology (ESPM 140 required for Insect Biology concentration. Lab included.)  4
ESPM C105  Natural History Museums and Biodiversity Science (lab included)  3
ESPM 113  Insect Ecology  3
ESPM 132  Spider Biology (lab included)  4
ESPM 134  Fire, Insects, and Diseases in Forest Ecosystems  3
ESPM 142  Insect Behavior  3
ESPM 144  Insect Physiology  3
ESPM 147  Field Entomology (“Ants,” “Beetles,” and “Spiders” (1 unit each) SP. All three courses must be completed to equal one “lab course”)  1
ESPM C148/ NUSCTX C114  Pesticide Chemistry and Toxicology  3
ESPM 157  Data Science in Global Change Ecology (lab included)  4
ESPM 172  Remote Sensing of the Environment (lab included)  3
ESPM C192  Molecular Approaches to Environmental Problem Solving  2

Reading and Composition (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/reading-composition-requirement/)

In order to provide a solid foundation in reading, writing and critical thinking all majors in the College require two semesters of lower division work in composition. Students must complete a first-level reading and composition course by the end of their second semester and a second-level course by the end of their fourth semester.

Foreign Language (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/foreign-language-requirement/): EEP Majors only

The Foreign Language requirement is only required by Environmental Economics and Policy (EEP) majors. It may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

Quantitative Reasoning (http://guide.berkeley.edu/undergraduate/colleges-schools/natural-resources/quantitative-reasoning-requirement/): EEP Majors only

The Quantitative Reasoning requirement is only required by Environmental Economics and Policy (EEP) majors. The requirement may be satisfied by exam or by taking an approved course.

Undergraduate Breadth

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 the Rausser College major requirements and each major requires a different number of breadth courses and categories. The EEP major is the only college major that requires the entire 7 course breadth. Refer to the major snapshots on each Rausser College major page (https://nature.berkeley.edu/advising/majors-minors/) for for additional information.

High School Exam Credit

Unit 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 Rausser College.
- 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 Rausser College students must enroll in at least 12 units each fall and spring semester.

Semester Unit Maximum

To request permission to take more than 20.5 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. Rausser College does not limit the number of total units a student can accrue.

Senior Residence Requirement

Once you achieve and exceed 90 units (senior status), you must complete at least 24 of the remaining 30 units in residence at the Rausser College of Natural Resources over at least 2 semesters. To count as residence, a semester must consist of at least 6 passed units taken while the student is a member of Rausser. At least one of the two terms must be a fall or spring semester. Senior residence terms do not need to be completed consecutively. All courses offered on campus for the fall, spring, and summer terms by Berkeley departments and programs and all Berkeley online (W) courses count. Inter-campus Visitor, Education Abroad Program, UC Berkeley Washington Program, and UC Berkeley Extension units do not count toward this requirement. Students may use Summer Session to satisfy one semester of the Senior Residence Requirement, provided that 6 units of coursework are completed.

Modified Senior Residence Requirement

Participants in a fall, spring or summer UC Education Abroad Program (UCEAP), Berkeley Summer Abroad, or the UC Berkeley Washington Program may meet a modified Senior Residence Requirement by completing 24 of their final 60 semester units in residence (excluding UCEAP). At least 12 of these 24 units must be completed after senior status is reached. International travel study programs sponsored by Summer Sessions and education abroad programs offered outside of the UC system do not qualify for modified senior residence.

Most students automatically satisfy the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless students go abroad for a semester or year or want to take courses at another institution or through University Extension during their senior year. In these cases, students should make an appointment to see an adviser to determine how they can meet the Senior Residence Requirement.

Grade Requirements

- A 2.0 UC GPA is required for graduation.
- A 2.0 average in all upper division courses required of the major program is required for graduation.
- A grade of at least C- is required in all courses for the major.

Mission

Molecular Environmental Biology (MEB) focuses on biological organisms and the hierarchy of life, from molecules and genes through cells, organisms, communities and ecosystems. The breadth of this biological science program provides an important perspective for students who have a passion for biology and are interested in the application of biological principles to understand how organisms function in their environment. Also a pre-medical or pre-health science major, the discipline offers an array of six areas of concentration within biology: animal health and behavior, biodiversity, ecology, environmental and human health, insect biology, and global change biology.

Learning Goals for the Major

1. Holistic multidisciplinary thinking - understanding the “big picture”
   a. Interdisciplinarity & Crossdisciplinarity: The ability to understand and work across different disciplines (crossdisciplinarity) and to integrate the knowledge and methods from them (interdisciplinarity)
   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 logical 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 organelar
genome structure and function, regulation of gene expression, heritability, measures of selection, etc.

e. Cell and developmental biology: Cell structure and function, cellular metabolic processes, embryonic and post-embryonic development and growth

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, global threats, how diversity is distributed, and the ecological and evolutionary processes that generate and maintain diversity.

h. Ecology: The nature of interactions, biotic or abiotic, that dictate organismal distributions in space and time, energy flows, or population dynamics

i. Laboratory experiences: Laboratory experiences allow students to gain hands-on experience in scientific approaches and methods

3. Analysis and application for students who 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 who 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 who 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 who 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 Global Change Biology area of concentration.

a. Global change biology expertise: How changes to the global environment impact organisms and ecosystems, including impacts to spatial and temporal distributions of organisms, ecological processes, and ecosystem functions.

b. Global change and the environment: Global change biology in environmental science, including effects of human activities and impacts on human health and well-being.

c. Environmental problem solving: Conservation and mitigation strategies, ecological analysis, and natural resource economics

8. 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.

c. Quantifying insects and biology: Skills in collecting and identifying insects

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, and coherently.

c. Thinking critically: Critical thinking through the 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.

c. Problem solving: To develop and practice scientific thinking and problem-solving skills, through data analysis, hypothesis testing, and critical reasoning, that translate to future careers inside and outside of biology.

Major Maps help undergraduate students discover academic, co-curricular, and discovery opportunities at UC Berkeley based on intended major or field of interest. Developed by the Division of Undergraduate Education in collaboration with academic departments, these experience maps will help you:

- **Explore** your major and gain a better understanding of your field of study
- **Connect** with people and programs that inspire and sustain your creativity, drive, curiosity and success
- **Discover** opportunities for independent inquiry, enterprise, and creative expression
- **Engage** locally and globally to broaden your perspectives and change the world
- **Reflect** on your academic career and prepare for life after Berkeley

Use the major map below as a guide to planning your undergraduate journey and designing your own unique Berkeley experience.

View the Molecular Environmental Biology Major Map PDF (https://vcue.berkeley.edu/sites/default/files/molecular_environmental_biology.pdf)

In the Rausser 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 advisor 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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