COURSES FOR BIOLOGICAL SCIENCES

Biological Sciences Courses

BSC500 Vertebrate Funct Morphol
Hours 4

Morphology of animals, primarily vertebrates, with emphasis on functional aspects of anatomy. Laboratory deals mainly with comparative anatomy of the vertebrates. Offered fall semester.

BSC501 Molecular Ecology
Hours 3

This course examines how variation in nucleic acid or protein sequences allow organisms or populations to function within, and adapt to, their environment.

BSC505 Introduction to Graduate Studies in Biological Sciences
Hours 2

This graduate level course presents topics designed to accelerate the progress and success of incoming and early stage graduate students as they transition into a M.S. or Ph.D. program in Biological Sciences. As a career preparation course, it aims to provide graduate students the practical skills and tools that will be applicable throughout their careers, regardless of their research focus.

BSC507 Research Tech In By
Hours 1-6

Individualized instruction and the application of research techniques to specific problems for graduate students in the department. Offered fall and spring semesters.

BSC511 Phage Discovery Laboratory
Hours 3

A research-based laboratory course that isolates and characterizes bacterial viruses (phages) using modern microbiology, microscopy, and molecular biology techniques.

Prerequisite(s): Graduate Standing or permission of the instructor.

BSC512 Limnology
Hours 3

A study of freshwater environments and organisms living in lakes, ponds, and streams. Offered fall semester.

BSC513 Cave Biology
Hours 3

This class focuses on biology related to caves and subterranean habitats, including biodiversity, ecology, evolution, microbiology, conservation, and applications to human health.

Prerequisite(s): Undergraduate courses in genetics and ecology or permission of the instructor

BSC514 Marine Biogeography and Evolution
Hours 3

Although the study of biogeography and evolution isn't fundamentally different in the ocean than it is on land, important differences exist in the history and pace of discovery, as well as in the mode and tempo of how biodiversity is generated, distributed, and maintained across geographic space. In this course we will focus on historical and contemporary biogeography in the marine realm, and compare and contrast evolutionary processes between marine and terrestrial ecosystems. There will be a special focus on the origin of marine biodiversity hotspots, geological processes & extinction, ocean currents, temperature gradients, depth gradients, the relative contribution of allopatric and sympatric speciation, gene flow, and effective population sizes.

Prerequisite(s): Undergraduate courses in general biology, genetics, and ecology or by instructor permission

BSC515 Wetland Ecology
Hours 3

An in-depth analysis of wetland ecology emphasizing the biology and ecology of vascular plants, including plant adaptations to anaerobic soils, reproductive adaptations, habitat, and plant zonation, and the role of plants in ecosystem function.

BSC516 Disease Ecology
Hours 3

This class will focus on the study of host-pathogen interactions within the context of their environment and evolution.

BSC517 Environmental Modeling
Hours 3

An integrated survey of quantitative principles and computer-based solution techniques important for understanding environmental systems and for environmental problem solving. Offered alternate fall semesters.

BSC518 Comparative Neuroanatomy
Hours 3

This course covers the study of the general principles of neuroanatomy across invertebrates and vertebrates, including their evolutionary relationships, brain morphology, and cellular biology. Anatomy will be learned via hands-on dissection and illustrations of various neural structures from flies to sheep.

Prerequisite(s): Undergraduate courses in cell biology and ecology or by permission of instructor

BSC519 Evolutionary Genomics
Hours 3

Evolutionary Genomics explores fundamental aspects of genome structure and function in an evolutionary context. Course topics range from chromatin structure evolution to whole genome duplication, and explores how these genomic traits impact the evolution of different organisms.

BSC520 Principles Of Systematics
Hours 4

An introduction to the principles, methods and applications of systematic zoology and the zoological classifications. Offered alternate fall semesters.

BSC521 Personalized and Genetic Medicine
Hours 3

This course will examine biological techniques that are advancing medical research and care. Topics include personalized medicine, direct-to-consumer genetic testing, predictive medicine, pharmacogenomics, and preimplantation genetic diagnosis. It will also explore concomitant ethical, legal, and societal ramifications related to many of these discoveries, such as ownership of biological material, informed consent for human experimentation, the burden of knowledge regarding genetic information, eugenics, and the Genetic Information Non-Discrimination Act.

BSC522 Biology of Cancer
Hours 3

This course is an introduction to the biological principals that explain the origins, development, pathology, and treatment of cancer. Students will work in teams assigned to particular types of cancer and will investigate what is known on various topics as related to that type of cancer.

Prerequisite(s): Must be enrolled in university graduate program.

BSC524 Human Physiology
Hours 3

Examines the cardiovascular, digestive, endocrine, muscular, neural, renal, reproductive and respiratory systems. Offered spring semesters.

BSC525 Human Physiology Lab
Hours 2

Centers on principles of physiology and instrumentation for physiology. Offered alternate fall semesters.

Prerequisite(s): None. Corequisite: BSC 524.

BSC526 Computational Biology Lab
Hours 3

Computational Biology Lab introduces the programming skills, statistical methods and conceptual foundations necessary to pursue computational analysis and modeling of biological systems. This course is designed for biology students, and it is not expected that students will have prior with experience with computing or programming.

BSC528 Biology Of Fishes
Hours 4

A survey of the structure, function, ecology, and classification of fishes. Offered alternate spring semesters.

BSC529 Neurophysiology
Hours 3

How do brains work? This course, designed for upper-level undergraduate and graduate students, aims to provide an in-depth examination of quantitative, physical and chemical principles that govern nervous system function. Topics covered include electrical properties of cells, ionic homeostasis, action potential generation, synaptic transmission and the generation of stereotypic activity patterns in neural circuit and systems.

Prerequisite(s): Graduate standing

BSC530 Introduction to Pharmacology
Hours 3

This course will cover the basic principles of pharmacology including mechanisms of drug action and drug absorption, distribution, metabolism, and excretion.

BSC531 Pathogenic Microbiology
Hours 3

A study of microorganisms related to health and disease. Offered spring semester.

BSC534 Plant Systematics
Hours 4

Characteristics and distribution of the major families of vascular plants, and practice in the collection and identification of flowering plants. One weekend field trip is required. Offered alternate spring semesters.

BSC535 Immunology
Hours 4

Thorough exploration of various aspects of modern immunology at the molecular and cellular levels. Offered fall semester.

BSC537 Epidemiology of Pathogens
Hours 3

This course will acquaint students with the principles of epidemiology and provide an understanding of the applications of epidemiology to public health and global disease burden. Major concepts include introductions into the various applications of epidemiological studies; discrimination between epidemics caused by infectious organisms, genetic backgrounds, and human behavior; and examples of how epidemiology can be applied in a clinical setting.

Prerequisite(s): Undergraduate course in microbiology or permission of the instructor

BSC539 Bch/Molecular Biology Lab
Hours 3

A survey of the common analytical techniques used in molecular biology. Topics include protein purification and characterization, enzymology, DNA isolation and restriction endonuclease mapping, and gene cloning. Offered spring semester.

BSC541 Developmental Biology
Hours 3

The course provides basic information about events in developing animal systems, emphasizing cellular, molecular, and genetic research approaches to the study of development. Offered spring semester.

BSC542 Integrated Genomics
Hours 4

This advanced undergraduate/graduate level course will introduce you the major technologies and concepts in genomics, familiarize you with some publicly available of bioinformatics databases and tools, contribute to the public knowledge base through your own bioinformatics and literature based research, and give you hands-on experience with genomics wet lab methods. This course will also provide information on careers in biotechnology.

BSC544 General Virology
Hours 3

The molecular biology of bacterial, animal, and plant virus replication, including the biophysical, biochemical, and biological properties of virus particles. Offered spring semester.

BSC548 Animal Behavior
Hours 3

This course is designed to provide modern perspectives on the study of animal behavior, pulling from fields as diverse as evolutionary biology, ecology, neurobiology and economics. However there will be a historical undercurrent which will illustrate the roots of this truly interdisciplinary field.

BSC549 Endocrinology
Hours 3

A detailed examination of the vertebrate endocrine system that uses a comparative approach to explore intricate relationships between the brain, endocrine glans, hormones and target organs.

BSC550 Fundamentals of Biochemistry
Hours 3

A one-semester survey of protein structure, enzyme kinetics, bioenergetics, and metabolism and its regulation. Offered fall and spring semesters.

BSC551 Bch/Molecular Biology II
Hours 3

A one-semester survey of the synthesis, processing, and degradation of DNA, RNA, and protein and the regulation of these processes. Offered spring semester.

BSC553 Biochemistry Lab
Hours 3

This course is an advanced laboratory course which will introduce students to some basic concepts and common modern techniques used in biochemical/molecular biology/cell biology research. A broad spectrum of techniques will be presented to students, including native protein purification from animal tissue, chromatography, electrophoresis, characterization of molecular weight and sequences of the purified protein through mass spectrometry, enzymatic kinetics studies, and spectroscopic analysis. For students who have interest and aspire to pursue a research career in biochemistry, cell biology, molecular biology, immunology and/or other related biological science areas, this course will provide basic training and experience for a smooth start for their future laboratory work.

BSC555 Chemical Ecology
Hours 3

Chemical interactions underlie and generate the biotic environment in which we live. This course will examine chemical interactions between organisms that can happen on different levels, from cell-cell interactions, intraspecific and multitrophic-level interactions, to community-wide interactions and ecological processes.

BSC556 Microbial Ecology
Hours 3

A study of microorganisms in the environment, with emphasis on their roles in energy transformations, biogeochemical cycles, and biotic interactions. Offered alternate fall semesters.

BSC558 Drug Discovery Laboratory
Hours 3

A research-based laboratory course that focuses on the identification of new drug leads from natural products using modern pharmacognosy, phytochemistry and phytopharmacology techniques.

BSC560 Human Developmental Biology
Hours 4

Development of the human embryo and fetus, including molecular, physiological, and structural aspects of morphogenesis and functional development. Offered irregularly.

BSC561 Ecohydrology
Hours 3

Ecohydrology is the interdisciplinary study of how water flows through and interacts with ecosystems. In this course, students will explore fundamental concepts in hydrology; plant-water interactions and their impact on the structure and function of ecosystems; the movement of materials and energy through watersheds; and ecohydrologic concepts in natural resource management.

Prerequisite(s): BSC 385 or permission of instructor.

BSC562 Biological Barriers in Health and Disease
Hours 3

The biological barriers offer a formidable separation between various compartments in the body or to the environment. Often times these are cellular barriers that when functioning properly, allow for normal healthy tissue function. However, when these barriers fail, complications such as infection, cancer, cystic fibrosis, and other diseases can occur. This course will examine the various physical and cellular barriers with special emphasis on human and biologically relevant model systems, to study their function in health and dysfunction in disease.

Prerequisite(s): BSC 300 or permission of instructor

BSC564 Biology Of Algae
Hours 4

Freshwater and marine algae and their structure, development, taxonomy, and distribution. Offered irregularly.

BSC565 Principles Of Toxicology
Hours 3

A study of the extent and significance of toxic agents in the environment and the biological processes which determine their behavior, fate, and ultimate effect on human health. We will cover basic principles of toxicology, including cellular penetration, distribution, metabolic conversion, and elimination of toxic agents, as well the basics of different body systems, and the effects of exogenous chemicals upon those systems.

Prerequisite(s): BSC 300 and BSC 315 or equivalent courses, or permission of the instructor

BSC567 Data Management and Visualization in R
Hours 3

An introduction to the R computing environment with emphasis on data management and visualization.

Prerequisite(s): BSC 300 or BSC 310 or BSC 385

BSC569 Histology Of Vertebrates
Hours 4

No description available

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BSC570 Principles of Population Genetics
Hours 3

Population genetics is the study of how evolutionary forces (genetic drift, natural selection, mutation, and gene flow) affect allele and genotype frequencies in populations. Population genetics is a field with a rich theoretical history that has allowed scientists to make predictions about these evolutionary processes. With the advent of massive amounts of genetic data in many species, it is now possible to test these predictions, and a solid foundation in theory, its expectations, and assumptions is crucial for interpreting results from genetic analyses. Students should expect to learn how evolutionary forces acting on individuals affect patterns of inheritance and ultimately drive the changes we see between species.

Prerequisite(s): Must be enrolled in university graduate program.

BSC571 Plant Physiology
Hours 3

Plant physiology is a survey sourse covering all aspects of plant transport, translocation of nutrients, plant biochemistry, plant metabolism and plant growth and development considered in depth.

BSC573 Bioinformatics
Hours 3

Bioinformatics BSC 473/573 is a lecture course that covers the tools and approaches necessary to perform computational analysis of large datasets. We will focus on analyzing high-throughput sequencing data although the tools we will learn are applicable to a wide range of modern biological questions. Specific topics include operating in a UNIX/bash shell environment, scripting, genome assembly, alignment, and algorithms. BSC 473/573 is a writing course and writing proficiency within this discipline is required for a passing grade in this course.

Prerequisite(s): Graduate standing

BSC575 General Entomology
Hours 4

A survey of the structure, function, classification, and habits of insects. Offered irregularly.

BSC576 Aquatic Insects
Hours 4

A survey of aquatic insects, with emphasis on their identification, life histories, and ecology. Offered alternate spring semesters.

BSC577 Invertebrate Zoology
Hours 4

The classification, morphology, evolution, and ecology of invertebrate animals.

BSC578 Microbiomes in Health and Disease
Hours 3

This class focuses on the study of host-microbiome interactions within the context of their environment, evolution, and global health.

BSC580 Plant Ecology
Hours 3

This course will examine the ecology of plants at different levels: individual, population and community.

BSC581 Foundations in Advanced Biostatistics with Applications to R
Hours 3

This course provides an overview to common statistical methods used in biological research, using case studies from biology, ecology, and natural resources management. The overarching objective of this course is to give students the ability to use and effectively evaluate biological data. We will demonstrate and conduct statistical analyses with an emphasis on utilizing the statistical computing language, R, to apply statistical concepts to biological and ecological data.

Prerequisite(s): Graduate standing or permission of the instructor.

BSC582 Conservation Biology
Hours 3

A thorough examination of the principles of conservation biology. Offered alternate spring semesters.

BSC583 Evolution
Hours 3

Thorough investigation of evolution, including population genetics, molecular evolution, adaptation, and speciation.

BSC584 Aquatic Biology Seminar
Hours 1

Review and discussion of current topics in aquatic biology. Offered spring semester.

BSC585 Foundations in Forest Resources and Conservation
Hours 4

This course provides an introduction to the foundational ideas of forest resources and conservation. The course includes a history of the forestry profession and a variety of perspectives to develop students' knowledge of forestry field and research methods. This course also helps students develop an understanding and appreciation of the diversity of forest resources both here in Alabama and globally.

BSC587 Biogeography
Hours 3

Examination of the ecological and historical factors influencing the geographical distribution of plants and animals.

Prerequisite(s): Undergraduate or graduate-level course in ecology.

BSC590 Stream Ecology
Hours 4

A thorough study of the structural (physical and biological) and functional (energy flow, nutrient cycling, community structure) attributes characteristic of stream and river ecosystems. Offered alternate spring semesters.

BSC594 Signal Transduction Neuroby
Hours 3

Seminar on current topics related to signal transduction, as it pertains to the molecular basis of neurobiology and development. Offered alternate fall semesters.

BSC598 Non-Thesis Research
Hours 1-15

Non-Thesis Research.

BSC599 Thesis Research
Hours 1-15

This independent research course partially fulfills required master's-level research thesis hours toward the master's degree in Biology. The course is conducted under the guidance of the thesis advisor. Material covered will be of an advanced nature aimed at providing master's students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be directed towards readings of research articles and development of research methodology, with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field.

BSC601 Biological Sciences Seminar
Hours 1

This course will introduce graduate students to a diversity of current topics and expand their knowledge of the methodology and application of research and research methods in the biological sciences. In addition to attending seminars by invited speakers and departmental faculty members, the course will also provide graduate students with instruction and practice in the oral presentation of research data.

BSC604 Scientific Writing and Data Presentation
Hours 3

This course will teach students writing skills for grant proposal and research paper preparation as well as other data presentation techniques in the biological sciences.

Prerequisite(s): Graduate standing or permission of the instructor.

BSC607 Adv Research Tech In By
Hours 1-6

Individualized instruction and the application of research techniques to specific problems at an advanced level for graduate students in the department. Offered fall and spring semesters.

BSC610 Pedagogy in Biological Sciences
Hours 3

Discussion of topics associated with teaching biology at the college-level, including reviews of the literature associated with science education, metacognition, and the scholarship of teaching and learning.

BSC615 Integrative Biology Seminar
Hours 1

This course is designed to provide modern perspectives on integrative biology through primary literature review and by reviewing graduate student manuscripts, conference presentations, and grant proposals. The course also will provide opportunities for graduate students to gain professional development advice and to learn more about statistical techniques for analyzing experimental data.

BSC620 Molecular Systematics
Hours 4

Theory and methods of phylogenetic analyses using molecular sequence data. Students will be able to select appropriate loci for the desired level of phylogenetic analysis, align sequences, generate phylogenetic hypotheses with a variety of inference methods, generate and evaluate branch-support values, and infer evolutionary patterns of from phylogenetic trees. Students will be able to critically evaluate phylogenetic methods and the support for conclusions reached in the phylogenetic literature for organisms across the Tree of Life.

Prerequisite(s): BSC 520

BSC621 Neurobiology
Hours 3

This course is an exploration of the fundamental principles of brain structure and function. Topic covered include the structure and function of neurons and glia, principles of sensory transduction, organization of sensory and motor circuits, and biological basis of complex behavior. Aspects of clinical neuroscience will be discussed to illustrate key concepts. Students will also critically evaluate foundational primary literature in the field of Neurobiology.

BSC650 Foundations of Ecology
Hours 3

This course emphasizes the current big ideas in ecology and the history behind these concepts. Students will gain an understanding of a common set of concepts and major lines of ecological development that characterize current research by reading early papers from the Foundations of Ecology. They will match current journal papers on a similar topic to compare changes in ecological thought over the decades. The progression of ideas will move from early to current work on populations, models of population growth, competition, and predator-prey dynamics as well as the early and more recent niche concepts. Students then consider community ecology, succession, and plant-animal interactions as well as ecosystem research on food webs, energy flow, and nutrient cycling. Students refine their research interests by leading discussions and selecting some of the papers for discussion that relate to their own research projects. Papers are meant to help students to initiate writing an introduction to their dissertation or thesis prospectus and prepare to meet with their dissertation committee members for further developing their ideas.

BSC652 Community Ecology
Hours 3

Thorough investigation of theory and empirical studies of ecological communities (plant, animal, microbial), including methods, community structure, diversity, succession, links to ecosystem function, resource management. Offered alternate spring semesters.

BSC656 Microscopical Techniques
Hours 4

An introduction to the methods and applications of electron microscopy in biological research, including techniques for preparation of biological specimens, operation of the transmission and scanning electron microscopes, and photography. Offered irregularly.

BSC657 Advanced Techniques in Microscopy
Hours 1

This course provides individual training on the use of different equipment in the Optical Analysis Facility in support of graduate student research. Emphasis will be placed on sample preparation techniques and advance microscopy usage (e.g., confocal microscopy, transmission electron microscopy and scanning electron microscopy).

BSC666 Disease Models and Mechanisms
Hours 3

A graduate level seminar on current topics related to use of animal model systems, as they pertains to the molecular basis of human disease. This course is designed to expose students to recent research in a variety of diseases. The instructor and students will give lectures that provide a general survey of current disease research topics. During each class, a student will give an introduction on the particular disease being discussed that week. This introduction usually contains some basic information about the disease (e.g. symptoms, incidence rate, diagnosis and prognosis) as well as the known and unknown aspects of what causes the disease. Detailed student presentations will then follow on specific and recent literature within that topic with a focus on molecular mechanisms. This is designed to foster interactive class discussion and to strengthen the analytical and presentation skills of graduate students in cell and molecular biology. Emphasis on critical thinking and evaluation of scientific approaches and application of methods will be a major component of this course. In addition to the presentation of a disease topic and participation of the course in each class, as a final assignment, students will be asked to write a "News and Views" type "preview" article on a recent or in-press article related to human disease modeling. If demonstrating appropriate scholarly value, select articles might be revised under the supervision of the instructor and then submitted for publication to an appropriate journal, such as Disease Models and Mechanisms or the Journal of Neuroscience. Specific guidelines for this assignment are provided. Assessment of student progress in terms of pre-test/post-test, written critiques of presentations and writing assignments will be provided. Following each class, Dr. Caldwell will provide immediate feedback on their presentation and suggest areas for improvement. Outline of Course Topics: 1) the molecular basis of select diseases 2) strengths/weaknesses of specific animal model systems (worms, flies, mice, zebrafish) 3) role of genetic, cellular, and molecular processes in disease 4) application of model systems toward therapeutic development.

Prerequisite(s): Graduate Student Status

BSC675 Global Change Biology
Hours 3

Students will take a detailed look at climate change across a variety of scales (species to biomes) using primary literature sources. Each student will lead a discussion in an area of climate change of their choice (e.g. climate change leading to disease, climate change and biological feed backs, alteration in climate and storm intensity, decline of amphibians); these topics need not be limited to biological subjects. Students will be expected to participate in critiques of primary literature, class discussions, and the development of an individual proposal (including preproposal, budgets, and panel discussions of funding).

Prerequisite(s): Must be enrolled in University Graduate Program.

BSC681 Topics in Drosophila Biology
SP

Hours 1

This is a graduate level course on the current genetic research methods and technologies using Drosophila as a model system. The course covers topics including using Drosophila to model human disease, developmental biology, evolution and development, and ethics and professionalism in science.

Special Topics Course

BSC695 Spec Topics Biolog Sci
SP

Hours 1-4

Courses with this number may address any biological topic not covered by existing courses. The credit hours and format are arranged as appropriate to each topic. The specific course title is added at the time the course is taught. Offered irregularly.

Special Topics Course

BSC696 Resident Study
Hours 2-6

Credit for the course is determined by the extent of the coursework. Offered fall and spring semesters.

BSC698 Res Not Rel Dissertation
Hours 1-15

Research Not Related to Dissertation.

BSC699 Dissertation Research
Hours 1-15

Dissertation Research.

Marine Science Course

MS548 Intro To Oceanography
Hours 4

A general introduction to the oceans, with emphasis on chemical, physical, and geological processes and the relationship of these processes to biological systems.