BIOTECHNOLOGY

Biology provides a broad, general overview of the structure, function, growth, origin, evolution, and distribution of living organisms. Biology students take courses in biology, chemistry, physics, calculus, and statistics. The major is flexible and combines the faculty and resources of two UF colleges to prepare students for career success.

About this Program

- **College:** Agricultural and Life Sciences (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/)
- **Degree:** Bachelor of Science
- **Specializations:** Applied Biology (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BLY_BS/BLY_BS01/) | Biotechnology (p. 1) | Natural Science (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BLY_BS/BLY_BS03/) | Preprofessional (http://catalog.ufl.edu/UGRD/colleges-schools/UGAGL/BLY_BS/BLY_BS04/)
- **Credits for Degree:** 120
- **More Info**

To graduate with this major, students must complete all university, college, and major requirements

This specialization prepares students for careers where knowledge of molecular biology and genetic engineering are important. Students will have the opportunity to learn various techniques and scientific procedures in molecular biology, virology, bioengineering, cell and tissue culture, microscopy and bioinformatics. They also will be prepared for graduate study in the biological sciences.

The Biology major develops fundamental knowledge of animals, plants, and microorganisms. The four specializations offered by the College of Agricultural and Life Sciences are tailored to meet the needs of preprofessional students, those preparing for graduate studies in biology, or specialized areas such as bioinformatics, ecology, genetics, and molecular biology and those seeking a career in biotechnology, education, natural resource management, and environmental or biotechnology law.

Coursework for the Major

College of Agricultural and Life Sciences (CALS) students in the biology major choose one of four specializations: applied biology, biotechnology, natural science, or preprofessional biology. These specializations require significant introductory coursework and credits in general biology, calculus and/or statistics, general chemistry, organic chemistry, and physics. Students who are uncertain about which specialization to choose should consult a biology advisor for information and guidance on curriculum planning. Students can individualize their curriculum through approved specialization electives in the life sciences.

Applied Biology

For students interested in learning how fundamental biology is applied to solving problems. This specialization provides exposure to the major issues facing sustainability of human populations and natural resources.

Biotechnology

Prepares students for careers where knowledge of molecular biology and genetic engineering are important. Students will have the opportunity to learn various techniques and scientific procedures in molecular biology, virology, bioengineering, cell and tissue culture and bioinformatics.

Natural Science

For students interested in descriptive and interpretive biology, with an emphasis on field biology. The specialization provides exposure to the major forms of flora and fauna, and integrates some of the major elements that influence flora and fauna, namely soil/water relations and human activities.

Preprofessional

For students preparing for admission to medical, dental, optometry, veterinary, or other professional schools.

Relevant Minors and Certificates

UFTeach Program

There is a severe shortage of qualified secondary school biology teachers in Florida and nationwide. Students interested in becoming part of this high-demand profession should see a biology advisor or the UFTeach advisor. UFTeach students complete the UFTeach minor in science teaching with their BS in Biology and have the coursework and preparation for professional teacher certification in Florida when they graduate.
More Info (http://education.ufl.edu/uf-teach/)

Bioinformatics

Bioinformatics skills are valuable for students who may seek careers which will necessitate the analysis of genomic data. This minor provides students the opportunity to learn programming skills, mine genomic data, and participate in independent research.

Research

All biology majors are encouraged to participate in research. Research experience is valuable on many levels: It diversifies the college experience; teaches how scientists apply the knowledge gained in the classroom to real world questions; provides the opportunity to work with and get to know researchers who are the best in their field; enables participation in cutting edge scientific questions and techniques; enhances the student's resume/CV when applying to graduate or professional school; and finally, it is essential to help the student determine if science is an appropriate career choice.

More Info (http://major.biology.ufl.edu/do-research/)

CALS biology majors may participate in research for course credit as a scholar (e.g., University Scholar, HHMI Science for Life Scholar), as a volunteer, or, in rare cases, as a paid research assistant.

Code	Title	Credits
Required Foundation Coursework		
BSC 2010	Integrated Principles of Biology 1	4
& 2010L	and Integrated Principles of Biology Laboratory	
BSC 2011	Integrated Principles of Biology 2	4
& 2011L	and Integrated Principles of Biology Laboratory 2	
CHM 2045	General Chemistry 1	4
& 2045L	and General Chemistry Laboratory	
CHM 2046	General Chemistry 2	4
& 2046L	and General Chemistry 2 Laboratory	
Select one option:		8-10
Option A		
CHM 2210	Organic Chemistry 1	
CHM 2211	Organic Chemistry 2	
& 2211L	and Organic Chemistry Laboratory	
Option B		
CHM 3217	Organic Chemistry/Biochemistry 1	
CHM 3218	Organic Chemistry/Biochemistry 2	
CHM 2211L	Organic Chemistry Laboratory	
MAC 2311	Analytic Geometry and Calculus 1	4
STA 2023	Introduction to Statistics 1	3
or MAC 2312	Analytic Geometry and Calculus 2	
Select one option:		8-10
Option A		
PHY 2004	Applied Physics 1	
& 2004L	and Laboratory for Physics 2004	
PHY 2005	Applied Physics 2	
& 2005L	and Applied Physics 2 Lab	
Option B		
PHY 2053	Physics 1	
& 2053L	and Laboratory for PHY 2053	
PHY 2054	Physics 2	
& 2054L	and Laboratory for PHY 2054	
Option C		
PHY 2048	Physics with Calculus 1	
& 2048L	and Laboratory for PHY 2048	
PHY 2049	Physics with Calculus 2	
& 2049L	and Laboratory for PHY 2049	
Required Core Coursework		
AGR 3303	Genetics	3
or PCB 3063	Genetics	
MCB 4304	Genetics of Microorganisms	3
or PCB 4522	Molecular Genetics	
MCB 3020	Basic Biology of Microorganisms	4
& 3020L	and Laboratory for Basic Biology of Microorganisms	
PCB 3134	Eukaryotic Cell Structure and Function	3
PCB 4674	Evolution	4
BCH 4024	Introduction to Biochemistry and Molecular Biology [1]	4
CHM 3120	Introduction to Analytical Chemistry	4
& 3120L	and Analytical Chemistry Laboratory	

BSC 4936	Critical Analysis of Biological Research	2
Approved biotechnology courses (minimum)		6
Total Credits		**72-76**

[1] Not required if CHM 3217 and CHM 3218 are taken.

Critical Tracking

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites (https://cpm.flvc.org/advance-search/) may be used for transfer students.

Semester 1

- Complete CHM 2045/CHM 2045L or MAC 2311
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 2

- Complete CHM 2045/CHM 2045L and MAC 2311
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 3

- Complete BSC 2010/BSC 2010L and CHM 2046/CHM 2046L
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 4

- Complete BSC 2011/BSC 2011L
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 5

- Complete all critical-tracking courses, including labs
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 6

- Complete a minimum of 2 of the remaining Biotechnology 3XXX/4XXX required core courses
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 7

- Complete a minimum of 2 of the remaining Biotechnology 3XXX/4XXX required core courses
- 2.0 upper division GPA required
- 2.0 UF GPA required

Semester 8

- Complete all the remaining Biotechnology 3xxx/4xxx required core courses
- BSC 4936 (Capstone)
- Complete all critical-tracking courses, including labs

- 2.0 UF GPA required
- 2.0 upper division GPA required

Model Semester Plan

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.

Course	Title	Credits
Semester One		
Quest 1 (Gen Ed Humanities)		3
CHM 2045 & 2045L	General Chemistry 1 and General Chemistry Laboratory (**Critical Tracking**; State Core Gen Ed Biological and Physical Sciences)	4
State Core Gen Ed Composition (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext); Writing Requirement		3
State Core Gen Ed Social and Behavioral Sciences (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)		3
Elective		2
	Credits	**15**
Semester Two		
Select one:		3-4
AEB 2014	Current Economic Issues, Food and You (Gen Ed Social and Behavioral Sciences)	
AEB 3103	Principles of Food and Resource Economics (Gen Ed Social and Behavioral Sciences)	
ECO 2013	Principles of Macroeconomics (Gen Ed Social and Behavioral Sciences)	
ECO 2023	Principles of Microeconomics (Gen Ed Social and Behavioral Sciences)	
CHM 2046 & 2046L	General Chemistry 2 and General Chemistry 2 Laboratory (**Critical Tracking**; Gen Ed Biological Sciences and Physical Sciences)	4
MAC 2311	Analytic Geometry and Calculus 1 (**Critical Tracking**; State Core Gen Ed Mathematics)	4
State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)		3
	Credits	**14-15**
Semester Three		
BSC 2010 & 2010L	Integrated Principles of Biology 1 and Integrated Principles of Biology Laboratory (**Critical Tracking**; Gen Ed Biological Sciences and Physical Sciences)	4
CHM 2210 or CHM 3217	Organic Chemistry 1 or Organic Chemistry/Biochemistry 1	3-4
STA 2023 or MAC 2312	Introduction to Statistics 1 (Gen Ed Mathematics) or Analytic Geometry and Calculus 2	3-4
Gen Ed Composition; Writing Requirement		3
Elective		2
	Credits	**15-17**
Semester Four		
Quest 2		3
BSC 2011 & 2011L	Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2 (**Critical Tracking**; Gen Ed Biological Sciences)	4
CHM 2211 or CHM 3218	Organic Chemistry 2 or Organic Chemistry/Biochemistry 2	3-4
CHM 2211L	Organic Chemistry Laboratory	2
Electives		4
	Credits	**16-17**
Semester Five		
AEC 3030C or SPC 2608	Effective Oral Communication or Introduction to Public Speaking	3
BCH 4024	Introduction to Biochemistry and Molecular Biology [1]	4
CHM 3120 & 3120L	Introduction to Analytical Chemistry and Analytical Chemistry Laboratory	4
Select one:		3-4

PHY 2004	Applied Physics 1	
PHY 2053	Physics 1	
PHY 2048	Physics with Calculus 1	
Select one:		1
PHY 2004L	Laboratory for Physics 2004	
PHY 2053L	Laboratory for PHY 2053	
PHY 2048L	Laboratory for PHY 2048	
	Credits	**15-16**
Semester Six		
AEC 3033C	Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)	3
AGR 3303	Genetics	3-4
or PCB 3063	or Genetics	
PCB 3134	Eukaryotic Cell Structure and Function	3
Select one:		3-4
PHY 2005	Applied Physics 2	
PHY 2054	Physics 2	
PHY 2049	Physics with Calculus 2	
Select one:		1
PHY 2005L	Applied Physics 2 Lab	
PHY 2054L	Laboratory for PHY 2054	
PHY 2049L	Laboratory for PHY 2049	
Elective		2
	Credits	**15-17**
Semester Seven		
MCB 3020	Basic Biology of Microorganisms	4
& 3020L	and Laboratory for Basic Biology of Microorganisms	
PCB 4674	Evolution	4
Biotechnology course		3
Electives		4
	Credits	**15**
Semester Eight		
BSC 4936	Critical Analysis of Biological Research (**Critical Tracking**)	2
MCB 4304	Genetics of Microorganisms	3
or PCB 4522	or Molecular Genetics	
Biotechnology course		3
Electives		7
	Credits	**15**
	Total Credits	**120**

[1] Not required if CHM 3218 was taken.

Academic Learning Compact

Biology is the study of the many diverse forms, processes, and systems of life. These studies range across all levels of the biological hierarchy, from the simplest to the most complex life forms, across all environments on the earth and across recent and evolutionary time that interconnects ancestors to their descendants.

To understand this vast diversity, the field of biology correspondingly relies on integrative and comparative approaches for the resolution of the general processes, principles, and unifying themes that govern living systems. Biology is therefore very interdisciplinary and biologists rely on knowledge from the physical sciences and mathematics, as well as from across the disciplines and subdisciplines of biology for advances and breakthroughs.

The Biology major is administered jointly by the College of Agricultural and Life Sciences and the College of Liberal Arts and Sciences.

Before Graduating Students Must

- Achieve a passing score for all content subsections of the Major Field Test for Biology. Content subscore areas are molecular biology and genetics, organismal biology, evolution, ecology, and population biology.
- Achieve a passing score on the analytical skills assessment indicator of the Major Field Test for Biology.

- Achieve a passing score on the bioethics module quiz in BSC 4936. The content of the module and quiz are reviewed and approved by a faculty committee.
- Achieve a passing score on the scientific literacy paper assignment given in BSC 4936. This paper is graded using a faculty-developed rubric.
- Complete requirements for the baccalaureate degree, as determined by faculty.

Students in the Major Will Learn to

Student Learning Outcomes | SLOs

Content

1. Identify, describe and explain the basic terminology, concepts, methodologies, and theories used within the biological sciences.

Critical Thinking

2. Analyze biological information and develop reasoned solutions to problems using the processes and applications of scientific inquiry.
3. Discriminate ethical behavior from unethical behavior in scientific research.

Communication

4. Communicate knowledge, ideas, and reasoning clearly and effectively in written or oral forms appropriate to the biological sciences.

Curriculum Map for All Specializations except CALS Biotechnology

I = Introduced; R = Reinforced; A = Assessed

Courses	SLO 1	SLO 2	SLO 3	SLO 4
AGR 3303 or PCB 3063 or PCB 4522	R	R		R
ANS 3319C or BOT 3503 or HOS 4304 or PCB 3713C or PCB 4723C	R	R		R
BSC 1920	I		I	I
BSC 2010	I	I	I	
BSC 2011	I	I	I	
BSC 4936	A	A	A	A
MCB 3020 and 3020L, or PCB 3134 or PCB 4674	R	R		R

Assessment Types

- Major field test for biology
- Bioethics module
- Scientific literacy paper

Curriculum Map for CALS Biotechnology

I = Introduced; R = Reinforced; A = Assessed

Courses	SLO 1	SLO 2	SLO 3	SLO 4
AGR 3303 or PCB 3063 or PCB 4522	R	R		
BSC 1920	I		I	I
BSC 2010	I	I	I	
BSC 2011	I	I	I	
BSC 4936	A	A	A	A
MCB 3020 and 3020L, or PCB 3134 or PCB 4674	R	R		R

Assessment Types

- Major field test for biology
- Bioethics module
- Scientific literacy paper