

MOLECULAR AND CELLULAR BIOTECHNOLOGY (M.S.)

<https://colsa.unh.edu/molecular-cellular-biomedical-sciences/molecular-cellular-biotechnology-ms>

Description

The Department of Molecular, Cellular, and Biomedical Sciences (MCBS) in the College of Life Sciences and Agriculture (COLSA) offers the professional M.S. in Molecular and Cellular Biotechnology (MCBT). This non-thesis degree program addresses the growing workforce and educational needs of the bioscience industries (including biotechnology, pharmaceutical, biomanufacturing, and medical device companies). The M.S. in MCBT provides continuing and accessible graduate-level education for individuals from broad backgrounds currently in the workforce, as well as for UNH undergraduate students, to gain specialized knowledge and skills prior to entering the workforce.

Distinctive Features of the Program

The program is founded on the existing academic rigor of the thesis-based graduate programs offered in MCBS and on the substantial innovative experiential learning opportunities enabled by existing biotechnology-relevant Centers: the University Instrumentation Center (UIC), the Center of Integrated Biomedical and Bioengineering Research (CIBBR), the NH Center for Multiscale Modeling and Manufacturing of Biomaterials (NH BioMade), and the Biomanufacturing Innovation Center (BIC). These resources will enable offering instrumentation training workshops in the following areas: genetic engineering of cells; recombinant protein production and purification; biological mass spectroscopy; nuclear magnetic resonance (NMR) spectroscopy; cell imaging and phenotyping; visualization of macromolecules.

Admission Requirements

A distinguishing feature of the M.S. in MCBT curriculum is its flexibility to accommodate students of diverse backgrounds, and to provide a customized curriculum to meet the career goals that attracted them to this program. For admission, program applicants will be expected to meet the following prerequisites:

- GPA > 3.0 in prior academic programs, and/or excellent relevant work experience.
- Demonstration of English proficiency for non-native, English-speaking applicants (i.e., TOEFL score).
- Three letters of recommendation
- Personal statement specifying the applicant's professional development and career plan.
- Required prerequisite courses: introductory biology (two semesters), genetics, organic chemistry.
- Strongly recommended prerequisite courses: microbiology, cell biology, math/statistics, biochemistry.

Please note that no departmental financial aid (i.e., teaching assistantships or research assistantships) is available to students admitted into this program. Information regarding tuition and fees is located [here](#). Information about other types of financial aid is located [here](#).

Requirements

Completion of the M.S in MCBT requires at least **30 graduate credits** in approved courses, including Core Curriculum courses, Elective courses, Workshops, and the custom-designed Capstone experience.

Required courses

Students are required to complete the Core Curriculum courses (chosen based on market analysis and additional industry input) to establish graduate-level skill competencies in the areas of protein biochemistry, molecular biology, and cell biology. Core requirements may be waived in those instances where the Admissions Committee ascertains that the student already possesses the knowledge and skills provided through these Core Curriculum courses.

The required core curriculum courses consist of Cell Culture (lecture/lab), Protein Biochemistry (lecture/lab), and Molecular Biology (lecture/lab). Typically, students will complete the core curriculum courses prior to enrolling in the more advanced offerings.

Code	Title	Credits
BCHM 825	Cell Phenotyping and Tissue Engineering Laboratory	4
BCHM 853	Cell Culture	5
BCHM 854	Molecular Biology Research Methods	5
BCHM 855	Protein Biochemistry Laboratory	5

Elective courses

In addition to the Core requirements, each student will develop a curriculum plan with the Admissions Committee and their Faculty Advisor that includes elective courses and workshops. Students will be encouraged to select elective courses and a capstone experience that encourage specialization (e.g., protein biochemistry, genetic engineering, cell imaging and phenotyping). Each curriculum plan will be customized to meet the career goals of the student. In addition to approved elective courses, other courses may be incorporated into the curriculum plan to provide breath of training. These courses offered by other academic programs include: bioengineering, biomanufacturing, entrepreneurship and business management, and bioregulatory science (including administrative law, intellectual property, and licensing).

Code	Title	Credits
General Electives		
ANFS 933	Design, Analysis, and Interpretation of Experiments	4
BCHM 802	Endocrinology	4
BCHM 851	Principles of Biochemistry I	4
BCHM 852	Principles of Biochemistry II	4
BIOL 811	Experimental Design & Analysis	4
BIOL 950	Scientific Communication	2
CHBE 814	Chemical Sensors	4
CHBE 861	Biochemical Engineering	4
CHBE 862	Biomedical Engineering	4
CHBE 866	Biomaterials	4
GRAD 930	Ethics in Research and Scholarship	2 or 3
LGP 971	BiInnovation Research Collaboration and the Law	2
MCBS 895	Special Topics	1-4
MCBS 997	Seminar	1
Cell Biology Electives		
BCHM 863	Biochemistry of Cancer	4
BIOL 805	Molecular and Cellular Neurobiology	4
MICR 805	Immunology	3
Molecular Biology Electives		
GEN 804	Genetics of Prokaryotic Microbes	5

GEN 811	Genomics and Bioinformatics	4
GEN 812	Programming for Bioinformatics	5
GEN 817	Molecular Microbiology	5
GEN 874	Techniques in Plant Genetic Engineering and Biotechnology	4
MCBS 913	Applied Bioinformatics	3
Protein Biochemistry Electives		
BCHM 850	Physical Biochemistry	3
BCHM 860	Pharmacology	4
BCHM 894	Protein Structure and Function	4
MS #910	Macromolecular Characterization	3

Workshops:

Workshops will be offered during the summer, J-term, and—in selected cases—during the academic year. For five prioritized areas, these workshops build from strong in-place MCBT faculty and staff expertise (and infrastructure) that are directly relevant to the biotechnology and pharmaceutical industry: (1) Cell Imaging and Phenotyping; (2) Cellular Engineering and Analysis of Recombinant Proteins; (3) Mass Spectrometry (4) Nuclear Magnetic Resonance (NMR) Spectroscopy; and (5) Macromolecular Visualization. These workshops will also feature invited participation from regional expert biotech and biopharma colleagues as well as technical specialists from instrument manufacturers, and will typically be developed as one-credit, five-day laboratory immersion experiences on the UNH campus.

Capstone experience (including co-op and internship experiences)

In consultation with the Faculty Advisor and with the approval of the Graduate Program Coordinator, students will design a Capstone experience (up to 10 cr.) that is consistent with their career development plans. The Capstone will typically consist of one of the following: (a) a research project in a UNH faculty member's research laboratory (usually the Faculty Advisor); (b) an internship/co-op experience in an industry setting (including the student's current workplace if applicable); or (c) an intentionally designed set of applied training workshops, as described above. The preferred scenario for the internship is a partnership between the student's off-site internship supervisor and the UNH Faculty Advisor in which the experiential learning experience has some components performed in the workplace and others on-campus.

Accelerated Master's

This graduate program is approved to be taken on an accelerated basis in articulation with certain undergraduate degree programs.

General Accelerated Master's policy, note that some programs have additional requirements (e.g. higher grade expectations) compared to the policy.

Please see the [Graduate School website](#) and contact the department directly for more information.

Accelerated Master's Admission Requirements for UNH Seniors

Accelerated master's admission is designed for highly motivated and qualified UNH students seeking additional training to further their career goals as a researcher in the life sciences. This program is an optimal way for qualified undergraduate students to begin earning graduate credits during their senior year. Students in most programs are able to take up to 12 credits that will count for both undergraduate and graduate credit, allowing them to maximize their time on campus and the return on their

educational investment as they seek to increase their marketability after graduation.

Admission to the Accelerated Master's is highly competitive. Students wishing to pursue this option must have a grade point average greater than 3.2 at the time of application. A faculty advisor must be identified during the junior year and the approval of the advisor must be obtained. Prior to the first semester of the senior year, the student must formally apply to the Graduate School and receive admission to the Accelerated Master's MCBT Graduate Program.

Student Learning Outcomes

All MCBS graduates will be able to:

- Critically apply theories, methodologies, and knowledge to address fundamental questions in their primary area of study.
- Pursue research of significance in the discipline (or an interdisciplinary or creative project). Students plan and conduct this research (or implement their project) under the guidance of an advisor, while developing intellectual independence that typifies true scholarship.
- Demonstrate skills in oral and written communication sufficient to present and publish work in their field, and to prepare grant proposals.
- Follow the principles of ethics in their field, and in academia.
- Demonstrate, through service, the value of their discipline to the academy and community at large.
- Demonstrate a mastery of skills and knowledge at a level required for college and university undergraduate teaching in their discipline and assessment of student learning.
- Interact productively with individuals from diverse backgrounds in the roles of team members, leaders and mentors with integrity and professionalism.

Graduates of the Molecular and Cellular Biotechnology M.S. degree program will be able to:

- Demonstrate hands-on, broad based technical skills in biotechnology methodology.
- Demonstrate the ability to critically review current scientific literature in biotechnology.
- Demonstrate critical thinking skills to solve problems in biotechnology.
- Demonstrate comprehensive knowledge of biotechnology concepts.
- Demonstrate professional and scientific communication skills in biotechnology settings.