

BIOLOGICAL SCIENCES

(330) 941-3608

Room 4037 Ward Beecher Science Hall

Courses in Biological Sciences may be applied toward a Bachelor of Science or a Bachelor of Arts degree. The department offers specialized courses in three major divisions:

- molecular biology and microbiology
- physiology and anatomy
- evolution, ecology and environmental biology

Biological Sciences offers courses to prepare a student for a wide variety of fields and future careers including:

- dentistry
- botany
- health-related careers
- physical therapy
- medicine
- veterinary medicine
- medical technology
- microbiology
- molecular biology
- biomedical research
- biotechnology

Advisement is available concerning course selection appropriate for a specific field in biology and in the choice of a minor or minors. These degrees may be earned in eight semesters if students average 16 hours per semester.

For more information, visit Biological Sciences (<http://www.yсу.edu/academics/science-technology-engineering-mathematics/biology-major/>).

Professor

David K. Asch, Ph.D., Associate Professor

Michael Butcher, Ph.D., Professor

Jonathan J. Caguiat, Ph.D., Professor

Chester R. Cooper, Ph.D., Professor

Thomas P. Diggins, Ph.D., Professor

Jill M. Gifford, Ph.D., Associate Professor

Carl G. Johnston, Ph.D., Professor

Heather E. Lorimer, Ph.D., Associate Professor

Xiangjia Min, Ph.D., Professor

Ian J. Renne, Ph.D., Associate Professor

Lecturer

Li (Linda) Sui, M.S., Lecturer

Stephen Tavoni, M.S., Lecturer

Stefania Panaitof, Ph.D., Assistant Professor

Majors

- BS in Biological Sciences (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/bs-biological-sciences/>)
- BA in Biological Sciences (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/ba-biological-sciences/>)

Certificates

- Certificate in Anatomy and Physiology (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/anatomy-and-physiology-certificate/>)
- Certificate in Biomedical Research (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/biomedical-research-certificate/>)
- Certificate in Molecular and Biotechnology (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/molecular-biology-and-biotechnology-certificate/>)

Minors

- Biological Sciences Minor (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-biological-sciences/biological-sciences-minor/>)

BIOL 1505 Biology and the Modern World 3 s.h.

Biology applied to critical issues of today's society. Focus on the scientific method as relevant to modern biology issues. Not applicable to the Biology major.

Gen Ed: Natural Science.

BIOL 1505L Biology and the Modern World Laboratory 1 s.h.

Student investigations in biological phenomena using a variety of laboratory approaches focused on a single theme or concept using the scientific method. Satisfies the Natural Science Laboratory requirement. Not applicable to the Biology major.

BIOL 1545 Allied Health Anatomy and Physiology 5 s.h.

Explores the structure and function of the human body and its organ systems. Diseases and their relationship to various physiological systems. Four hours lecture, two hours lab. Not applicable to the Biology major.

Prereq.: High school biology and chemistry, or equivalent.

Gen Ed: Natural Science.

BIOL 1545L Allied Health Anatomy and Physiology Laboratory 0 s.h.

Allied Health Anatomy and Physiology Laboratory.

BIOL 1551 Anatomy and Physiology 1 3 s.h.

Structure, function, and clinical applications of the integument, musculature, skeletal, and nervous systems. Targeted for students in nursing and associated health professions. Three hours of lecture. Not applicable to the Biology major.

Prereq.: High school biology, CHEM 1501 or equivalent, and MATH 1501 or equivalent.

Gen Ed: Natural Science.

BIOL 1551L Anatomy and Physiology 1 Laboratory 1 s.h.

Anatomical study of skeletal, muscular, and nervous systems. For students in nursing and associated health professions. Two hours of laboratory per week. Not applicable to the Biology major. BIOL 1551 must be taken either previous or concurrent.

BIOL 1552 Anatomy and Physiology 2 4 s.h.

Structure, function, and clinical applications of the endocrine, cardiovascular, respiratory, renal, digestive, and reproductive systems. Targeted for students in nursing and associated health professions. Three hours lecture, two hours lab. Not applicable to the Biology major.

Prereq.: BIOL 1551.

Gen Ed: Natural Science.

BIOL 1552L Anatomy and Physiology 2 Laboratory 0 s.h.

Anatomy and Physiology 2 Laboratory.

BIOL 1560 Microbiology for the Health Professions 2 s.h.

Characteristics, epidemiology, and pathology of viruses, bacteria, and protozoa of medical significance. Other topics dealing with the control of microorganisms and food microbiology will be covered. Not applicable to a biology major. Two hours of lecture. Must be taken concurrent with BIOL 1560L or substitute.

BIOL 1560L Microbiology Laboratory for Health Professions 1 s.h.

Microscopy, cultivation, and identification of bacteria. Microbiology of foods. Disinfection techniques. Not applicable to a biology major. Three hours of laboratory per week. Must be taken concurrent with BIOL 1560.

BIOL 2601 General Biology 1: Molecules and Cells 3 s.h.

The chemical and physical foundations of life, structure and function of cells and organelles, metabolism, basic molecular biology and inheritance, and principles of evolution. Three hours of lecture per week. Prereq. or Coreq.: CHEM 1515.

Coreq.: BIOL 2601L.

Gen Ed: Natural Science.

BIOL 2601L General Biology I: Molecules and Cells Laboratory 1 s.h.

The chemical and physical foundations of life, including scientific communication, cell biology, metabolism, basic molecular biology and diversity. Two hours of lab each week. Prereq. or Coreq.: CHEM 1515.

Coreq.: BIOL 2601.

BIOL 2602 General Biology 2: Organisms and Ecology 3 s.h.

The structure and function of plants and animals. Examination of the structure and functioning of organismic communities and ecosystems. Required of all biological sciences majors. Three hours of lecture per week.

Prereq.: BIOL 2601 and CHEM 1515.

Coreq.: BIOL 2602L.

Gen Ed: Natural Science.

BIOL 2602L General Biology: Organisms and Ecology Laboratory 1 s.h.

Structure and function of plants and animals including, biological diversity and basic physiology. Two hours of lab each week. 1 s.h.

Prereq.: BIOL 2601 and BIOL 2601L.

Coreq.: BIOL 2602.

BIOL 2603 Integrated Biology for BaccMed 4 s.h.

This course is an introduction to general biology that focuses on those aspects of biology that are the fundamental basis of medicine and human biology.

Prereq.: admittance to BS in Biochemistry or Electrical and Computer Engineering with a Biomedical emphasis.

BIOL 3702 Microbiology 3 s.h.

Fundamentals of the biology of microbes. The principles of microbial structure, function, reproduction, metabolism, genetics, phylogeny, host-parasite relationships, and immunity. Three hours lecture.

Prereq.: BIOL 2601 or BIOL 2603 and concurrent enrollment in BIOL 3702L.

BIOL 3702L Microbiology Laboratory 1 s.h.

Fundamental and applied technical skills acquired through laboratory experiences to include proper handling, microscopy, culture, and biochemical identification of microorganisms. Two 1.5-hour laboratory sessions per week.

Prereq.: BIOL 2601 or BIOL 2603.

Coreq.: BIOL 3702.

BIOL 3703 Clinical Immunology 3 s.h.

Fundamentals of immunology, including both humoral and cellular immunological responses. Applications of immunological methods in medical research and patient treatment.

Prereq.: BIOL 2601 or BIOL 2603 and BIOL 3702 recommended.

BIOL 3703L Clinical Immunology Laboratory 1 s.h.

VDRL, ASO, febrile, latex, pregnancy, and viral tests; flocculation, precipitation, complement fixation, and titration procedures for various diseases. Three hours lab per week. Identical with MLS 3703L and MLT 3703L.

Prereq.: BIOL 2602.

Concurrent with: BIOL 3703.

BIOL 3704 Biological Anthropology 3 s.h.

The physical origins and development of the human species as a member of the primate order and the biological bases of human differences disclosed by human paleontology and archaeology. Also listed with ANTH 3703.

Prereq.: ANTH 1500 and BIOL 2601.

BIOL 3705 Introduction to Human Gross Anatomy 4 s.h.

Overview of human structure, using a regional approach to examine the functional anatomy of the musculoskeletal, nervous, and visceral systems. Three hours lecture, two hours lab.

Prereq.: BIOL 2602 or BIOL 2603.

BIOL 3705L Introduction to Human Gross Anatomy Laboratory 0 s.h.

Introduction to Human Gross Anatomy Laboratory.

BIOL 3711 Cell Biology: Fine Structure 3 s.h.

Theoretical and conceptual background necessary for understanding cellular structure-function relationships. Basic architecture of the cell, various organelles. The basic behavior of cells analyzed illustrating the integrative interaction of organelle systems.

Prereq.: BIOL 2601 or BIOL 2603.

BIOL 3721 Genetics 3 s.h.

Genetic material, reproductive cycles, sex determination, mitosis, meiosis, mendelism, probability linkage, genes in populations, mutation, evolution.

Prereq.: BIOL 2601 or BIOL 2603.

BIOL 3725 Mammalogy 3 s.h.

Overview of structure, function, evolutionary history, behavior, ecology, and classification of mammals. Animal groups will be studied from diverse biological points of view. Three hours lecture.

Prereq.: BIOL 2601, BIOL 2602.

BIOL 3730 Human Physiology 4 s.h.

Concepts of human physiology that focus on the regulation of homeostatic mechanisms by the neural, endocrine, cardiovascular, respiratory, and renal systems. Four hours lecture.

Prereq.: BIOL 2602 or BIOL 2603.

BIOL 3730L Human Physiology Laboratory 1 s.h.

Experimental approach to the study of human physiology that explores regulation of homeostasis by the neural, endocrine, cardiovascular, respiratory, and renal systems. Three hours laboratory.

Prereq. or concurrent: BIOL 3730.

BIOL 3740 Plant Diversity 4 s.h.

Examination of the diversity of plant species and their interaction with the environment; the morphology, reproduction and ecology of a wide variety of vascular and nonvascular plants. Three hours lecture, two hours lab.

Prereq.: BIOL 2602.

BIOL 3740L Plant Diversity Laboratory 0 s.h.

Plant Diversity Laboratory.

BIOL 3741 Animal Diversity 4 s.h.

Examination of the diversity of animal species and their interaction with the environment; the morphology, reproduction and ecology of a wide variety of invertebrate and vertebrate phylon. Three hours lecture, two hours lab.

Prereq.: BIOL 2602.

BIOL 3741L Animal Diversity Laboratory 0 s.h.

Animal Diversity Laboratory.

BIOL 3745 Plant Physiology 3 s.h.

Examination of the physiology of higher plants with emphasis on the whole plant aspects as well as on biochemical, cellular and molecular aspects of how plants function including transport and translocation of water and solutes, photosynthesis and respiration, growth and development.

Prereq.: BIOL 2602.

BIOL 3759 Evolution 3 s.h.

Examination of fundamental evolutionary mechanisms integral to such covered topics as natural selection, drift, genetic variance maintenance, gene flow consequences, phylogenetic resolution, modes of speciation, coevolution, cooperation and mating system structure. Ecological concepts will be integrated throughout.

Prereq.: BIOL 2601 and BIOL 2602 or instructor consent.

BIOL 3762 Field Botany 4 s.h.

Identification, ecology, and significance of local plants. Two hours lecture, four hours lab.

Prereq.: BIOL 2602.

BIOL 3762L Field Botany Laboratory 0 s.h.

Field Botany Laboratory.

BIOL 3780 General Ecology 5 s.h.

Examination of ecological principles affecting species distributions, interactions and biodiversity; dynamics of populations, communities and ecosystems; life history evolution; origin, maintenance and loss of genetic variation; mechanisms of speciation and extinction; experimental design and analysis. Three hours lecture, four hours lab.

Prereq.: BIOL 2602.

BIOL 3780L General Ecology Laboratory 0 s.h.

General Ecology Laboratory.

BIOL 4800 Bioinformatics 3 s.h.

Fundamentals of the theories and applications of bioinformatics. Topics include the tools and databases used to analyze DNA and protein sequences and the evolutionary relationships between sequences from different organisms. Three hours of lecture.

Prereq.: BIOL 3721 or BIOL 3759.

BIOL 4800L Bioinformatics Laboratory 1 s.h.

Learn how to use common bioinformatics tools and how to access public database to retrieve DNA, RNA, and protein sequence data, and perform functional and structural analysis of these sequences.

Prereq.: BIOL 3721 or BIOL 3759.

BIOL 4801 Environmental Microbiology 4 s.h.

The occurrence, detection, and control of microbes, including bacteria and viruses, in food, water, and the environment. Two hours lecture, four hours lab.

Prereq.: BIOL 3702.

BIOL 4801L Environmental Microbiology Laboratory 0 s.h.

Environmental Microbiology Laboratory.

BIOL 4802 Ecology of Lakes 3 s.h.

A study of the physical, chemical, biological, and ecological structure and function of lake ecosystems.

Prereq.: 20 s.h. of BIOL and/or GES, or permission of instructor.

BIOL 4803 Stream Ecology 3 s.h.

A study of the physical, chemical, biological, and ecological structure and function of stream ecosystems, and of their associated riparian zones.

Prereq.: 20 s.h. of BIOL and/or GES, or permission of instructor.

BIOL 4805 Ichthyology 3 s.h.

Ecology, evolution, and taxonomy of fishes, especially those of Midwestern United States. Two hours lecture, two hours lab.

Prereq.: BIOL 3741.

BIOL 4805L Ichthyology Laboratory 0 s.h.

Ichthyology Laboratory.

BIOL 4806 Ecosystem Field Ecology 4 s.h.

Students will learn about destination ecosystems, including associated organisms, interactions, physical, chemical, and climatic conditions, culture, and human impacts. Can be taken more than once for different destinations. Students must be in good health, hike, swim, and handle primitive conditions. This course involves travel expenses in addition to lab fees.

Prereq.: permission from instructor.

Coreq.: 3000-level course.

BIOL 4809 The Human Microbiome 3 s.h.

Covers microbial communities and their interactions associated with the human host. Scientific literature on the identity and roles of microbes associated with the human gut, oral cavity, skin, genital-urinary tract and respiratory system will be reviewed, presented, and discussed.

Prereq.: BIOL 3702.

BIOL 4811 Comparative Biomechanics 4 s.h.

Overview of biomechanical principles involved with the structure and function of animals. Topics include mechanical properties of biomaterials, comparative muscle architecture and physiology, and locomotor mechanisms of human walking and running. Three hours lecture, two hours lab.

Prereq.: BIOL 2602 or BIOL 3705, and PHYS 1501 or PHYS 2610.

BIOL 4811L Comparative Biomechanics Laboratory 0 s.h.

Comparative Biomechanics Laboratory.

BIOL 4818 Microbiome Gut Brain Axis 3 s.h.

This course examines bidirectional interactions between the host gut microbiome community and the host central nervous system (CNS), via a complex neural, endocrine, immune, and humoral network. The class will cover associations between the gut microbiome, gut function, and a wide spectrum of CNS disorders, emotions, and stress response, with a primary focus on evaluating various dietary regimes and dietary probiotic intervention strategies.

Prereq.: BIOL 4809 or by permission of instructor.

BIOL 4822 Principles of Pharmacology 3 s.h.

Overview of drugs used for the diagnosis, prevention, and treatment of disease. Topics include mechanisms of action, therapeutic and adverse drug effects, and clinical uses for each drug category.

Prereq.: BIOL 3730.

BIOL 4823 Cancer Biology 2 s.h.

This course will present the student with the comprehensive body of knowledge concerning cancer biology. It will draw upon all areas of biological sciences; from environmental causal factors to the molecular mechanisms underlying tumor cell formation and development of malignant tumors. The scientific basis of therapies will be explored.

Prereq.: Junior standing.

BIOL 4829 Microbial Physiology 3 s.h.

This course synthesizes material covered in introductory microbiology and cell and molecular biology. Topics include biomolecule synthesis, molecular biology, bacterial genetics, gene expression, energy production photosynthesis, bacteriophages and microbial stress response.

Prereq.: BIOL 3702 or BIOL 3711.

BIOL 4839 Selected Topics in Physiology 1 s.h.

Advanced study of topics in physiology not covered in depth in other physiology courses. May be repeated twice up to 2 s.h.

Prereq.: BIOL 3730.

BIOL 4848 Biology of Fungi 3 s.h.

Examination of fungal and fungal-like organisms with emphasis placed upon their taxonomy, phylogenetic relationships, structure, function, physiology, genetics, and ecology. Exploration of their role in agriculture, medicine, and scientific research.

Prereq.: BIOL 2602 or graduate standing.

BIOL 4849 Medical Mycology 3 s.h.

Survey of infectious diseases caused by fungi including their etiology, epidemiology, histopathology, diagnosis, and treatment. Host-parasite interactions and the environmental and molecular factors that contribute to establishment of fungal disease in humans and animals.

Prereq.: BIOL 2602.

BIOL 4850 Problems in Biology 1-3 s.h.

Special biological problems for which materials and equipment are available and for which the student is qualified.

Prereq.: Senior standing or consent of the chairperson.

BIOL 4861 Senior Biology Capstone Experience 2 s.h.

A capstone experience for the major in Biological Sciences (B.A. or B.S. degree).

Prereq.: Senior status in Biological Sciences, completion of at least one 3700 and 4800 level laboratory course.

Gen Ed: Capstone.

BIOL 4866 Forest Ecology 4 s.h.

A study of the structure, function, and management/conservation of forest ecosystems, including the biology and taxonomy of woody plants. Major emphasis on eastern North America.

Prereq.: 20 s.h. BIOL or GES, or combination thereof, or PI.

Coreq.: BIOL 4866L.

BIOL 4866L Forest Ecology Laboratory 0 s.h.

Forest Ecology Laboratory.

Prereq.: 20 semester hours BIOL or GES, or combination thereof, or PI.

Coreq.: BIOL 4866.

BIOL 4867 Stem Cell Biology 3 s.h.

This course deals with the study of stem cells and their role in biology. Developmental aspects of stem cells will be presented. The relevance of stem cells to medicine and applied biology will be discussed.

Prereq.: BIOL 3711 or BIOL 4890 or consent of instructor.

BIOL 4878 Conservation Biology 3 s.h.

A socioeconomic, political and ecological approach to issues associated with the maintenance and value of biodiversity and ecosystem services; consequences of anthropogenic climate change, fragmentation, overharvesting, extinction, and invasion of non-native species; biofuels; ecological restoration, nature reserve design and sustainability. Three hours lecture.

Prereq.: BIOL 3759 or BIOL 3780 or permission of instructor.

BIOL 4890 Molecular Genetics 3 s.h.

Examination of DNA structure, DNA replication, transcription, translation, RNA processing, and gene control in both prokaryotes and eukaryotes.

Prereq.: BIOL 3711 or BIOL 3721.

BIOL 4890L Molecular Genetics Laboratory 1 s.h.

Introduction to basic molecular techniques such as transformation, use of restriction enzymes, agarose gel electrophoresis, and polymerase chain reaction (PCR). Three hours lab.

Prereq.: BIOL 4890 or concurrent.

BIOL 4896 Introduction to Biomedical Research 2 s.h.

The class will introduce students to processes and strategies at the core of modern biomedical research. Students will develop an understanding of experimental design, experimental implementation, data evaluation and communication. Cross-Listed: BIOL 6904.

Prereq.: BIOL 3730.

BIOL 4899 Internships in the Biological Sciences 2 s.h.

Internships integrate theory and practice through supervised learning experiences. Internships are available in any area of the biological/biomedical sciences, including field research and analytical, clinical, or research laboratories. Students submit a proposal of the internship, maintain a journal of experiences, and submit a final project paper.

Prereq.: Junior or senior standing in Biological Sciences and permission of the chairperson.

BIOL 5806 Field Ecology 4 s.h.

Field study involving quantitative methods for the collection, analysis, and interpretation of ecological data in populations and communities. Pre-field trip lectures, specified experiments, independent study, a written report, and an oral presentation of the independent study project. Required off-campus travel. Field conditions may be rigorous and/or primitive.

Prereq.: BIOL 3780.

BIOL 5811 Ornithology 4 s.h.

Structure, physiology, behavior, ecology, and evolution of birds. Natural history of common bird species and important bird groups, especially those in Ohio. Basic methods and skills for field study of birds. Three hours lecture, three hours lab.

Prereq.: BIOL 3741.

BIOL 5811L Ornithology Laboratory 0 s.h.

Ornithology Laboratory.

BIOL 5813 Vertebrate Histology 4 s.h.

The microscopic study of mammalian tissues and organs. Three hours lecture, two hours lab.

Prereq.: BIOL 3711 or BIOL 3730.

BIOL 5813L Vertebrate Histology Laboratory 0 s.h.

Vertebrate Histology Laboratory.

BIOL 5823 Advanced Eukaryotic Genetics 3 s.h.

Mechanisms and control of eukaryotic DNA replication, current advances in understanding the genetics basis of cancer and other genetic diseases, problems and benefits of the various eukaryotic genome projects (human and others), gene therapy and genetic engineering in animals and plants.

Prereq.: BIOL 3721 and BIOL 4890.

BIOL 5824 Behavioral Neuroscience 4 s.h.

Explores the biological basis of human experience and behavior. Topics include basic neuroanatomy and neuropharmacology, emotions, learning and memory, sleep and biological rhythms, reproductive behavior, and communication. Three hours lecture, three hours lab.

Prereq.: BIOL 3730.

BIOL 5824L Behavioral Neuroscience Laboratory 0 s.h.

Behavioral Neuroscience Laboratory.

BIOL 5827 Gene Manipulation 2 s.h.

Techniques of modern molecular biology including the use of restriction enzymes, plasmid and phage vectors, Southern blots and the polymerase chain reaction (PCR). Introduction and manipulation of foreign DNA in bacterial and eukaryotic systems. Six hours lab.

Prereq.: BIOL 4890.

BIOL 5833 Mammalian Endocrinology 3 s.h.

Detailed examination of the hormones of the hypothalamus, pituitary, thyroid, adrenal pancreas, gonads, and other organs with putative endocrine function. Focus on the physiological functions of hormones and their mechanisms of action with emphasis on the human.

Prereq.: BIOL 3730.

BIOL 5840 Advanced Microbiology 3 s.h.

Molecular mechanisms for virulence of pathogenic organisms.

Prereq.: BIOL 3702 or equivalent.

BIOL 5844 Physiology of Reproduction 3 s.h.

Current concepts of reproductive processes and their physiological control in mammalian systems.

Prereq.: BIOL 3730.

BIOL 5853 Biometry 3 s.h.

Application of fundamental theory and procedures to the statistical analysis of biological data.

Prereq.: 20 s.h. of Biological Sciences.

BIOL 5858 Computational Bioinformatics 3 s.h.

Project-based learning course with a focus on using a Linux environment and PERL for processing large genomic datasets and data mining. Relational database and BioPERL will also be introduced for genomic data analysis and display. Three hours of combined lecture and lab per week.

BIOL 5888 Environmental Biotechnology 3 s.h.

This course provides an overview of environmental biotechnology, engineering fundamentals, theory, and principles in application of biological treatment to solve environmental problems. Topics include relevant biological, chemical, and ecological processes, biological treatments of waste, land, and water. Environmental biotechnology is an essential tool to help humanity face enormous environmental health challenges, especially pollution, climate change, loss of habitat, and resulting threats to wildlife and human populations, their health outcomes and survival potential. This course is designed to summarize modern insights regarding evaluation and applications of environmental biotechnology.

Prereq.: CHEM 3719 or CEEN 3736.

BIOL 5888L Environmental Biotechnology Laboratory 0 s.h.

Environmental Biotechnology Laboratory.