**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. Bachelor’s 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.
4. Satisfactory completion of other University Graduate Program requirements.
BIOLOGY
MASTER OF SCIENCE IN BIOLOGY

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 Taxonomy . . . . . . . . . .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 . . . . . . . . . . . . . . . . . . . . . . . . . .4
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
- microscopes
- microplate fluorometer
- automated electrolyte analyzer
- microcomputers
- Beckman liquid scintillation counter
- electrophoresis and electrophoretic 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 field 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 313 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.
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.

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.

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 Schrödinger’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.