In general, Biology majors have flexibility for which GWAR course they can take to meet their requirement, as long as the prerequisites for the course have been completed.

In general,

- Cell & Molecular Biology majors should take BIOL 351GW;
- Microbiology majors should take BIOL 402GW;
- Botany, Ecology, and Zoology majors may choose between BIOL 475GW, BIOL 478GW or BIOL 529GW;
- Marine Biology majors may choose between BIOL 570GW or BIOL 631GW; and
- Physiology majors may choose between BIOL 613GW or BIOL 631GW.
- General Biology majors may take any BIOL GWAR class.

See also the Department of Biology home page for GWAR in Biology: biology.sfsu.edu/content/gwar (http://biology.sfsu.edu/content/gwar) or contact a departmental advisor for further information.

The department does not permit multiple concentrations within the biology degree program. All of the curricula require preliminary work in physics and chemistry because many important biological concepts are based squarely upon principles in the physical sciences. Also, each curriculum includes upper division work in the biological sciences so that students will receive reasonable breadth and depth in their degree program. Because of the sequential arrangement of courses students are urged to consult the descriptions for the prerequisites of all their courses.

Although course electives are listed for most of the majors, new electives are always being added to various programs. Therefore, we highly recommend that students seek advisement prior to enrolling in elective courses in their major.

**Concentration in Zoology**

This program provides students with a broad background in animal biology through coursework in evolutionary biology, ecology, behavior, anatomy, and physiology of both vertebrate and invertebrate animals. It is recommended that a background in both vertebrate and invertebrate biology be obtained through selection of appropriate elective courses.

**Biology (B.S.): Concentration in Zoology — 67 units**

**General Education Met in the Major**

General Education requirements met in the Biology major (all concentrations) or Undeclared with Interest in Biology:

The requirements below are deemed “met in the major” upon completion of the courses listed (even though the courses and their prerequisites are not approved for GE). This is true whether or not the student completes the major.

- Area B1 (Physical Science) is satisfied upon completion of CHEM 130 or CHEM 233.
- Areas B2 (Life Science) and B3 (Laboratory Science) are satisfied upon completion of BIOL 240.
- Upper-Division General Education: Physical and Life Sciences (UD-B) is satisfied upon completion of BIOL 355.

## Lower-Division Requirements (34-35 units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 230</td>
<td>Introductory Biology I</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 240</td>
<td>Introductory Biology II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 130</td>
<td>General Organic Chemistry</td>
<td>3</td>
</tr>
</tbody>
</table>

Select 16-17 units from the following: 16-17
Bachelor of Science in Biology: Concentration in Zoology

**General Chemistry II: Quantitative Applications of Chemistry Concepts**

**CHEM 215 & CHEM 216**

**General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts**

**MATH 226**

Calculus I

**MATH 227**

Calculus II

**PHYS 111 & PHYS 112**

General Physics I and General Physics I Laboratory

**PHYS 121 & PHYS 122**

General Physics II and General Physics II Laboratory

**Upper-Division Requirements (19-21 units)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 337</td>
<td>Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 355</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 458</td>
<td>Biometry</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one on advisement of the following: 3

- BIOL 350  Cell Biology
- BIOL 357  Molecular Genetics
- BIOL 380  Evolutionary Developmental Biology
- BIOL 382  Developmental Biology
- BIOL 453  General Parasitology
- BIOL 600  Animal Behavior
- BIOL 612  Human Physiology
- BIOL 620  Endocrinology
- BIOL 621  Reproductive Physiology
- BIOL 630  Animal Physiology

Select 3-4 units on advisement from the following: 3-4

- BIOL 482  Ecology
- BIOL 529GW  Plant Ecology - GWAR
- BIOL 530  Conservation Biology
- BIOL 532  Restoration Ecology
- BIOL 534  Wetland Ecology
- BIOL 577  Ecological and Environmental Modeling
- BIOL 580  Limnology
- BIOL 582  Biological Oceanography
- BIOL 585  Marine Ecology
- BIOL 586  Marine Ecology Laboratory

**Taxonomy or Whole Organism Biology of an Invertebrate or Vertebrate**

Select one course upon advisement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 460</td>
<td>General Entomology</td>
<td></td>
</tr>
<tr>
<td>BIOL 461</td>
<td>Insect Taxonomy</td>
<td></td>
</tr>
<tr>
<td>BIOL 464</td>
<td>Medical Entomology</td>
<td></td>
</tr>
<tr>
<td>BIOL 475GW</td>
<td>Herpetology - GWAR</td>
<td></td>
</tr>
<tr>
<td>BIOL 478GW</td>
<td>Ornithology - GWAR</td>
<td></td>
</tr>
<tr>
<td>BIOL 555</td>
<td>Marine Invertebrate Zoology</td>
<td></td>
</tr>
<tr>
<td>BIOL 570GW</td>
<td>Biology of Fishes - GWAR</td>
<td></td>
</tr>
</tbody>
</table>

**Electives (7-11 units)**

Upon advisement choose from the alternates not used in fulfilling the requirements listed above or any other upper-division biology courses not specifically excluded for major credit, or any graduate biology course.

**General Education Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Level</th>
<th>Units</th>
<th>Area Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Communication</td>
<td>LD</td>
<td>3</td>
<td>A1</td>
</tr>
<tr>
<td>Written English Communication I</td>
<td>LD</td>
<td>3</td>
<td>A2</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>LD</td>
<td>3</td>
<td>A3</td>
</tr>
<tr>
<td>Written English Communication II</td>
<td>LD</td>
<td>3</td>
<td>A4</td>
</tr>
<tr>
<td>Physical Science</td>
<td>LD</td>
<td>3</td>
<td>B1</td>
</tr>
<tr>
<td>Life Science</td>
<td>LD</td>
<td>3</td>
<td>B2</td>
</tr>
<tr>
<td>Lab Science</td>
<td>LD</td>
<td>1</td>
<td>B3</td>
</tr>
<tr>
<td>Mathematics/Quantitative Reasoning</td>
<td>LD</td>
<td>3</td>
<td>B4</td>
</tr>
<tr>
<td>Arts</td>
<td>LD</td>
<td>3</td>
<td>C1</td>
</tr>
<tr>
<td>Arts or Humanities</td>
<td>LD</td>
<td>3</td>
<td>C1 or C2</td>
</tr>
<tr>
<td>Humanities: Literature</td>
<td>LD</td>
<td>3</td>
<td>C3</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>LD</td>
<td>3</td>
<td>D1</td>
</tr>
<tr>
<td>Social Sciences: US History</td>
<td>LD</td>
<td>3</td>
<td>D2</td>
</tr>
<tr>
<td>Social Sciences: US &amp; CA Government</td>
<td>LD</td>
<td>3</td>
<td>D3</td>
</tr>
<tr>
<td>Lifelong Learning and Self-Development (LLD)</td>
<td>LD or UD</td>
<td>3</td>
<td>E</td>
</tr>
<tr>
<td>Physical and/or Life Science</td>
<td>UD</td>
<td>3</td>
<td>UD-B</td>
</tr>
<tr>
<td>Arts and/or Humanities</td>
<td>UD</td>
<td>3</td>
<td>UD-C</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>UD</td>
<td>3</td>
<td>UD-D</td>
</tr>
</tbody>
</table>

**SF State Studies**

Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), in a major or minor, or an elective.

American Ethnic and Racial Minorities (AERM)
on the degree requirements page for the major. The roadmap displays:

A sample advising roadmap for students who have earned an ADT and simultaneously pursue an additional major, a minor, certificate, or Degree completion in 60 units cannot be guaranteed when a student majors at SF State are made by faculty in the discipline. Determinations about “similar” major after transfer. Upon verification that the ADT has been awarded prior to matriculation if pursuing a “similar” major after transfer. Students who have earned an ADT should seek advising in the major department during the first semester of attendance.

General Advising Information for Transfer Students

1. Before transfer, complete as many lower-division requirements or electives for this major as possible.
2. The following courses are not required for admission but are required for graduation. Students are strongly encouraged to complete these units before transfer; doing so will provide more flexibility in course selection after transfer.
   - a course in U.S. History
   - a course in U.S. & California Government
   - a 2nd-semester course in written English composition

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit http://www.assist.org. Check any geographically accessible CCCs; sometimes options include more than one college. Use ASSIST to determine:

- Which courses at a CCC satisfy any lower division major requirements for this major, including 2nd-semester composition;

Remedial courses are not transferable and do not apply to the minimum 60 units/90 quarters required for admission.

Additional units for courses that are repeated do not apply to the minimum 60 units required for upper division transfer (for example, if course was not passed on the first attempt, or was taken to earn a better grade).

Before leaving the last California Community College of attendance, obtain a summary of completion of lower division General Education units (IGETC or CSU GE Breadth). This is often referred to as a GE certification worksheet. SF State does not require delivery of this certification to Admissions, but students should retain this document for verifying degree progress after transfer.

Credit for Advanced Placement, International Baccalaureate, or College-Level Examination Program courses: AP/IB/CLEP credit is not automatically transferred from the previous institution. Units are transferred only when an official score report is delivered to SF State. Credit is based on the academic year during which exams were taken. Refer to the University Bulletin in effect during the year of AP/IB/CLEP examination(s) for details regarding the award of credit for AP/IB/CLEP.

Students pursuing majors in science, technology, engineering and mathematics (STEM) disciplines often defer 6-9 units of lower-division general education in areas C and D until after transfer to focus on preparation courses for the major. (This advice does not apply to students pursuing associate degree completion before transfer.)

Transferring from institutions other than CCCs or CSUs

Review SF State’s lower division General Education requirements. Note that, as described below, the four basic skills courses required for admission meet A1, A2, A3, and B4 in the SF State GE pattern. Courses

<table>
<thead>
<tr>
<th>Environmental Sustainability (ES)</th>
<th>LD or UD</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Perspectives (GP)</td>
<td>LD or UD</td>
<td>3</td>
</tr>
<tr>
<td>Social Justice (SJ)</td>
<td>LD or UD</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: LD = Lower-Division; UD = Upper-Division.

First-Time Student Roadmap (4 Year)

This roadmap opens in a new tab (bulletin.sfsu.edu/colleges/science-engineering/biology/bs-biology-concentration-zoology/roadmap).

Transfer Student Roadmap (2 Year)

For students with an AS-T in Biology. This roadmap opens in a new tab (bulletin.sfsu.edu/colleges/science-engineering/biology/bs-biology-concentration-zoology/adt-roadmap).

This degree program is an approved pathway ("similar" major) for students earning the ADT in Biology

California legislation SB 1440 (2009) mandated the creation of the Associate Degree for Transfer (ADT) to be awarded by the California Community Colleges. Two types of ADTs are awarded: Associate in Arts for Transfer (AA-T) and Associate in Science for Transfer (AS-T). Note: no specific degree is required for admission as an upper-division student. However, the ADT includes specific guarantees related to admission and graduation and is designed to clarify the transfer process and strengthen lower-division preparation for the major.

An ADT totals 60 units and includes completion of all lower-division General Education requirements and at least 18 units in a specific major. Students pursuing an ADT are guaranteed admission to the CSU if minimum eligibility requirements are met, though not necessarily to the CSU campus of primary choice.

Upon verification that the ADT has been awarded prior to matriculation at SF State, students are guaranteed B.A. or B.S. completion in 60 units if pursuing a “similar” major after transfer. Determinations about “similar” majors at SF State are made by faculty in the discipline.

Degree completion in 60 units cannot be guaranteed when a student simultaneously pursues an additional major, a minor, certificate, or credential.

A sample advising roadmap for students who have earned an ADT and continue in a “similar” major at SF State is available on the Roadmaps tab on the degree requirements page for the major. The roadmap displays:

- How many lower-division units required for the major have been completed upon entry based on award of a specific ADT;
- Which lower-division requirements are considered complete upon entry based on award of a specific ADT;
- How to complete the remaining 60 units for the degree in four semesters.
that fulfill the remaining areas of SF State’s lower division GE pattern are available at most two-year and four-year colleges and universities.

Of the four required basic skills courses, a course in critical thinking (GE A3) may not be widely offered outside the CCC and CSU systems. Students should attempt to identify and take an appropriate course no later than the term of application to the CSU. To review more information about the A3 requirement, please visit http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL.

Identify and complete a 2nd-semester written English composition course before transfer. This is usually the next course after the typical “freshman comp” course, with a focus on writing, reading and critical analytical skills for academic purposes, and developing skills in composing, revising, and the use of rhetorical strategies.

Waiting until after transfer to take a single course at SF State that meets both US and CA/local government requirements may be an appropriate option, particularly if transferring from outside of California.

All students must meet the transfer eligibility requirements outlined below for admission.

For more information, visit the Undergraduate Admissions section.

- Complete 60 or more transferable semester units or 90 or more quarter units
- Earn a college grade point average of 2.00 or better in all transferable courses. Non-local area residents may be held to a higher GPA standard.
- Be in good standing at the last college or university attended
- Complete 30-semester units (45-quarter units) of general education, including four basic skills courses:
  a. One course in oral communication (same as CSU GE Area A1)
  b. One course in written composition (same as CSU GE Area A2)
  c. One course in critical thinking (same as CSU GE Area A3)
  d. One course in mathematics or quantitative reasoning (same as CSU GE Area B4)
- The four basic skills courses and a minimum of 60 transferable semester units (90-quarter units) must be completed by the spring semester prior to fall admission, or by the fall semester prior to spring admission. Earn a "C-" or better grade in each basic skills course.