BIOINFORMATICS (M.S.)

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 Bioinformatics. This non-thesis degree program addresses the growing workforce and educational needs of the life science industries (including biotechnology, environmental and agricultural sectors). The M.S. in Bioinformatics provides continuing and accessible graduate-level education for individuals from broad socioeconomic backgrounds currently in the workforce, as well as for UNH undergraduate students seeking to enroll in an accelerated Master's program, and to gain enhanced knowledge and specialized 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 Hubbard Center for Genome Studies (HCGS), 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 Bioinformatics 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: genetics, cell biology, math/statistics.

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.

Accelerated Master's Admission Requirements for UNH Seniors

The accelerated master's program is designed for highly motivated and qualified students seeking additional training to further their career goals as a researcher in the life sciences. This program is an optimal way for qualified UNH undergraduate students to begin earning graduate credit 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 Bioinformatics Graduate Program.

Requirements

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

Required courses

The required core curriculum courses consist of Genomics and Bioinformatics; Programming for Bioinformatics; Design, Analysis, and Interpretation of Experiments; and Applied Bioinformatics. Typically, students will complete the core curriculum courses prior to enrolling in the more advanced offerings. 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.

Code	Title	Credits
Core Courses		
GEN 811	Genomics and Bioinformatics	0 or 4
GEN 812	Programming for Bioinformatics	5
ANFS 933	Design, Analysis, and Interpretation of Experiments	4
MCBS 913	Applied Bioinformatics	3

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
Electives		
GEN 805	Population Genetics	3
GEN 806	Human Genetics	4
GEN 815	Molecular Evolution	4
GEN 821	Comparative Genomics	4
BMCB 794	Protein Structure and Function	4

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 6 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 experience in an industry setting (including the student's current workplace if applicable); or **(c)** an intentionally designed set of applied training workshops. 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. Two semesters of independent research experience in bioinformatics, including requirement to present at the Graduate Research Conference.

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 Bioinformatics M.S. program will be able to:

- Identify and/or develop appropriate bioinformatics workflows to address research questions for big data sets in the biological sciences.
- Implement appropriate software tools and statistical analyses packages (including Python, R, and shell scripts), and evaluate the outcomes and performance of these tools.
- Manage large-scale datasets for projects, document workflows, and manage version control in accordance with best practices for ensuring rigor and reproducibility.
- Effectively communicate methodologies and results to project team members, collaborators, and the general public.