BIOLOGY (BIO)

BIO 101. Biology and the Human Condition. (4 h)
Introduction to basic principles in biology, emphasizing recent advances in biology in the context of their ethical, social, political, and economic considerations. Intended for students with little or no previous experience in biology. BIO 101 is not recommended for those pursuing a career in the health professions or who are planning to continue in biology. Does NOT count toward the biology major or minor. Credit not given for both BIO 101 and BIO 111. C-BIO 101L. (D)

BIO 101L. Biology and the Human Condition-Lab. (0 h)
Lab only. No credit.

BIO 105. Plants and People. (4 h)
Explores the numerous associations between plants and people, the fundamental importance of plant diversity to humans and their role in the sustainability of the biosphere. This course is intended for students with little or no previous experience in biology and does NOT count toward the major or minor in Biology. (D)

BIO 111. Biological Principles. (4 h)
Study of the general principles of living things with focus on the cellular, organismal, and population levels of biological organization, emphasizing the role of heredity and evolution in these systems. Used as equivalent credit for prior college level or transfer course work only. Does NOT count toward the major or minor in biology. Credit not given for both BIO 101 and BIO 111. (D)

BIO 111L. Biological Principles Lab. (0 h)
Lab only. No credit.

BIO 150. Biology I. (3 h)
Introduction to macromolecules, cells, tissues, and resource acquisition. Both BIO 150 and BIO 150L must be taken to meet the divisional requirement. May not be taken Pass/Fail. (D)

BIO 150L. Biology I Lab. (1 h)
May not be taken Pass/Fail. P or C-BIO 150.

BIO 160. Biology II. (3 h)
Introduction to molecular genetics, evolution, ecology, and the environment. May not be taken Pass/Fail. P-BIO 150.

BIO 160L. Biology II Lab. (1 h)
May not be taken Pass/Fail. P-BIO 150 and 150L. P or C-BIO 160.

BIO 202. Bird Taxonomy (Florida). (2 h)
Immersion in bird taxonomy and ecology, conducted in southern Florida during six days of Spring Break. Two on-campus meetings are followed by a trip to top birding sites in North America, viewing over 100 species and covering most of the world's orders of birds. Out-of-pocket costs for food, transportation, and lodging expected to be $200 or less. P-Prerequisite override required.

BIO 208. Understanding Climate Change. (1.5 h)
Introduction to the scientific evidence for climate change.

BIO 210. Ethical Decision-Making in Biology and Medicine. (3 h)
Examines contemporary issues in bioethics, including responsible conduct in research, implications of technological advances in biology, environmental issues, and controversies in health care and medical practice.

BIO 212. Biodiversity. (4 h)
Investigates the history of life on earth and examines its diversification in an evolutionary and ecological context. Lectures cover the mechanisms of biological diversification and survey life on earth. Labs introduce students to the broad diversity of life through exercises with living organisms. P-BIO 150, 150L, 160, and BIO 160L. (D)

BIO 225. Field Biology and Natural History. (3 h)
Provides a hands-on study of organisms in their natural habitats with an emphasis on local North Carolina biodiversity. Well-established sampling methods in field biology are blended with emerging technologies. P-BIO 150, 150L, 160, and BIO 160L.

BIO 235. Genetics. (3 h)
Exploration of genetic inheritance, molecular genetics, population genetics, and genomics. Intended as an intermediate course for developing skills towards advanced studies in genetics, evolution, ecology, and molecular biology. P-BIO 150, 150L, 160, and BIO 160L.

BIO 245. Comparative Animal Physiology. (3 h)
Introduction to animal physiology in the context of animal diversity and evolution. P-BIO 150, BIO 150L, and BIO 160. P or C- BIO 160L.

BIO 265. Cellular and Molecular Biology. (3 h)
Exploration of the molecular mechanisms of cellular functions. P-BIO 150, BIO 150L, and BIO 160. P or C- BIO 160L.

BIO 301. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 302. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 303. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 304. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 305. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 306. Topics in Biology. (1-4 h)
Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated if the course title differs. Prerequisites may vary; check with the department.

BIO 308. Biomechanics. (3 h)
Analyzes the relationship between organismal form and function using principles from physics and engineering. Solid and fluid mechanics are employed to study design in living systems. P-BIO 150, 150L, 160, and BIO 160L.

BIO 308L. Biomechanics Lab. (1 h)
Laboratory study of biomechanics. P or C-BIO 308.

BIO 309. Comparative Anatomy. (4 h)
Study of the vertebrate body from an evolutionary, functional, and developmental perspective. Labs emphasize structure and function, primarily through the dissection of representative vertebrates. P-BIO 150, 150L, 160, and BIO 160L.

BIO 311. Ecology and Conservation Biology of Coral Reefs. (4 h)
In-depth study of the various biotic and abiotic components that come together to structure ecosystem function and biodiversity at all spatial scales in one of Earth's most productive and diverse environments, yet one most threatened by human use and climate change. Lab component is a one-week field trip over Spring Break. Fees are associated with the required travel component of the course. Interested students are advised to inquire about available scholarships. P-BIO 150, 150L, 160, 160L and prerequisite override required.

BIO 313. Herpetology. (4 h)
Explores the biology of reptiles and amphibians, emphasizing their unique morphological, physiological, behavioral and life-history adaptations, and their evolutionary relationships. The lab consists mostly of field trips. P-BIO 150, 150L, 160, and BIO 160L.

BIO 314. Evolution. (3 h)
Study of the evolutionary analysis of biological change in populations, lineages, and the history of Earth. Explores reconstruction of evolutionary histories, adaptation, complexity, and biodiversity through primary literature. P-BIO 150, 150L, 160, and BIO 160L..

BIO 314L. Evolution Lab. (1 h)
Introduces evolutionary analytic methods and interpretation of trait and molecular data through practical tutorials. P or C-BIO 314.

BIO 315. Population Genetics. (3 h)
Study of the amount and distribution of genetic variation in populations of organisms and of how processes such as mutation, recombination, and selection affect genetic variation. Lectures introduce theoretical studies and include discussion of molecular and phenotypic variation in natural populations. P-BIO 235. (QR)

BIO 315L. Population Genetics Lab. (1 h)
Introduces quantitative modeling of population genetic dynamics, and experiments using populations of organisms. P or C-BIO 315.

BIO 316. Biology of Birds. (4 h)
Lecture plus lab course emphasizing ecological and evolutionary influences on the physiology, behavior, diversity, and population biology of birds, and case studies in conservation biology. P-BIO 150, 150L, 160, and BIO 160L.

BIO 317. Plant Physiology and Development. (3 h)
Examines the molecular mechanisms that control growth, development, and physiological processes of plants. Control of these processes is examined on genetic, biochemical, and whole plant levels. P-BIO 265.

BIO 317L. Plant Physiology and Development Lab. (1 h)
Consists of structured experiments and an independently designed research project. P or C-BIO 317.

BIO 319. Biology of Soils. (3 h)
A survey of soil structure and biodiversity, with a detailed study of ecological interactions within soil communities and the impact of the soil biota on soil formation, nutrient cycling, and bioremediation within pristine, managed, and damaged soils. P-BIO 150, 150L, 160, and BIO 160L.

BIO 319L. Biology of Soils Lab. (1 h)
Laboratory study of physical, chemical, and biological methods for analyzing the soil habitat. P or C-BIO 319.

BIO 323. Animal Behavior. (3 h)
A survey of laboratory and field research on animal behavior. P-BIO 150, 150L, 160, or BIO 160L.

BIO 323L. Animal Behavior Lab. (1 h)
Laboratory study of animal behavior. P or C-BIO 323.

BIO 324. Hormones and Behavior. (3 h)
Exploration of the mechanisms of hormonal influences on behavior. P-BIO 150, BIO 150L, BIO 160, BIO 160L AND either BIO 245, HES 350 OR PSY 220.

BIO 327. Mycology: Biology of Fungi. (4 h)
Introduces fungi, their evolution and natural taxonomy; cell and molecular biology; genetics, mating, and development; primary and secondary biochemistry; and their interactions with other organisms and the environment. Lab introduces culturing, microscopic and molecular techniques. P-BIO 150, 150L, 160, and BIO 160L.

BIO 330. Land and Natural Resource Management. (3 h)
Provides a fundamental understanding of land and resource management. The major focus is on federal oversight and policies but state, local, non-profit, and international aspects are included. P-BIO 150, 150L, 160, and BIO 160L.

BIO 331. Microbial Physiology. (3 h)
A molecular study of how prokaryotes obtain the energy and nutrients required to live and reproduce amidst diverse environmental stressors, with an emphasis on structure-function relationships. Topics include molecular bioenergetics, central metabolism, macromolecule biosynthesis, and integration of metabolic events. P-BIO 370/BMB 370/CHM 370 or BIO 332.

BIO 332. Microbiology. (4 h)
Overview of the biology of microorganisms with emphasis on prokaryotes. Topics include cell structure and function, genetics and evolution, metabolic and ecological diversity, and medical microbiology. Lab emphasizes inquiry-based study of environmental microorganisms through a blend of classical and modern techniques. P-CHM 122 (or CHM 123) and BIO 150, BIO 150L, BIO 160, and BIO 160L.

BIO 334. Parasitology. (4 h)
Survey of protozoan, helminth, and arthropod parasites with a focus on cellular biology, life cycles, host-parasite relationships, and public health implications. Laboratory emphasizes microscopy-based techniques for examining parasite morphology and intracellular structures. P-BIO 265.

BIO 336. Development. (3 h)
Study of the molecular, cellular, and anatomical aspects of embryonic development of invertebrate and vertebrate animals. P-BIO 265.

BIO 336L. Development Lab. (1 h)
Laboratory study of the molecular, cellular, and anatomical aspects of embryonic development of invertebrate and vertebrate animals. P or C-BIO 336.

BIO 339. Animal Cognition. (3 h)
A survey of learning, reasoning and social cognition in animals, with an emphasis on species other than widely-used models such as rodents or primates. Classes are initially mostly lecture, and then mostly discussion of empirical studies from the primary literature. P-BIO 150, 150L, 160, and BIO 160L.

BIO 340. Ecology. (4 h)
Introduction to the interrelationships among living systems and their environments; structure and dynamics of major ecosystem types; contemporary problems in ecology. P-BIO 150, 150L, 160, and BIO 160L. (QR)

BIO 341. Marine Biology. (3 h)
Introduction to marine organismal and habitat diversity and marine ecological processes. P-BIO 150, 150L, 160, and BIO 160L and C-BIO 341L.

BIO 341L. Marine Biology. (1 h)
Develops practical knowledge of marine environments through extensive field work. C-BIO 341.

BIO 342. Oceanography. (4 h)
Introduces the geological, physical, chemical, and biological processes that govern the global oceans and their role in climate change. Lab focus is on tools and research questions pertinent to the field of biological oceanography and includes a five-day field trip over Fall Break. Fees are associated with the required travel component of the course. Interested students are advised to inquire about available scholarships. P-CHM 111 and BIO 150, 150L, 160, and BIO 160L and prerequisite override required.

BIO 343. Molecular Neuroscience. (3 h)
Investigates the cellular and molecular basis of neural function, including the molecular basis of neurological disorders. P-BIO 245 or BIO 265.

BIO 346. Neurobiology. (3 h)
Studies electrical and chemical signaling allowing nerve cell communication as the starting point for investigating molecular, cellular, and systems-level mechanisms underlying the generation and control of behavior. P-BIO 245 or NEU 200.

BIO 346L. Neurobiology Lab. (1 h)
Laboratory emphasizing electrophysiological techniques with experiments from the cellular to the behavioral level. Students will design and complete their own projects. C-BIO 346.

BIO 348. Physiological Plant Ecology. (3 h)
Provides a fundamental understanding of how plants have adapted to the stresses of their habitats, particularly in harsh or extreme environments such as deserts, the alpine, the arctic tundra, and tropical rain forests. P-BIO 150, 150L, 160, and BIO 160L.

BIO 348L. Physiological Plant Ecology. (1 h)
Physiological plant ecology lab. P or C-BIO 348.

BIO 349. Tropical Biodiversity of the Amazon and Andes. (4 h)
Intensive field course in tropical biodiversity focusing on ecosystems, natural resource management, and conservation. Students will travel to major tropical biomes in the vast tropical wildernesses. Lectures emphasize the basic ecological principles important in each ecosystem. Field-based labs focus on student-designed projects. Offered in the summer only. Fees are associated with the required travel component of the course. Interested students are advised to inquire about available scholarships. Prerequisite override required.

BIO 352. Developmental Neuroscience. (4 h)
Examines the development of neural structures and the plasticity of the mature nervous system. Laboratory covers the basics of embryology, immunocytochemistry, and primary neuron culture. P- BIO 265 or BIO 343 or BIO 346/BIO 346L.

BIO 353. Functional Neuroanatomy. (3 h)
Focuses on the functional organization of the vertebrate central nervous system, including regions, systems, and circuits, with emphasis on application to current topics, neuropathology, and clinical cases. P-BIO 245 or NEU 200 or HES 350.

BIO 354. Methods in Neuroscience. (3 h)
Introduces the techniques used in the field of neuroscience. Anatomical, physiological, molecular and behavioral methods are covered through lectures, laboratory work, and reading the primary literature. Also offered in Salamanca. P-BIO 150, 150L, 160, and BIO 160L.

BIO 354L. Neuroscience Methods Lab. (1 h)
Introduces the techniques used in the field of neuroscience. Offered in Salamanca. (C-BIO 354)

BIO 356. Ecology and Resource Management of Southeast Australia. (4 h)
Intensive field-oriented course focusing on ecosystems, natural resource management and environmental conservation of southeastern Australia. Students travel to major biomes including sub-tropical rainforests, coral reefs and the Australian urban environment. Laboratories are field-based, with some consisting of student-designed projects. Taught only in summers in Australia. Fees are associated with the required travel component of the course. Interested students are advised to inquire about available scholarships. P-BIO 150, 150L, 160, and BIO 160L and prerequisite override required.

BIO 360. Metabolic Diseases. (3 h)
Explores genetic and biochemical pathways in the context of inborn errors of metabolism. P-BIO 370/CHM 370/BMB 370.

BIO 361. Principles of Biological Microscopy. (4 h)
Introduces the fundamentals of biological imaging techniques. Students will explore a variety of microscopic methods as well as image acquisition, post-image processing, and scientific figure creation. Emphasis will be on both a theoretical and practical understanding of microscopic imaging principles. Concepts of experimental design and data critique will be explored through student projects and presentations. P-BIO 265.

BIO 362. Immunology. (3 h)
Study of the components and protective mechanisms of the human immune system, including innate and acquired immunity. P-BIO 265.

BIO 363. Sensory Biology. (3 h)
Introduction to sensory physiology and other aspects of sensory systems, e.g. molecular biology and anatomy. Also offered in Salamanca. P-BIO 150, 150L, 160, and BIO 160L.

BIO 363L. Sensory Biology Lab. (1 h)
Laboratory emphasizing electrophysiological and behavioral techniques to examine sensory systems. Students will design and complete their own projects. C-BIO 363.

BIO 365. Biology of the Cell. (3 h)
Lecture course on classic and recent experiments in cell biology. Analysis and interpretation of experimental data from the primary literature is emphasized. P-BIO 265.

BIO 365L. Biology of the Cell Lab. (1 h)
Laboratory course introducing basic techniques in cell biology, leading to an independent project. P or C-BIO 365.

BIO 367. Molecular Virology. (3 h)
Introduces molecular mechanisms of eukaryotic viral replication, viral-cell interactions, viral disease, and immune responses to viral infections . P-BIO 265 and BIO 370/BMB 370/CHM 370.

BIO 367L. Molecular Virology Lab. (1 h)
Provides hands-on experience with modern molecular virology techniques. Students will learn how to cultivate, quantify, and detect eukaryotic viruses. P or C-BIO 367.

BIO 368. Cells and Molecules of Disease. (3 h)
Examines defects in molecular and cellular mechanisms that underlie disease states. P-BIO 265.

BIO 368L. Cells and Molecules of Disease Lab. (1 h)
Use of microscopy and histological techniques to identify changes to normal cells and tissues as a result of disease. Lab is 3 hours. P or C-BIO 368.

BIO 369. Cancer Biology. (3 h)
Analysis of molecular and cellular mechanisms that transform normal cells, trigger abnormal proliferation, and lead to tumor formation. Emphasis is on the biological basis of cancer, with some exploration of clinical consequences. P-BIO 235 or BIO 245 or BIO 265.

BIO 372. Advanced Molecular Biology. (3 h)
Presents molecular mechanisms by which stored genetic information is expressed including the mechanisms for and regulation of gene expression, protein synthesis, and genome editing. Emphasizes analysis and interpretation of experimental data from the primary literature. Also listed as BMB 372. P-BIO 265 and BIO 370/BMB 370/CHM 370.

BIO 372L. Advanced Molecular Biology Laboratory. (1.5 h)
Introduces modern methods of molecular biology to analyze and manipulate expression of genes and function of gene products. Also listed as BMB 372L. P or C-BIO 372/BMB 372 or BMB 373/CHM 373.

BIO 374. Neuropharmacology. (3 h)
Introduces how pharmacological agents affect cellular and molecular functions in the nervous system of normal and disease states. Lecture and case studies will be used to examine topics including drugs targeting mood and emotion, memory and dementia, and movement disorders. Drugs of abuse and the neurological basis of addiction will also be evaluated. P-BIO 150, 150L, 160, and BIO 160L AND either BIO 265 or NEU 200.

BIO 379. Introduction to Geographic Information Systems (GIS). (3 h)
Introduces the concepts and use of GIS as a mapping and analytical tool with emphasis on applications in environmental modeling, global change, sociodemographic change, and site suitability analyses. Students may not receive credit for both ENV 379 and BIO 379. C-BIO 379L. P-BIO 150, 150L, 160, and BIO 160L or prerequisite override required.

BIO 379L. Geographic Information Systems (GIS) Lab. (1 h)
Students may not receive credit for both ENV 379L and BIO 379L. C - BIO 379.

BIO 380. Biostatistics. (3 h)
Introduction to inferential methods in biology. Focuses on recognizing, quantifying, and communicating uncertainty in biological data. Topics include summarizing data, making predictions, and testing hypotheses. Special emphasis on communicating statistics to scientific and general audiences. P-BIO 150, 150L, 160, and BIO 160L. (QR)

BIO 381. Epigenetics. (3 h)
Studies the molecular mechanisms for inheritance of genome modifications. Uses primary literature to explore the environmental and developmental signals that influence epigenetic controls of gene expression and disease. Also listed as BMB 381. P-BIO 265 and BIO/BMB/CHM 370.

BIO 381L. Epigenetics Laboratory. (1 h)
Provides hands-on experiences with genome editing and molecular genetics to address the function and expression of genes. Also listed as BMB 381L. P or C-BIO 381 or prerequisite override required.

BIO 382. Molecular Signaling. (3 h)
Examines the molecular and biochemical mechanisms by which hormones, neurotransmitters, and other signaling molecules act to change growth, development, and physiological and behavioral responses of organisms with a focus on discussion of primary literature. Also listed as BMB 382. P-BIO 265 and BIO 370/BMB 370/CHM 370.

BIO 383. Genomics. (3 h)
Examines the architecture, expression, and evolution of genomes. Uses current primary literature to examine the functional and evolutionary dynamics of genomes and the modern analytic techniques used to investigate genome-wide phenomena. Also listed as BMB 383. P-BIO 235.

BIO 383L. Genomics Lab. (1 h)
Introduces analytic methods and interpretation of genome wide data through practical tutorials. Also listed as BMB 383L. P or C-BIO 383.

BIO 385. Bioinformatics. (3 h)
Introduction to computational approaches essential to modern biological inquiry. Approaches may include large biological dataset analyses, sequence similarity and motif searches, and analysis of high-throughput genomic technologies. Emphasizes interdisciplinary interaction and communication. Credit not allowed for both BIO 385 and CSC 385 or PHY 385. P-BIO 150, 150L, 160, and BIO 160L (and CSC 201 or 221 if taken as CSC 385) or prerequisite override required.

BIO 386. Genetics & African Diaspora. (3 h)
Study of modern human population divergence from a genomic perspective, focusing on the role of parasites in driving evolutionary adaptations. Explores the intersection of genetic diversity, health and disease in humans of the African diaspora. P-BIO 265. (SWC)

BIO 387. Computational Systems Biology. (3 h)
Introduction of concepts and development of skills for comprehension of systems biology problems, including both biological and computational aspects. Topics may include genome-wide transcriptomic analysis, protein interaction networks, large-scale proteomics experiments, and computational approaches for modeling, storing, and analyzing the resulting data sets. Emphasizes interdisciplinary interaction and communication. Credit not allowed for both BIO 387 and CSC 387. P-BIO 150, 150L, 160, and BIO 160L (and CSC 201 or 221 if taken as CSC 387) or prerequisite override required.

BIO 388. Methods in Molecular Genetics. (4 h)
Hybrid lecture/laboratory course gives students a hands-on introduction to a diverse array of techniques commonly used in molecular genetics laboratories. P-BIO 150, 150L, 160, and BIO 160L.

BIO 390. Mentored Research. (2 h)
Introduces the technology and techniques of research. Working under the supervision of a faculty member or research staff, students will obtain experience in experimental design and analysis. Credit not given for both BIO 390 and BIO 391. Satisfies the research requirement for the BA and BS degrees. Pass/Fail only. P-BIO 150, 150L, 160, 160L, and prerequisite override required.

BIO 391. Independent Research. (2 h)
Students participate in a research project involving collection or analysis of data to investigate a defined research question. Students are required to submit a written paper or poster documenting research progress. The same numbered course cannot be repeated. Subsequent courses must be taken in consecutive order. Credit not given for both BIO 390 and BIO 391. Satisfies the research requirement for the BA and BS degree. May not be taken pass/fail. P-BIO 150, 150L, 160, 160L and prerequisite override required.

BIO 392. Independent Research. (2 h)
Continuation of research beyond BIO 391. Students are required to submit a written paper or poster documenting research progress. The same numbered course cannot be repeated. Pass/Fail option. P-BIO 391 and prerequisite override required.

BIO 393. Research in Biology. (2 h)
Continuation of research beyond BIO 392. Students are required to submit a written paper or poster documenting research progress. The same numbered course cannot be repeated. Pass/Fail option. P-BIO 392 and prerequisite override required.

BIO 394. Research in Biology. (2 h)
Continuation of research beyond BIO 393. Students are required to submit a written paper or poster documenting research progress. The same numbered course cannot be repeated. Pass/Fail option. P-BIO 393 and prerequisite override required.

BIO 399. Mentored Biology. (2 h)
Students explore career opportunities in biology-related fields or experiences. Students are required to submit a written paper or poster describing research internship or experience to their advisor. Plans must be approved in advance by the advisor. Course can be repeated for credit, but only 4 total hours will count toward the BA BIO major. Does not count toward the BS BIO major or the BIO minor. Pass/Fail only. P-BIO 150, 150L, 160, 160L and prerequisite override required.