

DOCTOR OF PHILOSOPHY IN BIOLOGY AND BIOCHEMISTRY

The Molecular Biology and Biochemistry (MB&B) Department program focuses on the molecular basis of life—on mechanisms by which cells process, integrate, and act on information to create and propagate living organisms. The PhD program focuses on advanced scientific inquiry in molecular genetics, molecular biology, biochemistry, and molecular biophysics. The program's low student-faculty ratio (2.5:1) ensures close contact between students and their mentors and enables students to customize their course of study.

The emphasis of the program is on an intensive research experience culminating in a dissertation. Within this general framework, an individual program of study tailored to fit the student's background and interests is designed in consultation with their advisor. PhD candidates will normally complete two lab rotations during their initial two semesters, gaining exposure to various research techniques and topics. The program of study also includes a series of courses covering the major areas of molecular biology, biochemistry, and biophysics; journal clubs in which current research is discussed in an informal setting; practica designed to introduce first-year students to the research interests of the faculty; and several seminar series in which either graduate students or distinguished outside speakers participate. Two specialized interdisciplinary paths in the areas of Molecular Biophysics (<https://www.wesleyan.edu/molbiophys/>) and Informatics and Modeling (<https://www.wesleyan.edu/imcp/>) are also offered. PhD candidates are expected to participate as teaching assistants (TAs) in undergraduate courses for at least their first 3 semesters.

The program culminates in the student's writing and defense of their PhD thesis—an original contribution to the field that merits publication. The PhD candidate will receive advice and guidance from their advising committee, and the thesis is expected to demonstrate both originality and scientific competence.

COURSES

Ideally, incoming students will have completed courses in general biology, cell and molecular biology, genetics, biochemistry, general chemistry, organic chemistry, physical chemistry, and calculus. Deficiencies in any of these areas would normally be made up in the first year on a case-by-case basis. A core curriculum of graduate courses in the following general areas is offered on a two-year cycle:

- regulation of gene expression
- regulation of chromosome dynamics and the cell cycle
- structural mechanisms and energetics of nucleic acid structure and protein-nucleic-acid interactions
- protein structure, folding, and trafficking in cells
- molecular genetics
- the cell cycle
- biological spectroscopy and physical techniques
- bioinformatics and functional genomics
- molecular, biochemical, and cellular bases of cancer and other human diseases

Within this general framework, an individual program of study tailored to fit the student's background and interests is designed in consultation with the

graduate committee and the student's advisor. Graduate students must take at least 3.0 credits of 'lecture-style' courses in order to be eligible to take the Stage I Qualifying examination, which is generally taken in January of the second year of study.

All degree-seeking graduate students are required to register for at least one credit in each semester that they are enrolled in the university.

PROGRESS AND QUALIFYING EXAMS

The criteria for admission to candidacy for the PhD will be performance in courses, aptitude for research, and two qualifying examinations taken in the second year. The Stage I Qualifying Examination is a written examination taken in January, and the Stage II Qualifying Examination is an oral defense of an original research proposal presented by the middle of the fourth semester.

TEACHING

PhD candidates in the MB&B department are expected to participate as teaching assistants (TAs) in undergraduate courses for at least their first 3 semesters. If available, some students may then receive research assistant stipends (RAs) from extramural grants for the remainder of their PhD studies; otherwise, students may continue to receive TA stipends with associated teaching responsibility for the remainder of their PhD studies.

RESEARCH

PhD students will normally complete two lab rotations during their initial two semesters, gaining exposure to a broad range of research techniques and topics in molecular biology. Students generally select one of these rotation labs to pursue their PhD thesis work by the end of the first year, and will begin working on their thesis project during the first summer. The overarching goals of the research experience are to: (i) develop expertise in research methodologies; (ii) develop expertise at the cutting edge of a scientific field, including mastery of relevant literature; (iii) to contribute to the advancement of the field, typically culminating in two published papers in international peer-reviewed scientific journals; (iv) to become effective presenters of scientific data, in the context of their own published manuscripts, seminar presentations, written reports and thesis documents, evaluating published data in journal clubs and coursework, and by presenting at a professional scientific meeting. The MB&B department offers research opportunities across a broad range of topics including but not limited to:

- molecular mechanisms of cell differentiation
- biological roles of transition metals
- mechanisms of DNA repair
- cell and molecular biology of meiosis
- single-molecular studies of protein-DNA interactions
- structural dynamics of nucleic acids and proteins
- chromatin control of chromosome dynamics and gene expression
- UV resonance Raman spectroscopy of biological macromolecules
- biological assembly mechanisms
- structural studies of bacterial virulence factors
- the mammalian olfactory system
- see individual faculty web pages (https://www.wesleyan.edu/mbb/grad_studies/research_areas.html) for specific research projects

CONCENTRATIONS

Molecular Biology and Biochemistry offers two interdisciplinary paths in the areas of Molecular Biophysics (<https://www.wesleyan.edu/molbiophys/>) and Informatics and Modeling (<https://www.wesleyan.edu/imcp/>). Specialization in these areas is achieved through course work, seminars, journal clubs, and dissertation work performed under the guidance of program faculty.

DISSERTATION AND DEFENSE

The most important requirement is a PhD thesis, an original contribution to the field that merits publication. The candidate will receive advice and guidance from their advising committee but must demonstrate both originality and scientific competence. Normally, the candidate will choose a thesis topic during the second year of graduate work in consultation with faculty mentors. Students will select a thesis committee consisting of three additional faculty members, chosen by the student and thesis advisor, with at least two of these members being from the MB&B department. Thesis committee meetings must be scheduled at least once per year in order to provide committee members with updates on progress towards the degree. This committee determines when sufficient experimental work has been completed to begin writing the thesis towards a defense of the body of work. This committee serves as the final examination committee that must approve the final written document and its defense.

ADDITIONAL INFORMATION

For additional information, please visit the department website (<https://www.wesleyan.edu/mbb/>).