

MOLECULAR AND EVOLUTIONARY SYSTEMS BIOLOGY (PH.D.)

<https://colsa.unh.edu/molecular-cellular-biomedical-sciences/program/phd/molecular-evolutionary-systems-biology>

Description

The Ph.D. in Molecular and Evolutionary Systems Biology (MESB) is a coherently-designed doctoral program that promotes interdisciplinary research, deep knowledge in specific disciplines, and technical, professional, and personal skills needed by 21st century scientists and educators. Graduates of the program are equipped for leadership roles in biotechnology and pharmaceutical companies, academic and government research laboratories, and successful careers in teaching and research at the college and university level.

Distinctive Features of the Program

- Emphasis on interdisciplinary research training including co-mentorship across traditional disciplines
- Innovative graduate curriculum that emphasizes ethical, legal, and social implications of bioscience research
- Well-equipped research laboratories and core facilities on the UNH campus
- Laboratory rotations upon entry to the program to become familiar with different research laboratories
- Weekly graduate student seminar presentations, as well as a departmental seminar series of invited speakers
- Opportunities to gain teaching experience as a Graduate Teaching Assistant

Research Opportunities

- Molecular and cellular biology
- Protein structure, function, and regulation
- Signal transduction pathways
- Molecular evolutionary genomics
- Genomics and bioinformatics
- Microbial ecology and evolution

Financial Support

- Students admitted to the Ph.D. program are typically supported by Research Assistantships or Teaching Assistantships
- Intramural summer and academic year fellowships are available to students on a competitive basis.

Career Prospects

- Research directors in biotechnology and pharmaceutical industries
- Principle investigators in academic research labs and research institutes, or state and federal government agencies
- Research and teaching positions in a college or university environment

Admission Requirements

- Completion of foundational courses in biology, chemistry (including organic chemistry), physics, and mathematics
 - Otherwise well-qualified applicants can correct academic deficiencies with enrollment in appropriate courses or independent study during the first year of graduate studies
- Applicants from non-English speaking countries must provide Test of English as a Foreign Language (TOEFL) scores
- Three letters of recommendation
- Personal statement, including research interests and names of two or three potential MESB faculty thesis advisors.

Requirements

Ph.D. Degree Requirements

Degree requirements for the MESB Ph.D. degree include a series of core courses in scientific communication, applied bioinformatics, and ethical, legal, and social implications of modern biotechnology, as well as a research proposal, qualifying examinations, and the completion of a dissertation.

Research Proposal and Oral Defense: No later than at the conclusion of the second full semester of dissertation research (typically the third semester if rotating), students prepare a succinct synopsis of their thesis project, including citations. The synopsis includes:

1. Background: a summary of problem and general knowledge in the field.
2. Hypotheses, Questions, and Relevance: articulates specific hypotheses, questions to be addressed, and importance of research.
3. Approach: a general description of approaches with caveats, possible problems, alternative approaches, and resources of expertise.
4. Timeline: a general timeline for completion of the work.
5. Communication: potential audiences for the work (meetings, publications).

Students submit this synopsis to their guidance committee who will provide input in a committee meeting, which should take place no later than the end of the third semester. Upon review by the guidance committee, students defend their proposal in an oral examination.

Qualifying Examination: The inter-disciplinarity inherent in the MESB graduate program requires that students integrate their training and research objectives across different fields of inquiry. This integration across fields is intended to foster unique perspectives on persistent questions in biology. To demonstrate the significance of the new perspectives reflected in their research proposals, students must also submit a written qualifying examination. Written qualifying examinations may take the form of a review or synthesis article that emphasizes the integration of the research disciplines of the primary and secondary mentors and the significance of this integration given the proposed research problem. The specific format and outline of the written examination will be determined by the guidance committee. Once complete, the written qualifying examination will be submitted to, and assessed by, the guidance committee on a pass/fail basis.

Advancement to Candidacy: The student is advanced to candidacy after the qualifying examination has been successfully passed and other requirements have been fulfilled.

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 all individuals from diverse backgrounds in the roles of team members, leaders and mentors with integrity and professionalism.

Graduates of the Molecular and Evolutionary Systems Biology Ph. D program will be able to:

- Describe general concepts of molecular evolution and systems biology.
- Demonstrate the ability to design, execute, and analyze research in their area of specialization within molecular evolution and systems biology.
- Critically evaluate hypotheses and form conclusions based on the analysis of genomic, and/or other types of biologically derived multivariate datasets.