

Department of Biology

George Murphy, Chair
Davis Science Building 127

The Department of Biology offers the Master of Science as well as a minor at the graduate level. Normally, the required test score for admission is a satisfactory Graduate Record Examination score (minimum expected score of 800 verbal and quantitative).

Requirements for the Master of Science

Candidate must

1. have an undergraduate minor in biology or its equivalent at time of admission.
2. complete a minimum of 30 semester hours including a thesis of 3 semester hours with no more than 30 percent of the total degree hours dually listed as undergraduate/graduate hours.
3. complete 6 semester hours of a foreign language or pass a language examination or complete one year of approved research tools in addition to the 30 hours.
4. pursue a major of at least 16 semester hours which includes

BIOL 6620 Biological Research
BIOL 6630 Biological Literature*
BIOL 6640 Thesis Research
BIOL 6650,6660 Seminar

Remaining courses will include approved courses in biology, chemistry, mathematics, physics, or certain other related disciplines. A minor is optional but if elected must include a minimum of 12 semester hours.

5. file a Candidacy Form with the Graduate Office prior to the completion of 24 credit hours.
6. successfully complete a written comprehensive examination (may be taken no more than twice).

*Students who completed BIOL 3230 or equivalent course should consult with department chair.

Courses in Biology [BIOL]

5010 Embryology. Four credits. Prerequisites: BIOL 1110 and 1120. Early development of the frog, chick, pig, and human. Living material, whole mounts, and serial sections used for the study of cleavage, germ layer formation, histogenesis, and organogenesis. Three lectures and one three-hour laboratory.

5020 Comparative Anatomy of the Vertebrates. Four credits. Prerequisites: BIOL 1110 and 1120. Vertebrate morphology and the development and function of systems and organs. Three lectures and one three-hour laboratory.

5030 Non-Flowering Plants. Four credits. Prerequisites: BIOL 1110 and 1120. Structure, physiology, methods of reproduction, and

classification of the algae, fungi, liverworts, mosses, and ferns. Three lectures and one three-hour laboratory.

5040 General Entomology. Three credits. Prerequisites: BIOL 1110 and 1120. Structure, classification, evolution, importance, and life history of insects. Two lectures and one three-hour laboratory.

5050 Parasitology. Three credits. Prerequisites: BIOL 1110 and 1120. Life histories, host-parasite relationships, and control measures of the more common parasites of humans and domesticated animals. Two lectures and one three-hour laboratory.

5100 History and Philosophy of Biology. Three credits. Prerequisites: BIOL 1110 and 1120. Development of biology; the philosophy, ideas, and contributions of outstanding biologists. Two lectures.

5120 Flowering Plants. Four credits. Prerequisites: BIOL 1110 and 1120. Structure and classification of seed plants and a survey of local flora. Three lectures and one three-hour laboratory.

5130 Histology. Four credits. Prerequisites: BIOL 1110, 1120, 2120, and CHEM 1110 and 1120. Microscopic anatomy of vertebrate cells, tissues, and organs. Three lectures and one three-hour laboratory.

5140 Invertebrate Zoology. Four credits. Prerequisites: BIOL 1110 and 1120. Structure, functions, life histories, and economic importance of the invertebrate phyla. Laboratory work comprises detailed studies of representative specimens. Three lectures and one three-hour laboratory.

5170 Endocrinology. Three credits. Prerequisites: BIOL 1110 and 1120, and CHEM 1110 and 1120. Structure, function, and integrative mechanisms of vertebrate endocrine organs, with additional attention to invertebrate hormones. Three lectures.

5180 Vertebrate Zoology. Four credits. Prerequisites: BIOL 1110 and 1120. Structure, life history, and classification of fish, amphibians, reptiles, birds, and mammals. Local representatives emphasized. Three lectures and one three-hour laboratory.

5220 Ichthyology. Four credits. Prerequisites: BIOL 1110 and 1120. The morphology, physiology, taxonomy, and ecology of fishes. Three lectures and one three-hour laboratory.

5240 General Ecology. Four credits. Prerequisites: BIOL 1110 and 1120, and CHEM 1110 or consent of instructor. Basic concepts of the ecosystem and community, aquatic and terrestrial habitats, and population ecology; complemented by field and laboratory activities. Three lectures and one three-hour laboratory per week.

5250 Limnology. Four credits. Prerequisites: BIOL 1110, 1120, 4240, and CHEM 1110. Biological, chemical, and physical aspects of lakes and streams. Not open to students who have had Aquatic Ecology. Three lectures and one three-hour laboratory.

5260 Nature Study. Three credits. Prerequisites: BIOL 1110 and 1120. Identification of local plants and animals and a consideration of the ecological principles governing them. Two lectures and one two-hour laboratory.

5320 Seminar: Advancements in Biology. Two credits. A broad overview of biological principles and recent research developments. Two lectures.

5331-Biome Analysis. One to four credits. Prerequisite: Permission of department. An intensive classroom and on-site study of a

specific biome with special emphasis on data collection and analysis. Consult department head for specific credits and costs.

5331 Biome Analysis - Cedar Glade

5332 Biome Analysis

5333 Biome Analysis - Desert

- 5390 Ethology.** Four credits. Prerequisite: BIOL 1110. Innate and learned animal behavior in primitive and advanced animals including behavior associated with space, reproduction, and food getting. Three lectures and one three-hour laboratory.
- 5460 Human Genetics.** Three credits. Prerequisite: BIOL 2120. Application of the fundamental laws of inheritance to humans. Two lectures and one two-hour laboratory.
- 5500 Plant Physiology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120, and CHEM 2030 or 3010. Plant growth; development and metabolism at the cellular and whole plant levels. Three lectures and one three-hour laboratory.
- 5510 Food/Industrial Microbiology.** Four credits. Prerequisite: BIOL 2230. The interaction between microorganisms and food and industrial processes of importance to humans. Two lectures and two two-hour laboratory periods.
- 5520 Plant Anatomy.** Four credits. Prerequisite: BIOL 1120. Plant cells, tissues, and organs. Emphasis on the survival value of the plant's various structural features. Three lectures and one three-hour laboratory.
- 5540 Topics in Environmental Education.** One to four credits. Prerequisite: Junior standing or above. An intensive classroom and field study of natural science and resources in Tennessee. Special emphasis on data collection, analysis, and problem solving. Target groups are graduate students and upper-division undergraduates in the areas of biology and education. Consult the department chair for specific credits and costs. This course will not apply to the biology major or minor.
- 5550 Biotechnology.** Three credits. Prerequisites: BIOL 1110, 1120, 2230, and senior/graduate level. Instruction in both theory and application of current research methodologies in biology and molecular biology. Topics included immunochemistry, polymerase chain reaction, restriction enzyme analysis, and electrophoresis. One two-hour block and one three-hour block which includes both lecture and laboratory.
- 5560 Neurobiology.** Four credits. Prerequisites: BIOL 1110 and 1120, and PSY 4030 or 4240. Introduces comparative neurobiology. Topics include the basic structure and function of the nerve cell and organization of nervous systems of representative species of invertebrate and vertebrate animals. Three hours lecture and one three-hour laboratory.
- 5570 Principles of Toxicology.** Three credits. Prerequisites: BIOL 1110 and 1120, and CHEM 1110, 1120, 3010. Adverse effects of chemical agents on living organisms; current toxicological techniques in laboratory portion of course. Two hours lecture and one three-hour laboratory.
- 5580 Marine Biology.** Four credits. Prerequisites: BIOL 1110 and 1120, and CHEM 1110 and 1120. Biological, chemical, and physical characteristics of major marine environments and their associated flora and fauna. Three lectures and one three-hour laboratory.
- 6060 Advanced Dendrology.** Three credits. Prerequisite: BIOL 1120. Woody plants with special emphasis on classification, identification, and literature of important timber trees of North America. Two lectures and one three-hour laboratory.
- 6070 Plants and Man.** Three credits. Prerequisite: BIOL 1120. Human dependence on plants emphasized. Topics include origin of agriculture, fruits and nuts, grains and legumes, vegetables, spices and herbs, oils and waxes, medicinal plants, psychoactive plants, beverages, fibers and dyes, tannins, wood and ornamental plants. Three lectures.
- 6080 Advanced Mycology.** Four credits. Prerequisites: Graduate standing plus BIOL 1120. Fungi, with emphasis on taxonomy, morphology, culture, and importance to humans. Three lectures and one three-hour laboratory.
- 6120 Aquatic Ecology.** Three credits. Physical, chemical, and biotic conditions of freshwater lakes and streams and of population structure and dynamics in these environments. Not open to students who have had Limnology. Two lectures and one three-hour laboratory.
- 6130 Ornithology.** Three credits. Structure, taxonomy, natural history, and identification of birds. Emphasizes field work. Two lectures and one three-hour laboratory.
- 6180 Mammalogy.** Three credits. Morphology, physiology, systematics, and the development of mammals. Two lectures and one three-hour laboratory.
- 6200 Speciation.** Three credits. Prerequisite: BIOL 2120. Mutation, natural selection, adaptation, isolating mechanisms, genetic drift, hybridization, ploidy in the process of species formation, and a history of the development and ideas of evolution. Two lectures.
- 6210 Protozoology.** Three credits. Morphology, physiology, reproduction, ecology, taxonomy, and life cycles of the protozoa. Two lectures and one three-hour laboratory.
- 6220 Herpetology.** Three credits. Prerequisites: BIOL 1110, 1120, and 4240. Morphology, natural history, and identification of amphibians and reptiles. Local representatives emphasized. Two lectures and one three-hour laboratory.
- 6270 Cell Metabolism.** Three credits. Prerequisites: Organic chemistry and one course in physiology or biochemistry or permission of instructor. Metabolic pathways in cells including regulation and genetic aspects of metabolism.
- 6290 Advanced Scanning Electron Microscopy.** Four credits. Prerequisite: Permission of instructor. Application of scanning electron microscopy to study materials with emphasis on theory of scanning electron microscopy and preparation of biological specimens for microscopy. One lecture and six hours laboratory.
- 6330 Principles of Physiology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120, and CHEM 1110 and 1120. Physical and chemical properties of protoplasm, cells, and organisms and their relationships to life processes. Three lectures and one three-hour laboratory.
- 6350 Biostatistical Analysis.** Four credits. Prerequisites: BIOL 1110, 1120, and 2120. Intermediate-level introduction to biostatistical procedures used in research. Three lectures and one three-hour laboratory.
- 6360 Energy Dispersive X-Ray Theory and Analysis.** One credit. Prerequisite: BIOL 4290 or 6290. Theory of X-ray analysis and elemental analysis of materials using an energy dispersive X-ray system with scanning electron microscopy. One three-hour laboratory.

6380 Experimental Immunology. Four credits. Prerequisite: BIOL 2230. Mechanisms of immunity including the more recent developments in immunology. Three lectures and one two-hour laboratory.

6390 Advanced Cell and Molecular Biology. Four credits. Prerequisites: BIOL 1110, 1120, 2120, 2230, and CHEM 3010 or 2030. Molecular biology of the cell with emphasis on current experimental techniques. Three lectures and one three-hour laboratory.

6400 Medicinal Plants. Three credits. Prerequisite: BIOL 1120. Plants affecting human health, including poisonous, psychoactive, and remedial plants. Ethnobotanical and modern medicinal uses are treated. Three lectures.

6410 Advanced Transmitting Electron Microscopy. Four credits. Prerequisite: Permission of instructor. Ultrastructure of the cell using basic and specialized techniques. One lecture and two three-hour laboratory periods.



6430 Clinical and Pathogenic Microbiology. Four credits. Prerequisite: BIOL 2230. Comprehensive coverage of the most recent discoveries and techniques used for the identification of pathogenic organisms and their relationships to disease processes. Two lectures and two two-hour laboratory periods.

6440 Advanced Virology. Four credits. Prerequisites: BIOL 2230, and CHEM 1110 and 1120. Emphasizes the main virus families and their biochemical composition. Experimental approaches and techniques will be developed in order to identify and manipulate viruses. Two lectures and two two-hour laboratory periods.

6450 Advancements in Molecular Genetics. Four credits. Prerequisites: BIOL 2120 and 2230, and CHEM 1110 and 1120. Recent advancements in microbial genetics and gene manipulation with emphasis on applications of molecular genetics, including gene regulation and recombinant DNA technology. Three lectures and three one-hour laboratory periods.

6460 Conservation Biology. Four credits. Prerequisite: BIOL 4240 or 5240. Measuring biodiversity: species, ecosystem, and genetic diversity. Topics include conservation ethics, extinctions, habitat degradation, exotic species, and management of populations and ecosystems. Meets six hours per week for lecture and laboratory.

6500 Special Problems in Biology. Four credits. Prerequisite: Permission of department. Plan, implement, and interpret a research problem in some area of biology. Available topics limited to areas of graduate faculty interest and expertise.

6590 Environmental Toxicology. Four credits. Prerequisites: BIOL 1110 and 1120, and CHEM 1110, 1120, and 3010. Ecological effects of chemicals in the environment and techniques currently utilized to assess these effects. Current environmental assessment techniques, including biomonitoring, will be covered in the laboratory. Three hours lecture and one three-hour laboratory.

6620 Biological Research. Three credits. Prerequisite: Permission of department. Selection of a research problem, review of pertinent literature, and execution of the research.

6630 Biological Literature. Three credits. Literature sources, forms of literature, bibliographic methods, scientific writing. Two lectures.

6640 Thesis Research. One to six credits. Prerequisites or corequisites: BIOL 6620 and permission of department. Completion of the research problem begun in BIOL 6620; preparation of the thesis. Once enrolled, student should register for at least one credit hour of master's research each semester until completion. Minimum of three credits required for M.S. degree. S/U grading.

6650/ 6660 Seminar. One credit each. Discussion of recent advances and problems in biology. Individual problems for oral and written reports.

6700 Plant-Animal Interactions. Three credits. Prerequisite: Graduate standing. Evolutionary and ecological perspectives on how plants attract and repel symbionts and how those symbionts influence plant fitness. Topics include angiosperm evolution, the coevolution of plants with pollinators, herbivores, mycorrhizae,

and N-fixing bacteria, and how plant secondary metabolites facilitate or mitigate these interactions. One two-hour block and one three-hour block include lecture and laboratory.

6710 Biostatistical Analysis II. Three credits. Prerequisite: BIOL 4350 or 6350. Advanced-level applied, multivariate biological statistics. Three lectures per week.

6720 Advanced Animal Development. Four credits. Prerequisites: BIOL 1110, 1120, and 2120; BIOL 4210 recommended. Processes and underlying molecular mechanisms by which a single fertilized egg develops into an adult organism. Focuses on vertebrate development, including insights gained from other model organisms. Three hours lecture and two hours lab.

6730 Advanced Microbial Physiology and Biochemistry. Four credits. Prerequisites: BIOL 1110, 1120, and 2230; CHEM 1110, 1120, and 2030 or 3010 or consent of instructor. Survey of the physiology and biochemistry of prokaryotic and eukaryotic microorganisms. Two three-hour blocks of lecture and lab.

6740 Brain Development and Learning Disabilities. One credit. Prerequisite: Permission of department. Biology and psychology underlying dyslexia and other common learning disabilities encountered in the school setting. Addresses practical classroom applications utilizing this background information. Five three-hour class meetings.

6750 Advanced Plant Biotechnology. Four credits. Prerequisites: BIOL 1110, 1120, 2120. Processes and reasoning behind the human manipulation of plant species for agricultural and technological purposes. Topics include traditional breeding techniques, tissue culture, plant cell transformation, and general plant molecular biology techniques as well as current debate over genetically modified organisms. Three hours of lecture and three hours of lab.

6760 Bioinformatics. Four credits. Prerequisites: BIOL 1110 and 1120 and CSCI 1170 or consent of instructor. Explores the emerging field of bioinformatics which involves the application of computer science to biological questions. Bioinformatics specifically applies to the computational aspects of data gathering, processing, storage, analysis, and visualization methods for use in revising and testing biological hypotheses. Student should have a strong background in either computer science or biology, be willing to learn about the other field in an accelerated fashion, and be willing to work cooperatively as part of an interdisciplinary team. Three hours of lecture/problem-solving per week.

6999 Comprehensive Examination and Preparation. One credit. Open only to students who are not enrolled in any other graduate course and who will take the master's comprehensive examination during the term. The student must contact the graduate advisor during the first two weeks of the term for specifics regarding the details of this comprehensive examination preparatory course. Credit may not be applied to degree requirements.

Field Station Affiliation

MTSU is an affiliate of the Gulf Coast (Miss.) Research Laboratory. Certain courses in marine biology may be taken for graduate credit and transferred to MTSU. See department head for list of courses.