Nanomedicine, MS

Overview

Northeastern University's Master of Science in Nanomedicine is a flexible, interdisciplinary, industry-aligned professional master's degree program. It is designed for scientists, engineers, and clinicians who want to develop competencies and skills in nanomedicine research, innovation, and commercialization. Our students receive hands-on training in nanomedicine challenges and opportunities, research tools and techniques, and translation from bench to bedside. The curriculum integrates immersive experiential learning with industry co-ops to prepare graduates for high-demand research and entrepreneurship roles in biotechnology, pharmaceutical, biomedical, and healthcare industries.

This two-year, full-time master's program consists of six core courses, year-round professional seminars, and a full-time co-op experience. In year two, students tailor their curriculum by selecting one of the following concentrations (or selecting 18 semester hours of electives).

Nanoformulation Research Concentration

The nanoformulation research concentration integrates nanoparticle design, formulation, characterization, and translation. Students gain experience in nanomedicine theory, materials and methods, advanced laboratory techniques, and state-of-the-art instrumentation through a combination of expert-led lectures, instrument demonstrations, and collaborative interdisciplinary project-based laboratory experiences. Students have an opportunity to acquire research and project management skills for roles in research, development, and manufacturing.

Translation and Commercialization Concentration

The translation and commercialization concentration studies scientific discovery, business, and management from the perspective of delivering nanomedicine products to patients. Students build real-world knowledge and skills in innovation, business development, and regulatory affairs—from initial discovery and R&D to FDA approval and launch—through a combination of case studies, industry-mentored projects, and creation of a virtual startup company.

Vaccine Development Concentration

Innovations in nanoparticle-based vaccine delivery during the SARS-CoV-2 pandemic have fundamentally changed the way we develop and test vaccines. The vaccine development concentration provides training in scientific, business, and regulatory principals of vaccine R&D. Students integrate molecular tools for vaccine design, knowledge of vaccine-tissue interactions, and best practices for biopharmaceutical cell culture and manufacturing to develop the industry-aligned skills needed at the forefront of vaccine development.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Core Requirements

Code	Title	Hours
Required Core		
BIOL 6381	Ethics in Biological Research	2
NNMD 5270	Foundations in Nanomedicine: Therapeutics	3
NNMD 5271	Foundations in Nanomedicine: Diagnostics	3
NNMD 5570	Preclinical and Clinical Study Design	3
NNMD 6272	Professional Nanomedicine Seminar	0
PHSC 5560	Nanotoxicity	3
PHSC 6214	Experimental Design and Biostatistics	2
Co-op		
Co-op may be started in the summer of Year 1, Year 2, or both.		
NNMD 6500	Professional Development for Co-op	0
NNMD 6964	Co-op Work Experience	0

Concentrations or Electives Option

A concentration is not required. Students may complete electives (from the electives list below) in lieu of a concentration.

Electives List

Code	Title	Hours
Complete electives from the following (electives not on this list may be chosen with faculty advisor approval):		
Laboratory Research		
BIOT 5145	Basic Biotechnology Lab Skills	
BIOT 7245	Biotechnology Applications Laboratory	
NNMD 5370	Nanomedicine Research Techniques	
NNMD 6370	Nanomedicine Experiential Capstone (Nanomedicine Experiential Capstone)	
NNMD 6984	Research	
PHSC 5212	Research Skills and Ethics	
Nanomaterials Design and Application		
BIOE 5820	Biomaterials	
BIOE 6100	Medical Physiology	
BIOT 5631	Cell Culture Processes for Biopharmaceutical Production	
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations	
BIOT 5910	Vaccines and Immunization	
BIOT 5930	Molecular Tools for Vaccine Design	
CHEM 5610	Polymer Chemistry	
CHME 5630	Biochemical Engineering	
CHME 5631	Biomaterials Principles and Applications	
CHEM 5640	Biopolymeric Materials	
CHME 5683	Introduction to Polymer Science	
PHSC 6216	Human Physiology and Pathophysiology	
PHSC 6290	Biophysical Methods in Drug Discovery	
PHYS 5260	Introduction to Nanoscience and Nanotechnology	
PHYS 7731	Biological Physics 1	
Drug Delivery		
CHEM 5648	Chemical Principles and Application of Drug Metabolism and Pharmacokinetics	
CHME 5160	Drug Delivery: Engineering Analysis	
CHME 7350	Transport Phenomena	
PMST 6252	Pharmacokinetics and Drug Metabolism	
PMST 6254	Advanced Drug Delivery Systems	
Commercialization and Regulatory Affairs		
BIOT 5219	The Biotechnology Enterprise	
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 5920	Foundations in Vaccine Regulatory Science	
BIOT 6290	Foundation in Quality for Biotechnology	
BIOT 6310	CGMP Statutes and Regulation	
BIOT 6320	Quality Management Systems and Validation	
BIOT 6340	Sterile Manufacturing Operations	
CHME 5631	Biomaterials Principles and Applications	
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	

Program Credit/GPA Requirements

34 total semester hours required
Minimum 3.000 GPA required

NANOFORMULATION RESEARCH CONCENTRATION

Code	Title	Hours
BIOE 5820	Biomaterials	4
or CHME 5631	Biomaterials Principles and Applications	
CHEM 5648	Chemical Principles and Application of Drug Metabolism and Pharmacokinetics	3

or PMST 6252	Pharmacokinetics and Drug Metabolism	
NNMD 5370	Nanomedicine Research Techniques	4
NNMD 6370	Nanomedicine Experiential Capstone (Nanomedicine Experiential Capstone)	4
Electives (see electives course list)		3

TRANSLATION AND COMMERCIALIZATION CONCENTRATION

Code	Title	Hours
BIOT 5145	Basic Biotechnology Lab Skills	1
or BIOT 5220	The Role of Patents in the Biotechnology Industry, Past and Future	
BIOT 5219	The Biotechnology Enterprise	2
BIOT 5225	Managing and Leading a Biotechnology Company	3
BIOT 6290	Foundation in Quality for Biotechnology	3
BIOT 6310	CGMP Statutes and Regulation	3
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	3
Electives (see electives course list)		3

VACCINE DEVELOPMENT CONCENTRATION

Code	Title	Hours
BIOT 5631	Cell Culture Processes for Biopharmaceutical Production	3
BIOT 5910	Vaccines and Immunization	3
BIOT 5920	Foundations in Vaccine Regulatory Science	3
BIOT 5930	Molecular Tools for Vaccine Design	3
BIOT 6310	CGMP Statutes and Regulation	3
Electives (see electives course list)		3

ELECTIVES OPTION

Code	Title	Hours
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	3-4
or NNMD 5370	Nanomedicine Research Techniques	
Electives (see electives course list)		15

Plan of Study

Sample Plans of Study

YEAR 1

Year 1

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOL 6381	2	NNMD 5570	3	NNMD 6964	0
NNMD 5270	3	NNMD 5271	3	(Co-op option 1: May–Aug.)	
NNMD 6500	0	NNMD 6272	0		
PHSC 5560	3	PHSC 6214	2		
	8		**8**		**0**

Total Hours: 16

YEAR 2

NANOFORMULATION RESEARCH CONCENTRATION

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOE 5820 or CHME 5631	4	CHEM 5648 or PMST 6252	3	NNMD 6964	0
NNMD 5370	4	NNMD 6272	0	(Co-op option 2: May–Aug.)	
NNMD 6272	0	NNMD 6370	4	(Co-op option 3: July-Dec.)	
		Elective	3		
	8		**10**		**0**

Total Hours: 18

TRANSLATION AND COMMERCIALIZATION CONCENTRATION

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOT 5145 or 5220	1	BIOT 5120	3	NNMD 6964	0
BIOT 5219	2	BIOT 5225	3	(Co-op option 2: May–Aug.)	
BIOT 6310	3	NNMD 6272	0	(Co-op option 3: July–Dec.)	
NNMD 5470	3	Elective	3		
NNMD 6272	0				
	9		**9**		**0**

Total Hours: 18

VACCINE DEVELOPMENT CONCENTRATION

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOT 5631	3	BIOT 5920	3	NNMD 6964	0
BIOT 5910	3	BIOT 5930	3	(Co-op option 2: May–Aug.)	
BIOT 6310	3	NNMD 6272	0	(Co-op option 3: July–Dec.)	
NNMD 6272	0	Elective	3		
	9		**9**		**0**

Total Hours: 18