BIOLOGY | BIOTECHNOLOGY

This program 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
- **Credits for Degree**: 120
- **Additional Information**

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

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/or 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 B.S. 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.

**Related Biology Programs**

- Bachelor of Arts or Bachelor of Science in Biology, CLAS (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/BIO_BA_BS)
- Bachelor of Arts in Biology, UF Online (http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/BIO_BA_UFO)

**Bioinformatics**

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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BSC 2010 &amp; 2010L</td>
<td>Integrated Principles of Biology Laboratory 1</td>
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BSC 2011 & 2011L Integrated Principles of Biology 2 and Integrated Principles of Biology Laboratory 2 4

CHM 2045 & 2045L General Chemistry 1 and General Chemistry 1 Laboratory 4

CHM 2046 & 2046L General Chemistry 2 and General Chemistry 2 Laboratory 4

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 Applied Physics 1
PHY 2005 Applied Physics 2
& 2005L and Laboratory for Applied Physics 2

Option B
PHY 2053 Physics 1
& 2053L and Laboratory for Physics 1
PHY 2054 Physics 2
& 2054L and Laboratory for Physics 2

Option C
PHY 2048 Physics with Calculus 1
& 2048L and Laboratory for Physics with Calculus 1
PHY 2049 Physics with Calculus 2
& 2049L and Laboratory for Physics with Calculus 2

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
& 3020L and Laboratory for Basic Biology of Microorganisms 4
PCB 3134 Eukaryotic Cell Structure and Function 3
PCB 4674 Evolution 4
BCH 4024 Introduction to Biochemistry and Molecular Biology 4
CHM 3120 & 3120L Introduction to Analytical Chemistry 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 records each student's progress in courses that are required for entry to 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 (http://www.flvc.org/cpp/displayRecord.jsp?cip=260101&track=01) 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
• 2.5 GPA required for all critical-tracking courses
• 2.0 UF 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.

<table>
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<th>Course Title</th>
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<td>AEB 2014</td>
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<tr>
<td>Economic Issues, Food and You (Gen Ed Social and Behavioral Sciences)</td>
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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 2210  Organic Chemistry 1  
or CHM 3217  Organic Chemistry/Biochemistry 1  
STA 2023  Introduction to Statistics 1 (Gen Ed Mathematics)  
or MAC 2312  Analytic Geometry and Calculus 2  

State Core Gen Ed Humanities (http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)  

Semester Three  
BSC 2010  Integrated Principles of Biology 1  
& 2011L  Integrated Principles of Biology Laboratory 1 (Critical Tracking; Gen Ed Biological Sciences and Physical Sciences)  
CHM 2210  Organic Chemistry 2  
or CHM 3218  Organic Chemistry/Biochemistry 2  

Gen Ed Composition; Writing Requirement  
Elective  

Semester Four  
BSC 2111  Integrated Principles of Biology 2  
& 2111L  Integrated Principles of Biology Laboratory 2 (Critical Tracking; Gen Ed Biological Sciences)  
CHM 2211  Organic Chemistry 2  
or CHM 3219  Organic Chemistry/Biochemistry 2  

Elective  

Semester Five  
AEC 3030C  Effective Oral Communication  
or SPC 2608  Introduction to Public Speaking  
BCH 4024  Introduction to Biochemistry and Molecular Biology  
CHM 3120  Introduction to Analytical Chemistry  
& 3120L  and Analytical Chemistry Laboratory  

Select one:  
PHY 2004  Applied Physics 1  
PHY 2053  Physics 1  
PHY 2048  Physics with Calculus 1  

Select one:  
PHY 2004L  Laboratory for Applied Physics 1  
PHY 2053L  Laboratory for Physics 1  
PHY 2048L  Laboratory for Physics with Calculus 1  

Semester Six  
AEC 3033C  Research and Business Writing in Agricultural and Life Sciences (Writing Requirement)  
AGR 3303  Genetics  
or PCB 3063  or Genetics  
PCB 3134  Eukaryotic Cell Structure and Function  

Select one:  
PHY 2005  Applied Physics 2  

PHY 2054  Physics 2  
PHY 2049  Physics with Calculus 2  

Select one:  
PHY 2005L  Laboratory for Applied Physics 2  
PHY 2054L  Laboratory for Physics 2  
PHY 2049L  Laboratory for Physics with Calculus 2  

Elective  

Semester Seven  
MCB 3020  Basic Biology of Microorganisms  
& 3020L  and Laboratory for Basic Biology of Microorganisms  

Biotechnology course  
Electives  

Semester Eight  
BSC 4936  Critical Analysis of Biological Research  

Biotechnology course  
Electives  

Total Credits  

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*

<table>
<thead>
<tr>
<th>Courses</th>
<th>SLO 1</th>
<th>SLO 2</th>
<th>SLO 3</th>
<th>SLO 4</th>
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</tbody>
</table>

**Assessment Types**
- Major field test for biology
- Bioethics module
- Scientific literacy paper

**Curriculum Map for CALS Biotechnology**

*I = Introduced; R = Reinforced; A = Assessed*

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