BIOLOGY, B.A.

Student Learning Outcomes for the B.A. Degree in Biology

Program graduates will be able to:

- Demonstrate knowledge of the evolution of biological systems
- Demonstrate knowledge of the structure and function of biological systems
- Demonstrate knowledge of information flow, exchange, and storage in biological systems
- Demonstrate knowledge of pathways and transformations of energy and matter in biological systems
- Demonstrate knowledge of the interconnections and interactions in biological systems
- Be able to apply the scientific method to solve problems in biology
- Effectively communicate biological concepts in written and oral forms
- Have experience using field and laboratory skills
- Apply computational and quantitative methods to describe biological systems

Students completing a B.A. with a Secondary Science Emphasis will also be able to:

- Think logically and critically evaluate new information
- Integrate information from different fields of science
- Synthesize information and communicate ideas to diverse groups of students
- Design lessons that engage students in the process of inquiry (NGSS)
- Connect course content to real life situations and local issues
- Value ongoing assessment and professional development

Major Requirements

Code	Title	Semester Hours
Lower Division Requirements		
BIOL 101	General Biology I [1]	3
BIOL 102	General Biology II [1]	3
BIOL 111	General Biology I Lab [1]	2
BIOL 112	General Biology II Lab [1]	2
BIOL 190	First Year Biology Seminar	0
BIOL 201	Cell Function [1]	3
BIOL 202	Genetics [1]	3
CHEM 110	General Chemistry I [1]	3
CHEM 111	General Chemistry I Lab [1]	1
CHEM 112	General Chemistry II [1]	3
CHEM 113	General Chemistry II Lab [1]	1
CHEM 220	Organic Chemistry I	3
Six semester hours of mathematics [1, 2]		6
Three additional semester hours in science to be approved by the Department Chairperson		3
Subtotal		36
Upper Division Requirements		
24 (B.A.) upper division semester hours in Biology, to be selected from the groups listed below, and include at least 6 lecture and 4 laboratory courses (these may include lecture/lab combinations, which are 4 semester hours) and a 2-semester-hour seminar or research course (see a-h below).		
Select one of the following Cell/Organism courses: [3]		3-4
BIOL 335	Comparative Anatomy	
BIOL 340	Embryology	
BIOL 343	Developmental Biology	
BIOL 351	General Physiology	
BIOL 353	Plant Physiology	
BIOL 355	Plants, Pharmacy, and Medicine	
BIOL 356	Cell Biology	
BIOL 357	Comparative Animal Physiology	
BIOL 358	Hormones and Behavior	
BIOL 440	Molecular Neurobiology	
BIOL 445	Endocrinology	
BIOL 446	Behavioral Endocrinology	
BIOL 449	Immunology	
BIOL 450	Physiology of Disease	
BIOL 456	Molecular Cell Biology and Lab	
BIOL 459	Stem Cell Biology	
Select one of the following Molecular Biology courses: [3]		3-4
BIOL 330	Embryology and Development	
BIOL 343	Developmental Biology	
BIOL 356	Cell Biology	
BIOL 367	Biological Databases	
BIOL 370	Plant Biotechnology	
BIOL 375	Advanced Genetics	
BIOL 388	Biomathematical Modeling	
BIOL 437	Plant Development	
BIOL 439	Molecular Biology Applications	
BIOL 440	Molecular Neurobiology	
BIOL 443	Molecular Biology	
BIOL 456	Molecular Cell Biology and Lab	
BIOL 459	Stem Cell Biology	
BIOL 478	Molecular Biology of the Genome	
BIOL 479	Molecular Mechanisms of Disease	
Select one of the following Organismal Diversity courses: [3]		3-4
BIOL 311	Plant Interactions	
BIOL 312	Field Botany	
BIOL 314	Tropical Ecology	
BIOL 319	Coastal Ecology	
BIOL 328	Tropical Marine Ecology	
BIOL 333	Biology of Mammals	
BIOL 334	Invertebrate Zoology	
BIOL 335	Comparative Anatomy	
BIOL 338	Animal Behavior	
BIOL 355	Plants, Pharmacy, and Medicine	
BIOL 361	General Microbiology	
BIOL 422	Marine Biology	
BIOL 460	Environmental Microbiology	
Select one of the following Populations courses: [3]		3-4

BIOL 304	Biostatistical Analysis	
BIOL 309	Applied Plant Ecology	
BIOL 314	Tropical Ecology	
BIOL 315	World Vegetation Ecology	
BIOL 316	Island Biology	
BIOL 318	Principles of Ecology	
BIOL 319	Coastal Ecology	
BIOL 321	Urban Ecology	
BIOL 328	Tropical Marine Ecology	
BIOL 338	Animal Behavior	
BIOL 422	Marine Biology	
BIOL 423	Marine Conservation Biology	
BIOL 472	Epidemiology	
BIOL 474	Principles of Evolution	
BIOL 475	Evolution	
BIOL 477	Conservation Genetics	
Select four of the following laboratory courses: [4]		4-16
BIOL 312	Field Botany	
BIOL 314	Tropical Ecology	
BIOL 318	Principles of Ecology	
BIOL 322	Urban Ecology Lab	
BIOL 325	Avian Biology Lab	
BIOL 327	Quantifying Biodiversity Field Laboratory	
BIOL 330	Embryology and Development	
BIOL 333	Biology of Mammals	
BIOL 334	Invertebrate Zoology	
BIOL 335	Comparative Anatomy	
BIOL 338	Animal Behavior	
BIOL 341	Embryology Lab	
BIOL 344	Developmental Biology Lab	
BIOL 352	General Physiology Lab	
BIOL 354	Plant Physiology Laboratory	
BIOL 358	Hormones and Behavior	
BIOL 359	Cell Biology Laboratory	
BIOL 360	Comparative Animal Physiology Laboratory	
BIOL 362	General Microbiology Laboratory	
BIOL 363	Microbial Genomics Laboratory	
BIOL 364	Cell Culture Laboratory	
BIOL 368	Bioinformatics Laboratory	
BIOL 371	Protein Biotechnology Lab	
BIOL 376	Genetics Laboratory	
BIOL 380	Tropical Marine Ecology Laboratory	
BIOL 381	Baja Marine Ecology Laboratory	
BIOL 422	Marine Biology	
BIOL 424	Marine Physiology Laboratory	
BIOL 438	Plant Development Laboratory	
BIOL 439	Molecular Biology Applications	
BIOL 456	Molecular Cell Biology and Lab	
BIOL 475	Evolution	
BIOL 477	Conservation Genetics	
BIOL 478	Molecular Biology of the Genome	
Select one two-semester-hour 500-level seminar or research course		2
Select two additional upper division biology courses [5]		8
Select one of the following plant biology courses:		3-4
BIOL 309	Applied Plant Ecology	
BIOL 311	Plant Interactions	
BIOL 312	Field Botany [6]	
BIOL 315	World Vegetation Ecology	
BIOL 353	Plant Physiology	
BIOL 355	Plants, Pharmacy, and Medicine	
BIOL 370	Plant Biotechnology	
BIOL 437	Plant Development	
Select one of the following field biology courses:		1-4
BIOL 312	Field Botany [6]	
BIOL 314	Tropical Ecology	
BIOL 318	Principles of Ecology	
BIOL 322	Urban Ecology Lab	
BIOL 325	Avian Biology Lab	
BIOL 327	Quantifying Biodiversity Field Laboratory	
BIOL 333	Biology of Mammals	
BIOL 328	Tropical Marine Ecology	
BIOL 338	Animal Behavior	
BIOL 380	Tropical Marine Ecology Laboratory	
BIOL 422	Marine Biology	
BIOL 424	Marine Physiology Laboratory	
BIOL 475	Evolution	
Subtotal		30-50
Total Semester Hours		**66-86**

1

A student must complete with a C (2.0) average the courses indicated with an asterisk, including a C (2.0) average in BIOL 101 General Biology I, BIOL 102 General Biology II, BIOL 111 General Biology I Lab, BIOL 112 General Biology II Lab, BIOL 201 Cell Function, and BIOL 202 Genetics, prior to becoming eligible to take any upper division biology course.

2

to include MATH 122 Calculus for the Life Sciences I

3

Classes above can only satisfy **one** area, even if listed in more than one area.

4

CHEM 371 Biochemistry Lab can be used to count as an upper division biology lab in the major. Students who are minoring or majoring in biochemistry cannot use CHEM 371 Biochemistry Lab to count as credit in both the biochemistry major/minor and biology major.

5

CHEM 370 Biochemistry and/or HSEG 515 Healthcare Delivery Systems can be used to count as an upper division biology elective in the major. If neither or only one of those is taken, one other upper division non-biology course can be used to count as an upper division biology elective in the major.
Students who wish to take a non-biology course (besides CHEM 370 Biochemistry or HSEG 515 Healthcare Delivery Systems) for upper division biology elective credit must receive approval from the chairperson of the biology department prior to taking the course. Students who are minoring or majoring in biochemistry cannot use CHEM 370 Biochemistry to count as credit in both the biochemistry major/minor and biology major.

6

BIOL 312 Field Botany can satisfy only one of these two categories (either plant OR field, not both).

Note:
Upper division biology courses that are taken to fulfill requirements for a different major or minor may not be used to fulfill biology major course requirements.

Upper division biology courses may be taken as electives. Students preparing for specific graduate careers should discuss appropriate courses with their advisors.

To graduate as a biology major, a student must accumulate a C (2.0) average in all major requirements.

B.A. Degree–Biology Secondary Science Education Emphasis Curriculum

The B.A. in Biology with a Secondary Science Emphasis has been accredited by the State of California. Students who have successfully completed the Single Subject Matter Program in Biology (SSEB) will receive a waiver and do not have to take the CSET (California Subject Examinations for Teachers) exam; completion of the program demonstrates subject matter competency. The program goal is to produce teachers who are confident in their ability to implement the next generation science standards (NGSS), to adapt to future changes, and who have the capacity to teach science as a process of inquiry and excite curiosity in their students. A student who has successfully completed our program should possess the knowledge and expertise that will enable him/her to become a confident, enthusiastic, and effective teacher.

For the B.A. in Biology, Secondary Science Education Emphasis, the prescribed 29 upper division semester hours provide the depth of subject matter content required by the State of California.

Major Requirements

Code	Title	Semester Hours
Lower Division Requirements		
BIOL 101	General Biology I	3
BIOL 102	General Biology II	3
BIOL 111	General Biology I Lab	2
BIOL 112	General Biology II Lab	2
BIOL 190	First Year Biology Seminar	0
BIOL 201	Cell Function	3
BIOL 202	Genetics	3
CHEM 110	General Chemistry I	3
CHEM 111	General Chemistry I Lab	1
CHEM 112	General Chemistry II	3
CHEM 113	General Chemistry II Lab	1
CHEM 220	Organic Chemistry I	3
CHEM 221	Organic Chemistry I Lab	1
ENVS 250	Earth System Science	3
MATH 122	Calculus for the Life Sciences I [1]	3
MATH 123	Calculus for the Life Sciences II [1]	3-4
or MATH 205	Applied Statistics	
PHYS 2500	General Physics I	4
PHYS 2550	General Physics II	4
PHYS 2710	Astronomy	3
Subtotal		48-49
Upper Division Requirements		
29 upper division semester hours, as follows:		
BIOL 318	Principles of Ecology	4
BIOL 351	General Physiology	3
BIOL 352	General Physiology Lab	1
BIOL 474	Principles of Evolution	3-4
or BIOL 475	Evolution	
BIOL elective		3-4
ENVS 358	Environmental Chemistry: Water, Soil, and Sediment	3
SCEM 370	Workshop Biology: Life Works I	3
SCEM 371	Workshop Biology: Life Works I Laboratory	1
SCEM 372	Workshop Biology: Life Works II	3
SCEM 373	Workshop Biology: Life Works II Laboratory	1
SCEM 491	Science Education Internship	1-4
SCEM 591	Science Education Internship	1-4
Subtotal		27-35
Total Semester Hours		**75-84**

1

MATH 131 Calculus I, MATH 132 Calculus II may be substituted for MATH 122 Calculus for the Life Sciences I, MATH 123 Calculus for the Life Sciences II/MATH 205 Applied Statistics

Notes:
A student must complete the lower division requirements with a C (2.0) average.

In order to graduate as a biology major and receive a subject matter waiver, a student must accumulate a C (2.0) average in all major requirements.

B.A. Degree–Biology Curriculum

(120 S.H.) [1]

Course	Title	Semester Hours
First Year		
Fall		
BIOL 101	General Biology I	3
BIOL 111	General Biology I Lab	2
BIOL 190	First Year Biology Seminar	0
CHEM 110	General Chemistry I	3

CHEM 111	General Chemistry I Lab	1
ORNT 1000	First Year Forum	0
FFYS 1000	First Year Seminar	4
MATH Mathematics [2]		3
	Semester Hours	**16**
Spring		
BIOL 102	General Biology II	3
BIOL 112	General Biology II Lab	2
CHEM 112	General Chemistry II	3
CHEM 113	General Chemistry II Lab	1
MATH 122	Calculus for the Life Sciences I	3
RHET 1000	Rhetorical Arts	3-4
	Semester Hours	**15-16**
Sophomore Year		
Fall		
BIOL 102	General Biology II	3
CHEM 220	Organic Chemistry I	3
University Core		4
University Core		4
	Semester Hours	**14**
Spring		
BIOL 202	Genetics	3
Science Elective		3
University Core		4
University Core		4
	Semester Hours	**14**
Junior Year		
Fall		
BIOL Upper Division		4
University Core		4
Select one of the following: [3]		4
University Core		
Elective		
Elective		4
	Semester Hours	**16**
Spring		
BIOL Upper Division		4
BIOL Upper Division		3
University Core		4
Elective		4
	Semester Hours	**15**
Senior Year		
Fall		
BIOL Upper Division		4
BIOL Seminar or Research		2
Upper Division Elective		4
Upper Division Elective		4
	Semester Hours	**14**
Spring		
BIOL Upper Division		4
BIOL Upper Division		3
Upper Division Elective		4
Upper Division Elective		4
	Semester Hours	**15**
	Minimum Semester Hours	**119-120**

1

A minimum of 45 upper division semester hours are required to complete the degree.

2

The course sequence in Mathematics depends on the results of the Mathematics Placement Exam.

3

A minimum of 32 core semester hours are required. The sequence of the University Core courses should be discussed with the student's advisor.

B.A. Degree–Biology Secondary Science Education Emphasis Curriculum Four Year Plan

Course	Title	Semester Hours
First Year		
Fall		
BIOL 101	General Biology I	3
BIOL 111	General Biology I Lab	2
BIOL 190	First Year Biology Seminar	0
CHEM 110	General Chemistry I	3
CHEM 111	General Chemistry I Lab	1
MATH 122	Calculus for the Life Sciences I	3
FFYS 1000	First Year Seminar	4
ORNT 1000	First Year Forum	0
	Semester Hours	**16**
Spring		
BIOL 102	General Biology II	3
BIOL 112	General Biology II Lab	2
CHEM 112	General Chemistry II	3
CHEM 113	General Chemistry II Lab	1
MATH 123 or MATH 205	Calculus for the Life Sciences II or Applied Statistics	3-4
RHET 1000	Rhetorical Arts	3-4
	Semester Hours	**15-17**
Sophomore Year		
Fall		
BIOL 201	Cell Function	3
CHEM 220	Organic Chemistry I	3
CHEM 221	Organic Chemistry I Lab	1
Select one of the following:		4
HIST 1300	Becoming America	
HIST 1301	American and the Atlantic World 1450-1850	
HIST 1401	The United States and the Pacific World	
EDUR 400	Sociocultural Analysis of Education	3
	Semester Hours	**14**
Spring		
BIOL 202	Genetics	3
ENVS 250	Earth System Science	3
University Core		3-4
Elective		3-4
Elective		3-4
	Semester Hours	**15-18**
Junior Year		
Fall		
BIOL 318	Principles of Ecology	4
PHYS 2500	General Physics I	4
SCEM 370	Workshop Biology: Life Works I	3
SCEM 371	Workshop Biology: Life Works I Laboratory	1
Upper Division Elective		3-4
	Semester Hours	**15-16**

Spring		
SCEM 372	Workshop Biology: Life Works II	3
SCEM 373	Workshop Biology: Life Works II Laboratory	1
PHYS 2550	General Physics II	4
University Core		3-4
Upper Division Elective		3-4
	Semester Hours	**14-16**
Senior Year		
Fall		
BIOL 351	General Physiology	3
BIOL 352	General Physiology Lab	1
Biology Upper Division Elective		3-4
PHYS 2710	Astronomy	3
SCEM 491 or SCEM 591	Science Education Internship or Science Education Internship	1-4
University Core		3-4
	Semester Hours	**14-19**
Spring		
BIOL 474 or BIOL 475	Principles of Evolution or Evolution	3-4
ENVS 358	Environmental Chemistry: Water, Soil, and Sediment	3
University Core		3-4
University Core		3-4
Upper Division Elective		3-4
	Semester Hours	**15-19**
	Minimum Semester Hours	**118-135**

Note:

1. The course sequence in Mathematics depends on the results of the mathematics placement examination.
2. Each of the listed history courses meets the US Constitution credential requirement for future teachers.
3. The science education internship is placed in the paradigm during the senior year where the units can be accommodated. However, students are encouraged to complete the internship requirement as early as possible after completion of their sophomore year.
4. Both ENVS 357 Environmental Chemistry: Atmosphere and Climate and ENVS 358 Environmental Chemistry: Water, Soil, and Sediment meet the environmental science requirement; however, ENVS 357 Environmental Chemistry: Atmosphere and Climate is offered in the Fall, therefore students must plan accordingly.

A minimum of 32 University Core semester hours are required. The sequence of the University Core courses should be discussed with the student's advisor.