# Bachelor of Science in Biology: Concentration in Cell and Molecular Biology Roadmap

This roadmap outlines the requirements for the Bachelor of Science in Biology Concentration in Cell and Molecular Biology at San Francisco State University for the academic years 2017-2018. The total units required for the major are 68, with a minimum of 120 units for the degree.

## First Semester
- **CHEM 115** General Chemistry I: Essential Concepts of Chemistry (5 units)
- **MATH 226** Calculus I (4 units)
- **GE Area A:** Oral Communication (A1) or Critical Thinking (A3) (3 units)
- **GE Area A:** Written English Communication (A2) (3 units)

Total Units: 15

## Second Semester
- **PHYS 111** & **PHYS 112** General Physics I and General Physics I Laboratory (4 units)
- **BIOL 230** Introductory Biology I (5 units)
- **GE Area A:** Oral Communication (A1) or Critical Thinking (A3) (3 units)
- **GE Area A:** Written English Communication II (A4) (3 units)

Total Units: 15

## Third Semester
- **CHEM 215** & **CHEM 216** General Chemistry II: Quantitative Applications of Chemistry Concepts and General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts (5 units)
- **Select One:**
  - **MATH 227** Calculus II (3 units)
  - **CSC 210** Introduction to Computer Programming (3 units)
  - **BIOL 358** Forensic Genetics: Math Matters (3 units)
  - **BIOL 458** Biometry (3 units)
- **GE Area C:** Arts (C1) (3 units)
- **GE Area C:** Arts (C1) or Humanities (C2) (3 units)
- **GE Area D:** U.S. History (D2) or U.S. and California Government (D3) (3 units)

Total Units: 17-18

## Fourth Semester
- **BIOL 240** Introductory Biology II (5 units)
- **CHEM 233** Organic Chemistry I (3 units)
- **PHYS 121** & **PHYS 122** General Physics II and General Physics II Laboratory (4 units)
- **GE Area D:** U.S. History (D2) or U.S. and California Government (D3) (3 units)

Total Units: 15

## Fifth Semester
- **BIOL 355** Genetics (3 units)
- **CHEM 335** Organic Chemistry II (3 units)
- **GE Area C:** Humanities: Literature (C3) (3 units)
Bachelor of Science in Biology: Concentration in Cell and Molecular Biology

Roadmap

GE Area D: Social Sciences (D1)  
3
SF State Studies or University Elective  
3

Units  
15

Sixth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 350</td>
<td>Cell Biology</td>
<td>3</td>
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<tr>
<td>BIOL 357</td>
<td>Molecular Genetics</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 349</td>
<td>General Biochemistry</td>
<td>3</td>
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<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>
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Seventh Semester

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 351GW</td>
<td>Experiments in Cell and Molecular Biology - GWAR</td>
<td>4</td>
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</tbody>
</table>

Select Major Electives Requirement (11 Units Total) – Take Two  
6-7
SF State Studies or University Elective  
3-6

Units  
15-16

Eighth Semester

Select Major Electives Requirement (11 Units Total)  
4-6
SF State Studies or University Elective – Take Three  
9

Units  
13-15

Total Units  
120-124

1. To avoid taking additional units, it is recommended that you meet LLD and SF State Studies requirements (AERM, GP, ES, SJ) within your GE.
2. 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 A2 upon successful completion of ENG 105 in the second semester; multilingual students may be advised into alternative English courses.
3. Major Electives

Chose 11 units upon advisement. At least one elective course must have an upper division laboratory component. Graduate level courses may be used upon advisement.

- BIOL 337 Evolution (3 units)
- BIOL 356 Honors Genetics (2 units)
- BIOL 380 Evolutionary Developmental Biology (3 units)
- BIOL 382 Developmental Biology (3 units)
- BIOL 401 General Microbiology (3 units)
- BIOL 420 General Virology (3 units)
- BIOL 425 Emerging Diseases (3 units)
- BIOL 435 Immunology (3 units)
- BIOL 446 Microbial Genomics (4 units)
- BIOL 525 Plant Physiology (3 units)
- BIOL 630 Animal Physiology (3 units)
- BIOL 638 Bioinformatics & Genome Annotation (4 units)
- BIOL 640 Cellular Neurosciences (3 units)
- BIOL 699 Independent Study in Biology (1-3 units)
- CHEM 343 Biochemistry I Laboratory (3 units)