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.
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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 160</td>
<td>Diversity and History of Life</td>
<td>4</td>
</tr>
<tr>
<td>BIO 161</td>
<td>Introduction to Cell and Molecular Biology (B2 &amp; B3)</td>
<td>4</td>
</tr>
<tr>
<td>BIO 263</td>
<td>Introductory Ecology and Evolution</td>
<td>4</td>
</tr>
<tr>
<td>BIO 351</td>
<td>Principles of Genetics</td>
<td>5</td>
</tr>
<tr>
<td>BIO 426</td>
<td>Immunology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 452</td>
<td>Cell Biology</td>
<td>4</td>
</tr>
<tr>
<td>MCRO 224</td>
<td>General Microbiology I</td>
<td>5</td>
</tr>
<tr>
<td>MCRO 225</td>
<td>General Microbiology II</td>
<td>5</td>
</tr>
<tr>
<td>MCRO 402</td>
<td>General Virology</td>
<td>4</td>
</tr>
<tr>
<td>MCRO 423</td>
<td>Medical Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>MCRO 424</td>
<td>Microbial Physiology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 461 or BIO 462</td>
<td>Senior Project - Research Proposal</td>
<td>2</td>
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</tbody>
</table>

Electives

Select from the following: 2,3,4,5 19

Biotechnology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ASCI 403</td>
<td>Applied Biotechnology in Animal Science</td>
</tr>
<tr>
<td>BIO 202</td>
<td>Orientation to Biotechnology</td>
</tr>
<tr>
<td>BIO/CHM 441</td>
<td>Bioinformatics Applications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIO/CHM 475</td>
<td>Molecular Biology Laboratory</td>
</tr>
<tr>
<td>BIO/CHM 476</td>
<td>Gene Expression Laboratory</td>
</tr>
<tr>
<td>BRAE 448</td>
<td>Bioconversion</td>
</tr>
<tr>
<td>CHEM 331</td>
<td>Quantitative Analysis</td>
</tr>
<tr>
<td>CHEM 372</td>
<td>Metabolism</td>
</tr>
<tr>
<td>CHEM 373</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>CHEM 474</td>
<td>Protein Techniques Laboratory</td>
</tr>
<tr>
<td>MCRO 433</td>
<td>Microbial Biotechnology</td>
</tr>
</tbody>
</table>

Food Microbiology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCI 402</td>
<td>Quality Assurance and Control of Dairy Products</td>
</tr>
<tr>
<td>DSCI 444</td>
<td>Dairy Microbiology</td>
</tr>
<tr>
<td>FSN 230</td>
<td>Elements of Food Processing</td>
</tr>
<tr>
<td>FSN 275</td>
<td>Elements of Food Safety</td>
</tr>
<tr>
<td>FSN 335</td>
<td>Food Quality Assurance</td>
</tr>
<tr>
<td>FSN 340</td>
<td>Fermented Foods</td>
</tr>
<tr>
<td>FSN 364</td>
<td>Food Chemistry</td>
</tr>
<tr>
<td>FSN 368</td>
<td>Food Analysis</td>
</tr>
<tr>
<td>FSN 374</td>
<td>Food Laws and Regulations</td>
</tr>
<tr>
<td>FSN 474</td>
<td>Advanced Food Processing</td>
</tr>
<tr>
<td>MCRO/WVIT 301</td>
<td>Wine Microbiology</td>
</tr>
<tr>
<td>MCRO 421</td>
<td>Food Microbiology</td>
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</tbody>
</table>

Medical and Public Health Microbiology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ASCI 203</td>
<td>Animal Parasitology</td>
</tr>
<tr>
<td>ASCI 312</td>
<td>Production Medicine</td>
</tr>
<tr>
<td>ASCI 321</td>
<td>Zoonoses and Veterinary Public Health Concerns</td>
</tr>
<tr>
<td>ASCI 438</td>
<td>Systemic Animal Physiology</td>
</tr>
<tr>
<td>ASCI 440</td>
<td>Immunology and Diseases of Animals</td>
</tr>
<tr>
<td>BIO 162</td>
<td>Introduction to Organismal Form and Function</td>
</tr>
<tr>
<td>BIO 406</td>
<td>Advanced Anatomy and Physiology: Neuroscience</td>
</tr>
<tr>
<td>BIO 407</td>
<td>Advanced Anatomy and Physiology: Endocrinology</td>
</tr>
<tr>
<td>BIO 408</td>
<td>Advanced Anatomy and Physiology: Cardiovascular and Renal</td>
</tr>
<tr>
<td>BIO 409</td>
<td>Advanced Anatomy and Physiology: Muscle and Locomotion</td>
</tr>
<tr>
<td>BIO 410</td>
<td>Functional Histology</td>
</tr>
<tr>
<td>BIO 428</td>
<td>Hematology</td>
</tr>
<tr>
<td>BIO 429</td>
<td>Parasitology</td>
</tr>
<tr>
<td>CHEM 331</td>
<td>Quantitative Analysis</td>
</tr>
<tr>
<td>CHEM 349</td>
<td>Chemical and Biological Warfare</td>
</tr>
<tr>
<td>CHEM 377</td>
<td>Chemistry of Drugs and Poisons</td>
</tr>
<tr>
<td>CHEM 477</td>
<td>Biochemical Pharmacology</td>
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<tr>
<td>KINE 301</td>
<td>Functional Anatomy</td>
</tr>
<tr>
<td>MCRO 320</td>
<td>Emerging Infectious Diseases</td>
</tr>
<tr>
<td>MCRO 342</td>
<td>Public Health Microbiology</td>
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</tbody>
</table>

Microbial Ecology and Evolution

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 413</td>
<td>Evolutionary Medicine</td>
</tr>
<tr>
<td>BIO 414</td>
<td>Evolution</td>
</tr>
</tbody>
</table>
### General Education (GE) Requirements

- **Area A**
  - English Language Communication and Critical Thinking
    - A1 Oral Communication 4
    - A2 Written Communication 4
    - A3 Critical Thinking 4

- **Area B**
  - Scientific Inquiry and Quantitative Reasoning
    - B1 Physical Science (4 units in Support) 1
    - B2 Life Science (4 units in Major) 1
    - B3 One lab taken with either a B1 or B2 course
    - B4 Mathematics/Quantitative Reasoning (4 units in Support) 1

- **Area C**
  - Arts and Humanities

Lower-division courses in Area C must come from three different subject prefixes.

### Free Electives

- 56 units

Total units 180

1. Required in Major or Support, also satisfies General Education (GE) requirement.
2. Consultation with advisor is recommended prior to selecting Electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
3. Maximum of 6 units may be applied toward Approved Electives: BIO 200, BIO 300, BIO 400, BIO 450, BIO 485, BIO 495, MSCI 401. At least 14 units must be upper-division (300-400 level).
4. 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.
5. Care must be taken to ensure compliance with the "60 units of upper-division" requirement.
6. If BIO 462 is used to meet the senior project requirement, it cannot also be counted as an Elective.
7. CHEM 371 suggested for students who plan to pursue graduate school or a health professions career.

### Support Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 127</td>
<td>General Chemistry for Agriculture and Life Science I (B1 &amp; B3)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 128</td>
<td>General Chemistry for Agriculture and Life Science II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 129</td>
<td>General Chemistry for Agriculture and Life Science III</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 216</td>
<td>Organic Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 217 &amp; CHEM 220</td>
<td>Organic Chemistry II and Organic Chemistry Laboratory for Life Sciences II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 313</td>
<td>Survey of Biochemistry and Biotechnology</td>
<td>5</td>
</tr>
<tr>
<td>or CHEM 371</td>
<td>Biochemical Principles</td>
<td></td>
</tr>
<tr>
<td>MATH 161</td>
<td>Calculus for the Life Sciences I (B4)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 123</td>
<td>College Physics III</td>
<td>4</td>
</tr>
</tbody>
</table>

### Other electives for Microbiology Majors

- AEPS 313 Agricultural Entomology
- AEPS/BOT 323 Plant Pathology
- AEPS 441 Biological Control for Pest Management
- BIO 300 Research Experience for Undergraduates
- BIO 335 General Entomology
- BIO 336 Invertebrate Zoology
- BIO 361 Principles of Animal Physiology
- BIO 400 Special Problems for Advanced Undergraduates
- BIO 434 Environmental Physiology
- BIO 450 Undergraduate Laboratory Assistantship
- BIO 462 Senior Project Research Experience
- BIO 463 Honors Research
- CHEM 218 Organic Chemistry III
- CHEM 223 and Organic Chemistry Laboratory for Life Sciences III
- CHEM 418 Neurochemistry
- CSC 101 Fundamentals of Computer Science
- DATA 301 Introduction to Data Science
- MATH 162 Calculus for the Life Sciences II
- MCRB 100 Introduction to Microbiology Research
- STAT 313 Applied Experimental Design and Regression Models
- STAT 419 Applied Multivariate Statistics
- STAT 421 Survey Sampling and Methodology

### 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/generalrequirementsbachelordegree/#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).
<table>
<thead>
<tr>
<th>Area</th>
<th>Course Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Arts: Arts, Cinema, Dance, Music, Theater</td>
<td>4</td>
</tr>
<tr>
<td>C2</td>
<td>Humanities: Literature, Philosophy, Languages other than English</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Lower-Division C Elective - Select a course from either C1 or C2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Upper-Division C</td>
<td>4</td>
</tr>
<tr>
<td>Area D</td>
<td>Social Sciences - Select courses in Area D from at least two different prefixes</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>American Institutions (Title 5, Section 40404 Requirement)</td>
<td>4</td>
</tr>
<tr>
<td>D2</td>
<td>Lower-Division D</td>
<td>4</td>
</tr>
<tr>
<td>Area E</td>
<td>Lifelong Learning and Self-Development</td>
<td>4</td>
</tr>
<tr>
<td>Area F</td>
<td>Ethnic Studies</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GE Electives in Areas B, C, and D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select courses from two different areas; may be lower-division or upper-division courses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GE Electives (4 units in Support plus 4 units in GE)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>56</td>
</tr>
</tbody>
</table>

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