

BS in Biological Sciences

Degree Program Description

Biology is a broad field centered on the study of living organisms and processes. While the degree program requires general education courses in behavioral sciences, social sciences, and the humanities, students can specialize their curriculum through their course selections. The main difference between the BS degree and the BA degree is that the BS degree requires more credit hours in biology, chemistry, physics, and math than the BA degree. The curriculum for the BS degree currently has the option of completing a foreign language sequence or substituting one of two tracks for the foreign language requirement. Some of the knowledge that students acquire includes basic sciences necessary for upper-level biological science coursework (i.e., mathematics, statistics, physics, general and organic chemistry), how biologists use mathematical modeling and simulation to describe living systems, and arguments employed by scientists and others in key ethical controversies in biological science and research (for example, stem cell research). This degree is designed to prepare students for graduate study, professional schools, or direct entry into the workplace. Undergraduates majoring in biological sciences go on to careers in a wide range of fields, including medicine and other health professions, biotechnology, industry, government service, conservation and ecology, and secondary and higher education.

Major Program Requirements

The following degree requirements must be completed in addition to University (<http://catalog.missouri.edu/academicdegreerequirements/universityrequirements/>), general education (<http://catalog.missouri.edu/academicdegreerequirements/generaleducationrequirements/>), and College of Arts and Science (<http://catalog.missouri.edu/collegeofartsandscience/#undergraduatetext>) requirements, students must also meet the following major program requirements. All major requirements in the College of Arts and Science must be completed with grades of C- or higher unless otherwise indicated.

Requirements

Requirements for the BA and BS degrees with a major in Biological Sciences include course work in biology and related science departments (chemistry, physics and math). The BS degree program requires more extensive course work, with additional studies in biology and the related sciences. The BA degree program is more flexible and has fewer required courses to accommodate students with dual degrees or minors in other departments. Both degree programs can be used to prepare for graduate study or professional school. Students must also complete college and university graduation requirements, including university general education requirements.

All courses in the major (including related sciences) must be completed with a grade of C- or higher with a cumulative GPA of 2.0 or higher. (Satisfactory/Unsatisfactory grading is not acceptable for courses in the major.)

Major Core Requirements Biology

BIO_SC 1500	Introduction to Biological Systems with Laboratory
or BIO_SC 1010 & BIO_SC 1020	General Principles and Concepts of Biology and General Biology Laboratory

or BIO_SC 1200	General Botany with Laboratory	
(Grades of B- or higher required for BIO_SC 1010/BIO_SC 1020)		
BIO_SC 2200	General Genetics	4
BIO_SC 2300	Introduction to Cell Biology	4
Evolutionary Biology (select from):		
BIO_SC 3400	Evolution and Ecology	
BIO_SC 4600	Evolution	
Biological Diversity (select from):		
MICROB 3200	Medical Microbiology and Immunology	3-5
BIO_SC 3210	Plant Systematics	
BIO_SC 3240	Vertebrate Biology	
BIO_SC 3260	Invertebrate Zoology	
BIO_SC 3360	Herpetology	
BIO_SC 3510	Biology of Fungi	
BIO_SC 3710	Introductory Entomology	
BIO_SC 3750	General Microbiology	
F_W 2600	Ornithology	
F_W 2700	Ichthyology	
F_W 3660	Mammalogy	
Capstone course (select one) (complete in last 45 hours):		
BIO_SC 4950 & BIO_SC 4952	Undergraduate Research in Biology and Undergraduate Research in Biology	3-5
BIO_SC 4950H & BIO_SC 4952H	Honors Research in Biology and Honors Research in Biology	
BIO_SC 4972	Developmental Biology	
BIO_SC 4976	Molecular Biology	
BIO_SC 4978	Cancer Biology	
BIO_SC 4982	Human Inherited Diseases	
BIO_SC 4983	Molecular Ecology	
BIO_SC 4984	Mammalian Reproductive Biology	
BIO_SC 4988	Nerve Cells and Behavior	
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	
BIO_SC 4994	Senior Seminar	

Degree Requirements

Related Science Requirements

CHEM 1400 & CHEM 1401	College Chemistry I and College Chemistry I Laboratory	4
CHEM 1410 & CHEM 1411	College Chemistry II and College Chemistry II Laboratory	4
CHEM 2100	Organic Chemistry I	3
CHEM 2110	Organic Chemistry II	3
CHEM 2130	Organic Laboratory I	2
One of the following physics sequences		
PHYSICS 1210 & PHYSICS 1220	College Physics I and College Physics II	5-8
or PHYSICS 2750/2760	University Physics I	
One semester of calculus and one semester of statistics, selected from the following:		
MATH 1400	Calculus for Social and Life Sciences I	3-5
or MATH 1500	Analytic Geometry and Calculus I	
STAT 1200	Introductory Statistical Reasoning	3
or STAT 2500	Introduction to Probability and Statistics I	

No more than 5 credits of introductory coursework (BIO_SC 1010, BIO_SC 1020, BIO_SC 1030, BIO_SC 1100, BIO_SC 1200, and

BIO_SC 1500) may be included in the major. At least 12 hours of biology coursework must be taken in residence at MU.

Electives

All biology majors must take additional biology courses to total at least 33 credits for the BS degree, of which at least 16 credits must be at the 3000 level or higher.

Elective credits must be in formal courses numbered above 2000 and must include at least one 3000- or 4000-level laboratory course, one 4000-level course, and one WI course at the 3000- or 4000-level in a natural science. In addition to the biological diversity and capstone courses listed above, the following courses may be used as elective credit:

BIO_SC 3002	Topics in Biological Sciences - Biological Sciences	1-3
BIO_SC 3040	Genetic Engineering: Miracle for Humanity or New Pathway to Eugenics?	3
BIO_SC 3050	Genetics and Society	3
BIO_SC 3060	Science and Society: Past, Present and Future	3
BIO_SC 3075	The Human Microbiome	3
BIO_SC 3210	Plant Systematics	4
BIO_SC 3240	Vertebrate Biology	3
BIO_SC 3260	Invertebrate Zoology	4
BIO_SC 3360	Herpetology	3-4
BIO_SC 3400	Evolution and Ecology	3
BIO_SC 3510	Biology of Fungi	3
BIO_SC 3650	General Ecology	5
BIO_SC 3700	Human Physiology	5
BIO_SC 3710 & BIO_SC 3715	Introductory Entomology and Insect Diversity	5
BIO_SC 3750	General Microbiology	3
BIO_SC 3760	Microbiology Laboratory	2
BIO_SC 3780	Genetics Laboratory	2
BIO_SC 4002	Topics in Biological Science - Biological Science	1-3
BIO_SC 4320	Molecular Plant Physiology	3
BIO_SC 4400	Plant Anatomy	4
BIO_SC 4500	Neurobiology	3
BIO_SC 4590	Computational Neuroscience	4
BIO_SC 4600	Evolution	3
BIO_SC 4640	Behavioral Biology	3-4
BIO_SC 4642	Animal Communication	3
BIO_SC 4950 & BIO_SC 4952	Undergraduate Research in Biology and Undergraduate Research in Biology	2-6
BIO_SC 4972	Developmental Biology	3
BIO_SC 4974	Molecular Biology Laboratory	3
BIO_SC 4976	Molecular Biology	3
BIO_SC 4978	Cancer Biology	3
BIO_SC 4982	Human Inherited Diseases	3
BIO_SC 4983	Molecular Ecology	4
BIO_SC 4984	Mammalian Reproductive Biology	3
BIO_SC 4988	Nerve Cells and Behavior	3
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	5
BIO_SC 4994	Senior Seminar	3
BIOCHM 4270	Biochemistry	3

BIOCHM 4272	Biochemistry	3
F_W 2600	Ornithology	5
F_W 2700	Ichthyology	4
F_W 3660	Mammalogy	4
MICROB 3200	Medical Microbiology and Immunology	4

List of 3000/4000 level lab courses.

BIO_SC 3210	Plant Systematics	4
BIO_SC 3260	Invertebrate Zoology	4
BIO_SC 3360	Herpetology	3-4
BIO_SC 3510	Biology of Fungi	3
BIO_SC 3650	General Ecology	5
BIO_SC 3700	Human Physiology	5
BIO_SC 3710 & BIO_SC 3715	Introductory Entomology and Insect Diversity	5
BIO_SC 3760	Microbiology Laboratory	2
BIO_SC 3780	Genetics Laboratory	2
BIO_SC 4400	Plant Anatomy	4
BIO_SC 4590	Computational Neuroscience	4
BIO_SC 4640	Behavioral Biology	3-4
BIO_SC 4974	Molecular Biology Laboratory	3
BIO_SC 4983	Molecular Ecology	4
BIO_SC 4990	Vertebrate Histology and Microscopic Anatomy	5
F_W 3660	Mammalogy	4

The following two courses satisfy the lab requirement if taken for 4 credit hours.

BIO_SC 3260	Invertebrate Zoology	4
BIO_SC 4640	Behavioral Biology	4

Students completing research courses (BIO_SC 2950, BIO_SC 4950, BIO_SC 4950H, BIO_SC 4952, or BIO_SC 4952H) for 6 credits may apply 3 credits toward fulfillment of capstone or biology elective hours for the BS degree.

Students may repeat readings, internships, problems, or research courses for a total of 18 hours. Any credits remaining after 3 hours are used as a capstone or an elective in biology will be applied toward total hours to graduate. A maximum of 18 credit hours from the following courses (BIO_SC 2940, BIO_SC 2950, BIO_SC 2960, BIO_SC 2965H, BIO_SC 4085, BIO_SC 4950, BIO_SC 4950H, BIO_SC 4952 and BIO_SC 4952H) can be counted toward graduation.

Second Language Alternative (SLA) for students pursuing a BS degree in biological sciences

Students may opt to satisfy the second language requirement through alternative coursework consisting of at least 12 credits in courses numbered 2000 or above. These courses may not be used to satisfy other degree requirements. Students should confer with the Biology Advising Office to ensure that alternative courses meet departmental requirements. All alternative courses must be approved by the Director of Undergraduate Studies.

Second Language Alternative (choose one option)

Environmental and Conservation Biology		
AN_SCI 3213	Genetics of Agricultural Plants and Animals	3
AN_SCI 4323	Applied Livestock Genetics	3
AN_SCI 4324	Genomics of Plants and Animals	3

ANTHRO 4320	Ecological and Environmental Anthropology	3	CHEM 2400	Fundamentals of Inorganic Chemistry with Lab	3
ENV_SC 2600	Sustainability Foundations: An Introduction to Sustainability	3	CHEM 3200	Quantitative Methods of Analysis with Lab	4
ENV_SC 3400	Water Quality and Natural Resources Management	3	F_S 2172	Elements of Food Microbiology	3
ENV_SC 4024	Foundations of Environmental Education	3	F_S 4370	Food Microbiology	3
ENV_SC 4051	Environmental Art	3	HIST 3550	Science and Medicine in Ancient and Medieval Europe	3
ENV_SC 4100	Lake Ecology	3	HLTH_SCI 2400	Contemporary Health Issues	3
ENV_SC 4200	Stream Ecology and Hydrology	3	HLTH_SCI 3800	Holistic Health Systems for the Health Professions	3
ENV_SC 4320	Hydrologic and Water Quality Modeling	3	HLTH_SCI 3700	Health Care in the United States	3
ENV_SC 4400	Environmental Law, Policy, and Justice	3	HLTH_SCI 4430	Health Care Across the Lifespan	3
F_W 2900	Principles of Wildlife Management	4	MICROB 4304	Immunology for Health Professions	3
F_W 3600	Introduction to Conservation Biology	3	MPP 4204	Medical Pharmacology	4
F_W 4200	Urban Wildlife Conservation	3	NEP 2222	Socio-Cultural Perspectives on Obesity	3
F_W 4300	Fisheries Management	3	NEP 2340	Human Nutrition I	3
F_W 4600	Ecosystem Management	3	NEP 2380	Diet Therapy for Health Professionals	3
F_W 4650	Natural Resource Planning and Management	4	NEP 2450	Nutrition Throughout the Life Span	3
FOREST 2151	Dendrology	4	NEP 2460	Eating Disorders	3
FOREST 4320	Forest Ecology	5	NEP 3450	Activity Throughout the Lifespan	3
FOREST 4390	Watershed Management and Water Quality	3	NEP 4400	Pathophysiology of Diseases Affecting Metabolic Health	3
GEOG 2610	Climate, Landforms and Vegetation: Introduction to Physical Geography	3	PHIL 2440	Medical Ethics	3
GEOG 2660	Environmental Geography	3	PHIL 4400	The Nature of Scientific Inquiry	3
GEOG 3040	Introduction to Geographic Information Systems GIS	3	P_HLTH 2200	Introduction to Public Health and Health Promotion	3
GEOG 3610	Physical Geography of the United States	3	P_HLTH 3310	Social and Behavioral Health Theory and Practice	3
GEOG 4620	Biogeography: Global Patterns of Life	3	P_HLTH 4350	Principles of Environmental Health for Public Health	3
GEOG 4810	Landscape Ecology and GIS Analysis I	3	P_HLTH 4485	Ethics in Public Health	3
HIST 4440	History of the American Environment	3	PSYCH 3830	Health Psychology	3
NAT_R 2325	Introduction to Geographic Information Systems	3	PTH_AS 2201	Human Anatomy Lecture	3
PHIL 2900	Environmental Ethics	3	PTH_AS 2203	Human Anatomy Laboratory	2
PLNT_SCI 4500	Biology and Pathogenesis of Plant-Associated Microbes	4	PTH_AS 4220	Forensic Pathology and Death Investigation	2
SOIL 2100	Introduction to Soils	3	SOCIOL 3440	Sociology of Health	3
SOIL 2106	Soil Science Laboratory	2	WGST 2050	Gender and Public Health	3
SOIL 3290	Soils and the Environment	3	WGST 4600	Women and Health	3
PRST 4260	Sustainable Tourism	3	V_PBIO 3345	Fundamentals of Parasitology	3
Medicine, Health and Society			V_PBIO 3551	Introduction to Immunology I	3
ANTHRO 2050	Introduction to Biological Anthropology with Laboratory	5	V_PBIO 3554	Introduction to Virology	3
ANTHRO 2500	Primate Anatomy and Evolution	3	V_PBIO 3554	Introduction to Virology	3
ANTHRO 2580	Evolution of Human Sexuality	3	V_PBIO 3600	Bacterial Genetics and Genomics	3
ANTHRO 3560	Plagues and Peoples	3	V_PBIO 3658	Public Health Microbiology	3
ANTHRO 4360	Medical Anthropology	3	Semester Plan		
ANTHRO 4540	Human Biological Variation	3	NOTE: These plans are intended only as general guides. Courses outside Biology and Chemistry are provided only for illustrative purposes. Advanced credit or exemption from the Foreign Language requirement and/or advanced credit in non-science courses, along with the interests of each individual student will determine a final combination of courses in each semester that is unique for each student. Note also that the sample schedules in Semester 5 and beyond are left incomplete on purpose because each schedule should be highly individualized at that point.		
ANTHRO 4580	Evolutionary Medicine	3			
ANTHRO 4890	Human Skeletal Identification and Analysis	5			
BIOCHM 4272	Biochemistry	3			
BIOMED 2110	Biomedical Terminology	3			
CDS 2190	Medical Terminology	3			
CHEM 2140	Organic Laboratory II	2			

Plan 1

A student that is exempt from MATH 1100

First Year			
Fall	CR	Spring	CR
CHEM 1400 & CHEM 1401		4 CHEM 1410 & CHEM 1411	4
ENGLISH 1000		3 BIO_SC 1500	5
Behavioral Sciences Course		3 Humanities Course (2000 level)**	3
Social Sciences Course (MO State Law)		3 Social Science Course**	3
Elective		1-2	
			15
Second Year			
Fall	CR	Spring	CR
CHEM 2100		3 CHEM 2110	3
BIO_SC 2200		4 CHEM 2130	2
STAT 1200		3 BIO_SC 2300	4
Second language I or Second Language Alternative		3-4 MATH 1400 *See Grad Plan for Mathematical Sciences Option	3
Elective		1-2 Second language II or Second Language Alternative	3-4
			15-16
Third Year			
Fall	CR	Spring	CR
Biology Elective Lab (3000 level)		5 PHYSCS 1220	4
PHYSCS 1210		4 Biology Elective	3
Second language III or Second Language Alternative		3-4 Behavioral Science	3
Elective		3 Humanities (2000 Level)	3
			13
Fourth Year			
Fall	CR	Spring	CR
Biology Capstone		3 Biology Elective- Writing Intensive	3
Biology Diversity		4 Evolutionary Biology	3
Social Science (2000 level)		3 Humanities	3
Humanities		3 Elective/FLA	3
Writing Intensive Elective		3 Elective	3
			15

Total Credits: 117-122

** Could meet A&S Diversity Intensive Requirement (3 hrs).

Plan 2

A student that needs MATH 1100

First Year			
Fall	CR	Spring	CR
BIO_SC 1500		5 CHEM 1400 & CHEM 1401	4
MATH 1100		3 ENGLISH 1000	3
Behavioral Sciences Course		3 Humanities Course (2000 level)**	3
Social Sciences Course (MO State Law)		3 Social Sciences Course**	3

Elective		1 Elective	1-2
			14-15
Second Year			
Fall	CR	Spring	CR
CHEM 1410 & CHEM 1411		4 CHEM 2100	3
BIO_SC 2200		4 BIO_SC 2300	4
STAT 1200		3 MATH 1400	3
Second Language or Second Language Alternative		3-4 Second Language or Second Language Alternative	3-4
Elective		Elective	3
			14-15
Third Year			
Fall	CR	Spring	CR
Biology Elective Lab (3000 level)		5 PHYSCS 1210	4
CHEM 2110		3 Biology Elective	3
CHEM 2130		2 Behavioral Science	3
Second Language or Second Language Alternative		3-4 Humanities (2000 level)	3
Elective		3	
			13
Fourth Year			
Fall	CR	Spring	CR
Biology Capstone		3 Biology Elective- Writing Intensive	3
PHYSCS 1220		4 Evolutionary Biology	3
Social Science (2000 level)		3 Biology Diversity	4
Humanities		3 Elective/FLA	3
Writing Intensive Elective		3 Humanities	3
			16

Total Credits: 120-124

** Could meet A&S Diversity Intensive Requirement (3 hrs).