BIOTECHNOLOGY: INDUSTRIAL AND BIOMEDICAL SCIENCES (M.S.)

https://manchester.unh.edu/program/ms/biotechnology-industrial-biomedical-sciences

Description

Biotechnology focuses on the application of the biological and biochemical sciences, and particularly genetics, to the preparation of new and enhanced biomedical, industrial, agricultural, and environmental products. Graduate instruction in this area would include molecular biology, cell and tissue culturing, protein biologic development, bioinformatics, functional and comparative genomics, applied immunology, DNA sequencing, tissue biology and engineering, industrial microbiology, drug development, intellectual property, clinical trials, biotechnology management and marketing, applicable regulations, and biotechnology ethics.

The M.S. in Biotechnology: Industrial and Biomedical Sciences (MS Biotech:IBMS) program at the University of New Hampshire is a STEM-designated graduate degree program that offers its students innovative experiential learning opportunities and delivers a content-rich, skills-based, and highly versatile curriculum for individuals seeking to advance their careers in the biotechnology, pharmaceutical, and biomanufacturing sectors. Students will complete a project, internship, or co-op experience as part of their degree program. The MS Biotech:IBMS program has a core foundation in the theory and wet-laboratory skills of cell and tissue biology and culturing; protein and immunologic methods and therapeutics; and the molecular biotechnology of nucleic acids. Students are also required to develop a substantial background understanding of biotech product lifecycle and the regulatory and legal implications therein. After demonstrating proficiency in the core biotechnology knowledge areas, MS Biotech:IBMS students will work with a faculty advisor to create a customized program of study that may include content from diverse graduate programs across the UNH campuses.

Completion of the M.S. in Biotechnology: Industrial and Biomedical Sciences program requires completion of 30 graduate credits including 4 required core courses, 1 required seminar course, and a project, internship, or co-op work experience. Full-time students can complete the program in 18 months. Students admitted from a UNH Bachelor's degree program can complete the Accelerated Master's program in 12 months depending on the courses completed during their undergraduate program. Students choosing the project or internship track would undertake an internship or internships in industry, applied research in an industrial job where the student is already employed, or research in a faculty member's laboratory at UNH. Students choosing the co-op work experience route would spend 6 months in a full-time industrial placement as part of their degree program.

The MS Biotech:IBMS program welcomes students from varied scientific and other backgrounds who have the required basic skills to succeed in the degree program. Normally, this background includes completion of a Bachelor's degree (GPA > 3.0) with an introductory biology two-course sequence with lab, a genetics course (lab not required), and at least one semester of organic chemistry. Students with non-biomedical Bachelor's degrees with these skills are encouraged to apply for admission. UNH Bachelor's degree students in a variety of curricular areas would similarly be able to apply for admission as an Accelerated student if they meet the pre-requisite requirements above. For all applicants, the MS Biotech:IBMS program recommends this additional level of preparation: one semester of microbiology with laboratory, one semester of bioethics, one semester of cell biology, one semester of statistics, one semester of mathematics to the pre-calculus or calculus level, and one semester of biochemistry. GREs are not required. International students must submit a TOEFL score or equivalent evidence of English proficiency as required by the UNH Graduate School.

The Biotechnology industry in New England is currently expanding at a substantial rate (2018 Job Trends Forecast, MassBioEd Foundation) and graduates of the M.S. in Biotechnology: Industrial and Biomedical Sciences program will be well-prepared for anticipated growth in jobs projected for the biotech R&D, medical testing laboratory, pharmaceutical and biotech manufacturing laboratory instrumentation, academic, and other sectors in New England in the coming years.

Requirements

Curriculum
The M.S. in Biotech:IBMS is offered in traditional and accelerated formats each of which require students to complete **30 credits** comprised of 4 Core Curriculum courses and a Graduate Biotech Seminar course (13 total credits), a series of Elective Courses (7-14 credits), and a Capstone experience (3-10 credits). Traditional full-time enrolled students will be able complete the degree in 18 months. UNH Bachelor's degree students entering into the Accelerated Master's program as full time students will be able to complete their degree in as little as 12 months.

Core Curriculum
The MS Biotech:IBMS core curriculum is centered around research project team-based lab courses. This provides you with important industry-relevant transferrable job skills, such as clear communication, cooperation and relationship building, teamwork and conflict resolution, and creative problem-solving and strategic thinking. These transferrable skills are developed hand-in-hand with the wet-lab skills. In addition to the core lab and lecture coursework covering the major industry areas of cell, molecular, and protein biochemistry, the program incorporates a core course entitled "Biotechnology Products and Regulation." This course takes a critical look at industry from the initial stages of research and development in the biomedical sciences through the legal and regulatory stages of biotechnology product development and manufacturing. This content is key to understanding how the biotech industry functions and thus is a centerpiece in your training in our degree program. Finally, you are required to enroll in a minimum of one graduate biotech seminar course. While the specific content of the seminar courses will vary to reflect the dynamics of the ever-changing biotech field, the two typical focus areas of the semester-long seminars will be *"Instrumentation in the Biotech Industry"* and *"Cutting edge topics in the Biotech Industry today".*

Code	Title	Credits
Course Requirements		
BIOT 877	Molecular Biology and Biotechnology	3
BIOT 877	Molecular Biology and Biotechnology (Lab)	
BIOT 853	Cell Culture	3
BIOT 853	Cell Culture (Lab)	
BIOT 825	Biotech Products and Regulation	3
BIOT 866	Protein and Immunological Techniques	3
BIOT 866	Protein and Immunological Techniques (Lab)	
BIOT 896	Graduate Seminar in Biotechnology	1
Elective Coursework [1]		**7-14**

Capstone Experience Options [2]		**3-10**
Capstone A		
BIOT 893	Directed Graduate Research	
Capstone B		
BIOT 891	Applied Research	
or BIOT 892	Graduate Internship	
Capstone C		
BIOT 895	Graduate Co-op Experience	

1 **Elective Courses**
In addition to the Core requirements, you will develop a curriculum plan with your Faculty Advisor that includes elective courses. This curriculum plan will be customized to meet your career goals. While most students will likely choose elective courses offered in the Department of Life Sciences at UNH Manchester, the program welcomes you to enroll in courses in other UNH colleges in order to complete your elective requirements. In some cases (and with the recommendation of the Faculty Advisor and approval of the Graduate Program Coordinator), courses not on the approved electives list may be incorporated into the curriculum plan.

2 **Capstone**
In consultation with the Faculty Advisor and with the approval of the Graduate Program Coordinator, you will design a Capstone experience (up to 10 cr.) that is consistent with your career development plans. The Capstone will consist of one of the following: **Capstone A**, a research project in a UNH Manchester faculty member's research laboratory (typically your Faculty Advisor); **Capstone B**, an internship or applied research experience in an industry setting (including the student's current workplace if applicable); or, **Capstone C**, an industry co-op experience. Capstone A or B may earn up to 6 credits, depending upon hours spent in experience as dictated by requirements for credit hours . Capstone C will be a 6 month industry placement at 40 hours per week and earn 10 credits. In each Capstone experience, you will be enrolled in a course in which you will report on your progress in your experience and interact with others participating in capstone experiences as dictated by capstone syllabi.

Accelerated Master's Program for UNH Undergraduate Students

An exciting Accelerated Master's program leading to a combined Bachelor's degree (usually in a biological or biomedical field) at UNH and a Master's degree in Biotechnology: Industrial and Biomedical Sciences is designed for highly motivated and qualified students seeking additional training to further their career goals as a researcher and practitioner in the biotechnology field.

Students accepted into the program complete up to 12 graduate credits in combined 700/800-level courses during the student's senior year in their B.A. or B.S. program. The student must complete 30 total graduate level (800-999) credits of course work (including the dual credit courses). All other requirements for the M.S. degree are required. While five-year total time to completion of the Accelerated Master's dual degree is possible, actual time to completion will vary depending on the number of graduate credits taken during the completion of the undergraduate degree.