

# DEPARTMENT OF BIOLOGY

## Overview

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The Department of Biology includes programs of study in the biological sciences as well as the physical sciences of earth and environmental science and geography.

### Biology

Biology students study all forms of life at the molecular, organismal, population, community, and ecosystem levels of complexity. Students work in well-equipped laboratories using current tools and techniques and in natural areas on and off-campus. Students are encouraged to get involved in research with faculty, and often have the opportunity to present their findings at regional, national, and international conferences.

The department offers four biology majors, Biochemistry and Molecular Biology, General Biology, Biology with a Health Science Concentration, and Wildlife Conservation and Management. The curriculum consists of core courses taken by all biology majors followed by electives in specific areas that result in a degree in biology, biology with a health science concentration, or wildlife conservation and management. The department curriculum provides excellent preparation for a wide variety of future careers including: science teachers, research biologists, wildlife managers, and conservation agents. It also provides an excellent foundation for further study in graduate programs and professional programs such as medicine, dentistry, and veterinary medicine.

### Earth and Environmental Science

Earth and environmental scientists study the interdependent relationships between the solid Earth and its water, air and living organisms, as well as how humanity alters its natural processes. The Earth and Environmental Science (EaES) minor provides a solid foundation for any student who wishes to supplement or focus on a more environmental- or sustainability-focused aspect of their career. People with earth- or environmental science backgrounds work as geologists, environmental scientists, soil scientists, meteorologists, agronomists, and hydrologists, among other fields. The EaES minor will also make graduates more marketable in areas such as business, population health, biology and wildlife conservation, engineering technology, and many others.

### Geography

Geography is the study of how humans spatially interact with the physical environment. Geographers seek to describe, relate, and explain the natural and cultural phenomena that distinguish places around the world. Studying geography increases students' ability to analyze complex situations, events, trends, and draw logical inferences from them. Geography often functions as a bridge between the natural sciences and the social sciences. Its perspective on the location of phenomena makes it unique among the academic disciplines. Geographers integrate information from other disciplines with their own research to provide a spatial understanding of the world. Geographers work in business, environmental research, climatology, meteorology, cartography, GIS/GPS, and elementary, secondary, and higher education.

## Missouri Western Medical School Partnership Programs

### Kansas City University: College of Osteopathic Medicine Early Matriculation Partners Program

Missouri Western students have the opportunity to be selected into the Partners Program with the Kansas City University (KCU). This program is designed for outstanding students interested in Osteopathic Medicine to enter KCU College of Osteopathic Medicine following their junior year.

Following successful completion of the first year of medical school at KCU, appropriate credits will be transferred to MWSU and students will be awarded a Bachelor of Science degree majoring in Biology/Health Science concentration. Students will be selected in the sophomore year based on the following criteria:

1. ACT score- 24 minimum
2. Freshman year academic performance (minimum 3.25 GPA/3.50 Science GPA)
3. Community service
4. Extracurricular activities
5. Physician shadowing experiences
6. Knowledge of and dedication to the field of osteopathic medicine.

To be considered, students must make application to the committee no later than the advertised deadline during the fall semester of the sophomore year. Selection of qualified applicants will be made by the Missouri Western Health Professions Advisory Committee following an interview. Selected students will then complete an online application with KCU and complete the required steps. Final selection into the Partners Program is made by the KCU Admissions Committee. Selected students must declare a Biology/Health Science major at MWSU and complete the following academic requirements by the end of the junior year:

A minimum of 90 credits, including:

Code	Title	Credit Hours
All MWSU general studies courses required for graduation		
All MWSU Biology Major Core Requirements		
BIO 105	Principles of Organismal Biology	4
BIO 106	Principles of Cell Biology	4
BIO 205	Genetics	4
BIO 225	Ecology	4
CHE 111	General Chemistry I	5
CHE 120	General Chemistry II with Qualitative Analysis	5
CHE 310	Organic Chemistry I	3
CHE 311	Organic Chemistry Laboratory I	2
CHE 370	Biochemistry I	4
MAT 111	Introductory Statistics	3-4
	or MAT 111E Introductory Statistics	
MAT 116	College Algebra	3
PHY 110	College Physics I	4
PHY 111	College Physics II	4
Select a minimum of three of the following courses:		
BIO 250	Anatomy and Physiology	5
BIO 310	Molecular Cell Biology	4
BIO 311	Animal Physiology	4
BIO 390	Microbiology	4

BIO 411	Developmental Biology	4
BIO 416	Vertebrate Biology	4
BIO 417	Medical Parasitology	4
BIO 421	Immunology	4
BIO 430	Molecular Basis of Disease	4
BIO 441	Virology	4

To remain in the Partners Program, students must maintain an overall GPA of 3.25 and a science GPA of 3.5 with all science classes earning a grade of "C" or better. Failure to maintain these academic standards will result in dismissal from the program. The MCAT will not be required for admission through this early matriculation Partners Program. However, selected students must attend a mandatory course conducted at KCU following the junior year and prior to matriculation. For questions, additional details, or application material, please contact the MWSU Department of Biology.

### Kansas City University: College of Dental Medicine Early Matriculation Partners Program

Missouri Western students have the opportunity to be selected into the Partners Program with the Kansas City University (KCU). This program is designed for outstanding students interested in Dental Medicine to enter KCU College of Dental Medicine following their junior year. Following successful completion of the first year of dental school at KCU-Joplin campus, appropriate credits will be transferred to MWSU and students will be awarded a Bachelor of Science degree majoring in Biology/Health Science concentration. Students will be selected in the sophomore year based on the following criteria:

1. ACT score- 24 minimum
2. Freshman year academic performance (minimum 3.25 GPA/3.50 Science GPA)
3. Community service
4. Extracurricular activities
5. Dental shadowing experiences
6. Knowledge of and dedication to the field of dentistry

To be considered, students must make application to the committee no later than the advertised deadline during the fall semester of the sophomore year. Selection of qualified applicants will be made by the Missouri Western Health Professions Advisory Committee following an interview. Selected students will then complete an online application with KCU and complete the required steps. Final selection into the Partners Program is made by the KCU Admissions Committee. Selected students must declare a Biology/Health Science major at MWSU and complete the following academic requirements by the end of the junior year:

A minimum of 90 credits, including:

Code	Title	Credit Hours
All MWSU general studies courses required for graduation		
All MWSU Biology Major Core Requirements		
BIO 105	Principles of Organismal Biology	4
BIO 106	Principles of Cell Biology	4
BIO 205	Genetics	4
BIO 225	Ecology	4
CHE 111	General Chemistry I	5
CHE 120	General Chemistry II with Qualitative Analysis	5

CHE 310	Organic Chemistry I	3
CHE 311	Organic Chemistry Laboratory I	2
CHE 370	Biochemistry I	4
MAT 111	Introductory Statistics	3-4
or MAT 111E	Introductory Statistics	
MAT 116	College Algebra	3
PHY 110	College Physics I	4
PHY 111	College Physics II	4
Select a minimum of three of the following courses:		
BIO 250	Anatomy and Physiology	5
BIO 310	Molecular Cell Biology	4
BIO 311	Animal Physiology	4
BIO 390	Microbiology	4
BIO 411	Developmental Biology	4
BIO 416	Vertebrate Biology	4
BIO 417	Medical Parasitology	4
BIO 421	Immunology	4
BIO 430	Molecular Basis of Disease	4
BIO 441	Virology	4

To remain in the Partners Program, students must maintain an overall GPA of 3.25 and a science GPA of 3.5 with all science classes earning a grade of "C" or better. Failure to maintain these academic standards will result in dismissal from the program. The DAT will not be required for admission through this early matriculation Partners Program. However, selected students must attend a mandatory course conducted at KCU following the junior year and prior to matriculation. 30 credits of first-year dental school coursework will transfer to MWSU to complete the bachelor's degree. For questions, additional details, or application material, please contact the MWSU Department of Biology.

### Palmer College of Chiropractic: Dual Degree Program

Missouri Western students interested in Chiropractic can participate in the Dual Degree Program with Palmer College of Chiropractic (PCC).

Students will attend approximately three years at Missouri Western State University, completing 90 credit hours including the entrance requirements for PCC. The first year Palmer curriculum coursework will be transferred to MWSU for completion of the BS-Biology/Health Science degree. Students must declare the BS-Biology/Health Science major. An "intent to participate" in this program may be signed as early as the first semester at MWSU. Participants can select their PCC matriculation semester and which Palmer campus they wish to attend.

While at MWSU, participants must complete the following curriculum:

A minimum of 90 credit hours, including:

Code	Title	Credit Hours
All MWSU general studies courses required for graduation		
All MWSU Biology major Core Requirements		
BIO 105	Principles of Organismal Biology	4
BIO 106	Principles of Cell Biology	4
BIO 205	Genetics	4
BIO 225	Ecology	4
BIO 250	Anatomy and Physiology	5
CHE 111	General Chemistry I	5
CHE 120	General Chemistry II with Qualitative Analysis	5

CHE 310	Organic Chemistry I	3
CHE 311	Organic Chemistry Laboratory I	2
CHE 370	Biochemistry I	4
MAT 111	Introductory Statistics	3-4
or MAT 111E	Introductory Statistics	
MAT 116	College Algebra	3
PHY 110	College Physics I	4
Select two of the following courses:		
BIO 310	Molecular Cell Biology	4
BIO 311	Animal Physiology	4
BIO 390	Microbiology	4
BIO 411	Developmental Biology	4
BIO 416	Vertebrate Biology	4
BIO 417	Medical Parasitology	4
BIO 421	Immunology	4
BIO 430	Molecular Basis of Disease	4
BIO 441	Virology	4
Select any additional elective credit hours to reach the required 90 credit hour minimum		

Missouri Western State University students will be accepted for admission to PCC under this dual degree program upon completing the above curriculum. Accepted students must attain a minimum 3.0 cumulative grade point average in Missouri Western State University coursework; however, students receiving a minimum of 2.75 cumulative GPA may be considered for PCC admissions but are not guaranteed a seat under this agreement. Students must make timely submission of all application materials to PCC and receive a positive recommendation of the Chair (or designee) of the Department of Biology.

Upon successful completion of the first year of studies at PCC, a maximum of 30 PCC credit hours may be transferred toward completion of the Bachelor Degree in Biology/Health Science at Missouri Western State University. An official transcript must be sent from PCC to the Missouri Western State University Registrar's Office, and the student must submit an application for graduation with the Missouri Western State University Registrar's Office. Students who successfully complete the dual degree program will be eligible to participate in commencement ceremonies at both PCC and Missouri Western State University.

For additional information please contact the MWSU Biology Department.

### Logan University, College of Chiropractic 3+3 Program

Missouri Western students interested in Chiropractic can participate in the 3+3 Program with Logan University. Students will complete a prescribed minimum 90 credit hours in undergraduate coursework at MWSU, matriculate to Logan, and transfer a maximum of 30 credit hours in coursework from the Logan first-year curriculum to MWSU in order to complete the BS – Biology/Health Science degree.

A minimum of 90 credits including:

Code	Title	Credit Hours
All MWSU general studies courses required for graduation		
All MWSU Biology major Core Requirements		
BIO 105	Principles of Organismal Biology	4
BIO 106	Principles of Cell Biology	4
BIO 205	Genetics	4
BIO 225	Ecology	4

CHE 111	General Chemistry I	5
CHE 120	General Chemistry II with Qualitative Analysis	5
CHE 310	Organic Chemistry I	3
CHE 311	Organic Chemistry Laboratory I	2
CHE 370	Biochemistry I	4
MAT 111	Introductory Statistics	3-4
or MAT 111E	Introductory Statistics	
MAT 116	College Algebra	3
PHY 110	College Physics I	4
Any three of the following courses:		12-13
BIO 250	Anatomy and Physiology <sup>1</sup>	5
BIO 310	Molecular Cell Biology <sup>1</sup>	4
BIO 311	Animal Physiology	4
BIO 390	Microbiology <sup>1</sup>	4
BIO 411	Developmental Biology	4
BIO 416	Vertebrate Biology	4
BIO 417	Medical Parasitology	4
BIO 421	Immunology <sup>1</sup>	4
BIO 430	Molecular Basis of Disease	4
BIO 441	Virology	4
Select any additional elective credit hours to reach the required 90 credit hour minimum		

<sup>1</sup> Preferred courses for program

### Logan Coursework:

A minimum of 30 credit hours of Logan first-year coursework must be completed with a cumulative grade point average of at least a 2.00 on a scale of 4.00. A maximum of 30 credits from the first year chiropractic curriculum at Logan University will be transferred to MWSU and applied toward completion of the 120 credit hour BS – Biology/Health Science degree at MWSU.

For every subject required by Logan (either offered by MWSU or Logan), no grade below a 2.0 on a 4.0 scale will be accepted for credit in this articulated program. In addition, all 3+3 Program students must have earned a cumulative grade point average of at least 2.75 for the 90 credit hours at MWSU to be considered for admission. Students who earn less than a 3.0 GPA, but at least a 2.75 or higher, and satisfy core competencies described in the Council on Chiropractic Education's *Doctor of Chiropractic Program Requirements for Institutional Standards*, may be eligible for admission to Logan at the discretion of the Vice President of Enrollment Management, and will receive appropriate consideration in the standard admission process for having completed the MWSU Pre-Chiropractic Program. Such students will not receive the assurance of a seat reserved for students earning a 3.0 or higher GPA and will be assessed under an alternative admission track. Students will complete an "Application of Intent" as early as possible in the undergraduate career and an application to Logan six months to a year in advance of their desired entrance date.

For additional information please contact the MWSU Biology Department.

## Cooperative Missouri Western Medical School Admissions Programs

- A.T. Still University's Missouri School of Dentistry & Oral Health: Still Scholars Early Acceptance Program (<https://www.missouriwestern.edu/biology/atsu-dentistry/>)
- A.T. Still University's Kirksville College of Osteopathic Medicine: Still Scholars Early Acceptance Program (<https://www.missouriwestern.edu/biology/still-scholars/>)
- University of Missouri-Columbia, School of Medicine: Bryant Scholars Program (<https://www.missouriwestern.edu/biology/mu-som/>)
- University of Missouri – Kansas City, School of Medicine: Medical Scholars Program (<https://www.missouriwestern.edu/biology/umkc-som/>)

## Majors

- Biochemistry and Molecular Biology (Bachelor of Science, B.S.) (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/biochemistry-molecular-biology-bs/>)
- Biology (Bachelor of Science, B.S.) (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/biology-bs/>)
- Wildlife Conservation and Management (Bachelor of Science, B.S.) (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/wildlife-conservation-management-bs/>)

## Minors

- Biology Minor (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/biology-minor/>)
- Earth and Environmental Science Minor (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/earth-and-environmental-science-minor/>)
- Entrepreneurship Minor (<http://catalog.missouriwestern.edu/undergraduate/interdisciplinary-studies/entrepreneurship-minor/>)
- Geography Minor (<http://catalog.missouriwestern.edu/undergraduate/science-and-health/biology/geography-minor/>)

## Courses Biology (BIO)

### BIO 101 Principles of Biology Credits: 4

**Typically Offered:** Fall, Spring.

**Course Description:** Introductory course on the principles of living phenomena intended for students not majoring in biology. Three hours lecture, two hours lab.

**CORE 42:** MOTR BIOL 100L; Essentials in Biology with Lab (attributes MO32, MLAB)



### BIO 105 Principles of Organismal Biology Credits: 4

**Typically Offered:** Fall, Spring.

**Course Description:** Examines basic concepts and principles of evolutionary biology, behavior, ecology, physiology and morphology at the organismal level. Three hours lecture, three hours lab per week.

**Prerequisite(s):** ACT math score of 22 or higher or a score of 70 or higher on the MWSU Math Placement Exam or completion of MAT 110, MAT 110E, MAT 111, MAT 111E or MAT 116 with a grade of C or higher.

**CORE 42:** MOTR BIOL 150LOR; Biology w/Lab (attributes MO32, MLAB)



### BIO 106 Principles of Cell Biology Credits: 4

**Typically Offered:** Fall, Spring.

**Course Description:** This introductory biology course examines the structure and function of animal and plant cells, interactions between cells, intra- and intercellular signaling mechanisms and basic cellular biochemistry. Within the above context, students are also introduced to basic concepts of molecular biology and development. Three hours lecture, three hours lab. **Prerequisite(s):** ACT math score of 22 or higher or a score of 70 or higher on the MWSU Math Placement Exam or completion of MAT 110, MAT 110E, MAT 111, MAT 111E or MAT 116 with a grade of C or higher.

**CORE 42:** MOTR BIOL 150LCB; Biology with Lab (attributes MO32, MLAB)



### BIO 205 Genetics Credits: 4

**Typically Offered:** Fall, Spring.

**Course Description:** Explore and study classical, molecular, and evolutionary genetics. Three hours lecture and three hours lab per week.

**Prerequisite(s):** BIO 106 and CHE 111 with a grade of C or higher.

### BIO 207 Human Ecology Credits: 3

**Typically Offered:** Fall.

**Course Description:** Environmental Science/Studies course analyzing how human society interacts with the natural world. **Prerequisite(s):** A grade of C or higher in either BIO 101, BIO 105 or BIO 106.

### BIO 209 Introduction to Wildlife Conservation Credits: 3

**Typically Offered:** Spring.

**Course Description:** This course surveys the historic and modern development of conservation biology. How the principles of conservation are applied to the management, restoration, and preservation of wildlife natural resources is emphasized. **Prerequisite(s):** A grade of C or higher in BIO 105 or BIO 106. BIO 225 recommended.

### BIO 220 Field Natural History Credits: 1-3

**Typically Offered:** Departmental Discretion.

**Course Description:** Involves participation in an off-campus field trip to experience a focused study of a unique biotic habitat. May involve pre-trip lectures and organizational meetings and/or post-trip class sessions or presentations. Different BIO 220 courses may be repeated for credit.

**Prerequisite(s):** BIO 101, BIO 105, or BIO 106 or departmental approval.

### BIO 225 Ecology Credits: 4

**Typically Offered:** Fall, Spring.

**Course Description:** Covers principles of ecology and evolution, including field and research methods. Three hours lecture, three hours lab.

**Prerequisite(s):** A grade of C or higher in BIO 105.

**BIO 250 Anatomy and Physiology Credits: 5****Typically Offered:** Fall, Spring, Summer.**Course Description:** Concepts of human structure and function and relationships of these concepts to cells, tissues, organs and systems. Four hours lecture, two hours lab. **Prerequisite(s):** A grade of C or higher in either BIO 101 or BIO 106.**CORE 42:** MOTR LIFS 150LAP; Human Biology with Lab (attributes MO36, MLAB)**BIO 251 Medical and Public Health Microbiology Credits: 4****Typically Offered:** Fall, Spring.**Course Description:** Medically significant microorganisms, their characteristics, relationship to disease, transmission, and control methods. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 101 or BIO 106 and CHE 101 or CHE 111 each with a grade of C or higher.**BIO 283 Introduction to Research Methods in Biology Credits: 1-5****Typically Offered:** Departmental Discretion.**Course Description:** Introduction to basic research in biology. Individual and team projects involving methods for solving biology-related research problems. **Prerequisite(s):** Departmental approval.**BIO 307 Plant Morphology Credits: 4****Typically Offered:** Fall.**Course Description:** This course discusses the morphological and anatomical features of plants within the context of their function, development, evolution, and diversity. Emphasis is also placed on surveying mechanisms affecting morphological and anatomical diversification. Laboratory and field investigations focus on modern techniques used in comparative plant morphology-, anatomy- and development investigations. Three hours lecture, three hours lab.**Prerequisite(s):** A grade of C or higher in BIO 105.**BIO 308 History and Philosophy of the Natural Sciences Credits: 3****Typically Offered:** Spring.**Course Description:** A study of the history of the natural sciences with an emphasis on the philosophical analysis of these events. Same as CHE 308 and PHL 308. **Prerequisite(s):** Completion of General Studies Mathematics and Natural Sciences requirements.**BIO 310 Molecular Cell Biology Credits: 4****Typically Offered:** Fall.**Course Description:** Advanced cell biology covering topics relevant to cellular structure and function. Selected topics may include: cell signaling, cell adhesion, membrane function, cell motility and cytoskeletal structure and function. The cellular basis for some human syndromes and disease will also be covered. Three hours lecture, three hours lab.**Prerequisite(s):** BIO 205 with a grade of C or higher.**BIO 311 Animal Physiology Credits: 4****Typically Offered:** Fall.**Course Description:** The physiological systems, their functions and interactions in animal physiology with emphasis on the human animal. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 205 with a grade of C or higher.**BIO 314 Technology and Society Credits: 3****Typically Offered:** Departmental Discretion.**Course Description:** Participatory course emphasizing a particular problem and/or issue related to technology and society. Class participants will investigate the semester's theme using currently available technologies. Same as ENG 314, HUM 314, PSY 314, and PSC 314.**BIO 318 Ornithology Credits: 4****Typically Offered:** Spring.**Course Description:** Biology of birds covering avian taxonomy, anatomy, physiology, behavior, evolution, and both sight and sound identification.**Prerequisite(s):** BIO 225 with a grade of C or higher.**BIO 325 Introduction to Paleontology Credits: 4****Typically Offered:** Spring (even-numbered years).**Course Description:** This class reviews the history of life on Earth, and the principles of quantitative and qualitative techniques used in paleontology. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 101 or BIO 105 or ESC 111 with a grade of C or higher, or consent of the instructor.**BIO 349 Plant Systematics and Applications Credits: 4****Typically Offered:** Spring.**Course Description:** Gain an in-depth knowledge and hands on experience in the taxonomy, ecology, natural history, phylogenetics, and biogeography of plant groups crucial to humans and other animals, including crops and medicinal plants, as well as native plants of Northwest Missouri. Three hours lecture and three hours lab. A plant collection and field trips, including one weekend field trip are required.**Prerequisite(s):** A grade of C or higher in BIO 307.**BIO 353 Philosophy of Biology Credits: 3****Typically Offered:** Departmental Discretion.**Course Description:** An introduction to current issues in the philosophy of biology such as the nature of biological organization, classification, and living systems and some of the problems that have arisen in the attempt to understand these complex systems. Same as PHL 353.**Prerequisite(s):** BIO 101 or BIO 105 or BIO 106.**BIO 357 Ichthyology Credits: 4****Typically Offered:** Departmental Discretion.**Course Description:** The study of fishes, including morphology, physiology, taxonomy, phylogeny, evolution, ecology and behavior. Labs will cover field and laboratory techniques for studying fishes, including identification of families and species with an emphasis on the fishes of Missouri. Three hours lecture and three hours lab. One weekend field trip is required. **Prerequisite(s):** A grade of C or higher in BIO 106 and BIO 225.**BIO 360 Development of Federal Wildlife Law Credits: 3****Typically Offered:** Fall (even-numbered years), Summer (online on demand).**Course Description:** Introduction to the principles of federal wildlife law as currently practiced in the United States. The course will survey the historical and constitutional origins of federal wildlife law and discuss the influence major statutes currently in effect exert on the biopolitics and daily practice of wildlife resource management and conservation. Three hours lecture, including discussions and/or special topics.**BIO 375 Pathophysiology Credits: 4****Typically Offered:** Fall, Spring.**Course Description:** The etiology, pathogenesis, and manifestations of human diseases, with an emphasis on underlying pathophysiological mechanisms. **Prerequisite(s):** A grade of C or higher in BIO 250 or BIO 311.

**BIO 380 Biology Teaching: Materials and Methods Credits: 3****Typically Offered:** Departmental Discretion.**Course Description:** This course provides pre-service secondary biology teachers with opportunities to develop a framework that can be used to coordinate biological concepts and techniques obtained from science courses with pedagogical concepts and methods from education classes and teaching experiences. The development of a science teaching portfolio is required. Students enrolled in this course must also be available to work in one of the scheduled BIO 101 labs. **Prerequisite(s):** 20 credit hours in science.**BIO 385 Herpetology Credits: 4****Typically Offered:** Spring (even-numbered years).**Course Description:** Natural history of the amphibians and reptiles, including ecology, biology, evolution, and anatomy, with an emphasis on local species. Three hours lecture and one, three-hour lab each week. One weekend field trip is required. **Prerequisite(s):** A grade of C or higher in BIO 106 and BIO 225.**BIO 390 Microbiology Credits: 4****Typically Offered:** Fall.**Course Description:** Identification, characteristics, and importance of microorganisms; application to human needs, infection and immunity. Three hours lecture and three hours lab per week. **Prerequisite(s):** A grade of C or higher in BIO 205.**BIO 409 Principles of Terrestrial Wildlife Management Credits: 3****Typically Offered:** Spring (even-numbered years).**Course Description:** Students will survey the principles, theories, and practices of terrestrial wildlife management. Activities include discussions of local, national, and international issues as well as exploration of major techniques used in the management of terrestrial wildlife resources. Lectures, field experiences, discussions, and in-class activities are integrated throughout the course. **Prerequisite(s):** A grade of C or higher in both BIO 209 and BIO 225.**BIO 411 Developmental Biology Credits: 4****Typically Offered:** Spring.**Course Description:** Examines the morphological changes and the genetic and molecular pathways involved in animal embryonic development. Three hours lecture and three hours lab. **Prerequisite(s):** BIO 205 with a grade of C or higher.**BIO 415 Invertebrate Biology Credits: 4****Typically Offered:** Fall (even-numbered years).**Course Description:** Biology of the invertebrates, emphasizing their taxonomy, anatomy, life cycles, evolution, and ecology. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 106 and BIO 225 with a grade of C or higher.**BIO 416 Vertebrate Biology Credits: 4****Typically Offered:** Spring (odd-numbered years).**Course Description:** Comparative anatomy and physiology, evolution, and systematics of the vertebrates. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 205 and BIO 225 with a grade of C or higher.**BIO 417 Medical Parasitology Credits: 4****Typically Offered:** Spring.**Course Description:** An overview of the biology, ecology, pathology, and medical/veterinary relevance of parasites, with an emphasis on the major protozoal, helminth, and arthropod parasites of humans. Three hours lecture, two hours lab. **Prerequisite(s):** A grade of C or higher in both BIO 205 and BIO 225.**BIO 418 Mammalogy Credits: 4****Typically Offered:** Fall (odd-numbered years).**Course Description:** The morphology, systematics, evolution, taxonomy, distribution, comparative physiology, life history, behavior, and ecology of mammals. Research and collections dealing with mammals will also be a part of this course. Three hours lecture and three hours lab.**Prerequisite(s):** A grade of C or higher in BIO 225.**BIO 419 Animal Behavior Credits: 4****Typically Offered:** Fall.**Course Description:** An introduction to the principles of animal behavior, including the evolutionary, ecological, physiological, and psychological basis of animal behavior. Topics will include social interactions, mating behavior, communication, learning, foraging, predator-prey interactions, and habitat selection. Three hours lecture and three hours lab. Same as PSY 419. **Prerequisite(s):** A grade of C or higher in BIO 105, or a grade of C or higher in both BIO 101 and PSY 101.**BIO 420 Biology Teaching Practicum Credits: 1-2****Typically Offered:** Fall, Spring, Summer.**Course Description:** A laboratory or classroom teaching assistant experience. This experience may not be substituted for other courses required in the student's major area. Course grades assigned on a pass/fail basis. May be repeated for credit. **Prerequisite(s):** Overall GPA 2.75 and departmental approval.**BIO 421 Immunology Credits: 4****Typically Offered:** Spring (odd-numbered years).**Course Description:** Investigation of the cellular and molecular basis of the immune response. Methods in immunology as applied to various fields. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 310 or BIO 390 with a grade of C or higher.**BIO 425 Biology Internship Credits: 1-2****Typically Offered:** Fall, Spring, Summer.**Course Description:** An extracurricular experience related to a unique approved career experience or a Preprofessional experience. Course grades assigned on a pass/fail basis. May be repeated for credit.**Prerequisite(s):** Departmental approval.**BIO 430 Molecular Basis of Disease Credits: 4****Typically Offered:** Spring (even-numbered years).**Course Description:** Investigation of the basic biological causes of human diseases at molecular, cellular, and physiological levels. Three hours lecture, three hours lab per week. **Prerequisite(s):** A grade of C or higher in BIO 205 and a grade of C or higher in either BIO 310, BIO 311, or CHE 370.**BIO 440 Plant Physiology Credits: 4****Typically Offered:** Spring.**Course Description:** This course examines plant functions in the context of plant-environment interactions. The course emphasizes aspects of plant growth and development, water relations and mineral nutrition, plant primary and secondary metabolism, plant-plant and plant-environment interactions, plant stress responses and discusses aspects of advances in plant biotechnology. Laboratory exercises will introduce students to modern investigative lab-bench, greenhouse and field based techniques. Three hours lecture, three hours lab. **Prerequisite(s):** BIO 307 with a grade of C or higher.**BIO 441 Virology Credits: 4****Typically Offered:** Spring (even-numbered years).**Course Description:** Principles of virology that will focus on virus classification, various molecular aspects of virus replication, and pathogenesis. **Prerequisite(s):** A grade of C or higher in BIO 310 or BIO 390.

**BIO 450 Independent Research/Project Credits: 1-5**

**Typically Offered:** Fall, Spring, Summer.

**Course Description:** Investigation of a research problem, project, or topic on an individual conference basis. May be repeated for credit.

**Prerequisite(s):** Departmental approval.

**BIO 455 Entomology Credits: 4**

**Typically Offered:** Fall (odd-numbered years).

**Course Description:** Introduction to the insects that will focus on their taxonomy, natural history, physiology, development, and ecology. Three hours lecture, three hours lab. **Prerequisite(s):** A grade of C or higher in BIO 105, BIO 106 and BIO 225.

**BIO 456 Aquatic Ecology Credits: 4**

**Typically Offered:** Fall (even-numbered years).

**Course Description:** This course uses lectures and discussions of primary literature to provide an overview of selected topics in aquatic ecology, including characteristics or different aquatic ecosystems, biology and ecology of aquatic organisms, and current issues in conservation and management of aquatic systems. The lab portion of this course focuses on field techniques and methodology, exploration of local aquatic ecosystems, identification of organisms, and experimental design and data interpretation. This course includes required weekend field trips. Three hours lecture, three hours lab. **Prerequisite(s):** A grade of C or higher in BIO 225.

**BIO 461 Renewable Resources Policy and Administration Credits: 3**

**Typically Offered:** Spring (odd-numbered years).

**Course Description:** This course explores wildlife resources policy and administration from several perspectives. It examines environmental and administrative decision making in developing and implementing policy designed to address contemporary resource management challenges, conflicts and problems as they impact wildlife resources at the state and national level.

## Earth Science (ESC)

**ESC 111 Physical Geology Credits: 4**

**Typically Offered:** Fall, Spring.

**Course Description:** Survey of geologic materials and processes, including quantitative and qualitative methods for studying geology. Three hours lecture, two hours lab.

**CORE 42:** MOTR GEOL 100L; Geology with Lab (attributes MO35, MLAB)

**ESC 120 Meteorology Credits: 4**

**Typically Offered:** Spring (odd-numbered years).

**Course Description:** Studies the nature and phenomena of the atmosphere and surveys climates and their classification. Three hours lecture, two hours lab.

## Geography (GEO)

**GEO 100 World Geography Credits: 3**

**Typically Offered:** Fall, Spring.

**Course Description:** A systematic and regional analysis of the world's diverse cultural realms emphasizing the five themes of geography (location, place, interaction of people and the physical environment, movement, and region).

**CORE 42:** MOTR GEOG 101; World Regional Geography (attribute MO11)

**GEO 160 Physical Geography Credits: 4**

**Typically Offered:** Fall, Spring.

**Course Description:** Analysis of Earth's physical systems, Earth-Sun relationships, weather and climate, soils and landforms, fluvial processes, global vegetation, exercises involving data collection, aerial photography and map interpretation, and data analysis. Three hours lecture and two hours lab.

**CORE 42:** MOTR GEOG 100L; Physical Geography with Lab (attributes MO34, MLAB)

**GEO 210 Geography of the United States and Canada Credits: 3**

**Typically Offered:** Departmental Discretion.

**Course Description:** A systematic and regional analysis of the contemporary physical, cultural, and economic geography of the United States and Canada. Examination of environmental influences on people and the ways people change the environment as evidenced in agriculture, religion, industry, and urban areas.

**GEO 310 Geography of Asia Credits: 3**

**Typically Offered:** Departmental Discretion.

**Course Description:** A systematic and regional analysis of the contemporary physical, cultural, historical, and economic geography of Asia. Regional analysis will be selected from topics in Central, East, South, Southeast, and Southwest Asia, as well as Oceania and Antarctica.

**GEO 320 Geography of Europe Credits: 3**

**Typically Offered:** Departmental Discretion.

**Course Description:** A systematic and regional analysis of the contemporary physical, cultural, and economic geography of the nations and regions west of Russia; trends of development as affected by changing political structures and the European Union. **Prerequisite(s):** A course in geography or European history.

**GEO 340 Sustainable Energy Credits: 3**

**Typically Offered:** Departmental Discretion.

**Course Description:** Basic concepts of development and sustainability as they relate to energy usage. Implications on human population, weather and climate, global climate change, and agriculture will be discussed. Course will focus on energy conservation, fossil fuel energies, and alternative energy strategies, including, but not limited to, solar, wind, water, nuclear, geothermal, and biofuels. Class is in both lecture and seminar format. **Prerequisite(s):** A course in geography or BIO 207, or departmental approval.

**GEO 426 Geographic Information Systems Credits: 4**

**Typically Offered:** Departmental Discretion.

**Course Description:** Basic concepts of Geographic Information Systems and applications; raster and vector data models; exercises involving data collection, GPS usage, database management, editing databases and shapefiles, querying and analyzing data, and cartographic design using ArcGIS and Google software. Three hours lecture and two hours lab.

**Prerequisite(s):** Junior standing or departmental approval.

**GEO 430 Globalization, Labor, and Resources Credits: 3**

**Typically Offered:** Departmental Discretion.

**Course Description:** Patterns of distribution, production, and consumption of the world's resources; theories of geographic location related to agricultural, industrial, and service activities; globalization and internationalization; population and migration impacts on the economy; the role of the state in the economy; theories of development and underdevelopment. **Prerequisite(s):** ECO 260 or GEO 100.

**GEO 450 Independent Research/Project Credits: 1-6**

**Typically Offered:** Fall, Spring.

**Course Description:** Investigation of a research problem, project, or topic on an individual conference basis. May be repeated with departmental approval. **Prerequisite(s):** Departmental approval.

**GEO 490 Geography Internship Credits: 1-12**

**Typically Offered:** Fall, Spring, Summer.

**Course Description:** Students arrange an internship with a suitable government agency or employer engaged in geographic activities, subject to the approval of the Department of Biology via its geography faculty. The field work will provide first-hand applied learning experience and career-related skills using knowledge learned in geography classes. These skills include, but are not limited to: GIS, GPS, planning, critical thinking, writing, and public speaking. Internships must be arranged and approved by the department in the semester preceding the internship. For more details contact the Coordinator of the Internship Practicum in the Department of Biology. **Prerequisite(s):** Departmental approval.

## Faculty

**Jason Baker** (2000) Professor, Biology. Ph.D., Kansas State University.

**Csengele Barta** (2012) Professor, Biology. Ph.D., University of Szeged.

**Cary Chevalier** (1996) Professor, Biology. Ph.D., University of California.

**Todd Eckdahl** (1993) Professor, Biology. Ph.D., Purdue University.

**Ashley Elias** (2019) Assistant Professor, Biology. Ph.D., Purdue University.

**Carissa Ganong** (2016) Associate Professor, Biology. Ph.D., University of Georgia.

**Michael Grantham** (2016) Associate Professor, Biology. Ph.D., Louisiana State University.

**Julie Jedlicka** (2015) Associate Professor, Biology. Ph.D., University of California-Santa Cruz.

**Karen Koy** (2008) Associate Professor, Biology. Ph.D., University of Illinois at Chicago.

**Jay Meyers** (2022) Instructor, Biology. Ph.D., University of Missouri-Columbia.

**Mark Mills** (2008) Professor, Biology. Ph.D., University of Georgia.

**Aracely Newton** (2019) Assistant Professor, Biology. Ph.D., University of Kansas.

**Tilottama Roy** (2017) Associate Professor, Biology. Ph.D., The State University of New York at Buffalo.

**Kristen Walton** (2006) Professor, Biology. Ph.D., University of North Carolina.