



ABOUT THE PROGRAM

Picture the living cell as an elaborate factory filled with microscopic machines; transportation, information and control systems; and repair facilities. It has the ability to process raw materials into useful products and adapt itself to changing conditions, as well as to defend itself against invasion and even the capacity to replicate itself. The purpose of studying biological physics is to understand this amazing system in terms of structure, forces, energy and system design. The biological physics major prepares students for research, in an academic or industry environment, that combines techniques from mathematics, physics, chemistry and biology to answer outstanding problems in the fields of biology and medicine.

What makes the program distinctive?

Brandeis is one of only a handful of schools in the country to offer a biological physics major. Students can participate in cutting-edge research, such as using nuclear magnetic resonance and electron microscopy

to see the structure of molecules and mechanically manipulating molecular motors using “laser tweezers.” There are research projects involving lab research, theory, data analysis and computational simulations.

FAST FACTS

Number of faculty: 10

Can you minor in this program? No

Emphasis within the major: interdisciplinary study, with faculty and students from biology, chemistry and physics working side by side

Popular second majors: biology, physics

Website: brandeis.edu/programs/biophysics

ACADEMICS AND RESEARCH

Guest speakers

There are weekly seminars and colloquia by invited guests from all over the world who come to Brandeis to speak about their research. The graduate program in quantitative biology, which is one of only 10 such programs in the country, specifically brings speakers whose interest is at the interface of physics, chemistry and biology.

Research opportunities

Nearly all biological physics majors carry out research working one-on-one with faculty and graduate students. This may be during the semester or during the summers, usually in paid positions. Students have the opportunity to present their research at conferences and symposia held during the year in the Boston area.

Introductory course

The first-year seminar "Nature's Nanotechnology" explores the inner workings of molecular machines within cells, using no more than high school science and math. This course also serves as an introduction to the biological physics major.

Microscopy techniques

Students have used cutting-edge microscopy techniques to study the molecular mechanisms of DNA-damage repair inside living cells. They also have studied how certain bacteria are capable of detecting magnetic fields, and they have exploited viruses to make new, designer materials.

Other opportunities

Biological physics is one of the fastest-growing fields of science at Brandeis. Biological physics students can take courses for credit at Boston University, Boston College, Wellesley College, Tufts University and Olin College of Engineering.

AWARDS AND RECOGNITION

Grant-supported research

Faculty members participating in the biological physics major are funded by grants from the National Science Foundation (NSF), the Department of Energy and the National Institutes of Health. Two particularly noteworthy grants are a \$1 million, three-year award from the W.M. Keck Foundation for interdisciplinary research into possible mechanisms by which life could have arisen on earth, and a \$12 million, six-year award from the NSF for a materials science and engineering research center. The center will be dedicated to studying cells and biological molecules from a physics perspective, and how scientists can use principles and materials from biological systems to create advanced materials. All of these grants help support undergraduate research.

Distinguished faculty

Robert Meyer is a recipient of the Benjamin Franklin Medal in Physics and the Buckley Prize from the American Physics Society for his work on liquid crystals. Alfred Redfield has received the Biophysics Prize from the American Physics Society for his work on magnetic resonance imaging. In 2015, Jané Kondev received a \$1 million grant from the Hughes Foundation to advance undergraduate research; Kondev is also a recipient of the Jeanette Lerman-Neubauer '69 Prize for Excellence in Teaching and Mentoring.

Student awards

Biological physics majors are eligible for the Stephan Berko Memorial Prize for undergraduate research and the Physics Department Prize, given to a graduating senior. Leah Shapiro '17 received the Giumette Academic Achievement Award for outstanding scholarship and academic achievements at Brandeis.

BEYOND THE CLASSROOM

Extracurricular activities

The Physics Club is open to all biological physics majors and meets regularly. Its activities include special lectures, outside trips, tutoring, outreach to local schools and special creative projects.

Summer research

Many students participate in the summer Research Experiences for Undergraduates program funded by the National Science Foundation at institutions across the United States.

AFTER BRANDEIS

Graduate degrees

Most students go to graduate school to earn a PhD in a field such as biomedical engineering, biotechnology, materials science and engineering, or biophysics. Students routinely receive full scholarships for graduate studies leading to a PhD from the universities they attend after Brandeis. Recent graduates have gone on to advanced degrees at Harvard University, Carnegie Mellon, Yale University, Caltech and the University of California, Berkeley.

