# Department of Biological Sciences

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## Master of Science in Biology

The graduate degree offered in the Department of Biological Sciences is intended to enrich and enhance education in biological sciences in order to prepare students for leadership roles in industrial, educational and research-oriented careers. The Department of Biological Sciences offers the Master of Science degree with thesis and non-thesis options, as well as a non-thesis Life Science Education option.

Students should have an undergraduate major in biology in order to gain full admission to the program. Those lacking the desired background will be required to complete appropriate leveling work. The departmental graduate advisor will review the student's transcript and determine the nature and amount of leveling work, and will assist the student in establishing his or her advisory committee. The committee chair, who will assume duties for the student through the remainder of their graduate program, should be chosen by the end of the first semester of graduate work. The advisory committee should consist of a minimum of three members. At least two members will be selected from Biological Sciences graduate faculty. Remaining members may be selected from the Biological Sciences graduate faculty or from graduate faculty outside the Biological Sciences that have expertise relevant to the student's area of interest.

The thesis, consisting of the written report of the research, must be the student's original work and must reflect his or her ability to express thoughts accurately and clearly. Both the thesis proposal and thesis must be written according to guidelines and deadlines established by the College of Graduate Studies and the Department of Biological Sciences. Students should refer to the Graduate Handbook, Thesis Manual, and the Biological Sciences Graduate Students Handbook for more detailed information.

Thesis students are encouraged to quickly establish and begin working with their advisory committee on a research proposal. To continue matriculation in the thesis option, students are required to gain approval of their research proposal from their advisory committee and submit the proposal to the College of Graduate Studies by the end of their first year in the program. Students failing to meet this deadline will be required to meet with their advisory committee to discuss a possible extension of the proposal deadline or switching to the non-thesis option. Thesis hours (BIOL 5088 Thesis) cannot be taken until the thesis proposal has been approved by the advisory committee and submitted to the College of Graduate Studies.

Upon completion of the thesis and approval by the advisory committee and College of Graduate Studies, the student is required to schedule a public, oral presentation of his or her research followed by a comprehensive oral examination administered by the advisory committee. The oral examination will emphasize topics related to the thesis and course work. Successful completion of the comprehensive oral examination completes the program. If the attempt at the comprehensive oral examination is unsuccessful, it is at the discretion of the advisory committee to dismiss the student from the program or recommend to the student a plan of action to repeat the comprehensive oral examination. If a plan to repeat the examination is recommended, the plan may include recommendations to repeat courses in the weak areas, take additional course work, or spend more time in individual preparation prior to rescheduling a second attempt at the exam.

## Master of Science in Biology Program Requirements

| | | |
|---|---|---|
| BIOL 5185 | Seminar [1] | 1 |
| BIOL 5185 | Seminar [1] | 1 |
| BIOL 5398 | Research Design and Analysis | 3 |
| Additional BIOL Coursework* | | 13 |

*Select no more than 12 hours from the following: BIOL 5086, BIOL 5310, BIOL 5315, BIOL 5340, BIOL 5345, BIOL 5374, BIOL 5375, BIOL 5378, BIOL 5401, BIOL 5402, BIOL 5406, BIOL 5410, BIOL 5413, BIOL 5415, BIOL 5420, BIOL 5430, BIOL 5436, BIOL 5440, BIOL 5441, BIOL 5445, BIOL 5449, BIOL 5451, BIOL 5460, BIOL 5462, BIOL 5470, BIOL 5475

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|---|---|
| **Total Hours** | **18** |

### Non-Thesis

| | |
|---|---|
| Additional BIOL Coursework* | 8 |
| Additional BIOL or Supporting Area* | 10 |

*Select no more than 12 hours from the following: BIOL 5086, BIOL 5310, BIOL 5315, BIOL 5340, BIOL 5345, BIOL 5374, BIOL 5375, BIOL 5378, BIOL 5401, BIOL 5402, BIOL 5406, BIOL 5410, BIOL 5413, BIOL 5415, BIOL 5420, BIOL 5430, BIOL 5436, BIOL 5440, BIOL 5441, BIOL 5445, BIOL 5449, BIOL 5451, BIOL 5460, BIOL 5462, BIOL 5470, BIOL 5475

| | |
|---|---|
| **Total Hours** | **18** |

### Thesis

| | | |
|---|---|---|
| BIOL 5088 | Thesis | 6 |
| BIOL 5380 | Biological Scientific Writing | 3 |
| Additional BIOL Coursework* | | 2 |
| Additional BIOL or Supporting Area* | | 3 |

*Select no more than 12 hours from the following: BIOL 5086, BIOL 5310, BIOL 5315, BIOL 5340, BIOL 5345, BIOL 5374, BIOL 5375, BIOL 5378, BIOL 5401, BIOL 5402, BIOL 5406, BIOL 5410, BIOL 5413, BIOL 5415, BIOL 5420, BIOL 5430, BIOL 5436, BIOL 5440, BIOL 5441, BIOL 5445, BIOL 5449, BIOL 5451, BIOL 5460, BIOL 5462, BIOL 5470, BIOL 5475

| | |
|---|---|
| **Total Hours** | **14** |

The non-thesis Master's candidate, during the final semester of course work, is required to successfully complete a comprehensive written and oral examination. For the written exam, instructors of degree plan courses are invited to submit questions over course material as the basis of the written exam. After successful

completion of the written exam, students are required to schedule an oral examination with their advisory committee. Successful completion of the written and oral examination completes the program. If an attempt at the written or oral exam proves unsuccessful, it is at the discretion of the advisory committee to dismiss the student from the program or recommend a plan of action to the student to repeat the written or oral comprehensive examination. If a plan to repeat the examination is recommended, the plan may include recommendations to repeat courses in weak areas, take additional course work, or spend more time in individual preparation prior to rescheduling a second attempt at the exam.

## Courses

**BIOL 5086. Biological Problems. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**
Independent research under the supervision of an instructor. A formal report will be submitted to the instructor. A student may not count more than 6 hours of biological problems toward a degree. Lab fee $10.

**BIOL 5088. Thesis. 1-6 Credit Hours (Lecture: 1-6 Hours, Lab: 0 Hours).**
Scheduled when the student is ready to begin the thesis. No credit until thesis is completed. Prerequisite: BIOL 5398 and consent of major professor.

**BIOL 5185. Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**
A graduate seminar course providing the opportunity for students to lead discussions on a current topic in Biology. Topics vary according to interests of faculty and/or students. May be repeated for credit as topics vary. Prerequisite: 12 hours of biology.

**BIOL 5188. Immunology Lab Techniques. 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).**
Apply current techniques in experimental immunology and serology. Credit will not be awarded for both BIOL 3185 and BIOL 5188. Prerequisite: BIOL 5385 or concurrent enrollment Lab Fee: $2.

**BIOL 5302. Ecological Plant Physiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
The interrelations of plants and their environments with emphasis on those which are subject to manipulation. Critical processes such as dormancy, photosynthesis, nutrition, reproduction, and water relations and their interactions in survival and biomass production. Prerequisite: BIOL 3426 or approval by the department head.

**BIOL 5309. Cellular Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of cellular morphology and function at the ultrastructural and molecular level. Prerequisites: Organic chemistry and 18 hours of BIOL or approval by the department head.

**BIOL 5310. Developmental Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Introduction to basic principles of developmental biology. The course will include sections on classical embryology, the molecular basis of development, and evolution of development. In addition, students will read/discuss relevant articles from the primary literature. Students cannot receive credit for both BIOL 5310 and BIOL 4340. Prerequisite: A course in genetics.

**BIOL 5315. Vaccines. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course will cover the basic principles in the study of vaccines by providing a foundation to the understanding of the immune response to vaccinations, development of vaccinations, and the significance of individual human and animal vaccines. Students cannot receive credit for both BIOL 5315 and BIOL 4350. Prerequisite: A course in microbiology.

**BIOL 5320. Environmental and Restoration Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Study of human interactions with plants and animals within ecosystems with an emphasis on conservation and restoration ecology. Outdoor laboratories and restoration of plant communities are required.

**BIOL 5321. The Aquatic Environment. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of the basic principles involved in the ecology of the aquatic community including biotic and abiotic relationships. Emphasis placed on the sources of water contamination to include the effects of the contamination upon the changes in water chemistry and their possible biological implication. Prerequisites: 18 hours of BIOL and 2 semesters of CHEM or approval by the department head.

**BIOL 5330. Development of Modern Biological Concepts. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of the development of biological concepts and their impact upon science and society. Biographical as well as contemporary readings will be involved. Prerequisite: Graduate classification or approval by the department head.

**BIOL 5331. Conservation Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Principles of conservation biology and the major issues that define the discipline. Study of value, threats to, and conservation of biodiversity. Conservation issues at the population and species levels, policy, and practical applications of the science will be included. Prerequisites: Genetics and Ecology, or approval of department head.

**BIOL 5340. Measuring Biological Diversity. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course is designed to give graduate students real world experience in acquiring and analyzing basic ecological data on the distribution and abundance of living organisms.

**BIOL 5345. Behavioral Ecology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
The aim of this course is to understand variation in behavior among species and among individuals within a species. The course will focus on how behavior affects an animal's ability to survive and reproduce. Students cannot receive credit for both BIOL 5345 and BIOL 4320.

**BIOL 5350. Environmental Microbiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course is online. Students will learn about the microorganism populations in the soil and water, and then learn about how they impact these environments, both positively and negatively, while learning about DNA sequencing technologies, biochemistry, and biogeochemical cycling. Prerequisite: enrolled in graduate school.

**BIOL 5360. Bacterial Genetics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course is designed to be an advanced course in molecular biology and genetics, focusing on DNA structure, transcription, translation, and regulation of the central dogma of life. Bacteria (E. coli) are used as a model system due to their simplicity and extensive information available. Prerequisite: Enrolled in graduate school. Undergraduate level cell biology or genetics.

**BIOL 5361. Evolutionary Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Examination of evolutionary patterns, mechanisms and processes at the organismal, chromosomal and molecular levels; modes of adaptation and the behavior of genes in populations. Prerequisite: Genetics.

**BIOL 5374. Biochemistry. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
An introduction to the basic principles of biological chemistry and to fundamental processes of plants, animals and microorganisms. Students cannot receive credit for both BIOL 5347 and BIOL 4374. Prerequisite: Organic Chemistry with "C" or better.

**BIOL 5375. Biochemistry II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A detailed survey of intermediary metabolism. The metabolism of carbohydrates, lipids, proteins and nucleic acids, and the regulation of metabolism are emphasized. Students cannot receive credit for both BIOL 5375 and BIOL 4375. Prerequisites: Courses in Organic Chemistry and Biochemistry.

**BIOL 5378. Biochemistry Lab. 3 Credit Hours (Lecture: 1 Hour, Lab: 5 Hours).**
Principles and applications of basic methodology for the isolation, purification, characterization, and quantitative determination of biologically important compounds. Students cannot receive credit for both BIOL 5310 and BIOL 4378. Prerequisites: Courses in Organic Chemistry and Biochemistry Lab fee: $2.

**BIOL 5380. Biological Scientific Writing. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course covers the basic principles of scientific writing with an emphasis on writing for the biological sciences. A specific focus of the course will be on the design, planning and writing of a research proposal in terms of problem selection, objectives, methodology, and formatting. Students will learn the types of literature and complete a literature search and review. Students will present their research proposal in an oral presentation.

**BIOL 5385. Immunology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Emphasis on the basic concepts of humoral and cell-mediated immunity. Prerequisite: Undergraduate Microbiology.

**BIOL 5390. Special Topics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Selected topics in an identified area of biology, biochemistry or biotechnology. May be repeated for credit as topics vary. Prerequisites: 12 hours of biology and 8 hours of chemistry or approval of department head.

**BIOL 5395. Pathogenic Microbiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of the disease-producing capacities of various microorganisms with emphasis on the diagnostic procedure of isolation and identification. Students cannot receive credit for both BIOL 5340 and BIOL 3395. Prerequisites: A course in microbiology Lab Fee: $2.

**BIOL 5398. Research Design and Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Statistical principles and techniques applicable to the procurement, analysis, and evaluation of quantitative data. Prerequisite: MATH 1314 or approval by the department head.

**BIOL 5399. Practicum, Field Problem, or Internship. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Supervised practice in specialized laboratory or professional settings. Prerequisites: 12 hours of biology and 8 hours chemistry or approval of department head.

**BIOL 5401. Ecology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
The scientific study of the biotic and abiotic interactions that determine the distribution and abundance of organisms. Students cannot receive credit for both BIOL 5401 and BIOL 4401. Lab fee: $2.

**BIOL 5402. Histology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
Introduction to cellular ultrastructure. Study of vertebrate tissues and their arrangement in various organs. Students cannot receive credit for both BIOL 5402 and BIOL 3402. Lab fee: $2.

**BIOL 5406. Comparative Vertebrate Anatomy. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).**
The morphology, physiology, and phylogeny of the organ systems of vertebrates. Laboratory study of representative vertebrates. Students cannot receive credit for both BIOL 5406 and BIOL 3406. Lab fee: $2.

**BIOL 5410. Terrestrial Field Ecology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A study of the structure and functioning of terrestrial communities with an emphasis on plants. Laboratories will be conducted over three weekends. Students cannot receive credit for both BIOL 5410 and BIOL 4420. Prerequisite: A course in plant taxonomy or department head approval Lab fee: $2.

**BIOL 5413. Molecular Biology. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).**
Fundamentals of gene expression, gene regulation, DNA metabolism and nucleic acid structure, recombinant DNA techniques and protein structure. Students cannot receive credit for both BIOL 5413 and BIOL 3413. Prerequisites: Course in genetics and organic chemistry Lab fee: $2.

**BIOL 5415. Plant Taxonomy. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
Principles of plant taxonomy. Field and laboratory studies of common Texas wild flowers and trees with emphasis on identification, collection, and preparation of herbarium specimens. Students cannot receive credit for both BIOL 5415 and BIOL 3415. Lab fee: $2.

**BIOL 5420. Plant Pathology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
Study of the various types of plant diseases and specific examples of each type. Emphasis upon identification, host-parasite interactions, pathogen dissemination, and control methods. Students cannot receive credit for both BIOL 5420 and BIOL 3420. Lab fee: $2.

**BIOL 5430. Ornithology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A study of the basic biology of birds, including origins, systematics, ecology, biogeography, physiology, anatomy, and reproductive biology. Laboratory emphasizes identification of regional avifauna and includes multiple field trips. Students cannot receive credit for both BIOL 5430 and BIOL 4430. Lab fee: $2.

**BIOL 5436. Plant Physiology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A study of physiology of green plants with emphasis on nitrogen metabolism, respiration, mineral nutrition, photosynthesis, and growth. Students cannot receive credit for both BIOL 5436 and BIOL 3436. Lab fee: $2.

**BIOL 5440. Herpetology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A survey of the biology of amphibians and reptiles, with emphasis on phylogenetics, ecology, physiology, morphology, zoogeography, conservation, and taxonomy. Laboratory and field work will provide students with practical experience in collecting, identifying, and preparing specimens of regional species, as well as observing populations in natural settings. Students cannot receive credit for both BIOL 5440 and BIOL 4440. Lab fee: $2.

**BIOL 5441. Freshwater Biology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
The study of aquatic communities and the biogeochemical factors affecting the productivity of ponds, reservoirs, and streams (Limnology). Labs focus on field collections and student-driven experimental research. Students cannot receive credit for both BIOL 5441 and BIOL 4441. Lab fee: $2.

**BIOL 5445. Parasitology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
This course will cover parasite diversity (focusing on parasitic organisms of medical and veterinary importance) and parasite biology including aspects of morphology, identification, pathology, treatment, and ecology of the parasite-host relationship. Students cannot receive credit for both BIOL 5445 and BIOL 4445. Lab fee: $2.

**BIOL 5449. Animal Diversity. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
The study of the morphology, taxonomy, biology, and phylogeny of the invertebrate animals. In lecture, students concentrate on basic concepts of structures, function and evolutionary development of major invertebrate groups. In lab, students are exposed to a large collection of invertebrates, learning about systematics, ecology, structure and phylogenetic relationships. Students cannot receive credit for both BIOL 5449 and BIOL 3449. Lab fee: $2.

**BIOL 5451. Mammalogy. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A study of the evolution, anatomy, behavior, ecology, systematics, and basic biology of mammals. Laboratory work includes identification of regional mammals as well as techniques for the collection and preparation of mammalian specimens. Students cannot receive credit for both BIOL 5451 and BIOL 4451. Lab fee: $2.

**BIOL 5460. Animal Physiology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
An advanced course in the fundamentals of vertebrate physiology emphasizing physiologic mechanisms from a basic molecular/cellular level up to the level of organ systems, which include the nervous, endocrine, muscular, cardiovascular, respiratory, digestive and urinary systems. The basic physiologic mechanisms are presented in the context of human physiology, however, how selected animals are adapted to particular environments is addressed. Laboratory exercises involve the use of electronic instrumentation to measure physiologic responses non-invasively in human volunteers or in surgically prepared animals. Students cannot receive credit for both BIOL 5460 and BIOL 4460. Lab fee: $2.

**BIOL 5462. Icthyology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
A study of the anatomy, behavior, ecology, evolution, taxonomy, and zoogeography of fishes. Field and laboratory work provide students with practical experience in collecting, identifying, and studying fishes. Emphasis will be placed on local fauna. Students cannot receive credit for both BIOL 5462 and BIOL 4462. Lab fee: $2.

**BIOL 5470. Phycology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
Hands-on training in the taxonomy, ecology, and ecophysiology of algae. Discussion of current uses of algae for water quality, biofuel, food production, forensic science, and nanotechnology. Students cannot receive credit for both BIOL 5470 and BIOL 3430. Lab fee: $2.

**BIOL 5475. Immunology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**
Emphasis on the basic concepts of humoral and cell-mediated immunity. Laboratory: current techniques in experimental immunology and serology. Students cannot receive credit for both BIOL 5475 and BIOL 3485. Lab fee: $2.

**BIOL 6181. Philosophy of Biology Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**
A graduate seminar course providing student-led discussion over directed readings related to the Philosophy of Biology. Topics include mechanism, consilience and abduction in scientific reasoning; demarcation between science and pseudoscience, the nature of life, genes, individuals, and species; adaptation and function; information and signaling; partitioning variation and the tree of life.

**BIOL 6182. Ethical Conduct of Research Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**
A graduate seminar course emphasizing the importance of ethical conduct of research, reporting research, and the reproducibility crisis in science. Faculty and students will lead discussions on the importance of institutional oversight of research, moral responsibility in conducting research, data 'ownership,' the proper storage and manipulation of data for reproducible research, the deposition of data in curated databases such as Dryad and Genbank, the merits of curating raw data vs. vetted data/data summaries, presenting caveats/weaknesses in research, and responsible reporting of financial sources and conflicts of interest.

**BIOL 6301. Advanced Ecology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
An investigation of seminal and modern concepts of ecological theory. Theoretical and empirical approaches to the study of ecology in terms of interactions between organisms and their environment and interactions among organisms at various levels of biological organization. Prerequisite: Genetics; Evolutionary Biology or equivalent; introductory ecology course or equivalent strongly recommended.

**BIOL 6302. Advanced Evolutionary Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
The study of evolution as the unifying discipline across the life sciences; principles of population genetics, systematics and phylogenetic theory, paleontology and macroevolution, speciation and modes of adaptation; application of evolutionary theory to questions in molecular biology, developmental biology, ecology, animal behavior and biomedicine. Prerequisite: Genetics; Principles of Evolution or equivalent.

**BIOL 6309. Cellular Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of cellular morphology and function at the ultrastructural and molecular level. Prerequisite: Organic chemistry and 18 hours of biology courses or approval by the department head.

**BIOL 6311. Methods in Ecology. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).**
Introduction to the application of statistical, mathematical and computational tools to questions in ecology. Classic and current conceptual and mathematical approaches to population, community, ecosystem, disease, and evolutionary ecology. Hands-on application of computational tools for quantitative analysis of ecological datasets using R. Emphasis on the development of scientific hypotheses, employment of modern statistical and computational approaches for parameter estimation, and evaluation of alternate models using strength of evidence. The course will also explore the different statistical schools of thought common in ecological research, including frequentist, likelihood-based (including information-theoretic), and Bayesian approaches. Prerequisite: Advanced Ecology Lab Fee: $2.

**BIOL 6321. The Aquatic Environment. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of the basic principles involved in the ecology of the aquatic community including biotic and abiotic relationships. Emphasis placed on the sources of water contamination to include the effects of the contamination upon the changes in water chemistry and their possible biological implication. Prerequisite: 18 hours of biology and 2 semesters of chemistry courses or approval by the department head.

**BIOL 6322. Methods in Evolutionary Biology. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).**
Introduction to the application of statistical, mathematical and computational tools to questions in evolutionary biology. Topics may include: Introduction to phylogenetic theory, including advanced construction of phylogenies, dating phylogenetic splits using molecular data, detecting historical admixture and conducting comparative analyses; Analyzing population genomic data, including estimating population substructure and gene flow, estimating genetic diversity and detecting loci under selection; Application of basic game-theoretic models to the study of frequency-dependent selection, including the evolution of sex and cooperative behavior. Estimation of heritability for quantitative traits, as well as linear and nonlinear selection gradients from empirical data. Prerequisite: Genetics; Evolutionary Biology or equivalent Lab Fee: $2.

**BIOL 6330. Development of Modern Biological Concepts. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A study of the development of biological concepts and their impact upon science and society. Biographical as well as contemporary readings will be involved.

**BIOL 6331. Conservation Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Principles of conservation biology and the major issues that define the discipline. Study of value, threats to, and conservation of biodiversity. Conservation issues at the population and species levels, policy, and practical applications of the science will be included. Prerequisite: Undergraduate Genetics and undergraduate Ecology, or approval of department head.

**BIOL 6350. Environmental Microbiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course is online. Students will learn about the microorganism populations in the soil and water, and then learn about how they impact these environments, both positively and negatively, while learning about DNA sequencing technologies, biochemistry, and biogeochemical cycling.

**BIOL 6360. Bacterial Genetics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
This course is designed to be an advanced course in molecular biology and genetics, focusing on DNA structure, transcription, translation, and regulation of the central dogma of life. Bacteria (E. coli) are used as a model system due to their simplicity and extensive information available. Prerequisite: undergraduate cell biology or genetics.

**BIOL 6370. Population Genetics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
A general introduction to mathematical population genetics and evolutionary theory. Theoretical and empirical approaches to the study of the effects of mutation, recombination, selection, and migration on the genetic composition of populations through time and across space. Modern concepts in both theoretical and experimental population genetics are covered, including quantitative trait loci (QTL) analyses, coalescent theory and demographic modeling, multivariate techniques for analyzing genetic data and site-frequency spectra. Prerequisite: Genetics; Adv. Evolutionary Biology or equivalent; Methods in Evolutionary Biology strongly recommended.

**BIOL 6371. Evolution of Development. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Mixed format course (lecture, readings, discussion) surveying foundations and current developments in Evo-Devo. The course will integrate evolutionary biology and developmental biology in a common framework, focusing on the evolution of developmental pathways as a basis for the evolution of animal morphology. Topics will include the following: the developmental toolkit, HOX genes, and debates regarding evolution of regulatory elements vs. secreted proteins; evolution of the vertebrate body plan with emphasis on neural crest; evolution and development of specific organ systems, such as the eye and tetrapod limb, mechanisms of growth and development of cancer; targets of selection during ontogeny; morphogenesis and patterning mechanisms; roles of developmental robustness, heterochrony, and modularity in generating macro-scale evolutionary patterns. Prerequisite: Methods in Evolutionary Biology, Advanced Evolutionary Biology.

**BIOL 6372. Macroecology and Biogeography. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Mixed format course (lecture, readings, discussion) surveying foundations and current developments macroecology and biogeography. The course will integrate evolutionary and ecology principles as applied to large spatial and temporal scales to understand statistical patterns of distribution, abundance, and diversity of organisms and ecosystems. Topics will include the following: latitudinal and elevational gradients in diversity; species-area curves and island biogeography; ecogeographic 'rules' and the evolution of phenotypic variation; relationships between body size, range size, and abundance; relationships between genome size and complexity and organismal longevity, body size, and abundance; site-occupancy and species distribution modeling. Students will use public databases or otherwise compile a dataset suitable for macroecological or biogeographical analysis, analyze, interpret, and present their results. Prerequisite: Methods in Ecological Research, Advanced Ecology.

**BIOL 6390. Special Topics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**
Selected topics in an identified area of biology. May be repeated for credit as topics vary.