

BIOLOGY (BIOL)

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The Department of Biology provides students with a strong foundation in the biological sciences, pre-professional, or forensic sciences. Using experiential, inquiry-based learning and scholastic rigor, our curriculum stimulates academic excellence through independent thinking, interdisciplinary applications and critical analysis to develop tomorrow's leaders in the natural sciences. The major is divided into five possible tracks: (1) Biology A.B., (2) Forensic Biology A.B., (3) Biology B.S. (4) Pre-professional Biology B.S., and (5) Forensic Biology B.S.

All biology courses include laboratory experiences, fieldwork and/or off-campus field trips. Expanded study and research opportunities are available on the Guilford campus, at the North Carolina coast, in the mountains, and at regional universities and organizations. Several biology courses are included as options for majors in environmental studies, public health, sports studies, and health sciences. Numerous study abroad programs offer students the opportunity to study in various places around the world. Biology (B.S. track) majors are encouraged to pursue independent research projects under the supervision of a biology faculty member through collaborations with other universities, summer REUs or with Guilford faculty. This research can lead to the generation of a senior thesis (BIOL 470) or departmental honors (BIOL 490). In addition, there are numerous opportunities for student participation in independent studies (BIOL 260 or 460) and internships (BIOL 290).

Degrees Offered

The Bachelor of Arts and Bachelor of Science degrees are offered in biology and in forensic biology.

- **Biology, BA Major**
- Biology, BS Major (<https://catalog.guilford.edu/catalog/academic-departments-majors/biology/biology/#bachelorofsciencetext>)
- Pre-Professional Biology (<https://catalog.guilford.edu/catalog/academic-departments-majors/biology/biology/#bachelorofsciencetext>)
- Biology Minor (<https://catalog.guilford.edu/catalog/academic-departments-majors/biology/biology-minor/>)
- Forensic Science (<https://catalog.guilford.edu/catalog/academic-departments-majors/biology/forensic-science-minor/>)
- Integrated Science (<https://catalog.guilford.edu/catalog/academic-departments-majors/biology/integrated-science-minor/>)

BIOL 101. Explorations in Biology: Special Topics. 4.

In this course, students will be exposed to the discipline of biology by examining a particular topic in depth. Students will engage in the process of science through a research experience and will draw connections between biology and society. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 113. Intro Molecular & Cell Biology. 4.

This course will focus on the molecular and cellular aspects of Biology, including the molecular building blocks of life, genetics and DNA, cellular structure/function, reproduction and the energy pathways of photosynthesis and respiration. In the laboratory, the students will become familiar with the scientific method, applying the concepts they are learning in class through inquiry-based laboratory exercises. Biology 113 is a prerequisite for higher-level biology courses and is required for Biology and Forensic Biology majors. This course will not count towards any the Biology major degree tracks. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 150. Special Topics. 8.

Possible courses include: Dendrology, Vertebrate Social Behavior, Genetic Engineering and Human Disease. May also be offered at the 250, 350 and 450 levels. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 151. HPEvolution. 4.

An examination of the views of species origins prior to Darwin, Darwin's theories and those of his contemporaries and the history of evolutionary theory in modern times. One of the weekly class periods will be used to give students practical experience in the methods of evolutionary study, such as techniques for determining protein all types, and examining species relationships through DNA analysis.

Prerequisite: ENGL 102. Fulfills historical perspectives requirement (1998 & 2019).

BIOL 201. Intro Biol: Form and Function. 4.

In this course, students will be exposed to the diversity of life on Earth. An evolutionary perspective will be taken throughout, as the course underscores the relationship between form and function of organisms. This course explores various aspects of animal and plant diversity with an emphasis on form and function. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 202. Intro Biol: Ecol and Evolution. 4.

This course covers evolutionary biology and ecology, with the goal of exposing students to a broad range of topics and ideas in both disciplines and as an integrated whole. We will examine how organisms interact with their environment at the individual, population, and community levels, while also This course covers evolutionary biology and ecology, with the goal of exposing students to a broad range of topics and ideas in both disciplines and as an integrated whole. We will examine how organisms interact with their environment at the individual, population, and community levels, while also looking at the effects of humans on the natural world. Additionally, we will explore the mechanisms of evolution that have resulted in the diversity of life on Earth. This course is designed to help students develop skills of science, including observation, experimental design, written and oral communication, critical thinking, and problem-solving, in a collaborative environment. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 203. Intro Biol:Molecules and Cells. 4.

This course focuses on the molecular and cellular aspects of Biology, including the molecular building blocks of life, genetics and DNA, cellular structure/function, reproduction and the energy pathways of photosynthesis and respiration. In the laboratory, the students will become familiar with the scientific method, applying the concepts they are learning in class through a semester-long, authentic research project. Fulfills the natural science/mathematics requirement (1998 & 2019).

Prerequisite: CHEM 111

BIOL 209. Human Biology. 4.

An introductory study of the human body, including the basic structure and function of the major organ systems (nervous, endocrine, circulatory, reproductive, etc.) and the effects of diet, exercise, stress and environmental change on human health. Does not count toward the major. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 212. Environmental Science. 4.

Study of the structure and function of ecosystems with reference to energy flow, nutrient cycling, population growth and regulation, and community organization and dynamics. Particular emphasis on the relationship between humans and the environment. Fulfills natural science and mathematics and social justice/environmental responsibility requirements (1998). Fulfills the natural science/mathematics and evaluating systems and environments requirements (2019).

BIOL 215. General Botany. 4.

Introductory study of the plant kingdom including morphology, anatomy, physiology, ecology and evolution. Laboratory study includes observation of the morphology and anatomy of typical plant species and a variety of plant physiology experiments. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 224. Field Botany. 4.

Taxonomic study of vascular plants involving classification, collection and identification in the field and laboratory.

Prerequisite: BIOL 201, 202 and 203 or instructor permission.

BIOL 233. North Carolina Freshwater Fishes. 4.

A field course for those students desiring an outdoor lab science. Field studies introduce students to the diversity, distribution and ecology of North Carolina freshwater fishes.

Prerequisite: BIOL 201, 202 and 203 or instructor permission. Fulfills natural science/mathematics and social justice/environmental responsibility requirements (1998). Fulfills the natural science/mathematics and evaluating systems and environments requirements (2019).

BIOL 235. Vertebrate Field Zoology. 4.

Advanced study of vertebrates, emphasizing morphology, taxonomy, ecology and behavior of representative tetrapod species. Laboratory work includes field studies of the major groups of North Carolina tetrapod vertebrates.

Prerequisite: BIOL 201, 202 and 203 or instructor permission.

BIOL 238. Field Biology. 4.

Exploration of the natural systems around you inspires endless scientific questions. In this class, we'll travel to a variety of sites near and far from campus, using each to become familiar with the types of ecosystems found in the region, to identify common plant and animal species, and to address ecological questions employing common methods used in the collection of ecological data. The course will be organized around an environmental theme that students investigate in a variety of habitats throughout the region. During this course we will spend a significant amount of time in the field, including overnight field trips.

Prerequisite: BIOL 202 or instructor permission.

BIOL 242. Natural Science Seminars. 4.

Studies of the biology, geology, ecology and natural history of different field areas, including the American Southwest, the Galapagos, East Africa, Brannenburg, North Carolina and other areas. Includes a one-to three-week trip to the area being studied, depending on when the course is offered; trip includes research project. When course is offered for a minimum of 4 semester credits, the course will fulfill natural science/mathematics and social justice/environmental responsibility requirements (1998); natural science/mathematics, evaluating systems and environments requirements, and embodied and creative engagement requirements (2019).

BIOL 245. Introduction to Forensic Science. 4.

Introduction to in-depth study of the application of the biological, chemical and physical sciences to the examination of forensic evidence. Explores the underlying physiological and biochemical basis for forensic methods; laboratory analysis includes microscopy, chromatography, hair, fingerprints, serology and introduction to DNA profiling. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 250. Special Topics. 8.**BIOL 260. Independent Study. 1-8.**

May also be offered at 360 and 460 levels.

BIOL 290. Internship. 1-8.

May also be offered at the 390 level.

BIOL 291. Introduction to Scientific Inquiry. 4.

This course is designed to 1) build students' understanding and ability to judge scientific information from sources including, first, the media and common lay outlets, then secondary popular sources and finally peer-reviewed primary journals and research papers; and 2) help students use this knowledge to develop and refine their own writing.

Prerequisite: BIOL 202, BIOL 203, or instructor permission, and Historical Perspectives.

BIOL 292. Scientific Inquiry: Introduction to Research in Community Health Issues (PBH 292). 4.

This course embraces multiple aspects of community-based, interdisciplinary research. Prior to beginning research projects, students will learn about the changing demographics of Guilford County including refugees and underserved populations. They will also receive training in anti-racism and cultural competency to prepare students for working with community members. Through community outreach efforts, students will be involved in the formation and implementation of focus groups and community events to build trusting relationships with community members as well as to identify and assess community needs. Students will work with faculty and student leaders to design, implement and evaluate a community-based research project. Projects will address current community concerns ranging from access to health care to medical and nutritional needs. This instruction will help in the promotion of effective, focused research and will prepare students for developing sustainable relationships with the targeted community.

Prerequisite: BIOL 202, 203 or instructor permission. Fulfills the natural science/mathematics requirement (1998 2019).

BIOL 313. Molecular Cell Biology. 4.

A study of the structure and function of eukaryotic cells including: microscopic structure, biochemical components, the organization of macromolecules into organelles, and coordinated function of organelles in the living cell. Includes a detailed study of chromosome structure and function; DNA, RNA and protein synthesis.

Prerequisite: BIOL 203 and CHEM 112 or BIOL 246 or instructor permission.

BIOL 315. Microbiology. 4.

A study of microbial classification, structure, metabolism and genetics with primary foci on bacterial cells and viruses. This course includes a survey of microbial importance in human disease, immunology, environmental studies and industrial applications. The laboratory experience includes methods of aseptic technique, bacterial isolation, metabolic characterization and microbial identification with an introduction to molecular techniques.

Prerequisite: CHEM 112, BIOL 202 and 203.

BIOL 322. Mec. of Medicine & Magic. 4.

This experiential team-taught, intensive, three-week, interdisciplinary study abroad course will take place in and on the grounds of Alnwick Castle in Northumberland, in the far northeastern reaches of England. The course explores the intersections and distinctions between the causal systems, modalities, and mechanisms of magic and medicine. With site visits to the island castle and priory of Lindisfarne, the Scottish city of Edinburgh, the Magic & Medicine Garden of Dilston, Alnwick town, and the castle's bucolic gardens and park grounds, the course will begin with a rigorous investigation into the history of the importance of the concept of causality in both scientific and non-empirical thought, and with student projects about medicinal herbs. The centerpiece of the course will utilize the Reacting to the Past pedagogical engaged-learning collaborative theatrical scenario about Charles Darwin. The final week will involve classes on the castle grounds about postmodern intercultural understandings of magic and the mysteries of the mechanisms of medicine and health. Students will spend the full three-week course living in Alnwick Castle, famously the cinematographic setting of Harry Potter's Hogwarts. There are no prerequisites for this course. Instructor permission required prior to registration. Fulfills the natural science/mathematics requirement (1998 & 2019).

BIOL 332. Invertebrate Zoology. 4.

Advanced study of invertebrate phyla with emphasis on taxonomy, physiology and ecology of the several groups.

Prerequisite: BIOL 201, 202, 203 or instructor permission. Offered when demand and scheduling permit.

BIOL 333. Ichthyology. 4.

Study of the diversity, distribution and ecology of the world fish fauna with emphasis on field studies of North Carolina populations. Basic anatomy and physiology will also be covered.

Prerequisite: BIOL 201, 202, 203 or instructor permission. Offered when demand and scheduling permit.

BIOL 334. Animal Behavior. 4.

The zoological approach to the study of animal behavior (ethology), behavioral ecology, types of social organization and communication in animals, and the evolution of behavior in selected species. The laboratory section of the course will provide opportunities for students to observe and record the behavior of a variety of animals. Students will conduct individual research projects at the North Carolina Zoo.

Prerequisite: BIOL 201, 202, 203 or instructor permission. Alternate years.

BIOL 336. Ornithology. 4.

This field-oriented course introduces students to the scientific study of birds, including broad concepts in avian biology, bird identification, and field research techniques. Through a combination of in-class learning, field trips, and student-led research projects, students will gain an understanding of avian ecology, anatomy, physiology, and behavior. During this course we will spend a significant amount of time in the field. Some semesters this course may be taught on campus and in other semesters as a study abroad experience.

Prerequisite: BIOL 201 and 202 or instructor permission. Spring, three week.

BIOL 338. Conservation Biology. 4.

This course introduces students to the discipline of conservation biology, the scientific approach to the conservation of biological diversity. Students will examine the causes and consequences of biodiversity loss, approaches and strategies to prevent it, and ecological and evolutionary theory underlying conservation. Because conservation biology is a multidisciplinary field students will also examine the connections between humans, biodiversity threats, and the complexities of implementing science-based conservation policy and management. The course combines lectures and class discussions on assigned readings and case studies, fieldwork, and assignments that expose students to the type of work conservation biologists do. Special emphasis is placed on critical thinking, problem solving, and global understanding. Students will also interact with professionals with careers in conservation biology.

Prerequisite: BIOL 201 or BIOL 202 or instructor permission. Preferred Prerequisites or Corequisites: BIOL 338L

BIOL 338L. Conservation Biology Lab. 4.**BIOL 340. Psychobiology (PSY 340). 4.**

Study of behavior from a biological point of view. Focus on the structure and function of the nervous system and on the relationships between behavior and the nervous system. Corequisite: laboratory work.

Prerequisite: Either two courses in biology or one course in biology and one course in psychology.

BIOL 341. Human Anatomy and Physiology I. 4.

Detailed study of the structure and function of human nervous, sensory, endocrine, integumentary, skeletal, muscular and respiratory systems.

Prerequisite: Biol 203. Fall.

BIOL 342. Human Anatomy and Physiology II. 4.

Detailed study of the structure and function of human cardiovascular, lymphatic, immune, digestive, excretory and reproductive systems.

Prerequisite: BIOL 203 and 341. Spring.

BIOL 343. Sensory Systems. (PSY 343). 4.

Detailed study of each of the major sensory systems, including the anatomy and physiology of each system, an analysis of the stimulus and measurements of sensory abilities. Laboratory work.

Prerequisite: either two courses in biology or one course in biology and one course in psychology. Alternate years. Fall.

BIOL 345. SURVEY IN FORENSICS. 1-4.

This course introduces the theories and fundamentals of the investigative process. Topics include crime scene and incident processing, information gathering techniques, collection and presentation of evidence, preparation of appropriate reports, court presentations and other related topics. Upon completion students should be able to identify, explain and demonstrate the techniques of the investigative process, report preparation and courtroom presentation.

BIOL 345L. Survey in Forensics. 4.

This course introduces the theories and fundamentals of the investigative process. Topics include crime scene and incident processing, information gathering techniques, collection and presentation of evidence, preparation of appropriate reports, court presentations and other related topics. Upon completion students should be able to identify, explain and demonstrate the techniques of the investigative process, report preparation and courtroom presentation.

Prerequisite: BIOL 245

BIOL 346. Forensic Chemistry. 4.

Explores methods used to examine and identify evidence of criminal activity, including chemical techniques for developing fingerprints, the chemistry of explosives, drug identification, PCR for DNA profiling and STR analysis.

Prerequisite: BIOL 203 and 245 or instructor permission. Alternate years. Spring.

BIOL 349. Forensic Anthropology. 4.

4. The study of human osteology and skeletal anatomy. Students learn how to collect and process skeletal remains, use tables and to use tales and apply formulae to identify bones and bone fragments. Skeletal remains are used to illustrate the range of normal variation, for the determination of sex, race and age and to determine the cause and manner of death. Additional topics include forensic odontology, forensic entomology and fiber analysis.

Prerequisite: BIOL 245 and BIOL 341 or instructor permission.

BIOL 350. Special Topics. 8.**BIOL 351. Comparative Vertebrate Anatomy. 4.**

Brief survey of the main classes of vertebrates; detailed comparative study of the major vertebrate organ systems.

Prerequisite: BIOL 201, 202. Offered when demand and scheduling permit.

BIOL 352. Animal Physiology. 4.

The various physiological processes characteristic of living organisms; functioning of the individual organ systems with emphasis on interrelationships between organ systems and functioning of organ systems in the maintenance of homeostasis; and selected topics in comparative vertebrate physiology.

Prerequisite: BIOL 201, 203. Offered when demand and scheduling permit.

BIOL 360. Independent Study. 1-8.**BIOL 390. Internship. 8.****BIOL 434. Biochemistry (CHEM 434). 4.**

A study of the chemical structure and physiological function of the biochemical building blocks of living organisms including proteins, carbohydrates, lipid metabolism and nucleic acid synthesis. The laboratory experience includes techniques used in the isolation and identification of proteins, lipids and nucleic acids.

Prerequisite: BIOL 203 and CHEM 232.

BIOL 438. General Ecology. 4.

Basic ecological principles governing the structure and function of populations, communities and ecosystems.

Prerequisite: BIOL 201, 202, and 203 or instructor permission. Fulfills social justice/environmental responsibility requirement (1998).

Evaluating systems and environments requirement (2019).

BIOL 443. Genetics. 4.

A study of structural and functional prokaryotic and eukaryotic molecular genetics including: replication, mitosis, meiosis, chromosome mapping, gene structure, expression and mutation. Mendelian inheritance and population genetics are also explored.

Prerequisite: BIOL 201, 202, and 203, CHEM 231; recommended BIOL 313 or BIOL 315 or instructor permission.

BIOL 449. Forensic Anthropology. 4.

The study of human osteology and skeletal anatomy. Students learn how to collect and process skeletal remains, use tables and to use tales and apply formulae to identify bones and bone fragments. Skeletal remains are used to illustrate the range of normal variation, for the determination of sex, race and age and to determine the cause and manner of death. Additional topics include forensic odontology, forensic entomology and fiber analysis.

Prerequisite: BIOL 203, 245 and BIOL 341 or instructor permission.

BIOL 450. Special Topics. 8.**BIOL 460. Independent Study. 1-8.**

May also be offered at the 260 and 360 levels.

BIOL 470. Senior Thesis.. 1-8.

Individual experience in biological research and writing of a professional paper.

BIOL 475. Research Seminar (CHEM 475). 2.

This course introduces the principles and concepts of presenting scientific research. Emphasis is placed on the preparation of oral and poster presentations and the implementation of proper etiquette for undergraduate symposia. This course also covers the preparation of funding proposals, curriculum vitae, Statements of Intent and the interview process for post-undergraduate programs. Students are required to present their research at two undergraduate meetings including the Guilford Undergraduate Symposium.

BIOL 490. Departmental Honors. 1-8.

4-8.