

BIOLOGY

DEPARTMENT OFFICE

Darwin Hall 200
(707) 664-2189
www.sonoma.edu/biology/

DEPARTMENT CHAIR

Richard Whitkus

ADMINISTRATIVE COORDINATORS

Rosemary Galten, Elisabeth Kettmann

Faculty

Lisa P. Bentley
Michael F. Cohen
Daniel E. Crocker
Nicholas R. Geist
Derek J. Girman
Joseph Lin
Murali C. Pillai
Sean Place
Nathan E. Rank
Richard Whitkus
Mackenzie Zippay

Programs Offered

Bachelor of Arts in Biology
 Zoology Concentration
Bachelor of Science in Biology
 Ecology and Evolutionary Biology Concentration
 Marine Biology Concentration
 Molecular Cell Biology Concentration
 Physiology Concentration
Minor in Biology
Master of Science in Biology

The Department of Biology offers a dynamic learning environment, exciting research and training opportunities, and intensive mentoring of students at all levels. Our faculty members are dedicated educators and active scholars who engage in primary research to address diverse topics in the biological sciences. The overall mission of our undergraduate and graduate programs is to educate the next generation of scholars, professionals, and citizens so that they are prepared to meet the biological, environmental, and technological challenges of the future.

Students in the Department of Biology may select from two broadly based Bachelor's degree programs or a Master of Science degree. Within the Bachelor of Arts and Bachelor of Science program, students can select a more focused concentration.

The educational and research activities in the department explore the full range of biology, including molecular and cell biology, physiology, marine biology, microbiology, genetics, ecology, conservation biology, evolutionary biology, and zoology.

Laboratory instruction includes use of modern facilities to provide students with valuable hands-on experience in the latest techniques and research methods. Excellent laboratory and greenhouse facilities exist for maintaining live material for education and research. A radioisotope laboratory is also available.

Field courses draw upon the unparalleled diversity of habitats in the North Bay region. They also capitalize on two spectacular nature preserves: Fairfield Osborn Preserve and Galbreath Wildlands Preserve, administered by Sonoma State University. In addition, the department maintains museum collections of local plants, (North Coast Herbarium of California), vertebrates (Jack Arnold Vertebrate Collection) insects, and other invertebrates.

The Master's program is comprised of an active cohort of graduate students engaged in primary research with faculty members. External funding sources often support graduate student research. Graduate student support includes teaching associate positions that involve close mentoring relationships with instructional faculty.

Careers in Biology

The biology curriculum, supported by physical sciences and mathematics, is designed to provide students with a strong background in the principles of biology and their application to current research questions and biological resource management challenges. This combination of breadth and in-depth instruction allows students to develop the intellectual foundations, skills and flexibility needed to deal with the specific biological concerns of today and future needs of the profession.

Biology graduates enter careers in many areas including health care, biological and biotechnology research, education, agency positions in parks, recreation, conservation and restoration. Graduates from the department have an outstanding record of acceptance in advanced degree programs in health professions and graduate programs.

Secondary Education Teaching Credential Preparation in Life Science

Contact the department chair for information on completing a biological sciences preparation program for a Single Subject Credential.

Biology Degree Plans

The B.A. and B.S. plans share a common lower- and upper-division core, which allows beginning students to select an optional degree plan after the first or second year. Students seeking B.A. may select the Zoology concentration, while those seeking a B.S. may select one of the four concentrations listed below. Students should contact the department and their assigned advisor for additional advice concerning how to complete the requirements for various concentrations.

Bachelor of Arts in Biology

(See page 71 for a sample four-year program.)

General Education (50 units, 12 covered in major)	38
Major core requirements	20
Major electives	20
Support courses	20-21
General electives	21-22
Total units needed for graduation	120

Major Core Requirements

BIOL 130 Introductory Cell Biology and Genetics	4
BIOL 131 Biological Diversity and Ecology	4
BIOL 320 Integrated Ecology and Evolution	4
BIOL 321 Molecular Cell Biology and Physiology	4
One organismal / diversity course from the following list (check Concentration for preferred Course Selection)	
BIOL 322 Invertebrate Biology	4
BIOL 323 Entomology	4
BIOL 327 Vertebrate Biology	4
BIOL 329 Plant biology	4
BIOL 340 General Bacteriology	4
Total units in the major core	20

Major Electives

Choose 20 units of upper division biology electives in consultation with a department advisor.

Total units in major elective	20
Support courses	
CHEM 115A General Chemistry	5
CHEM 115B General Chemistry	5
CHEM 335A Organic Chemistry	3
PHYS 210A General Physics and PHYS 209A General Physics laboratory OR	4
GEO 102 Our dynamic Earth: Introduction to Geology	3
Math 161 Differential and Integral Calculus OR	
Math 165 Elementary Applied Statistics	4
Total units in support courses	20-21

Zoology Concentration

One Course in Biology of invertebrates	
BIOL 322 Invertebrate Biology	4
BIOL 323 Entomology	4
One Course in Biology of vertebrates	
BIOL 324 Marine mammals	3
BIOL 327 Vertebrate Biology	4
BIOL 328 Vertebrate Evolutionary Morphology	4
Two additional concentration specific courses from the following list	
BIOL 322 Invertebrate Biology	4
BIOL 323 Entomology	4
BIOL 324 Marine Mammals	3
BIOL 326 Dinosaurs and Mesozoic Vertebrates	3
BIOL 327 Vertebrate Biology	4
BIOL 328 Vertebrate Evolutionary Morphology	4

BIOL 333 Ecology	4
BIOL 337 Behavioral Ecology	3
BIOL 341 Evolution	4
BIOL 347 Environmental Physiology OR BIOL 349 Animal Physiology	4
BIOL 472 Developmental Biology	4
Total concentration specific units	13-16

Major electives for concentration

Choose 8-11 units of upper-division biology electives in consultation with department advisor.

Total units in major electives for concentration	8-11
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Bachelor of Science in Biology

(See page 72 for a sample four-year program.)

General Education (50 units, 12 covered in major)	38
Major core requirements	23
Major electives	24
Support courses	31
General electives	4
Total units needed for graduation	120

Major Core Requirements

BIOL 130 Introductory Cell Biology and Genetics	4
BIOL 131 Biological Diversity and Ecology	4
BIOL 320 Integrated Ecology and Evolution	4
BIOL 321 Molecular Cell Biology and Physiology	4
One organismal / diversity course from the following list (check concentration for preferred course selection)	
BIOL 322 Invertebrate Biology	4
BIOL 323 Entomology	4
BIOL 327 Vertebrate Biology	4
BIOL 329 Plant Biology	4
BIOL 340 General Bacteriology	4
Research experience (minimum 3 units)	
BIOL 494 Independent Research OR	
BIOL 496A and 496B Honors Thesis	3
Total units in major core	23

Major Electives

Choose 24 units of upper division biology electives in consultation with a department advisor.

Total units in major elective	24
Support courses	
CHEM 115A General Chemistry	5
CHEM 115B General Chemistry	5
BIOL 335A Organic Chemistry	3
CHEM 335B Organic Chemistry	3
PHYS 210A General Physics	3
PHYS 210B General Physics	3
PHYS 209A General Physics Laboratory	1
Math 161 Differential and Integral Calculus AND	4
Math 165 Elementary Applied Statistics	4
Total units in support courses	31

Concentrations

A. Ecology and Evolutionary Biology Concentration

Both courses

BIOL 333 Ecology	4
BIOL 341 Evolution	4

Total concentration specific units 8

Major electives for concentration

Choose 16 units of upper-division biology electives in consultation with a department advisor.

Total units in major electives for concentration 16

B. Marine Biology Concentration

BIOL 332 Marine Biology	3
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Four additional concentration specific courses from the following list

BIOL 322 Invertebrate Biology (if not used to satisfy the Organismal/Diversity Requirement)	4
BIOL 324 Marine Mammals	3
BIOL 333 Ecology	4
BIOL 335 Marine Ecology	4
BIOL 337 Behavioral Ecology	3
BIOL 341 Evolution	4
BIOL 347 Environmental Physiology	4
BIOL 485 Biometry	4

Total concentration specific units 17-19

Major electives for concentration

Choose 5-7 units of upper-division biology electives in consultation with a department advisor.

Total units in major electives for concentration 21

C. Physiology Concentration

Complete one course from the following list

BIOL 347 Environmental Physiology	4
BIOL 348 Plant Physiology	4
BIOL 349 Animal Physiology	4

Three additional concentration specific course from the following list

BIOL 341 Evolution	4
BIOL 342 Molecular genetics	4
BIOL 344 Cell Biology	4
BIOL 347 Environmental Physiology	4
BIOL 348 Plant Physiology	4
BIOL 349 Animal Physiology	4
BIOL 472 Developmental Biology	4
BIOL 480 Immunology	4

Total concentration specific units 16

Major electives for concentration

Choose 8 units of upper-division biology electives in consultation with a department advisor.

Total units in major electives for concentration 8

D. Molecular Cell Biology Concentration

All of the following courses

BIOL 325 Molecular Cell Biology Lab Techniques	1
BIOL 342 Molecular Genetics	4
BIOL 344 Cell Biology	4

Total concentration Specific Units 9

Major electives for concentration

Choose 10 units of upper-division biology electives in consultation with a department advisor.

Total units in major electives for concentration 10

Additional Physical Science Courses for Concentration

CHEM 336A Organic Chemistry lab	2
CHEM 445 Structural Biochemistry OR CHEM 446 Metabolic Biochemistry	3

Total additional Physical Science units in Concentration 5

Upper-Division Biology Electives

Major electives are used to meet the total upper-division unit requirement for the B.A. or B.S. Major electives are chosen from the following:

1. Additional upper division courses in a concentration.
2. Any Biology course numbered greater than 321 (except BIOL 398). This list is subject to revision following this catalog edition. Students should check with their academic advisor for updates. Seniors may also take graduate courses (500 level) with permission of the instructor.
3. Supervisory courses in biology. These courses are: BIOL 393, 494, 495, 496A, 496B, 498, and 499 (see Restrictions below for unit limits for these courses).
4. Biology colloquium, BIOL 390, may be taken twice (2 units total) for major credit.
5. A maximum of 4 units from courses related to biology from other departments, or from Biology non-majors courses numbered 200-319. To apply the units to the major, students are required to obtain written permission from their advisor and Department chair before taking these courses by completing academic requirements report- update forms (available from the department office). Acceptable courses in this category from other departments include: ANTH 301, 302, 318, 345, 414; CHEM 441, 445, 446; GEP 362; 341; 445; GEOL 313.

Restrictions

1. A maximum of 4 units taken in the Cr/NC grading mode may be applied to the major from the following courses: BIOL 390, 498, 499. All other courses in the Biology major must be taken in the traditional grading mode (A-F).
2. A maximum of 7 units from the following list of courses may be applied to the major: BIOL 390, 393, 494, 495, 496A, 496B, 498, and 499.

Preparation for Applying to Health Professions Programs

Students majoring in biology and intending to pursue careers in the health care profession may follow the guidelines for a B.S. degree, or a B.A. degree with the addition of MATH 161, CHEM 335B and 336A, and PHYS 210AB and 209AB. They are encouraged to enroll in SCI 150, Introduction to Careers in the Health Professions, during their first fall semester.

For admission to most health profession schools, regardless of major, it is typically recommended that specific upper-division biology courses be incorporated into the B.A. or B.S. degree. These include:

BIOL 328 Vertebrate Evolutionary Morphology	4
BIOL 340 General Bacteriology	4
BIOL 342 Molecular Genetics	4
BIOL 344 Cell Biology	4
BIOL 349 Animal Physiology	4
BIOL 472 Developmental Biology	4
BIOL 480 Immunology	4

An upper-division biochemistry course (e.g. CHEM 446) is often recommended as well.

Minor in Biology

The minor consists of a minimum of 20 units in the Department of Biology. The purpose of the minor is to provide a student with a rigorous background in biology that supplements the student's major. Students must develop a program in consultation with a faculty advisor in the Biology Department. Requirements of the Biology Minor are:

<i>Two lower-division major courses listed below</i>	8
BIOL 130 (4)	
BIOL 131 (4)	
Additional units in Biology	12

At least eight units must be upper-division courses for majors and at least one course must have a laboratory. One GE course in Biology, or one unit of Biology Colloquium (BIOL 390) may also be applied. All courses applied to the minor must be taken for a letter grade, except BIOL 390.

Master of Science in Biology

The Master of Science degree in the Department of Biology is a thesis based program. Students complete 30 units of course work, which may include classroom courses in addition to mentor-supervised research units, to master the concepts and techniques in their chosen area. They also conduct original research under the direction of a member of the graduate faculty and write up their findings as a Master's Thesis.

Graduate students in the Department of Biology are supported through a variety of sources. The Department has a limited number of paid teaching associate positions available each semester. The University offers a limited number of tuition fee waivers for quali-

fied teaching associates. In addition, students may receive research associate positions through their faculty mentor's research grants. Students can also obtain academic scholarships and financial aid.

Faculty in the Biology Graduate Program are actively involved in research in a wide range of disciplines, including ecology and restoration ecology, evolutionary biology, molecular and cell biology, biochemistry, physiology, microbiology, functional morphology, marine biology, and primatology.

Graduates find themselves with an enhanced understanding of biology and first-hand experience in the practice of science. Many M.S. students go on to doctoral programs; others pursue careers in teaching, research, environmental consulting, resource management, industry and health care professions.

Admission to the Program

To apply, you must submit: A) items 1-2 (listed below) to SSU Admissions and Records Office and B) copies of items 1-2 and originals of items 3-5 to the Department of Biology Graduate Coordinator. The application deadline in the department is January 31 for Fall semester admission and October 31 for Spring semester admission.

1. Complete an online University application via Cal State Apply (<https://www2.calstate.edu/apply>) NOTE: After you submit online, be sure to print a hardcopy to send to the Department of Biology.
2. Official copies of all undergraduate transcripts.
3. One-to-two page Statement of Purpose essay detailing your background in biology, objectives for graduate school and career goals.
4. Two letters of recommendation from individuals familiar with your background in biology and able to comment on your potential for conducting original work.
5. Graduate Record Examination (GRE) scores for the General test. Biology Subject scores are recommended, but not required.

IMPORTANT: A completed application package must be received in the Admissions and Records Office, and by the Graduate Coordinator in Biology, before an applicant will be considered for admission.

Admission to the program requires:

- I. Meeting California State University admissions requirements.
- II. Acceptance by a biology graduate faculty member to serve as a faculty advisor. Students should contact their potential faculty advisor prior to completing an application and refer to this communication in the Statement of Purpose.
- III. Approval of the Graduate Committee. Applications will be reviewed for evidence that the prospective student is capable of initiating and performing original research. Applicants deficient in undergraduate course preparation will be expected to demonstrate competency before being advanced to candidacy. As a general guideline, the Department of Biology uses the following criteria to determine this potential:

IV. An undergraduate degree in biology or related field. The following course guidelines will also be used to determine admission, including:

- A. One course in calculus or statistics;
- B. One year of general chemistry and one semester of organic chemistry;
- C. At least one other course in physical sciences;
- D. Upper-division coursework demonstrating competence in three of four core areas (organismal biology; physiology; molecular or cellular biology; ecology or evolutionary biology);
- E. GPA of 3.00 or higher in the last 60 units;
- F. A score at or above the 50th percentile on each section of the General Examination of the GRE; and
- G. Evidence in letters of recommendation of potential for conducting independent and original research in Biology.

Admission requirements, policies, and other information related to the Master's Degree program in Biology can be found at: www.sonoma.edu/biology/graduate/

Sample Four-Year Program for Bachelor of Arts Degree in Biology

FRESHMAN YEAR: 29 Units

Fall Semester (13 Units)

BIOL 130 (B2) (4)
 CHEM 115A (B1) (5)
 ENGL 101 (A2) (4)

Spring Semester (16 Units)

BIOL 131 (B2) (4)
 CHEM 115B (B1) (5)
 MATH 161/165 (B4) (4)
 GE (3)

SOPHOMORE YEAR: 30 Units

Fall Semester (15 Units)

BIOL 320 (4)
 CHEM 335A (3)
 GE (8)

Spring Semester (15 Units)

BIOL 321 (4)
 PHYS 210A/209A or GEOL 102 (3-4)
 GE (3)

JUNIOR YEAR: 31 Units

Fall Semester (16-17 Units)

BIOL Diversity course (4)
 BIOL Elective (4)
 BIOL Elective (4)
 GE/ Electives (7)

Spring Semester (16 Units)

BIOL UD Electives (8)
 Support Course or BIOL UD Elective (3-4)
 GE (3-4)

SENIOR YEAR: 32-36 Units

Fall Semester (15 Units)

BIOL UD Electives (15)
 BIOL elective (4)
 GE/ Elective (11)

Spring Semester (15 Units)

BIOL Electives (4)
 GE/ Electives (11)

TOTAL UNITS: 120

Sample Four-Year Program for Bachelor of Science Degree in Biology

FRESHMAN YEAR: 29 Units

Fall Semester (13 Units)

BIOL 130 (B2) (4)
CHEM 115A (B1) (5)
ENGL 101 (A2) (4)

Spring Semester (16 Units)

BIOL 131 (B2) (4)
CHEM 115B (B1) (5)
MATH 165 (B4) (4)
GE (3)

SOPHOMORE YEAR: 30 Units

Fall Semester (15 Units)

BIOL 320 (4)
CHEM 335A (3)
MATH 161 (B4) (4)
GE (4)

Spring Semester (15 Units)

BIOL 321 (4)
CHEM 335B (3)
PHYS 210A/ 209A (4)
GE (4)

JUNIOR YEAR: 31 Units

Fall Semester (15 Units)

BIOL Diversity Course (4)
BIOL Elective (4)
PHYS 210B (3)
GE (4)

Spring Semester (16 Units)

BIOL 321 (4)
CHEM 335B (3)
MATH 161 (4)
PHYS 210A/209A (4)

SENIOR YEAR: 30 Units

Fall Semester (15Units)

BIOL Elective (8)
BIOL research (1-2)
GE / Electives (5-6)

Spring Semester (15 Units)

BIOL Electives (4)
BIOL research (1-2)
GE / Electives (9-10)

TOTAL UNITS: 120
