The objectives of the Biology Department are as follows:

1. to train professional biologists in the nature of scientific investigation, the principles of biology, and the value of scientific enterprise.
2. to prepare students for career opportunities in research, industry, and government.
3. to prepare students for graduate study in the biological sciences.
4. to prepare students for admission to professional schools (i.e. medical, dental, and veterinary school).
5. provide courses in biology that fulfill the general education core requirements of the University.
6. to provide cognate courses for students majoring in or receiving certification in other fields including, but not limited to, agricultural sciences, home economics, nursing, horticulture, and physical education.
7. to act as a resource to the University and community through cooperative programs, workshops, seminars, course offerings, and public service.
8. to conduct research and scholarly activity in the areas of biology, biotechnology, computational biology, and biology education.
9. to provide students with experience in the applications of computers in biological research.

DEGREES OFFERED

Biology – Bachelor of Science
Biology – Master of Science*
Computational Science and Engineering – Master of Science*
Energy and Environmental Studies – Doctor of Philosophy*
* See the Graduate School Bulletin

Students interested in pursuing the Bachelor of Science degree in the Department of Biology are advised that rigorous high school preparation is important to success. The Department strongly recommends that a prospective student’s preparation include 5 units of high school science (including units in biology, chemistry and physics) and at least 1 unit of mathematics beyond Algebra II.

GENERAL ADMISSION REQUIREMENTS

The admission of students to the undergraduate degree program in the Department of Biology is based upon the general admission requirements of the University.

DEPARTMENTAL REQUIREMENTS

Biology (Pre-Professional) – Students are required to complete a minimum of 125 hours for graduation. This includes a minimum of 47 semester hours of biology and 40 semester hours of supporting math and science courses. The remaining courses satisfy other requirements of the Department and University.

ENRICHMENT PROGRAMS

Several enrichment programs and activities are available to students in the department, which are designed to increase the knowledge and competitiveness of biology majors. They include:

1. Departmental Seminars (including the Artis P. Graves Lecture Series and monthly departmental seminars). All students are encouraged to attend seminars presented by research scientists from industry, medical institutions, research laboratories and universities.
2. Annual Life and Physical Sciences Research Symposium. The Department of Biology sponsors an annual research symposium to provide a forum for students and faculty members to present their research in poster and oral formats. The symposium is designed to increase student awareness of research opportunities and to facilitate interactions between local students and faculty researchers with prominent scientists from other institutions including government, industry, and academia.
3. Health Careers Opportunity Program. This program is a collaborative effort with the University of North Carolina at Chapel Hill School of Medicine designed to increase the number of underrepresented students entering the health professions. It focuses on academic skills improvement, counseling, and mentoring.
ENRICHMENT FACILITIES

1. **Herbarium (NCATG).** A collection of approximately 6,000 specimens, several dozen of which were collected in the 1800’s. NCATG is registered internationally.

2. **Computer Room.** This satellite computer center, located in Barnes Hall, has 16-networked computers available for students. The room also houses printers and scanners for specific student needs.

3. **Research Laboratories.** The Department of Biology houses several state-of-the art research laboratories to support faculty and student research in molecular biology, biotechnology, microbiology, virology, ecology, and other biological sciences. In support of research, the Department has a suite with transmission and scanning electron microscopes, an adjacent dark room, a cell tissue culture laboratory, plant growth chambers, a cold room and greenhouse.

4. **Lecture Facilities.** The teaching facilities in the Department include a seminar room, auditorium, and a videoconferencing center equipped with state-of-the art computer and audiovisual technology.

RESEARCH & EXTRAMURAL FUNDING

As is the standard in quality programs nationally, the department receives training and research support from Federal, State and private funding agencies to support its educational and research missions. Research areas in the department include:

- Biotechnology
- Cell & Molecular Biology
- Endocrinology/Biochemistry
- Developmental Biology
- Electron Microscopy
- Bacteriology/Biochemistry
- Virology/Immunology
- Environmental Biology/Ecology
- Experimental Plant Taxonomy/Floristics
- Plant Physiology

CAREER OPPORTUNITIES

Due to the depth of required courses in biology and the breadth of support courses in the quantitative sciences, languages, humanities, the arts and others, Biology majors qualify for employment in many fields. Highly motivated graduates in biology compete successfully for entry into graduate and professional schools. Research careers in government and industry as well as jobs in technical and pharmaceutical sales, biotechnology, environmental science, and teacher education are some of the career opportunities available to majors in biology.

REQUIRED MAJOR COURSES FOR BIOLOGY

<table>
<thead>
<tr>
<th></th>
<th>BIOL 101</th>
<th>BIOL 160</th>
<th>BIOL 221</th>
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CURRICULUM GUIDE FOR BIOLOGY

FRESHMAN YEAR

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<th>Credit</th>
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SOPHOMORE YEAR

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<td>MATH 131(^2)</td>
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\(^1\) HPED 101 is required for all majors.

\(^2\) MATH 131 is recommended for all majors.
### JUNIOR YEAR

<table>
<thead>
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<th>Credit</th>
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<tr>
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<td>BIOL 466</td>
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<td>BIOL 260</td>
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<td>PHYS 242</td>
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<tr>
<td></td>
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<td>Total Credit Hours:</td>
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</tbody>
</table>

1. *Substitute courses are accepted for HPED 101 upon approval of major advisor.*
2. *Students not eligible to enter MATH 131 must complete MATH 110 prior to enrolling in MATH 131.*
3. *Courses taken for Biology electives must be numbered 400 or above.*
4. *Two consecutive courses in the same foreign language.*

### SENIOR YEAR

<table>
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<th>Second Semester</th>
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<td>BIOL 561</td>
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<tr>
<td>BIOL Elective(^3)</td>
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<td>CHEM 651</td>
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<td>Free Elective</td>
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<tr>
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</tr>
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</table>

### COURSE DESCRIPTIONS IN BIOLOGY

**Undergraduate**

**BIOL 100. Biological Science**

This is a general education course that stresses the objectives presented under the general education program of the University. This course stresses central concepts in biology including: basic chemical and physical phenomena, biochemistry, cell form and function, genetics, evolution, and multicellular organization. The laboratory will examine major biological concepts. Biological Science is not open to Biology majors. *(F;S;SS)*

**BIOL 101. Concepts of Biology**

This course is an introduction to science and the scientific method, basic biochemistry, cell structure and function, energy and metabolism, reproduction and genetics, evolution, life's diversity, and basic ecological principles for those students planning to enroll in additional major courses in the biological sciences. The laboratory will emphasize central biological concepts. Prerequisite: Credit or concurrent enrollment in CHEM 106 and 116. *(F;S)*

**BIOL 160. General Zoology**

This is an introductory study of structure, physiology and phylogeny of the major animal phyla. The laboratory emphasizes the comparative anatomy and taxonomy of the animals. Prerequisite: BIOL 101. *(F;S;SS)*

**BIOL 220. Basic Microbiology**

This is an introduction to the fundamentals of microbiology and the role of microorganisms in daily life. Special emphasis is placed on infectious diseases and immunology. The laboratory introduces students to the principles of microscopy, specimen preparation for light microscopy, aseptic techniques, cultivation techniques, and the biochemical activities of microorganisms. This course is not open to majors in Biology and Chemistry. Prerequisites: BIOL 100 or 101; CHEM 104 or its equivalent. *(F;S;SS)*

**BIOL 221. General Microbiology**

This is an introduction to the basic principles of microbiology. Microbial ultrastructure, growth, metabolism, molecular genetics, diversity, infectious diseases, and immunology will be discussed. The laboratory introduces students to the principles of microscopy, specimen preparation for light microscopy, aseptic techniques, cultivation techniques, and the biochemical activities of microorganisms. Prerequisites: BIOL 101, CHEM 107 and 117. *(F;S;SS)*

**BIOL 240. General Botany**

Plants as living organisms constitute an integral part of man's environment. Emphasis is placed on the relationship between plant structure and function, the diversity of organisms traditionally classified as plants, and plant physiology. The laboratory will emphasize plant structure and function. Prerequisite: BIOL 101. *(F;S)*

**BIOL 260. Comparative Evolution of the Vertebrates**

This course is a comparative study of chordate organ systems with rather detailed emphasis on the evolution and organogenesis of primitive chordates, dogfish shark and the cat. The laboratory emphasizes the comparative anatomy of...
representative chordates. Prerequisite: BIOL 101. (F;S)

**BIOL 361. Human Anatomy and Physiology**
Credit 4(2-4)
This course is a study of the general structure and function of the human body. It is not open to Biology majors. The laboratory emphasizes human anatomy and major physiological processes. Prerequisites: BIOL 100, CHEM 104 or its equivalent. (F;S;SS)

**BIOL 369. Human Anatomy**
Credit 3(2-2)
This course is a general introduction to human anatomy. The laboratory emphasizes the fundamental structure of the human body. This course is not open to Biology majors. Prerequisites: BIOL 100, CHEM 104 or its equivalent. (F;S;SS)

**BIOL 370. Human Physiology**
Credit 3(2-2)
This is an introductory course with emphasis placed on basic principles and mechanisms of physiological functioning of body cells, tissues and systems. The laboratory emphasizes major physiological concepts. This course is not open to Biology majors. Prerequisite: BIOL 361 or 369. (F;S;SS)

**BIOL 400. Field Biology**
Credit 3(2-2)
This course emphasizes how ecological knowledge is acquired and communicated. Fundamental techniques of sampling, numerical analysis, and the measurement of environmental factors will be studied using local aquatic and terrestrial communities. The laboratory emphasizes the study of local biomes. Prerequisite: BIOL 410. (DEMAND)

**BIOL 401. Molecular Biology (Formerly BIOL 201)**
Credit 4(2-4)
This course examines the molecular events in cell function using molecular genetics, cell biology, and fundamental biochemistry; using both prokaryotic and eukaryotic systems. The laboratory will emphasize fundamental techniques used in molecular biology. Prerequisites: BIOL 101 and CHEM 107. (F)

**BIOL 410. Ecology (Formerly BIOL 310)**
Credit 3(3-0)
This course surveys the major principles underlying the interactions between living organisms and their environment. Both plant and animal examples will be used to illustrate the basic ecological processes. Emphasis is placed on the characterization of different physical environments, ecosystem processes such as ecological energetics and nutrient cycling; and current organismal concepts of adaptation, niche, population dynamics, life-history phenomena, organismal interactions and community organization. Major environmental issues concerning humans and their cultures will also be presented. Prerequisites: BIOL 101, CHEM 107 and 117. (F)

**BIOL 430. Plant Taxonomy**
Credit 4(2-4)
The fundamentals of taxonomy, botanical nomenclature and modern systematics are covered. An introduction to selected families and genera of vascular plants is included. The laboratory provides exposure to the common elements of the local flora and instruction in herbarium techniques. Prerequisite: BIOL 240. (DEMAND)

**BIOL 432. Plant Physiology**
Credit 4(2-4)
This course is designed to develop a clear understanding of the basic physiological processes related to the structure, growth, and function of seed plants. The laboratory will emphasize major concepts in plant physiology. Prerequisites: BIOL 240 and CHEM 107. (DEMAND)

**BIOL 460. Invertebrate Zoology**
Credit 4(2-4)
A comprehensive study of the morphology, function, phylogeny, classification and the life histories of representative forms of lower and higher invertebrate groups exclusive of insects. The laboratory emphasizes the functional morphology of the invertebrates. Prerequisite: BIOL 160. (DEMAND)

**BIOL 461. Sociobiology**
Credit 3(3-0)
This course stresses the biological basis of social behavior and the organization of animal societies. Prerequisite: BIOL 410. (DEMAND)

**BIOL 462. Introductory Cell Physiology**
Credit 4(2-4)
This course is a treatment at the molecular level of the fundamental processes of living cells. The biochemistry of cellular constituents, bioenergetics, intermediary metabolism, and the regulatory mechanisms of the cell will be discussed. The laboratory will include exercises on the measurement of hydrogen ion activity, physical and chemical properties of macromolecules and membranes, chromatography, enzymes and enzyme kinetics, cell fractionation studies, and the use of spectrophotometry in the identification and characterization of cellular macromolecules. Prerequisites: BIOL 401 and CHEM 222. (S)

**BIOL 465. Histology**
Credit 4(2-4)
This course is a study of the microscopic anatomy of cells, tissues, and organs with special emphasis on normal histological structure and function. The laboratory emphasizes the major tissues. Prerequisite: BIOL 160. (DEMAND)

**BIOL 466. Principles of Genetics**
Credit 3(2-2)
This course is a study of the traditional, classical areas of genetics as well as an introduction to gene action at the molecular level, including DNA and RNA structure, function and interactions in cellular systems. The laboratory features exercises with Drosophila. Prerequisite: BIOL 401 and CHEM 221. (F)

**BIOL 467. General Entomology**
Credit 3(2-2)
This course emphasizes the structure, description, and habits of the principal orders of insects. Laboratory work will consist of collecting, mounting, preserving, and classification of principal insect representatives. Recommended for
general science and biological science majors. Prerequisite: BIOL 160. (DEMAND)

BIOL 468. Biology, Technology, and Ethics I  Credit 1(0-2)
This course evaluates recent technological advances in biology and how these advances impact societal issues and create ethical concerns. The course uses a seminar format. It is required for all undergraduate biology majors. Prerequisite: Senior standing. (F)

BIOL 469. Biology, Technology, and Ethics II (Formerly BIOL 569)  Credit 1(0-2)
This seminar course is concerned with ethical issues in biology. It is required for all pre-professional Biology majors. Prerequisite: BIOL 568. (S)

BIOL 498. Independent Study  Credit 1(0-2)
Independent study under the direction of a faculty member. The submission of a written report is required. This course should be taken as a precursor to Undergraduate Research (BIOL 499) by students who plan to conduct their research on campus. Permission of instructor required. (F;S)

BIOL 499. Undergraduate Research  Credit 3 (0-6)
Biological research under the direction of a faculty member. The research may be carried out in the department or as part of an internship in an off-campus academic or industrial setting. A written paper, an abstract, and an oral presentation open to the public are required. Limited to Biology majors with a 3.0 GPA overall and in the major. The student should register for the course the semester the research will be completed or in the fall for research done the previous summer. Permission of instructor required. (F;S)

BIOL 501. Senior Project  Credit 3(2-2)
This course will require that students develop an independent hypothesis-based project in the area of biology. Each student will be required to submit a written paper followed by a public defense of the research project. Literature review, experimental design, hypothesis testing, data analysis, scientific writing and presentation will be major elements of the course. Prerequisites: Biology major, senior classification. (F;S)

BIOL 530. Plant Pathology  Credit 4(2-4)
This course is an introduction to the organisms and environmental conditions that cause disease in plants, the disease cycle, the effects of diseases on host plants, the nature of plant resistance, and strategies for controlling plant disease. A survey of major pathogens and plant diseases with an emphasis on important agricultural and horticultural plants is included. The laboratory emphasizes the identification of plant pathogens. Prerequisite: BIOL 240. (DEMAND)

BIOL 561. Developmental Biology  Credit 4(2-4)
This course is an introduction to the cellular and molecular aspects of development in animal and plant systems. Laboratory exercises provide an introduction to techniques in classical experimental embryology and modern developmental biology. Prerequisites: BIOL 401, 260. BIOL 462 is recommended. (S)

Advanced Undergraduate and Graduate

BIOL 610. Prokaryotic Biology  Credit 4(2-4)
This course is a survey of the taxonomy, classification, ultrastructure, reproduction, physiology, and ecology of selected bacteria and bacteriophages. The laboratory will emphasize self-instruction and independent study. Prerequisites: BIOL 220 or 221 and BIOL 466. (DEMAND)

BIOL 620. Food Microbiology (Formerly BIOL 420)  Credit 4(2-4)
This is a survey of selected topics in food microbiology. The course will cover the metabolic pathways, organisms and processes involved with food production from fermented dairy products, vegetables, fruits and meats. Food spoilage, preservation, infection, and intoxication will also be discussed. The laboratory will introduce students to the microorganisms involved with food production and spoilage. Prerequisite: BIOL 220 or 221. (F)

BIOL 621. Soil Microbiology (Formerly BIOL 421)  Credit 4(2-4)
This is a study of the major groups of soil organisms including their classification and relation to soil environments. The abundance, significance, and functions of soil microorganisms as well as their role in chemical cycles in soil will be discussed. The laboratory will emphasize methods for studying soil microbes. Prerequisite: BIOL 220 or 221. (S)

BIOL 630. Molecular Genetics  Credit 3(3-0)
This course will examine DNA and RNA structure, function, and processing in prokaryotic and eukaryotic systems. Various aspects of recombinant DNA technology will be examined. Prerequisites: BIOL 401 and 466. (DEMAND)

BIOL 631. Endocrine Physiology  Credit 3(3-0)
This course will provide a basic introduction to endocrine function and include recent advances in the field of endocrinology. Emphasis will be placed on general aspects of endocrine physiology, the organization of the endocrine system, mechanisms of hormone action, and control of endocrine secretion. Prerequisites: BIOL 401 and 462. (DEMAND)

BIOL 640. Introduction to Bioinformatics and Genomics Research  Credit 3(1-4)
The purpose of this course is to provide integrative experiences in computer and bench research in bioinformatics and genomic science. Students will acquire hands-on experiences with web-based software and the tools research scientists are using to study the genomes of plants, microbes, humans and other organisms. They will input experimental data into one or more of these databases to perform genetic analyses for making predictions about gene identity, structure, function, similarities and phylogenetic relationships. They will also use the databases to develop biochips, probes and
primers for various laboratory applications. The integrative benchwork will involve testing results from database queries in the laboratory. This course will merge education and research and where possible, engage students in investigative activities that involve collaborations with scientists on and off the campus. Prerequisites: BIOL 401 and 466. (F;S)

BIOL 642. Special Problems in Biology Credit 3(2-2)
This course offers laboratory research projects on specific problems in biology for advanced students. The lecture portion of the course will emphasize central concepts in the research area. Prerequisites: BIOL 462, or 466 or permission of instructor and advisor. (DEMAND)

BIOL 650. Frontiers in Molecular Biology Credit 4(2-4)
This course focuses on the theory, methods, and applications of recombinant DNA technology. It includes special topics in molecular, cellular, and developmental biology. The laboratory will provide hands-on exposure to the polymerase chain reaction, gene sequencing, development of gene libraries, and other techniques in molecular biology. (DEMAND)

BIOL 661. Mammalian Biology Credit 3(3-0)
This course is a study of the evolutionary history, classification, adaptation and variation of representative mammals. Prerequisites: BIOL 160 and 260. (DEMAND)

BIOL 665. Evolution Credit 3(3-0)
This course will emphasize the genetics of populations and sources of genetic variation; causes of genetic change in populations including natural selection; speciation; and the evolutionary history of life on earth. Prerequisites: BIOL 410 and 466. (DEMAND)

BIOL 667. Animal Physiology Credit 3(3-0)
This course will provide students with an understanding of the current state of animal physiology at the level of the whole organism and its component organs and organ systems. Emphasis will be placed on function as it relates to survival of organisms in natural environments and on the regulation of homeostatic mechanisms. Topics would include metabolism, temperature regulation, reproductive mechanisms, circulation, gaseous exchange, nutrient processing, osmoregulation and ionic balance. Prerequisites: BIOL 160 and 462. (DEMAND)

BIOL 668. Animal Behavior Credit 3(3-0)
This course is a study of the qualitative and quantitative difference between behavioral characteristics at different evolutionary level. Adaptiveness of differences in behavior and the development of behavior will be emphasized. Prerequisites: BIOL 410 and 466. (DEMAND)

BIOL 671. Principles and Practices of Immunology Credit 3(3-0)
This course is a study of mammalian immune responses; particularly in humans. Special emphasis will be placed on the physiology, genetics, and regulation of immune responses. Interrelationships between nonspecific and specific immune reactions, humoral and cell-mediated immunity, effector cells, and diseases are also stressed along with research and diagnostic methodologies. Prerequisites: BIOL 221, 466; CHEM 221, 222. (S)

BIOL 681. Statistical Methods for Research Credit 3(3-0)
Introductory statistical methods for biological research including: descriptive statistics, probability distributions (binomial, normal, student's t-distribution), parametric and non-parametric hypothesis tests, confidence intervals, chi-square tests/contingency table analysis, introduction to one-way ANOVA, and bivariate regression. Laboratory exercises will provide the student with experience using statistical software packages for data analysis. Prerequisites: MATH 224 or 231. (F;S)

DIRECTORY OF FACULTY

David W. Aldridge
Professor and Associate Dean for Research and Graduate Programs
B.S., M.A., University of Texas-Arlington; Ph.D., Syracuse University; Postdoctoral, Woods Hole Marine Biological Laboratories

Goldie Smith Byrd
Associate Professor and Chairperson
B.S., North Carolina A&T State University; Ph.D., Meharry Medical College; Postdoctoral, Meharry Medical College

Roy Coomans
Associate Professor
B.S., Eckerd College; Ph.D., University of North Carolina at Chapel Hill

Doretha B. Foushee
Associate Professor
B.S., Shaw University; M.S., North Carolina Central University; Ph.D., University of Maryland

Joseph L. Graves, Jr.
Professor and Dean for Division of University of Studies
A.B., Oberlin College; M.S., University of Lowell; Ph.D., Wayne State University

Gregory D. Goins
Research Assistant Professor
B.S., UNC-Chapel Hill; M.S., Ph.D., North Carolina State University

Andrew G. Goliszek
Associate Professor
B.S., University of West Florida; M.S., Ph.D., Utah State University; Postdoctoral, Wake Forest University

Ethel J. Gordon
Associate Professor

Department of Biology http

B.A., Southern Illinois University; M.S., Northeastern University; Ph.D., Rutgers University

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**Minnie Holmes-McNary**

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**Thomas L. Jordan**

B.A., Rockhurst College; M.S., University of Washington-Seattle; Ph.D., University of Wisconsin-Madison

**Vinaya A. Kelkar**

B.S., Gujarat University-India; M.S., Old Dominion University; Ph.D., University of North Carolina at Greensboro

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**Mary A. Smith**

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**Joseph J. Whittaker**

A.B., Talladega College; Ph.D., Meharry Medical College; Postdoctorals, Purdue University and Washington University

**Assistant Professor**

**Associate Professor**

**Research Assistant Professor**

**Professor**

**Associate Professor and Associate Chairperson**

**Associate Professor**

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Departments in the College of Arts & Sciences

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