Microbial Biology

Bachelor of Science (BS)

The Department of Plant and Microbial Biology (PMB) offers an undergraduate major program in Microbial Biology, leading to a Bachelor of Science (BS) degree. Microbial Biology focuses on small life forms such as microbes, viruses and fungi that make up the majority of planetary biomass. Microbes play fundamental roles in maintaining biosphere health. They degrade environmental pollutants, supply essential nutrients and chemicals directly to multi-cellular organisms, and engage in numerous beneficial symbioses with higher organisms.

Admission to the Major

Freshman students may apply directly to the major or select the College of Natural Resource's undeclared option and declare the major by the end of their fourth semester. For further information regarding how to declare the major after admission including information on a change of major or a change of college, please see the College of Natural Resources Undergraduate Student Handbook (http://www.cnr.berkeley.edu/site/forms/oisa/undergrad_handbook.pdf) .

Minor Program

There is no minor program in Microbial Biology.

Other Major Program offered by the Department of Plant and Microbial Biology

Genetics and Plant Biology (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/genetics-plant-biology)

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.

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/Not 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.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

Lower-division Requirements

MATH 16A & MATH 1A	Analytic Geometry and Calculus and Calculus	7
MATH 16B & MATH 1B	Analytic Geometry and Calculus and Calculus	7
Chemistry:		
CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory	4
CHEM 3A & 3AL	Chemical Structure and Reactivity and Organic Chemistry Laboratory	5
CHEM 3B & 3BL	Chemical Structure and Reactivity and Organic Chemistry Laboratory	5
STAT 2	Introduction to Statistics [1]	4
STAT 20	Introduction to Probability and Statistics [1]	4
STAT 131A	Introduction to Probability and Statistics for Life Scientists [1]	4
BIOLOGY 1A & 1AL	General Biology Lecture and General Biology Laboratory	5
BIOLOGY 1B	General Biology Lecture and Laboratory	4
PLANTBI 22	Microbes Make the World Go Around (recommended but not required)	2
Physics:		
PHYSICS 8A	Introductory Physics	4

Upper-division Requirements

Upper Division Core Requirements		
Select one of the following:		4
MCELLBI C100B	Biophysical Chemistry: Physical Principles and the Molecules of Life	
MCELLBI 100B	Biochemistry: Pathways, Mechanisms, and Regulation	
MCELLBI 102	Survey of the Principles of Biochemistry and Molecular Biology	
MCELLBI 110	Molecular Biology: Macromolecular Synthesis and Cellular Function	
PLANTBI C148	Microbial Genomics and Genetics	4
PLANTBI C112 & C112L	General Microbiology and General Microbiology Laboratory	6
Upper Division Core Electives		
Select two of the following:		8
PLANTBI 104L	Course Not Available	
PLANTBI C103	Bacterial Pathogenesis	
or INTEGBI 11	Host-Pathogen Interactions: A Trans-Discipline Outlook	
or PB HLTH 16	Public Health Microbiology	

PLANTBI 110 & 110L	Course Not Available and Course Not Available	
PLANTBI 113	California Mushrooms	
PLANTBI C114	Introduction to Comparative Virology	
PLANTBI C116	Microbial Diversity	
PLANTBI 120 & 120L	Biology of Algae and Laboratory for Biology of Algae	
BIO ENG 135	Frontiers in Microbial Systems Biology	
ESPM 112	Microbial Ecology	
or ESPM 131	Soil Microbial Ecology	
Microbial Biology Tracks:		
Option 1: Select a track (see below) and select four courses [1]		
Option 2, General Microbiology Track: Select any four courses from any of the tracks (see below) and/or the Upper-division Core Electives [2]		

1 One of the four courses may be selected from the Upper-division Core Electives listed above; however, this course may not be counted for both the Upper-division Core Electives and the student's track.

2 Courses selected for this track option may not overlap with the two courses used to fulfill the Upper-Division Core Electives requirement.

Microbial Biology Tracks

Host-Pathogen Interactions

PLANTBI 135	Physiology and Biochemistry of Plants [1]	3-4
or MCELLBI 150	Molecular Immunology	
PLANTBI 150	Plant Cell Biology [1]	3-4
or MCELLBI 104	Genetics, Genomics, and Cell Biology	
PLANTBI 160	Plant Molecular Genetics [1]	3-4
or MCELLBI 140	General Genetics	
PLANTBI 165	Plant-Microbe Interactions	3
PLANTBI 185	Techniques in Light Microscopy	3
BIO ENG 100	Ethics in Science and Engineering [1]	3-4
or ESPM 162	Bioethics and Society	
INTEGBI 115	Introduction to Systems in Biology and Medicine	4
INTEGBI 119	Evaluating Scientific Evidence in Medicine	3
PB HLTH 150A	Introduction to Epidemiology and Human Disease	4
PB HLTH 150B	Introduction to Environmental Health Sciences	3
PLANTBI H196/199	Honors Research - Plant and Microbial Biology	4

1 No more than one course may be taken from this group to satisfy the track requirement.

Evolution/Computational Genomics

PLANTBI C144	Introduction to Protein Informatics [1]	3-4
or PLANTBI C144L	Protein Informatics Laboratory	
BIO ENG 131	Introduction to Computational Molecular and Cell Biology [1]	4
or COMPSCI 61A	The Structure and Interpretation of Computer Programs	
or COMPSCI 61B	Data Structures	
BIO ENG 135	Frontiers in Microbial Systems Biology	4
BIO ENG 143	Computational Methods in Biology [1]	4
or MATH 127	Mathematical and Computational Methods in Molecular Biology	
INTEGBI 160	Evolution	4
or INTEGBI 161	Population and Evolutionary Genetics	
INTEGBI 166	Evolutionary Biogeography	4
MCELLBI 111	Course Not Available	3
MCELLBI 140	General Genetics	4
MCELLBI 143	Evolution of Genomes, Cells, and Development	3
PLANTBI H196/199	Honors Research - Plant and Microbial Biology	4

1 No more than one course may be taken from this group to satisfy the track requirement.

Ecology & Environmental Microbiology

BIO ENG 100	Ethics in Science and Engineering [1]	3-4
or ESPM 162	Bioethics and Society	
BIO ENG 135	Frontiers in Microbial Systems Biology	4
ESPM 134	Fire, Insects, and Diseases in Forest Ecosystems	3
ESPM 192	Course Not Available	
INTEGBI 153	Ecology [1]	3
or INTEGBI 153LF	Course Not Available	
INTEGBI 161	Population and Evolutionary Genetics	4
INTEGBI 162	Ecological Genetics	4
INTEGBI 166	Evolutionary Biogeography	4
MCELLBI 137	Computer Simulation in Biology	3
PLANTBI H196/199	Honors Research - Plant and Microbial Biology	4

1 No more than one course may be taken from this group to satisfy the track requirement.

Microbial Biotechnology

PLANTBI 122	Bioenergy	2
PLANTBI C124	The Berkeley Lectures on Energy: Energy from Biomass	3
PLANTBI 150	Plant Cell Biology [1]	3-4
or MCELLBI 104	Genetics, Genomics, and Cell Biology	
PLANTBI 170	Modern Applications of Plant Biotechnology	2
BIO ENG 22/22L	Course Not Available	
BIO ENG 100	Ethics in Science and Engineering [1]	3-4
or ESPM 162	Bioethics and Society	
BIO ENG 135	Frontiers in Microbial Systems Biology	4
ESPM 192	Course Not Available	
MCELLBI 111	Course Not Available	3
MCELLBI 137	Computer Simulation in Biology	3
MCELLBI 140	General Genetics	4
PLANTBI H196/199	Honors Research - Plant and Microbial Biology	4

[1] No more than one course may be taken from this group to satisfy the track requirement.

For College Requirements, please refer to the College of Natural Resources (http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/natural-resources/#collegerequirementstext) .

Learning Goals for the Major

Students should be able to do the following:

1. Demonstrate a solid grasp of the fundamentals of biology, chemistry, and math that are necessary for understanding the more advanced concepts that are presented in upper-division major coursework
2. Have the skills to evaluate scientific information as a result of receiving adequate training in statistics, computational biology and genomics
3. Have an understanding and appreciation of microbial diversity in various ecosystems
4. Have an understanding of the importance of microbes as related to biotechnology and human health
5. Have an understanding of the scientific method and the microbial research process
6. Demonstrate proficiency in scientific writing and presentation
7. Have exposure to an undergraduate research experience. The goal is to give every microbial biology undergraduate the opportunity to do research in either a laboratory or field research setting. This experience would include reading and evaluating primary literature, critical thinking and the development of a hypothesis to test and other aspects of the scientific method including data analysis, as well as oral and written presentation of their research
8. Appreciate the relationship between a Microbial Biology major and the community at large

Microbial Biology

BIOLOGY 1A General Biology Lecture 3 Units
General introduction to cell structure and function, molecular and organismal genetics, animal development, form and function. Intended for biological sciences majors, but open to all qualified students.
Rules & Requirements

Prerequisites: Chemistry 1A and 1AL or equivalent with grade of C- or higher, or a 4 or 5 score on the Chemistry AP test; Chemistry 3A or 112A recommended; BIOLOGY 1AL must be taken concurrently (unless exempt by major)

Credit Restrictions: 1B may be taken before 1A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

BIOLOGY 1AL General Biology Laboratory 2 Units
Laboratory that accompanies 1A lecture course. Intended for biological science majors, but open to all qualified students.
Rules & Requirements

Prerequisites: 1A must be taken concurrently

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 3 hours of laboratory per week

Summer: 8 weeks - 3 hours of lecture and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

BIOLOGY 1B General Biology Lecture and Laboratory 4 Units
General introduction to plant development, form, and function; population genetics, ecology, and evolution. Intended for students majoring in the biological sciences, but open to all qualified students. Students must take both BIOLOGY 1A and 1B to complete the sequence. Sponsored by Integrative Biology.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 4 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.