Cell and Systems Biology Programs

The Cell and Systems Biology department offers a number of programs. The programs include animal physiology, cell and molecular biology, developmental biology and genome biology. These programs are designed to allow you to follow a certain sub-discipline within cell and systems biology. A broader biology program is available for those who prefer to follow a more general program. All of these programs can help guide you towards a career as a scientist in academia or business, or as a healthcare or other professional.

Animal Physiology (Major - ASMAJ1538)

Animal physiology is the study of the anatomical and functional similarities and differences between different kinds of animals. Knowledge of how organisms are able to tolerate and exploit extreme environments has led to insight into why other animals, including human beings, are vulnerable to such conditions. Animal physiology is also concerned with the ways in which animal structure and function are able to adapt so as to facilitate or constrain behavioural performance.

Cell and Molecular Biology (Specialist - ASSPE1003, Major - ASMAJ1003)

Cell and molecular biology research answers fundamental questions. How does a tadpole develop from a single fertilized egg cell? How do stem cells regenerate body parts? What goes wrong when cells become cancerous? To answer all of these questions we must understand how the thousands of genes in our genomes function together to orchestrate cellular processes. Students joining the Cell and Molecular Biology Specialist or Major program offered by the Department of Cell and Systems Biology at the University of Toronto will examine how genes interact in cells and how cells interact to form organisms. They will also learn how cell and molecular biology research is conducted, and receive training in advance microscopy, molecular biology and computer analysis. Cell and molecular biology research is one the most demanding fields in science, requiring the integration of multiple subject areas, experimental skill and creative thinking. Our Cell and Molecular Biology Specialist and Major programs foster growth in these areas. Our students gain an understanding of cell and molecular biology, and leave the program equipped to tackle fundamental cell and molecular biology questions themselves.

In addition to the general Cell and Molecular Biology program, there are areas of focused study for high-achieving students with an interest in one of three major areas of cell and molecular biology. These Focuses also connect students together with faculty-led learning communities through years 2-4. The Focuses are:

Cell and Molecular Biology: Focus in Molecular Networks of the Cell (Specialist or Major)

Course offerings include: Techniques in Molecular and Cell Biology; Neurobiology of the Synapse; Extracellular Matrix Dynamics and Associated Pathologies; Advanced Cell Biology I: Cellular Dynamics During Development; Introduction to Plant-Microbe Interactions; Drosophila as a Model in Cancer Research; Advanced Cell Biology II: Cell Polarity and Cytoskeletal Dynamics; Germ Cell Biology; Regulatory Networks and Systems in Molecular Biology; Epigenetics; Plant Molecular Biology and Biotechnology; Plant Signal Transduction; Plant Metabolomics

Cell and Molecular Biology: Focus in Plant Genomics and Biotechnology (Specialist or Major)

Course offerings include: Plant Development; Laboratory in Molecular Plant Biology; Bioinformatic Methods; Introduction to Plant-Microbe Interactions; Regulatory Networks and Systems in Molecular Biology; Proteomics in Systems Biology; Molecular Plant-Microorganism Interactions; Plant Molecular Biology and Biotechnology; Plant Signal Transduction; Computational Genomics and Bioinformatics; Chemical Genomics; Methods in Genomics and Proteomics; Plant Metabolomics

Cell and Molecular Biology: Focus in Stem Cells and Developmental Biology (Specialist or Major)

Course offerings include: Developmental Biology; Stem Cell Biology: Developmental Models and Cell-based Therapeutics; Plant Development; Drosophila as a Model in Cancer Research; Germ Cell Biology; Neurogenesis; Evolution and Development: Gastrulation; Seminar in Development

Joint Program with Biochemistry, Computer Science, Ecology and Evolutionary Biology and Molecular Genetics

Bioinformatics and Computational Biology (Specialist - ASSPE1868)

The genomic and post-genomic era brings opportunities for new insight into all aspects of biology and medicine, based on the computational analysis of very large datasets in a biological context. The Bioinformatics and Computational Biology program is an interdepartmental, interdisciplinary program of study that balances computer-science and life-science courses towards that goal.

Joint Program with Ecology and Evolutionary Biology and Molecular Genetics

Genome Biology (Major - ASMAJ2655)

Genomics, the study of the structure, function and evolution of the genome, is among the newest and most rapidly growing fields of both basic and applied science, and nearly all of the more traditional disciplines in biology are being revolutionized by genomic tools. The growing flood of data on the DNA, RNA and protein sequences of organisms provides unprecedented opportunities to address fundamental biological questions such as the causes of disease, the genetic basis of development, the extent and causes of adaptive evolution, and the nature of gene regulation. Genome biology is a highly interdisciplinary field, encompassing concepts and practices from such diverse fields as Cell and Molecular Biology, Evolutionary Genetics, and Computer Science. Students in the Genome Biology program will receive a uniquely broad training in these concepts and practices, with a key focus on conceptual training in molecular biology, bioinformatics and evolutionary genetics, and practical training in both computational and wet-lab genomics research. A key focus of the program is to train biologists in the breadth of knowledge and skills required to understand, generate, and use results from genomics.

For more information on any of the above programs, please visit https://csb.utoronto.ca/undergraduate-studies/undergraduate-programs/ or contact: undergrad.csb@utoronto.ca.

Joint Program with Ecology and Evolutionary Biology

Biology (Specialist – ASSPE2364, Major – ASMAJ2364, Minor – ASMIN2364)

This program is for students interested in the study of living organisms (micro-organisms, plants, fungi, and animals), including diversity, cell and molecular biology, anatomy, physiology, development, genetics, ecology, evolution, and systematics. The study of biology has vast applications – in understanding one's own body, in grappling with the ethical questions that face humanity, and in understanding the interdependent web of living organisms on the planet. **For more information about the Biology programs, please contact the EEB Department at undergrad.eeb@utoronto.ca.**