

BIOLOGICAL SCIENCES

The biological sciences is a field that encompasses the study of all life and living organisms. Students who are interested in biology have opportunities to pursue a wide range of careers and academic pursuits. Students have the choice of pursuing a bachelor of science (B.S.) or bachelor of arts (B.A.) degree option, with elective coursework in one of three focal areas: 1) cell and molecular biology, 2) ecology, environment and conservation, or 3) health sciences.

The core curriculum required of all biological sciences majors consists of basic course work in introductory biology, biodiversity, cellular biology, evolution, genetics, and ecology. A variety of advanced courses in focal areas offer greater depth, and preparation for employment or many postgraduate opportunities.

Cell and Molecular Biology - Students who are interested in cellular and molecular biology and genetics will find a variety of rewarding career opportunities in public, government, corporate and private agency positions. Individuals with a BS or BA can find careers in fields such as biotechnology, microbiology, cell biology, and neuroscience conducting both basic and applied research. More advanced opportunities are available to students who choose to pursue training in master's and Ph.D. programs after receiving their bachelor's degree in biological sciences.

Ecology, Environment and Conservation - Students who are interested in ecology, environment and conservation biology will find rewarding career opportunities with public and government agencies, companies, contractors, environmental organizations, and more. Job descriptions may include field or lab data collection, natural resource management, policy development and enforcement, and consultancy. Students may also be interested in advanced studies in a variety of fields at the master's or Ph.D.-level, or advanced professional training in fields like environmental law and public policy.

Health Sciences - Students who are interested in health sciences may choose, upon graduation, to pursue professional studies in a variety of rewarding health professions, such as medicine, dentistry, pharmacy, physical therapy, physician assistant, chiropractic, public health, or veterinary medicine, to name a few. Upon graduation, students may also be interested in pursuing a master's or Ph.D. degree in a health science field.

At Missouri S&T, faculty members active in research teach biological sciences courses. Classes are small, providing exceptional opportunity for discussion and individual attention. Most undergraduate students participate in research, learning techniques and developing skills that will prepare them for postgraduate opportunities. A background in mathematics and physical sciences, together with supporting course work in the humanities and social sciences, provides a well-rounded educational experience.

The biological sciences department offers bachelor of science and bachelor of arts degrees. Most students pursue a B.S. degree, which prepares students for careers in biology or postgraduate study including medical school, graduate school, and other options. An emphasis area under the B.S. option is available in medical laboratory scientist. Two emphasis areas are also offered under the B.A. option: pre-medicine and secondary education.

Bachelor of Arts Biological Sciences Degree Requirements

Specific requirements for the B.A. degree in biological sciences include a minimum of 120 semester hours of credit, including 30 hours of biology core courses. A "C" or better is required for all Biological Science courses.

Core Courses		
BIO SCI 1201	Biological Sciences Freshman Seminar	1
BIO SCI 1113	General Biology	3
or BIO SCI 1213	Principles of Biology	
BIO SCI 1219	General Biology Lab	1
BIO SCI 1223	Biodiversity	3
BIO SCI 1229	Biodiversity Lab	1
BIO SCI 2213	Cell Biology	3
BIO SCI 2219	Cell Biology Laboratory	1
BIO SCI 2223	General Genetics	3
BIO SCI 2263	Ecology	3
BIO SCI 3233	Evolution	3
BIO SCI 4010	Seminar	1
Advanced courses, 2000 level or higher (at least one with laboratory and one 3000 or 4000 level)		9
Chemistry		
CHEM 1310	General Chemistry I	4
CHEM 1319	General Chemistry Laboratory	1
CHEM 1320	General Chemistry II	3
CHEM 1100	Introduction To Laboratory Safety & Hazardous Materials	1
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3
Mathematics & Physical Science		
Various courses in mathematics, physics, and/or geology chosen in consultation with academic advisor. (Note: Proficiency in College Algebra must be demonstrated by a grade of "C" or better in a College Algebra course or by examination)		9
Computer Science/Statistics (Select one of the following:)		
COMP SCI 1570	Introduction To C++ Programming	4
& COMP SCI 1580	and Introduction To Programming Laboratory	
COMP SCI 1971	Introduction To Programming Methodology	3
& COMP SCI 1981	and Programming Methodology Laboratory	
STAT 3111	Statistical Tools For Decision Making	3
STAT 3425	Introduction to Biostatistics	4
General Requirements for BA		
English Composition		
ENGLISH 1120	Exposition And Argumentation	3
One additional composition course		3
Western Civilizations		
HISTORY 1100	Early Western Civilization	3
HISTORY 1200	Modern Western Civilization	3
Foreign Language (three semesters of a foreign language)		12
Humanities (including one class in each of literature, philosophy, and fine arts)		12
Social Sciences (including classes in two of the following three subjects: economics, political science, psychology)		12

Elective credits: In consultation with his or her advisor, each student will elect sufficient additional courses to complete a minimum of 120 credit hours.

Bachelor of Arts Biological Sciences Pre-Medicine Emphasis Area Degree Requirements

The student will fulfill the requirements for a bachelor of arts in biological sciences as outlined above. The following classes are also required:

CHEM 2219	Organic Chemistry I Lab	1
CHEM 2229	Organic Chemistry II Lab	1
2 semesters of Physics and labs:		
PHYSICS 1145	College Physics I	4
or PHYSICS 1135	Engineering Physics I	
PHYSICS 2145	College Physics II	4
or PHYSICS 2135	Engineering Physics II	

The following classes are highly recommended:

BIO SCI 3333	Human Anatomy and Physiology I	3
BIO SCI 3339	Human Anatomy Physiology I Lab	1
BIO SCI 3343	Human Anatomy and Physiology II	3
BIO SCI 3349	Human Anatomy and Physiology II Laboratory	1
CHEM 4610	General Biochemistry	3
PREMED 3010	Communication Workshop for the Pre-Health Student	1

Bachelor of Arts Biological Sciences Secondary Education Emphasis Area Degree Requirements

You may earn a B.A. degree in biological sciences from Missouri S&T and certification to teach at the secondary level in the schools of Missouri with this emphasis area. This program can be completed in four academic years, and student teaching is arranged with public schools anywhere in the state.

Students interested in this emphasis area should consult with the advisor for biological sciences education majors in the biological sciences department.

In order to successfully complete this emphasis area, students must attain at least a 3.0 GPA average for all biology courses and professional education courses required by the Missouri Department of Elementary and Secondary Education for teacher certification. Students must also meet all requirements listed under the teacher education website including passing the state-required assessments.

A degree in this emphasis area requires 128 credit hours. The required courses are provided below. A minimum grade of "C" is required by the department in all biological sciences courses counted toward this degree.

Humanities: 18 semester hours		
ENGLISH 1120	Exposition And Argumentation	3
ENGLISH 1160	Writing And Research	3
or ENGLISH 3560	Technical Writing	
SP&M S 1185	Principles Of Speech	3
At least one course in each of the following: Literature, Philosophy and Fine Arts		
Social Sciences: 15 semester hours		
HISTORY 3530	History of Science	3
HISTORY 1100	Early Western Civilization	3
HISTORY 1200	Modern Western Civilization	3

POL SCI 1200	American Government	3
PSYCH 1101	General Psychology	3
Mathematics/Physical Science: 9 semester hours		
MATH 1103	Fundamentals Of Algebra	3
PHYSICS 1145	College Physics I	3
or PHYSICS 1505	Introductory Astronomy	
GEOLOGY 1110	Physical And Environmental Geology	3
Computer Science/Statistics: 3 semester hours		
3 semester hours of Computer Science or Statistics		
Chemistry: 15 semester hours		
CHEM 1310	General Chemistry I	4
CHEM 1319	General Chemistry Laboratory	1
CHEM 1320	General Chemistry II	3
CHEM 1100	Introduction To Laboratory Safety & Hazardous Materials	1
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3
Biological Sciences: 26 semester hours		
BIO SCI 1201	Biological Sciences Freshman Seminar	1
BIO SCI 1213	Principles of Biology	3
or BIO SCI 1113	General Biology	
BIO SCI 1219	General Biology Lab	1
BIO SCI 1223	Biodiversity	3
BIO SCI 1229	Biodiversity Lab	1
BIO SCI 1173	Introduction to Environmental Sciences	3
BIO SCI 2213	Cell Biology	3
BIO SCI 2219	Cell Biology Laboratory	1
BIO SCI 2223	General Genetics	3
BIO SCI 2263	Ecology	3
BIO SCI 3233	Evolution	3
BIO SCI 4010	Seminar	1
Education: 42 semester hours		
EDUC 1040	Perspectives In Education	2
EDUC 1104	Teacher Field Experience I	1
EDUC 1164	Teacher Field Experience II	2
EDUC 1174	School Organization and Administration For Teachers	2
EDUC 2310	Education Of The Exceptional Child	3
EDUC 3216	Instructional Literacy in the Content Area	3
EDUC 3280	Instructional Strategies in the Content Area	3
EDUC 3298	Teacher Field Experience III	1
EDUC 3340	Assessment of Student Learning	3
EDUC 4298	Student Teaching Seminar	1
EDUC 4299	Student Teaching	12
ENGLISH 3170	Teaching And Supervising Reading and Writing	3
PSYCH 2300/ EDUC 2102	Educational Psychology	3
PSYCH 3310	Developmental Psychology	3

Bachelor of Science Biological Sciences Degree Requirements

A minimum of 124 credit hours is required for a Bachelor of Science degree in Biological Science.

A minimum grade of "C" is required for each Biological Science course used to fulfill the B.S. degree requirements.

These requirements for the B.S. degree are in addition to credit that is received for basic ROTC.

The Biological Science B.S. degree must include 48 semester hours of biological sciences course work, to include:

BIO SCI 1201	Biological Sciences Freshman Seminar	1
BIO SCI 1113	General Biology	3
or BIO SCI 1213	Principles of Biology	
BIO SCI 1219	General Biology Lab	1
BIO SCI 1223	Biodiversity	3
BIO SCI 1229	Biodiversity Lab	1
BIO SCI 2213	Cell Biology	3
BIO SCI 2219	Cell Biology Laboratory	1
BIO SCI 2223	General Genetics	3
BIO SCI 2263	Ecology	3
BIO SCI 3233	Evolution	3
BIO SCI 4010	Seminar	1
Advanced biological sciences or approved course work in other departments for a total of 48 credit hours of biology-related classes to include at least two laboratory courses from the following:		
BIO SCI 2242	Cave Biology	2
BIO SCI 2252	Vegetation of the Ozarks	2
BIO SCI 2264	Field Ecology	2
BIO SCI 2359	Zoology Laboratory	1
BIO SCI 2389	Plant Biology Laboratory	1
BIO SCI 3319	Microbiology Lab	2
BIO SCI 3339	Human Anatomy Physiology I Lab	1
BIO SCI 3349	Human Anatomy and Physiology II Laboratory	1
BIO SCI 3353	Comparative Vertebrate Anatomy	4
BIO SCI 3359	Physiology Lab	1
BIO SCI 4099	Undergraduate Research (minimum 2 hours)	1-3
BIO SCI 4329	Molecular Genetics Laboratory	2
BIO SCI 4369	Freshwater Ecology Laboratory	1
BIO SCI 5453	Forest Insect Diversity & Ecology	2
BIO SCI 5523	Ichthyology	4
17 semester hours of chemistry to include general chemistry		
CHEM 1310	General Chemistry I	4
CHEM 1319	General Chemistry Laboratory	1
CHEM 1320	General Chemistry II	3
CHEM 1100	Introduction To Laboratory Safety & Hazardous Materials	1
CHEM 2210	Organic Chemistry I	3
CHEM 2219	Organic Chemistry I Lab	1
CHEM 2220	Organic Chemistry II	3
CHEM 2229	Organic Chemistry II Lab	1
2 semesters of College (Engineering) Physics and labs		
PHYSICS 1145	College Physics I	4
or PHYSICS 1135	Engineering Physics I	
PHYSICS 2145	College Physics II	4
or PHYSICS 2135	Engineering Physics II	
Math and Statistics		
STAT 3425	Introduction to Biostatistics	4
MATH 1211	Calculus I-B	4
or MATH 1212	Survey of Calculus	
or MATH 1214	Calculus I	
12 semester hours of humanities, excluding foreign language, and to include:		
ENGLISH 1120 & ENGLISH 1160	Exposition And Argumentation and Writing And Research (entering students will normally take ENGLISH 1120 either semester of the first year)	12
9 hours of social sciences, to include:		
HISTORY 1200	Modern Western Civilization (or equivalent)	
or HISTORY 130	American History To 1877	
or HISTORY 131	American History Since 1877	
or POL SCI 1200	American Government	

Elective credits: In consultation with his or her advisor, each student will elect sufficient additional courses to complete a minimum of 124 credit hours.

Bachelor of Science Biological Sciences Medical Laboratory Scientist Emphasis Area Degree Requirements

The Medical Laboratory Scientist 3+1 emphasis area is designed for students who wish to earn a B.S. degree in Biological Sciences, and become board certified by the American Society of Clinical Pathologists as a Medical Laboratory Scientist. Students who pursue this emphasis area complete three years of course work at Missouri S&T. The fourth year of clinical/professional study takes place at an affiliated accredited school of medical technology. Students who wish to complete this emphasis area will apply to University affiliated clinical programs in their third year, and must be accepted into a clinical program in order to complete this emphasis area. Students who are interested in the MLS 3+1 emphasis area should seek advisement early in their degree program from the Biological Sciences MLS 3+1 emphasis area advisor in order to insure adherence to special program requirements.

The Biological Science B.S. degree in the MLS 3+1 emphasis area must include a minimum of 38 semester hours of biological sciences course work plus an additional minimum of 32 hours of clinical program coursework.

Required biological sciences courses:

BIO SCI 1201	Biological Sciences Freshman Seminar	1
BIO SCI 1113	General Biology	3
or BIO SCI 1213	Principles of Biology	
BIO SCI 1219	General Biology Lab	1
BIO SCI 1223 & BIO SCI 1229	Biodiversity and Biodiversity Lab	4
BIO SCI 2213 & BIO SCI 2219	Cell Biology and Cell Biology Laboratory	4
BIO SCI 2223	General Genetics	3
BIO SCI 3233	Evolution	3
BIO SCI 3313 & BIO SCI 3319	Microbiology and Microbiology Lab	5
BIO SCI 4393	Immunology	3
BIO SCI 4010	Seminar	1

Selection of ten hours of additional advanced biological sciences courses should be informed by the recommendations of specific clinical affiliate programs. Suggested electives:

BIO SCI 5313	Pathogenic Microbiology	3
BIO SCI 4493	General Virology	3
BIO SCI 3333	Human Anatomy and Physiology I	3
BIO SCI 3343	Human Anatomy and Physiology II	3
BIO SCI 3359	Physiology Lab	1

Clinical program coursework typically includes a total of 32 credit hours, but may include more, depending on clinical affiliate program. Courses are enrolled at Missouri S&T from the following options in consultation with the MLS 3+1 emphasis area advisor:

BIO SCI 4900	Clinical Chemistry	5-10
BIO SCI 4901	Clinical Microscopy	1-3
BIO SCI 4902	Hematology and Coagulation	5-8
BIO SCI 4903	Serology Immunology	2-4
BIO SCI 4904	Clinical Microbiology	5-9

BIO SCI 4905	Blood Bank Immunohematology	2-4
BIO SCI 4906	Topics in Medical Technology	1-8
20 semester hours of chemistry to include:		
CHEM 1100	Introduction To Laboratory Safety & Hazardous Materials	1
CHEM 1301 & CHEM 1319	Introductory Chemistry and General Chemistry Laboratory	4
CHEM 1320	General Chemistry II	3
CHEM 2210 & CHEM 2219	Organic Chemistry I and Organic Chemistry I Lab	4
CHEM 2220 & CHEM 2229	Organic Chemistry II and Organic Chemistry II Lab	4
CHEM 4610	General Biochemistry	3
2 semesters of College (Engineering) Physics and labs		
PHYSICS 1145 or PHYSICS 1135	College Physics I Engineering Physics I	4
PHYSICS 2145 or PHYSICS 2135	College Physics II Engineering Physics II	4
Math and Statistics		
MATH 1120	College Algebra	5
STAT 3425	Introduction to Biostatistics	4
12 semester hours of humanities, excluding foreign language, and to include:		
ENGLISH 1120	Exposition And Argumentation	3
ENGLISH 1160	Writing And Research	3
9 hours of social sciences, to include:		
HISTORY 1100 or HISTORY 1300 or HISTORY 1310 or POL SCI 1200	Early Western Civilization American History To 1877 American History Since 1877 American Government	3

Biological Sciences Minor Curriculum

A student wishing to minor in biological sciences must take a minimum of 20 hours of biological sciences course work. This course of study should include at least one laboratory or field course, at least two courses at the 3000 level or above, and be approved by a BioSci faculty advisor.

Bioinformatics Minor

Students majoring in biological sciences are eligible to pursue a minor in bioinformatics. See the description of the bioinformatics minor here (<http://catalog.mst.edu/undergraduate/degreeprogramsandcourses/bioinformaticsminor/>).

Undergraduate Certificate in BioInnovation

The Biological Sciences Department offers a unique course, **BIO SCI 3783**, that combines biology with entrepreneurship. Students use their scientific knowledge to create a novel biological product. Throughout the process, students interact with marketing experts, patent attorneys, regional biogenerators, funding agencies, and entrepreneurs.

The purpose of a Certificate in BioInnovation will be to further engage students who enroll in the Biological Design and Innovation course with training in entrepreneurship and advanced, innovative biological courses. Students who complete the prescribed coursework in this area will be recognized with a certificate.

In order to receive a Certificate in BioInnovation, the student must have an average cumulative grade point of 3.0 or better in the certificate courses. Once admitted to the program, a student will be given three years to complete the program.

To be awarded a certificate in BioInnovation, a student must meet the following requirements:

Required Course:

BIO SCI 3783	Biological Design and Innovation I	3
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One of the following:

BUS 1110	Introduction to Management and Entrepreneurship	3
BUS 5980	Business Models for Entrepreneurship and Innovation	3
IS&T 5251	Management and Leadership of Technological Innovation	3
MKT 5310	Digital Marketing and Promotions	3

Two of the following:

BIO SCI 3110 or CER ENG 3110 or CHEM ENG 3210	Introduction to Biomedical Engineering	3
BIO SCI 3483	Biomedical Problems	3
BIO SCI 4329	Molecular Genetics Laboratory	2
BIO SCI 4373	Stem Cell Biology	3
BIO SCI 4666	Nanobiotechnology	3
BIO SCI 5210 or CHEM ENG 5200 or MS&E 5310	Biomaterials I	3
BIO SCI 5240 or MS&E 5210	Tissue Engineering	3
CHEM 4630	Introduction to Bio-Nanotechnology	3
CHEM 4810	Chemistry And Inherent Properties Of Polymers	3

David Duvernell, Professor

PHD Virginia Tech

Chen Hou, Associate Professor

PHD University of Missouri-Columbia

Yue-Wern Huang, Professor

PHD University of Wisconsin Madison

Jinling Liu, Assistant Professor

PHD The Pennsylvania State University

Melanie R Mormile, Professor

PHD University of Oklahoma, Norman

Dev K. Niyogi, Professor

PHD University of Colorado Boulder

Andrea Scharf, Assistant Professor

PHD Heinrich Heine University Düsseldorf

Julie A Semon, Associate Professor

PHD Tulane University

Katie B Shannon, Teaching Professor

PHD Harvard Medical School

Theodore Sumnicht, Instructor

MASTER University of Arkansas

Matthew Scott Thimgan, Associate Professor

PHD The University of North Carolina at Chapel Hill

Robin Verble, Associate Professor

PHD University of Arkansas-Little Rock

David J Westenberg, Professor

PHD University of California-Los Angeles

Terry J Wilson, Associate Teaching Professor
MASTER Missouri State University

BIO SCI 1001 Special Topics (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

BIO SCI 1103 Microbes And Man -- Introductory Microbiology (LEC 3.0)

An introduction to the study of microorganisms in nature, especially as they affect humans. Consideration of the involvement of microorganisms in disease, decomposition, nutrition, agriculture, food processing and preservation, industrial applications and waste treatment.

BIO SCI 1113 General Biology (LEC 3.0)

A comprehensive study of the general principles of the biology of plants, animals, and protists including population biology and regulation mechanisms. Prerequisite: Entrance requirements.

BIO SCI 1113 - MOTR BIOL 100: Essentials in Biology

BIO SCI 1113 - MOTR BIOL 100L: Essentials in Biology with Lab

BIO SCI 1163 Biotechnology in Film (LEC 3.0)

Popular films that use biology-based plots influence society by disseminating facts and providing misinformation. Popular movies serve as the basis for discussing the biotechnology behind popular movie plots and examining the relationship between public perceptions and biotechnology.

BIO SCI 1173 Introduction to Environmental Sciences (LEC 3.0)

An introduction to environmental science, with an emphasis on biological aspects of current environmental problems. Topics range from chemical toxicity to global climate change. Environmental challenges facing local species and ecosystems will be emphasized. (Co-listed with Env Sci 1173).

BIO SCI 1173 - MOTR BIOL 100: Essentials in Biology

BIO SCI 1201 Biological Sciences Freshman Seminar (RSD 1.0)

An introduction to the study of biology at Missouri S&T. Students will consider personal and professional opportunities within the various areas of biology and become acquainted with Biological Sciences faculty and departmental and campus facilities. Required of freshman Biological Sciences majors. Prerequisite: Biological Sciences majors only.

BIO SCI 1213 Principles of Biology (LEC 3.0)

This course will investigate biological concepts including the chemical basis for life, the structure and function of molecules and cells, cellular metabolism and enzyme activity, bioenergetics, cellular reproduction and communication, genetics, evolution and the scientific process. Cannot also receive credit for Bio Sci 1113. Prerequisite: Biological Science majors only.

BIO SCI 1213 - MOTR BIOL 150: Biology

BIO SCI 1213 - MOTR BIOL 150L: Biology with Lab

BIO SCI 1219 General Biology Lab (LAB 1.0)

The laboratory work accompanying general biology consists of experiments designed to supplement and extend lectures in General Biology and Principles of Biology. Prerequisite: Preceded or accompanied by either Bio Sci 1113 or Bio Sci 1213.

BIO SCI 1219 - MOTR BIOL 100L: Essentials in Biology with Lab

BIO SCI 1219 - MOTR BIOL 150L: Biology with Lab

BIO SCI 1223 Biodiversity (LEC 3.0)

This course provides a survey of all life, but emphasizes diversity of eukaryotes including protists, fungi, plants, and animals. Emphasis is on form, function, ecology, and evolution of plants and animals and other organisms.

BIO SCI 1229 Biodiversity Lab (LAB 1.0)

This lab course is designed to accompany instruction in the Biodiversity class. Lab and field explorations of the varieties of life, with an emphasis is on form, function, ecology, and evolution of plants and animals and other organisms. Prerequisite: Preceded or accompanied by Biodiversity (Bio Sci 1223).

BIO SCI 1943 Introduction to Human Anatomy and Physiology I (LEC 3.0)

First semester of a two-semester sequence dealing with the structure and function of human organ systems. Includes the study of cells, tissues, and the integumentary, skeletal, muscular and nervous systems. Prerequisite: Any high school or college Biology course.

BIO SCI 1943 - MOTR LIFS 150: Human Biology

BIO SCI 1953 Introduction to Human Anatomy and Physiology II (LEC 3.0)

Second semester of a two-semester sequence of the study of the structure and function of human organ systems, including the endocrine, cardiovascular, lymphatic, respiratory, digestive, urinary and reproductive systems.

BIO SCI 1982 Introduction to Biomedical Problems (LEC 3.0)

Problem based learning approach to issues in medical science. Students will work in groups and individually to answer problems related to diagnostic testing and evaluation of diseases and other medical conditions.

BIO SCI 1983 Introduction to Biological Design and Innovation (LAB 3.0)

Students will identify problems in biomedical sciences, and then design and implement innovative solutions using advanced techniques. Students will present and defend their proposals and results.

BIO SCI 2001 Special Topics (LAB 2.0 and LEC 1.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

BIO SCI 2213 Cell Biology (LEC 3.0)

The structure and function of eukaryotic and prokaryotic cells. Emphasis on macromolecules, organelles, metabolic pathways, bioenergetics, cell signaling, the cell cycle, and gene expression. Prerequisites: Preceded or accompanied by CHEM 1320.

BIO SCI 2219 Cell Biology Laboratory (LAB 1.0)

Laboratory course to accompany Cell Biology (Bio Sci 2213). Laboratory work includes microscopy, biochemical assays, enzymology, and genetic analysis (PCR, mapping, electrophoresis, transfection, sequencing). Prerequisite: Preceded or accompanied by Bio Sci 2213.

BIO SCI 2223 General Genetics (LEC 3.0)

The study of the principles of heredity and reasons for variation in living organisms. Includes Mendelian principles, molecular, population, and evolutionary genetics with examples from a diverse array of species. Prerequisite: Bio Sci 1113, Bio Sci 1173, or Bio Sci 1213.

BIO SCI 2242 Cave Biology (LAB 1.0 and LEC 1.0)

In Cave Biology, we will study cave organisms and cave ecosystems. We will cover such topics as growth of speleothems, caves as a natural laboratory, behavior of cave animals, and regressive characteristics of cave species. We will investigate the relationship between Karst topography (caves, springs, sinkholes) and underground water contamination. Prerequisites: Any Geology, Environmental Engineering, or Biological Sciences class except Bio Sci 1201.

BIO SCI 2243 Sleep: Function and Dysfunction (LEC 3.0)

Students will learn the genes, proteins, and anatomy that govern sleep regulation. The course will also cover how sleep deprivation changes the body and degrades health and performance as well as sleep disorders that may disrupt sleep. Prerequisite: Bio Sci 1113 or Bio Sci 1213.

BIO SCI 2252 Vegetation of the Ozarks (LAB 1.0 and LEC 1.0)

The Vegetation of the Ozarks class is an intense, outdoor educational experience focusing on the plants and plant communities of the Missouri Ozarks. The five day long course teaches participants to identify much of the flora of the region and provides practice and instruction in the use of dichotomous keys for plant identification. Prerequisites: Bio Sci 1213 or Bio Sci 1113.

BIO SCI 2263 Ecology (LEC 3.0)

Relationships between organisms and the environment. Topics include the influence of environmental factors on individual organisms, population dynamics, interspecific associations, and entire ecosystems. Prerequisite: Bio Sci 1113 or Bio Sci 1213 or Bio Sci 1223.

BIO SCI 2264 Field Ecology (LAB 1.0 and LEC 1.0)

Field-based class designed to teach students applications of ecological research. Students will study distribution and abundance of organisms in aquatic and terrestrial systems in the Ozarks. Class includes lectures and field sampling in the Rolla area. Prerequisite: Any Bio Sci course.

BIO SCI 2333 Nutrition (LEC 3.0)

This introductory course provides an overview of the principles of nutritional science. Topics include the description and functions of nutrients, how nutrients are digested and absorbed, effects of nutrient imbalances, food sources, nutrient interactions, dietary guidelines, and the role of nutrition in weight management, health and disease. Prerequisites: Bio Sci 1113 or Bio Sci 1213.

BIO SCI 2353 Zoology (LEC 3.0)

Survey class that explores the diversity of animal life. Emphasis on the morphology, physiology, development, ecology, and phylogeny of animals and protozoans.

BIO SCI 2359 Zoology Laboratory (LAB 1.0)

Bio Sci 2359 is designed to accompany Bio Sci 2353 and consists of laboratory and field explorations of the diversity of animal life. Prerequisite: Preceded or accompanied by Bio Sci 2353.

BIO SCI 2372 Issues in Public Health (LEC 3.0)

Issues in Public Health investigates chronic and infectious diseases and the impact of globalization on such diseases, environmental toxins, and controversies in public health. Students will develop an awareness of current public health issues and trends in order to make informed arguments and personal choices. Prerequisite: Bio Sci 1113 or Bio Sci 1213.

BIO SCI 2383 Plant Biology (LEC 3.0)

An intermediate class covering plant form and function. Topics include the cellular structures unique to plants, their life cycles, and the mechanisms they use to survive, reproduce, and convert solar energy into a form usable by all other organisms. Prerequisite: Bio Sci 1113 or Bio Sci 1213 or Bio Sci 1223.

BIO SCI 2389 Plant Biology Laboratory (LAB 1.0)

Bio Sci 2389 is designed to accompany Bio Sci 2383 and consists of experiments that will supplement and extend the lectures in Bio Sci 2383. Among the topics to be covered are photosynthesis, diversity, respiration, anatomy and development, hormones, and transpiration. Prerequisites: Bio Sci 1219, preceded or accompanied by Bio Sci 2383.

BIO SCI 3000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

BIO SCI 3001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

BIO SCI 3110 Introduction to Biomedical Engineering (LEC 3.0)

This course will provide an introduction to the interdisciplinary field of biomedical engineering. The molecular, cellular, physiological and engineering principles that govern the field will be covered. Applications will include biomaterials, tissue engineering, biomechanics, bioimaging, bioinstrumentation, bio-nanotechnology and artificial organs. Prerequisite: Junior standing or above. (Co-listed with Cer Eng 3110 and Chem Eng 3210).

BIO SCI 3233 Evolution (LEC 3.0)

A survey of the genetic and environmental mechanisms associated with organic evolution. Prerequisites: Bio Sci 2223.

BIO SCI 3313 Microbiology (LEC 3.0)

General introduction to the culture and study of microorganisms, their physiology, structure, and contribution to biology. Prerequisite: Chem 1320 and Bio Sci 2213.

BIO SCI 3319 Microbiology Lab (LAB 2.0)

General introduction to the techniques used for the culture and identification of microorganisms, their physiology, structure, and contribution to biology. Prerequisite: Preceded or accompanied by Bio Sci 3313.

BIO SCI 3333 Human Anatomy and Physiology I (LEC 3.0)

First semester of a two-semester sequence dealing with the structure and function of human organ systems. Includes the study of cells, tissues, and the integumentary, skeletal, muscular and nervous systems. Prerequisites: BIO SCI 1113 or BIO SCI 1213; BIO SCI 2213.

BIO SCI 3339 Human Anatomy Physiology I Lab (LAB 1.0)

Laboratory accompanying Human Anatomy and Physiology I (Bio Sci 3333). This course may be taken separately at a later date. Prerequisite: Preceded or accompanied by Bio Sci 3333.

BIO SCI 3343 Human Anatomy and Physiology II (LEC 3.0)

Second semester of a two-semester sequence of the study of the structure and function of human organ systems, including the endocrine, cardiovascular, lymphatic, respiratory, digestive, urinary and reproductive systems. Prerequisites: BIO SCI 1113 or BIO SCI 1213; BIO SCI 2213.

BIO SCI 3349 Human Anatomy and Physiology II Laboratory (LAB 1.0)

Laboratory accompanying Human Anatomy and Physiology II (Bio Sci 3343). This course may be taken separately at a later date. Prerequisite: Preceded or accompanied by Bio Sci 3343.

BIO SCI 3353 Comparative Vertebrate Anatomy (LAB 2.0 and LEC 2.0)

An integrated, comparative study of vertebrate structures and systems, with emphasis on evolution, development and function. Includes examination of gross anatomy and histology of selected forms. Prerequisites: Bio Sci 1223, Bio Sci 1229.

BIO SCI 3359 Physiology Lab (LAB 1.0)

Laboratory activities and demonstrations of basic physiology of animals, including humans, ranging from cell to organ systems. Prerequisites: Preceded or accompanied by either Bio Sci 3333 or Bio Sci 3343.

BIO SCI 3363 Ecophysiology (LEC 3.0)

Study of physiological adaptations that improve species' fitness. We will focus on animals and discuss how selection has shaped the basic physiology of species in different niches. Although some molecular and cellular mechanisms will be addressed, the major themes of the course will be comparative, ecological, evolutionary, integrative, and organismal. Prerequisites: Bio Sci 1113 or Bio Sci 1213, and Bio Sci 1223.

BIO SCI 3383 Plant Physiology (LEC 3.0)

This course will cover structures and functions of plants from the cellular to the whole plant levels. Topics covered include absorption and transport of water and mineral nutrients, photosynthesis, metabolism of starch and lipids, secondary metabolism, plant stress physiology, and plant hormones. Prerequisites: Bio Sci 1213, 1113; Bio Sci 2383, 2389.

BIO SCI 3483 Biomedical Problems (LEC 3.0)

This course will use a problem-based learning approach to examine biological aspects of various medical conditions. Students will work in groups and individually to answer problems related to diagnostic testing and evaluation of diseases and other medical conditions. Prerequisites: Bio Sci 3333 or 3343.

BIO SCI 3783 Biological Design and Innovation I (LAB 3.0)

Students identify significant problems in biological/biomedical sciences, and then design and implement innovative solutions using advanced techniques. Students present and defend proposals and results. Prerequisite: At least two 2000 level or higher Biology courses.

BIO SCI 4001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

BIO SCI 4010 Seminar (RSD 1.0)

Students will work in groups to propose, research, develop, complete, and present service-learning projects that are related to the biological sciences. Prerequisites: Senior standing.

BIO SCI 4099 Undergraduate Research (IND 1.0-3.0)

Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six credit hours for graduation credit. Subject and credit to be arranged with the instructor. Prerequisite: Consent of instructor.

BIO SCI 4313 Introduction to Environmental Microbiology (LEC 3.0)

Environmental Microbiology is an interdisciplinary study of how microorganisms can impact humans and applied to solve problems such as water treatment and environmental cleanup of contaminants. This course differs from Bio Sci 6313 as no NSF-style report or presentation is required. Prerequisite: Bio Sci 3313.

BIO SCI 4316 Introduction to Geomicrobiology (LEC 3.0)

Microorganisms have profound effects on the environment around them and have influenced biochemical and mineralogical processes throughout time. This course will explore the impact microorganisms have on geological processes. Prerequisites: Bio Sci 3313.

BIO SCI 4323 Molecular Genetics (LEC 3.0)

A study of the properties and functions of DNA that make this macromolecule unique in the universe. Examples of replication, transcription, translation, repair, and regulation will be examined in viruses, prokaryotes, and eukaryotes. Prerequisites: Bio Sci 2223 and Bio Sci 2213.

BIO SCI 4329 Molecular Genetics Laboratory (LAB 2.0)

This course provides experience in the use of a variety of DNA manipulation techniques that are common to molecular studies. These include DNA extraction, restriction mapping, Southern blotting, recombinant plasmid construction, DNA sequencing and analysis, and polymerase chain reaction. Prerequisite: Preceded or accompanied by Bio Sci 4323.

BIO SCI 4353 Cancer Cell Biology (LEC 3.0)

Advanced biology course examining cellular processes that go awry during tumorigenesis. We will discuss cell cycle controls, signal transduction pathways, DNA repair, telomerase, apoptosis, cell migration and adhesion that are altered in cancer cells. Prerequisite: Bio Sci 2213.

BIO SCI 4363 Freshwater Ecology (LEC 3.0)

The ecology of streams, lakes, and wetlands. The course will cover the physical and chemical characteristics of freshwater environments, the diversity of life in freshwaters, biogeochemical processes, and threats to freshwater systems. Prerequisite: Bio Sci 2263.

BIO SCI 4369 Freshwater Ecology Laboratory (LAB 1.0)

This lab course will include fieldtrips and lab work to collect and process samples related to the ecology of lakes and rivers. Samples of water and life will be collected from several aquatic ecosystems in Missouri, and analyzed in the lab for water quality, biological communities, and ecosystem processes. Prerequisites: Preceded or accompanied by Bio Sci 4363.

BIO SCI 4373 Stem Cell Biology (LEC 3.0)

This course will cover the fast-moving field of stem cell biology. Topics include: development and organogenesis, regeneration and repair, stem cell types and sources, pluripotency and reprogramming, stem cells and cancer, therapeutics, and ethics. Prerequisites: Bio Sci 2213.

BIO SCI 4383 Toxicology (LEC 3.0)

A study of natural and man-made toxicants, various possible routes of exposure, absorption, distribution, biotransformation, specific target sites, and mechanisms involved in elicitation of toxic effects, as well as detoxification and excretion. Prerequisites: Bio Sci 2213, at least Junior standing.

BIO SCI 4423 Introduction to Astrobiology (LEC 3.0)

An overview of the origins of life on early earth and the possibility of life on extraterrestrial bodies will be examined in this course through lectures and journal articles. The techniques that astrobiologists use to investigate the possibility of life beyond earth will be explored. Assessment will be based on exam performance and participation in class. Prerequisites: Bio Sci 2213 or Bio Sci 3313.

BIO SCI 4433 Genomics (LEC 3.0)

This course offers a general overview of the field of genomics. Topics covered include genome sequencing and annotation, transcriptomics, proteomics, metabolomics, genomic variation, and an overview of human, and several animal, plant, and microbial genome projects. Prerequisite: Bio Sci 4323.

BIO SCI 4533 Neurobiology (LEC 3.0)

An intermediate course in cellular neurobiology. Emphasis will be placed on the unique properties of neurons and other excitable cells. Topics covered include the structure and biophysical properties of neurons, synaptic transmission, neurochemistry, signal transduction, neuropharmacology and neurodevelopment. Prerequisite: Bio Sci 2213.

BIO SCI 4563 Global Ecology (LEC 3.0)

This class covers ecological topics at large scales, emphasizing global scales. Topics include global energy balance, biogeochemical cycles of water, carbon, nitrogen, and other biologically important elements, and global biodiversity. Students will focus on primary literature related to global ecology. Prerequisite: Bio Sci 2263.

BIO SCI 4663 Animal Behavior (LAB 1.0 and LEC 2.0)

An introduction to key concepts in Animal Behavior. Topics include communication, foraging, spatial behavior, parental care, social behaviors, the effects of environment on behavior, phenotypic plasticity, behavioral ecology, and anthropomorphism. The course will consist of lectures and laboratory exercises. Prerequisites: Bio Sci 1113 or Bio Sci 1213.

BIO SCI 4666 Nanobiotechnology (LEC 3.0)

Nanotechnology has emerged to change human economy and society in many aspects. Applications of nanotechnology in life science is termed nanobiotechnology. This course describes recent development of nanobiotechnology in basic biological research as well as biomedical applications. Prerequisite: Bio Sci 2213 or Bio Sci 2223.

BIO SCI 4900 Clinical Chemistry (LAB 5.0-10)

Identification and quantification of specific chemical substances in blood and body fluids by analytical techniques; clinical correlation and disease states; principles of instrumentation; data processing; toxicology; quality control; and quality improvement. Course will be taken at an affiliated accredited school of medical technology. Prerequisite: Acceptance into an affiliated accredited school of medical technology.

BIO SCI 4901 Clinical Microscopy (LAB 1.0-3.0)

Microscopic examination of urine, analysis of fecal specimens, spinal fluids and other body fluids. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance to an affiliated accredited school of medical technology.

BIO SCI 4902 Hematology and Coagulation (LAB 5.0-8.0)

Theory of blood cell formation; disease states; hemostasis; microscopic examination of blood/bone marrow films; practical experience with instruments and techniques that determine major hematologic and coagulation parameters; quality control; and quality improvement. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance into an affiliated accredited school of medical technology.

BIO SCI 4903 Serology Immunology (LAB 2.0-4.0)

Antigen/antibody structure, function and interaction; basic principles and procedures of humoral and cellular immunology; performance and clinical correlation of serologic testing; basic flow cytometry; quality control; and quality improvement. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance at an affiliated accredited school of medical technology.

BIO SCI 4904 Clinical Microbiology (LAB 5.0-9.0)

Theory and techniques of cultivation, isolation and identification of bacteria, fungi, parasites and viruses; determination of sensitivity to antimicrobial agents; molecular diagnostics testing; clinical correlation to disease states. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance to an affiliated accredited school of medical technology.

BIO SCI 4905 Blood Bank Immunohematology (LAB 2.0-4.0)

Major blood group systems; principles and procedures for antigen/antibody detection, identification, donor blood collection, preservation and processing; component therapy; transfusion reaction evaluation; Rh immune globulin evaluation; quality control; and quality improvement. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance to an affiliated accredited school of medical technology.

BIO SCI 4906 Topics in Medical Technology (LAB 1.0-8.0)

Techniques of blood collection; computer applications; application of education and management theories and methodology in the field of laboratory medicine; ethical and legal aspects of the profession, and method evaluation. To be taken at an affiliated accredited school of medical technology. Prerequisites: Acceptance into an affiliated accredited school of medical technology.

BIO SCI 5000 Special Problems (IND 0.0-6.0)

Graduate problems or readings on specific subjects or projects in the department. Prerequisite: Consent of the instructor.

BIO SCI 5001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

BIO SCI 5010 Graduate Seminar (RSD 1.0)

Presentation and discussion of current topics in Biology.

BIO SCI 5020 Data Analysis and Presentation (LEC 1.0)

This class will evaluate effective oral communication methodologies by introducing students to ways to communicate visual and auditory information. Student will lead an audience through a series of scientific findings. Moreover, students will use primary literature to evaluate conclusions. The class will assist in developing professional networks.

BIO SCI 5040 Oral Examination (IND 0.0)

(Variable) After completion of all other program requirements, oral examinations for on-campus M.S./PH.D students may be processed during intercession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

BIO SCI 5099 Graduate Research (IND 0.0-15)

Investigation of an advanced nature leading to the preparation of a thesis or dissertation.

BIO SCI 5210 Biomaterials I (LEC 3.0)

This course will introduce senior undergraduate students to a broad array of topics in biomaterials, including ceramic, metallic, and polymeric biomaterials for in vivo use, basic concepts related to cells and tissues, host reactions to biomaterials, biomaterials-tissue compatibility, and degradation of biomaterials. Prerequisite: Senior undergraduate standing. (Co-listed with Chem Eng 5200, MS&E 5310).

BIO SCI 5240 Tissue Engineering (LEC 3.0)

The course will use problem-based case studies to introduce junior and senior undergraduate students to the principles and clinical applications of tissue engineering. Topics include the use of biomaterials, scaffolds, cells, and external factors to develop implantable parts for the restoration, maintenance, or replacement of tissues and organs. Prerequisite: Junior or Senior standing. (Co-listed with MS&E 5210).

BIO SCI 5313 Pathogenic Microbiology (LEC 3.0)

A study of medically important microorganisms. Students will learn about the properties that enable organisms to cause disease as well as the disease process within the host. Special emphasis will be placed on recent advances in the molecular genetics of host pathogen interaction. Prerequisite: Bio Sci 3313 or Civ Eng 2601.

BIO SCI 5323 Bioinformatics (LEC 3.0)

The course will familiarize students with the application of computational methods to biology, as viewed from both perspectives. It will introduce problems in molecular, structural, morphological, and biodiversity informatics, and will discuss principles, algorithms, and software to address them. Prerequisites: A grade of "C" or better in both one of Bio Sci 1113 or Bio Sci 1213 and one of Comp Sci 1570 and Comp Sci 1580 or Comp Sci 1971 and Comp Sci 1981. (Co-listed with COMP SCI 5700).

BIO SCI 5343 Biology of Aging (LEC 3.0)

We will discuss the proximate and ultimate mechanisms of aging, and review a few leading theories of aging with the emphases on oxidative stress and life history tradeoffs. We will take the comparative approach to study aging across species, and the interventions that extend animals' lifespan, and explore why they may or may not work on humans. Prerequisites: Bio Sci 2213.

BIO SCI 5353 Developmental Biology (LEC 3.0)

Study of the patterns of development of the vertebrate embryo, the molecular mechanisms of tissue induction, and interactions among developing tissues. Prerequisite: Bio Sci 2213.

BIO SCI 5393 Immunology (LEC 3.0)

Introduction to the immune system, and the role of immunology in diseases and treatments. Major topics include the development of the immune system, including T cell and B cell development, innate and adaptive immunity, autoimmunity and tumor immunology. Prerequisites: Bio Sci 2213 and Bio Sci 2223; Bio Sci 3313 is recommended.

BIO SCI 5423 Advanced Biodiversity (LEC 3.0)

This course focuses on the enhancement and reduction of biodiversity and modern techniques of measuring and monitoring it. Topics include biogeography, community structure, competition, predation, food webs, geology-biology relationships, environmental change, and human impact. Additional costs and a week-long field trip are required. Prerequisite: Bio Sci 2233 or Bio Sci 2263.

BIO SCI 5443 Population and Conservation Genetics (LEC 3.0)

An overview of population genetics theory with a focus on evolutionary processes (mutation, natural selection, genetic drift, inbreeding, recombination and gene flow), and a review of molecular data collection and analysis methods. Emphasis will be placed on application to conservation genetics with a review of examples from current literature. Prerequisites: Bio Sci 2223 and Bio Sci 3233.

BIO SCI 5453 Forest Insect Diversity & Ecology (LAB 2.0)

In this course, you will learn key insect characteristics, common forest insects, insect life history and ecology, and entomological collection techniques. This course will be taught at the Ozark Research Field Station and will consist of several field trips to collecting sites and laboratory identification of insects. Prerequisites: Bio Sci 2263.

BIO SCI 5493 General Virology (LEC 3.0)

An overview of the field of virology, including plant, animal, and bacterial viruses. Discussions will include morphology, classification, virus-host interactions, genetics, clinical and industrial aspects of viruses, and viruses as model systems for basic biological studies. Prerequisites: Bio Sci 1113 or Bio Sci 1213; Bio Sci 2213 or Bio Sci 3313, Chem 1310, Chem 1320, Chem 2210.

BIO SCI 5523 Ichthyology (LAB 1.0 and LEC 3.0)

An introduction to evolutionary relationships, ecology, morphology, physiology and behavior of fishes. Includes a lab that focuses on anatomy, taxonomy, and identification with an emphasis on regional fauna. The lab includes some required field trips. Prerequisites: Bio Sci 1113 or Bio Sci 1213; and Bio Sci 1219, and Bio Sci 1223, and Bio Sci 1229.

BIO SCI 5533 Pharmacology (LEC 3.0)

The basic principles of drug action, pharmacokinetics, pharmacodynamics and toxicity. We will emphasize the actions of drugs used to treat cardiovascular and nervous system disorders. Students will review the primary literature to prepare both written and oral reports on drug actions. Prerequisite: Bio Sci 2213.
