

# Department of Biology

**George Murphy, Chair**  
**Davis Science Building 128**

**Bailey, Barlow, Blum, Butler, Clark, Doyle, DuBois, Elrod-Erickson, Ervin, Farone, Hemmerly, Howard, Jetton, Johnson, Kelly, Klukowski, Leblond, Mathis, McGhee, Miller, Mullen, Newsome, Reyes, Rosing, Rutledge, Seipelt, Smith-Walters, Stewart, Swain, Walck, Walters, Wells, Wright, Zamora**

The Department of Biology offers preparation for teachers of biology, for biologists in industrial and governmental employment, and for students planning for graduate study in biology or for advanced professional courses in health sciences. The program for the Biology major leads to the Bachelor of Science degree. Students choose from concentrations in Animal Biology, General Biology, Microbiology, and Plant Biology. A minor in Secondary Education is suggested for those persons planning to teach. A minor in Biology is also available.

Environmental Science and Technology is an interdisciplinary major and minor offered by Agribusiness and Agriscience, Biology, Chemistry, Physics and Astronomy, and Engineering Technology and Industrial Studies. A complete description of the program is found under the Department of Engineering Technology and Industrial Studies.

**In all curricular listings, (Area \_\_ ) refers to the General Studies requirements as outlined on pages 59-61.**

## Major in Biology

The major in Biology requires 40 semester hours including a biology core for all concentrations of 24 semester hours:

1. BIOL 1110 and 1120 or, with approval of the department head, BIOL 1030 with a grade of A or B plus 4 hours from upper-division courses;
2. BIOL 2120, 2230, 3230, 4240;
3. BIOL 4110 or 4210 or 4500.

Other requirements include

1. 6 hours of college mathematics or one calculus course or advisor-approved substitution;
2. 12 hours of chemistry (1110, 1111, 1120, 1121, and 2030 or 3010);
3. CSCI 1000 or equivalent.

All Biology majors are assigned a faculty advisor through the Biology Department Office (DSB 128). The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Every Biology major is required to declare a concentration area. Each area requires semester hours to be selected from a set of designated courses.

### Concentration: Animal Biology

Minimum of 10 hours selected from  
 BIOL 3010, 3020, 3040, 3050, 4130, 4140, 4180

### Concentration: General Biology

Select one course from each of the following three areas:

1. BIOL 3010 or 3020 or 4180;
2. BIOL 3030 or 4080 or 4120 or 4520;
3. BIOL 3040 or 3050 or 4130 or 4140.

### Concentration: Microbiology

Minimum of 10 hours selected from  
 BIOL 3050, 3210, 4080, 4300, 4430, 4440, 4450, 4510

### Concentration: Plant Biology

Minimum of 10 hours selected from  
 BIOL 3030, 4060, 4080, 4120, 4520

### Suggested freshman and sophomore program for majors not planning to teach

FRESHMAN		SOPHOMORE	
BIOL 1110, 1120	8	BIOL 2120, 2230	8
Chemistry (Area IV-A)	8	English (Area II-A)	6
English (Area I-A)	6	History (Area III-A)	6
Mathematics (Area IV-B)	6	Gen. Studies (Areas I-B, II-B, and III-B)	9
PHED or M S (Area V)	2	PHED or M S (Area V)	2
CSCI 1000 or equivalent	1	CHEM 2030 or 3010	4
	<b>31</b>	Elective	3
			<b>38</b>



## Teacher Licensure

Students seeking a license to teach in secondary schools (grades 7-12) must complete (1) a major in the subject they intend to teach, (2) a minor in professional education, and (3) courses in addition to the general education program.

## Enhanced General Education Requirements

The following courses are required in addition to the General Studies requirements (see pages 59-61).

MATH 1710 College Algebra, 3 hours

MATH 1720 Plane Trigonometry, 3 hours

### General Science Core:

BIOL 1110, 1120 General Biology, 8 hours

CHEM 1110, 1111, 1120, 1121 General Chemistry, 8 hours

CHEM 2030 Elements of Organic Chemistry, 4 hours, OR

CHEM 3010 Organic Chemistry, 4 hours

ASTR 1030 Exploring the Universe, 3 hours

PHYS 2010, 2011 Non-Calculus Based-Physics I/Physics Problems

Laboratory I, 4 hours

PHYS 2020, 2021 Non-Calculus Based-Physics II/Physics Problems

Laboratory II, 4 hours

GEOL 1040 Physical Geology, 4 hours

## Professional Education Requirements

Students must contact their minor advisor in professional education for approval of appropriate courses. (For specific procedures and additional requirements for teacher licensure, see page 184.)

## Biology Major Requirements for Licensure

Complete the following General Biology concentration:

BIOL 1110, 1120, 8 hours

BIOL 2120, 4 hours

BIOL 2230, 4 hours

BIOL 3230, 2 hours

BIOL 4240, 4 hours

**Select one:** BIOL 3010, 4 hours; BIOL 3020, 4 hours; BIOL 4180, 4 hours

**Select one:** BIOL 3030, 4 hours; BIOL 4080, 4 hours; BIOL 4120, 4 hours; BIOL 4520, 4 hours

**Select one:** BIOL 3040, 3 hours; BIOL 3050, 3 hours; BIOL 4130, 4 hours; BIOL 4140, 4 hours

**Select one:** BIOL 4110, 4 hours; BIOL 4210, 4 hours; BIOL 4500, 4 hours

**Biology electives to total 40 hours minimum.**

## Minor in Biology

There are two options for the minor in Biology:

- 19 semester hours in biology including one year of freshman biology or equivalent and BIOL 2120 and 2160.
- 19 semester hours in biology including BIOL 1030 with a grade of A or B plus 4 hours chosen from upper-division courses and approved by the department head and BIOL 2120 and 2230.

Each option requires at least one upper-division course to be taken at MTSU. A 2.00 GPA is required for courses satisfying the minor in Biology.

Four or more semester hours of freshman-level General Studies equivalent biology in transfer credits may be substituted for BIOL 1030.

Students who have taken BIOL 1110 or 1120 and also BIOL 1030 may use BIOL 1030 to satisfy their General Studies requirement and BIOL 1110 or 1120 as elective hours toward graduation. However, neither BIOL 1110 nor 1120 alone will substitute for BIOL 1030.

## Course in General Studies Biology [BIOL]

**1030 (100) Topics in Biology.** Four credits. Biological principles and processes and their importance to humans. Three lectures and one two-hour laboratory.

## Courses in Biology [BIOL]

**1110, 1120 (111, 112) General Biology.** Four credits. Primarily for Biology majors and minors and other science-oriented students. Fundamental concepts of organisms as exemplified by different groups of animals and plants. BIOL 1110 is primarily zoology and BIOL 1120 is primarily botany. It is recommended that BIOL 1110 precede BIOL 1120. Three lectures and one three-hour laboratory.

**2000 (201) Orientation to the Medical Lab.** Two credits. Open to anyone in medical and allied medical careers, but may not be taken as part of Biology major. Survey of medical lab careers, curricula, and affiliated laboratory programs; experience in medical laboratory testing procedures. One lecture and one two-hour laboratory.

**2010, 2020 (313, 314) Human Anatomy and Physiology I and II.** Four credits each. Prerequisites: BIOL 2010 - C or better in high school chemistry and biology within the last five years or consent of instructor; BIOL 2020 - C or better in 2010. Strongly recommend BIOL 1030/1110 prior to BIOL 2010. Meets requirements for many pre-health professional programs including nursing. Structure and function of humans covered. Three lectures and one three-hour laboratory.

**2030 (308) Anatomy and Physiology.** Three credits. Prerequisite: BIOL 1030 or 1110. General structure and physiological activities of human systems. Two lectures and one two-hour laboratory.

**2120 (212) Genetics.** Four credits. Prerequisites: BIOL 1110, 1120. An introductory course in genetics. Surveys and explores the sub-disciplines of genetics, including classical, molecular, and evolutionary genetics. Emphasis on the experiments, techniques, and theories forming the foundation of modern genetic research and its applications. Three lectures and one two-hour laboratory.

**2230 (216) Microbiology.** Four credits. Prerequisites: BIOL 1110, 1120 or 2010, 2020; background in general chemistry strongly recommended. Morphology, physiology, isolation, and cultivation of bacteria, fungi, and viruses. Three lectures and one two-hour laboratory.

**3000 (300) Life Science for Elementary Teachers.** Four credits. Prerequisites: 8 hours of science including BIOL 1030 or equivalent. A process-oriented approach to the study of life with emphasis on execution and analysis of activities and experiments suited to the elementary school classroom. Six hours lecture and laboratory. (May not be used for Biology majors or minors.)

- 3010 (301) Embryology.** Four credits. Prerequisites: BIOL 1110, 1120. Early development of the frog, chick, pig, and human. Living material, whole mounts, and serial sections are used for studying cleavage, germ layer formation, histogenesis, and organogenesis. Three lectures and one three-hour laboratory.
- 3020 (302) Comparative Anatomy of the Vertebrates.** Four credits. Prerequisites: BIOL 1110, 1120. Vertebrate morphology and the development and function of systems and organs. Three lectures and one three-hour laboratory.
- 3030 (303) Non-Flowering Plants.** Four credits. Prerequisites: BIOL 1110, 1120. Structure, physiology, methods of reproduction, and classification of the algae, fungi, liverworts, mosses, and ferns. Three lectures and one three-hour laboratory.
- 3040 (304) Entomology.** Three credits. Prerequisites: BIOL 1110, 1120. Structure, classification, evolution, importance, and life history of insects. Five hours of lecture and laboratory.
- 3050 (305) Parasitology.** Three credits. Prerequisites: BIOL 1110, 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.
- 3070 (307) Biology Seminar on Environmental Problems.** Three credits. Causes, effects, and solutions of environmental problems. Three lectures.
- 3100 (310) History and Philosophy of Biology.** Three credits. Prerequisites: BIOL 1110, 1120. Historical development of biology; the philosophy, ideas, and contributions of outstanding biologists. Two lectures.
- 3160 (316) Social Issues and Genetic Technology.** Three credits. Prerequisite: BIOL 1030 or 1110 or 1120. Exploration of genetic principles related to contemporary issues. Provides students with the background needed to evaluate topics such as the release of genetically engineered plants and animals, the use of DNA fingerprinting techniques, the relationship between race and IQ, and others which impact their lives. Impact of genetics on society as well as society's influence on the science will be explored. Role of genetics in medicine and agriculture also emphasized.
- 3200 (320) Internship in Biology.** Two to four credits. Prerequisite: Permission of department. Practical experience for students in a professional setting.
- 3210 (321) Environmental Microbiology.** Three credits. Prerequisite: BIOL 2230. Deals with microorganisms commonly found in air, water, and soil. Two lectures and one three-hour laboratory.
- 3220 (322) Environmental Regulations and Compliance.** Three credits. Prerequisites: BIOL 1110, 1120. An in-depth review and application of governmentally established regulations concerning environmental quality. Emphasis on major federal acts. Three lectures.
- 3230 (323) Introduction to Biological Literature.** Two credits. Prerequisites: BIOL 1110, 1120. Application of methods of literature research in the biological sciences and techniques of scientific writing.
- 3240 (324) Introduction to Evolution.** Three credits. Prerequisites: BIOL 1110 and 1120 or 1030. Scientific principles and concepts formulating the biological theory of evolution. Includes historical development of modern theory; Darwin's natural selection theory; and problems in speciation, systematics, and geographical distribution of species.
- 3340 (334) Pathophysiology.** Three credits. (Same as NURS 3010.) Prerequisites: BIOL 2230, 2010, 2020. Basic mechanisms of disease processes and their role in disrupting normal physiology. Three lectures.
- 4060 (406) Dendrology.** Three credits. Prerequisite: BIOL 1120. Woody plants with emphasis on important timber trees of North America. Two lectures and one three-hour laboratory.
- 4070 (407) Economic Botany.** Three credits. Prerequisite: BIOL 1120. Useful plants which have shaped civilization. Topics include origin of agriculture, fruits and nuts, grains and legumes, vegetables, spices and herbs, oils and waxes, medicinal plants, psychoactive plants. Three lectures.
- 4080 (408) Mycology.** Four credits. Prerequisite: BIOL 1120. Emphasizes taxonomy, morphology, and culture of fungi and their importance to humans. Three lectures and one three-hour laboratory.
- 4110 (411) General Physiology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 1110, 1120. Physiochemical properties and functions of life processes in animals using a comparative approach. Three lectures and one three-hour laboratory.
- 4120 (412) Flowering Plants.** Four credits. Prerequisites: BIOL 1110, 1120. Structure and classification of seed plants; a survey of local flora. Three lectures and one three-hour laboratory.
- 4130 (413) Histology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 1110, 1120. Microscopic anatomy of vertebrate cells, tissues, and organs. Three lectures and one three-hour laboratory.
- 4140 (414) Invertebrate Zoology.** Four credits. Prerequisites: BIOL 1110, 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.
- 4150 (415A) Radiation Biology.** Three credits. Prerequisites: Junior standing and permission of department. Types and properties of ionizing radiation, isotopes and tracer study techniques, and the biological effects of ionizing radiations on living things.
- 4170 (417) Endocrinology.** Three credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 1110, 1120. Strongly recommend BIOL 2010 and 2020 or 4110 (or equivalent). Where and how hormones are produced and how they coordinate and control bodily functions, focusing on humans and other vertebrates. Three lectures.
- 4180 (418) Vertebrate Zoology.** Four credits. Prerequisites: BIOL 1110, 1120. Structure, life history, and classification of fish, amphibians, and mammals. Local representatives emphasized. Three lectures and one three-hour laboratory.
- 4210 (421) Cell and Molecular Biology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120, 2230; CHEM 2030 or 3010. Cellular morphology and function. Three lectures and one three-hour laboratory.
- 4220 (422) Ichthyology.** Four credits. Prerequisites: BIOL 1110, 1120. The morphology, physiology, taxonomy, and ecology of fishes. Three lectures and one three-hour laboratory.

- 4240 (424) General Ecology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110. 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.
- 4250 (425) Limnology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110. Biological, chemical, and physical aspects of lakes and streams. Three lectures and one three-hour laboratory.
- 4260 (426) Nature Study.** Three credits. Prerequisites: BIOL 1110, 1120. Identification of local plants and animals and a consideration of the ecological principles governing them. Two lectures and one two-hour laboratory.
- 4270 (427) Transmitting Electron Microscopy.** Four credits. Prerequisite: Permission of department. Tissue fixation, dehydration, embedding, and thin sectioning for examination and development of micrographs using a Zeiss electron microscope. One-hour lecture and three two-hour laboratory periods.
- 4280 (428) Undergraduate Research in Biology.** Three credits. Prerequisite: Permission of department. Selection, design, and conduction of projects.
- 4290 (429) Scanning Electron Microscopy.** Four credits. Prerequisite: Permission of department. Preparation of biological and non-biological materials for examination and development of micrographs using an ISI electron microscope. One-hour lecture and three two-hour laboratory periods.
- 4300 (430) Immunology.** Four credits. Prerequisite: BIOL 2230. Humoral and cellular mechanisms of immunity. Two lectures and one two-hour laboratory.
- 4320 (432) Seminar: Advancements in Biology.** Two credits. Prerequisite: Senior standing. A broad overview of biological principles and recent research developments. Two lectures.
- 4331-4333 Biome Analysis.** One to four credits. Prerequisite: Permission of department and junior or senior standing. An intensive classroom and on-site study of a specific biome. Special emphasis on data collection and analysis. Consult the department chair for specific credits and costs.
- 4331 (433A) Cedar Glade**  
**4332 (433B) Biome Analysis**  
**4333 (433C) Desert**
- 4350 (435) Biometry.** Four credits. Prerequisites: BIOL 1110, 1120, 2120. Statistical methods utilized in biological research. Three lectures and one two-hour laboratory.
- 4360 (436) Energy Dispersive X-Ray Analysis.** One credit. Prerequisite: BIOL 4290. Elemental analysis of materials using an energy dispersive x-ray system with scanning electron microscopy. One three-hour laboratory.
- 4390 (439) 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.
- 4400 (440) Medical Botany.** Three credits. Prerequisite: BIOL 1120. Plants affecting human health. Included are poisonous and psychoactive as well as remedial plants; both ethnobotanical and modern medicinal uses treated. Three lectures.
- 4430 (443) Diagnostic Microbiology.** Four credits. Prerequisite: BIOL 2230. Microorganisms that cause disease in humans and other animals, their isolation and identification, mechanisms of disease causation, and methods of control. Two lectures and one four-hour laboratory.
- 4440 (444) General Virology.** Four credits. Prerequisites: BIOL 2230; CHEM 1110, 1120. Viruses, with emphasis on their clinical importance and impact on biotechnology. Two lectures and one four-hour laboratory.
- 4450 (445) Molecular Genetics.** Four credits. Prerequisites: BIOL 2230, 2120; CHEM 1110, 1120. Basic techniques of microbial genetics and gene manipulation with emphasis on the application of molecular genetics in basic and applied research. Six hours lecture/laboratory.
- 4460 (446) Human Genetics.** Three credits. Prerequisite: BIOL 2120. Application of the fundamental laws of inheritance to humans. Two lectures and one two-hour laboratory.
- 4500 (450) Plant Physiology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 2030 or 3010. Plant growth, development, and metabolism at the cellular and whole plant levels. Six hours of lecture/laboratory.
- 4510 (451) Food/Industrial Microbiology.** Four credits. Prerequisite: BIOL 2230. Interaction between microorganisms and food; industrial processes of importance to humans. Two lectures and two two-hour laboratory periods.
- 4520 (452) 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.
- 4540 (454A-Z) 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 upper-division students in biology and education. Consult the department chair for specific credits and costs. THIS COURSE DOES NOT APPLY TO THE BIOLOGY MAJOR OR MINOR.
- 4550 (455) Biotechnology.** Three credits. Prerequisites: BIOL 1110, 1120, 2230. Instruction in both theory and application of current research methodologies in biology and molecular biology. Topics include immunochemistry, polymerase chain reaction, restriction enzyme analysis, and electrophoresis. Five hours lecture/laboratory.
- 4560 (456) Neurobiology.** Four credits. Prerequisites: BIOL 1110, 1120; 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. Two lectures and one three-hour laboratory.
- 4570 (457) Principles of Toxicology.** Three credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120, 3010. Study of adverse effects of chemical agents on living organisms; current toxicological techniques used in the laboratory. Two-hour lecture and one three-hour laboratory.

**4580 (458) Marine Biology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120. Introduction to the biological, chemical, and physical characteristics of major marine environments and their associated flora and fauna. Three lectures and one three-hour laboratory.

**4590 (459) Principles of Environmental Toxicology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120, 3010. Ecological effects of chemicals in the environment and techniques currently utilized to assess these effects. Lab includes current environmental assessment techniques, including biomonitoring. Three-hour lecture and three-hour laboratory.

**4700 (470) Principles of Plant-Animal Interactions.** Three credits. Prerequisites: BIOL 1110, 1120. Evolutionary and ecological perspectives on how plants attract and repel organisms that influence their ability to survive and leave progeny. Topics include angiosperm evolution; the coevolution of plants with pollinators, herbivores, mycorrhizae, and N-fixing bacteria; how plant secondary metabolites facilitate or mitigate these interactions. Two-hour lecture and three-hour laboratory.

### Gulf Coast Research Laboratory

MTSU is an affiliate of the Gulf Coast (Miss.) Research Laboratory. Marine biology courses may be taken at the Station during the summer and the credits transferred to MTSU. Summer course offerings are as follows:

BOT	331	Coastal Vegetation. Three credits.
BOT	341	Marine Botany. Four credits.
BOT	441	Salt Marsh Plant Ecology. Four credits.
CH	461	Marine Chemistry. Six credits.
GEO	431	Coastal Marine Geology. Three credits.
MIC	452	Marine Microbiology. Five credits.
MS	400	Special Problems in Marine Science. One-six credits.
MS	405	Special Topics in Marine Science. One-six credits.

MSE	431	Marine Science for Teachers I. Three credits.
MSE	432	Marine Science for Teachers II. Three credits.
MSE	433	Marine Science for Elementary Teachers. Three credits.
OCE	251	Oceanography I. Five credits.
OCE	252	Oceanography II. Five credits.
ZO	141	Introduction to Marine Zoology. Four credits.
ZO	361	Marine Invertebrate Zoology. Six credits.
ZO	362	Marine Vertebrate Zoology and Ichthyology. Six credits.
ZO	408	Comparative Histology of Marine Organisms. One-six credits.
ZO	442	Marine Fisheries Management. Four credits.
ZO	443	Behavior and Neurobiology of Marine Animals. Four credits.
ZO	447	Fauna and Faunistic Ecology of Tidal Marshes. Four credits.
ZO	448	Early Life History of Marine Fishes. Four credits.
ZO	452	Marine Ecology. Five credits.
ZO	464	Aquaculture. Six credits.

### Graduate Study

The Master of Science and Master of Science in Teaching degrees are offered in Biology. Requirements for these degrees and a list of the courses offered for graduate credit are published in the Graduate Catalog.

### Honors College

The Department of Biology offers the following courses in Honors:

BIOL	1030 (100H)	(Fall/Spring Semester)
BIOL	1110 (111H)	(Fall/Spring Semester)
BIOL	1120 (112H)	(Spring Semester)
BIOL	2120 (212H)	(Fall Semester)
BIOL	2230 (216H)	(Spring Semester)
BIOL	3160 (316H)	(Spring Semester of even-numbered years)

