BS IN BIOLOGICAL SCIENCE (CELL AND MOLECULAR BIOLOGY)

Units required for Major: 73-85, includes units of study in chosen concentration (see below).
Total units required for BS: 120

Program Description
The concentration in Cell and Molecular Biology is designed for students interested in advanced studies at the Masters or Ph.D. level, students pursuing career working in biotechnology, or pre-health professions majors pursuing a fundamental understanding of the bimolecular basis of disease. Students completing the degree requirements for the Cell and Molecular Biology concentration also fulfills the requirements for a minor in Chemistry.

Pre-Major Requirements
The Biological Sciences program at Sacramento State is one of the most highly sought after programs in Northern California. Due to the large number of applications, the program is now officially impacted.
Students wishing to become Biological Science majors must complete a series of required lower division and then must apply for admission to the program. Check the department website for requirements, and it is highly recommended that interested students speak with an advisor at the Natural Sciences Advising Center (NSAC) as soon as possible.

Freshmen interested in the major are admitted as pre-Biological Science majors.

To change to the Biological Sciences major, pre-major students are required to complete the following courses and grade requirements and submit a Declaration of Major form to the Biological Science Department Office along with transcript copies.

1. Completion of the following lower division "pre-major" courses with a minimum "C" or better. Only first or second attempt will be considered:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 1</td>
<td>Biodiversity, Evolution and Ecology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 2</td>
<td>Cells, Molecules and Genes</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>STAT 1</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 5</td>
<td>Accelerated Academic Literacies</td>
<td>3</td>
</tr>
</tbody>
</table>

1. Overall GPA of 2.5 based on the pre-major courses listed above.
2. Minimum of 30 units completed at the college level.

Courses also satisfy General Education (GE)/Graduation Requirement.

Program Requirements

<table>
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<tr>
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<td>5</td>
</tr>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 1B</td>
<td>General Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 20</td>
<td>Organic Chemistry Lecture--Brief Course</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 24</td>
<td>Organic Chemistry Lecture I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 124</td>
<td>Organic Chemistry Lecture II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 26A</td>
<td>Calculus I for the Social and Life Sciences</td>
<td>4</td>
</tr>
<tr>
<td>MATH 30</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 5A</td>
<td>General Physics: Mechanics, Heat, Sound</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 5B</td>
<td>General Physics: Light, Electricity and Magnetism, Modern Physics</td>
<td>4</td>
</tr>
<tr>
<td>STAT 1</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>BIO 100</td>
<td>Introduction to Scientific Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BIO 184</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>BIO 100</td>
<td>Introduction to Scientific Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BIO 184</td>
<td>General Genetics</td>
<td>4</td>
</tr>
</tbody>
</table>

Concentration (29-37 Units)
Select from the following concentrations:

- General Biology
- Biomedical Sciences
- Cell and Molecular Biology
- Clinical Laboratory Sciences
- Ecology, Evolution, and Conservation
- Forensic Biology
- Microbiology

Total Units: 73-85

Notes:
- Pre-Health Professional students should take the Chemistry and Math requirements as stated in the Pre-Health Professional Program section of this catalog.
- With approval, up to six units of upper division coursework from related fields may be applied as electives in the major.
- No more than 3 units from the following combined can be applied to the Biological Sciences upper division major requirement. No more than 2 units of Bio 195 and 197 series courses may be used to count toward the degree.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 195</td>
<td>Biological Internship</td>
<td>1</td>
</tr>
<tr>
<td>BIO 197A</td>
<td>Laboratory Teaching Assistant</td>
<td>1</td>
</tr>
<tr>
<td>BIO 197B</td>
<td>Laboratory Techniques</td>
<td>1</td>
</tr>
</tbody>
</table>
BS in Biological Science (Cell and Molecular Biology)

Concentration in Cell and Molecular Biology (34-36 units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 121</td>
<td>Molecular Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIO 180</td>
<td>Advanced Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 187</td>
<td>Advanced Cell Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 188</td>
<td>Evolution</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 20L</td>
<td>Introductory Organic Chemistry Laboratory</td>
<td>1-2</td>
</tr>
<tr>
<td>or CHEM 25</td>
<td>Organic Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 31</td>
<td>Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 161</td>
<td>General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 162</td>
<td>General Biochemistry Laboratory</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective Courses (9 Units)

- Select one of the following: 4
  - BIO 126 Comparative Vertebrate Morphology
  - BIO 127 Developmental Biology
  - BIO 128 Plant Anatomy and Physiology
  - BIO 131 Systemic Physiology

- Select one of the following Ecology, Evolution, and Biodiversity electives: 3

  Part A: Biodiversity Electives
  - BIO 103 Plants and Civilization
  - BIO 112 Plant Taxonomy
  - BIO 140 Medical Microbiology and Emerging Infectious Diseases
  - BIO 145 The Diversity of Microorganisms
  - BIO 152 Human Parasitology
  - BIO 157 General Entomology
  - BIO 162 Ichthyology: The Study of Fishes
  - BIO 164 Amphibians and Reptiles: An Introduction to Herpetology
  - BIO 166 Ornithology

  Part B: Ecology and Evolution Electives
  - BIO 113 Evolution and Speciation in Flowering Plants
  - BIO 118 Natural Resource Conservation
  - BIO 160 General Ecology
  - BIO 169 Animal Behavior
  - BIO 173 Principles of Fisheries Biology
  - BIO 179 Conservation Biology & Wildlife Management

Select additional upper division electives in consultation with an advisor to total 9 units.

Total Units 34-36

General Education Requirements

- Area A: Basic Subjects (6 Units)
  - A1 - Oral Communication 3
  - A2 - Written Communication 2 0
  - A3 - Critical Thinking 3

- Area B: Physical Universe and Its Life Forms
  - B1 - Physical Science 2 0
  - B2 - Life Forms 2 0
  - B3 - Lab (Note: Lab experience to be taken with one of the following: B1, B2 or B5) 0
  - B4 - Math Concepts 2 0
  - B5 - Additional Course (Any B to reach 12 units) - Take upper-division course to complete Area & upper division requirements. 2 0

- Area C: Arts and Humanities (12 Units)
  - C1 - Arts 3
  - C2 - Humanities 3
  - C1/C2 - Area C Course 3
  - C1/C2 - Area C Course - Take upper-division course to complete Area & upper division requirements. 3

- Area D: The Individual and Society (9 Units)
  - Area D Course 3
  - Area D Course 3
  - Area D Course - Take upper-division course to complete Area & upper division requirements. 3

- Area E: Understanding Personal Development (3 Units)
  - Area E Course 3

- Area F: Ethnic Studies (3 Units)
  - Area F Course 3

Total Units 33

Graduation Requirements

- Graduation Requirements (required by CSU) (9 Units)
  - American Institutions: U.S. History 3
  - American Institutions: U.S. Constitution & CA Government 3
  - Writing Intensive (WI) 3

- Graduation Requirements (required by Sacramento State) (12 Units)

1. To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (http://catalog.csus.edu/colleges/academic-affairs/general-education/).

2. Required in Major; also satisfies GE.

1. CHEM 160A and CHEM 160B may be taken in lieu of CHEM 161. Only three units of the package may be counted toward the upper division major requirement.

2. CHEM 162 is included in the 36 upper division unit requirement for this concentration.
To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (http://catalog.csus.edu/colleges/academic-affairs/general-education/).

**Note:** There is no way to list all possible overlaps so please consult with a professional advisor. The Academic Advising Center can be visited online (http://www.csus.edu/acad/), by phone (916) 278-1000, or email (advising@csus.edu).

If not satisfied before entering Sacramento State, it may be satisfied in General Education Area C2 (Humanities). "C- or better required."

The alternative methods for satisfying the Foreign Language Proficiency Requirement are described here: www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html (https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html)