

# BIOLOGY, BA

**Degree:** Bachelor of Arts (BA)

**Major:** Biology

## Program Overview

The Biology, BA program provides a general background in biology and has the most flexible scheduling of the three biology degrees offered. It is especially recommended for students who are pre-professional, have multiple majors, intend to study abroad or participate in an internship program, or have significant extracurricular commitments (e.g., varsity athletics, student government, Greek life, or other campus involvement). Since the Biology, BA degree does not formally require undergraduate research, students interested in graduate research careers should plan to take at least one semester of undergraduate research as an elective (BIOL 388 or BIOL 388S) sometime during the senior year.

The Biology, BA program has a core of foundation courses and provides options for specialization in a variety of areas, including biotechnology and genetic engineering, molecular and cellular biology, genetics, immunology, chemical biology, physiology and biophysics, neurobiology and animal behavior, developmental biology, population biology, ecology, and environmental science.

Ordinarily, all students begin their biology programs in their first year.

## Advising

Biology faculty advisors are assigned to students at the time of major or minor declaration. All biology majors are required to meet with their departmental advisors at least once each semester to discuss their academic program, receive clearance for electronic course registration, and obtain approval for any drops, adds, or withdrawals. Please contact the Undergraduate Services Coordinator for the Department of Biology for information about major or minor declaration.

## Learning Outcomes

- Students will be able to demonstrate and apply knowledge of fundamental biological concepts, including those in molecular, cellular, organismal, ecological, and evolutionary biology.
- Students will be able to make key observations, propose hypotheses, design experiments to test hypotheses and develop models to generate predictions, collect and analyze data, and draw appropriate conclusions.
- Students will be able to critically analyze published scientific research in the biological sciences, connecting previously learned information to current research.
- Students will be able to communicate biological ideas, arguments and experimental data both in oral and written forms to diverse audiences ranging from experts to lay persons.
- Students will be able to synthesize biological principles across other fields of science to arrive at holistic conclusions based on sound rationale, data, or modeling approaches. In addition, students will be able to contextualize biological discoveries on society and understand ethical implications of research.

## Teacher Licensure

Students admitted to Case Western Reserve University prior to Fall

2024 can declare a secondary major in Teacher Education and prepare for licensure in Adolescent to Young Adult (grades 7-12) in any one of the following areas: Integrated Language Arts (English major), Integrated Social Studies (history major), Integrated Mathematics (mathematics major), Life Science (biology major), or Physical Science (chemistry or physics major); or 2) Multi-Age (grades preK-12) in French, Spanish, or Latin. Eligible students interested in the teacher education program should refer to the General Bulletin for the year they entered Case Western Reserve University for the specific program requirements.

## Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics section of the General Bulletin.

## Accelerated Master's Programs

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Undergraduate Academics section of the General Bulletin.

## Program Requirements

Students seeking to complete this major and degree program must meet the general requirements for bachelor's degrees and the Unified General Education Requirements. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

Code	Title	Credit Hours
<b>Biology Core Courses</b>		
BIOL 214	Genes, Evolution and Ecology	3
BIOL 215	Cells and Proteins	3
BIOL 214L & BIOL 215L or BIOL 222L	Genes, Evolution and Ecology Lab and Cells and Proteins Laboratory Introductory Research Lab in Biology	2
BIOL 216	Development and Physiology	3
BIOL 216L	Development and Physiology Lab	1
BIOL 326	Genetics	3
<b>Choose one course from any two of the following three subject areas 6-8 (breadth requirement)</b>		
<i>Cell and Molecular Biology Electives</i>		
BIOL 224L	Bacteriophage Genome Annotation and Analysis Lab	
BIOL 303	From Black Box to Toolbox: How Molecular Biology Moves Forward <sup>d</sup>	
BIOL 308	From Cloning to CRISPR: Advancements and Prospects in Genetic Engineering <sup>d</sup>	
BIOL 316	Fundamental Immunology	
BIOL 324	Introduction to Stem Cell Biology	
BIOL 325	Cell Biology	
BIOL 328	Plant Genomics and Proteomics	
BIOL 329	Genome Dynamics	
BIOL 334	Disciplinary Communication Seminar in Cancer Biology <sup>d</sup>	
BIOL 341	Basic Biology of Blood and Blood Diseases	
BIOL 342	Parasitology	

BIOL 343	Microbiology	
<b>Organismal Biology Electives</b>		
BIOL 223	Vertebrate Biology <sup>a</sup>	
BIOL 248	Human Anatomy and Physiology Laboratory	
BIOL 302	Human Learning and the Brain	
BIOL 305	Herpetology	
BIOL 312	Introductory Plant Biology	
BIOL 318	Introductory Entomology <sup>a</sup>	
BIOL 322	Sensory Biology	
BIOL 333	The Human Microbiome	
BIOL 338	Ichthyology <sup>a</sup>	
BIOL 340	Human Physiology	
BIOL 346	Human Anatomy	
BIOL 362	Principles of Developmental Biology	
BIOL 370	Seminar on Unifying Concepts in Neuroscience <sup>d</sup>	
BIOL 373	Introduction to Neurobiology <sup>a</sup>	
BIOL 374	Neurobiology of Behavior	
BIOL 379	Transformative Animal Models in Modern Biology	
BIOL 381	Nervous System Development	
<b>Population Biology and Ecology Electives</b>		
BIOL 225	Evolution	
BIOL 336	Aquatic Biology	
BIOL 351	Principles of Ecology	
BIOL 358	Animal Behavior	
BIOL 364	Research Methods in Evolutionary Biology	
BIOL 368	Topics in Evolutionary Biology	
BIOL 375	Brain Evolution and Function	
<b>Choose two laboratory courses <sup>b</sup></b>		<b>4-8</b>
BIOL 223	Vertebrate Biology <sup>a</sup>	
BIOL 300	Dynamics of Biological Systems: A Quantitative Introduction to Biology	
BIOL 301	Biotechnology Laboratory: Genes and Genetic Engineering	
BIOL 304	Fitting Models to Data: Maximum Likelihood Methods and Model Selection	
BIOL 305L	Herpetology Lab	
BIOL 309	Biology Field Studies	
BIOL 314	Taming the Tree of Life: Phylogenetic Comparative Methods-from Concept to Practical Application	
BIOL 315	Quantitative Biology Laboratory	
BIOL 318	Introductory Entomology <sup>a</sup>	
BIOL 321	Design and Analysis of Biological Experiments	
BIOL 327	Functional Genomics	
BIOL 338	Ichthyology <sup>a</sup>	
BIOL 339	Aquatic Biology Laboratory	
BIOL 344	Laboratory for Microbiology	
BIOL 345	Mammal Diversity and Evolution	
BIOL 351L	Principles of Ecology Laboratory	
BIOL 352	Ecology and Evolution of Infectious Diseases	
BIOL 353	Ecophysiology of Global Change	
BIOL 354	Evolutionary Game Theory	
BIOL 358L	Animal Behavior Lab	

BIOL 360	Experimental Lab in Genetics, Cell or Developmental Biology <sup>a</sup>	
BIOL 373	Introduction to Neurobiology <sup>a</sup>	
<b>BIOL Electives <sup>c</sup></b>		<b>3-6</b>
<b>Mathematics Core Courses</b>		
MATH 125	Math and Calculus Applications for Life, Managerial, and Social Sci I	4
or MATH 121	Calculus for Science and Engineering I	
MATH 126	Math and Calculus Applications for Life, Managerial, and Social Sci II	4
or MATH 122	Calculus for Science and Engineering II	
<b>Chemistry Core Courses</b>		
CHEM 105	Principles of Chemistry I	3
CHEM 106	Principles of Chemistry II	3
CHEM 113	Principles of Chemistry Laboratory	2
CHEM 223	Introductory Organic Chemistry I	3
or CHEM 323	Organic Chemistry I	
CHEM 224	Introductory Organic Chemistry II	3
or CHEM 324	Organic Chemistry II	
CHEM 233	Introductory Organic Chemistry Laboratory I	2
<b>Physics Core Courses</b>		
PHYS 115	Introductory Physics I	4
or PHYS 121	General Physics I - Mechanics	
PHYS 116	Introductory Physics II	4
or PHYS 122	General Physics II - Electricity and Magnetism	
<b>Total Credit Hours</b>		<b>60-69</b>

a Can count as an elective or a laboratory course, not both.

b Excluding BIOL 388, BIOL 388S, and BIOL 390.

c Excluding 100-level courses and BIOL 390.

d Fulfills UGER Disciplinary Communication course requirement.

At least 15 credit hours of the selected electives and additional laboratory courses must be at the 300-level or higher.

## Focus Areas in the Biological Sciences

Students are encouraged to utilize their elective courses in the biology major to take advantage of various specialized focus areas. These focus areas have been developed between the biology department, the basic science departments of the School of Medicine, and other departments. Currently, focus areas have been developed in the following areas: biotechnology and genetic engineering; computational biology; developmental biology; genetics; cell and molecular biology; neurobiology and animal behavior; population biology, ecology and environmental science.

Note: these focus areas are informal; they are not declared, and will not appear on the student's diploma or transcript.

## Departmental Honors

To receive a bachelor's degree "with Honors in Biology" (formally noted on the transcript), the student must meet the following criteria:

1. Maintain a 3.6 overall grade point average, with a 3.8 in BIOL courses. GPA requirements refer only to courses taken since the start of their third semester at CWRU. Alternatively, students may be nominated for

Honors by their research advisor.

2. Sign an attestation of their record of academic integrity.
3. Carry out 6 credit hours of independent research (taken as BIOL courses) or the equivalent at Case Western Reserve University.
4. Write a senior honors thesis with the approval of the Research Sponsor and (if applicable) the Biology Sponsor.
5. Submit no later than one week prior to the scheduled thesis defense the thesis for review by an *ad hoc* honors committee.
6. Successfully defend the thesis at an oral examination.

Additional information and application forms are available from the biology department office and website.

## Sample Plan of Study

### First Year

Fall		Credit Hours
BIOL 214	Genes, Evolution and Ecology	3
BIOL 214L or BIOL 222L	Genes, Evolution and Ecology Lab or Introductory Research Lab in Biology	1
MATH 125 or MATH 121	Math and Calculus Applications for Life, Managerial, and Social Sci I or Calculus for Science and Engineering I	4
CHEM 105	Principles of Chemistry I	3
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Credit Hours</b>		<b>14</b>
Spring		Credit Hours
BIOL 215	Cells and Proteins	3
BIOL 215L or BIOL 222L	Cells and Proteins Laboratory or Introductory Research Lab in Biology	1
CHEM 106	Principles of Chemistry II	3
CHEM 113	Principles of Chemistry Laboratory	2
MATH 126 or MATH 122	Math and Calculus Applications for Life, Managerial, and Social Sci II or Calculus for Science and Engineering II	4
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Credit Hours</b>		<b>16</b>

### Second Year

Fall		Credit Hours
BIOL 216	Development and Physiology	3
BIOL 216L	Development and Physiology Lab	1
CHEM 223 or CHEM 323	Introductory Organic Chemistry I or Organic Chemistry I	3
CHEM 233	Introductory Organic Chemistry Laboratory I	2
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
<b>Credit Hours</b>		<b>15</b>

### Spring

BIOL 326	Genetics	3
CHEM 224 or CHEM 324	Introductory Organic Chemistry II or Organic Chemistry II	3
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
<b>Credit Hours</b>		<b>15</b>

### Third Year

Fall		Credit Hours
BIOL 326	Genetics	3
PHYS 115 or PHYS 121	Introductory Physics I or General Physics I - Mechanics	4
Breadth, or Elective course <sup>a</sup>		3
BIOL Laboratory		2-4
BIOL Subject Area Breadth Course		3
<b>Credit Hours</b>		<b>15-17</b>
Spring		Credit Hours

PHYS 116 or PHYS 122	Introductory Physics II or General Physics II - Electricity and Magnetism	4
Breadth, or Elective course <sup>a</sup>		3
BIOL Subject Area Breadth Course		3
BIOL Laboratory		2-4
Open Elective		3
<b>Credit Hours</b>		<b>15-17</b>

### Fourth Year

Fall		Credit Hours
Breadth, or Elective course <sup>a</sup>		3
Open Electives		12
<b>Credit Hours</b>		<b>15</b>
Spring		Credit Hours
Breadth, or Elective course <sup>a</sup>		3
BIOL Elective		3
Open Electives		9
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>120-124</b>

<sup>a</sup> Unified General Education Requirement.