

# 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 (<http://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 160	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 426	Immunology	4
BIO 452	Cell Biology	4
MCRO 224	General Microbiology I	5
MCRO 225	General Microbiology II	5
MCRO 402	General Virology	4
MCRO 423	Medical Microbiology	5
MCRO 424	Microbial Physiology	5
BIO 461 or BIO 462	Senior Project - Research Proposal Senior Project Research Experience	2

### Electives

Select from the following: <sup>2,3,4,5</sup> 19

### Biotechnology

ASCI 403	Applied Biotechnology in Animal Science
BIO 202	Orientation to Biotechnology
BIO/CHEM 441	Bioinformatics Applications

BIO/CHEM 475	Molecular Biology Laboratory
BIO/CHEM 476	Gene Expression Laboratory
BRAE 448	Bioconversion
CHEM 331	Quantitative Analysis
CHEM 372	Metabolism
CHEM 373	Molecular Biology
CHEM 474	Protein Techniques Laboratory
MCRO 433	Microbial Biotechnology

### Food Microbiology

DSCI 402	Quality Assurance and Control of Dairy Products
DSCI 434	Cheese and Fermented Dairy Foods
DSCI 444	Dairy Microbiology
FSN 230	Elements of Food Processing
FSN 275	Elements of Food Safety
FSN 335	Food Quality Assurance
FSN 341	Fermented Foods
FSN 364	Food Chemistry
FSN 368	Food Analysis
FSN 374	Food Laws and Regulations
FSN 474	Advanced Food Processing
MCRO/WVIT 301	Wine Microbiology
MCRO 421	Food Microbiology

### Medical and Public Health Microbiology

ASCI 203	Animal Parasitology
ASCI 312	Production Medicine
ASCI 321	Zoonoses and Veterinary Public Health Concerns
ASCI 438	Systemic Animal Physiology
ASCI 440	Immunology and Diseases of Animals
BIO 162	Introduction to Organismal Form and Function
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 428	Hematology
BIO 429	Parasitology
CHEM 331	Quantitative Analysis
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
<b>Microbial Ecology and Evolution</b>	
BIO 413	Evolutionary Medicine

BIO 414	Evolution	
CHEM 341	Environmental Chemistry: Water Pollution	
ENVE 434	Water Chemistry and Water Quality Measurements	
MCRO 436	Microbial Ecology	
SS 422	Soil Ecology	
<b>Other electives for Microbiology Majors</b>		
AEPS 313	Agricultural Entomology	
AEPS/BOT 323	Plant Pathology	
AEPS 441	Biological Control for Pest Management	
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 434	Environmental Physiology	
BIO 450	Undergraduate Laboratory Assistantship <sup>3</sup>	
BIO 462	Senior Project Research Experience <sup>6</sup>	
BIO 463	Honors Research	
CHEM 218 & CHEM 223	Organic Chemistry III and Organic Chemistry Laboratory for Life Sciences III	
CHEM 418	Neurochemistry	
CHEM 419	Bioorganic Chemistry	
CSC 101	Fundamentals of Computer Science	
DATA 301	Introduction to Data Science	
MATH 162	Calculus for the Life Sciences II	
MCRO 100	Introduction to Microbiology Research	
STAT 313	Applied Experimental Design and Regression Models	
STAT 419	Applied Multivariate Statistics	
STAT 421	Survey Sampling and Methodology	

**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 313	Survey of Biochemistry and Biotechnology <sup>7</sup>	5
or CHEM 371	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.) 56

**FREE ELECTIVES**Free Electives<sup>5</sup> 8

Total units 180

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

<sup>2</sup> Consultation with advisor is recommended prior to selecting Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> Limited to a total of 4 units from BIO 300, BIO 400, BIO 450. At least 14 units must be upper-division (300-400 level).

<sup>4</sup> 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.

<sup>5</sup> Care must be taken to ensure compliance with the "60 units of upper-division" requirement.

<sup>6</sup> If BIO 462 is used to meet the senior project requirement, it cannot also be counted as an Elective.

<sup>7</sup> CHEM 371 suggested for students who plan to pursue graduate school or a health professions career.

**General Education (GE) Requirements**

- 72 units required, 16 of which are specified in Major and/or Support.
- If any of the remaining 56 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 (<http://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
<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</b>	
D1	American Institutions (Title 5, Section 40404 Requirement)	4
D2	Lower-Division D - Select courses from two different subject prefixes.	8
Upper-Division D		4
<b>Area E</b>	<b>Lifelong Learning and Self-Development</b>	
Lower-Division E		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
Total units		56

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