BS IN BIOLOGICAL SCIENCE (MICROBIOLOGY)

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 Microbiology is designed to prepare students for entry level technical positions in the industry and graduate programs in Microbiology leading to careers in research and teaching. This curriculum meets the educational requirements for various entry level career positions for biotechnology, environmental, pharmaceutical, wastewater treatment, and agricultural areas of microbiology. Concentration includes 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.

Program Requirements

Select one of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 26A</td>
<td>Calculus I for the Social and Life Sciences</td>
<td>3</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>
</tbody>
</table>

Required Upper Division Core Courses (7 Units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<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

<table>
<thead>
<tr>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>73-85</td>
</tr>
</tbody>
</table>

1. Course also satisfies General Education (GE)/Graduation Requirement.
2. CHEM 24 and CHEM 124 may be taken in lieu of CHEM 20. (CHEM 124 is not counted toward the 36 upper division unit requirement in the major except in the Biomedical Sciences Concentration.)

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 can count toward the major requirement.

<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>
<tr>
<td>BIO 197C</td>
<td>Co-curricular Activities in Biology</td>
<td>1</td>
</tr>
</tbody>
</table>

1. Course also satisfies General Education (GE)/Graduation Requirement.
BS in Biological Science (Microbiology)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 199A</td>
<td>Introductory Undergraduate Research</td>
<td>1 - 2</td>
</tr>
<tr>
<td>BIO 199B</td>
<td>Directed Readings</td>
<td>1 - 2</td>
</tr>
</tbody>
</table>

Concentration in Microbiology (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 139</td>
<td>General Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 143</td>
<td>General Virology</td>
<td>3</td>
</tr>
<tr>
<td>BIO 145</td>
<td>The Diversity of Microorganisms</td>
<td>4</td>
</tr>
<tr>
<td>BIO 180</td>
<td>Advanced Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 20L</td>
<td>Introductory Organic Chemistry Laboratory</td>
<td>1 - 3</td>
</tr>
<tr>
<td>or CHEM 25</td>
<td>Organic Chemistry Laboratory</td>
<td></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 (5 Units)

Select 5 units from the following Cell and Molecular Biology electives or Clinical Laboratory Science and Infectious Disease electives.

Cell and Molecular Biology Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 149A</td>
<td>Immunology</td>
<td></td>
</tr>
<tr>
<td>BIO 150</td>
<td>Forensic Biology</td>
<td></td>
</tr>
<tr>
<td>BIO 151</td>
<td>Advanced Laboratory Techniques in Forensic Biology</td>
<td></td>
</tr>
<tr>
<td>BIO/FACS 170</td>
<td>Advanced Nutrition and Metabolism</td>
<td></td>
</tr>
<tr>
<td>BIO 178</td>
<td>Molecular Ecology</td>
<td></td>
</tr>
<tr>
<td>BIO 183</td>
<td>Cancer Biology</td>
<td></td>
</tr>
<tr>
<td>BIO 185</td>
<td>Topics in Biology</td>
<td></td>
</tr>
<tr>
<td>BIO 186A</td>
<td>Cell and Molecular Biology Seminar</td>
<td></td>
</tr>
<tr>
<td>BIO 187</td>
<td>Advanced Cell Biology</td>
<td></td>
</tr>
</tbody>
</table>

Clinical Laboratory Science and Infectious Disease Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 134</td>
<td>Medical Mycology</td>
<td></td>
</tr>
<tr>
<td>BIO 140</td>
<td>Medical Microbiology and Emerging Infectious Diseases</td>
<td></td>
</tr>
<tr>
<td>BIO 144</td>
<td>Pathogenic Bacteriology</td>
<td></td>
</tr>
<tr>
<td>BIO 149B</td>
<td>Immunology and Serology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIO 152</td>
<td>Human Parasitology</td>
<td></td>
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<tr>
<td>HLSC 148</td>
<td></td>
<td></td>
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</tbody>
</table>

Total Units 34-36

General Education Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area A: Basic Subjects (6 Units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1 - Oral Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A2 - Written Communication</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>A3 - Critical Thinking</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area B: Physical Universe and Its Life Forms (3 Units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1 - Physical Science</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B2 - Life Forms</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B3 - Lab (Note: Lab experience to be taken with one of the following: B1, B2 or B5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B4 - Math Concepts</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B5 - Additional Course (Any B to reach 12 units) - Take upper-division course to complete Area &amp; upper division requirements.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area C: Arts and Humanities (12 Units)</td>
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<td></td>
</tr>
<tr>
<td>C1 - Arts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C2 - Humanities</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C1/C2 - Area C Course</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C1/C2 - Area C Course - Take upper-division course to complete Area &amp; upper division requirements.</td>
<td>3</td>
<td></td>
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<tr>
<td>Area D: The Individual and Society (9 Units)</td>
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<td></td>
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<tr>
<td>Area D Course</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area D Course</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area D Course - Take upper-division course to complete Area &amp; upper division requirements.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area E: Understanding Personal Development (3 Units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area E Course</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Area F: Ethnic Studies (3 Units)</td>
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<tr>
<td>Area F Course</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 36

Graduation Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Institutions: U.S. History</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>American Institutions: U.S. Constitution &amp; CA Government</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Writing Intensive (WI)</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

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).

1 Required in Major; also satisfies GE.
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race and Ethnicity in American Society (RE)</td>
<td>3</td>
</tr>
<tr>
<td>Foreign Language Proficiency Requirement</td>
<td>6</td>
</tr>
</tbody>
</table>

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/).

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2. 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: https://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)