Biotechnology, MS (Toronto)

Northeastern's Master of Science in Biotechnology is a professional master's program, an innovative, nonthesis graduate degree. This program is designed to prepare graduates to innovate, collaborate, and lead as research, managerial, or technical professionals in a wide range of biotechnology specialties. The two-year program offers students the possibility to pursue concentrations to further their knowledge in a specific topical area of the field.

Concentrations

AGRICULTURAL BIOTECHNOLOGY CONCENTRATION

The agricultural concentration goes beyond the production of biological drugs and focuses on the key agricultural biotechnology (agritech) principles and methods used today. Students have an opportunity to learn the principles of agritech and the role they play in the concepts and fundamentals of agriculture today. The concentration addresses plant, animal, food, and ecological biotechnology. The learning of the students is reinforced by both lecture courses and project-driven laboratory experience that provides hands-on learning of modern agricultural methodologies.

BIODEFENSE CONCENTRATION

The biodefense concentration is designed to prepare students for the initial homeland biodefense and bioterrorism response. Students have an opportunity to learn the microbiology and epidemiology of biological agents that are potential threats, identify and propose countermeasures, and develop expertise in response and recovery strategies and policies. The learning combines the foundational biotechnology courses with case-based and hands-on bioethical, biowarfare, and bioterrorism courses.

BIOPHARMACEUTICAL TECHNOLOGIES AND ANALYTICS CONCENTRATION

The biopharmaceutical technologies and analytics track focuses on structures, variants and activities of biological molecules as well as how to convert purified proteins to biopharmaceutical drug products that are compatible for clinical use. Students learn the diversity of molecular forms derived from biological products, techniques to analyze and characterize these forms, and the impact of these structural changes on the safety and efficacy of biopharmaceuticals. The track addresses design of product formulation, development and implementation of drug product manufacturing processes, and relevant process technology, such as aseptic operations and freeze-drying, needed for drug product manufacturing. This is accomplished through both lecture courses and project-driven laboratory experiences that utilize analytical techniques and provide hands-on learning of formulation design and drug product process development.

BIOTECHNOLOGY OPERATIONS CONCENTRATION

The biotechnology operations track is an operationally inclusive concentration that offers relevant insights to the inner workings of a biotech company while preparing students for new entry or promotions to a variety of biotech functions. Students learn the principles of quality, regulatory science, process science and manufacturing, while integrating business and management skills with the science of biotechnology. The track covers the science behind compliance and the principles and practices of state-of-the-art biopharmaceutical manufacturing and quality operations, enabling students to move across positions in discovery, clinical operations, manufacturing, quality, regulatory affairs, and consulting for operations and operational strategy and/or remediations.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Core Requirements

Code	Title	Hours
Required Core		
BIOT 5120	Foundations in Biotechnology	3
BIOT 5219	The Biotechnology Enterprise	2
BIOT 5401	Scientific Communication and Problem Solving in Biotechnology	3
BIOT 5621	Protein Principles in Biotechnology	3
BIOT 5630	Cell Culture Applications for Biopharmaceuticals	2
BIOT 5750	Molecular Approaches in Biotechnology	3
BIOT 6214	Experimental Design and Biostatistics	2
BIOT 7245	Biotechnology Applications Laboratory	3
Co-op and Experiential Learning		
EESC 6500	Pathways to Professional Success	1
BIOT 7001	Managing Innovation in Biotechnology	3

Concentration or Electives Option

A concentration is not required. Students may complete the Electives Option in lieu of a concentration.

Note: All students will be assessed for lab skills proficiency. Students who need to complete Biotechnology Lab Skills (BIOT 5145) and seek to graduate at 34 total program hours must select the Electives Option. For students who need to complete Biotechnology Lab Skills (BIOT 5145), choosing a concentration will require an additional 1 SH of coursework.

- Agricultural Biotechnology (p. 2)
- Biodefense (p. 2)
- Biopharmaceutical Technologies and Analytics (https://catalog.northeastern.edu/graduate/science/chemistry-chemical-biology/biotechnology-ms/#Biopharmaceutical%20Technologies%20and%20Analytics)
- Biotechnology Operations (https://catalog.northeastern.edu/graduate/science/chemistry-chemical-biology/biotechnology-ms/#Biotechnology%20Operations)
- Electives Option (p. 2)

Program Credit/GPA Requirements

34 total semester hours required (35 total semester hours required for students assessed to need Biotechnology Lab Skills (BIOT 5145) and who choose to declare a concentration)
Minimum 3.000 GPA required

CONCENTRATION IN AGRICULTURAL BIOTECHNOLOGY

Code	Title	Hours
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	3
BIOT 6100	Agricultural Biotechnology	3
Choose one from the following:		3
BIOT 5225	Managing and Leading a Biotechnology Company	
BIOT 5850	Higher-Order Structure Analytics	

CONCENTRATION IN BIODEFENSE

Code	Title	Hours
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	3
BIOT 6600	Agents of Bioterrorism	3
BIOT 6610	Biosecurity and Bioterrorism	3

CONCENTRATION IN BIOPHARMACEUTICAL TECHNOLOGIES AND ANALYTICS

Code	Title	Hours
BIOT 5640	Drug Product Processes for Biopharmaceuticals	3
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations	3
Choose one from the following:		3
BIOT 5225	Managing and Leading a Biotechnology Company	
BIOT 5910	Vaccines and Immunization	
BIOT 5930	Molecular Tools for Vaccine Design	
BIOT 5850	Higher-Order Structure Analytics	
BIOT 6320	Design and Development of Biopharmaceuticals	
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis	

CONCENTRATION IN BIOTECHNOLOGY OPERATIONS

Code	Title	Hours
BIOT 6290	Foundation in Quality for Biotechnology	3
BIOT 6320	Design and Development of Biopharmaceuticals	3
Choose one from the following:		3
BIOT 5225	Managing and Leading a Biotechnology Company	
BIOT 5228	Planning and Executing Biotechnology Projects	
BIOT 5330	Drug Safety and Immunogenicity	
BIOT 5340	Introduction to Biotherapeutic Approvals	
BIOT 5500	Concepts in Regulatory Science	
BIOT 5560	Bioprocess Fundamentals	
BIOT 5635	Downstream Processes for Biopharmaceutical Production	

BIOT 6300	Pharmaceutical Microbiology
BIOT 6340	Sterile Manufacturing Operations

ELECTIVES OPTION

Code	Title	Hours
Complete at least 9 semester hours from this program's Electives List (p. 3)		9

Electives List

Code	Title	Hours
BINF 6200	Bioinformatics Programming	
BINF 6310	Introduction to Bioinformatics	
BIOT 5145	Biotechnology Lab Skills	
BIOT 5225	Managing and Leading a Biotechnology Company	
BIOT 5228	Planning and Executing Biotechnology Projects	
BIOT 5330	Drug Safety and Immunogenicity	
BIOT 5340	Introduction to Biotherapeutic Approvals	
BIOT 5500	Concepts in Regulatory Science	
BIOT 5560	Bioprocess Fundamentals	
BIOT 5635	Downstream Processes for Biopharmaceutical Production	
BIOT 5640	Drug Product Processes for Biopharmaceuticals	
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations	
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	
BIOT 5850	Higher-Order Structure Analytics	
BIOT 5910	Vaccines and Immunization	
BIOT 5930	Molecular Tools for Vaccine Design	
BIOT 6100	Agricultural Biotechnology	
BIOT 6290	Foundation in Quality for Biotechnology	
BIOT 6300	Pharmaceutical Microbiology	
BIOT 6310	CGMP Statutes and Regulation	
BIOT 6320	Design and Development of Biopharmaceuticals	
BIOT 6340	Sterile Manufacturing Operations	
BIOT 6600	Agents of Bioterrorism	
BIOT 6610	Biosecurity and Bioterrorism	
BIOT 7983	Special Topics in Biotechnology	
BIOE 5430	Principles and Applications of Tissue Engineering	
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis	
DA 5020	Collecting, Storing, and Retrieving Data	
DA 5030	Introduction to Data Mining/Machine Learning	
HINF 6201	Organizational Behavior, Work Flow Design, and Change Management	
INSH 5301	Introduction to Computational Statistics	
NNMD 5271	Foundations in Nanomedicine: Diagnostics	
NNMD 5272	Nanomedicine Seminar	
NNMD 5370	Nanomedicine Research Techniques	
PHSC 5212	Research Skills and Ethics	
PPUA 5390	Special Topics in Public Policy and Urban Affairs	