

BIOCHEMISTRY (PH.D.)

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

Description

The Ph.D. in Biochemistry combines a rigorous curriculum in biochemistry and related disciplines with interdisciplinary research opportunities at the frontiers of biochemistry, molecular biology, and cell biology. Graduates of the program are equipped for leadership positions 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

- Advanced course offerings include signal transduction pathways, pharmacology, physical biochemistry, proteomics, endocrinology, structural biology, bioinformatics, and cancer biology
- Emphasis on interdisciplinary research training
- 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 experiences as a Graduate Teaching Assistant

Research Opportunities

- Cancer biology
- Protein structure, function, and regulation
- Signal transduction pathways
- Molecular and cellular neuroscience
- Genomics and bioinformatics
- Regenerative biology
- Molecular immunology
- Chemical biology

Financial Support

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

Career Prospects

- Research directors in biotechnology and pharmaceutical industries
- Principle investigators of academic research labs and research institutes, state and federal government agencies
- Academic preparation for future teaching roles 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 identification of two or three potential Biochemistry faculty thesis advisors.

Requirements

Ph.D. Requirements

The Ph.D. in Biochemistry requires the completion of significant, original independent research and preparation of a dissertation for submission to the Graduate School. A minimum of two semesters of Doctoral Research (MCBS 999) is required. Graduate credits are earned for courses numbered 800-999. In most cases, it is expected that the Ph.D. degree will be completed within four to six years of admission to the graduate program. Demonstration of proficiency in biochemistry will be assessed in the first year by examination or coursework.

Guidance Committee: Initially, the Graduate Program Coordinator will assist the student in choosing courses. Following selection of the thesis advisor, the student and the advisor jointly agree on the members of the Guidance Committee, and communicate this recommendation to the Biochemistry Graduate Program Coordinator. The Doctoral Guidance Committee Nomination Form must be completed and submitted to the Graduate School by the end of the first year. The Guidance Committee consists of five faculty members: the advisor (as chairperson), two other members of the biochemistry graduate faculty, and up to two faculty members from other graduate programs. However, only three members of the Guidance Committee are required for the second-year exam. The Committee meets soon after selection of a thesis advisor to determine the student's curriculum. Courses required by the Guidance Committee must be taken for credit and completed with a passing grade (at least a B-minus-). Courses recommended by the committee may be audited or taken for credit, but in either case, the student is expected to be familiar with the subject matter of these courses. It is recommended that the Guidance Committee meet each semester thereafter to assess the student's academic and research progress.

Doctoral Dissertation Committee: The Doctoral Committee is composed of the faculty advisor (as chairperson), two other faculty members in the graduate program in biochemistry, and up to two faculty members from other graduate programs. In most cases, the Guidance Committee constitutes the Doctoral Committee. The Doctoral Committee evaluates the dissertation and administers the final examination. The Doctoral Committee meets annually to assess the progress toward completion of the Ph.D. requirements.

Candidacy: After all coursework is completed, a doctoral student should advance to candidacy. Candidacy is reached after passing:

1. Qualifying Exam – Part 1

The student will prepare and defend a written research proposal on a topic that is outside the thesis topic and approved by the Guidance Committee. To pass *Part 1 of Qualifying Exam*, the student is expected to demonstrate both the ability to write a coherent proposal and broad knowledge of biochemistry and molecular biology that extends beyond the research project.

2. Qualifying Exam – Part 2

The student will submit to the Guidance Committee a written description of the thesis problem, summary of research progress to date, and outline of research goals yet to be attained. To pass Part 2 of the Qualifying Exam, the student is expected to demonstrate ability to plan and conduct research, to think critically and creatively about questions in the student's area of interest, and to be aware of current and recent research literature in these areas. The approval of the qualifying exams will be determined by a majority vote of the committee.

Further details can be found at <https://colsa.unh.edu/molecular-cellular-biomedical-sciences/diagnostic-exams-phd-qualifying-exams>.

Dissertation: The student is required to prepare a written doctoral dissertation for submission to the Doctoral Committee. The dissertation must represent significant and original research written in a clear, comprehensible style. A copy of the complete thesis must be made available to the committee at least two weeks before the date of the final examination. Publication of the dissertation by ProQuest is required.

Final Defense: An oral examination of the doctoral dissertation consists of two parts: an oral presentation of the research that is open to the public, and an oral defense of the dissertation conducted by the doctoral committee. Final approval of the doctoral dissertation will be determined by a majority vote of the doctoral committee.

Teaching Requirement: Teaching assignments in the laboratory, in lectures, or in an individual instruction format are an essential part of the graduate academic programs of the department and are designed to give graduate students practical teaching experience. Normally, one year of part-time teaching will be required of each doctoral student.

- Critically apply theories and methodologies to address fundamental questions in biochemistry through research activities.
- Design and conduct biochemical experiments in their area of specialization, analyze and interpret research data, and draw critical conclusions.
- Communicate biochemical concepts and experimental results effectively in writing and orally both in scientific technical language as well as at an appropriate level tailored for the general audience.

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, as well as adhere to established principles of scientific rigor and reproducibility.
- 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 Biochemistry Ph.D. degree program will be able to:

- Demonstrate extensive knowledge and understanding of fundamental biochemistry principles and their area of specialization in the field.