
Department of Biology

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<http://www.missouriwestern.edu/Biology/>

271-4552

Biology students study all forms of life at the molecular, organismal, and population levels of complexity. Students work in well-equipped laboratories using current tools and techniques, and in the department's campus natural area where students study life in its natural environment. Independent research and special problems courses are offered for advanced students.

The biology curriculum consists of core courses taken by all biology majors, followed by biology electives in specific areas. The department curriculum provides excellent preparation for prospective science teachers, graduate students, and research biologists, among others, and for professional programs in medicine, dentistry, and veterinary medicine.

Earth Science and Physical Science (for the elementary teacher) are also listed in the Biology Department.

EXIT REQUIREMENTS FOR DEPARTMENT MAJORS

All students completing any B.S. degree requirement in the Biology Department will be required to take the departmental exit exam prior to graduation.

BACHELOR OF SCIENCE DEGREE REQUIREMENTS

Major in Biology

Students may select among the following options as a Biology major:

1. Major in Biology
2. Major in Biology with Zoology Concentration
3. Major in Biology with Botany Concentration
4. Major in Biology with Health Science Concentration

Core Requirements

			<i>Credits</i>
BIO	105	Principles of Organismal Biology	5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	225	Evolutionary Ecology	4
CHE	111	General Chemistry	5
CHE	120	General Chemistry II	5
CHE	310	Organic Chemistry I	3
CHE	311	Organic Chemistry Laboratory I	2
CHE	370	Biochemistry	4
MAT	132	Elementary Statistics	3
PHY	110	College Physics I	4
		TOTAL CORE	<hr/> 43

Major in Biology

Core plus 22 additional credits from biology courses numbered 300 or higher selected from the following areas:

A. Organismal Diversity (12 credits). Select three (3) courses from at least two (2) of the following areas:

1. BIO	415	Invertebrate Biology	OR	
			4	
2. BIO	350	Plant Systematics	OR	
			4	
3. BIO	390	Microbiology	OR	
			OR	
	BIO	315	Medical Parasitology	OR
			OR	
	BIO	455	Entomology	4
		Total A	12	

B. Physiology (4 hours). Select one of the following:

BIO	311	Animal Physiology	OR
			4
BIO	340	Plant Physiology	OR
		Total B	4

C. Biological Electives. Complete an additional six (6) credits of upper division biology courses.

Total C	6
TOTAL CONCENTRATION	22
TOTAL CORE AND CONCENTRATION AREA	65

Major in Biology with Botany Concentration

Core plus 22 additional credits from biology courses numbered 300 or higher selected from the following areas:

A. Organismal Diversity (14 credits)

BIO	350	Plant Systematics	4	
			4	
BIO	407	Plant Morphology	2	
			4	
BIO	351	Local Flora: Spring & Summer	4	
			4	
	BIO	455	Entomology	4
		Total A	14	

B. Physiology (4 hours)

BIO	340	Plant Physiology	4
		Total B	4

C. Biological Electives. Complete an additional four (4) credits of upper division biology courses.

Total C	4
TOTAL CONCENTRATION	22
TOTAL CORE AND CONCENTRATION AREA	65

Major in Biology with Zoology Concentration

Core plus 21 additional credits from biology courses numbered 300 or higher selected from the following areas:

A. Organismal Diversity (13-16 credits). Select two (2) courses from each of the following two (2) areas:

1.	BIO	315	Medical Parasitology	3
	BIO	415	Invertebrate Biology	4
	BIO	455	Entomology	4
2.	BIO	318	Ornithology	2
	BIO	416	Vertebrate Biology	4
	BIO	418	Mammology	4
			Total A	13-16

B. Physiology (4 hours)

	BIO	311	Animal Physiology	4
			Total B	4

C. Biological Electives. Complete an additional 1-4 credits of upper division biology courses.

Total C	1-4
TOTAL CONCENTRATION	21-24
TOTAL CORE AND CONCENTRATION AREA	64-67

Major in Biology with Health Science Concentration

The courses required for this concentration should prepare the student interested in a health and preprofessional program to apply and, if admitted, to succeed in the health professional program of their choice.

Students selecting the Health Science concentration must be aware that additional courses may be needed to complete the admission requirements for the health professional program that they are interested in. In addition to the 43 credit core above, a minimum of 21 credits of coursework must be selected from the following areas:

A. Health Science Electives (choose 5 of the following courses)

	<i>Credits</i>
BIO 250 Human Anatomy and Physiology (5)	20-21
BIO 311 Animal Physiology (4)	OR
BIO 315 Medical Parasitology (4)	
BIO 390 Microbiology (4)	
BIO 410 Molecular Biology (4)	
BIO 411 Developmental Biology (4)	
BIO 421 Immunology (4)	
BIO 430 Molecular Basis of Disease (4)	
BIO 431 Molecular Biology (4)	

B. Science Electives

Upper division biology or chemistry course(s)	1-5
TOTAL CONCENTRATION AREA	21-26
TOTAL CORE AND CONCENTRATION AREA	64-69

Kansas City University of Medicine and Biosciences

Osteopathic Medicine Early Matriculation Partners Program

Missouri Western students have the opportunity to be selected into the Partners Program between the Kansas City University of Medicine and Biosciences and MWSU. This program is designed for outstanding students interested in osteopathic medicine to enter KCUMB following their junior year. Following successful completion of the first year of medical school at KCUMB, 30 credits will be transferred to MWSU and students will be awarded a Bachelor of Science degree in Biology / Health Science concentration. Students will be selected in their sophomore year based on the following criteria: 1) ACT score - 26 minimum, 2) freshman year academic performance (3.25 GPA / 3.50 Science GPA), 3) community service, 4) extracurricular activities, 5) physician shadowing experiences, and 6) knowledge of and dedication to the field of osteopathic medicine.

Selection of eligible students will be made by the Missouri Western Health Professions Advisory Committee and a representative member of the KCUMB admissions committee. To be considered, students must make application to the committee no later than November 1st of the fall semester of the sophomore year. A maximum of two MWSU students will be selected each academic year. Selected students must declare a Biology / Health Science concentration major and complete the following academic requirements by the end of the junior year:

A minimum of 94 credits, including:

1. All MWSU general studies courses required for graduation
2. All MWSU Biology Major Core Requirements
3. PHY 111 College Physics II (4)
4. A minimum of three of the following courses:
 - BIO 250 Human Anatomy and Physiology (5)
 - BIO 311 Animal Physiology (4)
 - BIO 315 Medical Parasitology (4)
 - BIO 390 Microbiology (4)
 - BIO 410 Molecular Cell Biology (4)
 - BIO 411 Developmental Biology (4)
 - BIO 421 Immunology (4)
 - BIO 430 Molecular Basis of Disease (4)
 - BIO 431 Molecular Biology (4)

To remain in the Partners Program, students must maintain an overall GPA of 3.25 and a science GPA of 3.50. 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 participate in a five-day pre-med preparatory course conducted at KCUMB following the junior year. Information and application material can be obtained through the MWSU Department of Biology.

Still Scholars - PreOsteopathic Early Acceptance Program

The Still Scholars, PreOsteopathic Program is designed to provide early admission to outstanding sophomore level students who have as their goal to become Doctors of Osteopathic Medicine. A.T. Still University, Kirksville College of Osteopathic Medicine (ATSU, KCOM) works in joint collaboration with Missouri Western to offer this program.

The advantage for those students, a maximum of two per year, accepted after completing their sophomore year is to have a reserved seat in KCOM's entering class upon graduation. The Medical College Admission Test (MCAT) is not required. After acceptance to the program, students can spend the last two years at their undergraduate institution meeting graduation major/minor requirements, taking electives, fulfilling internship and/or service opportunities, and otherwise broadening his/her life experiences. Scholars will be awarded an academic scholarship for ATSU, KCOM.

Students may enroll in any major, provided the KCOM entry requirements are met by the designated year of enrollment. Students apply for admission to this program after completing three semesters (approximately 45 credit hours). Applications will be available through Western's Pre-medical advisors in the spring of their sophomore year. Applications must be submitted to the MWSU Health Advisory Committee and KCOM by June 1. Applicants will interview with KCOM during the summer following their sophomore year. Selected students will be awarded reserved admissions to KCOM at the beginning of the junior year. Eligibility criteria for this program include:

Applicant Criteria

- Minimum 28 composite ACT score or 1860 SAT score
- Minimum grade point average (GPA) of 3.4 overall and 3.40 in the sciences
- Submission of application and official transcripts by specified date

Application Process

- Submit application to the MWSU Pre-Health advisor by specified date
- Applicant must forward letters of evaluation from the Pre-Health Advisor and/or a science faculty member

Additional information and other specifics about the program can be obtained through the MWSU Department of Biology.

Major in Wildlife Conservation and Management

Provides the student interested in Conservation and/or Wildlife Management with the background needed to be hired as a biologist by various state, federal, and nongovernmental agencies, as well as at the GS-5 or GS-7 level by the U.S. Fish and Wildlife Service as well as meet the education requirements for certification as Associate and Certified Wildlife Biologist by the Certification Program of Professional Wildlife Biologists of The Wildlife Society.

Major Requirements

BIO	105	Principles of Organismal Biology	5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	209	Introduction to Wildlife Conservation	3
BIO	225	Evolutionary Ecology	4
BIO	311	Animal Physiology (4)	OR
BIO	340	Plant Physiology	4
BIO	318	Ornithology	2
BIO	350	Plant Systematics (4)	OR
BIO	407	Plant Morphology	4
BIO	351	Local Flora: Spring and Summer	2
BIO	360	Development of Federal Wildlife Law	3
BIO	409	Principles of Terrestrial Wildlife Management	3
BIO	415	Invertebrate Biology (4)	OR
BIO	455	Entomology	4
BIO	418	Mammalogy	4
BIO	461	Renewable Resources Policy and Administration (3)	OR
PHL	325	Ethics of Environmental and Natural Resource Policy	3
CHE	111	General Chemistry	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	132	Elementary Statistics	3
PHY	110	College Physics I	4

Conservation Internships:

BIO	425	Biology Teaching Internship (2)	OR and <u>2</u> 78
BIO	425	Biology Teaching Internship (1)	
BIO	450	Independent Research/Project	
TOTAL			

Major in Biochemistry and Molecular Biology

The Bachelor of Science Major in Biochemistry and Molecular Biology is an interdisciplinary program offered jointly by the departments of Biology and Chemistry. It is designed to prepare students for graduate level education or careers in biochemistry, cell and molecular biology, and related biotechnology fields.

Students pursuing the Bachelor of Science degree majoring in Biochemistry and Molecular Biology are required to complete the following curriculum.

The following core courses are required:

Core Requirements			<i>Credits</i>
BIO	105	Principles of Organismal Biology	5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	225	Evolutionary Ecology	4
BIO	331	Bioinformatics	2
BIO	431	Molecular Biology	4
CHE	111	General Chemistry	5
CHE	120	General Chemistry II with Qualitative Analysis	5
CHE	310	Organic Chemistry I	3
CHE	311	Organic Chemistry Laboratory I	2
CHE	321	Quantitative Analysis	4
CHE	340	Physical Chemistry for the Biological Sciences (4)	OR
CHE	383/384	Physical Chemistry Thermodynamics/Laboratory (5)	4-5
CHE	370	Biochemistry I	4
CHE	470	Biochemistry II	3
CHE	495	Seminar in Chemistry	2
PHY	110/111	College Physics I/II (8)	OR
PHY	210/211	University Physics I/II* (10)	8-10
MAT	167	Calculus with Analytic Geometry I	5
SUBTOTAL			<u>68-71</u>

*Prerequisite MAT 177

CHE 383 may not be used as an elective course if CHE 340 is taken in the core requirements.

Electives: Complete a minimum of twelve (12) credits from Biology or Chemistry courses numbered 300 or higher from the following recommended list. Other Biology or Chemistry courses numbered 300 or higher may be substituted with prior departmental approval.

BIO	311	Animal Physiology (4)
BIO	315	Medical Parasitology (4)
BIO	340	Plant Physiology (4)
BIO	390	Microbiology (4)
BIO	410	Molecular Cell Biology (4)
BIO	411	Developmental Biology
BIO	421	Immunology (4)
BIO	430	Molecular Basis of Disease (4)
BIO	450	Independent Research/Project (var.)

CHE	312	Organic Chemistry II (3)	
CHE	313	Organic Chemistry II Laboratory (2)	
CHE	326	Instrumental Analysis (4)	
CHE	426	Instrumental Methods** (5)	
CHE	381/382	Physical Chemistry: Chem Dynamics & Quantum Mech/Lab*(5)	
CHE	441	Advanced Inorganic Chemistry (3)	
CHE	490	Research in Chemistry (3)	
		SUBTOTAL	<u>12</u>
		TOTAL	<u>80-83</u>

ACS Certification in Biochemistry

Students are eligible to receive certification in the area of Biochemistry from the American Chemical Society (ACS) if the following course work is completed.

The following courses must be taken in the core requirements:

CHE	383/384	Physical Chemistry: Thermodynamics/Lab (substitutes for CHE340)	5
PHY	210/211	University Physics I/II (substitutes for PHY110/111)	10

Where choices are available for major electives the following courses must be taken:

CHE	312/313	Organic Chemistry II/Laboratory (5)	
*CHE	381/382	Physical Chemistry: Chem Dynamics & Quantum Mech/Lab (5)	
**CHE	426	Instrumental Methods (5)	
CHE	441	Advanced Inorganic Chemistry (3)	
MAT	177	Calculus with Analytic Geometry II (5)	

Major in Biotechnology

The Bachelor of Science degree with a major in Biotechnology is designed to prepare students for careers in the growing biotechnology industry in St. Joseph and beyond. Students with a B.S. degree in Biotechnology will be qualified to enter the workforce as bench scientists.

Students can earn the B.S. degree in Biotechnology by completing the following curriculum:

A. Life Science Courses:

BIO	105	Principles of Organismal Biology	<i>Credits</i> 5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	225	Evolutionary Ecology	4
BIO	331	Bioinformatics	2
BIO	390	Microbiology	4
BIO	421	Immunology	4
BIO	431	Molecular Biology	4
CHE	370	Biochemistry I	<u>4</u>
		TOTAL A	35

B. Physical Science Courses:

CHE	111	General Chemistry	5
CHE	120	General Chemistry II with Qualitative Analysis	5
CHE	310	Organic Chemistry I	3
CHE	311	Organic Chemistry Laboratory I	2
CHE	321	Quantitative Analysis	4
MAT	132	Elementary Statistics *	0-3
PHY	110	College Physics	<u>4</u>
		TOTAL B	23-26

C. Business & Ethics Courses:

GBA	210	Business Statistics I *	0-3
GBA	211	Business Law I	3
ECO	261	Principles of Microeconomics	3
MGT	305	Management of Organizations	3
MKT	301	Principles of Marketing	3
PHL	230	Ethics	3
TOTAL C			15-18

D. Electives. Complete a minimum of three (3) credits from the following group:

BIO	311	Animal Physiology (4)	
BIO	340	Plant Physiology (4)	
CHE	326	Instrumental Analysis (4)	
CHE	470	Biochemistry II (3)	
BIO	430	Molecular Basis of Disease (4)	
BIO	450	Independent Research / Project (3-4)	
TOTAL D			3-4
TOTAL FOR THE MAJOR			79-80

*Students must select either MAT132 (from category B) **OR** GBA210 (from category C).

Major in Natural Science in Biology

Requirements

			<i>Credits</i>
BIO	105	Principles of Organismal Biology	5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	225	Evolutionary Ecology	4
BIO	390	Microbiology	4
CHE	111	General Chemistry	5
CHE	120	General Chemistry II with Qualitative Analysis	5
CHE	310	Organic Chemistry I	3
CHE	311	Organic Chemistry Laboratory I	2
CHE	321	Quantitative Analysis	4
CHE	370	Biochemistry I	4
MAT	132	Elementary Statistics	3
PHY	110	College Physics I	4
PHY	111	College Physics II	4
ESC	111	Physical Geology	4
SUBTOTAL			59

Plus 12 additional credits from biology courses numbered 300 or higher selected from the following areas:

A. Organismal Diversity (4 credits). Select one (1) from the following areas:

BIO	415	Invertebrate Biology	OR
BIO	416	Vertebrate Biology	OR
BIO	350	Plant Systematics	OR
BIO	407	Plant Morphology	OR
BIO	455	Entomology	4

B. Physiology (4 credits). Select one of the following:

BIO	311	Animal Physiology	OR
BIO	340	Plant Physiology	4

C. Biological Electives. Complete an additional four (4) credits of upper division biology courses.

TOTAL FOR THE MAJOR			4
			71

Major in Natural Science in Biology for Secondary Teachers

Students desiring to teach Biology at the secondary school level are required to complete the Bachelor of Science degree program in Biology along with the Professional Education Sequence for teacher certification at the secondary school level (see description under Professional Education Sequence).

Requirements			<i>Credits</i>
BIO	105	Principles of Organismal Biology	5
BIO	106	Principles of Cell Biology	4
BIO	205	Genetics	4
BIO	225	Evolutionary Ecology	4
BIO	380	Biology Teaching: Materials & Methods	3
BIO	390	Microbiology	4
BIO	308	History and Philosophy of the Natural Sciences	3
CHE	111	General Chemistry	5
CHE	120	General Chemistry II with Qualitative Analysis	5
CHE	310	Organic Chemistry I	3
CHE	311	Organic Chemistry Laboratory I	2
CHE	321	Quantitative Analysis	4
CHE	370	Biochemistry I	4
MAT	132	Elementary Statistics	3
PHY	110	College Physics I	4
PHY	111	College Physics II	4
ESC	111	Physical Geology	4
ESC	120	Meteorology	4
SUBTOTAL			69

Plus 8 additional credits from biology courses numbered 300 or higher selected from the following areas:

A. Organismal Diversity (2-4 credits). Select one (1) from the following:

BIO	318	Ornithology (2)	
BIO	350	Plant Systematics (4)	
BIO	351	Local Flora: Spring and Summer (2)	
BIO	407	Plant Morphology (4)	
BIO	415	Invertebrate Biology (4)	
BIO	416	Vertebrate Biology (4)	
BIO	418	Mammalogy (4)	
BIO	455	Entomology (4)	
TOTAL A			2-4

B. Physiology (4 credits). Select one (1) of the following:

BIO	311	Animal Physiology	OR
BIO	340	Plant Physiology	4
TOTAL B			4

Completion of the Professional Education Sequence:

EDU	202	Introduction to Education	3
EDU	203	Participation in Teaching I	1
EDU	225	Educational Psychology	2
EDU	303	Experience in Teaching II	2
EDU	304	Applied Methods and Management	3
EDU	311	Secondary Reading Techniques	2
EDU	315	Psychology & Education of the Exceptional Student	2
EDU	404	Seminar in Secondary Education & Human Relations	3
EDU	409	Student Teaching III	9
TOTAL EDUCATION			27
TOTAL FOR THE MAJOR			102-104

Students completing this program will qualify for Missouri Teaching Certification in Biology, Chemistry and Physics.

MINORS

Minor in Biology

A minor in biology consists of 20 credits including at least one course from areas 1-5 listed below.

1. Basic Biology:

BIO	101	Principles of Biology (5)
BIO	105	Principles of Organismal Biology (5)
BIO	106	Principles of Cell Biology (4)

2. Environmental Biology:

BIO	225	Evolutionary Ecology (4)
BIO	305	Human Ecology (3)

3. Physiology:

BIO	250	Anatomy and Physiology (5)
BIO	311	Animal Physiology (4)
BIO	340	Plant Physiology (4)

4. Organismal Diversity:

BIO	218	Field Identification of Birds (2)
BIO	251	Medical and Public Health Microbiology (4)
BIO	315	Medical Parasitology (4)
BIO	318	Ornithology (2)
BIO	350	Plant Systematics (4)
BIO	351	Local Flora: Spring and Summer (2)
BIO	390	Microbiology (4)
BIO	407	Plant Morphology (4)
BIO	411	Developmental Biology (4)
BIO	415	Invertebrate Biology (4)
BIO	416	Vertebrate Biology (4)
BIO	418	Mammalogy (4)
BIO	455	Entomology (4)

5. Biology Electives:

BIO	205	Genetics (4)
ALH	352	Applied Nutrition (2)

Or any 300- or 400-level BIO course not used in any of the above categories.

TOTAL

20

Careful attention must be given to course prerequisites in the planning of the minor program.

Semester Designation

F -- the course is offered in the fall semester

Sp -- the course is offered in the spring semester

Su -- the course is offered in the summer semester

DD -- the course is offered at the discretion of the department

BIOLOGY COURSES

Waiving of any course prerequisites requires prior departmental authorization.

BIO 101 Principles of Biology (5) F, Sp, Su. Principles of living phenomena; meets the general education biological science requirement. Four hours lecture, two hours lab.

BIO 105 Principles of Organismal Biology (5) F, Sp. Examines basic concepts and principles related to organismal morphology and homeostasis of representative organisms. Three hours lecture and three hours lab per week. Prerequisites: ACT math score of 20 or higher or the equivalent, ACT English score of 19 or higher or the equivalent, and ACT reading score of 19 or higher or the equivalent. LAS Writing.

BIO 106 Principles of Cell Biology (4) F, Sp. An integrated lecture and laboratory course for biology majors and students planning to take additional courses in biology, covering basic biochemistry, cell structure and function, molecular biology, genetics, physiology and development of plants and animals. Three hours lecture and three hours lab. Prerequisites: ACT math score of 20 or higher or the equivalent, ACT English score of 19 or higher or the equivalent, and ACT reading score of 19 or higher or the equivalent. LAS Writing.

BIO 116 Naturalist Training (1) F. This course emphasizes the interpretation of Missouri habitats, plants and animals. The history and philosophy of nature interpretation and its importance to conservation education is covered. The course is designed for students who wish to serve as official volunteers for the Missouri Department of Conservation during their college career and beyond. Prerequisite: BIO101 or BIO105 recommended.

BIO 205 Genetics (4) F. Explore and study classical, molecular, and evolutionary genetics. Three hours lecture and three hours lab per week. Prerequisites: BIO106 with a grade of C or above and credit or concurrent enrollment in CHE111. BIO225 recommended.

BIO 209 Introduction to Wildlife Conservation (3) Sp. This course surveys the historic and modern development of conservation biology. How the principles of conservation are applied to the management, restoration, conservation and preservation of wildlife natural resources is emphasized. Prerequisites: BIO105 with a grade of C or above. BIO225 recommended.

BIO 218 Field Identification of Birds (2) Sp (odd-numbered years). Concentrates on the sight and sound identification of birds in their natural habitats. Prerequisite: BIO101 or BIO105.

BIO 220 Field Natural History (1-3) DD. 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 BIO220 courses may be repeated for credit. Prerequisites: BIO101 or BIO105 or departmental approval.

BIO 225 Evolutionary Ecology (4) Sp. Covers principles of ecology and evolution, including field and research methods. Three hours lecture and three hours. Prerequisites: A grade of C or better in BIO105, ACT math score of 20 or higher or the equivalent, ACT English score of 19 or higher or the equivalent, and ACT reading score of 19 or higher or the equivalent. LAS Computer Literacy.

BIO 250 Anatomy and Physiology (5) F, Sp, Su. Concepts of human structure and function and relationships of these concepts to cells, tissues, organs and systems. Four hours lecture, two hours lab. Prerequisite: A grade of C or better in either BIO101 or BIO106.

BIO 251 Medical and Public Health Microbiology (4) F, Sp. Medically significant microorganisms, their characteristics, relationship to disease, transmission, and control methods. Three hours lecture, three hours lab. Prerequisite: BIO101 or 106 and CHE104 both with a grade of C or above.

BIO 265 Biology of Aging (3) DD. Introductory course examining the aging process in humans and other living organisms. Research into the causes of aging, prospects of retarding or reversing the aging process and the outlook for increasing life expectancy and life span in humans is reviewed. Prerequisite: BIO101.

BIO 283 Introduction to Research Methods in Biology (1-5) (DD). Introduction to basic research in biology. Individual and team projects involving methods for solving biology- related research problems. Prerequisite: Departmental approval.

BIO 305 Human Ecology (3) F. Mankind and the environment; pollution, population, resources, environmental law, and environmental ethics. Prerequisite: A grade of C or better in either BIO101 or BIO105.

BIO 308 History and Philosophy of the Natural Sciences (3) Sp. A study of the history of the natural sciences with an emphasis on the philosophical analysis of these events. Prerequisites: Completion of General Studies Mathematics and Natural Sciences requirements.

BIO 311 Animal Physiology (4) F. The physiological systems, their functions and interactions in animal physiology with emphasis on the human animal. Three hours lecture, three hours lab. Prerequisite: BIO106.

BIO 313 Topics in Molecular Genetics (1) F (even-numbered years). A selected topics lecture course dealing with the molecular biology of the gene, i.e., the storage, modification, transmission, and retrieval of macromolecular information. One hour lecture/discussion. Prerequisites: Either BIO101 or BIO106, and BIO205.

BIO314 Technology and Society (3) F, Sp. 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 ENG314, HUM314, PSY314, and PSC314. Prerequisites: Category One - Basic Skills courses.

BIO 315 Medical Parasitology (4) Sp (even-numbered years). An introduction to the major protozoal, helminth, and arthropod parasites of humans. Three hours lecture, two hours lab. Prerequisite: BIO105.

BIO 318 Ornithology (2) Sp (odd-numbered years). This course covers the taxonomy, anatomy, physiology, behavior and evolution of birds. Prerequisite: BIO225.

BIO 320 Histology (4) DD. Identification and description of microscopic structure, organization of tissues and organs, preparation of tissues for observation and study. Three hours lecture, three hours lab. Prerequisite: BIO106.

BIO 325 Introduction to Paleontology (4) Sp (even-numbered years). A review of major principles and techniques in paleontology including but not limited to systematics, evolutionary history and relationships within the tree of life, comparative anatomy and community analysis. Three hours lecture, three hours lab. Prerequisites: BIO101 or BIO105 or ESC111 with a grade of C or above, or consent of the instructor.

BIO 331 Bioinformatics (2) Sp (odd-numbered years). Bioinformatics is both the acquisition and the analysis of molecular genetic information. This course will concentrate on the growing repertoire of software available for bioinformatics studies and will give students an opportunity to design, complete, and present independent bioinformatics projects that address biological questions. Prerequisite: A grade of C or better in BIO205.

BIO 340 Plant Physiology (4) F (odd-numbered years). Plant functions; emphasis on water relations, mineral nutrition, plant biochemistry, development, and responses to environmental factors in higher plants. Three hours lecture, two hours lab. Prerequisite: BIO106.

BIO 350 Plant Systematics (4) F (even-numbered years). Identification, characteristics, and importance of seed plants; studies classification, techniques, and literature of taxonomy. Requires a plant collection and field trips. Three hours lecture, two hours lab. Prerequisite: BIO106.

BIO 351 Local Flora: Spring and Summer (2) Su (even-numbered years). This course concentrates on the identification, systematics, ecology, and natural history of native plants in forests, prairies, wetlands, and successional habitats in northwest Missouri. Field experiences, lectures and discussions are integrated throughout the course. (In order to take advantage of unique field opportunities, BIO351 begins in late April and finishes in late June.) Prerequisite: BIO225.

BIO 353 Philosophy of Biology (3) F (odd-numbered years). 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 PHL353. Prerequisite: BIO101 or BIO105 or BIO106.

BIO 355 Cave Ecology (3) Sp (odd-numbered years). The ecology of cave habitats. Includes information on biotic and abiotic factors affecting cave organisms, cave microhabitats, trophic interactions, and evolutionary adaptations. Field activities will emphasize miniprojects that relate to cave ecology. Two hours lecture and the equivalent of three hours lab. Prerequisites: BIO105 and BIO225.

BIO 360 Development of Federal Wildlife Law (3) F (even-numbered years). 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. Field trips may occasionally substitute for lecture/discussion periods at instructor's discretion, depending upon the topic. Prerequisite: A grade of C or better in BIO105.

BIO 375 Pathophysiology (4) F, Sp. Human diseases and the physiological disorders produced by disease. The origin, incidence and symptoms of disease. Prerequisite: A grade of C or better in BIO250.

BIO 380 Biology Teaching: Materials and Methods (3) Sp (even-numbered years). 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 BIO101 labs. Prerequisite: 20 credit hours in science.

BIO 385 Herpetology (4) Sp. (even-numbered years). Natural history of the amphibians and reptiles, including ecology, biology, evolution, and anatomy, with an emphasis on local species. Three lectures and one, three-hour lab each week. One weekend field trip is required. Courses exposing students to vertebrate anatomy and/or physiology would also be desirable. Prerequisites: A grade of C or better in BIO225.

BIO 390 Microbiology (4) F. Identification, characteristics, and importance of microorganisms; application to human needs, infection and immunity. Prerequisite: A grade of C or better in BIO106 or consent of instructor.

BIO 407 Plant Morphology (4) Sp (odd-numbered years). Structure, development, and evolutionary relationships of algae, fungi, and bryophytes and representative vascular plants. Three hours lecture, two hours lab. Prerequisite: A grade of C or better in BIO105.

BIO 409 Principles of Terrestrial Wildlife Management (3) Sp (even-numbered years). 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: A grade of C or better in both BIO209 and BIO225.

BIO 410 Molecular Cell Biology (4) Sp (even-numbered years). 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: BIO106.

BIO 411 Developmental Biology (4) Sp (odd-numbered years). Examines the morphological changes and the genetic and molecular pathways involved in animal embryonic development. Prerequisite: BIO106.

BIO 412 Seminar in Biology (1) (DD). Individual reports and group discussion on problems and current research in biology. May be repeated for a maximum of 2 credits. Prerequisite: Departmental approval.

BIO 415 Invertebrate Biology (4) F (even-numbered years). Biology of the invertebrates, emphasizing their taxonomy, anatomy, life cycles, evolution, and ecology. Three hours lecture, two hours lab. Prerequisites: BIO225 and a grade of C or better in BIO105.

BIO 416 Vertebrate Biology (4) Sp (odd-numbered years). Comparative anatomy, biological principles, and taxonomy of the vertebrates. Three hours lecture, three hours lab. Prerequisites: BIO205 and a grade of C or better in both BIO105 and BIO106.

BIO 418 Mammalogy (4) F (odd-numbered years). 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. Prerequisite: A grade of C or better in BIO225.

BIO 420 Biology Teaching Practicum (1-2) F, Sp, Su. 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. Prerequisites: Junior or senior standing, declared Biology major, and departmental approval.

BIO 421 Immunology (4) Sp (odd-numbered years). Investigation of the cellular and molecular basis of the immune response. Methods in immunology as applied to various fields. Prerequisites: BIO390 and a grade of C or better in BIO106.

BIO 425 Biology Internship (1-2) F, Sp, Su. 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. Prerequisites: Junior or senior standing, declared Biology major, and departmental approval.

BIO 430 Molecular Basis of Disease (4) F (even-numbered years). Investigation of the basic biological causes of human disease at molecular, cellular, and physiological levels. Three hours lecture, three hours lab per week. Prerequisite: A grade of C or better in BIO205.

BIO 431 Molecular Biology (4) Sp (even-numbered years). In-depth study of the molecular and cellular basis of life. Investigation of molecular genetic techniques as applied to diverse biological disciplines. Prerequisites: A grade of C or better in both BIO106 and BIO205.

BIO 450 Independent Research/Project (1-5) F, Sp, Su. Investigation of a research problem, project, or topic on an individual conference basis. Prerequisites: Junior or senior standing, declared Biology major, overall GPA of 2.5, BIO105, CHE111, CHE120, and MAT116.

BIO 455 Entomology (4) F (odd-numbered years). Introduction to the insects that will focus on their taxonomy, natural history, physiology, development, and ecology. Three hours lecture, three hours lab. Prerequisites: A grade of C or better in BIO105 and BIO225.

BIO 461 Renewable Resources Policy and Administration (3) Sp (odd-numbered years). 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 COURSES

ESC 111 Physical Geology (4) F, Sp. Survey of geologic materials and processes.

ESC 120 Meteorology (4) Sp (odd-numbered years). Studies the nature and phenomena of the atmosphere and surveys climates and their classification.

PHYSICAL SCIENCE COURSES

PHS 230 Physical Science for Elementary Teachers (3) F, Sp. Basic concepts of the physics, chemistry, astronomy, meteorology, and geology emphasizing topics taught in grades K-6. Elementary Education majors may not take the course until officially admitted to teacher education.