Biotechnology, MS (Boston)

Overview

Northeastern's Master of Science in Biotechnology is a professional master's program, an innovative, nonthesis graduate degree. It combines advanced interdisciplinary training in biotechnology, biology, chemistry, and pharmaceutical sciences with the development of high-value business skills critical to success in today's dynamic workplace. 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 one of ten 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.

GORDON INSTITUTE OF ENGINEERING LEADERSHIP

MASTER'S DEGREE IN BIOTECHNOLOGY WITH GRADUATE CERTIFICATE IN ENGINEERING LEADERSHIP

Students may complete a Master of Science in Biotechnology in addition to earning a Graduate Certificate in Engineering Leadership (https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/engineering-leadership-graduate-certificate/). Students must apply and be admitted to the Gordon Engineering Leadership Program in order to pursue this option. The certificate program requires fulfillment of the 16-semester-hour curriculum required to earn the Graduate Certificate in Engineering Leadership, which includes an industry-based challenge project with multiple mentors. For students who concurrently enroll in the Graduate Certificate in Engineering Leadership, 6 semester hours of the certificate coursework may be applied to the general elective requirement of this program and to the elective requirement of any concentration.

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
EESC 6500	Pathways to Professional Success	1
Electives		
Complete 3 semester hours based on lab skills placement test results:		3
Option A (Student exempted from basic lab skills instruction due to placement test results)		
Complete 3 semester hours from the Electives list. (p. 3)		
Option B (Student requires lab skills instruction)		
BIOT 5145	Biotechnology Lab Skills	
Complete 2 semester hours from the Electives list. (p. 3)		

Concentration or Electives Option

A concentration is not required. Students may complete the electives option in lieu of a concentration.

- Agricultural Biotechnology (p. 2)
- Biodefense (p. 2)
- Biopharmaceutical Technologies and Analytics (p. 3)
- Biotechnology Operations (p. 3)
- Electives Option (p. 3)

Optional Co-op Experience

Code	Title	Hours
BIOT 6964	Co-op Work Experience	0

Program Credit/GPA Requirements

34 total semester hours required
Minimum 3.000 GPA required

AGRICULTURAL BIOTECHNOLOGY CONCENTRATION

Code	Title	Hours
Required		
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	3
BIOT 6100	Agricultural Biotechnology	3
Elective		
In consultation with advisor, complete a minimum of 3 semester hours from the following:		3
BIOT 5850	Higher-Order Structure Analytics	
BIOT 5225	Managing and Leading a Biotechnology Company	
ENVR 5150	Climate and Atmospheric Change	
ENVR 5190	Soil Science	
ENVR 5210	Environmental Planning	
ENVR 5350	Sustainable Energy and Climate Solutions	
ENVR 5670	Global Biogeochemistry	
ENVR 5800	Climate Adaptation and Nature-Based Solutions	
ENVR 6150	Food Security and Sustainability	

BIODEFENSE CONCENTRATION

Code	Title	Hours
Required		
BIOT 6600	Agents of Bioterrorism	3
BIOT 6610	Biosecurity and Bioterrorism	3
Elective		
In consultation with advisor, complete a minimum of 3 semester hours from the following:		3
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	
PPUA 6532	Building Resilience into Local Government	
PHTH 5230	Global Health	

PHTH 5202	Introduction to Epidemiology
PHTH 5212	Public Health Administration and Policy
SCHM 6223	Managing Healthcare Supply Chain Operations

BIOPHARMACEUTICAL TECHNOLOGIES AND ANALYTICS CONCENTRATION

Code	Title	Hours
Required		
BIOT 5640	Drug Product Processes for Biopharmaceuticals	3
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations	3
Elective		
In consultation with advisor, complete a minimum of 3 semester hours from the following:		3
BIOT 6320	Design and Development of Biopharmaceuticals	
BIOT 5910	Vaccines and Immunization	
BIOT 5930	Molecular Tools for Vaccine Design	
BIOT 5850	Higher-Order Structure Analytics	
BIOT 5225	Managing and Leading a Biotechnology Company	
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis	
CHEM 5617	Protein Mass Spectrometry Laboratory	

BIOTECHNOLOGY OPERATIONS CONCENTRATION

Code	Title	Hours
Required		
BIOT 6320	Design and Development of Biopharmaceuticals	3
BIOT 6290	Foundation in Quality for Biotechnology	3
Elective		
In consultation with advisor, complete a minimum of 3 semester hours from the following:		3
Process Sciences Focus		
BIOT 5560	Bioprocess Fundamentals	
BIOT 5635	Downstream Processes for Biopharmaceutical Production	
Manufacturing Quality Operations Focus		
BIOT 6300	Pharmaceutical Microbiology	
BIOT 6340	Sterile Manufacturing Operations	
BIOT 5330	Drug Safety and Immunogenicity	
Regulatory Science Focus		
BIOT 5340	Introduction to Biotherapeutic Approvals	
BIOT 5500	Concepts in Regulatory Science	
Enterprise Focus		
BIOT 5225	Managing and Leading a Biotechnology Company	
BIOT 5228	Planning and Executing Biotechnology Projects	

ELECTIVES OPTION

Code	Title	Hours
Complete 9 semester hours from the Electives list. (p. 3)		9

Electives List

Code	Title	Hours
Electives not on this list may be taken with academic advisor approval.		
BINF 6200	Bioinformatics Programming	
BINF 6310	Introduction to Bioinformatics	
BIOE 5430	Principles and Applications of Tissue Engineering	
BIOL 5543	Stem Cells and Regeneration	
BIOL 5549	Inventions in Microbial Biotechnology	
BIOL 5573	Medical Microbiology	
BIOL 5583	Immunology	

BIOL 5587	Comparative Neurobiology
BIOL 5591	Advanced Genomics
BIOL 5597	Immunotherapies of Cancer and Infectious Disease
BIOL 6381	Ethics in Biological Research
BIOT 5220	The Role of Patents in the Biotechnology Industry, Past and Future
BIOT 5225	Managing and Leading a Biotechnology Company
BIOT 5227	Launching Your Science: Biotechnology Entrepreneurship
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 5920	Foundations in Vaccine Regulatory Science
BIOT 5930	Molecular Tools for Vaccine Design
BIOT 5976	Directed Study
BIOT 6100	Agricultural 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 7001	Managing Innovation in Biotechnology
BIOT 7983	Special Topics in Biotechnology
Any 1 SH course from BUSN 5000 to BUSN 7999 (https://catalog.northeastern.edu/course-descriptions/busn/)	
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis
CHEM 5617	Protein Mass Spectrometry Laboratory
CHEM 5621	Principles of Chemical Biology
CHEM 5625	Chemistry and Design of Protein Pharmaceuticals
CHEM 5638	Molecular Modeling
CHME 7340	Chemical Engineering Kinetics
DA 5020	Collecting, Storing, and Retrieving Data
DA 5030	Introduction to Data Mining/Machine Learning
EMGT 5220	Engineering Project Management
ENTR 6210	Managing Operations in Early Stage Ventures
ENTR 6211	Entrepreneurship: Services and Retail Business Creation
ENTR 6212	Business Planning for New Ventures
ENTR 6241	Entrepreneurial Marketing and Selling
ENTR 6250	Lean Design and Development
ENVR 6102	Environmental Science and Policy Seminar 2
HINF 5105	The American Healthcare System
HINF 6201	Organizational Behavior, Work Flow Design, and Change Management
INNO 6200	Enterprise Growth and Innovation
INNO 6225	Acquisitions, Alliances, and Growth
INSH 5301	Introduction to Computational Statistics
INTB 6200	Managing the Global Enterprise
INTB 6212	Cultural Aspects of International Business
MECN 6205	Sustainability and the Economics of Markets

MGMT 6225	Sustainability and Leadership
MGSC 6200	Information Analysis
MGSC 6204	Managing Information Resources
NNMD 5270	Foundations in Nanomedicine: Therapeutics
NNMD 5271	Foundations in Nanomedicine: Diagnostics
NNMD 5272	Nanomedicine Seminar
NNMD 5370	Nanomedicine Research Techniques
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market
NNMD 5570	Preclinical and Clinical Study Design
PHSC 5212	Research Skills and Ethics
PHSC 5300	Pharmaceutical Biochemistry
PHSC 5500	Repurposing Drugs for Cancer Immunotherapies
PHSC 5560	Nanotoxicity
PHSC 6224	Behavioral Pharmacology and Drug Discovery
PHSC 6290	Biophysical Methods in Drug Discovery
PHSC 7010	Pharmaceutical Sciences Laboratory
PHTH 5320	Grant Writing in Public Health
POLS 7341	Security and Resilience Policy
POLS 7346	Resilient Cities
POLS 7343	Counterterrorism
PPUA 5261	Dynamic Modeling for Environmental Decision Making
PPUA 5262	Big Data for Cities
PPUA 5263	Geographic Information Systems for Urban and Regional Policy
PPUA 6532	Building Resilience into Local Government
SCHM 6201	Operations and Supply Chain Management
SCHM 6214	Sourcing and Procurement
STRT 6200	Strategic Decision Making in a Changing Environment