Biological and Environmental Sciences

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Location: Science Building, room 260, 903-886-5378
Biological and Environmental Sciences Web Site (https://new.tamuc.edu/department-of-biological-and-environmental-science/)

The Department of Biological and Environmental Sciences offers a Master of Science degree in Biological Sciences. The graduate programs in biology are designed to provide opportunities for students to pursue advanced training in particular fields of biology, to advance their professional goals, or to prepare students for entry into doctoral or professional health programs. The Master of Science degree in Biological Science offers both thesis and non-thesis options. The program is available face to face or online for students completing the non thesis option. Students wanting to enroll in the thesis option are encouraged to contact faculty members with similar research interests. Faculty research interests within the department include cell and molecular Biology, genetics and epigenetics, microbiology, neuroscience, environmental sciences, behavioral ecology, quail biology, and wildlife ecology and conservation.

Programs of Graduate Work

Master of Science in Biological Sciences (Thesis) and (Non-Thesis)

Admission

Admission to a graduate program is granted by the Dean of the Graduate School upon the recommendation of the department. Applicants must meet the following requirements for admission in addition to meeting the general university requirements in Biological Science.

- Admission Requirements (https://www.tamuc.edu/programs/biological-science-ms/#Admission)

Departmental Requirements

Students accepted in the graduate programs of the Department of Biological and Environmental Sciences are expected to follow all of the rules and procedures established by the Department. Students in all programs must pass a final comprehensive examination. The comprehensive exam for the MS Biology program consist of a written examination of basic concepts covering five chosen topic areas. Comprehensive exams are proctored by faculty advisors for thesis option students, and are available in the BSC 595 course shell for non-thesis/online students.

Successful completion of the Comprehensive Exam is required of all students.

Note: Individual departments may reserve the right to dismiss from their programs students who, in their judgment, would not meet the professional expectations of the field for which they are training.

Biological Sciences MS (https://coursecatalog.tamuc.edu/grad/colleges-and-departments/science-engineering/biological-environmental-sciences/biological-sciences-ms/)

Master of Science in Biological Sciences (Non-Thesis) Two year degree plan (Fall Start- Odd year).

The following course sequence is recommended to complete the program in two years. Note: Only one course is required in each of the three topic areas. If two courses are taken in a single topic area, one of them will count as an elective.

First Year

Fall	Hours	Spring	Hours	Summer	Hours
BSC 515 (core)	3	BSC 504 (core)	3	In Summer I, take two courses (6 hrs) from the following:	
plus one course (3 hrs) from the following		plus one course (3 hrs) from the following:		BSC 519 (elective)	3
BSC 509 (elective)	3	BSC 521 (elective)	3	BSC 516 (elective)	3
BSC 561 (elective)	3	BSC 520 (elective)	3	BSC 537 (elective)	3
BSC 539 (elective)	3	BSC 526 (elective)	3	BSC 560 (topic area 2)	3
BSC 552 (topic area 3)	3	BSC 534 (elective)	3	In Summer II, take two courses (6 hrs) from the following:	
BSC 541 (elective)	3	BSC 510 (topic area 2)	3	BSC 511 (elective)	3
BSC 535 (elective)	3	BSC 523 (elective)	3	BSC 513 (topic area 1)	3
				BSC 552 (topic area 3)	3
				BSC 524 (elective)	3
	6		**6**		**12**

Second Year

Fall	Hours	Spring	Hours
Take two courses (6 hrs) from the following:		BSC 595 (required)	3
BSC 512 (topic area 1)	3	Plus one course (3 hrs) from the following:	
BSC 531 (elective)	3	BSC 513 (topic area 1)	3

BSC 562 (elective)	3	BSC 514 (elective)	3
BSC 525 (elective)	3	BSC 524 (elective)	3
BSC 540 (elective)	3	BSC 560 (topic area 2)	3
BSC 550 (topic area 3)	3	BSC 527 (elective)	3
		BSC 533 (elective)	3
	6		**6**

Total Hours: 36

Master of Science in Biological Sciences (Non-Thesis) Two year degree plan (Fall Start- Even year).

The following course sequence is recommended to complete the program in two years. Note: Only one course is required in each of the three topic areas. If two courses are taken in a single topic area, one of them will count as an elective.

First Year

Fall	Hours	Spring	Hours	Summer	Hours
BSC 515 (core)	3	BSC 504 (core)	3	In Summer I, take two courses (6 hrs) from the following:	
Plus one course (3 hrs) from the following:		Plus one course (3 hrs) from the following:		BSC 512 (topic area 1)	3
BSC 512 (topic area 1)	3	BSC 513 (topic area 1)	3	BSC 532 (elective)	3
BSC 531 (elective)	3	BSC 514 (elective)	3	BSC 525 (elective)	3
BSC 562 (elective)	3	BSC 524 (elective)	3	BSC 550 (topic area 3)	3
BSC 525 (elective)	3	BSC 560 (topic area 2)	3	In Summer II, take two courses (6 hrs) from the following:	
BSC 540 (elective)	3	BSC 527 (elective)	3	BSC 517 (elective)	3
BSC 550 (topic area 3)	3	BSC 533 (elective)	3	BSC 530 (elective)	3
				BSC 510 (topic area 2)	3
				BSC 523 (elective)	3
	6		**6**		**12**

Second Year

Fall	Hours	Spring	Hours
Take two courses (6 hrs) from the following:		BSC 595 (required)	3
BSC 509 (elective)	3	Plus one course (3 hrs) from the following:	
BSC 561 (elective)	3	BSC 521 (elective)	3
BSC 539 (elective)	3	BSC 520 (elective)	3
BSC 552 (topic area 3)	3	BSC 526 (elective)	3
BSC 541 (elective)	3	BSC 534 (elective)	3
BSC 535 (elective)	3	BSC 510 (topic area 2)	3
		BSC 523 (elective)	3
	6		**6**

Total Hours: 36

BSC 500 - Graduate Seminar
Hours: 1
Graduate Seminar. One semester hour. Discussions and presentations of issues of current interest in the biological sciences and of related career opportunities. Prerequisite: Graduate standing.

BSC 504 - Advanced Biostatistics
Hours: 3
The objective of this course is to provide students with the knowledge and understanding of the methods of statistical analysis applicable to biological research. Emphasis will be placed on the concepts and application of statistical thinking. Basic probability theory, parametric and non-parametric statistics including t-test, analysis of variance, correlation, simple linear regression will be reviewed. Advanced statistical methods including multiple regression, logistic regression, model selection and other quantitative methods will be introduced. Prerequisites: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor.

BSC 504A - Advanced Biostatistics
Hours: 3
(Same as BSC 504) The objective of this course is to provide students with the knowledge and understanding of the methods of statistical analysis applicable to biological research. Emphasis will be placed on the concepts and application of statistical thinking. Basic probability theory, parametric and non-parametric statistics including t-test, analysis of variance, correlation, simple linear regression will be reviewed. Advanced statistical methods including multiple regression, logistic regression, model selection and other quantitative methods will be introduced. Prerequisites: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor. Crosslisted with: BSC 504.

BSC 505 - Methods in Field Ecology
Hours: 3
Methods in Field Ecology. Three semester hours. A study of advanced contemporary knowledge in field ecology. Prerequisite: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor

BSC 509 - Microbial Ecology
Hours: 3
This course is designed to provide in-depth understanding of the interrelationship between microorganisms and their living (biotic) and nonliving (abiotic) environments. The comprehensive understanding will help students evaluating and creating a holistic approach to sustainable environmental quality as all living organisms interplay to maintain ecological balance. The term “microbial ecology” came into frequent use only in the early 1960s. The current popularity of microbial ecology and the rapid development of this field are reflective of public interest in ecology and the scientific recognition of the essential roles of microorganisms in ecosystems.

BSC 510 - Community Ecology
Hours: 3
Community ecology is the study of biotic interactions in plant and animal assemblages. This course begins with a description of community types. More detailed material follows: competition and ecological niche, predator-prey interactions, food webs, habitat selection, and diversity. The material is supported by numerous examples from models and experimental studies.

BSC 511 - Avian Biology
Hours: 3
This course looks at current research in the areas of avian evolution, systematics, foraging ecology, mate choice, mating systems, and reproductive behavior and ecology. Prerequisites: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor.

BSC 512 - Advanced Ecological Genetics
Hours: 3
Ecological genetics is a study of the genetic processes that occur within and among populations and which contribute to population differentiation and microevolution. Topics covered include measures of genetic variation, genetic drift, natural selection and adaptation, phenotypic evolution, the evolution of life histories, sex and reproductive success. Prerequisite: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor

BSC 513 - Molecular Genetics
Hours: 3
This course is designed for students with a thorough background in biology and cell biology. This course provides students with an in-depth investigation into the development of gene concepts and practical application of genetic study and hereditary disease. Following a brief review of DNA structure, function, nature of genes and mendelian genetics, an extension of mendelian analysis is explored. Emphasis will be placed on eucharyotic gene mapping, recombinant DNA technology and practical applications. Next, comprehension of genetic mutations at the nucleotide, and chromosomal level is sought in the context of aging and human disease. Students are expected to gain an in-depth understanding of basic principles and concepts. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 514 - Advanced Pharmacology - Principles and Practice
Hours: 3
This course is designed for graduate students with a thorough background in biology and cell biology. Therefore, this course provides students with a greater understanding of general concepts of pharmacology. Specific drugs and sites of drug action are examined beginning with the peripheral, followed by the central nervous system. We then will focus on the pharmacology of the endocrine system and conclude with drugs affecting the immune system. Emphasis will be distribution, metabolism and transport as well excretion of drugs. In each system pharmacological effects, cautions and contraindications are discussed. Clinical indications and hypothetical scenarios are discussed. Students are expected to gain an in-depth understanding of basic principles and concepts of drugs at the molecular levels, to learn to reason scientifically, and to understand and describe the cooperative function of pharmacology in body systems. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 515 - Advanced Cell Biology
Hours: 3
This course is designed for graduate students with a thorough background in biology and cell biology. Therefore, this course provides students with a greater understanding of molecular mechanisms of cellular function. Emphasis will be placed on internal organization of the cell. Students are expected to gain an in-depth understand of basic principles and concepts of eukaryotic cells at the molecular levels, to learn to reason scientifically, and to understand and describe the cooperative function of organelles in the specialized cells. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 515A - Advanced Cell Biology
Hours: 3
(Same as BSC 515) This course is designed for graduate students with a thorough background in biology and cell biology. Therefore, this course provides students with a greater understanding of molecular mechanisms of cellular function. Emphasis will be placed on internal organization of the cell. Students are expected to gain an in-depth understand of basic principles and concepts of eukaryotic cells at the molecular levels, to learn to reason scientifically, and to understand and describe the cooperative function of organelles in the specialized cells. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor. Crosslisted with: BSC 515.

BSC 516 - Medical Microbiology
Hours: 3
Medical Microbiology. Three semester hours. This is a course for biology graduate students designed to provide knowledge of pathogenic microorganisms and infections and to help students develop a means of analyzing the nature of infectious diseases. Specific topics covered during this class include pathogenic microorganisms, diagnostic procedures, infection control & treatment, and emerging diseases. This course will focus on the pathogenic mechanisms of microorganisms aided with corresponding individual case studies of diseases in order to foster critical thinking and problem solving techniques. Prerequisite: Graduate standing, An undergraduate degree in Biology or related discipline or permission from instructor. Prerequisites: Graduate standing, An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 517 - Stem Cell Biology
Hours: 3
This course will provide students with an in-depth account of stem cell biology, various forms of stem cells and their application to regenerative medicine. Special reference will be made to molecular, epigenetic, and genetic control of stem cell differentiation and specializations. Existing and potential clinical use of stem cells, its derivatives, and induced pluripotent stem cells also will be discussed. Since this is rapidly developing field with sweeping social implications, strong emphasis will be placed on understanding the current controversies surrounding stem cell research.

BSC 518 - Thesis
Hours: 3-6
Thesis. Six semester hours. A problem is chosen in the student's major field of interest with approval of the major professor. No credit is given until an acceptable thesis is completed. Prerequisite: Graduate standing.

BSC 519 - Advanced Gene Regulation
Hours: 3
This course will provide a rigorous and advanced knowledge in regulation of gene expression so that students will be ready for Ph.D. level courses. This course will emphasize the molecular biology gene expression in eukaryotes. Based on the review of the seminal works in gene regulation, presentations and discussions, this course will familiarize the student with current technology and driving principles of the field of gene regulation.

BSC 520 - Advanced Immunology
Hours: 3
This course is designed for graduate students with a thorough background in biology and cell biology. Therefore, this course provides students with a review of basic immunological principles and the generation of immune responses. Emphasis will be placed on human physiology and the cooperative interplay between innate and acquired immunity. An in-depth view of the immune system will be sought in the context of immune effector mechanisms as well as the immune system in health and disease. Principles and applications of antibody-antigen interactions will also be discussed. Students are expected to learn the principles and concepts of immunology both at the molecular and cellular levels, to learn to reason scientifically, and to understand and describe the function of immune systems in the human body. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 521 - Epigenetics
Hours: 3
This course will provide students with a rigorous foundation in epigenetics and epigenomics. This course will emphasize the epigenetic process of gene regulation, its involvement in disease processes, therapies and recent advances in assessing epigenetic changes. Based on the review of the seminal works in epigenetics course will familiarize the student with current technology and driving principles of the field of epigenetics.

BSC 522 - Reproductive Physiology
Hours: 3
Students will acquire familiarity with the vocabulary of reproductive physiology. Gain a fundamental understanding of the basic biological aspects of animal reproductive anatomy, physiology and endocrinology. Understand sexual determination and differentiation. Understand the cellular and molecular mechanisms controlling Reproduction. Understand the comparative differences and similarities among several mammalian species.

BSC 523 - The Plant Microbiome
Hours: 3
This graduate course provides an overview of the concepts of plant microbiome; gives an insight into the dynamic relationships between plant and microorganisms; covers various aspects about the use of plant-microbiome interaction for nutrients uptake, nitrogen and carbon fixation, pollutants cleaning and soils/plants health improvement.

BSC 524 - Advanced Soil and Biogeochemistry
Hours: 3
This graduate course will compose pathways of nutrients in different critical zones of ecosystem which are rich in nutrients and microorganisms like hyporheic zone, vadose zone, riparian zone etc. This course will have an overview of the biogeochemical processes affecting elemental and nutrient cycling in rhizosphere to the landscape level environmental systems. In summary, students will receive in depth knowledge of soil biogeochemistry to demonstrate how air, soil, and water are unique mediums for biogeochemical cycles, identify biotic and abiotic interactions and potential exchange routes involved in biogeochemical cycles.

BSC 525 - Advanced Neuroscience
Hours: 3
This course is designed for graduate students with a thorough background in biology and cell biology. Therefore, this course provides students with a greater understanding of molecular, developmental, and network mechanisms of neuronal function. Emphasis will be placed on molecular and cellular components of neurons at their most basic level as well in unique specific systems particularly sensory, and movement systems as well as cognitive development & aging. Students are expected to gain an in-depth understand of basic principles and concepts of neurons at the molecular levels, to learn to reason scientifically, and to understand and describe the cooperative function of organelles in the specialized cells. Prerequisite: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 526 - Advanced Developmental Biology
Hours: 3
This course is intended for master's level students who understand genetics and cell biology/biochemistry. This course examines the molecular mechanisms of development covering fertilization through senescence. It is organized around an in depth analysis and careful reading of primary research papers taken from the current literature. Topics vary but include events in early embryogenesis such as fertilization, embryonic stem cells, gastrulation and layer determination, and axis formation. Later events in embryogenesis covered include tissue specific stem cells, digit formation, cell differentiation, muscle formation, neural development, and synapse formation. Postembryonic development includes studies on hormonal regulation, aging, and senescence. A variety of organisms are introduced, with common mechanisms of development emphasized. Prerequisite: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 527 - Advanced Human Physiology
Hours: 3
This advanced course focuses on human physiology. It provides a comprehensive understanding of how each organ/tissue works down to the cellular level and what role(s) each organ system plays in maintaining homeostasis. This information is then used to solve case studies involving human physiology.

BSC 528 - Case Studies in Endocrinology
Hours: 3
This advanced course in physiology focuses on the human endocrine (hormonal) system. Students will learn how to differentiate between endocrine, paracrine, and autocrine systems and they will understand the major mechanisms of action of peptides, steroid, and thyroid hormones. The course materials will allow students to compare and contrast hormone actions exerted via plasma membrane receptors with those mediated via intracellular receptors. Other topics include the role of hormone-binding proteins, feedback control mechanisms of hormone secretion, the effects of secretion, degradation, and excretion on plasma hormone concentrations and hormone measurements (eg, radioimmunoassay, immunometric assay) and their interpretation.

BSC 529 - Workshop
Hours: 3
Workshop - Three semester hours Topics may vary

BSC 530 - Advanced Virology
Hours: 3
An advanced detailed study of contemporary knowledge of virology. Prerequisites: An undergraduate degree in Biology or related discipline or permission from instructor.

BSC 531 - Biogeography
Hours: 3
Biogeography is the study of the geological, evolutionary, and ecological processes that have resulted in the geographic patterns of biodiversity that we see today. This course provides a comprehensive overview of this most fascinating subject. The material begins with an overview of ecological communities and the geographic patterns of biodiversity. It then follows with coverage of the interactions of geological and evolutionary histories and ends with a brief discussion of on-going human impacts.

BSC 532 - Behavioral Ecology
Hours: 3
Behavioral ecology is the study of the adaptive value of behavior in its ecological context. This course looks at current research in the areas of foraging ecology, mate choice, mating systems, reproductive behavior and ecology, decision making, game theory and optimality in animals. Prerequisites: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor.

BSC 533 - Invertebrate Zoology
Hours: 3
Invertebrate Zoology. Three semester hours. A study of advanced contemporary knowledge in invertebrate zoology. Prerequisite: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor

BSC 534 - Vertebrate Zoology
Hours: 3
Vertebrate Zoology. Three semester hours. A study of advanced contemporary knowledge in vertebrate zoology. Prerequisite: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor

BSC 535 - Evolution
Hours: 3
Evolution. Three semester hours. This course deals primarily with macroevolution. Topics include models of gene flow, agents of evolution, natural selection, isolating mechanisms, geographic variation, phylogenetics, the fossil record, the species concept and speciation, adaptation and the evolution of morphological traits. Prerequisite: An undergraduate degree in Biology, Wildlife, or related discipline or permission from instructor

BSC 536 - Plant Diversity & Conservation
Hours: 3
An advanced study of plant diversity and conservation strategies at the species, population, and landscape levels.

BSC 537 - Behavior and Conservation
Hours: 3
This course examines how animal behavior can be utilized to make informed decisions in conservation biology. It begins with a brief description of the principles of animal behavior and behavioral ecology. The course then focuses on how a consideration of animal behavior affects the design and effectiveness of conservation programs.

BSC 538 - Respiratory Physiology
Hours: 3
This is an advanced course in respiratory physiology. Couses topics include detailed examinations of pulmonary ventilation, alveolar ventilation, pulmonary circulation, pulmonary gas exchange, oxygen and carbon dioxide transport, respiratory control, and non-respiratory lung functions.

BSC 539 - Herpetology
Hours: 3
An investigation of the study of amphibians and reptiles, with emphasis on diversity, evolution, and natural history of extant groups. Current controversies, conservation, and behavior will be topics of note.

BSC 540 - Animal Behavior
Hours: 3
An investigation of the principles of animal behavior with an emphasis on evolution and the proximate and ultimate causes of behavior. Aspects of methods of observations, physiology and development of behavior, instinct and learning, and modern cognitive ethology will be addressed.

BSC 541 - Genetic Engineering
Hours: 3
This course will provide graduate students with basics and applied aspects of genetic engineering. The course is organized into three parts. Part I of the course will introduce the field of genetic engineering and provide basics of cell and molecular biology, the scientific driver of genetic engineering. Part II discusses the methodologies and principles of recombinant DNA technology and strategies for gene manipulation. In Part III, applications and use of genetic engineering. Since this is rapidly developing field with sweeping social implications, ethics surrounding recombinant DNA technology will be discussed. Prerequisites: An undergraduate level course in Cell Biology, Genetics, Biochemistry, or Molecular Biology.

BSC 542 - Reproductive Physiology
Hours: 3
This graduate level course is designed for students interested in advancing their contemporary knowledge in reproductive physiology. In addition to exploring basic human reproductive physiology, the course includes current topics such as reproductive aging, hormone therapies, fertility studies and treatments, sexual behavior, and the latest issues related to pregnancy as well as contraception. The study of human reproductive physiology is supplemented by review of primary research literature in alternative vertebrate models. Prerequisites: Graduate student status.

BSC 550 - Microbial Physiology
Hours: 3
This is an advanced microbiology course designed for graduate students majoring in biology. Microbial physiology is a study of the cell structure, growth factors, metabolism and genetic composition of microorganisms and the interrelatedness of microbiology, biochemistry, and genetics in the context of a functional bacterial cell. This course provides a survey of microbial physiology with emphasis on metabolism, regulation, cell walls, membranes, ecology, and adaptation to extreme environments.

BSC 551 - Ecophysiology
Hours: 3
A study of physiological adjustments made by animals to changes in their external environment. The topics include fundamental mechanisms of adaptation, central issues in comparative physiology such as water balance, osmoregulation, metabolism and energy supply, respiration and circulation, temperature and its effects, excitable tissues as well as hormonal and chemical controls that allow adjustments in the changing aquatic and terrestrial environments.

BSC 552 - Comparative Animal Physiology
Hours: 3
A comparative study of the general principles of organismal function in terms of similarities that exist between very different animals and the exceptions to the general rules. The focus will be on understanding how whole animals, both invertebrates and vertebrates, solve particular challenges of living in different habitats.

BSC 560 - Advanced Landscape Ecology
Hours: 3
Students will study the relationships between ecological processes in the environment and particular ecosystems using a variety of landscape scales, development of spatial patterns, and organizational levels of research and policy.

BSC 561 - Bioremediation
Hours: 3
Students will study the use of either naturally occurring or deliberately introduced microorganisms or other forms of life to consume and break down environmental pollutants, in order to clean up a polluted site.

BSC 562 - Ecotoxicology
Hours: 3
Students will study of the effects of toxic chemicals on biological organisms, especially at the population, community, ecosystem level. Ecotoxicology is a multidisciplinary field, which integrates toxicology and ecology.

BSC 589 - Independent Study
Hours: 1-4
Independent Study . One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member. May be repeated when the topic varies. Prerequisite: Consent of department head.

BSC 595 - Research Literature and Techniques
Hours: 3
Research Literature and Techniques. Advisor approval required. Prerequisites: BSC 504 and BSC 515.

BSC 597 - Special Topics
Hours: 1-4
Special Topics. One to four semester hours. Organized class. May be repeated when topics vary.