B.S. IN BIOCHEMISTRY
AND M.S. CHEMISTRY:
BIOCHEMISTRY SF STATE SCHOLARS ROADMAP

The San Francisco State Scholars program provides undergraduate students with an accelerated pathway to a graduate degree. Students in this program pursue a bachelor’s and master’s degree simultaneously. This program allows students to earn graduate credit while in their junior and/or senior year, reducing the number of semesters required for completion of a master’s degree.

This roadmap is a suggested plan of study and does not replace meeting with an advisor. Please note that students may need to adjust the actual sequence of courses based on course availability. Please consult an advisor in your major program for further guidance.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td><strong>First Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fall Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry (Major Lower-Division)</td>
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<tr>
<td>ENG 114</td>
<td>Writing the First Year: Finding Your Voice (A2)</td>
<td>3</td>
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<tr>
<td>MATH 226</td>
<td>Calculus I (Major Lower-Division, B4)</td>
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<tr>
<td>GE Area A</td>
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<tr>
<td><strong>Units</strong></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
<td></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 (Major Lower-Division)</td>
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<tr>
<td>MATH 227</td>
<td>Calculus II (Major Lower-Division)</td>
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<tr>
<td>GE Area A</td>
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<tr>
<td>GE Area E</td>
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<td><strong>Units</strong></td>
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<tr>
<td><strong>Second Year</strong></td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<tr>
<td>CHEM 233 &amp; CHEM 234</td>
<td>Organic Chemistry I and Organic Chemistry I Laboratory (Major Lower-Division)</td>
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<tr>
<td>CHEM 321</td>
<td>Quantitative Chemical Analysis (Major Upper-Division)</td>
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<tr>
<td>Select One Set of Courses (Major Lower-Division):</td>
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<td>4</td>
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<tr>
<td>PHYS 111 &amp; PHYS 112</td>
<td>General Physics I and General Physics I Laboratory (B1, B3)</td>
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<tr>
<td>PHYS 220 &amp; PHYS 222</td>
<td>General Physics with Calculus I and General Physics with Calculus I Laboratory (B1, B3)</td>
<td>4</td>
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<tr>
<td>GE Area C</td>
<td></td>
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<tr>
<td><strong>Units</strong></td>
<td></td>
<td>15</td>
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<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 230</td>
<td>Introductory Biology I (Major Lower-Division)</td>
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</tr>
<tr>
<td>CHEM 335</td>
<td>Organic Chemistry II (Major Upper-Division)</td>
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<tr>
<td>Select One Set of Courses (Major Lower-Division):</td>
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<td>4</td>
</tr>
<tr>
<td>PHYS 121 &amp; PHYS 122</td>
<td>General Physics II and General Physics II Laboratory</td>
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</tr>
<tr>
<td>PHYS 230 &amp; PHYS 232</td>
<td>General Physics with Calculus II and General Physics with Calculus II Laboratory</td>
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</tr>
<tr>
<td>PHYS 240 &amp; PHYS 242</td>
<td>General Physics with Calculus III and General Physics with Calculus III Laboratory</td>
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<td>GE Area D</td>
<td></td>
<td>3</td>
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<tr>
<td><strong>Units</strong></td>
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<td>15</td>
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<tr>
<td><strong>Third Year</strong></td>
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<tr>
<td><strong>Summer Semester</strong></td>
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<tr>
<td>SF State Studies or University Elective - Take Two</td>
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<td>6</td>
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<tr>
<td><strong>Units</strong></td>
<td></td>
<td>6</td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<td></td>
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<tr>
<td>CHEM 300</td>
<td>Physical Chemistry for Life Sciences I (Major Upper-Division)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 340</td>
<td>Biochemistry I (Major Upper-Division)</td>
<td>3</td>
</tr>
<tr>
<td>GWAR Elective</td>
<td></td>
<td>3-4</td>
</tr>
</tbody>
</table>

1. A2
2. B4
3. GE Area A
4. GE Area C
5. GE Area D
6. GWAR Elective
7. 3-4
Major Electives (15 Units Total) - Take One \(^6\) | 3
GE Area D | 3

### Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 341</td>
<td>Biochemistry II (Major Upper-Division)</td>
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</tr>
<tr>
<td>CHEM 343</td>
<td>Biochemistry I Laboratory (Major Upper-Division)</td>
<td>3</td>
</tr>
</tbody>
</table>

Major Electives (15 Units Total) - Take One \(^6\) | 3
GE Area C - Take Two | 6

### Fourth Year

#### Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 301</td>
<td>Physical Chemistry for Life Sciences II (Major Upper-Division)</td>
<td>3</td>
</tr>
</tbody>
</table>

Major Electives (15 Units Total) - Take One \(^6\) | 3
GE Area F \(^5\) | 3
GE Area UD-B: Upper-Division Physical and/or Life Sciences | 3
GE Area UD-C: Upper-Division Arts and/or Humanities | 3

### Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 879</td>
<td>Research Methods I (Graduate Core)</td>
<td>3</td>
</tr>
</tbody>
</table>

Major Electives (15 Units Total) - Take One \(^6\) | 3
Related Study - Take One \(^8\) | 3
GE Area UD-D: Upper-Division Social Sciences | 3
U.S. and California Government (http://bulletin.sfsu.edu/undergraduate-education/american-institutions/#usg) | 3

### Fifth Year

#### Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 897</td>
<td>Research (Graduate Requirement - Take 3 units)</td>
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</table>

Related Study - Take Three \(^8\) | 9

### Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 880</td>
<td>Research Methods II (Graduate Core)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 897</td>
<td>Research (Graduate Requirement - Take 6 units)</td>
<td>6</td>
</tr>
</tbody>
</table>

Culminating Experience - Select One \(^9\) | 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 895</td>
<td>Research Project</td>
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</tr>
<tr>
<td>CHEM 898</td>
<td>Master's Thesis</td>
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</tr>
</tbody>
</table>

**Total Units** | 150-151

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1. 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.

2. To determine the best B4 course option, students should complete the online advising activity at mathadvising.sfsu.edu (https://mathadvising.sfsu.edu/). Questions? Contact Gator Smart Start. (https://gatorsmartstart.sfsu.edu/)

3. To avoid taking additional units, it is recommended that you meet the SF State Studies (AERM, GP, ES, SJ) requirements within your GE or major.

4. PHYS 111 and PHYS 112 are prerequisites for PHYS 121 and PHYS 122. PHYS 220 and PHYS 222 are prerequisites for PHYS 240 and PHYS 242.

5. CHEM 351 may be substituted for CHEM 300 and CHEM 353 may be substituted for CHEM 301 if prerequisites for CHEM 351 and CHEM 353 are met.

6. **Upper-Division Electives (15 units)**
   - Students must complete at least 15 units of upper-division Chemistry and Biology electives selected from the lists below. Courses from community colleges cannot be substituted for the courses on the list below.
   - Electives must include at least:
     i. one course with a CHEM prefix,
     ii. one GWAR (GW) course (See Footnote 7), and
     iii. three laboratory courses.
   - Note that many Biology electives have a BIOL 240 prerequisite.
   - Students wishing to enroll in BIOL 350, BIOL 355, and BIOL 612 without completing the BIOL 240 prerequisite should contact the instructor of record before registration.
   - Students should consult an advisor regarding the selection of elective courses and check course co- and pre-requisites before enrolling.
   - Graduate-level courses in chemistry or appropriate courses in biology, physics, geosciences, and computer science may be substituted upon prior approval of an advisor.

**Upper-Division Electives in Chemistry**

Students should keep in mind that non-Biochemistry courses may require additional prerequisites that are not met in the Biochemistry degree or permission of the instructor.

- CHEM 322 Quantitative Chemical Analysis Laboratory (2 units)*
- CHEM 325 Inorganic Chemistry (3 units)
- CHEM 336 Organic Chemistry II Laboratory (2 units)*
- CHEM 370 Computer Applications in Chemistry and Biochemistry (3 units)*
- CHEM 390GW Contemporary Chemistry and Biochemistry Research - GWAR (3 units)
- CHEM 420 Environmental Analysis (3 units)*
- CHEM 422 Instrumental Analysis (4 units)*
- CHEM 426 Advanced Inorganic Chemistry Laboratory (2 units)*
- CHEM 433 Advanced Organic Chemistry (3 units)
- CHEM 443 Biophysical Chemistry Laboratory (4 units)*
- CHEM 451 Experimental Physical Chemistry Laboratory (2 units)*
- CHEM 645GW Research Trends in Chemistry and Biochemistry - GWAR (3 units)
- CHEM 667/BIOL 667 Optical Engineering for the Biological Sciences (3 units)
- CHEM 680 Chemical Oceanography (3 units)
- CHEM 699 Independent Study (1-6 units)*

**Upper-Division Electives in Biology and Computer Science**

- BIOL 350 Cell Biology (3 units)
- BIOL 612 Optical Engineering for the Biological Sciences (3 units)
- BIOL 667 Optical Engineering for the Biological Sciences (3 units)
- BIOL 699 Independent Study (1-6 units)*
- CHEM 699 Independent Study (1-6 units)*
- BIOL 755 Plant Physiology (3 units)
- BIOL 767 Molecular Biology (3 units)
- BIOL 770 Evolutionary Biology (3 units)
- BIOL 780 Animal Physiology (3 units)
- BIOL 790B Marine Biology (3 units)
- BIOL 790C Marine Biology (3 units)
- BIOL 790D Marine Biology (3 units)
- BIOL 800B Bacterial Genetics (3 units)
- BIOL 800C Bacterial Genetics (3 units)
- BIOL 800D Bacterial Genetics (3 units)
- BIOL 810A Molecular Ecology (3 units)
- BIOL 810B Molecular Ecology (3 units)
- BIOL 810C Molecular Ecology (3 units)
- BIOL 820A Animal Behavior (3 units)
- BIOL 820B Animal Behavior (3 units)
- BIOL 820C Animal Behavior (3 units)
- BIOL 830A Ecological Genetics (3 units)
- BIOL 830B Ecological Genetics (3 units)
- BIOL 830C Ecological Genetics (3 units)
- BIOL 840A Marine Mammalogy (3 units)
- BIOL 840B Marine Mammalogy (3 units)
- BIOL 840C Marine Mammalogy (3 units)
- BIOL 850A Herpetology (3 units)
- BIOL 850B Herpetology (3 units)
- BIOL 850C Herpetology (3 units)
- BIOL 860A Comparative Physiology (3 units)
- BIOL 860B Comparative Physiology (3 units)
- BIOL 860C Comparative Physiology (3 units)
- BIOL 870A Evolutionary Genetics (3 units)
- BIOL 870B Evolutionary Genetics (3 units)
- BIOL 870C Evolutionary Genetics (3 units)
- BIOL 880A Marine Biology (3 units)
- BIOL 880B Marine Biology (3 units)
- BIOL 880C Marine Biology (3 units)
- BIOL 890A Molecular Biology (3 units)
- BIOL 890B Molecular Biology (3 units)
- BIOL 890C Molecular Biology (3 units)
- BIOL 900A Cell Biology (3 units)
- BIOL 900B Cell Biology (3 units)
- BIOL 900C Cell Biology (3 units)
- BIOL 910A Plant Biology (3 units)
- BIOL 910B Plant Biology (3 units)
- BIOL 910C Plant Biology (3 units)
- BIOL 920A Animal Physiology (3 units)
- BIOL 920B Animal Physiology (3 units)
- BIOL 920C Animal Physiology (3 units)
- BIOL 930A Marine Mammalogy (3 units)
- BIOL 930B Marine Mammalogy (3 units)
- BIOL 930C Marine Mammalogy (3 units)
- BIOL 940A Herpetology (3 units)
- BIOL 940B Herpetology (3 units)
- BIOL 940C Herpetology (3 units)
- BIOL 950A Comparative Physiology (3 units)
- BIOL 950B Comparative Physiology (3 units)
- BIOL 950C Comparative Physiology (3 units)
- BIOL 960A Evolutionary Genetics (3 units)
- BIOL 960B Evolutionary Genetics (3 units)
- BIOL 960C Evolutionary Genetics (3 units)
- BIOL 970A Molecular Biology (3 units)
- BIOL 970B Molecular Biology (3 units)
- BIOL 970C Molecular Biology (3 units)
- BIOL 980A Cell Biology (3 units)
- BIOL 980B Cell Biology (3 units)
- BIOL 980C Cell Biology (3 units)
- BIOL 990A Plant Biology (3 units)
- BIOL 990B Plant Biology (3 units)
- BIOL 990C Plant Biology (3 units)
- CHEM 325 Inorganic Chemistry (3 units)
- CHEM 336 Organic Chemistry II Laboratory (2 units)*
- CHEM 370 Computer Applications in Chemistry and Biochemistry (3 units)*
- CHEM 390GW Contemporary Chemistry and Biochemistry Research - GWAR (3 units)
- CHEM 420 Environmental Analysis (3 units)*
- CHEM 422 Instrumental Analysis (4 units)*
- CHEM 426 Advanced Inorganic Chemistry Laboratory (2 units)*
- CHEM 433 Advanced Organic Chemistry (3 units)
- CHEM 443 Biophysical Chemistry Laboratory (4 units)*
- CHEM 451 Experimental Physical Chemistry Laboratory (2 units)*
- CHEM 645GW Research Trends in Chemistry and Biochemistry - GWAR (3 units)
- CHEM 667/BIOL 667 Optical Engineering for the Biological Sciences (3 units)
- CHEM 680 Chemical Oceanography (3 units)
- CHEM 699 Independent Study (1-6 units)*
- Upper-Division Electives in Biology and Computer Science
  - BIOL 350 Cell Biology (3 units)
  - BIOL 612 Optical Engineering for the Biological Sciences (3 units)
  - BIOL 667 Optical Engineering for the Biological Sciences (3 units)
  - BIOL 699 Independent Study (1-6 units)*
  - CHEM 699 Independent Study (1-6 units)*
BIOL 351GW Experiments in Cell and Molecular Biology - GWAR (4 units)*
BIOL 355 Genetics (3 units)
BIOL 357 Molecular Genetics (3 units)
BIOL 358 Forensic Genetics: Math Matters (4 units)*
BIOL 401 General Microbiology (3 units)
BIOL 402GW General Microbiology Laboratory - GWAR (3 units)*
BIOL 420 General Virology (3 units)
BIOL 435 Immunology (3 units)
BIOL 436 Immunology Laboratory (2 units)*
BIOL 612 Human Physiology (3 units)
BIOL 613GW Human Physiology Laboratory - GWAR (3 units)*
BIOL 638 Bioinformatics and Genome Annotation (4 units)*
BIOL 640 Cellular Neurosciences (3 units)
Select a maximum of one:
CSC 306 An Interdisciplinary Approach to Computer Programming (3 units)
CSC 508 Machine Learning and Data Science for Personalized Medicine (3 units)
CSC 509 Data Science and Machine Learning for Medical Image Analysis (3 units)

GWAR Elective (3-4 units of the 15 total Elective units)
BIOL 351GW Experiments in Cell and Molecular Biology - GWAR (4 units)
BIOL 402GW General Microbiology Laboratory - GWAR (3 units)
BIOL 613GW Human Physiology Laboratory - GWAR (3 units)
CHEM 390GW Contemporary Chemistry and Biochemistry Research - GWAR (3 units)

Related Study (9-12 units)
Graduate courses in biochemistry, chemistry, physics, mathematics, or biology on advisement of a graduate major advisor. Upper-division courses may be used with permission of a graduate major advisor.

Analytical/Environmental/Methods (AEM)
CHEM 741/BIOL 741/ERTH 741 Electron Microscopy (4 units)
CHEM 800 Special Topics in Chemistry (3 units)
CHEM 820 (units)
CHEM 821 Mass Spectrometry - Principles and Practice (3 units)
Biochemistry (BIO)
CHEM 800 Special Topics in Chemistry (3 units)
CHEM 841 Enzymology (3 units)
CHEM 851 Biochemical Spectroscopy (3 units)
Organic/Medicinal (OM)
CHEM 800 Special Topics in Chemistry (3 units)
CHEM 832 Organic Synthesis (3 units)
CHEM 834 Organic Spectroscopic Methods (3 units)
CHEM 842 Bioorganic and Medicinal Chemistry (3 units)
Physical/Inorganic/Computational (PIC)
CHEM 800 Special Topics in Chemistry (3 units)
CHEM 851 Biochemical Spectroscopy (3 units)
CHEM 852 (units)
CHEM 870 Computational Methods in Chemistry (3 units)
Chemical Education
CHEM 885 (units)

Both options also require an oral defense.

CHEM 699 - By petition only. To be used as an upper-division elective in Chemistry, a minimum of 3-units must be taken in a single semester.

* Can be used to fulfill the laboratory requirement.