

BIOLOGY, BACHELOR OF SCIENCE

Requirements

Total Course Requirements for the Bachelor's Degree

See the "Requirements for the Bachelor's Degree (<https://catalog.csudh.edu/general-information/baccalaureate-degrees-undergraduate-studies/>)" in the University Catalog for complete details on general degree requirements. A minimum of 40 units, including those required for the major, must be upper division.

Elective Requirements

Completion of elective courses (beyond the requirements listed below) to reach a total of a minimum of 120 units.

General Education Requirements (49 units)

See the "General Education (<https://catalog.csudh.edu/general-education/>)" requirements in the University Catalog or the Class Schedule for the most current information on General Education requirements and course offerings.

Graduation Writing Assessment Requirement

See the "Graduation Writing Assessment Requirement (<https://catalog.csudh.edu/general-information/baccalaureate-degrees-undergraduate-studies/gwar-certifying-courses/>)" in the University Catalog.

Minor Requirements

Single field major, no minor required. However, for students who wish to complete the Biochemistry minor, Organic Chemistry is considered a pre-requisite class for both programs and therefore can be double counted for both major and minor requirements.

Major Requirements (76-84 units)

Students must select one of the options listed.

All courses applied to the B.S. in Biology must be passed with a grade of "C" or better.

Cellular and Molecular Biology Option (76-81 units)

Code	Title	Hours
Lower Division Requirements		
BIO 120	Principles of Biology I	3
BIO 121	Principles of Biology Lab I	1
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 110	General Chemistry I	5
CHE 112	General Chemistry II	5
MAT 131	Elementary Statistics and Probability	3
MAT 171	Survey of Calculus for Management and Life Sciences	4-5
or MAT 191	Calculus I	
Select one of the following:		8-10

PHY 120 & PHY 122	Elements Of Physics I and Elements Of Physics II	
PHY 130 & PHY 132	General Physics I and General Physics II	
Upper Division Requirements		
BIO 320	Cell Biology	3
BIO 340	Genetics	3
BIO 342	Cell And Genetics Lab	1
BIO 421	Advanced Molecular Biology	3
or BIO 440	Molecular Genetics	
BIO 490	Senior Project	3
Select one of the following:		4-5
CHE 310 & CHE 311	Organic Chemistry I and Organic Chemistry Lab I	
CHE 300 & CHE 301	Organic Chemistry I and Organic Chemistry Lab I	
Select one of the following:		4-5
CHE 312 & CHE 313	Organic Chemistry II and Organic Chemistry Laboratory II	
CHE 302 & CHE 303	Organic Chemistry II and Organic Chemistry Lab II	
Select one of the following:		4
BIO 310 & BIO 311	Plant Physiology and Plant Physiology Laboratory	
BIO 312 & BIO 313	Animal Physiology and Animal Physiology Laboratory	
BIO 314 & BIO 315	Developmental Biology and Developmental Biology Lab	
BIO 326 & BIO 327	General Microbiology and General Microbiology Laboratory	
Select a minimum of 10 additional units of upper division Biology or Chemistry Courses		10
Total Hours		76-81

Ecology and Environmental Biology Option (76-81 units)

Code	Title	Hours
Lower Division Requirements		
BIO 120	Principles of Biology I	3
BIO 121	Principles of Biology Lab I	1
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 110	General Chemistry I	5
CHE 112	General Chemistry II	5
MAT 131	Elementary Statistics and Probability	3
MAT 171	Survey of Calculus for Management and Life Sciences	4-5
or MAT 191	Calculus I	
Select one of the following:		8-10
PHY 120 & PHY 122	Elements Of Physics I and Elements Of Physics II	

PHY 130 & PHY 132	General Physics I and General Physics II	
Upper Division Requirements		
BIO 312	Animal Physiology	3
BIO 313	Animal Physiology Laboratory	1
BIO 330	Botany	3
BIO 331	Botany Laboratory	1
BIO 332	Ecology	3
BIO 333	Ecology Laboratory	1
BIO 340	Genetics	3
BIO 490	Senior Project	3
Select one of the following:		4-10
CHE 310 & CHE 311	Organic Chemistry I and Organic Chemistry Lab I	
CHE 300 & CHE 301	Organic Chemistry I and Organic Chemistry Lab I	
CHE 312 & CHE 313	Organic Chemistry II and Organic Chemistry Laboratory II	
CHE 302 & CHE 303	Organic Chemistry II and Organic Chemistry Lab II	
CHE 316 & CHE 317	Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory	
Select a minimum of 9-15 additional units of upper division Biology, Chemistry, Anthropology or Earth Science courses approved by a Biology advisor		9-15

Total Hours **72-87**

Microbiology Option (79-84 units)

Code	Title	Hours
Lower Division Requirements		
BIO 120	Principles of Biology I	3
BIO 121	Principles of Biology Lab I	1
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 110	General Chemistry I	5
CHE 112	General Chemistry II	5
MAT 131	Elementary Statistics and Probability	3
MAT 171	Survey of Calculus for Management and Life Sciences	4-5
or MAT 191	Calculus I	
Select one of the following:		8-10
PHY 120 & PHY 122	Elements Of Physics I and Elements Of Physics II	
PHY 130 & PHY 132	General Physics I and General Physics II	

Upper Division Requirements

BIO 320	Cell Biology	3
BIO 324	Microbiology with Clinical Applications	3
BIO 325	Microbiology with Clinical Applications Laboratory	1
BIO 340	Genetics	3

BIO 425	Medical Bacteriology	2
BIO 435	Medical Bacteriology Laboratory	2
BIO 426	Immunology	3
BIO 436	Immunology Laboratory	1
BIO 490	Senior Project ¹	3

Select one of the following: 4-5

CHE 310 & CHE 311	Organic Chemistry I and Organic Chemistry Lab I	
CHE 300 & CHE 301	Organic Chemistry I and Organic Chemistry Lab I	

Select one of the following: 4-5

CHE 312 & CHE 313	Organic Chemistry II and Organic Chemistry Laboratory II	
CHE 302 & CHE 303	Organic Chemistry II and Organic Chemistry Lab II	

Electives

Select a minimum of 9 units from the following: 9

BIO 420 & BIO 419	Histotechnology and Histotechnology Laboratory	
BIO 421	Advanced Molecular Biology	
BIO 422 & BIO 424	Histology and Histology Laboratory	
BIO 428	Virology	
BIO 458 & BIO 459	Human Parasitology and Human Parasitology Laboratory	
BIO 491	Seminar in Biological and Biomedical Research	
CHE 450 & CHE 451	Biochemistry I and Biochemistry I Lab	
CHE 450 & CHE 456	Biochemistry I and Clinical Chemistry	

Total Hours **79-84**

¹ BIO 490 Senior Project: Major students may substitute this course for General Education Area E. Please contact the University Advisement Center to request the course substitution.

Program Learning Outcomes

Upon successful completion of the B.A. and B.S. Programs in Biology, a degree recipient will be able to:

1. describe the detail the major unifying themes of biology, such as evolution, energy flow and transformation, homeostasis, genetic information storage and utilization, structure-function relationships, and hierarchies of organization;
2. apply scientific reasoning to generate and test hypotheses by designing and executing experiments using appropriate methods in the laboratory or in the field;
3. analyze and interpret quantitative biological data;
4. communicate scientific information in a variety of written and oral formats;
5. discuss the relevance of scientific research to society from a historic and a modern perspective, including the ethical implications of scientific research and of new technology; and
6. find, read, understand, critically evaluate, summarize, and use scientific information.

Cellular and Molecular Biology Option

4-Year Degree Roadmap

Course	Title	Hours
First Year		
Fall		
MAT 131	Elementary Statistics and Probability (satisfies GE Area B4)	3
GE Area A1 Oral Communication		3
GE Area A3 Logic/Critical Thinking		3
GE Area C1 Arts Course		3
GE Area D1 Perspectives on Individuals, Groups, and Society		3
Hours		15
Spring		
GE Area A2 Written Communication		3
GE Area C2 Letters Course		3
GE Area C1 or C2		3
GE Area D2 Global and Historical Perspectives		3
CHE 108	Introduction to College Chemistry	5
Hours		17
Second Year		
Fall		
HIS 101	History Of United States	3
POL 101	American Institutions	3
BIO 120	Principles of Biology I (may meet GE Area B2 for BIO majors)	3
BIO 121	Principles of Biology Lab I (may meet GE Area B3 for BIO majors)	1
CHE 110	General Chemistry I (May meet GE Area B1 and B3 for BIO majors)	5
Hours		15
Spring		
GE Area F Ethnic Studies		3
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
CHE 112	General Chemistry II	5
MAT 171	Survey of Calculus for Management and Life Sciences	4
Hours		16
Third Year		
Fall		
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
CHE 310	Organic Chemistry I	4
CHE 311	Organic Chemistry Lab I	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
GE Area C3 Integrative Studies in the Humanities		3
Hours		16
Spring		
BIO 320	Cell Biology	3
BIO 340	Genetics (satisfies GE Area B5)	3
BIO 342	Cell And Genetics Lab	1
CHE 312	Organic Chemistry II	3
CHE 313	Organic Chemistry Laboratory II	2
GE Area D3 Integrative Studies in the Social Sciences		3
Hours		15
Fourth Year		
Fall		
BIO UD requirement lecture		3
BIO UD requirement lab		1
BIO 421	Advanced Molecular Biology (or major elective)	3
Major Elective		4

PHY 120	Elements Of Physics I	4
Hours		15
Spring		
BIO 440	Molecular Genetics (or major elective)	3
BIO 490	Senior Project (satisfies GEAR requirement; May also satisfy GE Area E, see major advisor)	3
PHY 122	Elements Of Physics II	4
Major Elective		3
Hours		13
Total Hours		122

2-Year Roadmap (transfer students)

Course	Title	Hours
First Year		
Fall		
GE Area C3 Integrative Studies in the Humanities		3
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 310	Organic Chemistry I	4
CHE 311	Organic Chemistry Lab I	1
Hours		16
Spring		
GE Area D3 Integrative Studies in the Social Sciences		3
BIO 320	Cell Biology	3
BIO 340	Genetics (satisfies GE Area B5)	3
BIO 342	Cell And Genetics Lab	1
CHE 312	Organic Chemistry II	3
CHE 313	Organic Chemistry Laboratory II	2
Hours		15
Second Year		
Fall		
BIO 421	Advanced Molecular Biology (or major elective)	3
PHY 120	Elements Of Physics I	4
BIO UD requirement lecture		3
BIO UD requirement lab		1
Major Elective		4
Hours		15
Spring		
BIO 440	Molecular Genetics (or major elective)	3
BIO 490	Senior Project (satisfies GEAR requirement; May also satisfy GE Area E if needed, see major advisor)	3
PHY 122	Elements Of Physics II	4
Major Elective		4
Hours		14
Total Hours		60

ECOLOGY AND ENVIRONMENTAL BIOLOGY OPTION

4- Year Degree Roadmap

Course	Title	Hours
First Year		
Fall		
GE Area A1 Oral Communication		3
GE Area A3 Logic/Critical Thinking		3
GE Area C1 Arts Course		3
GE Area D1 Perspectives on Individuals, Groups, and Society		3

MAT 131	Elementary Statistics and Probability (satisfies GE Area B4)	3
Hours		15
Spring		
GE Area A2 Written Communication		3
GE Area C2 Letters Course		3
Additional lower division GE in Area C1 or C2		3
GE Area D2 Global and Historical Perspectives		3
CHE 108	Introduction to College Chemistry	5
Hours		17
Second Year		
Fall		
HIS 101	History Of United States	3
POL 101	American Institutions	3
BIO 120	Principles of Biology I (may meet GE Area B2 for BIO majors)	3
BIO 121	Principles of Biology Lab I (May meet GE Area B3 for BIO majors)	1
CHE 110	General Chemistry I (May meet GE Area B1 and B3 for BIO majors)	5
Hours		15
Spring		
GE Area F Ethnic Studies		3
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
CHE 112	General Chemistry II	5
MAT 171	Survey of Calculus for Management and Life Sciences	4
Hours		16
Third Year		
Fall		
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
CHE 310 or CHE 316	Organic Chemistry I or Survey of Organic Chemistry	3-4
CHE 311 or CHE 317	Organic Chemistry Lab I or Survey of Organic Chemistry Laboratory	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
GE Area C3 Integrative Studies in the Humanities		3
Hours		15-16
Spring		
BIO 332	Ecology	3
BIO 333	Ecology Laboratory	1
BIO 340	Genetics (satisfies GE Area B5)	3
CHE 312	Organic Chemistry II (or major elective)	3
CHE 313	Organic Chemistry Laboratory II (or major elective)	2
GE Area D3 Integrative Studies in the Social Sciences		3
Hours		15
Fourth Year		
Fall		
BIO 312	Animal Physiology	3
BIO 313	Animal Physiology Laboratory	1
BIO 330	Botany	3
BIO 331	Botany Laboratory	1
PHY 120	Elements Of Physics I	4
Major Elective		4
Hours		16
Spring		
BIO 490	Senior Project (satisfies GVAR requirement; May also satisfy GE Area E, see major advisor)	3
PHY 122	Elements Of Physics II	4
Major Elective		3

Major Elective	3
Hours	13
Total Hours	122-123

2-Year Roadmap (transfer students)

Course	Title	Hours
First Year		
Fall		
GE Area C3 Integrative Studies in the Humanities		3
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 310 or CHE 316	Organic Chemistry I or Survey of Organic Chemistry	3-4
CHE 311 or CHE 317	Organic Chemistry Lab I or Survey of Organic Chemistry Laboratory	1
Hours		15-16
Spring		
GE Area D3 Integrative Studies in the Social Sciences		3
BIO 340	Genetics (satisfies GE Area B5)	3
BIO 332	Ecology	3
BIO 333	Ecology Laboratory	1
CHE 312	Organic Chemistry II (or major elective)	3
CHE 313	Organic Chemistry Laboratory II (or major elective)	2
Hours		15

Second Year		
Fall		
BIO 312	Animal Physiology	3
BIO 313	Animal Physiology Laboratory	1
BIO 330	Botany	3
BIO 331	Botany Laboratory	1
PHY 120	Elements Of Physics I	4
Major Elective		4
Hours		16

Spring		
BIO 490	Senior Project (GVAR satisfying course; May also satisfy GE Area E if needed, see major advisor)	3
PHY 122	Elements Of Physics II	4
Major Elective		3
Major Elective		3
Elective to meet 120 units		3
Hours		16

Total Hours	62-63
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Microbiology Option 4-Year Degree Roadmap

Course	Title	Hours
First Year		
Fall		
GE Area A1 Oral Communication		3
GE Area A3 Logic/Critical Thinking		3
GE Area C1 Arts Courses		3
GE Area D1 Perspectives on Individuals, Groups, and Society		3
MAT 131	Elementary Statistics and Probability (satisfies GE Area B4)	3
Hours		15
Spring		
GE Area A2 Written Communication		3
GE Area C2 Letters Course		3
GE Area C1 or C2		3

GE Area D2 Global and Historical Perspectives		3
CHE 108	Introduction to College Chemistry	5
Hours		17
Second Year		
Fall		
HIS 101	History Of United States	3
POL 101	American Institutions	3
BIO 120	Principles of Biology I (may meet GE Area B2 for BIO majors)	3
BIO 121	Principles of Biology Lab I (may meet GE Area B3 for BIO majors)	1
CHE 110	General Chemistry I (may meet GE Areas B1 and B3 for BIO majors)	5
Hours		15
Spring		
GE Area F Ethnic Studies		3
BIO 122	Principles of Biology II	3
BIO 123	Principles of Biology II Lab	1
CHE 112	General Chemistry II	5
MAT 171	Survey of Calculus for Management and Life Sciences	4
Hours		16
Third Year		
Fall		
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
CHE 310	Organic Chemistry I	4
CHE 311	Organic Chemistry Lab I	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
GE Area C3 Integrative Studies in the Humanities		3
Hours		16
Spring		
BIO 320	Cell Biology	3
BIO 340	Genetics (satisfies GE Area B5)	3
Major Elective		3
CHE 312	Organic Chemistry II	3
CHE 313	Organic Chemistry Laboratory II	2
GE Area D3 Integrative Studies in the Social Sciences		3
Hours		17
Fourth Year		
Fall		
BIO 324	Microbiology with Clinical Applications	3
BIO 325	Microbiology with Clinical Applications Laboratory	1
BIO 426	Immunology	3
BIO 436	Immunology Laboratory	1
Major Elective		4
PHY 120	Elements Of Physics I	4
Hours		16
Spring		
BIO 425	Medical Bacteriology	2
BIO 435	Medical Bateriaology Laboratory	2
BIO 490	Senior Project (satisfies GWAR requirement; May meet GE Area E, see major advisor)	3
Major Elective		3
PHY 122	Elements Of Physics II	4
Hours		14
Total Hours		126

2- Year Roadmap (transfer students)

Course	Title	Hours
First Year		
Fall		
GE Area C3 Integrative Studies in the Humanities		3
BIO 124	Principles of Biology III	3
BIO 125	Principles of Biology Lab III	1
BIO 220	Molecular Biology	3
BIO 221	Molecular Biology Laboratory	1
CHE 310	Organic Chemistry I	4
CHE 311	Organic Chemistry Lab I	1
Hours		16
Spring		
GE Area D3 Integrative Studies in the Social Sciences		3
BIO 320	Cell Biology	3
BIO 340	Genetics (satisfies GE Area B5)	3
Major Elective		3
CHE 312	Organic Chemistry II	3
CHE 313	Organic Chemistry Laboratory II	2
Hours		17
Second Year		
Fall		
BIO 324	Microbiology with Clinical Applications	3
BIO 325	Microbiology with Clinical Applications Laboratory	1
BIO 426	Immunology	3
BIO 436	Immunology Laboratory	1
Major Elective		4
PHY 120	Elements Of Physics I	4
Hours		16
Spring		
BIO 425	Medical Bacteriology	2
BIO 435	Medical Bacteriology Laboratory	2
BIO 490	Senior Project (satisfies GEAR requirement; May also satisfy GE Area E, see major advisor)	3
Major Elective		3
PHY 122	Elements Of Physics II	4
Hours		14
Total Hours		63