Biology - B.A.

College of Arts and Sciences

To address the breadth and depth essential to educating biologists, the biology major is structured to include both a broad foundation through core courses and opportunity for specialization within a biological subfield through biology electives. The major is designed to prepare the student for a post-baccalaureate profession in biology, for advanced professional training in the health sciences, or for graduate study in basic and applied areas of the biological sciences.

120 hours (minimum)

Any student earning a Bachelor of Arts (BA) degree must complete a minimum of 39 hours at the 300+ level. These hours are generally completed by the major requirements. However, keep this hour requirement in mind as you choose your course work for the requirements in the major. See the complete description of College requirements for a Bachelor of Arts degree in the *Arts and Sciences* section of the 2023-2024 Undergraduate Catalog.

UK Core Requirements

See the *UK Core* section of the 2023-2024 Undergraduate Catalog for the complete UK Core requirements. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity

Choose one course from approved list 3

II. Intellectual Inquiry in the Humanities

Choose one course from approved list 3

III. Intellectual Inquiry in the Social Sciences

Choose one course from approved list 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences

CHE 105 General College Chemistry I 4
CHE 111 General Chemistry I Laboratory 1

V. Composition and Communication I

CIS/WRD 110 Composition and Communication I 3

VI. Composition and Communication II

CIS/WRD 111 Composition and Communication II 3

VII. Quantitative Foundations

MA 137 Calculus I With Life Science Applications
or
MA 113 Calculus I
or
MA 123 Elementary Calculus and its Applications 4

VIII. Statistical Inferential Reasoning

STA 296 Statistical Methods and Motivations 3

IX. Community, Culture and Citizenship in the USA

Choose one course from approved list 3

X. Global Dynamics

Choose one course from approved list 3

UK Core hours 33

Graduation Composition and Communication Requirement (GCCR)

In order to meet the Graduation Composition and Communication Requirement (GCCR), students must successfully complete **both** BIO 425 to fulfill the oral communication requirement **and** one course from the list below to fulfill the written communication requirement. In order to receive GCCR credit a student must:

a. Earn an average grade of C or better on all GCCR assignments; and
b. Have completed at least 30 credit hours of college-level course work prior to registering for the course.

Oral Communication Requirement

BIO 425 Biology Seminar (Subtitle required) 1

Written Communication Requirement

Choose one course from the following 8 options:
BIO 398 Research and Writing in Biology 1-3
BIO 404 Advanced Genetics 3
BIO 405 Human Genetics 3
BIO 418 Ecological Genetics 3
BIO 430G Plant Physiology 4
BIO 445 The Biology of Sex 3
WRD 305 Writing Public Science 3
WRD 310 Writing in the Natural Sciences 3

Graduation Composition and Communication Requirement hours (GCCR) 2-5

College Requirements

Humanities – two courses 6
Social Science – two courses 6
Third and fourth semesters of language 6
Free Electives 6
Race and Ethnicity Requirement 0-3
Lab or Field Experience – *satisfied by major*
Graduation Writing Requirement (choose any GWR Humanities 300-level course; this will also count as one of the two Humanities courses in the College Requirements)

UK Core and College hours: 57-60 (*45-48*)

Premajor Requirements

BIO 148 Introductory Biology I 3
BIO 152 Introductory Biology II 3

BIO 155 Biological Research Skills Lab
or
BIO 198 Scholars Biology Research 1-2

†CHE 105 General College Chemistry I 4
CHE 111 General Chemistry I Laboratory 1
CHE 107 General College Chemistry II 3
CHE 113 General Chemistry II Laboratory 2

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MA 137 Calculus I With Life Science Applications
or
MA 113 Calculus I

or
MA 123 Elementary Calculus and its Applications 4

Free Elective 0-1

†The CHE 105 requirement can be satisfied with CHE 109 and CHE 110.

Premajor hours: **21**

Major Requirements

Minimum major requirement for graduation is 54 credit hours in courses as detailed below. **Once all other major requirements are completed, students must complete Biology electives until the 54 credit hour requirement has been met.** The minimum GPA of all major and premajor courses must be at least **2.0**.

First Tier Core

BIO 303 Introduction to Evolution 4
BIO 304 Principles of Genetics 4

Second Tier Core

To be taken **after** completion of First Tier Core.

Choose **two** of the following to complete 8 hours:
BIO 350 Animal Physiology
or
BIO 430G Plant Physiology 4

BIO 315 Introduction to Cell Biology 4
BIO 325 Ecology 4

plus:
STA 296 Statistical Methods and Motivations 3

BIO 425 Biology Seminar (Subtitle required)
or
BIO 499 Biology Research Seminar 1

Core hours: **20**

Other Course Work Required for the Major

From Outside the Major Department

CHE 236/231 Survey of Organic Chemistry/
Organic Chemistry Laboratory I
or
CHE 230/231 Organic Chemistry I/Laboratory I 4

PHY 211 General Physics
or
††PHY 151 Introduction to Physics 3-5

††PHY 151 is not accepted for admission into Medical, Dental or Pharmacy School. Check with your advisor before choosing a physics course.

Other Major hours: **7-9**

Options

Complete **one** of the following options. **Students cannot mix and match requirements from the two options**. An option must be completed in its entirety.

Option A – Minor Option

NOTE: Fourteen of these hours must be at the 300-level or above.

Complete the requirements for any minor other than the biology minor 18-21

Biology Electives 4-9
Biology Electives – **A minimum of 6 of the 4-9 upper-level elective credit hours must be BIO courses (i.e., have a BIO prefix).** If fewer than 6 hours are required to complete the requirements, all hours must be upper-level elective BIO courses. A maximum of 3 credits of independent research course work may be used in this section.

If students double-dip major and minor requirements, additional biology electives must be taken to meet the graduation requirement of 54 hours for the B.A. in Biology.

Total hours Option A **25-27**

Option B – Topical Focus Option

Complete a 12 credit hour sequence of courses with a topical focus. At least 6 of these hours must be at the 300-level or above 12

NOTE: Students who have multiple interests or interests that do not fall into the requirements for a minor offered at the University of Kentucky may select a 12 credit hour sequence of courses with a topical focus. Courses in several disciplines and in the various interdisciplinary programs may be combined to pursue the topical focus. Students interested in pursuing Option B must have the 12 credit hour sequence of courses APPROVED IN ADVANCE by the Director of Undergraduate Studies, Department of Biology. Students must submit an Approval of Topical Focus Form to the Director of Undergraduate Studies.

Biology Electives 13-15
Biology Electives – **A minimum of 9 of the 13-15 upper-level elective credit hours must be BIO courses (i.e., have a BIO prefix).** A maximum of 6 credits of independent research course work may be used in this section.

Total Hours Option B **25-27**

Hours to be chosen from 300+ level BIO courses or the list below. Note: ANA 209, BIO 208, BIO 209 and PGY 206 CANNOT be used for this requirement. A maximum of 1 credit hour of seminar course work (for example BIO 425, BIO 426, BIO 427) may be counted within this elective requirement.

Complete one of the following tracks below to fulfill your 13-15 hours of Biology electives. If an alternative track is not declared, the default track will be General Biology.

Cellular, Molecular, and Developmental Biology Track

The Cellular, Molecular, and Developmental Track provides a broad background in biology, with a focus on the molecular, cellular, and integrative mechanisms by which organisms regulate life processes. Students will learn about the molecular and cellular mechanisms that provide the basis for biological structure, growth, evolution, embryonic development, and genetic inheritance. Students will understand how eukaryotic cells process information from their environment and initiate programs of gene expression leading to growth, development, and functional specification.

A degree in biology with an emphasis in Cellular, Molecular, and Development will prepare students for a career in the life sciences, whether they are interested in understanding the molecular mechanisms underlying cell growth, or the complex patterns of organismal development. This can help prepare students for a career in academic or industrial research, biotechnology, genetic engineering, or any of the health professions.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 308 General Microbiology 3
BIO 309 Microbiology Laboratory 2
BIO 429 Developmental Biology 3
BIO 494G Immunobiology 3
BIO 394/395/397 Research in Neuroscience/Biology/
Microbiology (maximum 3 credits toward track) 1-3
BIO 495G Bacterial Pathogenesis 3
BIO 502 Systems, Cellular and Molecular Physiology 5
BIO 510 Recombinant DNA Techniques Laboratory 4
BIO 520 Bioinformatics 3
BIO 527 Stem Cells, Tissue Engineering, and Regenerative Medicine 3
BIO 582 Virology 3
BIO 542 Histology 5
BIO 410 Vertebrate Endocrinology 3
*BIO 315 Introduction to Cell Biology 4
**BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

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Courses from Outside the Biology department:
BCH 401G Fundamentals of Biochemistry 3

CHE 233 Organic Chemistry Laboratory II 1
or
CHE 533 Advanced Organic Chemistry Laboratory 2

CHE 550 Biological Chemistry I 3
CHE 552 Biological Chemistry II 3
CHE 532 Spectrometric Identification of Organic Molecules 2
MI/PAT 598 Clinical Microbiology 3
ANA 442 Molecular and Cellular Neurobiology 3

Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Only for students who do not use the course to fulfill the 2nd Tier Core.*

***Subtitle must be approved by Director of Undergraduate Studies.*

Ecology and Evolutionary Biology Track

The Ecology and Evolutionary Biology Track focuses on the diversity of life on Earth, including diversity in genes, physiology, and behaviors. Students will learn about how this diversity emerged, as plants, animals, and microbes became adapted to the environment and to each other. A wide variety of scientific disciplines are integrated within the track, including ecology, organismal biology, physiology, genetics, evolution, conservation biology, and behavior. A degree in biology with an emphasis in Ecology and Evolution will prepare students for a career in the life sciences, whether they are interested in having a deep understanding of evolutionary process, or are interested in the interactions between organisms and their environment. This can help prepare students for careers in areas such as: 1. conservation and restoration biology – addressing the impacts of climate change, developing plans for habitat conservation and wildlife protection, or other issues critical to maintaining a healthy planet; 2. working as a doctor or veterinarian; 3. science education – educating students and the public on the history and diversity of life on earth and the need to conserve it; 4. basic research in biology – helping to expand the frontiers of knowledge by studying the evolution of organisms and their ecosystems.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 300 General Entomology 3
BIO 337 Mathematical Modeling in the Life Sciences 3
BIO 351 The History of Plants on Earth 3
BIO 375 Behavioral Ecology and Sociobiology 3
BIO 395 Research in Biology (maximum 3 credits toward track) 1-3
*BIO 430G Plant Physiology 4
BIO 440 Comparative and Functional Anatomy 4
BIO 445 The Biology of Sex 3
BIO 461G Introduction to Population Genetics 3
BIO 508 Evolution 3
BIO 418 Ecological Genetics 3
BIO 520 Bioinformatics 3
BIO 525 Advanced Ecology 3
BIO 530 Biogeography and Conservation 3
BIO 555 Vertebrate Zoology 5
BIO 559 Ornithology 4
BIO 568 Insect Behavior 3
*BIO 325 Ecology 4
**BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

Courses from Outside the Biology department:
CHE 565 Environmental Chemistry 3
EES 401G Invertebrate Paleobiology and Evolution 3
FOR 340 Forest Ecology 4
PLS 450G Biogeochemistry 3
PLS 502 Ecology of Economic Plants 3
PGY 512 Evolutionary Medicine 3
FOR 370 Wildlife Biology and Management 4
FOR 435 Conservation Biology 3
FOR 510 Herpetology 4
FOR 530 Freshwater Ecology 3
Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Only for students who do not use the course to fulfill the 2nd Tier Core.*

***Subtitle must be approved by Director of Undergraduate Studies.*

General Biology Track

This is the default option for students who do not declare another track.

Choose 13-15 credit hours from the upper-level electives listed below.

Biology
BIO 3XX, BIO 4XX, BIO 5XX, BIO 6XX

Anthropology
ANT 332 Human Evolution 3

Chemistry
CHE 226 Analytical Chemistry 3
CHE 233 Organic Chemistry Laboratory II 1
CHE 440G Introductory Physical Chemistry 3
CHE 441G Physical Chemistry Laboratory 2
CHE 446G Physical Chemistry for Engineers 3
CHE 532 Spectrometric Identification of Organic Molecules 2
CHE 533 Advanced Organic Chemistry Laboratory 2
CHE 550 Biological Chemistry I 3
CHE 552 Biological Chemistry II 3
CHE 558 Hormone Receptors and Cell Signals 3
CHE 565 Environmental Chemistry 3

Geology
EES 401G Invertebrate Paleobiology and Evolution 3

Psychology
PSY 459 Neuropharmacology: Drugs and Behavior 3

Statistics
(Biology usually accepts only one of the following for each student)
STA 570 Basic Statistical Analysis 3
STA 580 Biostatistics I 2

Other STA courses may be accepted at the discretion of your advisor.

Writing, Rhetoric, and Digital Studies
WRD 305 Writing Public Science 3
WRD 310 Writing in the Natural Sciences 3

Martin-Gatton College of Agriculture, Food and Environment
ABT/ENT 460 Introduction to Molecular Genetics 3
ASC 364 Reproductive Physiology of Farm Animals 4
ASC 378 Animal Nutrition 4
ENT 310 Insect Pests of Field Crops 3
ENT 320 Horticultural Entomology 3
ENT/FOR 502 Forest Entomology 3
ENT 561 Insects Affecting Human and Animal Health 3
ENT 564 Insect Taxonomy 4
ENT 568 Insect Behavior 3
FOR 340 Forest Ecology 4
FOR 370 Wildlife Biology and Management 4
FOR 435 Conservation Biology 3
FOR 530 Freshwater Ecology 3
FOR 510 Herpetology 4
FSC 530 Food Microbiology and Safety 5
HRT 320 Woody Horticultural Plants 4
NRE 420G Taxonomy of Vascular Plants 4
PLS 330 Herbaceous Horticultural Plants I 2
PLS 332 Herbaceous Horticultural Plants II 2
PLS 366 Fundamentals of Soil Science 4
PLS 450G Biogeochemistry 3
PLS 502 Ecology of Economic Plants 3
PLS 566 Soil Microbiology 3
PLS 567 Methods in Soil Microbiology 1
PPA 400G Principles of Plant Pathology 3

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College of Medicine

ANA 410G Neurobiology of Brain and Spinal Cord Disorders 3
ANA 442 Molecular and Cellular Neurobiology 3
ANA 511 Introduction to Human Anatomy 5
ANA 512 Microscopy and Ultrastructure 4
ANA 516 Selected Topics in Advanced Neuroscience 3

Some other anatomy courses at the 500-level are acceptable, but they are usually restricted to professional students.

BCH 401G Fundamentals of Biochemistry 3
MI/BIO 494G Immunobiology 3
MI 595 Immunobiology Laboratory 2
MI/PAT 598 Clinical Microbiology 3
PGY 412G Principles of Human Physiology 4

PGY 412G is acceptable as an elective for upper level biology credit ONLY IF a student DOES NOT complete BIO 350. It DOES NOT substitute for BIO 350 or BIO 430G.

PGY 431 Introduction to Neuroendocrinology 3
PGY 417 Genomics and Epigenetics 2
PGY 512 Evolutionary Medicine 3
PGY 560 Pathophysiology: Integrative Study in Physiology and Medicine 1
PGY 502 Systems, Cellular and Molecular Physiology 5
TOX 509 Environmental and Regulatory Toxicology 2

Unacceptable courses often mistakenly thought to be acceptable. These courses are not acceptable electives for Biology majors:

ANA 209 Principles of Human Anatomy 3
PGY 206 Elementary Physiology 3

Other courses may be accepted at the discretion of the Director of Undergraduate Studies in the Department of Biology.

Genetics, Genomics, and Bioinformatics Track

The Genetics, Genomics, and Bioinformatics Track will provide guidance and structure to students with a desire to specialize in the study of inheritance and will formally recognize their chosen area of specialization in the description of their degree. The selected course offerings span the spectrum of studies within the area of inheritance, allowing students to select broadly from courses that provide sophisticated insight into genetic information and genetic analysis. The selected courses also allow students to dive deeply into different realms of genetics, including: emphasis on microbes (BIO 308, 309 and 510); emphasis on animals (BIO 404, 405, 429, 527); emphasis on analytical technology (BIO 337, 404, 461G, 510, 520, STA 580, ABT 460); emphasis on development (BIO 404, 405, 429, 445, 527, PGY 417); and emphasis on evolution (BIO 461G, 508).

Students selecting this track will be able to demonstrate a clear understanding of the most important and fundamental theories and ideas in contemporary biology from a perspective that emphasizes inheritance, organization, and analysis of genetic information.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 308 General Microbiology 3
BIO 309 Microbiology Laboratory 2
BIO 337 Mathematical Modeling in the Life Sciences 3
BIO 395/397 Research in Biology/Microbiology
(maximum 3 credits toward track) 1-3
BIO 404 Advanced Genetics 3
BIO 405 Human Genetics 3
BIO 429 Developmental Biology 3
BIO 445 The Biology of Sex 3
BIO 461G Introduction to Population Genetics 3
BIO 508 Evolution 3
BIO 510 Recombinant DNA Techniques Laboratory 4
BIO 418 Ecological Genetics 3
BIO 520 Bioinformatics 3
BIO 527 Stem Cells, Tissue Engineering, and Regenerative Medicine 3
*BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

Courses from Outside the Biology department:

STA 570 Basic Statistical Analysis 3
STA 580 Biostatistics I 2
ABT/ENT 460 Introduction to Molecular Genetics 3
PGY 417 Genomics and Epigenetics 2

Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Subtitle must be approved by Director of Undergraduate Studies.*

Physiology and Behavior Track

Physiology is the study of function of living organisms, primarily plants and animals. The field studies cells, tissues, organs, and the whole organism. To understand function, a mechanistic approach is used to integrate the cell level to the whole organism. The study of animal behavior and physiology go hand and hand in addressing the functional mechanisms which regulate behavior. This track will prepare pre-professionals in health science areas (MD, DO, DDS, and PT), researchers in the function of animals and plants (MS /PhD), and ecologists.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 302 Introduction to Neuroscience 3
BIO 305 Introduction to Neuroscience Techniques 4
BIO 375 Behavioral Ecology and Sociobiology 3
BIO 394/395/397 Research in Neuroscience/Biology/
Microbiology (maximum 3 credits toward track) 1-3
*BIO 430G Plant Physiology 4
BIO 440 Comparative and Functional Anatomy 4
BIO 445 The Biology of Sex 3
BIO 446 Neurophysiology Laboratory 3
BIO 494G Immunobiology 3
BIO 502 Systems, Cellular and Molecular Physiology 5
BIO 507 Biology of Sleep and Circadian Rhythms 3
BIO 535 Comparative Neurobiology and Behavior 3
BIO 550 Advanced Physiology 3
*BIO 350 Animal Physiology 4
BIO 410 Vertebrate Endocrinology 3
**BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

Courses from Outside the Biology department:

ASC 364 Reproductive Physiology of Farm Animals 4
ENT 568 Insect Behavior 3
MI 595 Immunobiology Laboratory 2
PGY 560 Pathophysiology: Integrative Study in Physiology and Medicine 1
PSY 459 Neuropharmacology: Drugs and Behavior 3
ANA 410G Neurobiology of Brain and Spinal Cord Disorders 3
ANA 442 Molecular and Cellular Neurobiology 3
PGY 431 Introduction to Neuroendocrinology 3

Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Only for students who do not use the course to fulfill the 2nd Tier Core.*

***Subtitle must be approved by Director of Undergraduate Studies.*

Plant Biology Track

The Plant Biology Track focuses on fundamental aspects of how plants function as organisms and interact with their environment. A wide variety of scientific disciplines are integrated within the track, including physiology, taxonomy, reproduction, and ecology.

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A degree in biology with an emphasis in plant biology serves as an excellent launching point for a wide range of career options, including domestic and international opportunities in business, research, and teaching. The program is excellent preparation for students wishing to enter graduate or other professional schools. Plant biologists can work in the laboratory or field, forestry, botanical gardens and nurseries, agricultural companies, biotechnology, pharmaceuticals, energy and chemical industries, or environmental protection.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 310 The Life Processes of Plants 3
BIO 351 The History of Plants on Earth 3
BIO 394/395/397 Research in Neuroscience/Biology/
Microbiology (maximum 3 credits toward track) 1-3
BIO 420G Taxonomy of Vascular Plants 4
*BIO 430G Plant Physiology 4
BIO 525 Advanced Ecology 3
**BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

Courses Outside the Biology department:
ENT 310 Insect Pests of Field Crops 3
ENT 320 Horticultural Entomology 3
FOR 340 Forest Ecology 4
ENT/ FOR 502 Forest Entomology 3
HRT 320 Woody Horticultural Plants 4
PLS 366 Fundamentals of Soil Science 4
PLS 502 Ecology of Economic Plants 3
PLS 566 Soil Microbiology 3
PLS 567 Methods in Soil Microbiology 1
PPA 400G Principles of Plant Pathology 3

Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Only for students who do not use the course to fulfill the 2nd Tier Core.*

***Subtitle must be approved by Director of Undergraduate Studies.*

Pre-Professional Track

The Pre-Professional Track in the biology major broadly explores organismal structure and function in the context of preparing students for health-related professional programs. The courses in this track give the students a broad view of both normal and abnormal organismal function, with courses specializing in neuroscience, physiology, microbiology, and molecular biology. Independent research in this track will be an opportunity for students to work with science professionals within their desired field. Through completion of this track, students can fulfill prerequisite and recommended courses for most pre-professional health programs. Students who excel in this track can go on to enroll in a variety of professional programs, including medical, dental, optometry, veterinary, and physician's assistant programs. A biology degree with a pre-professional health emphasis also prepares students for careers as research scientists, research lab technicians, microbiologists, genetic counselors, biology teachers, and many other general biology careers.

12 upper-level guided elective hours out of the required 13-15 hours of guided electives must be completed from the courses listed below. Of those 12 hours, a maximum of 3 hours can be independent research (BIO 394/395/397). The remaining 1-3 credit hours may come from the list of approved electives for the general biology track, which may include an additional 3 hours of independent research (BIO 394/395/397). A maximum of 6 credit hours of independent research can be counted toward the Biology degree. Of the 13-15 hours of total upper-level electives required, 9 credit hours must have a BIO prefix.

BIO 302 Introduction to Neuroscience 3
BIO 305 Introduction to Neuroscience Techniques 4
BIO 308 General Microbiology 3
BIO 309 Microbiology Laboratory 2
BIO 394/395/397 Research in Neuroscience/Biology/
Microbiology (maximum 3 credits toward track) 1-3
BIO 405 Human Genetics 3
BIO 410 Vertebrate Endocrinology 3
BIO 440 Comparative and Functional Anatomy 4
BIO 445 The Biology of Sex 3
BIO 446 Neurophysiology Laboratory 3
BIO 494G Immunobiology 3
BIO 495G Bacterial Pathogenesis 3
BIO 502 Systems, Cellular and Molecular Physiology 5
BIO 507 Biology of Sleep and Circadian Rhythms 3
BIO 510 Recombinant DNA Techniques Laboratory 4
BIO 520 Bioinformatics 3
BIO 527 Stem Cells, Tissue Engineering, and Regenerative Medicine 3
BIO 429 Developmental Biology 3
BIO 535 Comparative Neurobiology and Behavior 3
BIO 550 Advanced Physiology 3
BIO 582 Virology 3
BIO 542 Histology 5
*BIO 315 Introduction to Cell Biology 4
*BIO 350 Animal Physiology 4
**BIO 380 Special Topics in Biology (Intermediate Level)
(Subtitle required) 1-4

Courses from Outside the Biology department:
ANA 410G Neurobiology of Brain and Spinal Cord Disorders 3
ANA 442 Molecular and Cellular Neurobiology 3
BCH 401G Fundamentals of Biochemistry 3
CHE 550 Biological Chemistry I 3
CHE 552 Biological Chemistry II 3
MI/PAT 598 Clinical Microbiology 3
PGY 560 Pathophysiology: Integrative Study in Physiology and Medicine 1
PSY 459 Neuropharmacology: Drugs and Behavior 3
PGY 512 Evolutionary Medicine 3
PGY 431 Introduction to Neuroendocrinology 3

Other courses can be accepted by the Director of Undergraduate Studies in Biology on a case by case basis.

**Only for students who do not use the course to fulfill the 2nd Tier Core.*

***Subtitle must be approved by Director of Undergraduate Studies.*

Total Hours Option B 25-27

Total Minimum Hours Required for Degree 120