

# FACULTY

## DIVISION HEAD

L. Scott Ellis, PhD

## GRADUATE FACULTY

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L. Scott Ellis, PhD  
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Stephanie Fore, PhD  
Jose Herrera, PhD  
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Elisabeth Hooper, PhD  
Diane Janick-Buckner, PhD  
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Michael Kelrick, PhD  
Keesoo Lee, PhD  
David B. Lesczynski, PhD  
Michael L. Lockhart, PhD  
Thomas E. Marshall, PhD  
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John Rutter, PhD  
Jeffrey M. Osborn, PhD  
Nancy Sanders, PhD  
George J. Schulte, PhD  
James H. Shaddy, PhD  
George L. Shinn, PhD  
Linda C. Twining, PhD  
Glenn Wehner, PhD

# DEGREES OFFERED

## MASTER OF SCIENCE (BIOLOGY), MS

### GOALS

The Biology MS degree program is designed to provide students with practical training in biological research and advanced knowledge within a chosen specialty area. Through graduate coursework and a thesis research project, students learn to identify important research problems, to design and conduct experiments for the critical testing of hypotheses, to carry out specific research methodologies, and to develop expertise in communicating scientific information. The goal of the biology graduate program at Truman is to provide the additional knowledge, maturity, and experience necessary for graduating students to be actively recruited by the nation's foremost institutions granting doctoral level graduate and professional degrees and by private companies and governmental agencies for challenging and meaningful positions.

### MASTER OF SCIENCE IN BIOLOGY PROGRAM

The program is structured so that a student may concentrate effort in a selected area of biology. These include: 1) cell and molecular biology, 2) structural biology, 3) physiology, 4) genetics, and 5) ecology and evolutionary biology. Students complete a required common core of courses totalling 14 semester hours (including thesis) plus 22 semester hours of electives. Each graduate student also conducts an independent research project under the guidance of a faculty advisor and graduate committee. Advisors include faculty from the biology discipline as well as faculty from the Kirksville College of Osteopathic Medicine. The committee is composed of a minimum of three members of the graduate faculty, one of whom must be from outside the biology area.

### Admission Requirements

1. Bachelors degree in biology or chemistry
2. A 3.0 cumulative GPA on a 4.0 scale (in exceptional cases this may be waived).
3. Scores on the General Graduate Record Examination at or above the 50th percentile. (Scores on the GRE Biology exam are optional, but recommended.)
4. Three letters of recommendation.
5. Personal statement of interests in biology and career goals.

### Graduation Requirements

1. A 3.0 cumulative GPA on a minimum of 36 credit hours of coursework including both core requirements and electives.
2. An acceptable thesis based on independent scientific research and approved by a faculty advisor, graduate committee, and the Science Division Head.
3. Satisfactory completion of an oral defense of thesis, including an advertised seminar.
4. Satisfactory completion of other University Graduate Program requirements.

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SCIENCE

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**BIOLOGY**

**MASTER OF SCIENCE IN BIOLOGY**

	Semester	Hours
Core Courses		.14
BIOL 502	Biometry	.3
BIOL 606	Graduate Seminar I	.1
BIOL 607	Graduate Seminar II	.1
BIOL 640	Philosophy of Science Research	.3
BIOL 648	Thesis Research	.6
ELECTIVES (as approved by graduate committee)		.22
BIOL 501	Limnology	.3
BIOL 503	Evolutionary Biology	.3
BIOL 504	Herpetology	.3
BIOL 505	Cytology	.3
BIOL 506	Ornithology	.4
BIOL 508	Advanced Plant Taxonomy	.3
BIOL 509	Comparative Plant Morphology	.4
BIOL 510	Ecology	.4
BIOL 511	Comparative Animal Physiology	.4
BIOL 512	Cellular Physiology	.4
BIOL 513	Microbial Genetics	.3
BIOL 515	Animal Behavior	.3
BIOL 516	Ichthyology	.3
BIOL 517	Mammalogy	.3
BIOL 518	Advanced Topics (TOPIC)	.1-5
BIOL 519	Directed Field Studies	.1-5
BIOL 520	Immunology	.4
BIOL 598	Workshop	.1-3
BIOL 610	Advanced Plant Physiology	.3
BIOL 611	Advanced Plant Anatomy	.2
BIOL 615	Endocrinology	.3
BIOL 616	Graduate Seminar III	.1
BIOL 617	Graduate Seminar IV	.1
BIOL 618	Advanced Topics (TOPIC)	.1-4
BIOL 644	Readings in Biology I	.2
BIOL 645	Readings in Biology II	.2
BIOL 649	Biology Research	.1-6
CHEM 518	Advanced Topics (TOPIC)	.1-3
PHYS 518	Advanced Topics (TOPIC)	.1-5
TOTAL		.36

**COOPERATIVE PROGRAMS**

Truman State University is affiliated with the Gulf Coast Research Laboratory at Ocean Springs, Mississippi. The Gulf Coast Research Laboratory is not a degree-granting institution. Its educational function is to teach courses in marine science and to provide facilities for students to conduct research. Through a cooperative arrangement, courses may be taken during the summer at the Gulf Coast Research Laboratory with the credit being awarded by Truman State University. Students desiring to register for the courses should contact the Head of the Science Division.

Truman is also affiliated with the Reis Biological Station located near Steelville, Missouri. This site offers habitat in the Ozarks for forest, grassland, and freshwater aquatic research. Summer coursework, with credit transferred to Truman, is also available.

**FACILITIES**

The Biology Discipline, along with Chemistry, is housed in Science Hall. Facilities in Science Hall include a live-animal room, a greenhouse, an herbarium, a computer lab, controlled-environment growth chambers, and several instrument rooms. Most graduate students have office and work space in the faculty advisor's laboratory. Many teaching and research labs in Science Hall have been recently renovated.

Some of the instruments available to MS degree students:

- IR and NMR instrumentation
- GC
- GC-MS
- FT-NMR
- FT-IR
- P3E X-Ray diffractometer
- UV/Visible scanning spectrophotometers
- HPLC
- scanning and transmission electron microscopes
- vapor pressure osmometer
- Gilson respirometer
- low speed centrifuges
- high speed refrigerated centrifuges
- ultracentrifuge
- microcentrifuges
- physiographs
- oscilloscopes
- microplate fluorometer
- automated electrolyte analyzer
- microcomputers
- Beckman liquid scintillation counter
- electrophoresis and electroblotting equipment
- sequencing gel apparatuses
- PCR thermal cyclers
- polaroid electrophoresis documentation system
- digital electrophoresis documentation system
- research grade microscopes
- fluorescence microscopes
- camera attachments for microscopes
- ultramicrotome
- cryostats
- computerized densitometer
- carbon dioxide incubator
- laminar flow hoods
- autoclaves
- water potential meter
- leaf area meter
- stomatal resistance meter
- oxygen electrodes
- selective ion electrodes
- console freeze dry system
- ultrasound equipment
- radiotelemetry equipment
- aquatic sampling equipment
- jon boats

# COURSE DESCRIPTIONS

## BIOLOGY

### BIOL 501 – Limnology

3 hours

The ecology of aquatic habitats in which the biota of lakes and streams are studied by field surveys and individual projects.

### BIOL 502 – Biometry

3 hours

The design and conduct of experiments and the analysis of biological data. Prerequisite: STAT 190 or equivalent.

### BIOL 503 – Evolutionary Biology

3 hours

The study of evolution by natural selection, emphasizing mechanisms, historical development, and modern evidence. Data from the fields of genetics, molecular biology, population biology, paleontology, and behavior may be considered. Prerequisite: BIOL 300 or equivalent.

### BIOL 504 – Herpetology

3 hours

The taxonomy, life history, and distribution of amphibians and reptiles. The laboratory includes fields trips.

### BIOL 505 – Cytology

3 hours

Studies of cell structure and function by experimental methods.

### BIOL 506 – Ornithology

3 hours

Avian Biology with emphasis on field study.

### BIOL 508 – Advanced Plant Taxonomy

3 hours

Historical taxonomy and experimental approaches to plant systematics. Prerequisite: BIOL 314 or permission of instructor.

### BIOL 509 – Comparative Plant Morphology

4 hours

Comparative investigations of the structure, life-cycles, and evolution of fossil and living vascular plants. Emphasis on such topics as: the origins of land plants, evolution of the ovule and flower, and the origin of flowering plants. Prerequisite: BIOL 313.

### BIOL 510 – Ecology

3 hours

An advanced course in ecology examining the conceptual and theoretical foundations of population and community ecology. Reading and discussion of primary literature is emphasized. Prerequisite: BIOL 301 or permission of instructor.

### BIOL 511 – Comparative Animal Physiology

4 hours

Physiological mechanisms of the major animal groups; physiological basis of ecological mechanisms for tolerating stresses of habitats; functional adaptations enabling extension of the population range. Prerequisite: BIOL 315 or equivalent.

### BIOL 512 – Cellular Physiology

4 hours

An advanced study of the molecular biology of the cell with an experimental approach. The course will provide an in depth investigation into cell interactions with diverse environments, membrane functions, mechanisms of cellular regulation, the cytoskeleton, cell motility, evolution of cell functions, and energy matter conversions. Includes laboratory work.

### BIOL 513 – Microbial Genetics

3 hours

Advanced concepts of the structure, function, and replication of DNA, RNA, and protein. Includes principles of the genetic code, gene transfer and recombination, control of genetic information flow and enzyme activity, mechanisms of mutagenesis, DNA repair and modification, and genetic engineering. Prerequisite: BIOL 300 and BIOL 304 and one year of college chemistry.

### BIOL 515 – Animal Behavior

3 hours

Physiology, natural history, and evolution of behavior. Laboratory is part of the course.

### BIOL 516 – Ichthyology

3 hours

The life history, ecology, taxonomy, and distribution of fishes. The laboratory emphasizes the classification of North American freshwater fish.

### BIOL 517 – Mammalogy

3 hours

Mammal life history, behavior, classification, and distribution. Laboratory includes identification of Missouri species from prepared specimens and field trips.

### BIOL 518 – Advanced Topics (Topic)

1-5 hours (each topic)

An in-depth study of selected science topics presented under formal classroom organization (not intended for individualized study). The total number of hours on a program is limited to 8; only those hours which have the approval of the student's advisor may be counted as biology electives.

### BIOL 519 – Directed Field Studies

1-5 hours

An interim course to encourage scientific investigation of geographic regions. Ecological, geological, climatological, and anthropological phenomena are studied. Only 3 hours may be counted as Biology electives.

### BIOL 520 – Immunology

4 hours

A study of the cells, tissues, molecules, and processes involved in the human body's homeostatic and defense mechanisms. Laboratory includes immunological techniques utilized in both the research and clinical laboratories. Prerequisite: BIOL 200 and BIOL 300.

### BIOL 598 – Workshop (Topic)

1-3 hours (each topic)

In-depth study of selected topics presented in a short period of time. The total number of hours on a program is limited to 8; only those hours which have the approval of the student's advisor may be counted as biology electives.

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## SCIENCE

**BIOL 603 – Fundamental Processes in Biology I****2 hours**

Integration of new developments in biology with the discipline's major concepts.

**BIOL 604 – Fundamental Processes in Biology II****3 hours**

Similar to BIOL 603 with emphasis on curriculum design to teach these concepts.

**BIOL 606, 607 – Graduate Seminar I, II****1 hour each**

A series of presentations on a theme of current interest to biologists presented by biology graduate students, faculty, or invited speakers.

**BIOL 610 – Advanced Plant Physiology****3 hours**

Physiological and biochemical processes in higher plants.

**BIOL 611 – Advanced Plant Anatomy****2 hours**

Embryogeny, development, and maturity of flowering plants; emphasizes an experimental approach to teaching and research. Prerequisite: BIOL 509.

**BIOL 615 – Endocrinology****3 hours**

Synthesis of current knowledge of vertebrate endocrine systems with emphasis on mechanisms of hormone action and interaction.

**BIOL 616, 617 – Graduate Seminar III, IV**

Continuation of graduate seminars for elective credit by MS students.

**BIOL 618 – Advanced Topics (Topic)****1-4 hours (each topic)**

An in-depth study of selected science topics presented under formal classroom organization (not intended for individualized study). The total number of hours on a program is limited to eight; only those hours which have the approval of the student's committee may be counted as biology electives.

**BIOL 640 – Philosophy of Science Research****3 hours**

Historical, descriptive, experimental and philosophical views of scientific research and research techniques are presented.

**BIOL 644 – Readings in Biology I****2 hours**

Reading in areas representing current biological research and biology education.

**BIOL 645 – Readings in Biology II****2 hours**

A continuation of BIOL 644.

**BIOL 648 – Thesis Research****1-6 hours**

Completion of thesis under the direction of an advisor in the field of the student's research problem.

**BIOL 649 – Biology Research****1-6 hours**

This course is designed to award credit to a graduate student who is the principal investigator of a research project.

**CHEMISTRY****CHEM 518 – Advanced Topics (Topic)****1-3 hours (each topic)**

An in-depth study of selected Chemistry topics presented under formal classroom or laboratory organization. Prerequisite: Instructor's permission. (Not intended for individualized study).

**CHEM 620 – Fundamental Processes in Chemistry I****3 hours**

An in-depth study of selected topics in chemistry. Subject material varies according to the preparation of the students.

**CHEM 621 – Fundamental Processes in Chemistry II****3 hours**

Demonstration of chemical principles and student experiments used in beginning chemistry courses. Writing new laboratory materials and preparing new instructional aids.

**CHEM 640 – Philosophy of Science Research****3 hours**

Historical, descriptive, experimental and philosophical views of scientific research and research techniques are presented.

**PHYSICS****PHYS 518 – Advanced Topics (Topic)****1-5 hours (each topic)**

An in-depth study of selected science topics presented under formal classroom organization (not intended for individualized study). The number of courses which will be taken will depend upon the student's program and recommendation of the advisor and Division Head.

**PHYS 580 – Quantum Mechanics****3 hours**

The physical concepts of quantum mechanics and the solution of Schrodinger's equation for systems such as the hydrogen atom. Prerequisites: grade of "C" or better in PHYS 351, PHYS 382, PHYS 386 and MATH 365.

**PHYS 581 – Introduction to Solid State Physics****3 hours**

The physical properties of solids. Topics include crystal structure, thermal and magnetic properties, band theory, and semiconductors. Prerequisites: grade of "C" or better in PHYS 382 and PHYS 484.

**PHYS 640 – Philosophy of Science Research****3 hours**

Historical, descriptive, experimental and philosophical views of scientific research and research techniques are presented.

**PHYS 680 – Fundamental Processes in Physics I****2 hours**

For students having varied backgrounds in physics. Includes newer phases of physics.

**PHYS 681 – Fundamental Processes in Physics II****2 hours**

For students having varied backgrounds in physics. Not necessarily a continuation of PHYS 680.