Nanomedicine, MS (Boston)

Overview

The 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 individual and team-based research projects with a full-time industry co-op or laboratory experience 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 eight core courses and year-round professional seminars. In year two, students tailor their curriculum by selecting a concentration and at least one experiential learning opportunity. A reflection capstone course is taken concurrently with co-op or during the final semester of study. Students seeking additional course and co-op flexibility may substitute an electives only program plan in place of a concentration.

Concentration in Nanoformulation Research

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.

Concentration in Translation and Commercialization

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 research and development to FDA approval and launch—through a combination of case studies, industry-mentored projects, and creation of a virtual startup company.

Concentration in 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 research and development. 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		
EESC 6500	Pathways to Professional Success	1
NNMD 5270	Foundations in Nanomedicine: Therapeutics	3
NNMD 5271	Foundations in Nanomedicine: Diagnostics	3
NNMD 5310	Bioethics in the Age of Artificial Intelligence	1
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
or BIOT 6214	Experimental Design and Biostatistics	
Experiental Learning and Reflection		
NNMD 7500	Reflection Capstone	0
Complete at least one of the following (credit-bearing courses chosen to fulfill this requirement will also be applied to the elective requirements of this program):		
EESC 6954	Co-op Work Experience - Half-Time	
EESC 6964	Co-op Work Experience	
EESC 6965	Co-op Work Experience Abroad	
NNMD 6370	Nanomedicine Experiential Capstone	
NNMD 6984	Independent Research	

Concentration or Electives Option

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

- Nanoformulation Research (p. 2)
- Translation and Commercialization (p. 2)
- Vaccine Development (p. 2)
- Electives Option (p. 2)

Program Credit/GPA Requirements

34 total semester hours required
Minimum 3.000 GPA required

CONCENTRATION IN NANOFORMULATION RESEARCH

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 CHEM 5610	Polymer Chemistry	
NNMD 5370	Nanomedicine Research Techniques	4
NNMD 6370	Nanomedicine Experiential Capstone	4
Electives		
Complete 3 semester hours from the electives list. (p. 3)		3

CONCENTRATION IN TRANSLATION AND COMMERCIALIZATION

Code	Title	Hours
BIOT 5145	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		
Complete 3 semester hours from the electives list. (p. 3)		3

CONCENTRATION IN VACCINE DEVELOPMENT

Code	Title	Hours
BIOT 5220	The Role of Patents in the Biotechnology Industry, Past and Future	1
BIOT 5630	Cell Culture Applications for Biopharmaceuticals	2
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		
Complete 3 semester hours from the electives list. (p. 3)		3

ELECTIVES OPTION

Code	Title	Hours
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	3-4
or NNMD 5370	Nanomedicine Research Techniques	
Electives		
Complete 15 semester hours from the electives list. (p. 3)		15

Electives List

Code	Title	Hours
Complete electives from the following (electives not on this list may be chosen with faculty advisor approval):		
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	Design and Development of Biopharmaceuticals	
BIOT 6340	Sterile Manufacturing Operations	
CHME 5631	Biomaterials Principles and Applications	
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	
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	
Laboratory Research		
BIOT 5145	Biotechnology Lab Skills	
BIOT 5840	Cell and Gene Therapy Lab	
NNMD 5370	Nanomedicine Research Techniques	
NNMD 5380	Electron Microscopy Techniques	
NNMD 6370	Nanomedicine Experiential Capstone	
NNMD 6984	Independent Research	
PHSC 5212	Research Skills and Ethics	
Nanomaterials Design and Application		
BIOE 5820	Biomaterials	
BIOE 6100	Medical Physiology	
BIOT 5630	Cell Culture Applications for Biopharmaceuticals	
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	
CHEM 5640	Biopolymeric Materials	
CHME 5630	Biochemical Engineering	
CHME 5631	Biomaterials Principles and Applications	
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	Physics of Biological Processes and Living Systems 1	

Plan of Study

Sample Plans of Study

YEAR 1

Year 1

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
EESC 6500	1	NNMD 5271	3	EESC 6964 or 6965 (*)	0
NNMD 5270	3	NNMD 5570	3	(Co-op option 1: May–Aug.)	

NNMD 5310	1	NNMD 6272	0	
PHSC 5560	3	PHSC 6214 or BIOT 6214	2	
	8		**8**	**0**

Total Hours: 16

YEAR 2
CONCENTRATION IN NANOFORMULATION RESEARCH

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOE 5820 or CHME 5631	4	CHEM 5648 or PMST 6252	3	EESC 6964 or 6965 (*)	0
NNMD 5370	4	NNMD 6370	4	NNMD 7500	0
NNMD 6272	0	NNMD 6272 or 7500	0	(Co-op & reflection option 2: May–Aug.)	
		Elective	3	(Co-op & reflection option 3: July-Dec.)	
	8		**10**		**0**

Total Hours: 18

CONCENTRATION IN TRANSLATION AND COMMERCIALIZATION

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOT 5145 or 5220	1	BIOT 5120	3	EESC 6964 or 6965 (*)	0
BIOT 5219	2	BIOT 5225	3	NNMD 7500	0
BIOT 6310	3	NNMD 6272 or 7500	0	(Co-op & reflection option 2: May–Aug.)	
NNMD 5470	3	Elective	3	(Co-op & reflection option 3: July–Dec.)	
NNMD 6272	0				
	9		**9**		**0**

Total Hours: 18

CONCENTRATION IN VACCINE DEVELOPMENT

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
BIOT 5220	1	BIOT 5920	3	EESC 6964 or 6965 (*)	0
BIOT 5630	2	BIOT 5930	3	NNMD 7500	0
BIOT 5910	3	NNMD 6272 or 7500	0	(Co-op & reflection option 2: May–Aug.)	
BIOT 6310	3	Elective	3	(Co-op & reflection option 3: July–Dec.)	
NNMD 6272	0				
	9		**9**		**0**

Total Hours: 18

ELECTIVES OPTION

This year 2 sample plan of study shows how a student might combine electives with multiple hands-on experiential learning alternatives to co-op.

Year 2

Fall	Hours	Spring	Hours
NNMD 5370	4	NNMD 6984	4
NNMD 6370	4	NNMD 7500	0
NNMD 6272	0	Elective	3
		Elective	3
	8		**10**

Total Hours: 18

* Co-op is not required. Students may substitute an experiential learning course from the electives list during year 2 to satisfy the experiential learning requirement.