

Nanomedicine, MS (Online)

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 applied 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 multiple experiential learning options, including a full-time industry co-op or AI-powered research 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 RNA Therapeutics

The RNA therapeutics concentration integrates molecular biology, nucleic acid chemistry, and nanoparticle-mediated delivery to prepare students to design next-generation RNA medicines. Students study how to design and optimize nanoparticle-based solutions for endogenous RNA modulation and exogenous RNA delivery through expert-led lectures, case studies, and hands-on projects.

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 or BIOT 6214	Experimental Design and Biostatistics Experimental Design and Biostatistics	2
Experiential 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 5470	Nano/Biomedical Commercialization: Concept to Market
NNMD 6370	Nanomedicine Experiential Capstone
NNMD 6390	Experiential AI 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)
- RNA Therapeutics (p. 2)
- Translation and Commercialization (p. 2)
- Vaccine Development (p. 2)
- Electives Option (p. 3)

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 CHEM 5610	Polymer Chemistry	
NNMD 6390	Experiential AI Capstone	4
Electives		
Complete 7 semester hours from the electives list. (p. 3)		7

RNA THERAPEUTICS CONCENTRATION

Code	Title	Hours
A total of 18 semester hours or coursework is required to complete this concentration.		
BIOL 5821	Cell and Gene Therapies	3-4
or BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology	
BIOT 5750	Molecular Approaches in Biotechnology	3
or CHEM 5630	Nucleic Acid Chemistry	
NNMD 5580	Nanodrug Delivery Systems: Design, Visualization, and Modeling	3
NNMD 5590	RNA Therapeutics	3
Complete 5-6 semester hours from the electives list. (p. 3)		5-6

TRANSLATION AND COMMERCIALIZATION CONCENTRATION

Code	Title	Hours
BIOT 5219	The Biotechnology Enterprise	2
BIOT 5220	The Role of Patents in the Biotechnology Industry, Past and Future	1
BIOT 5225	Managing and Leading a Biotechnology Company	3
BIOT 6290	Foundation in Quality for Biotechnology	3
or BIOT 6310	CGMP Statutes and Regulation	
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market	3
Electives		
Complete 6 semester hours from the electives list. (p. 3)		6

VACCINE DEVELOPMENT CONCENTRATION

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

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BIOT 5920	Foundations in Vaccine Regulatory Science		3
BIOT 5930	Molecular Tools for Vaccine Design		3
Electives			
Complete 6 semester hours from the electives list. (p. 3)			6
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):			
AI-Driven Innovation			
BIOT 5900	Emerging Innovations in Biotechnology and Pharma		
BIOT 6900	AI-Powered Biotech Workflows: From Discovery to Clinic		
NNMD 6390	Experiential AI Capstone		
PHSC 5905	Artificial Intelligence and Machine Learning in Drug Discovery: Concepts and Applications		
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 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		
NNMD 5470	Nano/Biomedical Commercialization: Concept to Market		
Drug Delivery			
BIOL 5821	Cell and Gene Therapies		
CHEM 5648	Chemical Principles and Application of Drug Metabolism and Pharmacokinetics		
CHME 5160	Drug Delivery: Engineering Analysis		
CHME 7350	Transport Phenomena		
NNMD 5580	Nanodrug Delivery Systems: Design, Visualization, and Modeling		
PMST 6252	Pharmacokinetics and Drug Metabolism		
PMST 6254	Advanced Drug Delivery Systems		
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		
Nanomaterials Design and Application			
BIOE 5410	Molecular Bioengineering		
or BIOE 5411	Applied Molecular Bioengineering		
BIOE 5820	Biomaterials		
BIOL 6131	CRISPR: Gene Editing Fundamentals		
BIOT 5630	Cell Culture Applications for Biopharmaceuticals		
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations		
BIOT 5750	Molecular Approaches in Biotechnology		
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology		

BIOT 5910	Vaccines and Immunization
BIOT 5930	Molecular Tools for Vaccine Design
CHEM 5610	Polymer Chemistry
CHEM 5630	Nucleic Acid Chemistry
CHEM 5640	Biopolymeric Materials
CHME 5631	Biomaterials Principles and Applications
CHME 5683	Introduction to Polymer Science
NNMD 5272	Nanomedicine Seminar
NNMD 5590	RNA Therapeutics
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