

BIOLOGICAL SCIENCES

Biology is an extensive field that covers biochemistry, molecular biology, cell biology, microbiology, genetics, anatomy, physiology, embryology, ecology, evolution, field biology, and animal behavior. The Bachelor of Science in Biological Sciences is recommended for students who wish to study biology as part of an undergraduate liberal arts degree, to prepare for graduate study in biology or any of the health professions, or to study for a secondary teaching certificate in biology.

In addition to the major requirements, students must complete all CASL Degree Requirements (<http://catalog.umd.umich.edu/undergraduate/college-arts-sciences-letters/>).

Pre-Major Requirements

Code	Title	Credit Hours
BIOL 130	Intro Org and Environ Biology	4
BIOL 140	Intro Molec & Cellular Biology	4
CHEM 134	General Chemistry IA	4
or CHEM 144	Gen Chemistry IB	
CHEM 136	General Chemistry IIA	4
or CHEM 146	General Chemistry IIB	
CHEM 225	Organic Chemistry I	8
& CHEM 226	and Organic Chemistry II	
& CHEM 227	and Organic Chemistry Laboratory	
Select one of the following:		8
PHYS 125	Introductory Physics I	
& PHYS 126	and Introductory Physics II	
PHYS 150	General Physics I	
& PHYS 151	and General Physics II	
MATH 113	Calc I for Biology & Life Sci	4
or MATH 115	Calculus I	
Select one of the following:		3-4
MATH 114	Calc II for Biology & Life Sci	
MATH 116	Calculus II	
STAT 301	Biostatistics I	
STAT 455	Environmental Statistics	
Total Credit Hours		39-40

Mathematics and chemistry are essential to success in biology and should be taken as early as possible. Chemistry and mathematics course serve as prerequisites for many biology courses.

Major Requirements

30 credit hours of 300/400; 3000/4000 level biological sciences (BIOL) courses.

Code	Title	Credit Hours
Genetics:		
BIOL 306	General Genetics	3
Ecology:		
Select one of the following:		
BIOL/ESCI 304	Ecology	4
BIOL/ESCI 337	Plant Ecology	3

BIOL 456	Behavioral Biology	4
Evolution:		
BIOL 360	Population Genetics & Evolutn	3
Physiology:		
Select one of the following:		4
BIOL 303	Comparative Animal Physiology	
BIOL 305	Anatomy and Physiology IIB ³	
BIOL 335	Plant Physiology	
Cell & Molecular:		
Select one of the following:		3-4
BIOL 301	Cell Biology	
BIOL/BCHM/ CHEM 370	Principles of Biochemistry	
BIOL 385/ MICR 405	Microbiology	
Capstone Experience (CACY)		
Select one from the following:		3-4
BIOL 402	Physiology of Excitable Cells	
BIOL 404	Mech. Chronic Human Disease	
BIOL/MICR 405	Applied & Environ Microbiology	
BIOL 412	Vertebrates ¹	
BIOL 419	Behavior and Evolution	
BIOL/ESCI 420	Advanced Field Ecology	
BIOL/ESCI 422	Conservation Biology	
BIOL 452	Med & Env Toxicology	
BIOL 476	Cancer Cell Biology	
BIOL 480	Neurobiology of Brain Disorders	
BIOL 491	Capstone Course in Biology	
BIOL 492	Capstone Research Experience	
BIOL 493	Capstone Teaching Experience	
Additional Upper Level (300+) Biology Courses (BIOL)²		8-11

¹ BIOL 312 prior to Fall '15

² To total a minimum of 30 credit hours.

³ Credit cannot be earned for both BIOL 105 and BIOL 305. BIOL 105 cannot be used in the biology major.

Notes:

1. A maximum of 6 credit hours in BIOL 492, BIOL 493, BIOL 495, BIOL 497, BIOL 498 and BIOL 499 can be applied toward the 30 credit major requirement.
2. A maximum of 50 hours in biological sciences courses may be applied toward the 120-credit-hour total required for graduation.
3. In the 30 credit hours required for the major, students may use either BIOL 370/BCHM 370/CHEM 370 **or** BIOL 470/BCHM 470/CHEM 470 and/or BIOL 471 / BCHM 471 /CHEM 471.
4. At least 15 of the 30 upper level hours required in the BIOL major must be elected at UM-Dearborn.
5. A maximum of 6 credit hours combined of independent study/ research in any natural science discipline may be applied toward the 120 credit hours required for degree.

Minor or Integrative Studies Concentration Requirements

A minor or concentration consists of 12 credit hours of upper-level courses in biological sciences (BIOL). Note that all BIOL courses include prerequisites in biology and some include prerequisites in chemistry or mathematics.

BIOL 100 Principles of Biology 3 Credit Hours

A lecture course introducing non-science concentrators to major areas of biology, including cell biology, genetics, human physiology, plant biology, ecology, and evolution. Topics of current interest are discussed. Students cannot use both BIOL 100 and NSCI 120 to satisfy the Natural Sciences distribution requirements. Three hours lecture. (FW).

BIOL 103 Anatomy and Physiology I 4 Credit Hours

The structural and functional relationships of the human body at the cellular, tissue, organ, and system levels are analyzed. Students identify the major anatomical parts and relate these to the physiological activities of the circulatory, skeletal, nervous, muscular, and digestive systems.

The homeostatic effects of fluids, electrolytes, and acids and bases throughout the integrated human body are analyzed. Four hours lecture, three hours laboratory. (F).

Corequisite(s): BIOL 103L

BIOL 105 Anatomy and Physiology IIA 4 Credit Hours

The major anatomical parts of the cardiovascular, respiratory, reproductive, endocrine, nervous, and urinary systems of the human body are identified and related to the physiological activities of these systems. Emphasis is placed on the homeostatic effects of fluids, electrolytes, acids, and bases throughout the integrated human body. Four hours lecture, three hours laboratory. (W)

Prerequisite(s): BIOL 103

Corequisite(s): BIOL 105L

BIOL 130 Intro Org and Environ Biology 4 Credit Hours

An introduction to organismal and environmental biology, with emphasis on plant and animal diversity, structure, physiology, and development; ecology; and evolution. This course complements BIOL 140, which need not be taken as a prerequisite; together they constitute an introduction to biology. This course is intended for science concentrators. Three hours lecture, four hours laboratory/ recitation. (FW,S).

Corequisite(s): BIOL 130L

BIOL 140 Intro Molec & Cellular Biology 4 Credit Hours

An introduction to molecular and cellular aspects of biology with emphasis on cell structure and function, biochemistry, genetics, cell growth, and the origin of life. This course complements BIOL 130; together they constitute an introduction to biology. This course is intended for science concentrators. Three hours lecture, four hours laboratory/recitation.

Prerequisite(s): CHEM 134* or CHEM 144*

Corequisite(s): BIOL 140L

BIOL 240 Great Experiments in Biology 3 Credit Hours

An individualized-learning course that portrays the development of modern biological science. The course does not require attendance in classes since it can be completed at home and in the library by means of study guides, audio cassettes, slide/tape presentations, and computer-assisted instruction. (FW,S).

BIOL 242 Great Experiments Laboratory 1 Credit Hour

An individualized-learning laboratory science course that can be completed at home. Historically important and model experiments are performed in order to demonstrate how hypotheses are drawn and tested. Data are analyzed at a computer terminal. (F,W,S).

Prerequisite(s): BIOL 240*

BIOL 290 Topics in Biology and Society 3 Credit Hours

An introduction to themes of biology reflecting the interaction between biology and society. Topics vary and are announced in the current Schedule of Classes. The course may be repeated no more than once under a different topic. Three hours lecture. (OC).

BIOL 291 Biology and Society Laboratory 1 Credit Hour

A laboratory course to accompany BIOL 290. Three hours laboratory. (OC).

Corequisite(s): BIOL 290

BIOL 301 Cell Biology 4 Credit Hours

Functional and structural features of cells, organelles, and macromolecules. Topics in biochemistry, and physical chemistry of cellular processes are considered. Three hours lecture, four hours laboratory. CHEM 226 is recommended. (W).

Prerequisite(s): BIOL 140

Corequisite(s): BIOL 301L

BIOL 303 Comparative Animal Physiology 4 Credit Hours

Physiological processes and their control in higher animals. Emphasis ranges from the cellular mechanisms and systemic patterns of regulation of body functions to the evolutionary and environmental adaptations determining body form and function in diverse animal types. Three hours lecture, four hours laboratory. MATH 114 is recommended. (F).

Prerequisite(s): BIOL 130 and BIOL 140 and (CHEM 124 or CHEM 134 or CHEM 144)

Corequisite(s): BIOL 303L

BIOL 304 Ecology 4 Credit Hours

Relationships between organisms and their environments. Patterns in the physical environment, physiological and behavioral adaptations, population dynamics, energy flow, nutrient cycling; succession. Three hours lecture, four hours laboratory (with field trips). (F, S).

Prerequisite(s): BIOL 130 and (MATH 104 or MATH 105 or MATH 113 or MATH 115 or Mathematics Placement with a score of 116)

Corequisite(s): BIOL 304L

BIOL 305 Anatomy and Physiology IIB 4 Credit Hours

The major anatomical parts of the cardiovascular, respiratory, reproductive, endocrine, nervous, and urinary systems of the human body are identified and related to the physiological activities of these systems.

Emphasis is placed on the homeostatic effects of fluids, electrolytes, acids, and bases throughout the integrated human body. Students complete additional work beyond what is required in BIOL 105. Four hours lecture, three hours laboratory.

Prerequisite(s): BIOL 103

Corequisite(s): BIOL 305L

BIOL 306 General Genetics 3 Credit Hours

An intermediate course in classical, molecular and evolutionary genetics. The structure, function, and inheritance of genetic material in prokaryotes, eukaryotes and viruses are discussed. Topics include DNA and chromosome structure, genetic linkage and mapping, gene expression and its regulation, human genetic disease, and population genetics. Three hours lecture, one hour recitation. (F).

Prerequisite(s): BIOL 130 and BIOL 140

Corequisite(s): BIOL 306R

BIOL 306R General Genetics Recitation 0 Credit Hours

Recitation component of BIOL 306. Must be taken concurrently with BIOL 306.

Corequisite(s): BIOL 306

BIOL 307 General Genetics Laboratory 1 Credit Hour

A semester-long laboratory course dealing with investigation and analysis in genetics. Laboratory sessions will include genetic crosses of plants and animals and the subsequent analysis to determine linkage and gene mapping location. Computer exercises will also be used to establish genetic tools for modern molecular analysis. Four hours laboratory. (W).

Prerequisite(s): BIOL 306*

BIOL 309 Introduction to Mycology 4 Credit Hours

An introduction to the biology of the fungi. Classification, structure, industrial use, gastronomic qualities, and disease-producing ability of macroscopic and microscopic forms are studied. Laboratories include microscopic and macroscopic examinations of fungi and their growth and field studies on the occurrence and classification of edible and poisonous varieties. Three hours lecture, four hours laboratory. (OC).

Prerequisite(s): BIOL 130 and BIOL 140

BIOL 310 Histology 4 Credit Hours

Descriptive approaches to the study of the microscopic anatomy of animal tissue. The course emphasizes the study of cell and tissue types, selected organs and the interpretation of electron micrographs. Three hours lecture, four hours laboratory. (AY, F).

Prerequisite(s): BIOL 130 and BIOL 140

Corequisite(s): BIOL 310L

BIOL 311 Embryology 4 Credit Hours

Descriptive and experimental approaches to a comparative study of reproduction, morphogenesis, and growth. Emphasis is placed on the vertebrates, but some attention is focused on the development of invertebrates and plants. Three hours lecture, four hours laboratory. (AY, W).

Prerequisite(s): BIOL 130 and BIOL 140

Corequisite(s): BIOL 311L

BIOL 313 Plant Taxonomy and Systematics 4 Credit Hours

Characteristics, distribution, and relationships of plants with special reference to the local Michigan flora. Three hours lecture, four hours laboratory (including field work) per week. (OC).

Prerequisite(s): BIOL 130

BIOL 315 Aquatic Ecosystems 4 Credit Hours

An introduction to the physical, chemical, and biological characteristics of lakes, rivers, and wetlands emphasizing a comparison of ecosystem structure and function. Laboratory emphasizes data collection and analysis to characterize a representative lake, river, and wetland. Lecture and laboratory. (AY, F).

Prerequisite(s): BIOL 130 and (CHEM 124 or GEOL 118)

BIOL 320 Field Biology 4 Credit Hours

Adaptations, taxonomy, systematics, ecology, and behavior of southeastern Michigan flora and fauna. Techniques of field observation and recording are emphasized. Skills in the use of identification keys and guides are developed. The campus Environmental Study Area is used intensively. Three hours lecture, four hours laboratory (with field trips). (S).

Prerequisite(s): BIOL 101 or BIOL 130 or NSCI 120 or NSCI 233

BIOL 324 Invertebrate Zoology 4 Credit Hours

This course introduces students to the diversity of invertebrate animals from a functional evolutionary perspective. The lecture will focus on the unique aspects of the morphology, physiology, and ecology of major phyla in light of the selective forces that have favored their evolution, as well as consider the intersection of invertebrates and humans. Through dissection, prepared slides and field observations, the laboratory will introduce the diversity of invertebrate phyla and subgroups, with emphasis on form and function.

Prerequisite(s): BIOL 130

BIOL 333 Plant Biology 4 Credit Hours

A thorough survey of the evolutionary trends in plant reproduction and morphology will be considered. This survey will extend into the field of plant anatomy, but not plant physiology, which is covered in a separate course. Major groups to be studied include: bacteria, algae, fungi, liverworts, lichens, mosses, ferns, and seed plants. Certain less familiar groups will also be emphasized. Plant diversity will be examined from the perspective of its import to civilizations of the past and future. Three hours lecture, four hours laboratory. (F, S).

Prerequisite(s): BIOL 130

Corequisite(s): BIOL 333L

BIOL 335 Plant Physiology 4 Credit Hours

Physiological principles as they apply to the major plant groups. Topics include cellular metabolism, water balance, translocation, photosynthesis, mineral nutrition, growth and development and production of secondary substances. Three hours lecture, four hours laboratory. (W).

Prerequisite(s): BIOL 130 and BIOL 140

Corequisite(s): BIOL 335L

BIOL 337 Plant Ecology 3 Credit Hours

This course focuses on different aspects of the relationship between plants and their environment. Topics include: a) interactions of plants with the physical environment; b) ways in which the environment acts to shape plant populations through evolution; c) intra- and interspecific interactions among individuals; and d) large-scale patterns and processes at the landscape-level. Three hours lecture.

Prerequisite(s): BIOL 130

BIOL 350 Introduction to Neurobiology 4 Credit Hours

An introduction to nervous systems and how they function. This course includes the cellular physiology and anatomy of nervous systems in vertebrates and invertebrates, and how these cellular activities are integrated into systems to produce complex, coordinated behavior. Three hours lecture. (W).

Prerequisite(s): BIOL 130 and BIOL 140

Corequisite(s): BIOL 350L

BIOL 352 Endocrinology 3 Credit Hours

This class will provide intermediate and advanced undergraduates with a basic understanding of the function of the endocrine system. The course will progress from a consideration of basic concepts and mechanisms to the physiology (function) of specific endocrine systems. Interactions between organ systems will also be emphasized. Specific sections of the course will focus on function of the endocrine system during stress, fluid balance, metabolism (including calcium, glucose, lipid, and proteins), reproductive growth, development, and aging.

Prerequisite(s): BIOL 140 and BIOL 130 and CHEM 134

BIOL 353 Ornithology 3 Credit Hours

A study of the unique features of birds as representatives of vertebrates, including their morphology, anatomy, physiology, physics of flight, mating systems, social structure, vocalizations, orientation and migration, origin and evolution, growth and development, and issues in avian conservation. Students learn about the current research on bird migration at the Rouge River Bird Observatory on campus. Students develop individual species analysis of life and natural histories. Three hours lecture.

Prerequisite(s): BIOL 130

BIOL 357 Human Physiology 3 Credit Hours

Systems of the human body and their function are investigated individually and as part of an integrated natural living system. Topics include cell structure and function of nerves, muscles, the lungs, heart, blood vessels, kidneys, digestive tract, endocrine glands, brain, and reproductive organs.

Prerequisite(s): (BIOL 130 and BIOL 140) or (BIOL 103 and BIOL 105)

BIOL 360 Population Genetics & Evolutn 3 Credit Hours

Processes which change the genetic composition of populations: mutation, gene flow, genetic drift, and natural selection. The origin of subspecies, species, and higher taxa. Evidence of evolution from the geological recors, comparative anatomy, comparative biochemistry and other sources. Three hours lecture. (F,W)

Prerequisite(s): BIOL 130 and BIOL 140 and (MATH 104 or MATH 105 or MATH 113 or MATH 115 or Mathematics Placement with a score of 116)

BIOL 361 Population Genetics & Evol Lab 1 Credit Hour

A laboratory course to accompany BIOL 360. Four hours laboratory. (OC).

Prerequisite(s): BIOL 360*

BIOL 370 Principles of Biochemistry 3 Credit Hours

A concise but comprehensive survey of various areas of biochemistry designed for non-biochemistry majors. The course follows the standard approach to the subject including a description of cells, their structure and constituent macromolecules (proteins, nucleic acids, carbohydrates and lipids), enzymology, bioenergetics, intermediary metabolism and gene regulation. Students cannot take both BCHM 370 and 470 or 471 for any combination of concentration, cognate or minor requirement. Three hours lecture. (F).

Prerequisite(s): BIOL 140 and CHEM 226

BIOL 380 Epidemiology 3 Credit Hours

Introduces the methods for infectious disease epidemiology (occurrence and spread in population) and case studies of important disease syndromes and entities. Methods include definitions and nomenclature, outbreak investigations, disease surveillance, case-control studies, cohort studies, laboratory diagnosis, molecular epidemiology, dynamics of transmission, and assessment of vaccine field effectiveness. Case-studies focus on acute respiratory infections, diarrheal diseases, hepatitis, HIV, tuberculosis, sexually transmitted diseases, malaria, and other vector-borne diseases. This course emphasizes methods of study that would contribute to understanding diseases etiology.

Prerequisite(s): BIOL 140

BIOL 381 Biotechnology & Bioprocessing 4 Credit Hours

Biotechnology and Bioprocessing class is centered on the study of bioengineering applications found today in the medical and agricultural industries. Students use microorganisms, plant and animal tissue culture, and enzymes during the laboratory period, practicing the fundamentals of "hands-on" genetic engineering and material processing. Students establish and purify proteins from recombinant organisms. Besides technology, ethical and environmental concerns are discussed in the lecture. Three hours lecture, four hours laboratory.

Prerequisite(s): BIOL 140

BIOL 385 Microbiology 4 Credit Hours

The biology of microorganisms is considered through study of the properties of bacteria, fungi, algae, protozoa, and viruses. Microbial structures are discussed and correlated with their function. Aspects of cellular metabolism pertinent to microorganisms are emphasized. The interaction of microorganisms and their environment, animate and inanimate, is discussed with respect to the beneficial or harmful effects of the different microbial groups. Laboratory exercises introduce the student to basic, practical microbiological techniques and illustrate various principles of microbial life. Three hours lecture, four hours laboratory. (F,S).

Prerequisite(s): BIOL 140 and (CHEM 134* or CHEM 144*)

Corequisite(s): BIOL 385L

BIOL 390 Topics in Biology 1 to 4 Credit Hours

Examination of problems and issues in selected areas of biology. Title in Schedule of Classes changes according to content. This course may be repeated for credit when specific topics differ. Permission of Instructor. (OC).

BIOL 402 Physiology of Excitable Cells 3 Credit Hours

An in-depth analysis of the mechanisms underlying electrical communication within and between mammalian cells. The major emphasis is on excitable cells in the brain, heart, and skeletal muscle and their functional integration. Fulfills the Biology major capstone requirement.

Prerequisite(s): BIOL 130 and BIOL 140 and (BIOL 303 or BIOL 305 or BIOL 350)

Restriction(s):

Can enroll if Class is Senior

BIOL 404 Mech. Chronic Human Disease 3 Credit Hours

This course focuses on the biochemical, molecular and cellular mechanisms underlying the progression of chronic diseases, such as diabetes mellitus and atherosclerosis. Techniques in epidemiology, pathology, genetics, molecular biology, and biochemistry are used to understand how relevant physiological processes become pathological. The examination of chronic diseases provides an opportunity to understand biological processes across many scales of life, from extracellular matrix proteins to cells in blood vessel walls to risk factors in patient populations to the pharmacology of treatments. Use of primary literature is emphasized. Three hour lecture.

Prerequisite(s): BIOL 301 or BIOL 306 or BIOL 357 or BCHM 370 or BIOL 370 or CHEM 370 or BCHM 471 or BIOL 471 or CHEM 471

Restriction(s):

Can enroll if Class is Senior

BIOL 405 Applied & Environ Microbiology 4 Credit Hours

The study of the diversity, structure and function of microorganisms as they interact with their environment. Emphasis will be placed on soil microbiology (fungi, bacteria, microalgae) and plant-microbe interactions (pathogens, symbioses). Ecological topics include decomposition, nutrient cycling, bioremediation and agroecosystems. Three hours lecture, four hours laboratory. (W).

Prerequisite(s): BIOL 385 or MICR 385

Restriction(s):

Can enroll if Class is Senior

BIOL 406 Microbial Genetics 3 Credit Hours

This molecular genetics course emphasizes bacteria and viruses. Topics include chromosome structure and replication, recombination, DNA repair, genetic mapping, mechanisms of gene transfer, regulation of gene expression, and mutagenesis. Three hours lecture. (W, YR)

Prerequisite(s): MICR 385 or BIOL 385

BIOL 410 Diversity Issues Health Care 3 Credit Hours

This course will address the effect of race, age, gender, religion, and economic status on medical research and health care. Through an examination of clinical trials and case studies, students will learn how medical research is performed in the United States, and what health care treatments and options for patients are available. Medical treatment and disease topics will be selected and will be evaluated as to how they are influenced by the criteria listed. The examples will focus on both cultural differences and inequity, in national and global settings. (AY).

Prerequisite(s): BIOL 130 and BIOL 140

Restriction(s):

Can enroll if Class is Junior or Senior

BIOL 412 Vertebrates 5 Credit Hours

A comparative study of the morphology of living animals, including an analysis of structural and functional features, diversity, and macroevolution. The major emphasis is on the comparative functional anatomy of living vertebrates. Three hours lecture, eight hours laboratory. Fulfills the biology major capstone requirement. This course was formerly offered as 312; students cannot receive credit for both BIO 312 and 412. (W, AY)

Prerequisite(s): (BIOL 303 or BIOL 305 or BIOL 335) or BIOL 360

Restriction(s):

Can enroll if Class is Senior

BIOL 414 Limnology 4 Credit Hours

The study of the structural and functional relationships and productivity of organisms in lakes and streams as they are regulated by their physical, chemical and biotic environments. Laboratories will emphasize field study of area lakes and streams. Three hours lecture, four hours laboratory. BIOL/ESCI 304 or ESCI 275 recommended.

Prerequisite(s): BIOL 130 and (CHEM 136 or CHEM 146)

Corequisite(s): BIOL 414L

BIOL 416 Stream Ecology 4 Credit Hours

A study of the physical, chemical and biological characteristics of streams and rivers. Three hours lecture, four hours laboratory. (OC).

Prerequisite(s): BIOL 304

BIOL 419 Behavior and Evolution 3 Credit Hours

An in depth examination of how evolutionary processes shape behavior, focusing on the influence of natural, sexual, and kin selection. Topics include behavioral genetics, natural selection, sexual selection, kin selection, optimality, game theory, evolutionary stable strategies, phylogenetics, and the comparative method.

Prerequisite(s): BIOL 140 and BIOL 130

Restriction(s):

Can enroll if Class is Senior

Can enroll if Level is Undergraduate

BIOL 420 Advanced Field Ecology 4 Credit Hours

An intense study of behavioral ecology and field-oriented research at an advanced level, utilizing ecological habitats on campus and in surrounding urban areas. Focus will be on plant/animal interactions and will include pollination ecology, reproduction and distribution ecology, optimal foraging theory, as well as hypothesis testing of animal migration and distribution of species in extreme urban environments. Three hours lecture, four hours laboratory. (OC).

Prerequisite(s): BIOL 304 or BIOL 320

Restriction(s):

Can enroll if Class is Senior

BIOL 422 Conservation Biology 3 Credit Hours

This course is a study of the historical and current preservation of global biodiversity. The value of biodiversity, extinction, threats to biodiversity, and both ex situ and in situ conservation strategies are considered. (W, AY)

Prerequisite(s): BIOL 304 or ESCI 304

Restriction(s):

Can enroll if Class is Senior

Can enroll if Level is Undergraduate

BIOL 424 Biology of Spiders 4 Credit Hours

An introduction to the biology of spiders and related arachnids. Lectures include spider anatomy, natural history, ecology, and evolution. Laboratory work includes specimen preparation, use of dichotomous keys, spider behavior, field methods, rearing and collecting techniques, and identification of spiders and their webs. Three hours lecture, four hours laboratory. Students cannot receive credit for both Biology 424 and Biology 524.

Prerequisite(s): BIOL 130

Restriction(s):

Cannot enroll if Class is Graduate

BIOL 430 Medical Virology 3 Credit Hours

A general description of the history and nature of animal virus disease. Emphasis is placed on the pathogenesis and clinical description of specific diseases.

Prerequisite(s): BIOL 385 or MICR 385

BIOL 440 Micro Genetics & Physi Lab 1 Credit Hour

This course emphasizes the use of advanced microbiological techniques for understanding the genetics and physiology of microorganisms. Experiments focus on the understanding of general microbial phenomena, such as nutrition, metabolism and biochemistry; protein and nucleic acid synthesis; energy generation, enzyme regulation, membrane transport, motility, differentiation, cellular communication and the behavior of populations.

Prerequisite(s): BIOL 385* or MICR 385* or BIOL 301* or BIOL 406* or MICR 406* or BIOL 485* or MICR 485*

Restriction(s):

Cannot enroll if Class is Freshman

Can enroll if Level is Undergraduate

BIOL 450 Virology 4 Credit Hours

The first half of this course deals with bacterial viruses, with emphasis on classical events in this field. The second half surveys the field of animal viruses, with emphasis on recent discoveries, including replication, pathogenesis, and viral association with cancers. Three hours lecture, four hours laboratory. (AY,W).

Prerequisite(s): CHEM 226 and (MICR 385 or BIOL 385)

BIOL 452 Med & Env Toxicology 3 Credit Hours

Mechanistic concepts of toxicology at the cellular and molecular levels. The course is taught from a human health perspective focusing on contemporary problems and environmental associations. Three hours lecture. (W, AY)

Prerequisite(s): BIOL 140 and CHEM 225 and (BIOL 370 or BIOL 470 or BIOL 301)

Restriction(s):

Can enroll if Class is Senior

Can enroll if Level is Undergraduate

BIOL 455 Immunology 4 Credit Hours

A detailed study of the field of immunology. Among the topics covered are various aspects of the immunological response, such as humoral or cell-mediated immunity, cell-cell interactions, and immunology as related to the cause and prevention of disease. Three hours lecture, four hours laboratory. (AY,F).

Prerequisite(s): BIOL 385 or BIOL 301 or MICR 385

BIOL 456 Behavioral Biology 4 Credit Hours

This course uses evolutionary and ecological theory to evaluate behavioral adaptations of organisms to their environment. Topics discussed include game theory, kin selection, sexual selection, eusociality, orientation and navigation, and signal evolution. Laboratory sessions include: observations of animal behavior, required manipulations of live animals, and field trips. Three hours of lecture, one four-hour laboratory. Students cannot receive credit for both BIOL 456 and BIOL 556. Student seeking graduate credit should elect BIOL 556.

Prerequisite(s): BIOL 130

Restriction(s):

Cannot enroll if Class is Specialist or Graduate or Doctorate

BIOL 459 Pathogenic Microbiology 4 Credit Hours

An introduction to pathogenic microorganisms and mechanisms of microbial pathogenicity. Disease-causing bacteria, fungi, viruses, and protozoa are studied. Laboratories emphasize clinical approaches to isolation, identification, and treatment. Three hours lecture, four hours laboratory. (AY,F).

Prerequisite(s): BIOL 385 or MICR 385

BIOL 470 Biochemistry I 3 Credit Hours

Life processes from a chemical viewpoint: structure/function relationships of biomolecules with emphasis on proteins, enzyme kinetics, and mechanisms of action. Three hours lecture. (W)

Prerequisite(s): (BIOL 130 and BIOL 140 and CHEM 134) or (CHEM 144 and CHEM 136) or (CHEM 146 and CHEM 225)

BIOL 471 Biochemistry II 3 Credit Hours

Intermediary metabolism, bioenergetics, energy transformation, metabolic interrelationships, biochemical regulation, highly structured subcellular biochemical systems. Three hours lecture. (F).

Prerequisite(s): BCHM 470 or BIOL 470 or CHEM 470

BIOL 472 Biochemistry Lab I 1 Credit Hour

The techniques of preparative and analytical biochemistry. Preparation and characterization of proteins and nucleic acids. Physical and chemical properties of proteins and nucleic acids. Four hours laboratory. CHEM 344 Recommended. (F).

Prerequisite(s): (BIOL 470* or BCHM 470* or CHEM 470*) and CHEM 227

BIOL 473 Biochemistry Laboratory II 1 Credit Hour

The techniques of preparative and analytical biochemistry. Preparation and characterization of lipids and carbohydrates. Methods in metabolism. Four hours laboratory. (W).

Prerequisite(s): (BCHM 471* or BIOL 471* or CHEM 471*) and (BCHM 472* or BIOL 472* or CHEM 472*)

BIOL 474 Molecular Biology 4 Credit Hours

This course will emphasize the molecular biology of eukaryotes, and topics will include genome organization and complexity, chromatin structure and function, gene expression, DNA replication and repair, genetic rearrangements, and the molecular biology of development. The laboratory will emphasize the application of recombinant DNA technology to the study of biological problems. Three hours lecture, four hours laboratory. (W).

Prerequisite(s): (BCHM 470 or BIOL 470 or CHEM 470) or (BCHM 370 or BIOL 370 or CHEM 370) and CHEM 227

Corequisite(s): BIOL 474L

BIOL 476 Cancer Cell Biology 3 Credit Hours

Cancer is a disease of anti-social cell behavior. This course educates students on the genetics, molecular and cellular changes that normal cells undergo to become cancer cell. Major emphasis is on providing a mechanistic insight into fundamental questions in cancer cell biology. The course also discusses currently available therapeutic treatments and emerging issues in cancer therapy research. Fulfills capstone requirement for biology majors. Three hours lecture.

Prerequisite(s): BIOL 130 and BIOL 140 and (BIOL 301 or BIOL 306 or BIOL 370 or BCHM 370 or CHEM 370 or BIOL 385 or MICR 385)

Restriction(s):

Can enroll if Class is Senior

BIOL 480 Neurobiology of Brain Disorders 3 Credit Hours

This course aims to provide a foundation in the underlying mechanisms of neurological and psychiatric disorders. We will explore through lectures and readings of primary literature a number of important brain disorders, including autism spectrum disorder, traumatic brain injury, amyotrophic lateral sclerosis, Parkinson's disease, Huntington's disease, and Alzheimer's disease. This course focuses on the fundamental molecular and cellular mechanisms that underlie brain disorders and helps students understand the brain dysfunctions or diseases. (W).

Prerequisite(s): BIOL 350 or BIOL 357 or BIOL 305

Restriction(s):

Can enroll if Class is Senior

BIOL 485 Physiology of Micro-organisms 3 Credit Hours

An in-depth examination of the physiology of microorganisms. Areas of emphasis include the growth and nutrition of microorganisms, the development of viruses, the microbial degradation of organic compounds, the regulation of degradation reactions, and the biosynthesis of uniquely microbial compounds and secondary metabolites, such as antibiotics and toxins. Consideration is given to the natural environments of specific microorganisms. Three hours lecture. (W, YR)

Prerequisite(s): (BIOL 385 or MICR 385 or BIOL 370* or CHEM 370 or BCHM 370) and CHEM 225*

BIOL 489 Origins of Biological Sciences 3 to 4 Credit Hours

A study of the development of the science of biology as revealed in the writing and experiments of major biologists of the past and present. (OC).

BIOL 490 Sem in Biology/Microbiology 1 to 6 Credit Hours

Directed research on a problem culminating in the preparation of a paper and presentation of a public seminar. Tutorials, lectures and student seminars are given on selection and formulation of research problems, experimental design, and statistical treatment of data. May be repeated for credit with permission of advisor. (OC).

BIOL 491 Capstone Course in Biology 3 Credit Hours

A culminating course for biology majors which focuses on an area of current biological research and integrates material from different subdisciplines of biology. Topic varies and is announced in the Schedule of Classes. Three hours lecture.

Restriction(s):

Can enroll if Class is Senior
Can enroll if Major is Biological Sciences

BIOL 492 Capstone Research Experience 3 Credit Hours

An approved research experience with a UM-D biology faculty member which integrates material from different subdisciplines of biology. Research results are reported in a poster or seminar presentation or in a manuscript submitted for publication.

Restriction(s):

Can enroll if Class is Senior
Can enroll if Major is Biological Sciences

BIOL 493 Capstone Teaching Experience 3 Credit Hours

An approved teaching experience which integrates material from different subdisciplines of biology. Students work as a student teaching assistant/student mentor in the laboratory portion of a biology course.

Restriction(s):

Can enroll if Class is Senior
Can enroll if Major is Biological Sciences

BIOL 494 Emergency Medicine Research Associates Program (EMRAP) 2 to 3 Credit Hours

Full Course Title: Emergency Medicine Research Associates Program (EMRAP) at St. Mary Mercy hospital. This course provides a unique research experience through a partnership with the University of Michigan-Dearborn Biology Discipline in the NSCI Department. Enrolled students will assist in ongoing clinical research programs, will learn the basic principles behind clinical research design, hypothesis testing, results interpretation, including discussions of issues involving human subjects in research, informed consent, and health information privacy. Students will gain knowledge in the aforementioned areas through lecture and through clinical shift work, including clinical provider shadowing, participant enrollment, and data collection for several ongoing trials. This course runs for a full academic year (3 credits Fall and 2 credits Winter). (F,W, YR) Registration is by permission of instructor only. (F, W, YR).

BIOL 495 Off-Campus Research Participat 1 to 3 Credit Hours

Participation in ongoing experimental research at an off-campus laboratory (or in the field). Arrangements made between the off-campus researcher, the student, and the Biology concentration advisor. No more than six credit hours combined from BIOL 490, 495, 498, and 499 may be counted toward the 120 hours required for a degree. Four to twelve hours laboratory. Permission of instructor. (F,S).

BIOL 497 Seminar in Biology 1 Credit Hour

Topics of current interest in Biology will be presented by guest lecturers, faculty members or students. Topics chosen will vary from term to term. Can be elected up to three times. One hour seminar. (W).

BIOL 498 Independent Study in Biology 1 to 3 Credit Hours

Library research and independent study performed under the guidance of a faculty member. Four to twelve hours readings. Permission of instructor. (F,S).

BIOL 499 Laboratory in Biological Resrh 1 to 3 Credit Hours

Directed laboratory research performed under the guidance of faculty member. Four to twelve hours laboratory. Permission of Instructor. (F,S).

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally

* An asterisk denotes that a course may be taken concurrently.