# 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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<tbody>
<tr>
<td><strong>First Year</strong></td>
<td></td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<tr>
<td>CHEM 115</td>
<td>General Chemistry I (Major Lower-Division)</td>
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<tr>
<td>ENG 114</td>
<td>Writing the First Year: Finding Your Voice (A2)</td>
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<tr>
<td>MATH 226</td>
<td>Calculus I (Major Lower-Division, B4)</td>
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<td>GE Area A</td>
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<td><strong>Units</strong></td>
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<tr>
<td><strong>Spring Semester</strong></td>
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<tr>
<td>CHEM 215</td>
<td>General Chemistry II (Major Lower-Division)</td>
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<tr>
<td>MATH 227</td>
<td>Calculus II (Major Lower-Division)</td>
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<td>GE Area A</td>
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<td>GE Area E</td>
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<td><strong>Units</strong></td>
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<td><strong>Second Year</strong></td>
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<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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<td>CHEM 321</td>
<td>Quantitative Chemical Analysis (Major Upper-Division)</td>
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<td>Select One Set of Courses (Major Lower-Division)</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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<td><strong>Spring Semester</strong></td>
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<td>PHYS 220 &amp; PHYS 222</td>
<td>General Physics I and General Physics with Calculus I Laboratory (B1, B3)</td>
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<td>GE Area C</td>
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<td><strong>Units</strong></td>
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<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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<tr>
<td><strong>Units</strong></td>
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<td><strong>Third Year</strong></td>
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<td>CHEM 340</td>
<td>Biochemistry I (Major Upper-Division)</td>
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<td>CHEM 343</td>
<td>Biochemistry I Laboratory (Major Upper-Division)</td>
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<td>GWAR Elective</td>
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<td>Major Electives (15 Units Total) - Take One</td>
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<td>GE Area D</td>
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<td><strong>Units</strong></td>
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<td>Select One (Major Upper-Division):</td>
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<td>CHEM 300</td>
<td>Physical Chemistry for Life Sciences I</td>
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<td>CHEM 351</td>
<td>Physical Chemistry I: Thermodynamics and Kinetics</td>
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<tr>
<td>CHEM 341</td>
<td>Biochemistry II (Major Upper-Division)</td>
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<tr>
<td>Major Electives (15 Units Total) - Take One</td>
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<td>6</td>
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</table>
GE Area C - Take Two  

**Units** 15

**Fourth Year**

**Fall Semester**

Select One (Major Upper-Division):

- CHEM 301: Physical Chemistry for Life Sciences II (3 units)
- CHEM 353: Physical Chemistry II: Quantum Chemistry and Spectroscopy (3 units)

Major Electives (15 Units Total) - Take One

- GE Area F  
- GE Area UD-B: Upper-Division Physical and/or Life Sciences (3 units)
- GE Area UD-C: Upper-Division Arts and/or Humanities (3 units)

**Units** 15

**Spring Semester**

- CHEM 879: Research Methods I (Graduate Core) (3 units)

Major Electives (15 Units Total) - Take One

- Related Study - Take One  
- GE Area UD-D: Upper-Division Social Sciences (3 units)
- U.S. and California Government (http://bulletin.sfsu.edu/undergraduate-education/american-institutions/#usg) (3 units)

**Units** 15

**Fifth Year**

**Fall Semester**

- CHEM 897: Research (Graduate Requirement - Take 3 units) (3 units)

Related Study - Take Three

**Units** 9

**Spring Semester**

- CHEM 880: Research Methods II (Graduate Core) (3 units)
- CHEM 897: Research (Graduate Requirement - Take 6 units) (6 units)

**Units** 12

**Culminating Experience - Select One**

- CHEM 895: Research Project (3 units)
- CHEM 898: Master’s Thesis (3 units)

**Units** 12

**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. 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)

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:
     - one course with a CHEM prefix,
     - one GWAR (GW) course (See Footnote 7), and
     - 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.

7. 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 32Z 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 Physical 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/GWAR Elective (3-4 units of the 15 total Elective units)
   - BIOL 351GW Experiments in Cell and Molecular Biology - GWAR (4 units)

8. Upper-Division Electives in Biology

   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.
   - BIOL 350 Cell Biology (3 units)
   - BIOL 355 Experimental Cell Biology (3 units)
   - BIOL 612 Optical Engineering for the Biological Sciences (3 units)
   - BIOL 622 Electrical and Computer Engineering for the Biological Sciences (3 units)
   - BIOL 667 Optical Engineering for the Biological Sciences (3 units)
   - BIOL 667 Optical Engineering for the Biological Sciences (3 units)
   - BIOL 685 Cell and Molecular Biology (3 units)
   - BIOL 688 Experiences in Teaching Chemistry and Biochemistry (1 unit)
   - BIOL 699 Independent Study (1-6 units)*

9. Upper-Division Electives in Biology and Computer Science

   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.
   - BIOL 350 Cell Biology (3 units)
   - BIOL 355 Experimental 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 685 Cell and Molecular Biology (3 units)
   - BIOL 688 Experiences in Teaching Chemistry and Biochemistry (1 unit)
   - BIOL 699 Independent Study (1-6 units)*

10. Upper-Division Electives in Biological Sciences
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 Sequence Analysis (4 units)*
BIOL 640 Cellular Neurosciences (3 units)

Select a maximum of one:
CSC 306 An Interdisciplinary Approach to Computer Programming (3 units)
CSC 408 Machine Learning and Data Science for Personalized Medicine (3 units)
CSC 509 Data Science and Machine Learning for Medical Image Analysis (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 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 870 Computational Methods in Chemistry (3 units)

Both options also require an oral defense.

May be repeated and up to 2 units used towards Elective requirement.
CHEM 699 - By petition only. Units must be taken in the same semester to be used as an upper-division elective.

* Can be used to fulfill the laboratory requirement.

± Given catalog rights, fall 2023 transfer students do not need to complete an Area F course.