BIOL 1551L Anatomy and Physiology 1 Laboratory 1 s.h.
Anatomical study of skeletal, muscular, and nervous systems. Targeted for students in nursing and associated health professions. Three hours of lecture. Not applicable to the Biology major.
Prereq.: BIOL 1551.
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: 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, two hours of lab per week. 
Prereq.: BIOL 2601 or concurrent enrollment in CHEM 1515.

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.

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.

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 2604 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 2602L.

BIOL 2604L Microbiology Laboratory 0 s.h.
Microbiology Laboratory.

BIOL 2605 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 2602 recommended.

BIOL 2605L 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.

BIOL 2605L Clinical Immunology Laboratory 1 s.h.
Concurrent with: BIOL 3703.

BIOL 2606 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 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 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 or BIOL 3799.

**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 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 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 musculoskeletal, gastrointestinal, metabolic and thermoregulatory. Three hours lecture.
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 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 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 4882 Mathematical Biology Research 1-3 s.h.
Introduction to research in mathematical biology through an interdisciplinary study of a topic in biology and mathematics. May be repeated once. Grading is Traditional/PR. Cross-listed: MATH 4882.
Prereq.: MATH 1571 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 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.
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 5813</td>
<td>Vertebrate Histology</td>
<td>4 s.h.</td>
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<td>Vertebrate Histology Laboratory</td>
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<tr>
<td>BIOL 5823</td>
<td>Advanced Eukaryotic Genetics</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5824</td>
<td>Behavioral Neuroscience</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL 5827</td>
<td>Gene Manipulation</td>
<td>2 s.h.</td>
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<tr>
<td>BIOL 5832</td>
<td>Principles of Neurobiology</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL 5833</td>
<td>Mammalian Endocrinology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5840</td>
<td>Advanced Microbiology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5844</td>
<td>Physiology of Reproduction</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5853</td>
<td>Biometry</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5858</td>
<td>Computational Bioinformatics</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5868</td>
<td>Gross Anatomy 1</td>
<td>4 s.h.</td>
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<td>Gross Anatomy 1 Laboratory</td>
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<td>BIOL 5869</td>
<td>Gross Anatomy 2</td>
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<td>Gross Anatomy 2 Laboratory</td>
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<tr>
<td>BIOL 5888</td>
<td>Environmental Biotechnology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL 5888L</td>
<td>Environmental Biotechnology Laboratory</td>
<td>0 s.h.</td>
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**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 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 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 5844**
- **Physiology of Reproduction** 3 s.h.
  - Current concepts of reproductive processes and their physiological control in mammalian systems.
  - **Prereq.**: BIOL 3730.

**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.