

BIOLOGY

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The objectives of the Biology Department are to afford students an opportunity to gain an understanding of themselves and their environment and thus prepare themselves for taking a fuller, more satisfying role in society; to train students in their ability to reason inductively and deductively; to encourage original thought; to prepare teachers in the biological sciences for the elementary and secondary school; and to provide a background in subject matter and laboratory skills for curricula in which the fundamentals of the various sciences are used.

The department offers the following programs leading to the Bachelor of Science degree in Biology with indicated track or licensure and the Bachelor of Science degree in Environmental Science. Students should consult the department head for details of each program.

Biology (with tracks in **Botany**, **Zoology**, **Molecular Biology**, or **Environmental Biology** possible)

Biology with Teacher Licensure (approved by NSTA)

Biology — Medical Technology Program

Biology — Biomedical Emphasis

Environmental Science

Also available is a B.S. degree program with Teacher Licensure in Science Education with a concentration in Biology.

BACHELOR OF SCIENCE IN BIOLOGY

Requirements for a Bachelor of Science Degree in Biology	Sem. Hrs.
Core of Required Courses (below), including General Education	82-83
MAT 215	4
Electives	33-34
Total:	120

CORE OF REQUIRED COURSES (for all degree programs in biology)	Sem. Hrs.
Freshman Seminar	1
General Education Requirements *	44
Required Biology Courses: BIO 100, 100L, 101, 102, 304, 371, 472	24
Biology Track (see below): choose one	11-12
Botany Track; Zoology Track; Molecular Biology Track;	
Environmental Biology Track; or	
No Track (any biology course except those for non-majors)	
Chemistry Requirements: 130, 131, 110, 111	8
Mathematics Requirements: 107, 210	6
(in addition, MAT 215 is required for many programs; MAT 221 and 222 also satisfy Mathematics Requirement.)	

Core Total*: 82-83

*12 semester hours of Natural Sciences and Mathematics count toward General Education and toward major requirements. *Additional requirements apply to specific programs.*

Biology Tracks (choose one to meet Track Requirement in the Core)

Botany Track (11-12 sem hr): Three of the following:

BIO 231, 232, 305, 340, 354

Environmental Biology Track (11-12 sem hr): Three or four of the following:

BIO 231, 301, 305, 340, 410, 432, ENV 220, 230, 240

Molecular Biology Track (11-12 sem hr): Three of the following:

BIO 314, 315, 322, 323, 354, 461

Zoology Track (11-12 sem hr): Three of these, with 1 or more from each area

Invertebrate Area: BIO 301, 310, 319; Vertebrate Area: BIO 203, 205, 461

BACHELOR OF SCIENCE IN BIOLOGY EDUCATION (9-12)

Coordinator: Rachel McBroom

Upon successful completion of the program of study in Biology Education and related requirements, graduates are eligible for an "A" license to teach in the State of North Carolina. For a more detailed description, including the program standards and goals and objectives, turn to Undergraduate Licensure Programs in the School of Education section of this catalog.

Course Requirements	Sem. Hrs.
Freshman Seminar and General Education	45(33)*
Specialty Area (*12 semester hours of Natural Sciences and Mathematics may count toward General Ed)	59-60
BIO 100 & 100L, 101, 102, 304, 371, 422, 472	
Biology Electives 8-9 hours	
CHM 130 & 110, 131 & 111, 250	
MAT 107, 210	
PHY 150	
GLY 115	
Professional Studies	15
EDN 302, 308, 350, 419, SED 300	
Content Pedagogy	18
SCE 300, 301, 400	
CSC 405	
SCE 449	
General Electives	2-3
	Total: 128

NOTE: Students who desire teacher licensure in Biology Education should declare the major as soon as possible in their college career. Consultation with the Program Coordinator or program advisor prior to registering for General Education courses is strongly recommended.

BIOLOGY: MEDICAL TECHNOLOGY

Requirements for a Bachelor of Science Degree in Biology with Emphasis in Medical Technology (See Health Professions Programs for a description of this program.)	Sem. Hrs.
Core of Required Courses (above), except BIO 304 and BIO Electives	67
BIO 212, 315 (in lieu of BIO Electives)	8
CHM 250, 251	8
CSC 100	3
Electives	4
Clinical Work in Approved Hospital	30
	Total: 120
Fourth Year: Clinical Training in approved Program at McLeod Regional Medical Center—30 hours.	

BIOLOGY: BIOMEDICAL EMPHASIS

Requirements for a Bachelor of Science Degree in Biology with Biomedical Emphasis (See Health Professions Programs for a description of this program.)	Sem. Hrs.
Core of Required Courses (above), except BIO Electives	71
BIO 211, 212, 315, 461 (in lieu of BIO Electives)	16
CHM 226, 227, 250,251, 311, 312	20
PHY 150, 151, 156, 157	8
MAT 215	4
Electives	1
Total:	120

BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE

Requirements for a Bachelor of Science Degree in Environmental Science	Sem. Hrs.
Freshman Seminar	1
General Education*	44(31)
Required Courses:	
BIO 100*, 304, 431, 472;	12
ENV 210, 220, 230, 310, 320, 490	22
CHM 110*, 111, 130*, 131, 230, 250	12
GLY 115*; GGY 250; GLY 226, 246, or 262	6
MAT 107*, 210	3
Biology/Environmental Science Electives: choose 3 of the following:	
ENV 240, 410; BIO 422, 432	10-11
Electives	9-10
Total:	120

*Courses marked with an asterisk are General Education courses and their hours are counted as General Education hours.

BACHELOR OF SCIENCE IN SCIENCE EDUCATION (9-12)

Coordinator: Rachel McBroom

Upon successful completion of the program of study in Science Education and related requirements, graduates are eligible for an "A" license to teach in the State of North Carolina. For a more detailed description, including the program standards and goals and objectives, turn to Undergraduate Licensure Programs in the School of Education section of this catalog.

Course Requirements	Sem. Hrs.
Freshman Seminar and General Education	45(33)*
Specialty Area —Select one area of concentration (*12 semester hours of Natural Sciences and Mathematics may count toward General Ed)	
Biology Concentration:	62
BIO 100 & 100L, 101, 102, 304, 371, 422, 472	
MAT 107, 215	
CHM 130 & 110, 131 & 111, 250	
GLY 115 & 115L, 125 & 125L	
PHY 150 & 156, 151 & 157	
Chemistry Concentration:	62
See Chemistry and Physics Dept. for listing of course requirements.	
Earth Science Concentration:	62
See Chemistry and Physics Dept. for listing of course requirements.	
Physics Concentration:	62
See Chemistry and Physics Dept. for listing of course requirements.	
Professional Studies	15
EDN 302, 308, 350, 419, SED 300	

Content Pedagogy	18
SCE 300, 301, 400	
CSC 405	
SCE 449	
General Electives (as taken within area of concentration above)	0
	Biology Concentration Total: 128
	Chemistry Concentration Total: 128
	Earth Science Concentration Total: 128
	Physics Concentration Total: 128

NOTE: Students who desire teacher licensure in Science Education should declare the major as soon as possible in their college career. Consultation with the Program Coordinator or program advisor prior to registering for General Education courses is strongly recommended.

LICENSURE IN SCIENCE FOR MIDDLE GRADES EDUCATION (6-9)

Students majoring in Middle Grades Education (6-9) are required to complete two teaching specialty areas. For a detailed description of the program of study in Middle Grades Education, including the program standards and goals and objectives, turn to Undergraduate Licensure Programs in the School of Education section of this catalog.

Students majoring in Middle Grades Education (6-9) with a Science teaching specialty area should consult with the Coordinator of Undergraduate Science Education in the Department of Biology and the Middle Grades Program Coordinator in the School of Education.

Requirements for Licensure in Science for a B.S. in Middle Grades Education (6-9)	Sem. Hrs.
PHS 110, 108, 109 or PHY 150, 151, 156, 157; BIO 100, 100L, 103; CHM 130 & 110; GLY 115, 115L; SCE 300, 350	
	Total: 24

ACADEMIC CONCENTRATION IN BIOLOGY

For students seeking a baccalaureate degree in Elementary Education, Special Education, or Physical Education, the Biology Department offers an Academic Concentration of 26 hours. This Academic Concentration is available to other students, regardless of major.

Required Courses for an Academic Concentration in Biology:

BIO 100, 100L, 101, 102, 103, 210,
BIO 371 (or an approved upper-level biology course with a laboratory)
CHM 130, 110

Total: 26

COURSES

BIOLOGY (BIO)

BIO 100. Principles of Biology

An introduction to modern and classical biology concepts. Fall, Spring. Three lectures weekly. Credit, 3 semester hours.

BIO 100L. Laboratory Investigations and Experiences in General Biology

Introductory laboratory experiments in which basic principles of biology will be investigated. Fall, Spring. Credit, 1 semester hour. PREREQ: Enrollment in or credit for Biology 100.

BIO 101. General Botany

Introductory plant science with emphasis on morphology and physiology of the seed plants and a survey of representative types from the plant kingdom. A prerequisite to all other courses in botany. Fall, Spring. Three lectures and a two-hour laboratory weekly. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 102. General Zoology

Introductory coverage of the animal kingdom with emphasis on vertebrate systems, classification & survey of the animal phyla, and coverage of cellular respiration. Laboratory time will be spent on histology, anatomy, and a survey of phyla. A prerequisite to all other zoology courses. Fall, Spring. Three lectures and a two-hour laboratory weekly. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 103. Basic Human Biology

An elementary study of the human body in health and disease. This course relates fundamental knowledge about human anatomy and physiology to current issues. Questions such as how do birth control pills work? and what causes cancer? will be explored. Does not fulfill a BIO elective. Fall, Spring. Three lectures weekly. Credit, 3 semester hours.

BIO 203. Vertebrate Zoology

The biology of the major groups of vertebrate animals with emphasis on general structural and physiological plans and diversity. Spring of odd-numbered years. Three lectures and a two-hour laboratory weekly. Credit, 4 semester hours. PREREQ: BIO 100, 102.

BIO 205. Animal Behavior (PSY 204)

A survey of the functional and complexity categories of behavior with emphasis in the animal kingdom. Examples will range from one-celled organisms to humans. Other selected topics will include the evolution of behavior, sociobiology, animal cultures, behavioral ecology, behavioral genetics, neurobiology, consciousness and others. Three one-hour lectures and one two-hour laboratory per week. Laboratory time will consist of a mix of demonstrations, experiments, and films. Spring of odd-numbered years. Credit, 4 semester hours. PREREQ: BIO 100, 102.

BIO 211, 212. Human Anatomy and Physiology

A course covering the structure and function of the human body. Appropriate physiological exercises and dissections of a mammal are performed concurrently in the laboratory. Fall, Spring. Three lectures and a two-hour laboratory weekly. Credit, 4 semester hours each. PREREQ: BIO 100.

BIO 231. Morphology of the Non-Vascular Plants

A comprehensive survey of the algae, fungi, and bryophytes dealing with structure, form, and reproduction. Spring of even-numbered years. Three lectures and a two-hour laboratory period weekly. Credit, 4 semester hours. PREREQ: BIO 100, 101.

BIO 232. Morphology of the Vascular Plants

A continuation of Biology 231, a survey of the plant kingdom with emphasis on selected types of vascular plants. Spring of odd-numbered years. Three lectures and one two-hour laboratory weekly. Credit, 4 semester hours. PREREQ: BIO 100, 101.

BIO 301. Entomology

An introduction to the study of insects which emphasizes the classification, morphology, physiology, ecology, behavior, and importance of insects. Approximately one week will be devoted to spiders. A small collection with identification is required. Three lectures and a two-hour laboratory weekly. As Announced. Credit, 4 semester hours. PREREQ: BIO 100, 102.

BIO 304. Principles of Ecology

An analysis of the interactions of organisms with each other and the physical environment. Ecological process is examined at individual, community, and ecosystem levels. The basic kinds of ecosystems are surveyed. Three lectures and a three-hour laboratory weekly. Fall, Spring. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 305. Introductory Mycology

An introduction to the fungi, with emphasis upon taxonomy and physiology, including some reference to their economic importance. Special emphasis will be given to those that are animal or plant pathogens. As Announced. Two lectures and a two-hour laboratory period weekly. Credit, 3 sem. hrs. PREREQ: BIO 100, 101.

BIO 310. Invertebrate Zoology

A survey of the major invertebrate phyla emphasizing classification, morphology, natural history, evolution, and behavior. At least one Saturday coastal field trip is required. Fall of odd-numbered years. Credit, 4 semester hours. PREREQ: BIO 100, 102.

BIO 315. Microbiology

The biology of bacteria, fungi, algae, protozoa, and viruses, with special reference to bacteria. Microbial diseases, immunity and the role of microorganisms in human affairs are also emphasized. Three lectures and a two-hour laboratory weekly. Fall, Spring. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 319. Animal Parasitology

An introduction to the biology of parasites emphasizing classification, morphology, life history, pathology, treatment, ecology and evolution. Three lectures and a two-hour laboratory weekly. Spring of even-numbered years. Credit, 4 semester hours. PREREQ: BIO 100, 102.

BIO 320. Developmental Biology

A course on the classical, genetic, and molecular analysis of embryonic development with lab. Its purpose is to offer a blend of classical and modern topics, which are organized in three parts: 1. the natural sequence of developmental stages from gametogenesis and fertilization to histogenesis; 2. the differential gene expression; and 3. a series of core topics including pattern formation, sex determination, hormonal control, and growth. Examples are picked as they serve best to illustrate the general points to be made. Mammals or other vertebrates will be preferred whenever possible because we have a natural interest in their development. Spring as announced. Credit, 4 sem.hrs.

BIO 322. Biotechnology I

A laboratory-oriented course with lecture and laboratory components. Its purpose is to familiarize students with DNA science techniques in biotechnology and with scientific write-up of laboratory reports and to encourage their interest in graduate research and careers in this area. The course is open to Biology and Chemistry majors and is especially recommended to students that want to gain laboratory experience and dexterity before taking other higher level required courses. Fall as announced. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 323. Biotechnology II

A laboratory-oriented course to familiarize students with more advanced techniques in biotechnology, molecular genetics, and cell biology. The lecture portion of the course will cover concepts on which the techniques are based along with current and future applications. Students will gain experience with tissue and cell cultures, will learn techniques not covered in other required biology courses, and will become familiar with scientific write-up of laboratory reports. Spring as announced. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 340. Plant Systematics

An introduction to systematic botany and plant community ecology. The course emphasizes identification of the local flora as well as the recognition and characteristics of plant communities found in North Carolina. Spring of even-numbered years. Three lectures and a two hour lab weekly. Credit, 4 semester hours. PREREQ: BIO 100, 101.

BIO 351. Research Strategies

Introduction to scientific investigation including experimental design, data analysis, laboratory note-taking, and communication of the scientific results. Provides design and implementation of a focused project utilizing current techniques and methods in biotechnology. Recent research reports will also be analyzed to obtain an understanding of the principles underlying these approaches. Fall. Credit, 3 sem.hrs. PREREQ: BIO 100.

BIO 354. Plant Physiology

A study of the physiological activities in plants such as water relations, metabolism, plant growth hormones, as well as growth, development, and environmental adaptations. Fall of even-numbered years. Three lectures and a two-hour laboratory period weekly. Credit, 4 semester hours. PREREQ: BIO 100, 101.

BIO 370. Science Communication and Research Methods

A review of the current literature in a variety of biomedical journals. The format for presentation of material and the research methods employed will be examined. Designed so that students can obtain an understanding of how research is done and how it is reported. Credit, 1 semester hour. PREREQ: BIO 100, Consent of Instructor.

BIO 371. Cell Biology

A study of cellular ultrastructure, molecular organization, and physiology. Fall, Spring. Three lectures and a two-hour laboratory period weekly. Credit, 4 semester hours. PREREQ: BIO 100, CHM 130, 131; Recommended: CHM 250, 251.

BIO 381. Immunology

The biology and molecular events underlying the immune response and its relationship to the activities and strategies of foreign invaders (both infectious and non-infectious). Applied immunology including biotechnology and diagnostic tools is also presented. Fall. Credit, 3 sem.hrs. PREREQ: BIO 100, CHM 131.

BIO 410. Marine Biology

A survey of the common organisms associated with topical marine habitats. Emphasis will be on fish, invertebrates, algae, and birds. Coverage will include discussions of the coral reef and mangrove communities, ocean currents, and physical and geological factors. The course includes one week of on-campus study followed by one week of field and lab work at the Bermuda Biological Station for Research. There are additional costs involved in the Bermuda trip. Summer, As Announced. Credit, 3 semester hours. PREREQ: BIO 100.

BIO 414. Biogeography

The principles of biogeography will be discussed in light of current understanding of geology, geography and evolutionary biology. Biogeographic processes are examined at individual, community and ecosystem levels. The effects of a changing earth on species distribution and extinction will be assessed. Causes of modern and historical distributions of taxa will be examined. Three lectures weekly. Fall of even-numbered years. Credit, 3 sem.hrs. PREREQ: BIO 100.

BIO 422. Evolution

An introduction to and analysis of the concepts of organic evolution, mutation, adaptation, selection, competition, and origin of species are considered. Fall. Three lectures weekly. Credit, 3 sem.hrs. PREREQ: BIO 100.

BIO 431. Biometrics

This course covers the nature of the scientific method, hypothesis formulation, experimental protocols, and hypothesis testing. An emphasis is placed on the concepts of experimental design in biological systems, and on current methods of standard data analysis. During the semester, students will design a research project, collect data, analyze this data in an appropriate way, and write a research paper that conforms to standards of current biological journals. The course is recommended for students planning a research career in biology. Student understanding of basic statistics, and familiarity with microcomputer data bases and word processing programs are assumed. As Announced. Three lectures weekly and an independent research paper. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 432. Conservation Biology

The science of conserving the Earth's biodiversity. This course will examine mankind's impact on species, populations, and habitats. The role of government and the private sector in conservation will be discussed. Emphasis will be placed on defining the problems and identifying scientific solutions, based on ecological principles and case studies. Three lectures and a two-hour laboratory period weekly. As announced. Credit, 4 semester hours. PREREQ: BIO 100.

BIO 461. Animal Physiology

Physiological principles study as they occur throughout the animal kingdom with special emphasis on mammals. A detailed study of the mechanisms involved in the maintenance of the homeostatic condi-

tion. Spring of even-numbered years. Three lectures and a two-hour laboratory period weekly. Credit, 4 semester hours. PREREQ: BIO 100, 102; Recommended: CHM 250, 251, BIO 371.

BIO 472. Principles of Genetics

An introduction to the basic principles of heredity and molecular genetics. General aspects of human genetics are included. Fall, Spring. Three lectures and a two-hour laboratory period weekly. Credit, 4 semester hours. PREREQ: BIO 100, CHM 131, MAT 107.

BIO 495. Biomedical Seminar

A seminar series in which current biomedical research projects are presented and discussed. Most seminars will be presented by visiting scientists recruited from research laboratories in industry and universities. Fall, Spring. Credit, 1 semester hour per semester with a limit of 4 hours. PREREQ: BIO 100, Consent of Instructor.

BIO 499. Research in Biology

Restriction: Senior biology majors with a quality point average of 3.0 in the major. Designed to provide the student with experience in the analysis and solution of problems in the areas of his/her major interests. The problems will be presented to the biology faculty in written form. Fall, Spring. Credit, 1 to 3 semester hours per semester with a limit of 6 hours. PREREQ: Consent of the instructor and approval of the research proposal by a committee composed of biology faculty.

BIOS 3xx. Special Topics in Biology

A course designed to meet the unusual needs of individuals in special programs such as the Science Institute for school teachers and those working toward licensure. The specific contents and credit for the course will be determined by the needs of the students and is subject to departmental approval. As Announced. Credit, 1-4 semester hours. PREREQ: BIO 100.

ENVIRONMENTAL SCIENCE (ENV)

ENV 210. Environmental Science

A study of environmental science emphasizing the impact that an increasing human population has on the biosphere. The course deals specifically with the demands placed by humans on natural resources and the resulting acceleration of environmental deterioration, human attitudes toward the environment, and techniques and policies by which resources could be intelligently managed. Does not fulfill a BIO elective. Fall, Spring. Three lectures weekly. Credit, 3 semester hours.

ENV 220. Field Botany

An introduction to the theory and practice of field botany, with emphasis placed on higher plants. Topics covered will include basic taxonomy, collection of field data, monitoring of the physical environment, census/sampling techniques, physiological and population ecology, and a general treatment of the plant communities of North Carolina. Three hours of lecture and one two-hour laboratory weekly. Fall of even-numbered years. Credit, 4 sem.hrs.

ENV 230. Field Zoology

An introduction to the theory and practice of field zoology, with emphasis on vertebrates. Topics covered will include basic identification and taxonomy, collection of field data, monitoring of the physical environment, census/sampling techniques, physiological and population ecology, and mathematical modeling. Three hours of lecture and one two-hour laboratory weekly. Spring of odd-numbered years. Credit, 4 sem.hrs.

ENV 240. Field Microbiology

An introduction to the microorganisms of terrestrial and aquatic ecosystems. Emphasis will be placed on microbes that are important in ecosystem functions such as decomposition, nutrient cycling, and mutualistic relationships, as well as microbes that serve as indicators of water quality or environmental health. Three hours of lecture and one two-hour laboratory weekly. Spring of odd-numbered years. Credit, 4 sem.hrs.

ENV 310. Freshwater Ecosystems and Watershed Management

An introduction to the ecology of ponds, lakes, streams, and rivers. Topics covered include plant and animal communities, abiotic factors affecting these communities, water chemistry, sampling/monitoring techniques, and management strategies for aquatic ecosystems and adjacent watersheds. Three hours of lecture and one two-hour laboratory weekly. Fall of odd-numbered years. Credit, 4 sem.hrs.

ENV 320. Soils and Hydrology

An overview of soil physical properties, chemical properties, and hydrology. Topics covered include the formation, structure, and description of soils, soil water and the hydrologic cycle, and the modeling of soil systems. Three hours of lecture and one two-hour laboratory weekly. Spring of even-numbered years. Credit, 4 sem.hrs.

ENV 410. Environmental Laws and Regulations

An overview of major federal and state environmental legislation. Topics covered will include agriculture, air and water pollution, hazardous waste, wetlands, endangered species, multiple use management, the governmental agencies responsible for administering/enforcing these laws, and private environmental organizations that affect policy decisions. Three hours of lecture weekly. Fall of even-numbered years. Credit, 3 sem.hrs.

ENV 490. Internship

A course designed to give students an opportunity to obtain first-hand experience working with an environmental agency. Fall, spring. Credit, 3 sem.hrs. PREREQ: Departmental approval.

