# Bachelor of Science in Biology: Concentration in Microbiology Roadmap

120 Total Units Required
Minimum Number of Units in the Major: 68

## Course Title Units

### First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>MATH 226</td>
<td>Calculus I ¹</td>
<td>4</td>
</tr>
<tr>
<td>GE Area A: Oral Communication (A1) or Critical Thinking (A3)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE Area A: Written English Communication (A2) ³</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Units** 15

### Second Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 230</td>
<td>Introductory Biology I</td>
<td>5</td>
</tr>
<tr>
<td>PHYS 111 &amp; PHYS 112</td>
<td>General Physics I and General Physics I Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>GE Area A: Oral Communication (A1) or Critical Thinking (A3)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE Area A: Written English Communication II (A4)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or Written English Communication (A2) Stretch II</td>
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</tr>
</tbody>
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**Units** 15

### Third Semester

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 240</td>
<td>Introductory Biology II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 130</td>
<td>General Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 215 &amp; CHEM 216</td>
<td>General Chemistry II: Quantitative Applications of Chemistry Concepts and General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts</td>
<td>5</td>
</tr>
<tr>
<td>GE Area D: U.S. History (D2) or U.S. and California Government (D3)</td>
<td>3</td>
<td></td>
</tr>
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**Units** 16

### Fourth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 233</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 121 &amp; PHYS 122</td>
<td>General Physics II and General Physics II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>GE Area A: Written English Communication II (A4) if not already satisfied</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or SF State Studies or University Elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE Area C: Arts (C1)</td>
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<td>3</td>
</tr>
</tbody>
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### Fifth Semester

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<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>BIOL 355</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Lower Division Requirement – Select One ⁴</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>GE Area C: Arts (C1) or Humanities (C2)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE Area C: Humanities: Literature (C3)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE Area D: Social Sciences (D1)</td>
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**Units** 16

### Sixth Semester

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<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>BIOL 401 &amp; BIOL 402GW</td>
<td>General Microbiology and General Microbiology Laboratory - GWAR</td>
<td>6</td>
</tr>
<tr>
<td>CHEM 335</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>GE Area UD–C: Upper Division Arts and/or Humanities (Consider SF State Studies Course)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GE Area UD–D: Upper Division Social Sciences (Consider SF State Studies Course)</td>
<td>3</td>
<td></td>
</tr>
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**Units** 15-16

### Seventh Semester

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>BIOL 442</td>
<td>Microbial Physiology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 340 or CHEM 349</td>
<td>Biochemistry I or General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Upper Division Electives (12 Units Total) – Take Two ⁵</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>SF State Studies or University Elective</td>
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<td></td>
</tr>
</tbody>
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**Units** 15

### Eighth Semester

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<tbody>
<tr>
<td>Upper Division Electives (12 Units Total) – Take Two ⁵</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>SF State Studies or University Elective</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

**Units** 13

**Total Units** 120-121

¹ Depending on courses completed through Early Start and in high school, students in Pathway/Category 3 or 4 may be required to enroll in additional courses before they can take MATH 199 or MATH 226. Most students in Pathway/Category 3 or 4 will need to take a stretch format for MATH 199 (MATH 197 in Fall 2018 and MATH 198 in Spring 2019). Before enrolling in a B4 course, students should verify their MATH Pathway/Category in their Student Center (http://cms.sfsu.edu/content/student-center). Information regarding the courses that correspond with your MATH Pathway/Category can be found on the Developmental Studies Office Website (http://developmentalstudies.sfsu.edu).

² To avoid taking additional units, it is recommended that you meet LLD and SF State Studies requirements (AERM, GP, ES, SJ) within your GE.

³ ENG 114 can only be taken if you complete Directed Self-Placement (DSP) and select ENG 114; if you choose ENG 104/ ENG 105 through DSP you will satisfy GE Area A2 upon successful completion of ENG 105 in the second semester; multilingual students may be advised into alternative English courses.
4 Lower Division Requirement
   BIOL 358 Forensic Genetics: Math Matters (4 units)
   BIOL 458 Biometry (4 units)
   CSC 210 Introduction to Computer Programming (3 units)
   MATH 124 Elementary Statistics (3 units)
   MATH 227 Calculus II (4 units)
   MATH 228 Calculus III (4 units)

5 Electives in Microbiology
   Select 12 units from the following courses, including at least three
   laboratory courses with approval of an advisor. Any course taken
   as an elective that does not appear on this list will not be counted
   towards completion of the Microbiology degree requirements unless
   the course is approved by an advisor prior to enrolling in it. Any
   course taken as an elective that does not appear on this list will
   not be counted towards the completion of the Microbiology degree
   requirements unless it is approved by an advisor prior to enrolling in
   the course.
   BIOL 351GW Experiments in Cell and Molecular Biology - GWAR (4
   units)
   BIOL 420 General Virology (3 units)
   BIOL 425 Emerging Diseases (3 units)
   BIOL 430 Medical Microbiology (3 units)
   BIOL 431 Medical Microbiology Laboratory (2 units)
   BIOL 435 Immunology (3 units)
   BIOL 436 Immunology Laboratory (2 units)
   BIOL 443 Microbial Physiology Laboratory (2 units)
   BIOL 446 Microbial Genomics (4 units)
   BIOL 453 General Parasitology (3 units)
   BIOL 454 Parasitology Laboratory (1 units)
   BIOL 490 Ecology of Infectious Diseases (4 units)
   BIOL 625 Hematology (3 units)
   BIOL 638 Bioinformatics and Genome Annotation (4 units)
   BIOL 699 Independent Study in Biology (1-3 units)
   BIOL 741/CHEM 741/ERTH 741 Electron Microscopy (4 units)
   CHEM 336 Organic Chemistry II Laboratory (2 units)
   or CHEM 343 Biochemistry I Laboratory (3 units)