BIOLOGICAL SCIENCES (BS)

Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (https://catalog.calpoly.edu/academic-standards-policies/general-requirements-bachelors-degree/#generaleducationtext) section of this catalog, including:

- 40 units of upper-division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No Major, Support or Concentration courses may be selected as credit/no credit. In addition, no more than 12 units of cooperative or internship courses can count towards your degree requirements.

Code	Title	Units
MAJOR COURSES		
BIO 1150	Life: History and Diversity (5B & 5C) [1]	4
BIO 1151	Life: Molecules and Cells	4
BIO 2253	Principles of Ecology and Evolution	4
BIO 3351	Principles of Genetics	3
BIO 3352	Principles of Animal Physiology	4
Select from the following:		2
BIO 4461	Senior Project - Research Proposal	
BIO 4462	Senior Project - Research Experience	
BIO 4463	Senior Project - Meta-analysis in Biology	
Concentration or General Curriculum in Biology [2]		
(See list of Concentrations and General Curriculum in Biology below)		34
SUPPORT COURSES		
CHEM 1120	Fundamentals of Chemical Structure and Properties (5A) [1]	4
CHEM 1122	Fundamentals of Chemical Reactivity	4
CHEM 2240	Organic Chemistry: Fundamentals and Applications [3]	4-5
or CHEM 2242	Organic Chemistry I	
MATH 1264	Calculus for Data Science I (2) [1]	4
PHYS 1121	College Physics I	4
or PHYS 1141	General Physics I	
STAT 1110	Applied Statistical Concepts and Methods	3
Technical Electives		
Select from the following: [4]		3-4
CHEM 2244	Organic Chemistry II	
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	
GEOG 2218	Applications in GIS	
MATH 1265	Calculus for Data Science II	
NR/LA 2218	Introduction to Geographic Information Systems (GIS)	
PHYS 1123	College Physics II	
or PHYS 1143	General Physics II	
STAT 1810	Introduction to Statistical Computing with R	
STAT 3520	Statistics II	
GENERAL EDUCATION (GE)		
(See GE program requirements below)		33
FREE ELECTIVES		

Free Electives [5]	4-6
Total Units	**120**

1. Required in Major or Support; also satisfies General Education (GE) requirement.
2. Courses taken to meet a Major or Support requirement cannot be double-counted in a concentration or the General curriculum.
3. Students in the Molecular and Cellular Biology concentration should take CHEM 2242 to satisfy this requirement.
4. Consultation with an advisor is recommended prior to selecting electives; the best choice for an individual will depend on area of interest and career plans.
5. If a General Education (GE) course is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.

Concentrations

General Curriculum in Biology

Code	Title	Units
REQUIRED COURSES		
4000-level Electives [1,2]		
Select any 4000-level BIO, BOT, MCRO, or MSCI courses except BIO 4400, BIO 4450, BIO 4461, BIO 4462, BIO 4463		9
Bioscience Electives [1,2]		
Select any 3000-4000 level BIO, BOT, MCRO, or MSCI courses except BIO 3300, BIO 4400, BIO 4450, BIO 4461, BIO 4462, BIO 4463, and courses which are "not open for major credit in Biological Sciences"		9
Approved Electives [1,3,4,5,6,7]		
A minimum of 4 units must be at the 3000-4000 level		
A minimum of 3 units must be BIO, BOT, MCRO, or MSCI course(s)		
Select from the following:		16
Select any BIO, BOT, MCRO, or MSCI courses except those excluded for major credit in Biological Sciences		
or		
ANT 4401	Culture and Health	
ASCI 4403	Applied Biotechnology in Animal Science	
CHEM 2244	Organic Chemistry II	
CHEM 3330	Foundations of Chemical Analysis	
CHEM 3350	Biochemistry: Fundamentals and Applications	
or CHEM 3352	Biochemistry	
CHEM 3354	Metabolism	
CHEM 3372	Environmental Chemistry	
CHEM 4450	Nutritional Biochemistry	
CHEM 4454	Protein Techniques	
CHEM 4457	Chemistry of Drugs and Poisons	
COMS 4418	Health Communication	
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	
FSN 2202	Introduction to Human Nutrition	
GEOG 2250	Physical Geography	
LA/NR 2218	Introduction to Geographic Information Systems (GIS)	
or GEOG 2218	Applications in GIS	
MATH 1151	Linear Algebra	
MATH 1262	Calculus II	
or MATH 1265	Calculus for Data Science II	
NR 1141	Introduction to Forest Ecosystem Management	
NR 1142	Environmental Management	
NR 4418	Applied Geographic Information System	
or GEOG 4441	Advanced Applications in Geospatial Technologies	
NUTR 3310	Maternal and Child Nutrition	
PHIL 3323	Ethics, Science, and Technology	
or PHIL 3339	Biomedical Ethics	
or PHIL 3340	Environmental Ethics	
or PHIL 3341	Professional Ethics	
PHYS 1123	College Physics II	
PSC 2201	Physical Oceanography	
PSY 2240	Biopsychology	
PSY 3320	Health Psychology	
SCM 3302	The Learn By Doing Lab Teaching Practicum	
SS 1120	Introductory Soil Science	
SS 3321	Soil Morphology	

STAT 3430	Applied Regression Analysis
or STAT 3530	Applied Linear Models
STAT 3520	Statistics II
STAT 3800	Introduction to Statistical Computing with SAS and SQL
STAT 3820	Intermediate Statistical Computing with R
STAT 4760	Statistical Analysis of Time Series
STAT 4790	Applied Multivariate Statistics
WGQS/ES 3350	Gender, Race, Culture, Science, and Technology
Total Units	**34**

1 Consultation with advisor is recommended prior to selecting electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

2 Excess units will be applied to Bioscience Electives or Approved Electives.

3 Courses taken to meet a Major or Support requirement cannot be double-counted in the General Curriculum.

4 Taking a General Education (GE) course that double-counts as an elective may cause an upper-division unit shortage. Use care to ensure that you have taken enough 3000-4000 level courses to meet the required 40 units of upper-division coursework.

5 If BIO 4461, BIO 4462, or BIO 4463 is used to meet the senior project requirement, it cannot also be counted as an elective.

6 Maximum of 6 units may be applied toward Approved Electives from the following: BIO 2200, BIO 3300, BIO 4400, BIO 4450, BIO 4466, BIO 4485, or BIO 4495.

7 Maximum of 2 units may be applied toward Approved Electives from ENGR/SCM 3302 or MSCI 4401.

Anatomy and Physiology

Code	Title	Units
REQUIRED COURSES		
BIO 4431	Advanced Anatomy and Physiology I	4
BIO 4432	Advanced Anatomy and Physiology II	4
CHEM 3352	Biochemistry	4
Anatomy and Physiology Electives [1]		
Select from the following:		11
BIO 2255	Molecular and Cellular Biology Lab Skills	
BIO 3333	Advanced Human Gross Anatomy	
BIO 4413	Evolutionary Medicine	
BIO 4433	Neuroscience	
BIO 4434	Endocrinology	
BIO 4436	Functional Histology	
BIO 4437	Gastrointestinal Physiology and Microbiology	
BIO 4452	Cell Biology	
BIO 4456	Immunology	
CHEM 3354	Metabolism	
Approved Electives [2,3,4,5]		
Select from the following (a minimum of 3 units must be 3000-4000 level):		11
Any 3000-4000 level BIO, BOT, MCRO, or MSCI courses except those excluded for major credit in Biological Sciences		
ANT 4401	Culture and Health	
CHEM 2244	Organic Chemistry II	
CHEM 3354	Metabolism	
CHEM 4450	Nutritional Biochemistry	
CHEM 4458	Neurochemistry	
COMS 4418	Health Communication	
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	
FSN 2202	Introduction to Human Nutrition	
MATH 1262	Calculus II	
or MATH 1265	Calculus for Data Science II	
MCRO 2224	General Microbiology I	
MCRO 2227	General Microbiology II	
NUTR 3310	Maternal and Child Nutrition	
or NUTR 3315	Nutrition in Aging	
or NUTR 3331	Macronutrient Metabolism	
PHIL 3323	Ethics, Science, and Technology	
or PHIL 3339	Biomedical Ethics	
or PHIL 3340	Environmental Ethics	
or PHIL 3341	Professional Ethics	
PHYS 1123	College Physics II	
PSY 3320	Health Psychology	
SCM/ENGR 3302	The Learn By Doing Lab Teaching Practicum	
STAT 3520	Statistics II	
WGQS 3350	Gender, Race, Culture, Science, and Technology	
Total Units		**34**

1 Excess Anatomy and Physiology Elective units will be applied to Approved Electives.
2 Courses taken to meet a Major or Support requirement cannot be double-counted in Approved Electives.
3 Maximum of 6 units may be applied toward Approved Electives from: BIO 3300, BIO 4400, BIO 4450, BIO 4466, BIO 4485, BIO 4495.
4 Maximum of 2 units may be applied toward Approved Electives from ENGR/SCM 3302 or MSCI 4401.

[5] If BIO 4461, BIO 4462, or BIO 4463 is used to meet the senior project requirement, it cannot be double-counted as an approved elective.

Ecology, Evolution, Biodiversity, and Conservation

Code	Title	Units
REQUIRED COURSES		
Ecology Courses		
Select from the following: [1]		7
BIO 3327	Wildlife Ecology	
BIO 4442	Behavioral Ecology	
BIO 4444	Population and Community Ecology	
BOT 3326	Plant Ecology	
MSCI 3300	Marine Ecology	
Evolution Courses		
Select from the following:		4
BIO 4413	Evolutionary Medicine	
BIO 4414	Evolution	
Conservation Courses		
Select from the following: [1]		3
BIO 3343	Principles of Conservation Biology	
MSCI 4439	Marine Fisheries and Conservation	
Biodiversity Courses		
Select from the following: [1,2]		8
BIO 3321	Mammalogy	
BIO 3322	Ichthyology	
BIO 3323	Ornithology	
BIO 3324	Herpetology	
BIO 3325	General Entomology	
BIO 3326	Invertebrate Zoology	
BIO 4429	Parasitology	
BOT 3313	Plant Taxonomy	
BOT 4433	Field Botany: California Plant Diversity	
MSCI 3324	Marine Mammals, Birds, and Reptiles	
Approved Electives [3,4,5,6,7]		
Select from the following:		12
Select any 3000-4000 level BIO, BOT, MCRO, or MSCI courses, except those excluded for major credit in Biological Sciences		
ASCI 2239	Principles of Rangeland Management	
CHEM 2244	Organic Chemistry II	
CHEM 3372	Environmental Chemistry	
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	
GEOG 2218	Applications in GIS	
or NR 2218	Introduction to Geographic Information Systems (GIS)	
GEOG 4441	Advanced Applications in Geospatial Technologies	
or NR 4418	Applied Geographic Information System	
MATH 1151	Linear Algebra	
MATH 1262	Calculus II	
or MATH 1265	Calculus for Data Science II	
NR 1141	Introduction to Forest Ecosystem Management	
NR 1142	Environmental Management	
NR 4442	Environmental Life-Cycle Analysis	
NR 4404	Environmental Law	
NR 4445	Systems Thinking in Environmental Management	
PHYS 1123	College Physics II	

SCM 3302	The Learn By Doing Lab Teaching Practicum
STAT 1810	Introduction to Statistical Computing with R
STAT 3520	Statistics II
STAT 3430	Applied Regression Analysis
STAT 3800	Introduction to Statistical Computing with SAS and SQL
STAT 3820	Intermediate Statistical Computing with R
STAT 4790	Applied Multivariate Statistics
Total Units	**34**

1 Excess units will be applied to Approved Electives.
2 Students seeking certification (e.g., as an Associate Wildlife Biologist from the Wildlife Society) should see their faculty advisor for guidance.
3 Consultation with advisor is recommended prior to selecting courses; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
4 Courses taken to meet a Major or Support requirement cannot be double-counted in the concentration.
5 Maximum of 6 units may be applied toward Approved Electives from the following: BIO 3300, BIO 4400, BIO 4450, BIO 4466, BIO 4485, or BIO 4495.
6 If BIO 4461, BIO 4462, or BIO 4463 is used to meet the senior project requirement, it cannot be double-counted as an approved elective.
7 Maximum of 2 units may be applied toward the Approved Electives from ENGR/SCM 3302 or MSCI 4401.

Molecular and Cellular Biology

Code	Title	Units
REQUIRED COURSES		
BIO 2255	Molecular and Cellular Biology Lab Skills	1
BIO 4452	Cell Biology	3
BIO 4457	Molecular Biology Laboratory	3
Advanced Electives [1,2,3]		
Select from the following:		10
BIO 4451	Bioinformatics Applications	
BIO 4455	Developmental Biology	
BIO 4456	Immunology	
CHEM 3352	Biochemistry	
MCRO 4402	General Virology	
Approved Electives [3,4,5,6]		
Select from any 3000-4000 level BIO or MCRO courses except those not open for major degree credit in Biological Sciences, or from the following (a minimum of 7 units must be upper-division):		17
ASCI 4403	Applied Biotechnology in Animal Science	
BIO 2252	Orientation to Biotechnology	
BIO/BMED 3360	Cellular Immunotherapy	
BMED 4480	Drug Discovery and Development	
CHEM 2244	Organic Chemistry II	
CHEM 3330	Foundations of Chemical Analysis	
CHEM 3352	Biochemistry	
CHEM 3354	Metabolism	
CHEM 4450	Nutritional Biochemistry	
CHEM 4454	Protein Techniques	
CHEM 4458	Neurochemistry	
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	
MATH 1262	Calculus II	
or MATH 1265	Calculus for Data Science II	
MCRO 2224	General Microbiology I	
PHIL 3323	Ethics, Science, and Technology	
or PHIL 3339	Biomedical Ethics	
or PHIL 3341	Professional Ethics	
PHYS 1123	College Physics II	
SCM 3302	The Learn By Doing Lab Teaching Practicum	
STAT 3520	Statistics II	
WGQS 3350	Gender, Race, Culture, Science, and Technology	
Total Units		**34**

1 Excess units from Advanced Electives applied to Approved Electives.
2 Consultation with advisor is recommended prior to selecting electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
3 Courses taken to meet a Major or Support requirement cannot be double-counted in Advanced or Approved Electives.
4 Consult with your faculty advisor for approval to use other relevant upper-division coursework from other departments.
5 Maximum of 6 units may be applied toward Approved Electives from the following: BIO 3300, BIO 4400, BIO 4450, BIO 4466, BIO 4485, BIO 4495.
6 Maximum of 2 units may be applied toward Approved Electives from ENGR/SCM 3302 or MSCI 4401.

General Education (GE) Requirements

General Education (GE) Requirements

- 43 units required, 10 of which are specified in Major and/or Support.
- If any of the remaining 33 Units is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.
- See the complete GE course listing (https://catalog.calpoly.edu/academic-standards-policies/general-requirements-bachelors-degree/#generaleducationtext).
- A grade of C- or better is required in one course in each of the following GE Areas: 1A (English Composition), 1B (Critical Thinking), 1C (Oral Communication), and 2 (Mathematics and Quantitative Reasoning).

Lower-Division General Education

Area 1	**English Communication and Critical Thinking**	
1A	Written Communication	3
1B	Critical Thinking	3
1C	Oral Communication	3
Area 2	**Mathematics and Quantitative Reasoning**	
2	Mathematics and Quantitative Reasoning (3 units in Support) [1]	0
Area 3	**Arts and Humanities**	
3A	Arts	3
3B	Humanities: Literature, Philosophy, Languages other than English	3
Area 4	**Social and Behavioral Sciences (Area 4 courses must come from at least two different course prefixes.)**	
4A	American Institutions (Title 5, Section 40404 Requirement)	3
4B	Social and Behavioral Sciences	3
Area 5	**Physical and Life Sciences**	
5A	Physical Sciences (3 units in Support) [1]	0
5B	Life Sciences (3 units in Major) [1]	0
5C	Laboratory (may be embedded in a 5A or 5B course) (1 units in Major) [1]	0
Area 6	**Ethnic Studies**	
6	Ethnic Studies	3
Upper-Division General Education		
Upper-Division 2/5	Mathematics and Quantitative Reasoning or Physical and Life Sciences	3
Upper-Division 3	Arts and Humanities	3
Upper-Division 4	Social and Behavioral Sciences (Area 4 courses must come from at least two different course prefixes.)	3
Total Units		**33**

[1] Required in Major or Support; also satisfies General Education (GE) requirement.