

# BIOCHEMISTRY, CELLULAR AND MOLECULAR BIOLOGY, PHD

## Fields of Study and Research

The Departments of Biological Chemistry, Biophysics and Biophysical Chemistry, Cell Biology, Molecular Biology and Genetics, Neuroscience, Pharmacology and Molecular Sciences, and Physiology jointly provide a program of study leading to the PhD degree. The objective of the Biochemistry, Cellular and Molecular Biology (BCMB) program is to provide students with the breadth of knowledge and research training that will prepare them for their own independent and productive careers.

Strong emphasis is placed on molecular and cellular approaches to fundamental problems in research areas covered by the participating departments. The focus on a broad background in basic science for all students promotes the study of problems of biomedical importance from a mechanistic perspective. The multi-departmental nature of the program fosters a collaborative environment that is ideal for graduate training, and promotes the extensive interaction and collegiality that is a hallmark of Johns Hopkins science.

Training includes a rigorous and broad-based first year curriculum, research rotations in three different laboratories, a proposal-based qualifying exam (along with a proposal-writing workshop), and thesis research in the laboratory of one of more than 100 participating faculty members. Once they join a laboratory, students establish a departmental affiliation and participate in their departmental journal clubs and seminars. At the same time, students continue to maintain their BCMB identity and affiliation in a number of ways. These include attending the annual BCMB retreat, assisting in the recruitment of new students, hosting a one-day symposium with outside speakers, and participating in a monthly student research colloquium (organized by BCMB students for their peers). There is no formal teaching requirement for BCMB students, but many opportunities for gaining teaching experience are available.

Due to the multidisciplinary focus of the BCMB program, students are very well prepared for the full breadth of modern biomedical science careers. Greater than 90% of students in the BCMB program complete the PhD degree. The average time to degree over the last 10 years is 5.7 years. On average, BCMB students publish 4 research papers with 2 as first author.

To date, there are over 700 BCMB graduates; many hold leadership positions in academia, industry, government and other sectors. At least 97% of graduates in the last 5 years are following career paths in laboratory research, medicine, or research-related careers.

## Facilities

The lecture halls and the research laboratories are located in the Wood Basic Science Building and the adjoining Physiology, Biophysics, Hunterian, Preclinical Teaching, Ross Building, Miller Research, and Rangos Buildings. Modern equipment and state-of-the-art core facilities are available to students. This includes electron microscopes, confocal microscopes, nuclear magnetic resonance spectrometers, mass spectrometers, HPLC and gas-liquid chromatographs, protein sequencers, peptide synthesizers, oligonucleotide synthesizers, X-ray diffraction equipment, as well as instrumentation for microarray analysis and deep sequencing.

## Collaborative Facilities

All seven departments enjoy excellent working relationships with other departments in the medical school and with departments at the Homewood campus.

## Financial Support

All students accepted into the BCMB program receive full tuition, health and dental insurance, and stipend support for the duration of their studies.

## Admission Requirements

Candidates for admission should show a strong academic foundation with coursework in biology, chemistry, physical sciences, and quantitative analysis. A bachelor's degree from a qualified college or university will be required for matriculation.

The BCMB website (<https://bcmb.bs.jhmi.edu/>) has up-to-date information on "How to Apply (<https://bcmb.bs.jhmi.edu/how-to-apply/>)" and "Frequently Asked Questions (<https://bcmb.bs.jhmi.edu/faq-2/>)." For questions not addressed on these pages, please email [bcmb@jhmi.edu](mailto:bcmb@jhmi.edu).

## Program Requirements

Students must successfully complete all eight courses of the "Foundations of Modern Biology" core curriculum, and the Core Discussion course in the first three quarters of year one. During the fourth quarter, students complete two electives, the "BCMB Responsible Conduct in Research" course, and the "Method, Logic and Experimental Design" course. Three additional elective courses are required in the advanced years of study in addition to the BCMB "Seminar" and "Writing a Paper" courses.

An oral examination, conducted as prescribed by the Doctor of Philosophy Board of the University, must be completed before the end of the second year. Subsequently, students are required to participate in annual thesis committee meetings as they work on their thesis project, to review research progress and discuss plans for the next year.

Usually in year five, the student's thesis committee agrees that the student is nearing completion of their research and will be ready to write a dissertation. The student's advisor and one other member from their thesis committee will read and approve the dissertation. The student must present a public seminar on their completed thesis research.

The BCMB program recognizes the importance of students' professional development and career exploration during their graduate studies. In order to better integrate professional development into the training, the BCMB program is formally participating in the "OPTIONS" Career Curriculum offered by the Professional Development and Career Office (PDCO). During the first two years, students attend workshops and panel discussions facilitated by professionals in different fields discussing their career paths, what each profession entails, how the graduate training relates to the required skills and knowledge, and what additional skills would be useful. Several of the speakers are BCMB program alumni, and offer to follow-up with interested students, fostering a sense of community. In year 3, students join an OPTIONS Career Community which comprises six monthly workshops that provide exposure to careers and skills assessment (e.g., Academic Research; Business and Finance; Biotech and Pharma; Science Communication and Policy; Academic Teaching; etc.). In year 4 and beyond, students meet with a career coach

to create a plan for gaining more career-relevant experiences and/or participate in an internship.

## Courses

The first year required courses are as follows:

<b>Code</b>	<b>Title</b>	<b>Credits</b>
ME.800.806	BCMB Computational Biology Bootcamp	1
ME.100.716	Analysis of Macromolecules	2
ME.330.709	Organic Mechanisms in Biology	2
ME.260.709	Molecular Biology and Genomics	1.5
ME.110.733	Principles of Genetics	2
ME.110.728	Cell Structure and Dynamics	1.5
ME.360.728	Pathways and Regulation	2
ME.800.805	BCMB Quantitative Biology Lab	1
ME.800.713	BCMB Responsible Conduct of Research	0.5
ME.800.705	Method, Logic and Experimental Design	1
ME.800.708	BCMB Core Discussion	0.5

Courses are detailed under the course descriptions listed in the entries of the Departments of Biological Chemistry, Biophysics and Biophysical Chemistry, Cell Biology, Molecular Biology and Genetics, Neuroscience, Pharmacology and Molecular Sciences, and Physiology, or as Interdepartmental.