

# DEPARTMENT OF BIOLOGICAL SCIENCES

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## About

**Chair:** Aaron Lynne, Ph.D. ([aaronlynne@shsu.edu](mailto:aaronlynne@shsu.edu))

**Contact Information:** (936) 294-1540

**Website:** Department of Biological Sciences (<https://www.shsu.edu/academics/biological-sciences/>)

## Mission

The Department of Biological Sciences is dedicated to the pursuit and dissemination of knowledge and scientific discovery in the life sciences through innovative teaching and research programs. The department strives to instill in its students the philosophy of lifelong scholarship, producing scientifically literate members of society who have the knowledge to contribute and compete in a rapidly changing world.

## Highlights

The graduate program in biology is designed to prepare students for both a related doctoral program and for a career as a professional biologist in industry, government, and academia. This degree is research-oriented, requiring 26 hours of course work, and 6 hours of thesis. A diverse faculty allows students to choose among the gamut of biological research options, from studying the molecular basis of disease to investigating the ecological and evolutionary processes of macroorganisms. Faculty disciplines include:

- Cell and Molecular Biology
- Genetics
- Microbiology
- Physiology
- Forensic Science
- Systematics
- Animal Behavior
- GIS
- Ecology
- Entomology
- Botany
- Parasitology
- Ichthyology
- Herpetology
- Ornithology
- Mammalogy

Explore more about the faculty (<https://www.shsu.edu/academics/biological-sciences/people/faculty.html>) on the departmental website.

The Department of Biological Sciences houses greenhouses as well as laboratories with a confocal microscope, scanning electron microscope, transmission electron microscope, and modern cell and molecular biology research equipment. The department also maintains the Pineywoods Environmental Research Laboratory (PERL), a 250-acre field station that contains the Applied Anatomical Research Center, dedicated to biological and environmental research and teaching and is affiliated with the Sam Houston State University Natural History Collections.

- Master of Science in Biology (<http://catalog.shsu.edu/archives/2021-2022/graduate-and-professional/college-departments/science-and-engineering-technology/biological-science/biology-ms/>)
- See also Master of Science in Forensic Science (<http://catalog.shsu.edu/archives/2021-2022/graduate-and-professional/college-departments/criminal-justice/forensic-sciences/forensic-science-ms/>) in the College of Criminal Justice (<http://catalog.shsu.edu/archives/2021-2022/graduate-and-professional/college-departments/criminal-justice/>)

## Student Organizations and Activities

The Biological Sciences Graduate Student Organization (BSGSO) was established by graduate students. The purpose of the organization is to foster the interests of graduate students in the Department of Biological Sciences, to promote and support academic and social activities of interest to graduate students, and to serve as a liaison between the graduate students, faculty, staff, and other organizations. Membership in BSGSO consists of being a graduate student in the Department of Biological Sciences. Anne Gaillard is the faculty advisor for BSGSO.

## Scholarships

Academic scholarships and research and travel awards are available from the Department of Biological Sciences, the College of Science and Engineering Technology, and the Graduate School. These awards include:

- The Joey Harrison Scholarship from the Department of Biological Sciences
- The College of Science and Engineering Technology Graduate Achievement Scholarship
- The College of Science and Engineering Technology Graduate Recruitment Scholarship
- The General Graduate School Scholarship
- The Graduate School Graduate Student Travel Award

Departmental scholarship information may be obtained by writing to:

Scholarships  
Department of Biological Sciences  
Box 2116  
SHSU  
Huntsville, Texas 77341-2116

Please visit the College of Science and Engineering Technology and The Graduate School websites for specifics on their application processes.

## Graduate Student Support

Competitive teaching and research assistantships are available to graduate students in Biology through the Department of Biological Sciences (<https://www.shsu.edu/academics/biological-sciences/>) and individual faculty members. The Graduate School offers funding to graduate students to support travel to scientific meetings to present research findings. For details and application materials, contact:

### Graduate Committee Chair

James Harper (jmharper@shsu.edu)  
Department of Biological Sciences  
Box 2116  
Sam Houston State University  
Huntsville, TX 77341-2116  
(936) 294-1544

Details are also available at the Department of Biological Sciences (<http://www.shsu.edu/academics/biological-sciences/.html>).

### BIOL 5095. Independent Grad Study in BIOL. 4 Hours.

This course is designed to provide an avenue for selected graduate students to engage in independent studies. Registration is on an individual basis but is limited to students in residence. A topic of study is selected and approved by the Biology faculty. Variable Credit (1-3).

**Prerequisite:** Graduate standing in Biology and consent of department chair.

### BIOL 5300. Professional Aspects of Sci. 3 Hours.

This is an essential course on scientific professionalism for the beginning M.S. student. Students are provided with an introduction to the professional and ethical responsibilities of scientists. Students discuss philosophical and controversial issues in academia and science, as well as political issues that may influence the process and practice of science. Most importantly, this course encourages and helps students to develop skills needed for presenting their research to fellow scientists through the processes of publishing, giving conference presentations, writing grant proposals, and becoming active in the scientific community. Required of all graduate students in Biology.

**Prerequisite:** Graduate standing.

### BIOL 5301. Seminar in Biology Research I. 3 Hours.

Students examine research strategies used by professional biologists, including experimental design and interpretation of results. Additionally, students develop skills in reviewing and analyzing relevant scientific literature as part of their preparation for planning, executing, and completing an original research project.

### BIOL 5302. Seminar in Biology Research II. 3 Hours.

Students will develop skills in hypothesis development, research design, and scientific communication through the production of a research prospectus. This is done in preparation for planning, executing and completing an original research project.

**Prerequisite:** BIOL 5301.

### BIOL 5305. Medical/Criminal Entomology. 3 Hours.

Students discuss the methods and materials necessary for use of insects as forensic evidence in legal investigation. Laboratory included.

**Prerequisite:** Introductory entomology and graduate standing.

**BIOL 5310. Class And Natrl/Hist Plants. 3 Hours.**

Students are presented the classification and natural history of major groups of nonvascular and vascular plants. Emphasis is placed on morphological recognition, ecological and physiological differences and economic importance of major taxa. Laboratory included.

**Prerequisite:** Introductory botany course and graduate standing.

**BIOL 5320. Statistical Design in Biology. 3 Hours.**

Students engage in a survey of various experimental designs and associated statistical analyses common in biology. Using primarily the general linear model, students explore in detail appropriate designs for the following statistical applications: independent t-test, Analysis of Variance, block, multivariate, paired t-test, repeated measures, correlation, regression, Analysis of Covariance, ordination, clustering, randomization, and goodness of fit. The class consist of lecture, practical exercises in analyzing data (using SAS, SPSS, or another comparable analytical program), and class discussion of experimental designs published in the primary literature. This course is meant to be a follow-up to Biostatistics (BIOL4374) in that the basic statistical theory are not presented. Rather, this course focuses on the practical use of experimental design for analyzing and interpretation data. Grading in this class is be based on exams and individual practical exercises.

**Prerequisite:** BIOL 4374 (or equivalent), or permission of instructor.

**BIOL 5330. Model Organisms. 3 Hours.**

Students investigate the ways in which model organisms are employed and used in modern biological research. Primary topics may include genetics, genomics, physiology, and development of model organisms. Experimental design and application of animal models in research are also studied.

**BIOL 5350. Plant Evolutionary Biology. 3 Hours.**

The developmental program of many plants is sufficiently plastic to allow a suite of evolutionary scenarios not encountered in other major lineages. Mechanisms such as hybridization, polyploidy, somaclonal variation, chromosomal rearrangement, and the evolution of diverse and unique breeding systems have allowed plants to thrive in every terrestrial biome. Additionally, many of these mechanisms allow for rapid evolution that can be documented over the span of a few generations. Students study the myriad ways in which plants have diversified from their endosymbiotic ancestors as well as the hallmarks of evolution that characterize major plant lineages.

**Prerequisite:** Graduate standing in the Department of Biological Sciences and an introductory course in botany.

**BIOL 5360. Principles Of Systematics. 3 Hours.**

Systematics is the study of biological diversity, encompassing the evolutionary origins of this diversity and the construction of classification systems that recognize evolutionary lineages. Students study the history and philosophy of classification as a whole, from the development of nomenclature to modern techniques of molecular phylogenetics. Topics may include species concepts, nomenclature, interpreting and inferring phylogenies from many kinds of data, the use of DNA databases, DNA barcoding and alternatives to the Linnaean system of nomenclature.

**Prerequisite:** Graduate standing and an introductory course in statistics.

**BIOL 5361. Evolutionary Biology. 3 Hours.**

Evolution is the core theory of modern biology. Students investigate the major principles of evolutionary biology, from the history of evolutionary thought through theory and current concepts of evolution. Emphasis will be placed on molecular and cellular evolution, mechanisms of evolution including natural selection, gene flow, founder effect, and speciation. Note: Students who have taken BIOL 4361 may not take BIOL 5361.

**Prerequisite:** Graduate Standing.

**BIOL 5363. Genomics and Bioinformatics. 3 Hours.**

Students analyze advances in genomics and bioinformatics and apply computational and bioinformatic approaches to understand the genome structure, function, and evolution. Topics may include DNA sequencing, sequence assembly, gene and protein sequence alignments, whole genome comparison, annotation of DNA sequences, promoter analysis, transcriptomics, proteomics, and phylogenetic analysis. Note: Students who have taken BIOL 4363 may not take BIOL 5363.

**Prerequisite:** Graduate Standing.

**BIOL 5364. Cell Structure And Physiology. 3 Hours.**

Students study of signal transduction pathways in the cell, with emphasis on those relevant to human physiology and disease.

**Prerequisite:** Cell Biology and Organic Chemistry.

**BIOL 5365. Genetic Analysis of Human Disease. 3 Hours.**

Students analyze the transmission and molecular basis of human genetic traits and genetic diseases. Various simple and complex genetic disorders are examined using pedigree, molecular, and biochemical analyses. Novel approaches to the diagnosis and treatment of human genetic disorders are discussed. Topics such as the ethical, legal, social issues and concerns of genetic testing and discrimination, germ line therapy, genetic enhancement, and human cloning are examined. Note: Students who have taken BIOL 4360 may not take BIOL 5365.

**Prerequisite:** Graduate Standing.

**BIOL 5368. Advanced Invertebrate Zoology. 3 Hours.**

Invertebrates are the dominant form of life on earth, comprising greater than 75% of all described species. Students are briefly introduced to the phylum/class level characteristics of the major groups of invertebrate animals. The majority of the course deals with the evolutionary history and phylogeny of invertebrates, invertebrate ecology, and the myriad solutions invertebrates have evolved to deal with the common problems of reproduction, feeding, osmoregulation, respiration, locomotion and developmental patterns.

**Prerequisite:** 12 hours advanced biology, invertebrate zoology recommended.

**BIOL 5371. Advanced Evolution. 3 Hours.**

Students examine the modern concepts of the evolution of organisms. Extended reading and classroom discussion supplement the lecture treatment. Three one-hour lectures a week are scheduled.

**Prerequisite:** Introductory genetics.

**BIOL 5374. Biostatistics. 3 Hours.**

Students apply statistical methods to biological problems. Topics may include descriptive statistics, probability distributions, estimation, hypothesis testing, correlation and regression, and analysis of variance. Note: Students who have taken BIOL 4374 may not take BIOL 5374.

**Prerequisite:** Graduate Standing.

**BIOL 5375. Bacterial Physiology. 3 Hours.**

Students study bacterial metabolism that includes fermentation, anaerobic respiration, bacterial photosynthesis and nitrogen fixation. Students also discuss how bacteria sense their environment and adjust their metabolism accordingly. Three hours of lecture per week.

**Prerequisite:** Microbiology, Genetics, and Organic Chemistry II or General Physiology.

**BIOL 5378. Virology. 3 Hours.**

Students study viruses that infect plants, animals, and bacteria. Areas considered may include chemical and structural properties of viruses, virus-host relations, and infection and growth phenomena, including interference and regulation. In addition, the roles of viruses are included as agents of disease and malignancy, and as gene vectors in natural settings, but also as tools in biotechnology and gene therapy. Three hours of lecture per week.

**Prerequisite:** Microbiology, Genetics, and Organic Chemistry.

**BIOL 5380. Advanced Ecology. 3 Hours.**

Students engage in an advanced theoretical and practical study of biotic and abiotic ecosystem interactions encompassing the physiology of individuals, growth of populations, including social and species interactions within populations, analysis of population composition and change, the distribution of communities, and the functioning of ecosystems.

**Prerequisite:** General Chemistry I and II, General Ecology.

**BIOL 5381. Ecological Computer Modeling. 3 Hours.**

Students are provided an introduction to the development and application of computer models in ecology and population biology. Principles of modeling, programming concepts, specific model dynamics, and prepackaged computer models are explored. Two hours of lecture and two hours of laboratory per week.

**Prerequisite:** General Ecology.

**BIOL 5382. Ichthyology. 3 Hours.**

Students are introduced to general concepts in biology, taxonomy, systematics, evolution, zoogeography and ecology of fishes. Students learn the characteristics and identifying features for most of the dominant fish families on Earth. Moreover, students leave with a working knowledge on the taxonomy and nomenclature of the marine and freshwater fishes of Texas as well as the skills necessary to identify fishes from across the globe. This class includes a 2-hour weekly laboratory and field work.

**Prerequisite:** Introductory biology plus 12 hours advanced biology.

**BIOL 5383. Herpetology. 3 Hours.**

Students are introduced to the biology of amphibians and reptiles and one of the most important evolutionary events in natural history: the rise and diversification of terrestrial vertebrates. A comprehensive introduction addresses the taxonomy, systematics, evolution, anatomy, physiology, ecology, distribution, and natural history of these unique vertebrates. Upon completion of this course, students understand and appreciate why amphibians and reptiles serve as excellent biological models in research, and are familiar with the major research questions and programs in herpetology. A laboratory and field component introduce students to a variety of sampling and collecting techniques. Common museum practices for specimen preservation and documentation are also addressed. Although regional species receive the most emphasis, this course addresses the biology of all amphibians and reptiles. Two-hour laboratory plus field work.

**Prerequisite:** Introductory biology plus 12 hours advanced biology.

**BIOL 5384. Ornithology. 3 Hours.**

Students study the classification evolution, anatomy, physiology, ecology, behavior and conservation of birds. Laboratories may include general anatomy, taxonomy, identification and field techniques used in the study of behavior and migration. Laboratories may include independent research projects related to topics discussed in this course. Two-hour laboratory plus field work.

**Prerequisite:** Introductory biology plus 12 hours advanced biology.

**BIOL 5385. Mammalogy. 3 Hours.**

Students study the taxonomy, systematics, anatomy, ecology, distribution, and life history of mammals. Laboratories may include general taxonomy, identification, and field techniques. Two-hour laboratory plus field work.

**Prerequisite:** Introductory biology plus 12 hours advanced biology.

**BIOL 5390. Limnology. 3 Hours.**

Students examine physical, chemical, and biological characteristics of freshwater stream and lake ecosystems. Limnological techniques are stressed with special emphasis on physiochemical conditions of freshwater environments and their effects on aquatic life. Plankton analysis, a study of bottom fauna, lake and stream mapping and evaluation of aquatic productivity are included. Two-hour laboratory plus field work.

**Prerequisite:** 8 hours college chemistry plus 12 hours advanced biology.

**BIOL 5391. Advanced Genetics. 3 Hours.**

Students engage in an advanced study of the principles of heredity and the nature and function of genes.

**Prerequisite:** Introductory genetics with grade of C or better and organic chemistry.

**BIOL 5394. Spcl Topics In Graduate Bio. 3 Hours.**

This course of Graduate Faculty-led study is designed to provide exposure of graduate students to new biological topics and concepts in a course setting, prior to that course's formal Department, College, and University course adoption. This course may be repeated for different Advanced Special Topics (different courses).

**Prerequisite:** Graduate standing in the Department of Biological Sciences or consent of the instructor.

**BIOL 5410. General Entomology. 4 Hours.**

Students examine insect morphology, taxonomy, development, and life histories. Collection techniques and the use of keys to identify insects are stressed. Note: Students who have taken BIOL 4410 may not take BIOL 5410. Graduate Standing.

**Prerequisite:** Graduate Standing.

**BIOL 5480. Comparative Animal Physiology. 4 Hours.**

Students study of the physiological adaptive mechanisms and the comparison of adaptive strategies across vertebrate taxa. Emphasis is directed toward homeostatic mechanisms of water, energy and electrolyte balance, and metabolism. A two-hour laboratory to emphasize investigative skills employing modern laboratory techniques is included. Independent original research project required.

**Prerequisite:** Organic chemistry, general physiology, or instructor's consent.

**BIOL 6099. Thesis. 1-3 Hours.****BIOL 6398. Thesis. 3 Hours.**

Director/Chair: **Aaron Matthew Lynne**

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