

# BS MICROBIOLOGY

## Program Learning Objectives

1. Explain fundamental concepts and principles in microbiology and general biology (atom to ecosystem).
2. Demonstrate proficiency in common lab and field techniques for microbiology.
3. Locate, critically evaluate, and integrate scientific literature findings into the practice of microbiology.
4. Assess and analyze experimental data with objectivity.
5. Integrate statistics, math, physical sciences and technology to answer microbiological questions.
6. Communicate microbiology principles and research findings effectively to diverse audiences.
7. Relate ethical, social justice or global perspectives to the study and practice of microbiology.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<https://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper-division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No Major, Support, or Concentration courses may be selected as credit/no credit.

### MAJOR COURSES

BIO 150	Diversity and History of Life	4
BIO 161	Introduction to Cell and Molecular Biology (B2 & B3) <sup>1</sup>	4
BIO 263	Introductory Ecology and Evolution	4
BIO 351	Principles of Genetics	5
BIO 452	Cell Biology	4
MCRO 224	General Microbiology I	5
MCRO 225	General Microbiology II	5
MCRO 424	Microbial Physiology	5
BIO 461 or BIO 462	Senior Project - Research Proposal Senior Project Research Experience	2

Select three courses from the following: **11-13**

BIO 426	Immunology
BIO 475	Molecular Biology Laboratory
MCRO 402	General Virology
MCRO 423	Medical Microbiology
MCRO 436	Microbial Ecology

### Electives

Select from the following: <sup>2,3,4</sup> 19-21

### Biotechnology

ASCI 403	Applied Biotechnology in Animal Science
BIO 202	Orientation to Biotechnology
BIO 475	Molecular Biology Laboratory
BIO/CHEM 476	Gene Expression Laboratory
BRAE 448	Bioconversion
CHEM 372	Metabolism
CHEM 474	Protein Techniques Laboratory
MCRO 433	Microbial Biotechnology

### Food Microbiology

DSCI 402	Quality Assurance and Control of Dairy Products
DSCI 444	Dairy Microbiology
FSN 230	Elements of Food Processing
FSN 275	Elements of Food Safety
FSN 335	Food Quality Assurance
FSN 340	Fermented Foods
FSN 364	Food Chemistry
FSN 368	Food Analysis
FSN 374	Food Laws and Regulations
MCRO/WVIT 301	Wine Microbiology
MCRO 421	Food Microbiology

### Medical and Public Health Microbiology

ASCI 321	Zoonoses and Veterinary Public Health Concerns
BIO 406	Advanced Anatomy and Physiology: Neuroscience
BIO 407	Advanced Anatomy and Physiology: Endocrinology
BIO 408	Advanced Anatomy and Physiology: Cardiorespiratory and Renal
BIO 409	Advanced Anatomy and Physiology: Muscle and Locomotion
BIO 410	Functional Histology
BIO 426	Immunology
BIO 428	Hematology
BIO 429	Parasitology
CHEM 349	Chemical and Biological Warfare
CHEM 377	Chemistry of Drugs and Poisons
CHEM 477	Biochemical Pharmacology
KINE 301	Functional Anatomy
MCRO 320	Emerging Infectious Diseases
MCRO 342	Public Health Microbiology
MCRO 423	Medical Microbiology

### Microbial Diversity, Ecology and Evolution

BIO 413	Evolutionary Medicine
BIO 414	Evolution
MCRO 402	General Virology
MCRO 436	Microbial Ecology
SS 422	Soil Ecology

### Bioinformatics and Data Analysis

BIO 441	Bioinformatics Applications
DATA 301	Introduction to Data Science

STAT 313	Applied Experimental Design and Regression Models	
STAT 419	Applied Multivariate Statistics	
STAT 421	Survey Sampling and Methodology	
<b>Other Electives for Microbiology Majors</b>		
ASCI 203	Animal Parasitology	
ASCI 440	Immunology and Diseases of Animals	
ASCI 438	Systemic Animal Physiology	
BIO 162	Introduction to Organismal Form and Function	
BIO 300	Research Experience for Undergraduates <sup>3</sup>	
BIO 335	General Entomology	
BIO 336	Invertebrate Zoology	
BIO 361	Principles of Animal Physiology	
BIO 400	Special Problems for Advanced Undergraduates <sup>3</sup>	
BIO 412	Gastrointestinal Physiology and Microbiology	
BIO 434	Environmental Physiology	
BIO 450	Undergraduate Laboratory Assistantship <sup>3</sup>	
BIO 462	Senior Project Research Experience <sup>5</sup>	
BIO 463	Honors Research	
BOT/PLSC 323	Plant Pathology	
CHEM 218 & CHEM 223	Organic Chemistry III and Organic Chemistry Laboratory for Life Sciences III	
CHEM 331	Quantitative Analysis	
CHEM 341	Environmental Chemistry: Water Pollution	
CHEM 418	Neurochemistry	
ENVE 434	Water Chemistry and Water Quality Measurements	
MATH 162	Calculus for the Life Sciences II	
MCRO 100	Introduction to Microbiology Research	
PLSC 313	Agricultural Entomology	
PLSC 441	Biological Control for Pest Management	

**SUPPORT COURSES**

CHEM 127	General Chemistry for Agriculture and Life Science I (B1 & B3) <sup>1</sup>	4
CHEM 128	General Chemistry for Agriculture and Life Science II	4
CHEM 129	General Chemistry for Agriculture and Life Science III	4
CHEM 216	Organic Chemistry I <sup>4</sup>	5
CHEM 217 & CHEM 220	Organic Chemistry II and Organic Chemistry Laboratory For Life Sciences II <sup>4</sup>	4
CHEM 314 or CHEM 369	Biochemistry: Fundamentals and Applications (Upper-Division B) <sup>1,6</sup>	5
	Biochemical Principles	

MATH 161	Calculus for the Life Sciences I (B4) <sup>1,4</sup>	4
PHYS 121	College Physics I	4
PHYS 122	College Physics II	4
PHYS 123	College Physics III	4
STAT 218	Applied Statistics for the Life Sciences (GE Electives) <sup>1</sup>	4

**GENERAL EDUCATION (GE)**

(See list of GE program requirements below.) 52

**FREE ELECTIVES**Free Electives<sup>7</sup> 10-14

Up to 6 units of free electives may need to be at the 300-400 level to ensure completion of the required minimum of 60 units of upper-division courses. Consult college advisor for additional information.

**Total units** 180

- Required in Major or Support; also satisfies General Education (GE) requirement.
- Consultation with an advisor is recommended before selecting Electives; bear in mind that selections may impact pursuit of post-baccalaureate studies and/or goals. At least 14-16 units must be upper-division (300-400 level) to ensure completion of the required minimum of 60 units of upper-division courses.
- Maximum of 6 units may be applied toward Approved Electives: BIO 200, BIO 300, BIO 400, BIO 450, BIO 485, BIO 495, MSCI 401.
- Students planning to attend graduate or professional schools are strongly advised to meet with their advisors to ensure that they meet necessary prerequisites for entry into these programs. Additional courses in math and chemistry may be necessary.
- If BIO 462 is used to meet the senior project requirement, it cannot also be counted as an Elective.
- CHEM 369 suggested for students who plan to pursue graduate school or a health professions career.
- If a General Education (GE) course is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.

**General Education (GE) Requirements**

- 72 units required, 20 of which are specified in Major and/or Support.
- If any of the remaining 52 units is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.
- See the complete GE course listing (<https://catalog.calpoly.edu/generalrequirementsbachelorsdegree/#generaleducationtext>).
- A grade of C- or better is required in one course in each of the following GE Areas: A1 (Oral Communication), A2 (Written Communication), A3 (Critical Thinking), and B4 (Mathematics/Quantitative Reasoning).

<b>Area A</b>	<b>English Language Communication and Critical Thinking</b>	
A1	Oral Communication	4
A2	Written Communication	4
A3	Critical Thinking	4
<b>Area B</b>	<b>Scientific Inquiry and Quantitative Reasoning</b>	

B1	Physical Science (4 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	One lab taken with either a B1 or B2 course	
B4	Mathematics/Quantitative Reasoning (4 units in Support) <sup>1</sup>	0
Upper-Division B (4 units in Support) <sup>1</sup>		0
<b>Area C</b>	<b>Arts and Humanities</b>	
Lower-division courses in Area C must come from three different subject prefixes.		
C1	Arts: Arts, Cinema, Dance, Music, Theater	4
C2	Humanities: Literature, Philosophy, Languages other than English	4
Lower-Division C Elective - Select a course from either C1 or C2		4
Upper-Division C		4
<b>Area D</b>	<b>Social Sciences - Select courses in Area D from at least two different prefixes</b>	
D1	American Institutions (Title 5, Section 40404 Requirement)	4
D2	Lower-Division D	4
Upper-Division D		4
<b>Area E</b>	<b>Lifelong Learning and Self-Development</b>	
Lower-Division E		4
<b>Area F</b>	<b>Ethnic Studies</b>	
F	Ethnic Studies	4
<b>GE Electives in Areas B, C, and D</b>		
Select courses from two different areas; may be lower-division or upper-division courses.		
GE Electives (4 units in Support plus 4 units in GE) <sup>1</sup>		4
<b>Total units</b>		<b>52</b>

<sup>1</sup> Required in Major or Support; also satisfies General Education (GE) requirement.