

DEPARTMENT OF BIOLOGICAL SCIENCES

(330) 941-3601

Room 4037 Ward Beecher Science Hall

Courses in the Department of 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

The department 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 the **Department of Biological Sciences**.

Chair

Gary R. Walker, Ph.D., Professor, Chair

Professor

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

Deborah Fairchild Benyo, Ph.D., Assistant Professor

Michael Butcher, Ph.D., Associate Professor

Jonathan J. Caguiat, Ph.D., Associate Professor

Chester R. Cooper, Ph.D., Professor

Thomas P. Diggins, Ph.D., Professor

Diana L. Fagan, Ph.D., Professor

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

Carl G. Johnston, Ph.D., Professor

Johanna Krontiris-Litowitz, Ph.D., Professor

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

Xiangjia Min, Ph.D., Professor

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

Mark D. Womble, Ph.D., Professor

Majors

- BS in Biological Sciences (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-biological-sciences/bs-biological-sciences>)
- BA in Biological Sciences (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-biological-sciences/ba-biological-sciences>)

Certificates

- Certificate in Anatomy and Physiology (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-biological-sciences/anatomy-and-physiology-certificate>)
- Certificate in Biomedical Research (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-biological-sciences/biomedical-research-certificate>)
- Certificate in Molecular and Biotechnology (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-biological-sciences/molecular-biology-and-biotechnology-certificate>)

Minors

- Biological Sciences Minor (<http://catalog.yzu.edu/archives/2018-2019/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/departments-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 1505H Honors Biology and 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 1 Laboratory for Health Professions 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: Molecules and Cells 4 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, three hours of lab per week.

Prereq.: CHEM 1515 or concurrent enrollment in CHEM 1515.

Gen Ed: Natural Science.

BIOL 2601H Honors General Biology Molecules and Cells 4 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, three hours of lab per week.

Prereq.: CHEM 1515 or concurrent enrollment in CHEM 1515.

Gen Ed: Natural Science.

BIOL 2601L General Biology: Molecules and Cells Laboratory 0 s.h.

General Biology: Molecules and Cells Laboratory.

BIOL 2602 General Biology: Organisms and Ecology 4 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, three hours of lab per week.

Prereq.: BIOL 2601 and CHEM 1515.

Gen Ed: Natural Science.

BIOL 2602H Honors General Biology Organisms and Ecology 4 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, three hours of lab per week.

Prereq.: BIOL 2601 and CHEM 1515.

Gen Ed: Natural Science.

BIOL 2602L General Biology: Organisms and Ecology Laboratory 0 s.h.

General Biology: Organisms and Ecology Laboratory.

BIOL 2603 Integrated Biology for BS/MD 4 s.h.

Prereq.: admittance to the BS/MD program, BaccMed program, BS in Biochemistry, or Electrical and Computer Engineering with a Biomedical emphasis.

BIOL 3701 Biomathematics Seminar 1 s.h.

Introduction to interdisciplinary research in Biology and Mathematics. Topics include current research by faculty and students, cross disciplinary communication, report writing, technical presentations, literature reading, laboratory techniques and safety. May be repeated once. Listed also as MATH 3701.

Prereq.: MATH 1571 or BIOL 2601 or BIOL 2602.

BIOL 3702 Microbiology 4 s.h.

Fundamentals of the biology of microbes. The principles of microbial structure, function, reproduction, metabolism, genetics, phylogeny, host-parasite relationships, and immunity. Fundamental technical skills acquired through laboratory experiences. Three hours lecture, three hours laboratory.

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

BIOL 3702L Microbiology Laboratory 0 s.h.

Microbiology Laboratory.

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 3710 Mammalian Anatomy 3 s.h.

Composite study of the anatomical systems of mammals, based on the cat. One hour lecture, four hours lab.

Prereq.: BIOL 2602.

BIOL 3710L Mammalian Anatomy Laboratory 0 s.h.

Mammalian 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 3716 Molecular Microbiology 1: Nucleic Acids 4 s.h.

Isolation and characterization of DNA and RNA from microbes with an emphasis on cloning, sequencing, structural characterization, expression, and phylogenetic analysis. Two hours lecture, six hours laboratory.

Prereq.: BIOL 3702 and permission of the instructor.

BIOL 3717 Molecular Microbiology 2 4 s.h.

Protein Biology. Develops the analytical skills necessary to conduct molecular biology research in the area of protein analysis and proteomics. Two hours lecture and four hours laboratory per week.

Prereq.: BIOL 3702.

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 3775 Comparative Vertebrate Anatomy 3 s.h.

Comparison of morphology of vertebrates, emphasizing evolutionary development of organ systems. Two hours lecture, three hours lab.

Prereq.: BIOL 2602.

BIOL 3775L Comparative Vertebrate Anatomy Laboratory 0 s.h.

Comparative Vertebrate Anatomy 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 4 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, two hours of lab per week.

Prereq.: BIOL 3721.

BIOL 4800L Bioinformatics Laboratory 0 s.h.

Bioinformatics Laboratory.

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 4804 Aquatic Biology 3 s.h.

Ecological, physical, and chemical aspects of aquatic ecosystems. Study of the interaction between organisms and their environment.

Prereq.: BIOL 3780.

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 4819 Taxonomy of Flowering Plants 4 s.h.

Phylogenetics, systematics, geographical distribution, and evolutionary development of herbaceous plants; taxonomic systems based on morphology and biochemistry. Laboratory exercises include the writing of a genus revision. Two hours lecture, four hours lab.

Prereq.: BIOL 3740 or consent of instructor.

BIOL 4819L Taxonomy of Flowering Plants Laboratory 0 s.h.

Taxonomy of Flowering Plants Laboratory.

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 4830 Functional Neuroanatomy 4 s.h.

An examination of the structure, function, integration, and cellular control of the brain and spinal cord. Three hours lecture, two hours lab.

Prereq.: BIOL 3730.

BIOL 4830L Functional Neuroanatomy Laboratory 0 s.h.

Functional Neuroanatomy Laboratory.

BIOL 4834 Advanced Physiology: Integrative Mechanisms 3 s.h.

Examination of advanced human physiology through a detailed study of selected body systems. Systems examined may include the cardio-vascular, respiratory, and renal systems, exchange dynamics among body fluid compartments, and acid-base balance. Three hours lecture.

Prereq.: BIOL 3730.

BIOL 4834L Advanced Physiology: Integrative Mechanisms Laboratory 1 s.h.

Experimental approach to the examination of advanced human physiology through a detailed study of selected body systems. Systems examined may include the cardiovascular, renal and respiratory systems, exchange dynamics among body fluid compartments, and acid-base balance. Three hours lab.

Prereq. or concurrent BIOL 4834.

BIOL 4835 Advanced Physiology: Regulatory Mechanisms 3 s.h.

Examination of advanced human physiology through a detailed study of selected body systems. Systems examined may include musculoskeletal, gastrointestinal, metabolic and thermoregulatory. Three hours lecture.

Prereq.: BIOL 3730.

BIOL 4835L Advanced Physiology: Regulatory Mechanisms Laboratory 1 s.h.

Experimental approach to the examination of advanced human physiology through a detailed study of selected body systems. Systems examined may include the musculoskeletal, gastrointestinal, metabolic and thermoregulatory. Three hours lab.

Prereq. or concurrent BIOL 4835.

BIOL 4836 Cell Biology: Molecular Mechanisms 3 s.h.

The relationship of molecular structure to cellular function. Concepts will be presented integrating the biochemical dynamics of bio-membrane systems including receptors, bioenergetics, and the physiochemical environment. Three hours of lecture.

Prereq.: BIOL 3711 or consent of instructor.

BIOL 4836L Cell Biology: Molecular Mechanisms Laboratory 0 s.h.

Cell Biology: Molecular Mechanisms Laboratory.

BIOL 4837 Cell Biology: Protein Biology Laboratory 1 s.h.

The relationship of nucleic acid structure and protein structure will be studied in hands on series of laboratory experiments. Concepts presented will integrate the use of modern molecular biology techniques with contemporary approaches to current problems in biology. Three hours of laboratory.

Prereq.: BIOL 3711 or consent of instructor.

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 4841 Animal Parasitology 3 s.h.

Biological implications of parasitism. Diagnosis, morphology, and life histories of the parasites of humans and domestic animals. One hour lecture, four hours lab.

Prereq.: BIOL 3702.

BIOL 4841L Animal Parasitology Laboratory 0 s.h.

Animal Parasitology Laboratory .

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.

BIOL 4866 Dendrology 4 s.h.

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

Prereq.: BIOL 3740 or BIOL 3762.

BIOL 4866L Dendrology Laboratory 0 s.h.

Dendrology Laboratory.

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 4871 Entomology 4 s.h.

Introduction to the morphology, physiology, development, and control of insects. Survey of insect orders and families. Two hours lecture, four hours lab.

Prereq.: BIOL 3741.

BIOL 4871L Entomology Laboratory 0 s.h.

Entomology Laboratory.

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 4882 Biomathematics Research 1-2 s.h.

Interdisciplinary and individualized study of a topic in biology and mathematics. Student project mentored jointly by faculty in biology and mathematics. May be repeated once. Grading is Traditional/PR. Listed also as MATH 4882.

Prereq.: MATH 3701/BIOL 3701, senior status and permission of the department chairperson.

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 4893 Biology of Proteins 2 s.h.

This course engages the student in the world of proteins, from the basic structure and function of proteins in biological systems, to the applied sciences involved in the development of commercially valuable proteins. This course extends the students previous understanding and expertise in molecular biology to emphasize proteins.

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

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.

Prereq.: BIOL 3730.

BIOL 4897 Internship in Biomedical Research 3 s.h.

This course designed for a student pursuing the Certificate in Biomedical Research. Students enrolled in this course will be assigned to a research project in collaboration with physicians from the Mercy Health system. This course will provide the student with a comprehensive clinical research experience.

Prereq.: Accepted into Certificate in Biomedical Research program; concurrent or previously taking BIOL 4896.

BIOL 4898 Research in Physiology 3 s.h.

A comprehensive laboratory experience under the supervision of a faculty mentor. Course may be repeated once for a total of 6 s.h.

Prereq.: BIOL 3730, CHEM 3720, and acceptance into the Certificate in Anatomy and Physiology program.

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 5832 Principles of Neurobiology 4 s.h.

Topics include cell and molecular biology of the neuron, properties of excitable membranes, functional neuroanatomy, integrated motor control, sensory signal transduction, developmental neurobiology, mechanisms of disease processes, and higher cortical function.

Prereq.: BIOL 3730.

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 5861 Animal Behavior 3 s.h.

Detailed examination of a variety of topics necessary for understanding animal behavior. Historical approaches to animal behavior, evolution and behavior genetics, physiology of behavior, behavioral ecology, and social organization and mating systems.

Prereq.: BIOL 3741 or permission of instructor.

BIOL 5865L Functional Human Gross Anatomy Lab 0 s.h.

Functional Human Gross Anatomy Lab.

BIOL 5868 Gross Anatomy 1 4 s.h.

Regional study of the human body with emphasis on functional and topographic anatomy and clinical correlations. Two hours lecture-demonstration, four hours lab.

Prereq.: Admission to the YSU Physical Therapy program or permission of instructor.

BIOL 5868L Gross Anatomy 1 Laboratory 0 s.h.

Gross Anatomy 1 Laboratory.

BIOL 5869 Gross Anatomy 2 4 s.h.

Regional study of the human body with emphasis on functional and topographic anatomy and clinical correlations. Two hours lecture-demonstration, four hours lab.

Prereq.: BIOL 5868.

BIOL 5869L Gross Anatomy 2 Laboratory 0 s.h.

Gross Anatomy 2 Laboratory.

BIOL 5888 Environmental Biotechnology 4 s.h.

Lectures will cover the use of microbes for solving environmental problems. In the laboratory, teams of students will design and implement experiments in bioremediation. This course is intended for students in biology, environmental studies, chemistry, and engineering. Two hours lecture and four hours lab.

Prereq.: CHEM 3719 or CEEN 3736.

BIOL 5888L Environmental Biotechnology Laboratory 0 s.h.

Environmental Biotechnology Laboratory.