

# Biology (BIO)

The Department of Biology offers a major in Biology that emphasizes the development of scientific skills and competencies necessary for understanding living systems and critical analysis of scientific claims.

The six foundation courses introduce students to hypothesis testing, experimental design, data analysis and interpretation while investigating ecology, evolution, genetics, cell biology, and the chemical foundations of life. Throughout the major, students engage with current scientific literature and learn to communicate scientific information in written and oral formats.

The faculty value a liberal arts education and encourages our majors to pursue other academic interests, including study abroad and biology-linked programs listed below. Graduates will be well prepared to pursue a graduate or professional degree or seek a job in a biology-related field.

Students majoring in Biology are also eligible to complete the Program in Neuroscience or the Emphasis in Computational Science. The program in Neuroscience is an interdisciplinary examination of the nervous system and its regulation of behavior. It is administered by both the departments of Biology and Psychology. Many of the required courses will apply to both fields of study. A description of the Neuroscience (<http://catalog.wofford.edu/courses-programs-departments/neuroscience/>) program requirements can be found the *Catalog*. The Emphasis in Computational Science is an interdisciplinary field which applies computer science and mathematics to biology and other natural sciences. For requirements, see the Computational Science (<http://catalog.wofford.edu/courses-programs-departments/computer-science/>) section of the *Catalog*.

## Honors Courses

The Department of Biology encourages its students to undertake honors work. For further information, students should review the section on Honors Courses (<http://catalog.wofford.edu/academics/academic-honors/honors-courses/>) in this *Catalog*.

## Chair

Natalie W. Spivey

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## Professors

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Students planning to major in Biology should take BIO 150 Biological Inquiry (with lab), BIO 213 Introduction to Genetics & Molecular Biology, BIO 215 Introduction to Cellular Biology, BIO 216 Experimental

Design, Analysis, and Communication, CHEM 123 General Chemistry I (with lab), and CHEM 124 General Chemistry II (with lab) prior to enrolling in an upper-level (300-level or higher) course. Typically, these courses should be completed in the first four semesters. The CHEM 123-124 sequence should be taken no later than the sophomore year, and students in good standing are encouraged to start the sequence in the first year.

Majors will need a cumulative GPA of 2.00 or greater in the five foundational courses to enroll in upper-level courses. BIO 215 Introduction to Cellular Biology requires that students must have earned a 'C-' or better in BIO 213 Introduction to Genetics & Molecular Biology and have earned credit for CHEM 123 General Chemistry I (with lab). BIO 400 Evolutionary & Integrative Biology (with lab) must be taken in the junior or senior year. Majors are also encouraged to take coursework in statistics (MATH 140 Introduction to Statistics and/or BIO 241 Introduction to Biostatistics) as early as possible.

## Requirements for the Major in Biology

Course	Title	Hours
<b>Required Major Courses</b>		<b>25</b>
BIO 150	Biological Inquiry (with lab)	
CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
BIO 213	Introduction to Genetics & Molecular Biology	
BIO 215	Introduction to Cellular Biology	
BIO 216	Experimental Design, Analysis, and Communication	
BIO 400	Evolutionary & Integrative Biology (with lab)	
<b>Ecology Elective<sup>1</sup></b>		
BIO 281	Special Topics in Ecology	
BIO 305	Conservation Biology	
BIO 310	Seminar in Ecology	
BIO 313	Plants & Ecosystems	
BIO 314	Plant & Ecosystems (with lab)	
BIO 352	Research Methods & Communication, Ecology (with lab)	
BIO 370	Field Biology (with lab)	
BIO 372	Field Botany (with lab)	
BIO 382	Ecology (with lab)	
BIO 383	Ecotoxicology	
BIO 385	Marine Biology	
BIO 386	Freshwater Biology (with lab)	
BIO 481	Special Topics in Ecology	
BIO 497	Case Studies in Environmental Issues	
<b>Laboratory Electives</b>		<b>8</b>
Select two four-credit hour Biology (BIO) laboratory courses		
<b>General Electives</b>		<b>12</b>
Select four additional Biology (BIO) courses		
<b>Total Hours</b>		<b>45</b>

<sup>1</sup> The Ecology Elective course can apply to either the lab elective requirement or the general elective requirement. If the course is a 4-

*credit hour lab course, it will apply to the lab electives. Otherwise, it will apply to the general electives.*

**BIO 103. Biology: Science in Context. 3 Hours.**

Students will explore the features that make science an important way of understanding the natural world. This exploration will focus on science-based topics and issues important in our contemporary world.

**BIO 150. Biological Inquiry (with lab). 4 Hours.**

Students in Biology 150 will advance their knowledge of biology (from the ecosystem level to the molecular level), learn and practice skills essential to biological inquiry, and integrate scientific ways of knowing into their development as liberally educated, engaged citizens. Individually and in teams, students will work with research organisms commonly used in the discipline, read the primary literature, and develop their observational and analytical, and quantitative (especially statistical) skills. Students will also develop oral and written communication skills through informal discussions, oral presentations, and written reports of their experimental work, which will benefit from the peer-review process.

**BIO 213. Introduction to Genetics & Molecular Biology. 3 Hours.**

Introduction to the biological processes that control the transmission and expression of genetic information with emphasis on the structure and function of nucleic acids. Students will study inheritance at the biochemical, organismal, and population levels.

**Prerequisite:** BIO 150 with a minimum grade of D.

**BIO 215. Introduction to Cellular Biology. 3 Hours.**

Study of biochemical, metabolic, structural & functional aspects of cells & cellular systems.

**Prerequisite:** BIO 213 with a minimum grade of C- and CHEM 123 with a minimum grade of D.

**BIO 216. Experimental Design, Analysis, and Communication. 3 Hours.**

Focus will be on experimental design, analysis, and communication of biological research studies. Students will generate hypotheses based on observations and previously published studies and carry out experiments that allow them to practice standard laboratory, greenhouse, or field techniques used in biology.

**Prerequisite:** BIO 213 with a minimum grade of D.

**BIO 241. Introduction to Biostatistics. 3 Hours.**

General introduction to statistical procedures in the Biological Sciences. Topics include: describing and displaying data, descriptive statistics, sampling distributions, experimental design, hypothesis testing, categorical data analysis, ANOVA, and linear regression analysis. Students will use the statistical software package JMP to analyze data from studies in ecology, evolutionary biology, medicine and genetics.

**Prerequisite:** BIO 213 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 250. Introduction to Research. 0 to 4 Hours.**

Projects designed to introduce students to research and to critical reading of original research.

**BIO 275. Introduction to Bioinformatics. 3 Hours.**

An introduction to the basic computational methods used to analyze biological data with an emphasis on algorithms used in genomics. Other topics may include methods for storage, retrieval, analysis, and display of biological data.

**Prerequisite:** BIO 213 with a minimum grade of D.

**BIO 280. Selected Topics in Biology. 0 to 4 Hours.**

Selected topics in Biology at the introductory or intermediate level. Courses with this designation are typically newly designed and are being explored for possible adoption as a regular addition to the curriculum.

**BIO 281. Special Topics in Ecology. 0 to 4 Hours.**

Selected topics in Ecology at the introductory or intermediate level. These courses are typically newly designed and are being explored for possible adoption as a regular addition to the curriculum.

**BIO 301. Medical Terminology. 1 Hour.**

This course is designed to fill the requirement of many "allied health" graduate schools for a course in medical terminology. This will be a guided self study. A chapter of the textbook will be assigned every day, and you will complete the reading and take a quiz at any time of the following day. You should expect to spend about an hour per day on this course.

**Prerequisite:** BIO 342 with a minimum grade of D.

**BIO 303. Introduction to Public Health. 3 Hours.**

Effective public health systems require the application of biological knowledge to prevent and treat disease and improve the health of communities. In this course students will study the disciplinary foundations of public health and epidemiology. Then, using real examples and cases involving infectious and chronic diseases, students will investigate the biological and social factors that affect the health of human communities from the local to global levels. This course is open to all majors, but students must have junior or senior standing.

**BIO 305. Conservation Biology. 3 Hours.**

This course will provide an introduction to the discipline of conservation biology. Topics covered will include patterns of biodiversity and extinction, threats to biodiversity, biological principles guiding conservation, and strategies for protecting and restoring biodiversity.

**Prerequisite:** BIO 213 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 309. Seminar in Evolutionary Biology. 3 Hours.**

Designed to refine and extend student fluency (both verbal and written) in evolutionary biology topics and techniques through critical reading and analysis of primary research articles.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 310. Seminar in Ecology. 3 Hours.**

This seminar is designed to refine and extend student fluency (both verbal and written) in ecological topics and techniques through the dissection and discussion of research papers.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 311. Seminar in Genetics and Genomics. 3 Hours.**

Designed to refine and extend student fluency (both verbal and written) in current genetics and genomics topics and techniques through critical reading and analysis of primary research articles.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 313. Plants & Ecosystems. 3 Hours.**

A study of plants and how they interact with their environment. Topics include interactions with both abiotic and biotic portions of their environment, with emphasis on biotic interactions. The study of these interactions include: plants and their pollinators, herbivores, mycorrhizal fungi, and an introduction to plant-plant interactions.

**Prerequisite:** BIO 216 with a minimum grade of D.

**BIO 314. Plant & Ecosystems (with lab). 4 Hours.**

Identical to BIO 313, but with a lab component. The lab provides the opportunity to conduct hands-on experience with the scientific method in the context of plant biology and ecology. Skills in question formation, experimental design, experimental execution, and documentation of the results will be developed.

**Prerequisite:** BIO 216 with a minimum grade of D.

**BIO 322. Biology of the Vertebrates. 3 Hours.**

An exploration of the biology, natural history and diversity of vertebrates, and the evolution of form and function within this group.

**Prerequisite:** BIO 213 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 323. Biology of the Vertebrates (with lab). 4 Hours.**

Identical to BIO 322, but with a lab component. The lab focuses on developing and conducting an original research project centered on vertebrate biology. Skills in preparing a primary literature review, producing a grant proposal, sound experimental design and data analysis will be developed. Students will conduct an original research project and prepare results for written and oral presentation.

**Prerequisite:** BIO 213 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 324. Microbiology (with lab). 4 Hours.**

Study of the biology of microorganisms, with emphasis on bacteria and viruses. Laboratory work includes techniques for handling, culturing and identifying bacteria, identification of unknown bacterial species and development of epidemiological models for the spread of infectious diseases.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 325. Comparative Reproductive Biology. 3 Hours.**

An examination of the biology of reproduction in a variety of animal species. Topics include: the evolution of sex, sex determination, female and male reproductive systems, fertilization, and early embryonic development. Additionally, current topics in the field including reproductive disorders and endocrine disrupting contaminants will be discussed. Topics will be covered using approaches from genetics, cell biology, anatomy, and physiology. Students will read primary literature, and analyze case studies and clinical scenarios.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 326. Comparative Reproductive Biology (with lab). 4 Hours.**

Identical to BIO 325, but with a laboratory component. Students will design and conduct a multi-week experiment.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 331. Developmental Biology. 3 Hours.**

Study of the biological mechanisms driving organismal development, the process by which complex organisms are formed from single cells. Includes a description of early embryonic development from fertilization through formation of the nervous system.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 332. Developmental Biology (with lab). 4 Hours.**

Identical to BIO 331, but with a lab component. The lab focuses on a research project in which students explore the recent literature and practice the laboratory techniques used in this field.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 333. Nutrition. 3 Hours.**

An integrated overview of nutrition to include the physiology of digestion and absorption, basic nutrients and their utilization, vitamins and minerals, additives, healthy diets and lifestyle, cultural and social influences on diet, weight control and life-cycle nutrition.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 342. Human Physiology (with lab). 4 Hours.**

Study of the concepts of physiological mechanisms responsible for maintaining homeostasis in humans, including: thermoregulation, neural and hormonal control systems, muscle function, cardiovascular function, and renal function. In lab, physiological data are collected and analyzed using a variety of methods. Case studies are also incorporated.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 344. Mammalian Histology (with lab). 4 Hours.**

Microscopic study of the cellular structure of tissues and organs. In lab, students examine prepared microscope slides while consulting their text-atlas before reviewing digital images of histological material.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 342 with a minimum grade of C.

**BIO 351. Research Methods & Communication, Neurobiology (with lab). 4 Hours.**

Projects designed to engage students in research methods, critical reading of the primary literature, and oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 352. Research Methods & Communication, Ecology (with lab). 4 Hours.**

Projects designed to engage students in research methods in critical reading of the primary literature, and in oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 353. Research Methods & Communication, Organismal Biology (with lab). 4 Hours.**

Projects designed to engage students in research methods, in critical reading of the primary literature, and in oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 354. Research Methods & Communication, Genetics & Genomics (with lab). 4 Hours.**

Projects designed to engage students in research methods, in critical reading of the primary literature, and in oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 355. Research Methods & Communications, Cell & Molecular Biology (with lab). 4 Hours.**

Projects designed to engage students in research methods, in critical reading of the primary literature, and in oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 356. Research Methods and Communication, Evolutionary Biology (with lab). 4 Hours.**

Projects designed to engage students in research methods, in critical reading of the primary literature, and in oral and written communication of original research in this topic area.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 360. Current Topics in Biology. 3 Hours.**

An in-depth examination of selected topics, considered from biological, historical, philosophical and sociopolitical perspectives. Possible topics include: human embryonic stem cell research, AIDS, the environment, eugenics and human genetics, human experimentation, teaching evolution, emerging viruses, psychotropic drugs, world population, international public health, and biological warfare.

**Prerequisite:** BIO 213 with a minimum grade of D.

**BIO 370. Field Biology (with lab). 4 Hours.**

Introduction to the identification and natural history of arthropods, animals and selected groups of non-vascular "plants," emphasizing the identification of specimens using dichotomous keys and other print/web resources. Labs are typically in the field practicing the skills to identify organism by sight recognition.

**Prerequisite:** BIO 213 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 372. Field Botany (with lab). 4 Hours.**

Introduction to the vascular plants and plant communities of South Carolina, including ecology and natural history, use of dichotomous keys in identification, and field recognition of plants and plant communities.

**Prerequisite:** BIO 150 with a minimum grade of D.

**BIO 382. Ecology (with lab). 4 Hours.**

Scientific study of the interactions that determine the distribution and abundance of living organisms. Topics include: ecological principles are at the level of the organism, the population, the community, and the ecosystem. Current research literature will be utilized.

**Prerequisite:** BIO 216 with a minimum grade of D.

**BIO 383. Ecotoxicology. 3 Hours.**

Examines the effect of environmental contaminants on individuals, populations, communities, and ecosystems, including how special interests influence toxicological issues facing the nation and world today and in the future.

**Prerequisite:** BIO 215 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 385. Marine Biology. 3 Hours.**

Examines the physical and biological components of marine ecosystems with an emphasis on the diversity of organisms and their ecological adaptations to the sea. Additionally, issues that significantly impact the environmental and ecological stability of ocean communities will be discussed.

**Prerequisite:** BIO 215 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 386. Freshwater Biology (with lab). 4 Hours.**

An exploration of the physical attributes and biological communities of freshwater ecosystems. Topics include how and why many freshwater systems may be over-exploited and ill-used and the subsequent impact on our water resources. Lab includes travel to explore local/regional streams and lakes.

**Prerequisite:** BIO 215 with a minimum grade of D or ENVS 203 with a minimum grade of D.

**BIO 391. Animal Behavior. 3 Hours.**

An exploration of the diverse science of animal behavior. Topics will range from the ultimate evolutionary causes of behavior to the internal mechanisms (such as genes and hormones) that influence animals responding to complex, environmental factors.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 392. Animal Behavior (with lab). 4 Hours.**

Identical to BIO 391, but with a lab component. Students will apply the methods of ethology in field and laboratory settings and conduct an original research project centered on animal behavior.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 399. Evolution. 3 Hours.**

Introduction to the facts and theories of biological evolution. Topics include a historical overview, the evidence for evolution, adaptation and natural selection, the evolution of diversity, the fossil record, extinction, evo-devo, genomics, and evolutionary genetics.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 400. Evolutionary & Integrative Biology (with lab). 4 Hours.**

An advanced study of evolutionary biology and an exploration of complex biological questions and 21st century societal issues in biology from an integrative perspective.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 421. Human Genetics Seminar. 3 Hours.**

The study of genes and their function, concentrating on human genes and genetics.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 422. Human Genetics Seminar (with lab). 4 Hours.**

Identical to BIO 421, but with a lab component.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 423. Immunology. 3 Hours.**

A comprehensive introduction to the mechanisms of immune system function focusing on the mammalian immune system and utilizing case studies of immunological disorders.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 424. Immunology (with lab). 4 Hours.**

Identical to BIO 423, but with a lab component. Students will practice the research techniques used in this field.

**Prerequisite:** BIO 215 with a minimum grade of D.



**BIO 433. Cellular Biochemistry. 3 Hours.**

Study of the mechanisms of life on the cellular level. Topics may include cell metabolism, enzyme mechanisms and regulation, cell-cell communication, and errors of metabolism. Special attention will be focused on applications of biochemistry to health and disease.

**Prerequisite:** BIO 215 with a minimum grade of C-.

**BIO 440. Comparative & Human Anatomy (with lab). 4 Hours.**

Study of vertebrate and human anatomy with an emphasis on form and function. Topics include the evolution of vertebrates, developmental processes, biomechanics, pathology, and current research. Lab includes model construction, extensive dissection, and comparative morphology of extant species.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 445. Neurobiology. 3 Hours.**

Study of the structure and function of the nervous system from subcellular to systems levels with emphasis on the experimental foundation of modern principles.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 446. Neurobiology (with lab). 4 Hours.**

Identical to Biology 445, but with a lab component. The lab includes cellular and physiological studies using fly larvae as a model system, comparative anatomical studies using sheep brain as a model, and student generated hypothesis testing in the areas of sensation and perception, learning, and /or cognition. Students also explore complimentary research in this field, and assessments include written and oral presentations of their work.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 447. Cellular Neurobiology. 3 Hours.**

Study of the structure and function of the nervous system emphasizing the subcellular, electrochemical, and signaling properties of neurons that establish the foundation for functional neural circuits and neuronal plasticity. This course places special emphasis on the experimental foundation of modern principles.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 448. Systems Neurobiology. 3 Hours.**

Study of the structure, function, and anatomical organization of neural circuits comprising the sensory and motor circuits of the nervous system with special emphasis on sensory/ motor integration leading to behavior and cognition. This course places special emphasis on the experimental foundation of modern principles.

**Prerequisite:** BIO 215 with a minimum grade of D and BIO 216 with a minimum grade of D.

**BIO 449. Cancer Biology. 3 Hours.**

This course addresses the fastest growing and changing field in biology and medicine today: Oncology. We will study the function of cancer cells in depth and learn about the advances in molecular biology, genomics, cell biology and immunology that are revolutionizing the clinical battle against the myriad forms of cancer.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 450. Research. 1 to 4 Hours.**

Original research in an area of student's interest.

**Prerequisite:** BIO 250 with a minimum grade of D.

**BIO 480. Advanced Topics in Biology. 0 to 4 Hours.**

Selected topics in Biology at the advanced level. Courses with this designation are typically newly designed and are being explored for possible adoption as a regular addition to the curriculum.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 481. Special Topics in Ecology. 4 Hours.**

Selected topics in Ecology at the advanced level. Courses with this designation are typically newly designed and are being explored for possible adoption as a regular addition to the curriculum.

**BIO 491. Case Studies In Human Disease. 3 Hours.**

A survey of all of the broad disease categories: genetic and congenital abnormalities, inflammatory/autoimmune diseases, environmentally linked diseases, forensic pathology, infectious disease, and neoplasia/ cancer. Discussion of case studies will be used to reinforce disease concepts.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 493. Case Studies in Public Health. 3 Hours.**

Using a case study format and self-directed learning, students in this course will consider important local, national, and international public health issues. Community and or campus service projects may be incorporated.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 495. Case Studies in Biomedicine. 3 Hours.**

Study of the biology of human disease through patient-oriented problem solving and self-directed learning under the guidance of a mentoring physician. Discussions of readings on medically related topics (e.g., art of diagnosis, impact of technology on medicine, mortality and medicine) and a patient-interview exercise complement the case studies sessions.

**Prerequisite:** BIO 215 with a minimum grade of D.

**BIO 497. Case Studies in Environmental Issues. 3 Hours.**

The course challenges students to consider environmental issues that confront us locally, nationally and globally. A case study format will be used to provide students with a practical approach to environmental problems. This course is open to all majors, but students must have junior or senior standing.

**BIO 500. Honors Course. 3 Hours.**

At the discretion of the faculty, students may undertake a six-hour independent course of study in the senior year in order to broaden their educational experience within their major area of study. Students must meet specific GPA standards and arrange a faculty sponsor. The honors course criteria are outlined in the Academic Honors portion of the catalog.

**Prerequisite:** BIO 215 with a minimum grade of D.