DEPARTMENT OF MOLECULAR, CELLULAR AND DEVELOPMENTAL BIOLOGY

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Mission

The Department of Molecular, Cellular and Developmental Biology exists to provide the best possible educational experiences for all undergraduate and graduate students under its jurisdiction, to advance the frontiers of biology through research and to serve as an intellectual resource to the community at large.

Description

The Department of Molecular, Cellular and Developmental Biology is highly interdisciplinary with faculty employing a wide range of innovative experimental approaches and model systems to study topics such as cancer, immunology, reproductive biology, neurobiology, and virology. Our students benefit from the vibrant research and training atmosphere of our department, with undergraduate and graduate students working closely with faculty to find their passion for biology both within the lecture halls and at the lab bench. Together with other departments across the university, we strive to provide an integrative environment to prepare the next generation of leaders in the life sciences.

Degrees Offered

The Department of Molecular, Cellular and Developmental Biology offers degree programs for a Bachelor of Science and a Bachelor of Arts in Biology, a Bachelor of Science in Neuroscience, and a Bachelor of Science in Medical Laboratory Science. A concentration in neuroscience is available to students in either the Bachelor of Science or Bachelor of Arts in Biology programs. A concentration in Bioinformatics is available for students pursuing the BS in Biology + MS in Bioinformatics dual degree pipeline program.The Department of Environmental Sciences also offers a degree program for a Bachelor of Science in Biology, with a concentration in ecology and organismal biology (see that department's section for requirements).

Advanced Placement

- Students with a score of 3 will receive credit for BIOL 1120;
- students with a score of 4 will receive credit for BIOL 2170;
- students with a score of 5 will receive credit for BIOL 2150 and BIOL 2170.

Students earning Advanced Placement (AP) scores of 4 or 5 may receive credit for BIOL 2160 and/or BIOL 2180 upon evaluation of their AP laboratory materials by the Department of Molecular, Cellular and Developmental Biology.

Junior Year Studies in England for Biology Majors

The Department of Molecular, Cellular and Developmental Biology participates in a well-established exchange program with the University of Salford, England. Selected University of Toledo biology (and pre-medical, pre-dental and pre-veterinary) students have the opportunity to spend their junior year at Salford. Participants in the program will pay their instructional and general fees to The University of Toledo. Eligibility to participate in the program is based on criteria established by the Department of Molecular, Cellular and Developmental Biology. Information on the program may be obtained from the departmental exchange program advisor, Dr. Brian Ashburner. Details are available on academic issues, living accommodations, recreational opportunities and life in England on the departmental Web site at http://www.utoledo.edu/nsm/bio/salford/.

Degrees and Programs Offered

- BA in Biology (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/ba-biology/)
- BS in Biology (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/bs-biology/)
- BS in Medical Laboratory Science (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/bs-medical-laboratory-science/)
- BS in Neuroscience (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/bs-neuroscience/)
- Certificate in Biological Laboratory Technician (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/biological-laboratory-technician-certificate/)
- Certificate in Clinical Microbiology for Medical Laboratory Science (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/clinical-microbiology-for-medical-laboratory-science-certificate/)
- Minor in Biology (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/molecular-cellular-developmental-biology/minor-biology/)

BIOL 1120 Survey Of Biology
[3 credit hours]
A survey of major biological principles and phenomena in various plants and animals with emphasis on man. (not for major credit) .
Term Offered: Spring, Summer, Fall
Core Natural Sciences, OT36 Natural Science

BIOL 1220 Survey Of Biology Laboratory
[1 credit hour]
(Not for major credit) A series of laboratory exercises that supplement the material discussed in BIOL 1120.
Corequisites: BIOL 1120
Term Offered: Spring, Summer, Fall
Core Natural Sciences

BIOL 2010 Major Concepts In Biology
[3 credit hours]
This course will discuss topics related to the major concepts of biology such as evolution, the cell, the gene and homeostasis. This course is designed for students majoring in science, engineering or other fields that require biology as a prerequisite who have not had sufficient preparation to begin the Fundamentals of Life Science series (BIOL 2150 or BIOL 2170).
Term Offered: Spring, Summer, Fall
Core Natural Sciences

BIOL 2050 Fundamentals of Neuroscience I
[3 credit hours]
Introduction to the structure and function of the nervous system at cellular and anatomical levels, with an emphasis on neuronal communication, information flow, and integration among major nervous system components
Prerequisites: BIOL 2170 with a minimum grade of C and CHEM 1230 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 2150 Fundamentals Of Life Science: Diversity Of Life, Evolution And Adaptation
[4 credit hours]
An introduction to the diversity of multicellular life on earth, evolution and physiological adaptations.
Prerequisites: BIOL 2010 with a minimum grade of C or CHEM 1090 with a minimum grade of C or CHEM 1230 with a minimum grade of C or ACT Composite with a score of 21 or BIOL 2170 with a minimum grade of C or Aleks Chem Placement Highest with a score of 50
Term Offered: Spring, Summer, Fall
Core Natural Sciences, OT36 Natural Science

BIOL 2160 Fundamentals Of Life Science Laboratory: Diversity Of Life, Evolution And Adaptation
[1 credit hour]
A series of laboratory exercises which supplement the material discussed in BIOL 2150.
Corequisites: BIOL 2150
Term Offered: Spring, Summer, Fall
Core Natural Sciences, OT36 Natural Science

BIOL 2170 Fundamentals of Life Science: Biomolecules, Cells, and Inheritance
[4 credit hours]
A general introduction to cell structure and function, energy processing in plants and animals, basic genetics, molecular biology and development.
Prerequisites: CHEM 1090 with a minimum grade of C or CHEM 1230 with a minimum grade of C or BIOL 2010 with a minimum grade of C or BIOL 2150 with a minimum grade of C or ACT Composite with a score of 21 or Aleks Chem Placement Highest with a score of 50
Term Offered: Spring, Summer, Fall
Core Natural Sciences, OT36 Natural Science

BIOL 2180 Fundamentals of Life Science Laboratory: Biomolecules, Cells, and Inheritance
[1 credit hour]
A series of laboratory exercises which supplement the material discussed in BIOL 2170.
Corequisites: BIOL 2170
Term Offered: Spring, Summer, Fall
Core Natural Sciences, OT36 Natural Science

BIOL 2910 Biological Research
[1 credit hour]
A discussion/demonstration of opportunities for undergraduate research in Biology at the University of Toledo and elsewhere.
Term Offered: Spring

BIOL 2980 Special Topics in Biology
[1-4 credit hours]
Selected topics in biology for biology majors and non-majors.
Prerequisites: ENGL 1110 with a minimum grade of D- or MATH 1180 with a minimum grade of D-

BIOL 3010 Molecular Genetics
[3 credit hours]
The principles of heredity at the molecular level, covering gene and chromosome structure, replication and repair, recombination, control of gene expression, control of cell division.
Prerequisites: BIOL 2170 with a minimum grade of C and (CHEM 1230 with a minimum grade of C or CHEM 1240 with a minimum grade of C-)
Term Offered: Spring, Summer, Fall

BIOL 3020 Molecular Genetics Laboratory
[2 credit hours]
A laboratory course in experimental molecular biology involving gene cloning, analysis of cloned product and other techniques of modern molecular genetics.
Corequisites: BIOL 3010
Term Offered: Spring, Fall

BIOL 3030 Cell Biology
[3 credit hours]
A study of the internal organization of the eukaryotic cell, organelle and membrane function, cell-cell signaling, cell movement, cell adhesion, and the extracellular matrix.
Prerequisites: BIOL 2170 with a minimum grade of C and CHEM 1240 with a minimum grade of C-
Term Offered: Spring, Summer, Fall

BIOL 3040 Cell Biology Laboratory
[2 credit hours]
Laboratory exercises involving cell culturing, protein analysis, protein localization and other techniques of modern cell biology.
Corequisites: BIOL 3030
Term Offered: Spring, Summer, Fall

BIOL 3050 Fundamentals of Neuroscience II
[3 credit hours]
Exploration of the major neural mechanisms that generate, transform, integrate, and store information, drive behavior, maintain physiological homeostasis, and cause neurological disease when compromised.
Prerequisites: (BIOL 2050 with a minimum grade of C or NSCI 2050 with a minimum grade of C) and CHEM 1240 with a minimum grade of C
Term Offered: Fall

BIOL 3060 Neuroscience Laboratory
[2 credit hours]
A practical course providing training in foundational laboratory techniques in the neurosciences.
Prerequisites: NSCI 3050 with a minimum grade of C and BIOL 2180 with a minimum grade of C
Term Offered: Spring

BIOL 3070 Human Physiology
[3 credit hours]
Detailed structural and functional analysis of the human endocrine, nervous, reproductive, circulatory, respiratory, digestive and excretory systems. An emphasis will be placed on system-system interactions and homeostatic mechanisms.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Summer, Fall

BIOL 3090 Developmental Biology
[3 credit hours]
Lectures on molecular and cellular interactions in animal and plant embryogenesis and development.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 3100 Developmental Biology Laboratory
[1 credit hour]
An analysis of development by biochemical and biological methods using live materials.
Prerequisites: BIOL 3090 (may be taken concurrently) with a minimum grade of C
Term Offered: Fall

BIOL 3210 Human Nutrition
[3 credit hours]
Lectures covering nutrition and transport in humans, role of nutrition in growth and development, nutritional diseases.
Prerequisites: BIOL 3070 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 3510 Comparative Vertebrate Anatomy
[4 credit hours]
A comparative treatment of the evolutionary and developmental history of the major vertebrate organ systems.
Prerequisites: (BIOL 2150 with a minimum grade of C and BIOL 2160 with a minimum grade of C and BIOL 2170 with a minimum grade of C and BIOL 2180 with a minimum grade of C)
Term Offered: Spring, Fall

BIOL 3910 Research Project Laboratory
[2-3 credit hours]
Provides hands-on authentic research experience and comprehensive understanding of the scientific process. May be repeated once for credit, a maximum of 3 hours may be applied to BIOL elective credits in the major or minor.
Prerequisites: BIOL 2170 with a minimum grade of D- and BIOL 2180 with a minimum grade of D-
Term Offered: Spring, Fall

BIOL 4010 Molecular Biology
[3 credit hours]
Analysis of the regulatory mechanisms for nucleic acid and protein synthesis; genome structure; recombination; genetic damage and repair.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4030 Microbiology
[3 credit hours]
Lectures on the principles of modern microbiology and virology, including metabolism, growth, cellular morphology, genetics and host parasite relationships. Bacterial and viral diseases will be illustrated.
Prerequisites: BIOL 3030 with a minimum grade of C and CHEM 2410 with a minimum grade of C-
Term Offered: Spring, Fall

BIOL 4031 Cell Biology of Neurons and Glia
[3 credit hours]
An advanced course examining the cell biology of neurons and glia in normal nervous system function and disease.
Prerequisites: NSCI 3050 with a minimum grade of C and BIOL 3030 with a minimum grade of C
Term Offered: Fall

BIOL 4040 Microbiology Laboratory
[1 credit hour]
Laboratories utilizing basic microbiological techniques and illustrating principles of growth, identification and genetics and control of microbes.
Prerequisites: BIOL 4030 (may be taken concurrently) with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4050 Immunology
[3 credit hours]
Lectures on the chemical, genetic and cellular basis of the immune response.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4060 Immunology Laboratory
[1 credit hour]
Laboratory studies of the immune response.
Corequisites: BIOL 4050
Term Offered: Spring, Fall

BIOL 4090 Cancer Biology
[3 credit hours]
Introduction to carcinogenesis and the cellular and molecular features of malignancy. Methods to diagnose and treat malignancies will also be presented.
Prerequisites: (BIOL 3030 with a minimum grade of C and BIOL 3010 with a minimum grade of C)
Term Offered: Fall

BIOL 4110 Human Genetics and Genomics
[3 credit hours]
A systematic survey of genetic variation in man with emphasis on modern research methodology including genomics.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4210 Molecular Basis of Disease
[3 credit hours]
Examines the genetic, molecular, and biochemical defects associated with some of the most common human diseases. Includes a review of current research into the molecular causes of selected diseases.
Prerequisites: BIOL 3010 with a minimum grade of C and BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4230 Comparative Animal Physiology
[3 credit hours]
Lectures on the comparative and environmental physiology of vertebrates and invertebrates including metabolism, temperature regulation, respiration, circulation, excretion and osmotic regulation.
Prerequisites: (BIOL 3030 with a minimum grade of C and BIOL 3070 with a minimum grade of C)
Term Offered: Spring

BIOL 4250 Introduction to Neurobiology
[3 credit hours]
An introduction to the molecular, genetic and cellular aspects of neurobiology in humans and model organisms. Topics include neuronal physiology and signaling, neural development, sensation, muscle control, learning and memory.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Fall

BIOL 4330 Parasitology
[3 credit hours]
A study of the host-parasite interaction including aspects of parasite morphology, taxonomy, development and ecology.
Prerequisites: (BIOL 2150 with a minimum grade of C and BIOL 2170 with a minimum grade of C)
Term Offered: Spring, Fall

BIOL 4700 Biological Literature And Communication
[3 credit hours]
A writing intensive course that focuses on reading original literature in biology in a variety of formats. Required of all biology majors.
Prerequisites: BIOL 3030 with a minimum grade of C
Term Offered: Spring, Summer, Fall

BIOL 4790 Biology Field Trip
[2-4 credit hours]
Faculty directed course that incorporates extensive field experience and individual projects.
Term Offered: Spring

BIOL 4910 Undergraduate Research
[1-3 credit hours]
Faculty directed research. Both oral and written reports of results required.
Term Offered: Spring, Summer, Fall

BIOL 4940 Extramural Research
[1-4 credit hours]
Prior consent of both the department and the proposed supervisor. Scientist-supervised study of research done in an extramural research institute or scientific laboratory. Written and oral reports to the department required. Maximum of 6 hours may count toward BIOL electives.
Prerequisites: (BIOL 2150 with a minimum grade of C and BIOL 2170 with a minimum grade of C)
Term Offered: Spring, Summer, Fall

BIOL 4950 Internship In Biology
[1-12 credit hours]
Supervised practical experience in the field of biology. Maximum of 6 hours may be used as biology elective credit for BS degree.
Term Offered: Spring, Summer, Fall

BIOL 4980 Advanced Topics In Biology
[1-3 credit hours]
An advanced course for Biology majors in an important area of biology May be repeated for credit under different specialty numbers (topics).
Term Offered: Spring

BIOL 4990 Independent Study In Biology
[1-3 credit hours]
Faculty directed readings or projects in a specific area of biology.
Term Offered: Spring, Summer, Fall

Honors in Biology

The Department of Molecular, Cellular and Developmental Biology Honors Program is available for qualified majors. Interested students should contact the departmental honors advisor before the beginning of the sophomore year.

To receive an undergraduate degree with honors in biology, all requirements for the B.S. or B.A. degree plus an additional 6 credits of Undergraduate Research/Honors Thesis BIOL 4910) must be completed with a minimum GPA of 3.2 overall and in BIOL courses. The program of study must include honors sections of at least two BIOL courses in addition to BIOL 4910. No more than 3.0 hours of undergraduate research can be taken in any one semester. The Undergraduate Research/Honors Thesis credits are completed under the direction of a faculty research director selected by the student. Students must submit a written Honors Thesis to the department before completion of their senior year and make a formal public presentation of their research (typically at the spring Biology Undergraduate Research Symposium). The requirement of Honors Thesis research may be fulfilled in one of three ways:

1. Laboratory research in a Department of Molecular, Cellular and Developmental Biology faculty member's laboratory;
2. Laboratory research in a summer or academic year program, in which the student carries out full-time independent research for at least 10 weeks under the direction of a senior scientist on a topic approved by the departmental honors advisor and/or the department chair;
3. Laboratory research in the laboratory of a senior scientist who is not a member of the Department of Molecular, Cellular and Developmental Biology on a topic approved by the departmental honors advisor and/or the department chair.

For options 2 and 3, it is very important that the student get his/her proposed thesis research project approved in advance by the departmental honors advisor and/or the department chair, who will monitor progress and direct the BIOL 4910 courses.

Honors in Neuroscience

To receive an undergraduate degree with honors in neuroscience, all requirements for the B.S. or B.A. degree plus an additional 2 NSCI courses numbered 2000 level and above as Honors (may be honors sections or regular section with honors contract) plus 6 credits of Undergraduate Research/Honors Thesis BIOL 4910 or INDI 4000 must be completed with a minimum GPA of 3.2 overall and in NSCI courses. The 6 credits of BIOL4910 or INDI4000, includes the 3 BIOL4910/INDI4000 credits required by the Neuroscience Major. No more than 3.0 hours of undergraduate research can be taken in any one semester. The Undergraduate Research/Honors Thesis credits are completed under the direction of a faculty research director selected by the student, and must be broadly Neuroscience focused. Students must submit a written Honors Thesis to the department before completion of their senior year and make a formal public presentation of their research (typically at the spring Biology Undergraduate Research Symposium).

University Honors or Honors College Honors will consist of Departmental Honors plus additional Honors credits specified by the Honors College.