DEPARTMENT OF BIOLOGY (GRAD)

With the recommendation of the department and the approval of the Administrative Board of The Graduate School, special courses and the direction of graduate studies are offered by the staff of the Institute of Marine Sciences, Morehead City, North Carolina.

The Department of Biology offers a program of study leading to a doctor of philosophy degree in biology. It also offers two masters degrees: a master of science degree requiring independent research and a thesis, and a master of arts degree requiring a written library report. However, the master's degree programs only admit students on an individual basis in the following cases: 1. A request is initiated by a prospective student's graduate advisor, or 2. A current student in the Ph.D. degree program requests to move to a master's degree program. Special departmental rules and guidelines for advanced degrees are available upon request. For more information regarding our programs, please visit the Biology website.

Facilities

The Department of Biology is currently housed in four modern buildings. The newest building, the Genome Sciences Building, opened in July 2012. The department is equipped with modern instrumentation for research and research training in the diverse biological disciplines represented by the faculty.

UNC–Chapel Hill has a world-class library system, including the Health Science Library, which is dedicated to resources related to biological research. A major research asset is the location of the University, which makes the varied flora and fauna of the Appalachian Mountains, Piedmont Plateau, Coastal Plain, and Atlantic Coast accessible for research and instruction. The department operates a small field station a few miles from the Chapel Hill campus in the Mason Farm Biological Reserve, which includes several hundred acres of upland and floodplain habitats.

The Coker Arboretum and the North Carolina Botanical Garden are of value to students in the study of questions in plant biology. The Herbarium, containing more than 600,000 specimens, is especially rich in collections of the vascular plants and fungi of the Carolinas and the Southeastern United States.

The Highlands Biological Station, administered for the University system by Western Carolina University, is located in the biologically rich mountains at Highlands, North Carolina. Graduate courses offered cover various parts of the mountain biota. Credit may be obtained through UNC–Chapel Hill or Western Carolina University. A limited amount of research support is available on a competitive basis. (See the annual announcement of the Highlands Biological Station.)

The University is a member of the Organization for Tropical Studies (OTS). Financial support is available for students attending OTS courses in tropical ecology in Costa Rica.

Additional information about the graduate program including instructions for application is available online (http://bio.unc.edu).

Fellowships and Assistantships

Applicants interested in genetics, molecular biology, cell biology, development, or physiology should apply to the graduate program via the Biology and Biomedical Sciences Program (BBSP (http://bbsp.unc.edu/)) application portal. Applicants with an interest in evolutionary biology, ecology, behavior, organismal biology, or quantitative biology should apply to the biology graduate program using UNC's Graduate School application portal (http://gradschool.unc.edu/admissions/). Application for admission and graduate appointments should be submitted according to The Graduate School and departmental deadlines.

All outstanding prospective graduate students who apply for admission are automatically considered for University fellowships.

More than 45 teaching assistantships in undergraduate courses are open to graduate students. Duties of assistants can include lab preparation, grading, holding office hours, and other administrative tasks. Duties usually require 15 to 20 hours per week, including six contact hours in classes and 9 to 14 hours of preparation or other services associated with instruction.

Research assistantships are also available. Salaries and duties are variable as determined by the research needs of faculty supervising the work. Applications for these appointments must be made personally to faculty members directing grant-supported research.

The following awards are specifically for graduate students in the Biology Department:

- The Alma Holland Beers Scholarships are awarded annually to support summer research of students in botany. They are non-service awards.
- The William Chambers Coker Fellowship is awarded annually to a student or students in the final years of work toward a doctor of philosophy in a botanical field. This is a non-service award that carries with it an additional supplement for tuition and fees.
- The Mrs. W.C. Coker Fellowship is awarded annually to an outstanding first-year graduate student in plant biology. This is also a nonservice award that carries with it an additional supplement for tuition and fees.
- The H.V. Wilson Marine Scholarship is awarded annually for summer work at a marine laboratory. It is a nonservice award.

The faculty members in the Department of Biology offer instruction and research training in the following diverse biological disciplines.

Genetics and Molecular Biology

Genetics is both a discipline (the study of heredity) and an experimental approach (manipulation of genes or the genetic material). Today, most geneticists work at the molecular level by manipulating RNA, DNA, or entire genomes. Our group is strong in both model organism genetics and genomics. Areas of emphasis include biochemistry and molecular biology, chromosome biology, developmental genetics, genomics, protein synthesis, enzyme mechanics, and plant genetics.

Cell Biology, Development, and Physiology

Developmental biologists address the mechanisms through which cells acquire specialized functions to form complex body plans. These features are accomplished in part through cell proliferation, migration, and shape changes. The department has a strong research program in these areas, which are major topics in cell biology, as well as in

other aspects of developmental biology. Areas of emphasis include cytology, mitotic and meiotic mechanisms, histochemistry, experimental morphogenesis, morphogenetic movements, tissue culture, hormones, plant development, signal transduction, functional morphology, biomechanics and neuroethology, and membrane functions.

Evolutionary Biology

Evolution is inherited change in the characteristics of populations over time. Evolutionary biologists seek to explain the remarkable fit of organisms to their environment (adaptation), the origins of diversity, including the formation of new species (speciation), and the relationships among organisms. The department has a strong focus on the genetic and ecological mechanisms of adaptation and speciation.

Ecology

Ecologists study how organisms interact with other organisms and with their physical environment. UNC–Chapel Hill's group has strength in behavioral, conservation, community, disease, evolutionary, and marine ecology. Areas of emphasis include population biology, life histories, and ecosystem phenomena in diverse systems.

Behavior and Organismal Biology

Organismal biologists seek to understand the diversity of life forms on earth by analyzing organismal structure and function. UNC–Chapel Hill's Department of Biology takes an integrative approach to this research, combining analyses at levels ranging from molecules to whole organisms. The group also endeavors to understand the evolution and mechanisms of behavior. It uses theoretical, observational, and experimental approaches in a variety of species, from crawling behavior in sea slugs to communication in birds. Areas of emphasis include social and mating systems of vertebrates, communication, ecology and ontogeny of behavior, predator-prey interactions, marine ecology and oceanography, comparative physiology, neuroethology, functional morphology, and comparative biomechanics.

Plant Biology

The department has an active and diverse group that studies features specific to plants or that uses plant model systems to address questions of broad interest. Areas of emphasis include host-pathogen interactions, signal transduction, development, genomics, and chromosome biology.

Marine Biology

After completing required coursework in the department, students in marine biology have access to the research facilities of the Institute of Marine Sciences, Morehead City, North Carolina. By cooperative arrangements, deep water research can be carried out through the use of the research vessel of the Duke University Marine Laboratory.

Quantitative Biology

The quantitative biology track of study will develop young scientists who can investigate how basic physical processes have been brought together in living systems. One component of the training program will focus on events at smaller scales, micron-level and below, to cellular, sub-cellular, and multi-cellular processes. Another component will focus on events at larger scales, from the tissue to organ level, to processes at the organism and population level. Despite this distinction for most projects, a central goal of the training will be to prepare students to work on multi-scale problems that connect disparate levels of biology. This track of study features and fosters extensive interactions among students and faculty. Core training components will be rigorous, but will be combined with the programmatic flexibility as needed to accommodate the training goals of students with diverse backgrounds. Every aspect of the program will encourage innovative, imaginative, and unconventional approaches to physical biology.

Interdisciplinary Studies

Inter-departmental degree programs in genetics, ecology, neurobiology, and marine sciences offer unusual opportunities for special training through participation of staff from the Department of Biology and many other departments in the College of Arts and Sciences and the Division of Health Affairs.

Professors

Shawn C. Ahmed, Telomeres, Genomic Change and Germ Cell Immortality
Albert S. Baldwin, Signaling and Gene Expression in Cancer
Victoria L. Bautch, Molecular Basis of Development
Kerry S. Bloom, Chromosome Engineering, Molecular Biophysics
John Bruno, Marine Ecology and Conservation
Christina L. Burch, Experimental Evolution of Viruses
Sabrina S. Burmeister, Neurobiology and Behavior
Frank L. Conlon, Xenopus, Mesoderm, Heart, Tbox Genes
Gregory P. Copenhaver, Plant Genome Biology, Recombination, Centromeres
Jeffrey L. Dangl, Genetic and Molecular Analysis of Disease Resistance
Robert J. Duronio, Epigenetics and Cell Cycle Control
Terry Furey, Computational Gene Regulatory Genomics, Crohn's Disease
Patricia G. Gensel, Paleobotany and Morphology
Robert P. Goldstein, Cellular and Molecular Mechanisms
Tyson L. Hedrick, Biomechanics and Animal Locomotion
Allen H. Hurlbert, Community Ecology, Biogeography, Biodiversity
Corbin D. Jones, Evolutionary Genetics and Genomics
Joseph J. Kieber, Plant Cell Biology
Joel G. Kingsolver, Evolutionary Ecology and Physiological Ecology
Alain Laederach, Disease-Associated Mutations and Their Effect on RNA Structure
Kenneth J. Lohmann, Neuroethology and Invertebrate Zoology
Amy S. Maddox, Mechanisms of Cell Shape Change
A. Gregory Matera, RNA Processing and Epigenetics
Ann G. Matthysse, Molecular Biology and Plant Pathology
Daniel Matute, Evolutionary Genetics
Charles E. Mitchell, Ecology of Infectious Disease
Mark A. Peifer, Cell Adhesion and Cell-Cell Signaling
David Pfennig, Ecology, Evolutionary Biology, Developmental Biology
Karin S. Pfennig, Ecology, Behavior, and Evolution
Jason W. Reed, Plant Growth and Development
Jeff Sekelsky, Meiotic Recombination, DNA Repair
Maria R. Servedio, Evolutionary Theory, Speciation, Sexual Selection

Associate Professors

Jill M. Dowen, Three-Dimensional Genome Architecture and Gene Regulation
Paul S. Maddox, Cell Biology of Cell Division
Sophie McCoy, Community Ecology, Microbial Ecology, Marine and Aquatic Systems
Daniel J. McKay, Developmental Genomics
Zachary L. Nimchuk, Plant Biology, Developmental Genetics
Steven Rogers, Cytoskeletal Dynamics and Mechanosensation

Celia E. Shiau, Neuro-immune Interactions, Macrophage, Vertebrate Development, Genetics and Genomics, in Vivo Imaging
Kevin Slep, Cytoskeletal Structure and Dynamics
Keith W. Sockman, Reproductive Ecology and Plasticity
Todd J. Vision, Computational Genetics, Genome Evolution, and the Architecture of Complex Traits

Assistant Professors

Jiakun Chen, Neuroscience, Glial Biology, Astrocytes, Development, Genetics
Robert H. Dowen, Molecular Mechanisms of Cellular Homeostasis
Xiao Feng, Quantitative Ecology, Biogeography, Biodiversity
Kacy Gordon, Duplicate Gene Function in the Germ Line Stem Cell Niche
Toshihide Hige, Neurophysiology and Behavior in *Drosophila*
Parul Johri, Population Genetics, Statistical Inference, Evolutionary Genomics
Eric Riddell, Physiology, Ecology, and Evolution
En Yang, System neuroscience, Nueronal circuits implementation, Neuroengineering
Senay Yitbarek, Ecology and Evolution of Host-Microbe Interactions

Research Professors

Alan M. Jones, Signal Perception and the Regulation of Growth and Development
Punita Nagpal, Plant Development
Robert K. Peet, Plant Ecology, Plant Geography, EcoInformatics
Nathanael Prunet, Microscopy
Darrel W. Stafford, Developmental Biochemistry
Jianke Tie, Protein Biochemistry and Molecular Biology
Michael Werner, Cell Shape Changes and Cortical Dynamics in Cytokinesis
Chris S. Willett, Evolutionary Genetics and Genomics
Elaine Yeh, Nuclear Division in Yeast

Associated Faculty

Joerg Bauer, Agricultural Research and Development
James T. Costa, Social Behavior, History of Evolutionary Biology
Stephen T. Crews, Molecular Genetics
Frederick Joel Fodrie, Fish and Bivalve Population Ecology
Paul W. Gabrielson, Systematics of Marine Algae
Amy Gladfelter, Cytoskeleton Dynamics, Biophysical Cell Biology, Cytoplasm Organization
Kelly A. Hogan, Curriculum and Instruction: Inclusive Learning in Large STEM Courses
Julie Horvath, Genomics and Microbiology
William F. Marzluff, Transcriptional and Post-transcriptional Regulation of RNA Metabolism, Cell Cycle Regulation During Development
Joe Ruiz, Therapeutics for Nucleotide Expansion Disorders
John Salmeron, Plant Biotechnology and Plant-Based Pharmaceuticals
Aziz Sancar, DNA Repair and Cancer, Structure and Function of DNA Repair Enzymes, Molecular Neurobiology, Circadian Biology
Alecia Septer, Microbial Ecology, Microbiology
Bryan Stuart, Biodiversity, Systematics, Conservation and Herpetology
Brian K. Taylor, Animal Navigation and Magnetoreception
Damon E. Waitt, Professor of the Practice; Plant Evolution and Ecology
Alan Weakley, Plant Systematics
Scott Williams, Cell Division, Developmental Biology, Cell Biology

Universidad San Francisco de Quito Associated Faculty

Paul Andres Cardenas Aldaz, Pathogenic Microbiology, Molecular Markers, Microbial Genetics
Jaime Chaves, Population Genetics, Sea Turtle Conservation
Juan Guayasamin, Evolutionary Biology, Biogeography
Alexander Rafael Hearn, Oceanic Islets Role in Pelagic Environment, Sea Turtle Conservation
Antonio Leon-Reyes Sr., Plant Physiology, Plant Immunology, Plant-Microbe Interactions, Plant Biotechnology
Maria de Lourdes Torres, Hybridization Events between Endemic and Invasive Plant Species

Professors Emeriti

Edward G. Barry
Aristotle J. Domnas
J. Alan Feduccia
Sarah R. Grant
Albert Harris
Alan M. Jones
William M. Kier
Steven W. Matson
Gustavo Maroni
Donald W. Misch
Robert K. Peet
Lillie L. Searles
E.D. Salmon
Tom K. Scott
Alan E. Stiven
Peter White
R. Haven Wiley

BIOL

Advanced Undergraduate and Graduate-level Courses

BIOL 402. Infectious Disease in the Developing World. 3 Credits.
We will explore the challenges of infectious disease in the developing world, focusing on tuberculosis, HIV, and malaria. We will also examine the economics of different approaches to health care.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103 and BIOL 104 and BIOL 220 and BIOL 240.
Grading Status: Letter grade.

BIOL 405. Good Genes: Human Reproduction in the Social Context. 3 Credits.
Reproduction is the most ancient feature of life and a continued focus of cutting-edge medical technology. This interdisciplinary course examines our biological imperative and cultural quest to make babies. We examine reproduction from the perspectives of bioethics, reproductive medicine, behavioral economics, genetic engineering, disability studies, and gender studies. Teaching methods include traditional lectures, in-class discussions, group work, peer teaching, and occasional flipped-classroom. Students who previously took BIOL 89/490 with Dr. Zwemer may not enroll.

Rules & Requirements
Requisites: Prerequisite, BIOL 220; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOL 409L. Art and Science: Merging Printmaking and Biology. 1 Credits.
This is the lab component of ARTS 409 that brings together art majors and science majors to combine theory and practical learning in a biology laboratory, which focusing primarily on microscopic life and biological motion, with printmaking. Does not count as an elective towards the biology major. Permission of the instructor.

Rules & Requirements
Requisites: Prerequisites, A 200-level BIOL course, or a 200-level ARTS course; and permission of the instructor; Corequisite, ARTS 409.
Grading Status: Letter grade.

BIOL 421L. Microbiology Laboratory with Research. 2 Credits.
Sterile technique, bacterial growth, physiology, genetics and diversity, and bacteriophage. Research in bacterial genetics.

Rules & Requirements
Making Connections Gen Ed: EE- Mentored Research.
Requisites: Pre- or corequisite, BIOL 422.
Grading Status: Letter grade.

BIOL 422. Microbiology. 3 Credits.
Bacterial form, growth, physiology, genetics, and diversity. Bacterial interactions including symbiosis and pathogenesis (animal and plant). Use of bacteria in biotechnology. Brief introduction to viruses.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103 and BIOL 104 and BIOL 220; or permission of the instructor for students lacking the prerequisite(s).
Grading Status: Letter grade.

BIOL 422L. Microbiology Laboratory. 1-2 Credits.
Sterile technique, bacterial growth and physiology, bacterial genetics, bacteriophage, and bacterial diversity.

Rules & Requirements
Requisites: Pre- or corequisite, BIOL 422.
Grading Status: Letter grade.

BIOL 423. Genetics Experiments. 3 Credits.
This is a Course-based Undergraduate Research Experience (CURE) combination course/lab. Using genetics and genome biology, students will study DNA repair and chromosome stability using yeast as a model system in a cutting edge research laboratory.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 220; Corequisite, BIOL 423L.
Grading Status: Letter grade.

BIOL 423L. Genetics Experiments Laboratory. 1 Credits.
This is a Course-based Undergraduate Research Experience (CURE) combination course/lab. Using genetics and genome biology, students will study DNA repair and chromosome stability using yeast as a model system in a cutting edge research laboratory.

Rules & Requirements
Making Connections Gen Ed: EE- Mentored Research.
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 220; Corequisite, BIOL 423.
Grading Status: Letter grade.

BIOL 424. Microbial Ecology. 3 Credits.
Class emphasizes the creativity of the scientific process, using primary scientific literature as a framework to discuss topics in microbial ecology, including microbial diversity, distributions, genomics, and co-evolution; host-microbe and microbe-microbe interactions; nutrient cycling; and degradation of plant matter and biofuels.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and 202; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 425. Human Genetics. 3 Credits.
Pedigree analysis, inheritance of complex traits, DNA damage and repair, human genome organization, DNA fingerprinting, the genes of hereditary diseases, chromosomal aberrations, cancer and oncogenes, immunogenetics and tissue transplants. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103 and BIOL 104 and BIOL 220; or permission of the instructor for students lacking the prerequisite(s).
Grading Status: Letter grade.

BIOL 426. Biology of Blood Diseases. 3 Credits.
An introduction to the biology and pathophysiology of blood and the molecular mechanisms of some human diseases: anemias; leukemias; hemorrhagic, thrombotic, and vascular disorders; and HIV disease/AIDS. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103 and BIOL 104 and BIOL 240; or permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: PATH 426.

BIOL 427. Human Diversity and Population Genetics. 3 Credits.
Specifically, it addresses questions of human origins, population structure, and genetic diversity. This course investigates the facts, methods, and theories behind human population genetics, evolution, and diversity.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and 202; or BIOL 103 and 104; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 428. Biology of Viruses. 3 Credits.
Historically viruses are microscopic disease-causing vectors that make headlines around the world as they emerge, spread, and evolve. More recently, viruses are being used as therapeutic agents to treat disease. The course will provide a historical perspective of viruses past to present. Students will learn virus history, molecular biology of viruses and infection, discovery and treatment of emerging viruses, and the impact of viruses on society.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, and BIOL 104, and either BIOL 220 or BIOL 240.
Grading Status: Letter grade.

BIOL 430. Introduction to Biological Chemistry. 3 Credits.
The study of cellular processes including catalysts, metabolism, bioenergetics, and biochemical genetics. The structure and function of biological macromolecules involved in these processes is emphasized. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 101, and CHEM 262 or 262H.
Grading Status: Letter grade.
Same as: CHEM 430.

BIOL 431. Biological Physics. 3 Credits.
How diffusion, entropy, electrostatics, and hydrophobicity generate order and force in biology. Topics include DNA manipulation, intracellular transport, cell division, molecular motors, single molecule biophysics techniques, nerve impulses, neuroscience.

Rules & Requirements
Requisites: Prerequisites, PHYS 116 and 117, or PHYS 118 and 119.
Grading Status: Letter grade.
Same as: PHYS 405, BMME 435.

BIOL 434. Molecular Biology. 3 Credits.
Advanced studies in molecular biology from an experimental approach.

Rules & Requirements
Requisites: Prerequisites, BIOL 202 and CHEM 261; or BIOL 103, BIOL 104, BIOL 220, and CHEM 261; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 436. Plant Genetics, Development, and Biotechnology. 3 Credits.
Recent advances in plant molecular biology, genetics, development, and biotechnology, and their potential relevance to agriculture. The course will include lectures, reading and discussions of papers from the primary literature, and student presentations. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 271; or BIOL 103, BIOL 104, and BIOL 220; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 439. Introduction to Signal Transduction. 3 Credits.
This course presents an introduction to signal transduction pathways used by higher eukaryotes. Several signaling paradigms will be discussed to illustrate the ways that cells transmit information. Three lecture hours per week.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 440. Stem Cell Biology. 3 Credits.
Stem cells are important for a number of biological processes and have become topics of fascination in popular science and culture. This course will build from a solid foundation of genetics, cell, and developmental biology to give students a broad appreciation of stem cells in development, aging, disease, and bioengineering. Students will understand key concepts in stem cell biology like potential and immortality as well as understand stem cells' promise and limitations in therapeutic settings.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103 and BIOL 104 and (BIOL 220 or BIOL 240); or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 441. Vertebrate Embryology. 3 Credits.
Principles of development with special emphasis on gametogenesis, fertilization, cleavage, germ layer formation, organogenesis, and mechanisms, with experimental analysis of developmental processes. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, and BIOL 104, and either BIOL 240 or BIOL 252; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 441L. Vertebrate Embryology Laboratory. 1 Credits.
Descriptive and some experimental aspects of vertebrate development. Three laboratory hours a week.

Rules & Requirements
Requisites: Pre- or corequisite, BIOL 441.
Grading Status: Letter grade.

BIOL 442. Self Assembly in Cell Biology. 3 Credits.
In this class, we will read and discuss together the primary literature to understand how self-assembly in cell biology is harnessed in normal cells and goes awry in disease. A secondary goal will be for students to develop numeracy in cell biology so as to understand cell processes in a quantitative framework.

Rules & Requirements
Requisites: Prerequisites, BIOL 205 and another BIOL course numbered above 205; or BIOL 103, and BIOL 104, and BIOL 220 or BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 443. Developmental Biology. 3 Credits.
An experimental approach to an understanding of animals and plants. The approach covers developmental processes, molecular, genetic, cell biological and biochemical techniques, with an emphasis on the molecules involved in development.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, and BIOL 104, and BIOL 220 or BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 444. Molecular Basis of Disease. 3 Credits.
This course investigates the biological causes behind human diseases via critical thinking and analysis of experimental research outcomes. It approaches topics from a research perspective similar to a graduate seminar. Topics covered include genetic/inherited diseases, metabolic diseases, immunological disorders, infectious diseases, cancer, cardiovascular diseases, and neurological diseases.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 240.
Grading Status: Letter grade.

BIOL 445. Cancer Biology. 3 Credits.
Selected examples will be used to illustrate how basic research allows us to understand the mechanistic basis of cancer and how these insights offer hope for new treatments.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, BIOL 220, and BIOL 240.
Grading Status: Letter grade.

BIOL 446. Unsolved Problems in Cellular Biology. 3 Credits.
A survey of areas of current interest in cytology, embryology, and genetics with concentration on problems that remain unsolved but that appear to be near solution. Three lecture and discussion hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 447. Cell Biology: Beyond Core Basics. 1 Credits.
Modern methods in cell biology.

Rules & Requirements
Requisites: Prerequisites, BIOL 205 with C+ or better; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 447L.
Grading Status: Letter grade.

BIOL 447L. Cell Biology: Beyond Core Basics Laboratory. 3 Credits.
Modern methods in cell biology lab.

Rules & Requirements
Requisites: Prerequisites, BIOL 205 with C+ or better; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 447.
Grading Status: Letter grade.

BIOL 448. Advanced Cell Biology. 3 Credits.
An advanced course in cell biology, with emphasis on the biochemistry and molecular biology of cell structure and function. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 449. Introduction to Immunology. 3 Credits.
This course provides a general overview of the evolution, organization, and function of the immune system. Instruction will be inquiry-based with extensive use of informational and instructional technology tools.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: MCRO 449.

BIOL 450. Neurobiology. 3 Credits.
Recommended preparation, BIOL 205. Survey of neurobiological principles in vertebrates and invertebrates, including development, morphology, physiology, and molecular mechanisms. Three lectures a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 451. Comparative Physiology. 3 Credits.
An examination of the physiology of animals using a comparative approach. Both invertebrate and vertebrate animals are discussed in order to elucidate general principles.

Rules & Requirements
Requisites: Prerequisites, BIOL 101, and BIOL 101L or BIOL 102L, and PHYS 104 or 114 or 116, and PHYS 105 or 115 or 117.
Grading Status: Letter grade.

BIOL 451L. Comparative Physiology Laboratory. 1 Credits.
The fundamental principles of physiology are explored using physical models, animal experiments, and non invasive experiments on humans, reinforcing the understanding of concepts presented in lecture.

Rules & Requirements
Requisites: Pre- or corequisite, BIOL 451.
Grading Status: Letter grade.

BIOL 452. Marine Microbial Symbioses: Exploring How Microbial Interactions Affect Ecosystems and Human Health. 3 Credits.
Course material covers host-microbe and microbe-microbe interactions found in marine ecosystems, including beneficial and parasitic relationships among viruses, microbes, marine animals, and humans. Limited to upper-level undergraduate science majors and graduate students. Course previously offered as MASC 446.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: EMES 446.

BIOL 453. Molecular Control of Metabolism and Metabolic Disease. 3 Credits.
This class will cover the small molecules, enzymes, signaling proteins, and pathways that control metabolic processes and that are altered in metabolic disease. We will generally take an experimental approach to explore and understand the fundamental aspects of metabolism.

Rules & Requirements
Requisites: Prerequisites, BIOL 202 and CHEM 261; or BIOL 103, BIOL 104, BIOL 220, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 454. Evolutionary Genetics. 3 Credits.
The roles of mutation, migration, genetic drift, and natural selection in the evolution of the genotype and phenotype. Basic principles are applied to biological studies. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and BIOL 202; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 455. Behavioral Neuroscience. 3 Credits.
The neurobiological basis of animal behavior at the level of single cells, neural circuits, sensory systems, and organisms. Lecture topics range from principles of cellular neurobiology to ethological field studies.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 456. Marine Phytoplankton. 3 Credits.
For junior and senior science majors or graduate students. Biology of marine photosynthetic protists and cyanobacteria. Phytoplankton evolution, biodiversity, structure, function, biogeochemical cycles and genomics. Harmful algal blooms, commercial products, and climate change. Three lecture/practical session hours per week. Course previously offered as MASC 444. Permission of the instructor.

Rules & Requirements
Grading Status: Letter grade.
Same as: EMES 444, ENEC 444.

BIOL 457. Marine Biology. 3 Credits.
Recommended preparation, BIOL 201 or 475. A survey of plants and animals that live in the sea: characteristics of marine habitats, organisms, and the ecosystems will be emphasized. Marine environment, the organisms involved, and the ecological systems that sustain them. Course previously offered as MASC 442.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: EMES 442.

BIOL 458. Sensory Neurobiology and Behavior. 3 Credits.
Recommended preparation, BIOL 205. An exploration of sensory systems and sensory ecology in animals. Topics range from neurophysiological function of sensory receptors to the role of sensory cues in animal behavior.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104; BIOL 240 recommended.
Grading Status: Letter grade.

BIOL 459. Field Biology at Highlands Biological Station. 1-4 Credits.
Content varies. Summer field biology at the Highlands Biological Station focuses on the special faunal and floristic processes and patterns characteristic of the southern Appalachian mountains. Five lecture and three to five laboratory and field hours per week, depending on credit.

Rules & Requirements
Requisites: Prerequisite, BIOL 101; permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 8 total credits. 2 total completions.
Grading Status: Letter grade.

BIOL 461. Fundamentals of Ecology. 4 Credits.
Students will develop a comprehensive understanding of the field of ecology, including modern and emerging trends in ecology. They will develop literacy in the fundamental theories and models that capture ecological processes; emphasis will also be placed on the relevance of ecology and ecological research for human society.

Rules & Requirements
Requisites: Prerequisites, BIOL 201; or BIOL 103, BIOL 104, and BIOL 260.
Grading Status: Letter grade.
Same as: ENEC 461.

BIOL 462. Marine Ecology. 3 Credits.
Survey of the ecological processes that structure marine communities in a range of coastal habitats. Course emphasizes experimental approaches to addressing basic and applied problems in marine systems. Course previously offered as MASC 440.

Rules & Requirements
Requisites: Prerequisites, BIOL 201; or BIOL 475; or BIOL 103, BIOL 104, and BIOL 260.
Grading Status: Letter grade.
Same as: EMES 440.

BIOL 463. Field Ecology. 4 Credits.
Application of ecological theory to terrestrial and/or freshwater systems. Lectures emphasize quantitative properties of interacting population and communities within these systems. Required laboratory teaches methodology applicable for analysis of these systems. Projects emphasize experimental testing of ecological theory in the field. Two lecture and six field hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 260.
Grading Status: Letter grade.

BIOL 464. Global Change Biology. 3 Credits.
Responses of plants, animals, and communities to climate and other global changes, emphasizing ecology, physiology, behavior, and evolution. Investigation of past responses and tools for predicting future responses.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 260.
Grading Status: Letter grade.

BIOL 465. Global Biodiversity and Macroecology. 3 Credits.
We will explore global patterns of diversity of plants, animals, fungi, and microbes, and the insights gained by taking a statistical approach to describing these and other broad-scale ecological patterns.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI or FC-QUANT, RESEARCH.
Requisites: Prerequisites, BIOL 201; or BIOL 103, BIOL 104, and BIOL 260; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 465.

BIOL 466. Environmental Microbiology. 3 Credits.
This course surveys multiple dimensions of environmental microbiology, including methods and techniques for microbial genomics, transcriptomics, and metabolomics, ecological and evolutionary microbiology, the roles of microbes in ecological systems, and current applications of and issues in environmental microbiology.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104.
Grading Status: Letter grade.
Same as: EMES 466.

BIOL 469. Behavioral Ecology. 3 Credits.
BIOL 278 recommended but not required and can be taken concurrently. Behavior as an adaptation to the environment. Evolution of behavioral strategies for survival and reproduction. Optimality and games that animals play. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 201; or BIOL 103 and BIOL 104.
Grading Status: Letter grade.

BIOL 471. Evolutionary Mechanisms. 3 Credits.
Introduction to mechanisms of evolutionary change, including natural selection, population genetics, life history evolution, speciation, and micro- and macroevolutionary trends. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and BIOL 202; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 471L.
Grading Status: Letter grade.

BIOL 471L. Evolutionary Mechanisms Laboratory. 1 Credits.
Introduction to mechanisms of evolutionary change, including natural selection, population genetics, life history evolution, speciation, and micro- and macroevolutionary trends. Three laboratory hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and BIOL 202; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 471.
Grading Status: Letter grade.

BIOL 472. Introduction to Plant Taxonomy. 4 Credits.
Introduction to the taxonomy of vascular plants. Principles of classification, identification, nomenclature, and description. Laboratory and field emphasis on phytography, families, description, identification, and classification of vascular plant species. Three lecture and three laboratory hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and (BIOL 271 or BIOL 272); or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 473L. Mammalian Morphology Laboratory. 1 Credits.
Laboratory includes an opportunity for independent investigation of anatomy through dissection, virtual models, and/or 3D modeling.

Rules & Requirements
Requisites: Corequisite, BIOL 473.
Grading Status: Letter grade.

BIOL 473. Mammalian Morphology and Development. 3 Credits.
An in-depth examination of the anatomical, evolutionary, and developmental history of mammals, including humans. Particular attention will be given to nervous, musculoskeletal and craniofacial structures.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104; Corequisite, BIOL 473L.
Grading Status: Letter grade.

BIOL 474. Evolution of Vertebrate Life. 3 Credits.
Evolutionary history of the vertebrates. Emphasis on anatomical, physiological, behavioral adaptations accompanying major transitions: the move from water to land, the development of complex integrating systems. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 201; or BIOL 202; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 474L. Vertebrate Structure and Evolution Laboratory. 1 Credits.
Vertebrate comparative anatomy of organ systems and their evolution with emphasis on human anatomy. Three laboratory hours a week.

Rules & Requirements
Requisites: Pre- or corequisite, BIOL 474.
Grading Status: Letter grade.

BIOL 475. Biology of Marine Animals. 3 Credits.
Required preparation, one additional course in biology. An introduction to the major animal phyla emphasizing form, function, behavior, ecology, evolution, and classification of marine invertebrates. Three lecture and three laboratory hours per week.

Rules & Requirements
Requisites: Prerequisites, BIOL 101, and BIOL 101L or BIOL 102L; co-requisite, BIOL 475L.
Grading Status: Letter grade.

BIOL 475L. Biology of Marine Animals Laboratory. 1 Credits.
This lab serves as an introduction to the major animal phyla emphasizing form, function, behavior, ecology, evolution, and classification of marine invertebrates.

Rules & Requirements
Requisites: Prerequisites, BIOL 101, and BIOL 101L or BIOL 102L; co-requisite, BIOL 475.
Grading Status: Letter grade.

BIOL 476. Avian Biology. 3 Credits.
A study of avian evolution, anatomy, physiology, neurobiology, behavior, biogeography, and ecology. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 101, and BIOL 101L or BIOL 102L; corequisite, BIOL 476L.
Grading Status: Letter grade.

BIOL 476L. Avian Biology Laboratory. 1 Credits.
Techniques for the study of avian evolution, ecology, and behavior with emphasis on North Carolina birds. Three laboratory or field hours a week, including one or two weekend field trips.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Corequisite, BIOL 476.
Grading Status: Letter grade.

BIOL 479. Topics in Organismal Biology at an Advanced Level. 3 Credits.
Topics in organismal biology at an advanced undergraduate or graduate student level.

Rules & Requirements
Grading Status: Letter grade.

BIOL 479L. Laboratory in Organismal Biology: Advanced Topics. 1-2 Credits.
Laboratory in topics in organismal biology for advanced undergraduates and graduate students.

Rules & Requirements
Grading Status: Letter grade.

BIOL 480. Discoveries in Prevention and Cure of Infectious Disease in London. 3 Credits.
This is a Burch summer honors course taught in London. We will examine three major discoveries relating to infectious disease (vaccination, transmission via water, and antibiotics) and one major epidemic (plague) which led to no scientific response and explore how the thought of the time influenced scientific research. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 481. Biology, History, and Evolution of Epidemic Diseases. 3 Credits.
A consideration of the biology and evolution of epidemic diseases and the response of society and the scientific community. Plague, smallpox, cholera, influenza, polio, and COVID-19. Readings from recent scientific papers and history and literature. Students may not receive credit for both BIOL 480 and 481.

Rules & Requirements
Requisites: Prerequisite, BIOL 422; or MCRO 251; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 490. Advanced Topics in Biology. 3 Credits.
Permission of the instructor. Content will vary. Three lecture and discussion hours per week by visiting and resident faculty. Honors version available.

Rules & Requirements
Repeat Rules: May be repeated for credit. 12 total credits. 4 total completions.
Grading Status: Letter grade.

BIOL 495. Undergraduate Research in Biology. 1-3 Credits.
Permission of the instructor. Biology majors only. A continuation of the hands-on research in the laboratory and/or field that was started in BIOL 395. A final written paper is required each term. May be repeated. Does not count as a course in the major. Pass/fail credit only. Honors version available.

Rules & Requirements
Requisites: Prerequisite, BIOL 395.
Repeat Rules: May be repeated for credit. 12 total credits. 4 total completions.
Grading Status: Pass/Fail.

BIOL 501. Ethical Issues in Life Sciences. 3 Credits.
Permission of the instructor. A consideration and discussion of ethical issues in life sciences including cloning humans, genetic engineering, stem cell research, organ transplantation, and animal experimentation. Counts as a course numbered below 400 for biology major requirements.

Rules & Requirements
Grading Status: Letter grade.

BIOL 514. Ecological and Evolutionary Developmental Biology. 3 Credits.
This course explores the history, concepts, and applications of the emerging field of ecological and evolutionary developmental biology. In doing so, students will learn how traits emerge from the interplay of genes and the environment and how such developmental plasticity impacts ecology, evolution, and health. Students will also gain experience interpreting scientific literature, planning creative research, and integrating ideas from disciplines ranging from molecular biology and the health sciences to ecology and evolutionary biology. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and BIOL 205; or BIOL 103 and BIOL 104; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 523. Sex Differences in Human Disease. 3 Credits.
Many human diseases including cancer, cardiovascular disease, dementia, chronic kidney disease, obesity, and auto-immune disease differ in their pathology and treatment between males and females. The class will first cover the hormonal and genetic mechanisms of sex determination, and then build on this knowledge to understand sexual disparities in the development and potential treatments of disease. The course will be based on primary literature and discussions of experimental evidence.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 205; or BIOL 103 and BIOL 104.
Grading Status: Letter grade.

BIOL 524. Strategies of Host-Microbe Interactions. 3 Credits.
There is great variety in how microbes colonize and live with their hosts. The course will summarize strategies of pathogenicity, symbiosis, commensalism and mutualism. Evolutionary, cellular, and molecular aspects will be analyzed.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104 and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 525. Analysis and Interpretation of Sequence-Based Functional Genomics Experiments. 3 Credits.
Practical introduction to functional genomics experiments, such as RNA-seq and ChIP-seq, and computational techniques for the analysis of these data derived from high-throughput sequencing. Interpretation of results will be stressed. Basic knowledge of molecular biology, beginning level computational skills, and familiarity with basic statistical concepts are expected. Three lecture hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 202, or BIOL 103 and BIOL 104 and BIOL 220; and COMP 110 or COMP 116; and STOR 120 or STOR 155; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 525L.
Grading Status: Letter grade.

BIOL 525L. Analysis and Interpretation of Sequence-Based Functional Genomics Experiments Laboratory. 1 Credits.
Computer lab will provide students with experience using computational software for analysis of functional genomics experiments. Basic knowledge of molecular biology, beginning level computer skills, and familiarity with basic statistical concepts are expected. One laboratory hour a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 202, or BIOL 103 and BIOL 104 and BIOL 220; and COMP 110 or COMP 116; and STOR 120 or STOR 155; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 525.
Grading Status: Letter grade.

BIOL 526. Computational Genetics. 4 Credits.
Introduction to computational principles underlying sequence alignment and phylogenetics, genome assembly and annotation, analysis of gene function, and other bioinformatics applications. Includes a one-hour computer laboratory. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 220; and COMP 110 or COMP 116 or BIOL 226; and STOR 120 or STOR 155; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 527. Seminar in Quantitative Biology. 3 Credits.
Seminar in quantitative biology for advanced students. The course counts as a quantitative biology course for the major.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104; and COMP 110 or COMP 116; and MATH 232; or permission of the instructor for students lacking the prerequisites.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.
Grading Status: Letter grade.

BIOL 527L. Laboratory in Quantitative Biology. 1 Credits.
Laboratory in quantitative biology for advanced students. The laboratory will involve mathematical analysis and modeling of biological systems and processes.

Rules & Requirements
Repeat Rules: May be repeated for credit. 4 total credits. 4 total completions.
Grading Status: Letter grade.

BIOL 528. Quantitative Personalized Genomics. 3 Credits.
Personalized medicine, specifically using genetic markers to improve outcomes and minimize side effects (pharmacogenomics) requires the development and application of advanced computational and quantitative techniques. Students will develop computational skills to address contemporary genomic and statistical problems.

Rules & Requirements
Requisites: Prerequisites, BIOL 202, or BIOL 103 and BIOL 104 and BIOL 220; and COMP 110 or COMP 116 or BIOL 226; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 528L.
Grading Status: Letter grade.

BIOL 528L. Quantitative Personalized Genomics Laboratory. 1 Credits.
Personalized medicine, specifically using genetic markers to improve outcomes and minimize side effects (pharmacogenomics) requires the development and application of advanced computational and quantitative techniques. Students will develop computational skills to address contemporary genomic and statistical problems in a lab setting.

Rules & Requirements
Requisites: Prerequisites, BIOL 202, or BIOL 103 and BIOL 104 and BIOL 220; and COMP 110 or COMP 116 or BIOL 226; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 528.
Grading Status: Letter grade.

BIOL 529. Clinical and Counseling Aspects of Human Genetics. 3 Credits.
Topics in clinical genetics including pedigree analysis, counseling/ethical issues, genetic testing, screening, and issues in human research. Taught in a small group format. Active student participation is expected.

Rules & Requirements
Requisites: Prerequisite, BIOL 425; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: GNET 635.

BIOL 532. Recent Discoveries in Molecular Biology. 3 Credits.
This course examines recent insights into molecular and cellular processes obtained through modern experimental approaches. Extensive reading of primary literature, discussed in a seminar format.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 220; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 534. Mathematical Modeling in the Life Sciences. 3 Credits.
Requires some knowledge of computer programming. Model validation and numerical simulations using ordinary, partial, stochastic, and delay differential equations. Applications to the life sciences may include muscle physiology, biological fluid dynamics, neurobiology, molecular regulatory networks, and cell biology.

Rules & Requirements
Making Connections Gen Ed: QI.
Requisites: Prerequisites, MATH 383 and MATH 347 or MATH 577.
Grading Status: Letter grade.
Same as: MATH 564.

BIOL 535. Molecular Biology Techniques. 4 Credits.
Recommended preparation, BIOL 434. Experiments with bacterial phage, nucleic acid isolation and properties, recombinant DNA techniques, and DNA sequencing. Additional hours in laboratory will be necessary to complete assignments. Permission of the instructor.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 220; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 537. Biotechnology and Synthetic Biology. 3 Credits.
Recent advances in biotechnology and synthetic biology, and their potential relevance to medicine, agriculture, and engineering. The course will include lectures, reading and discussions of papers from the primary literature, and student projects and presentations.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103, BIOL 104, and BIOL 220; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 542. Light Microscopy for the Biological Sciences. 3 Credits.
Introduction to various types of light microscopy, digital and video imaging techniques, and their application in biological sciences. Permission of the instructor.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 543. Cardiovascular Biology. 3 Credits.
An experimental approach to understanding cardiovascular development, function, and disease. It covers cardiovascular development (heart, blood vasculature, lymphatic vasculature) and cardiovascular function as linked to selected diseases. Focus on molecular, genetic, cell biological, and biochemical techniques used to study the cardiovascular system, with an emphasis on the genes and signaling pathways involved in cardiovascular development and disease. Most topics will be paired with a research paper from the primary literature. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, BIOL 220, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 544L. Laboratory in Diseases of the Cytoskeleton. 3 Credits.
This laboratory course offers students the chance to engage in cutting-edge biochemical and cell biological research related to ongoing cytoskeletal research projects in the labs of two UNC faculty members. The course is composed of lectures and laboratory research. Students will become involved in all scientific processes: analysis of prior work, hypothesis generation and testing, data analysis and quantitation, and the presentation of data and conclusions.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI or FC-QUANT, FC-LAB, RESEARCH.
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 545. Exploring Brain, Gut, and Immunity. 3 Credits.
The course will explore topics that relate to how the brain and the gut communicate with one another. The course will also examine the connection between the brain-gut axis to the immune system and the microbiota at a molecular, cellular, and organismal level. Students will survey these emerging research topics and critically think, critique, and understand the experimental evidence for what we understand today about the gut and brain relationship. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, and BIOL 104, and BIOL 220 or BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 546. Biology of Aging. 3 Credits.
This course is designed for undergraduate or graduate students who are interested in understanding how aging is controlled at an advanced level. Emphasis will be placed on molecular and cellular mechanisms of aging in metazoans. Emphasis will also be placed on healthy aging and on how progress and discoveries are made in the field of aging. This course is based on scientific research or review papers and has no textbook.

Rules & Requirements
Requisites: Prerequisites, BIOL 205; or BIOL 103, BIOL 104, and BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 547. Synaptic Plasticity: Analysis of Primary Literature. 3 Credits.
In this highly interactive, small-group course, we will read a series of scientific papers that elegantly demonstrate molecular events that are fundamental to synaptic plasticity, a key mechanism of learning and memory. Students will become familiar with this exciting neuroscience topic, and also learn how to interpret experimental data and read papers critically and objectively. We will also think about the future experiments suggested by each paper we read.

Rules & Requirements
Requisites: Prerequisites, BIOL 202; or BIOL 103, and BIOL 104, and BIOL 220 or BIOL 240; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 551. Comparative Biomechanics. 3 Credits.
The structure and function of organisms in relation to the principles of fluid mechanics and solid mechanics.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and either PHYS 114 or PHYS 118.
Grading Status: Letter grade.

BIOL 552. Behavioral Endocrinology. 3 Credits.
Undergraduates need permission of the instructor to enroll. The study of the interactions among hormones, the brain, and behavior from how hormones shape the development and expression of behaviors to how behavioral interactions regulate endocrine physiology.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and BIOL 278.
Grading Status: Letter grade.

BIOL 553. Mathematical and Computational Models in Biology. 3 Credits.
This course introduces analytical, computational, and statistical techniques, such as discrete models, numerical integration of ordinary differential equations, and likelihood functions, to explore various fields of biology.

Rules & Requirements
Making Connections Gen Ed: QI.
Requisites: Prerequisites, (BIOL 201 and BIOL 202) or (BIOL 103 and BIOL 104); and MATH 231; and (MATH 232 or STOR 120 or STOR 155); or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 553L/MATH 553L.
Grading Status: Letter grade.
Same as: MATH 553.

BIOL 553L. Mathematical and Computational Models in Biology Laboratory. 1 Credits.
This lab introduces analytical, computational, and statistical techniques, such as discrete models, numerical integration of ordinary differential equations, and likelihood functions, to explore various fields of biology.

Rules & Requirements
Requisites: Prerequisites, (BIOL 201 and 202) or BIOL 103 and BIOL 104); and MATH 231; and (MATH 232 or STOR 120 or STOR 155); or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 553/MATH 553.
Grading Status: Letter grade.
Same as: MATH 553L.

BIOL 554. Introduction to Computational Neuroscience. 3 Credits.
This course covers various mathematical tools and techniques for modeling the various elements and phenomena that comprise the nervous system and brain.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104; and BIOL 220 or BIOL 250; and MATH 231; and COMP 110 or COMP 116 or BIOL 226; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 555. Paleobotany: An Introduction to the Past History of Plants. 3 Credits.
An introduction to the fossil record of plants, investigating how plants originated and changed through geological time to produce the modern flora. Both macrofossils and microfossils will be considered. Three lecture hours a week. Previously offered as GEOL 555.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, BIOL 103, BIOL 104, and either BIOL 250 or BIOL 271; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 555L; permission of the instructor for students lacking the requisites.
Grading Status: Letter grade.
Same as: EMES 555.

BIOL 555L. Paleobotany: An Introduction to the Past History of Plants Laboratory. 1 Credits.
The laboratory involves learning how to locate, collect, prepare, and analyze fossil plants; it also provides fossils that illustrate topics covered in lecture. Students will be involved in field trips to fossil sites and museums to learn about fossil curation and display of fossils for public education. Three laboratory hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and either BIOL 250 or BIOL 271; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 555.
Grading Status: Letter grade.

BIOL 561. Ecological Plant Geography. 3 Credits.
Description of the major vegetation types of the world including their distribution, structure, and dynamics. The principal causes for the distribution of plant species and communities, such as climate, soils, and history will be discussed.

Rules & Requirements
Requisites: Prerequisites, GEOG 110; or BIOL 103, 104, and 260; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 562. Statistics for Environmental Scientists. 4 Credits.
Introduction to the application of quantitative and statistical methods in environmental science, including environmental monitoring, assessment, threshold exceedance, risk assessment, and environmental decision making.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104, and either STOR 120 or STOR 155; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 562.

BIOL 563. Statistical Analysis in Ecology and Evolution. 4 Credits.
Application of modern statistical analysis and data modeling in ecological and evolutionary research. Emphasis is on computer-intensive methods and model-based approaches. Familiarity with standard parametic statistics is assumed.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, MATH 231, and either STOR 120 or STOR 155; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 563.

BIOL 564. Population Ecology. 3 Credits.
Permission of the instructor for those lacking the prerequisites. Corequisite, BIOL 546L. Principles governing the phenomena of single and interacting populations are examined, from basic tenets to cutting-edge research questions. Population and community-level perspectives are integrated by drawing parallels between approaches and considering how to scale up from phenomena involving one or a few species to the structure and dynamics of whole communities. This course is intended for advanced undergraduate and beginning graduate students. Emphasis will be on theoretical concepts and corresponding mathematical approaches.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104, BIOL 260 recommended.
Grading Status: Letter grade.

BIOL 564L. Population Ecology Lab. 1 Credits.
Permission of the instructor for those lacking the prerequisites. Corequisite, BIOL 564. In this laboratory course, students will understand the assumptions and predictions of core models in population and community ecology (and in general terms, how the predictions are derived from the models), and the role of these models and others like them in the development and testing of the theory of populations and communities, i.e. in the "core ideas" of population and community ecology.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104, BIOL 260 recommended.
Grading Status: Letter grade.

BIOL 565. Conservation Biology. 3 Credits.
The application of biological science to the conservation of populations, communities, and ecosystems, including rare species management, exotic species invasions, management of natural disturbance, research strategies, and preserve design principles. Honors version available.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and either BIOL 250 or BIOL 260; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 567. Evolutionary Ecology. 3 Credits.
Advanced consideration of the evolution of form and function. May include issues in life-history evolution, evolutionary physiology, evolutionary morphology, and the evolution of complexity. Three lecture hours per week.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and either BIOL 250 or BIOL 260; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 568H. Disease Ecology and Evolution. 3 Credits.
Recommended preparation, one course above 400 in ecology or evolution. An advanced class covering the causes and consequences of infectious disease at the levels of whole organisms, populations, communities, and ecosystems. Previously offered as BIOL 568.

Rules & Requirements
Requisites: Prerequisites, BIOL 201 and MATH 231; or BIOL 103, BIOL 104, BIOL 260 and MATH 231; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 579. Organismal Structure and Diversity in the Southern Appalachian Mountains. 4 Credits.
Permission of the instructor. An examination of the field biology of selected fungi, plants, or animals of the Appalachian Mountains. The morphology, taxonomy, ecology, life history, and behavior of the organisms will be explored both in the laboratory and in the field.

Rules & Requirements
Grading Status: Letter grade.

BIOL 590. Advanced Special Topics in Biology. 3 Credits.
Special topics in biology for advanced undergraduate students and graduate students.

Rules & Requirements
Repeat Rules: May be repeated for credit. 12 total credits. 4 total completions.
Grading Status: Letter grade.

BIOL 590L. Laboratory in Advanced Special Topics in Biology. 1 Credits.
Laboratory at an advanced level in special topics in biology. Students should have had considerable previous laboratory experience.

Rules & Requirements
Repeat Rules: May be repeated for credit. 2 total credits. 2 total completions.
Grading Status: Letter grade.

BIOL 602. Professional Development Skills for Ecologists and Biologists. 3 Credits.
The goal of this course is to help students who intend to become professional ecologists or biologists acquire critical skills and strategies needed for achieving their career goals.

Rules & Requirements
Grading Status: Letter grade.
Same as: ENEC 602.

BIOL 603. MiBio Seminar. 2 Credits.
This class is designed to 1) enhance students' ability to present scientific material to their peers in a comprehensive, cohesive manner, 2) familiarize students with scientific concepts and technologies used in multiple disciplines, 3) expose students to cutting edge research, 4) prepare students to gain substantial meaning from seminars and to ask questions, and 5) enhance students' ability to evaluate scientific papers and seminars.

Rules & Requirements
Grading Status: Letter grade.
Same as: BIOC 603, CBPH 603, GNET 603.

BIOL 604. Laboratory Practices for New Investigators. 1 Credits.
Required preparation, participation in an ongoing laboratory research project. Permission of the instructor. A seminar course designed to introduce students to approaches and methods needed in carrying out an independent research project in a particular focus area of biology. For advanced undergraduates and graduate students.

Rules & Requirements
Repeat Rules: May be repeated for credit. 2 total credits. 2 total completions.
Grading Status: Letter grade.

BIOL 605. Reading and Writing Scientific Literature. 1 Credits.
A seminar course designed to introduce students to how to read and write scientific papers. For advanced undergraduates and graduate students.

Rules & Requirements
Requisites: Prerequisite, BIOL 201 or 202.
Repeat Rules: May be repeated for credit. 2 total credits. 2 total completions.
Grading Status: Letter grade.

BIOL 620. Bacterial Genetics with Emphasis on Pathogenic and Symbiotic Interactions. 3 Credits.
Molecular genetics of bacteria. The emphasis will be on pathogenic and symbiotic interactions of bacteria with eukaryotes, although other aspects of bacterial genetics will be considered.

Rules & Requirements
Requisites: Prerequisites, BIOL 103, BIOL 104, and one of BIOL 220, MCRO 251, or EMES 204; or permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOL 621. Principles of Genetic Analysis I. 3 Credits.
Genetic principles of genetic analysis in prokaryotes and lower eukaryotes.

Rules & Requirements
Requisites: Prerequisite, BIOL 202 or BIOL 220; or permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: GNET 621.

BIOL 622. Principles of Genetic Analysis II. 4 Credits.
Principles of genetic analysis in higher eukaryotes; genomics.

Rules & Requirements
Requisites: Prerequisite, BIOL 621.
Grading Status: Letter grade.
Same as: GNET 622.

BIOL 624. Developmental Genetics. 3 Credits.
Permission of the instructor for undergraduates. Genetic and molecular control of plant and animal development. Extensive reading from primary literature.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 624.

BIOL 625. Seminar in Genetics. 2 Credits.
Permission of the instructor for undergraduates. Current and significant problems in genetics. May be repeated for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 6 total completions.
Grading Status: Letter grade.
Same as: GNET 625.

BIOL 631. Advanced Molecular Biology. 4 Credits.
This course explores cutting edge research in molecular biology -- the investigation at molecule-scale of the mechanisms behind life. We briefly review core-principles in molecular biology, then investigate more recent research that extends or overturns these core principles.

Rules & Requirements
Requisites: Prerequisites, BIOL 202, or BIOL 220, or CHEM 430, and permission of the course director.
Grading Status: Letter grade.
Same as: GNET 631, BIOC 631, MCRO 631.

BIOL 632. Advanced Molecular Biology II. 3 Credits.
Required preparation for undergraduates, at least one undergraduate course in both biochemistry and genetics. The purpose of this course is to provide historical, basic, and current information about the flow and regulation of genetic information from DNA to RNA in a variety of biological systems. Three lecture hours a week.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 632, BIOC 632, MCRO 632.

BIOL 635. Careers in Biotechnology. 1 Credits.
This seminar course will provide graduate and advanced undergraduate students information on career opportunities and culture in the field of biotechnology. The instructor and guest lecturers will present examples of global challenges addressed by modern biotechnology, and how research and development are carried out in the industry. Students will develop and present their own plan for a new biotechnology venture. Does not count within the Biology major or minor.

Rules & Requirements
Grading Status: Pass/Fail.

BIOL 639. Seminar in Plant Molecular and Cell Biology. 1 Credits.
Permission of the instructor. May be repeated for credit. Current and significant problems in plant molecular and cell biology are discussed in a seminar format. Can count as BIOL elective credit in the major if combined with other 600-level courses for a total of three credit hours.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 12 total completions.
Grading Status: Letter grade.

BIOL 642. Advanced Studies of Cell Division. 3 Credits.
An advanced course in cell and molecular biology integrating genetic, biochemical, and structural aspects of the cell cycle. Principles derived from a variety of biological systems. Extensive reading of classic papers as well as recent literature.

Rules & Requirements
Requisites: Prerequisite, BIOL 205 or BIOL 240; or permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOL 648. Palynology. 5 Credits.
Permission of the instructor. A consideration of various aspects of palynology, including the morphology, structure, development, systematics, evolution, preparation techniques, and analysis of living and fossil pollen grains, spores, and other palynomorphs. Two lecture and six laboratory hours a week.

Rules & Requirements
Grading Status: Letter grade.

BIOL 649. Seminar in Cell Biology. 2 Credits.
May be repeated for credit. Can count as BIOL elective credit in the major if combined with other 600-level courses for a total of three credit hours.

Rules & Requirements
Requisites: Prerequisite, BIOL 205 or BIOL 240; or permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 6 total completions.
Grading Status: Letter grade.

BIOL 650. Animal Cognition. 3 Credits.
For advanced undergraduates and graduate students. The goal of the course is to gain an in-depth understanding of animal cognition in the context of evolution and neurobiology with an emphasis on recent research.

Rules & Requirements
Grading Status: Letter grade.

BIOL 657. Biological Oceanography. 4 Credits.
For graduate students; undergraduates need permission of the instructor. Marine ecosystem processes pertaining to the structure, function, and ecological interactions of biological communities; management of biological resources; taxonomy and natural history of pelagic and benthic marine organisms. Three lecture and recitation hours per week. One mandatory weekend fieldtrip. Course previously offered as MASC 504.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: EMES 507, ENVR 520.

BIOL 659. Seminar in Evolutionary Biology. 2 Credits.
Permission of the instructor. Advanced studies in evolutionary biology. Can count as BIOL elective credit in the major if combined with other 600-level courses for a total of three credit hours.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 6 total completions.
Grading Status: Letter grade.

BIOL 661. Plant Ecology. 4 Credits.
Consideration of terrestrial, vascular plant ecology including environmental physiology, population dynamics, and community structure. Laboratory stresses collection and interpretation of field data. Three lecture and three laboratory hours a week.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisite, BIOL 260; or permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOL 669. Seminar in Ecology. 1-3 Credits.
May be repeated for credit.

Rules & Requirements
Requisites: Prerequisite, BIOL 201 or BIOL 260; or permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 12 total completions.
Grading Status: Letter grade.
Same as: ENEC 669.

BIOL 680. Advanced Seminar in Recent Biological Research and Methods. 1 Credits.
Permission of the instructor. The course will cover topics and experimental approaches of current interest. Students will learn intellectual and practical aspects of cutting-edge topics in biology. It will meet for one hour per week, in a lecture and discussion format.

Rules & Requirements
Repeat Rules: May be repeated for credit. 3 total credits. 3 total completions.
Grading Status: Letter grade.

BIOL 690. Advanced Special Topics with an Emphasis on Recent Research. 3 Credits.
Permission of the instructor. Special topics in biology with an emphasis on recent research. For advanced undergraduates and graduate students.

Rules & Requirements
Repeat Rules: May be repeated for credit. 6 total credits. 2 total completions.
Grading Status: Letter grade.

BIOL 692H. Senior Honors Thesis in Biology. 3 Credits.
Preparation of a written and oral presentation of honors thesis research. Research must continue in the same laboratory used in BIOL 395. Senior biology majors only (first or second majors). Required of all candidates for Highest Honors or Honors. Can be taken in either the fall or spring semester of their senior year. Approval of the Biology Honors Director required. Permission of a faculty research director and three credit hours of BIOL 395 in the same laboratory required.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Making Connections Gen Ed: CI, EE- Mentored Research.
Grading Status: Letter grade.

Graduate-level Courses

The stated prerequisites should be interpreted to read "or equivalent" and may be waived by the course instructor for students who are adequately prepared.

Courses numbered 900 and above are designed for applicants for advanced degrees. Each course requires permission of the instructor or the research director. Each may be repeated for two or more semesters for credit.

BIOL 701. Overview of Biology. 1-2 Credits.
Biology faculty will present individual research presentations followed by discussion.

Rules & Requirements
Grading Status: Letter grade.

BIOL 702. Student Seminars. 1 Credits.
Required of all candidates for the degree in genetics. A course to provide public lecture experience to advanced genetics students. Students present personal research seminars based on their individual dissertation projects. Lectures are privately critiqued by fellow students and genetics faculty.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 702.

BIOL 703. Recent Advances in Biology. 1-3 Credits.
A consideration of the methods and literature involved in the latest advances in selected areas of biology.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 704. Seminars in Biophysics. 2 Credits.
Permission of the instructor. Students present seminars coordinated with the visiting lecturer series of the Program in Molecular and Cellular Biophysics.

Rules & Requirements
Grading Status: Letter grade.
Same as: BIOC 704.

BIOL 705. Best Practices for Rigor and Reproducibility in Research. 1 Credits.
A workshop to introduce best practices for increasing rigor and reproducibility in research. Permission of course directors required.

Rules & Requirements
Grading Status: Letter grade.
Same as: BBSP 705.

BIOL 711. Genetic Lecture Series. 1 Credits.
Diverse but current topics in all aspects of genetics. Relates new techniques and current research of notables in the field of genetics.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 701.

BIOL 713. Student Seminars. 1 Credits.
Required of all candidates for the degree in genetics. A course to provide public lecture experience to advanced genetics students. Students present personal research seminars based on their individual dissertation projects. Lectures are privately critiqued by fellow students and genetics faculty.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 703.

BIOL 758. Molecular Population Biology. 4 Credits.
Hands-on training, experience, and discussion of the application of molecular genetic tools to questions of ecology, evolution, systematics, and conservation.

Rules & Requirements
Requisites: Prerequisite, BIOL 471; Permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: EMES 742.

BIOL 801. Seminar in Biological Sciences. 1-2 Credits.
Permission of the instructor. Advanced seminar in interdisciplinary biological sciences.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 810. Seminar in College Science Teaching. 2 Credits.
This interactive course will help graduate students develop the knowledge and skills needed to implement student-centered science instruction at the university level. Participants will support one another in creating a teachable unit, a personal teaching philosophy statement, and a course syllabus.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 829. Seminar in Quantitative Biology. 1-3 Credits.
Permission of the instructor. Advanced seminar in quantitative biology.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 831. Seminar in Insect Physiology, Biochemistry, and Endocrinology. 1-2 Credits.
Permission of the instructor. Advanced seminar in insect physiology, biochemistry, and endocrinology.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 832. Seminar in Molecular Biology. 1-2 Credits.
Advanced seminar in molecular biology.

Rules & Requirements
Requisites: Prerequisite, BIOL 202; permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 841. Seminar in Embryology. 1-2 Credits.
Advanced seminar in embryology.

Rules & Requirements
Requisites: Prerequisite, BIOL 205; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOL 842. Seminar in Cell Biology and Biochemistry. 1-2 Credits.
Permission of the instructor. Advanced seminar in cell biology and biochemistry.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 845. Advanced Seminar in Neurobiology. 2 Credits.
Advanced seminar in Neurobiology. Students should have previous experience in Neurobiology courses or research.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 3 total completions.
Grading Status: Letter grade.

BIOL 852. Seminar in Plant Systematics. 1-2 Credits.
Permission of the instructor. Advanced seminar in plant systematics.

Rules & Requirements
Grading Status: Letter grade.

BIOL 853. Seminar in Plant Morphology and Anatomy. 1-2 Credits.
Permission of the instructor. Advanced seminar in plant morphology and anatomy.

Rules & Requirements
Grading Status: Letter grade.

BIOL 854. Seminar in Neurophysiology. 1-2 Credits.
Permission of the instructor. Advanced seminar in neurophysiology. May be repeated for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 855. Seminar in Invertebrate Zoology. 1-2 Credits.
Advanced seminar in invertebrate zoology. May be repeated for credit.

Rules & Requirements
Requisites: Prerequisite, BIOL 475; permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 856. Seminar in Vertebrate Evolutionary Biology. 1-2 Credits.
Permission of the instructor. Advanced seminar in vertebrate evolutionary biology. May be repeated for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 857. Seminar in Comparative Animal Behavior. 1-2 Credits.
Permission of the instructor. Advanced seminar in comparative animal behavior. May be repeated for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.
Same as: NBIO 857.

BIOL 858. Seminar in Comparative Physiology. 1-2 Credits.
Advanced seminar in comparative physiology.

Rules & Requirements
Requisites: Prerequisite, BIOL 451; permission of the instructor for students lacking the prerequisite.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.
Same as: NBIO 858.

BIOL 859. Seminar in Marine Biology. 1-2 Credits.
Permission of the instructor. Advanced seminar in marine biology. May be repeated for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BIOL 861. Statistical Analysis in Ecology and Evolution using R. 1 Credits.
Graduate standing in biology, ecology or genetics required. Introduction to statistical analysis and modeling of ecological and evolutionary data using the R programming environment.

Rules & Requirements
Requisites: Prerequisite, STOR 155.
Grading Status: Letter grade.

BIOL 890. Special Topics in Biology. 1-2 Credits.
Permission of the instructor. Consideration of special topics in biology. May be repeated once for credit.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 891. Graduate Seminar in Biology. 2 Credits.
Graduate standing or permission of the instructor. This course will increase students' intellectual depth across the fields of ecology, evolution, and organismal biology (EEOB). Students will read and discuss papers, attend seminars, and present research ideas. Required of all candidates for the degree in biology in the EEOB graduate program.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 892. Special Topics in Biology for Graduate Students. 1-4 Credits.
This course is designed to allow graduate students to explore areas of biology outside their direct area of specialization. Three credits lecture only. Four credits lecture and lab.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 901. Introduction to Graduate Research. 1-15 Credits.
Graduate research for six weeks in two laboratories. Designed primarily to acquaint first-year students with research techniques and to assess their propensity for research. Arranged by mutual agreement of students and faculty members during fall orientation. May be repeated once for credit. Six to nine hours per week.

Rules & Requirements
Grading Status: Letter grade.

BIOL 921. Research in Genetics. 1-15 Credits.
May be repeated for credit.

Rules & Requirements
Grading Status: Letter grade.
Same as: GNET 905.

BIOL 931. Research in Molecular Biology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 932. Research in Plant Molecular Biology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 941. Research in Cytology and Cell Biology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 942. Research in Embryology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 943. Research in Physiology: Cellular, Comparative, Neurophysiology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 951. Research in Neurobiology. 3-12 Credits.
Permission of the department. Research in various aspects of neurobiology. Six to 24 hours a week.

Rules & Requirements
Grading Status: Letter grade.
Same as: NBIO 951, PHCO 951.

BIOL 952. Research in Ethology and Animal Behavior. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 953. Research in Marine Sciences. 2-21 Credits.
Rules & Requirements
Grading Status: Letter grade.
Same as: MASC 940.

BIOL 954. Research in Marine Sciences on Mollusca, Crustacea, Ichthyology, or Oceanography. 1-15 Credits.
Permission of the department. At the Institute for Marine Sciences, Morehead City, NC.

Rules & Requirements
Grading Status: Letter grade.

BIOL 955. Research in Vertebrate or Invertebrate Zoology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 957. Research in Plant Systematics. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 958. Research in Plant Morphology and Anatomy. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement for student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 959. Research in Paleobotany. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of student and faculty member.

Rules & Requirements
Grading Status: Letter grade.

BIOL 961. Research in Ecology. 1-15 Credits.
Acquaints early career graduate students with research techniques and assesses their propensity for research. Arranged by mutual agreement of the student and faculty member.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.

BIOL 992. Master's (Non-Thesis). 3 Credits.
Course for graduate students expecting to receive the degree of Master of Arts in Biology.

Rules & Requirements
Repeat Rules: May be repeated for credit.

BIOL 993. Master's Research and Thesis. 3 Credits.
Rules & Requirements
Repeat Rules: May be repeated for credit.

BIOL 994. Doctoral Research and Dissertation. 3 Credits.
Rules & Requirements
Repeat Rules: May be repeated for credit.

Contact Information

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