

# BIOPHYSICS AND BIOPHYSICAL CHEMISTRY, PHD/MOLECULAR BIOPHYSICS, PHD

## Biophysics and Biophysical Chemistry

In addition to its participation in the Program in Biochemistry, Cellular, and Molecular Biology (BCMB) described earlier, the Department of Biophysics and Biophysical Chemistry provides training for outstanding students with interests in such quantitative areas as crystallography, enzymology, kinetics, protein design, and mathematical computer modeling, which fall outside the scope of the BCMB Program. Two separate training programs are available. The Program in Molecular Biophysics (PMB) is a large training program involving about 35 faculty members from both campuses of the University. The Biophysics and Biophysical Chemistry Program is a small program tightly centered around the Department of Biophysics and Biophysical Chemistry, and is appropriate to applicants with varied interests and diverse training backgrounds. Requirements for these two programs are given below. Applicants should feel free to discuss with the department which program is most appropriate for them. This program is not accepting applications for the upcoming academic year.

## Molecular Biophysics

The Program in Molecular Biophysics (PMB) was established in 1990 and has evolved continuously over the years to provide its student participants with training in both the fundamental principles of biophysics and contemporary advances in the field. Over 35 faculty, members of 12 departments throughout the University, offer opportunities for learning in diverse and changing areas of research. The carefully designed set of courses and intensive laboratory work integrate various aspects of molecular biophysics into a dynamic curriculum.

Johns Hopkins has long been a leading research institution of world renown. The Hopkins biophysics community is known for its collaborative and congenial atmosphere. Students are encouraged to forge innovative paths by seeking the advice of other biophysicists and forming collaborations that enhance their research. PMB is committed to making the resources of experiment, theory, and computation available to its scientists.

In keeping with an institution of its caliber, a large number of technology hubs and instrumentation facilities are available to Hopkins researchers.

## Admission Requirements Biophysics and Biophysical Chemistry

Candidates for admission to graduate standing should present a Bachelor's degree or equivalent with some undergraduate training beyond the elementary level in at least two of the following areas: chemistry, biology, mathematics, physics, and computer science. Undergraduate courses in physical chemistry, general college physics, differential and integral calculus, and computer science are particularly important. However, deficiencies in some of these subjects can be made up during graduate residency.

## Molecular Biophysics

The Program in Molecular Biophysics is a cross-school program with participant laboratories on the School of Medicine campus and the Arts and Sciences and Engineering campus. The program encourages applications from students who have majored in biological sciences, biochemistry, chemistry, engineering, and physics. Backgrounds in related disciplines are welcomed as well.

The program derives its strength from participants with diverse interests. PMB students come from a range of undergraduate disciplines and, therefore, some may require additional courses or tutorials to round off their basic training. Individual needs can be interwoven into the required curriculum. Optimal background includes general chemistry, organic chemistry, physical chemistry, two semesters of college-level physics, biochemistry or molecular biology, and calculus or a high-level math course.

## Financial Support

All PMB students receive full financial support including tuition, health insurance, fees, and a 12-month stipend. Assuming satisfactory progress toward the Ph.D., students may expect continued support of tuition, health insurance, and stipend through six years of their graduate study.

Program in Molecular Biophysics graduate students are supported for the first two years by a training grant from the National Institutes of Health. However, this support is limited to U.S. citizens and U.S. permanent residents. To be admitted, international students must have funding from their own government or a formal agency.

Students are encouraged to apply for external sources of funding such as National Science Foundation Predoctoral Fellowships, NIH Predoctoral Fellowships to Promote Diversity in Health-Related Research, and the Association for Women in Science Predoctoral Awards. Students accepted in the PMB have an excellent record of success in pursuing these opportunities.

## HOW TO APPLY

Students must complete an online application (<https://applygrad.jhu.edu/apply/>). The GRE is not required. Materials include three letters of recommendation, transcripts, and a statement of purpose.

The deadline for receipt of complete applications is December 1. Promising applicants will be invited to a Visiting Weekend to meet with faculty on both campuses, talk with students, and have a look around Baltimore.

Visit our website at [pmb.jhu.edu](https://pmb.jhu.edu) (<https://pmb.jhu.edu/>). Questions [pmb@jhu.edu](mailto:pmb@jhu.edu)

## Program Requirements Biophysics and Biophysical Chemistry

During the course of graduate study the student must satisfactorily complete the following program of courses in the University or their equivalent at the intermediate or advanced level.

This list does not constitute an inflexible program; exceptions and modifications may be made at the discretion of the department to fit individual backgrounds, needs and interests.

## Required Courses

The following three, short courses, and modules in biophysics are required:

Code	Title	Credits
AS.250.685	Proteins & Nucleic Acids	3
AS.250.689	Physical Chemistry of Biological Macromolecules	3
ME.100.715	Proteins and Nucleic Acids II	3

Additional requirements for the Ph.D. degree are as follows:

**Examinations:** Applicants must pass a qualifying oral examination as prescribed by the Doctor of Philosophy Board of the University. This examination will normally take place during the second year of residency. After the completion of the thesis, the student must satisfactorily complete a comprehensive oral examination administered by the Department of Biophysics and Biophysical Chemistry.

**Dissertation:** Completion of an original investigation and presentation of a dissertation is required. The dissertation must be accepted by the department and must be considered worthy of publication by referees nominated by the department.

## Molecular Biophysics

### Major Research Areas

Protein Folding & Dynamics, Membranes & Membrane Proteins, DNA-Protein Interactions, Structural Biology & Prediction, RNA Biophysics, Enzymes & Metabolic Pathways, Computation & Theory, Protein Design & Evolution, Single Molecule Studies.

### Requirements for the Ph.D.

Degree Students must satisfactorily complete required and elective coursework. In addition, students must pass a Doctor of Philosophy Board Oral, a qualifying exam required university-wide, administered at the end of the second year. Students must continue to make satisfactory progress toward completion of their thesis research and meet annually with a thesis review committee in years 3 and 4 and semi-annually beyond year 4. Once thesis research is complete, students must defend their thesis before a final exam committee and present a final thesis seminar.

### Required Courses

The methods and tools of biophysics are drawn from physics, chemistry, biology, mathematics and computer science. Consequently, the curriculum is correspondingly broad and rigorous. Four required courses form the core of the PMB curriculum: Physical Chemistry of Biological Macromolecules, Introduction to Computing in Biology, Proteins & Nucleic Acids, Proteins & Nucleic Acids 2 and Modules in Molecular Biophysics, . Students also take a four week course, Introduction to Computing in Biology in fall of their first year. These courses provide a conceptual framework for understanding energetics, dynamics, structure and interactions at the molecular level, practical experience in computational analysis, and exposure to the current frontiers of biophysical research.

### Additional Academic Requirements

In addition to coursework, students attend weekly seminars and present one of their own in the third year. Proficiency in biochemistry, cell biology, and molecular biology is tested formally with an oral evaluation at the end of the first year. Tutorials and self-directed study provide alternative avenues for preparing for this evaluation.

The program aims to involve students in research projects from the start. First-year students complete three 7-10-week rotations in laboratories of their choosing. At the end of each rotation period, students present 10-minute talks with their rotation advisors, other faculty and students present. By summer of the first year, a student will have joined a research group and embarked on thesis research. Students are accepted to Ph.D.

candidacy after successful completion of a qualifying oral exam at the end of the second year. Beginning in the fifth semester, students meet - (semi-annually beyond year 4) with a faculty thesis review committee.

### Dissertation

Completion of an original Investigation and presentation of a dissertation are required. The dissertation must be accepted by the program and the results considered worthy of publication by the referees.