

# FACULTY

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## ASSOCIATE DEAN

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# DEGREES OFFERED

## MASTER OF SCIENCE, 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 Dean.
3. Satisfactory completion of an oral defense of thesis, including an advertised seminar.
4. Satisfactory completion of other University Graduate Program requirements.

### ACCELERATED TRACK MASTER OF SCIENCE IN BIOLOGY

The Accelerated Track is designed to provide high ability undergraduate students the opportunity to begin their graduate studies during the senior year. Such students are

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expected to have engaged in significant research activity with a member of the graduate faculty. Students currently enrolled at Truman may apply for admission to the Accelerated Track in the fall or spring of their junior year following regular graduate school procedure. Application materials are available in the Graduate Office. Submission of GRE scores is part of this process. In addition to the application materials required of all MS Biology applicants, students applying for the Accelerated Track must have a 3.25 GPA.

Students accepted into the Accelerated Track of the MS Biology program will begin their graduate coursework in the senior year by taking 5-6 hours of graduate credit recommended by the prospective thesis advisor. The courses taken for graduate credit may not be counted toward the bachelor's degree and must be paid for as graduate credit hours at the time of enrollment. Participation in the Accelerated Track allows the student to qualify for a summer research stipend and tuition waivers for each of two summers following graduation with the bachelor's degree. The academic year following the first summer may be supported with a standard GTRA. The purpose of the Accelerated Track MS Biology is to 1) recognize outstanding research at the undergraduate level by allowing its incorporation as part of the development of a master's research thesis, and 2) enable high-quality students to complete both bachelor's and master's degree programs in biology in approximately a five-year period.

**BIOLOGY**  
**MASTER OF SCIENCE IN BIOLOGY**

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

BIOL 644G	Readings in Biology I	2
BIOL 645G	Readings in Biology II	2
BIOL 649G	Biology Research	1-6
CHEM 518G	Advanced Topics (TOPIC)	1-3
PHYS 518G	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 Dean 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 Magruder Hall. Facilities in Magruder 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 Magruder 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

## GRE SCORES

Graduate Record Exam percentile rankings corresponding to mean scaled scores for incoming Biology students, fiscal year 2005:

Analytical Writing: 56.25%  
 Quantitative: 56.25%  
 Verbal: 58.75%

Average GPA of incoming Biology students, fiscal year 2003: 3.23.

## COURSE DESCRIPTIONS

Students who do not meet prerequisites for a course can request permission to take a course by meeting with the faculty member teaching the course, who in turn will recommend to the Dean that the student be enrolled in the class if appropriate.

### BIOLOGY

#### BIOL 501G – Limnology

4 hours

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

#### BIOL 502G – Biometry

3 hours

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

#### BIOL 503G – 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 504G – Herpetology

4 hours

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

#### BIOL 505G – Cytology

4 hours

Studies of cell structure and function by experimental methods.

#### BIOL 506G – Ornithology

4 hours

Avian Biology with emphasis on field study.

#### BIOL 508G – Advanced Plant Taxonomy

3 hours

Historical taxonomy and experimental approaches to plant systematics. Prerequisite: BIOL 314.

#### BIOL 509G – 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.

#### BIOL 510G – 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.

#### BIOL 511G – 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 512G – 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 513G – Microbial Genetics

4 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 515G – Animal Behavior

3 hours

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

#### BIOL 516G – Ichthyology

4 hours

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

#### BIOL 517G – Mammalogy

4 hours

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

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## SCIENCE

**BIOL 518G – 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 519G – 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 520G – 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 598G – 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.

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

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

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

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

**BIOL 606G, 607G – 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 610G – Advanced Plant Physiology****3 hours**

Physiological and biochemical processes in higher plants.

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

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

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

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

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

Continuation of graduate seminars for elective credit by MS students.

**BIOL 618G – 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 640G – Philosophy of Science Research****3 hours**

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

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

Reading in areas representing current biological research and biology education.

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

A continuation of BIOL 644G.

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

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

**BIOL 649G – 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 518G – 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 620G – 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 621G – 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 640G – Philosophy of Science Research****3 hours**

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

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## PHYSICS

### PHYS 518G – 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 Dean.

### PHYS 580G – Quantum Mechanics 3 hours

Quantum Mechanics is the physics of the very small. A system is described using a wave function, which evolves in time according to the Schrödinger Equation. Students will learn to interpret the wave function and how to expand it in terms of states of well-defined energy. These techniques will be applied to various systems in one and three dimensions, and the concepts of quantized angular momentum, intrinsic spin, and identical particles will be explored. Prerequisites: grades of "C" or better in PHYS 251, PHYS 275, and PHYS 382.

### PHYS 581G – 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 251, PHYS 275, and PHYS 382.

### PHYS 640G – Philosophy of Science Research 3 hours

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

### PHYS 680G – Fundamental Processes in Physics I 2 hours

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

### PHYS 681G – Fundamental Processes in Physics II 2 hours

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

## TEACHER EDUCATION

### SCED 608 – Management of Instruction 3 hours

Prerequisite: Admission to the MAE program.

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