

# BIOLOGY

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## DEPARTMENT OFFICE

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## DEPARTMENT CHAIR

Murali Pillai

## ADMINISTRATIVE COORDINATORS

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## Faculty

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Michael F. Cohen  
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Derek J. Girman  
Joseph Lin  
Murali C. Pillai  
Sean Place  
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## Programs Offered

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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 distinguished 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

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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

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

## Degree Requirements

(See page 68 for a sample four-year program.)

	B. A.	B. S.
General Education (50 units, 12 units covered by major requirements in math and science)	38	38
Lower-Division Biology (BIOL 130, 131)	8	8
Upper-Division Biology Core (BIOL 320, 321)	8	8
Upper-Division Organismal Biology/Diversity	4	4
Upper-Division Biology Electives (as specified by concentration)	20	24
Research Experience	--	3

### Physical Sciences and Mathematics:

CHEM 115AB	10	10
CHEM 335A	3	3
CHEM 335B	--	3
CHEM 336A*	--	2
CHEM 445 or 446*	--	3
MATH 165 or Math 161 (BA)	4	4
MATH 161	--	4

### B. A.

PHYS 210A and 209A or GEOL 102	4 or 3	--
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### B. S.

PHYS 210A, 209A and 210B (PHYS 114 and 116 may substitute for 210A and 209A)	--	7-8
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<b>General Electives</b>	<b>21-22</b>	<b>4</b>
<b>Total units needed for graduation</b>	<b>120</b>	<b>120</b>

\* Required for Molecular Cell Biology, and Physiology concentrations only.

### List of Upper Division Organismal Biology/Diversity Courses

BIOL 322 Invertebrate Biology	4
BIOL 323 Entomology	4
BIOL 327 Vertebrate Biology	4
BIOL 329 Plant Biology	4
BIOL 340 General Bacteriology	4

### Upper-Division Biology Electives

Biology major electives are upper-division courses beyond those used to fulfill the upper-division core B.A. and B.S. concentration specific requirements. 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 course substitution 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; ENSP 315, 322; 423; 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.

### General B.A. in Biology

The upper-division major requirements are:

BIOL 320 Integrated Ecology and Evolution	4
BIOL 321 Molecular Cell Biology and Physiology	4
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>
<b>Additional upper-division major electives</b>	<b>20</b>

### General B.S. in Biology

The upper-division major requirements are:

BIOL 320 Integrated Ecology and Evolution	4
BIOL 321 Molecular Cell Biology and Physiology	4
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>
<b>Additional upper-division major electives</b>	<b>24</b>
Research Experience (minimum of 3 units)	3
BIOL 494 Independent Research (3) or	
BIOL 496A and BIOL 496B Honors Thesis (3-5)	

### Concentrations in Biology

The following is the approved concentration in the B.A. that will appear on a student's diploma. The upper-division major requirement are:

#### B.A. Zoology Concentration

BIOL 320 Integrated Ecology and Evolution	4
BIOL 321 Molecular Cell Biology and Physiology	4
<b>Four additional upper-division courses selected from the list below</b>	<b>13-16</b>
Choices must include ONE each of the courses indicated by * and ^.	
*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	a B.A. degree with the addition of MATH 161, CHEM 335B and 336A,	
BIOL 347 Environmental Physiology	4	and PHYS 210AB and 209AB. They are encouraged to enroll in SCI	
OR BIOL 349 Animal Physiology	4	150, Introduction to Careers in the Health Professions, during their	
BIOL 472 Developmental Biology	4	first fall semester.	
<b>Additional upper-division major electives</b>	<b>8-11</b>	For admission to most health profession schools, regardless of	
The following are approved concentrations in the B.S. that will		major, it is typically recommended or required that specific upper-	
appear on a student's diploma. The upper-division major require-		division biology courses be incorporated into the B.A. or B.S. degree.	
ments for each are:		These include:	
<b>B. S. Molecular Cell Biology Concentration</b>		BIOL 328 Vertebrate Evolutionary Morphology	
BIOL 320 Integrated Ecology and Evolution	4	BIOL 340 General Bacteriology	
BIOL 321 Molecular Cell Biology and Physiology	4	BIOL 342 Molecular Genetics	
BIOL 325 Molecular and Cellular Lab Techniques	1	BIOL 344 Cell Biology	
BIOL 342 Molecular Genetics	4	BIOL 349 Animal Physiology	
BIOL 344 Cell Biology	4	BIOL 472 Developmental Biology	
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>	BIOL 480 Immunology	
<b>Research Experience (minimum of 3 units)</b>	<b>3</b>	An upper-division biochemistry course (e.g. CHEM 446) is often required/ recommended.	
BIOL 494 Independent Research (3) or			
BIOL 496A and 496B Honors Thesis (3-5)			
<b>Additional upper-division major electives</b>	<b>10</b>	<b>Minor in Biology</b>	
<b>B. S. Ecology and Evolutionary Biology Concentration</b>		The minor consists of a minimum of 20 units in the Department of	
BIOL 320 Integrated Ecology and Evolution	4	Biology. The purpose of the minor is to provide a student with a rig-	
BIOL 321 Molecular Cell Biology and Physiology	4	orous background in biology that supplements the student's major.	
BIOL 333 Ecology	4	Students must develop a program in consultation with a faculty	
BIOL 341 Evolution	4	advisor in the Biology Department. Requirements of the Biology	
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>	Minor are:	
<b>Research Experience (minimum of 3 units)</b>	<b>3</b>	<i>Two lower-division major's courses listed below</i>	<b>8</b>
BIOL 494 Independent Research (3) or		BIOL 130 (4)	
BIOL 496A and 496B Honors Thesis (3-5)		BIOL 131 (4)	
<b>Additional upper-division major electives</b>	<b>16</b>	<b>Additional units in Biology</b>	<b>12</b>
<b>B. S. Marine Biology Concentration</b>		At least eight units must be upper-division courses for majors and at	
BIOL 320 Integrated Ecology and Evolution	4	least one course must have a laboratory. One GE course in Biology,	
BIOL 321 Molecular Cell Biology and Physiology	4	one unit of Biology Colloquium (BIOL 390), or a third lower-division	
BIOL 332 Marine Biology	3	Biology major's course may also be applied. All courses applied to the	
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>	minor must be taken for a letter grade, except BIOL 390.	
<b>Additional upper-division requirements</b>	<b>14-16</b>	<b>Master of Science in Biology</b>	
<b>Additional upper-division major electives</b>	<b>5-7</b>	The Master of Science degree in the Department of Biology is a the-	
<b>Research Experience (minimum of 3 units)</b>	<b>3</b>	sis program. Students complete 30 units of course work, which may	
BIOL 494 Independent Research (3) or		include classroom courses in addition to mentor-supervised research	
BIOL 496A and 496B Honors Thesis (3-5)		units, to master the concepts and techniques in their chosen area.	
<b>B. S. Physiology Concentration</b>		They also conduct original research under the direction of a member	
BIOL 320 Integrated Ecology and Evolution	4	of the graduate faculty and write up their findings as a Master's	
BIOL 321 Molecular Cell Biology and Physiology	4	Thesis.	
<b>One upper-division Organismal Biology/Diversity course</b>	<b>4</b>	Graduate students in the Department of Biology are supported	
<b>Additional upper-division requirements</b>	<b>16</b>	through a variety of sources. The Department has a limited number	
<b>Additional upper-division major electives</b>	<b>8</b>	of paid teaching associate positions available each semester. The	
<b>Research Experience (minimum of 3 units)</b>	<b>3</b>	University offers a limited number of tuition fee waivers for quali-	
BIOL 494 Independent Research (3) or		fied teaching associates. In addition, students may receive research	
BIOL 496A and 496B Honors Thesis (3-5)		associate positions through their faculty mentor's research grants.	
		Students can also obtain academic scholarships and financial aid.	
<b>Preparation for Applying to Health Professions Programs</b>			
Students majoring in biology and intending to pursue careers in the			
health care profession may follow the guidelines for a B.S. degree, or			

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 CSU Mentor ([www.csumentor.edu](http://www.csumentor.edu)) 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:

An undergraduate degree in biology or equivalent, 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/](http://www.sonoma.edu/biology/graduate/)

### Sample Four-Year Program for Bachelor's Degree in Biology

#### FRESHMAN YEAR: 30-32 Units

<i>Fall Semester (16 Units)</i>	<i>Spring Semester (14-16 Units)</i>
BIOL 130 (B2) (4)	BIOL 131 (B2) (4)
CHEM 115A (B1) (5)	CHEM 115B (B1) (5)
GE A2, A3, or C3 (4)	GE A2, A3, or C3 (4)
GE Electives (3)	GE Electives (1-3)

#### SOPHOMORE YEAR: 28-30 Units

<i>Fall Semester (12-14 Units)</i>	<i>Spring Semester (16 Units)</i>
BIOL 320 (4)	BIOL 321 (4)
CHEM 335A (3)	ENGL 101 (A2) (4)
MATH 165 (4)	Support Course (4)
GE Electives (1-3)	GE Electives (4)

#### JUNIOR YEAR: 28-33 Units

<i>Fall Semester (16-17 Units)</i>	<i>Spring Semester (14-16 Units)</i>
Two BIOL UD Electives (8)	Two BIOL UD Electives (8)
GE (4)	Support Course or BIOL UD Electives (3-4)
Support Course (4-5)	GE (3-4)

#### SENIOR YEAR: 30-35 Units

<i>Fall Semester (15-17 Units)</i>	<i>Spring Semester (15-18 Units)</i>
BIOL UD Electives (9-13)	BIOL UD Electives (12-14)
Support Course (3)	GE (3-4)
GE (3-4)	

**TOTAL UNITS: 120**