

BIOMEDICAL ENGINEERING, PHD THROUGH THE SCHOOL OF MEDICINE

The Department of Biomedical Engineering is uniquely positioned within the Johns Hopkins School of Medicine and the Whiting School of Engineering, giving our students access to top clinicians, researchers, and engineers. Our students are passionate about discovery and innovation, with a demonstrated trajectory of laboratory experience, and maturing knowledge of biology, engineering, and science.

In their first year, students have the option to take many of the same courses as medical students, such as human anatomy, neuroscience, and immunology. Students also take advanced engineering and science courses. Students who apply to our program should have a strong background in quantitative sciences – e.g. engineering, physics, mathematics or applied math, as well as sufficient experience in chemistry and biology. Applicants with a strong background in biological sciences who also demonstrate ability and potential in quantitative sciences are also encouraged to apply. Students who receive a rotation offer are free to choose from almost any research lab in the university. To facilitate this process, students do two or more rotations during their first year and typically choose a lab by the end of the summer of their first year. Students who receive an offer to work with specific laboratories forego the rotation process and get into their thesis research from day one.

Emphasis is placed on original research leading to the doctoral dissertation. The research is usually experimental in nature, and students are expected to learn biological experimentation techniques. Nevertheless, experiment or theory can be emphasized in the research as desired by the student.

Financial Aid

All students are admitted with full financial support regardless of citizenship or national origin. This includes a yearly stipend, full tuition, matriculation fee, and individual medical and dental insurance. Students are encouraged to apply for individual fellowships from the National Science Foundation and for NRSA awards from the NIH.

Admission

The School of Medicine program accepts applications for the Ph.D. program until **December 1** of each year. We typically recruit students in seven broad areas: Biomedical Data Science, Computational Medicine, Genomics and Systems Biology, Imaging and Medical Devices, Immunoengineering, Neuroengineering, and Translational Cell and Tissue Engineering. That doesn't mean applicants have to fit into one of these areas; much of the best research comes from interdisciplinary work. These areas will help you review which faculty members might be best suited to be your research mentors, and will form part of the community you join when you matriculate. The program is unique in that it offers the BME student the strengths of one of the best medical schools in the world.

In their first year, our students have the option of taking many of the same courses as the medical students, including human anatomy, molecules and cells, and genes to society. In their second year, our students take advanced engineering courses. Therefore, students that apply to our program need to not only have a strong background in engineering and

mathematics, but also sufficient background in chemistry (including organic chemistry) and one year of college-level biology.

The admission process is led by committees organized by the seven focus areas listed above. Applicants should specify in which area (or areas) they are most interested, and describe the kind of research they foresee. Faculty in each area vote and rank the applicants in the initial selection round, and the final pool of applicants is ranked and voted on by the entire faculty.

Applications should be complete when submitted. In order to be considered a complete application we must have:

- A completed online application: <https://www.bme.jhu.edu/johns-hopkins-biomedical-engineering/apply/>
- **Official transcripts from each college or university attended**—Official transcripts from each college or university attended. Applicants may upload transcripts to the online application for review. Applicants who receive an offer or accept an offer of admission are required to submit official transcripts to OGSA via mail or electronically to gradadmissions@jhmi.edu.
- **Official Graduate Record Examination**—Please review our current GRE guidelines by going to: <https://www.bme.jhu.edu/academics/graduate/phd-program/apply-to-the-phd-program/>. The BME Ph.D. program does not rely heavily on the GRE exam in making admissions or financial aid decisions. Research experience, course grades, and recommendations carry more weight.
- **Three letters of recommendation**—Three letters of recommendation from faculty members who are acquainted with you and your academic work. These letters should include comments on your aptitude and promise for independent research.
- **Personal Statement**—A typewritten personal statement (one page maximum) indicating the basis of your interest in graduate study and your career objectives. Include discussion of any research experience you have had. Also mention here which faculty members you would be most interested in working with and why. A separate personal statement on diversity, equity, and inclusion in science is optional.
- **TOEFL scores**—for foreign students only; official copy.

Applicants for admission must fulfill the following course prerequisites:

- One year of college-level biology (may include quantitative biology or physiology)
- One semester of organic chemistry is required for students interested in the Immunoengineering or Translational Cell & Tissue Engineering research areas
- Sufficient mathematical training, typically including differential equations or other relevant mathematical preparation

If you are interested in applying and do not have the prerequisite courses, you may want to submit your application with an explanatory note indicating you have made or will make arrangements to take the prerequisites before you would matriculate, if your application is accepted. In the past, applicants have taken the prerequisites at their present schools, local community colleges, etc. Courses taken at any accredited college or university are acceptable.

Each applicant must have received a B.A. or B.S. degree or its equivalent prior to matriculation. A Masters degree is not required for admission to our program.

Processing

The Ph.D. Program admissions committee will not consider any application until it is complete. Once an application has been received the applicant will be notified if supporting materials are missing.

Interview

The admissions committee will review completed applications and invite selected applicants to interview with our faculty by phone, Zoom, or similar virtual platforms. Applicants must complete the interview process to be considered for admission, and final admissions decisions will be made from the pool of interviewed applicants. Interview invitations will be sent out to applicants via email by mid- to late- January, or earlier if feasible. Virtual interviews will be conducted in early February. Selected students will be invited to an in-person campus visit in early March to meet current faculty and graduate students, as well as learn more about the program the Hopkins BME environment.

Acceptance

Applicants will be notified via email by late March with the outcome of their application. A full offer of admission to the program will include a yearly stipend, full tuition, matriculation fee, and individual medical and dental insurance. This applies to every accepted applicant, regardless of citizenship or national origin unless the applicant receives a conditional acceptance. Those offered admission will be asked to communicate their decision as soon as possible. In any case, we must have the applicant's decision by April 15.

Program Requirements

The first two years are ordinarily devoted to advanced courses in engineering science and in biomedical science. A minimum of 30 credits are required with at least twelve credit hours of course work in engineering, mathematics, or physical sciences and at least twelve credit hours of course work in the life sciences. Engineering, mathematics, and other physical science courses to be taken are arranged between students and their advisors. Each student is assigned a faculty mentor during the first year. This relationship is designed to help students acclimate to the program.

Summers are spent working in a biomedical laboratory to gain experience and to seek out a suitable thesis research area. By the beginning of the third year, students should start original research leading to the dissertation. Students must fulfill a modest teaching requirement during one year of their program. The remaining time is spent in thesis research. The program typically takes five to six years to complete.

The student must pass a preliminary oral examination which will be a Graduate Board examination. This is taken no later than the end of the second year. The student must then conduct original research, describe it in a dissertation, and pass a final oral examination that is a defense of the dissertation. There is a minimum residency requirement of two consecutive academic years.

Integrated M.D./Ph.D. Program

Candidates for the Ph.D. in biomedical engineering who wish to apply jointly for the M.D. degree must apply directly through the School of Medicine. Although the combined programs would normally require at least seven years to execute sequentially, the combined program can ordinarily be completed in six years, with appropriate planning. Good preparation in biology and chemistry as well as mathematics, engineering, and the physical sciences is essential. Life science graduate

requirements are met by the first-year program of the School of Medicine. This program is more arduous than the Ph.D. program alone, but it may have marked advantages for students interested in clinical research and applications in hospital systems and in the delivery of health care. The catalogue for the School of Medicine should be consulted for admissions requirements and procedures.

Information about applying to the combined M.D.-Ph.D. program can be found at the MD-PhD website (<https://www.bme.jhu.edu/academics/graduate/phd-program/md-phd-program/>). Applications submitted for consideration of the combined degree will be reviewed by the Medical School admissions committee. If the Medical School admissions committee accepts the application, it is then passed along to the Biomedical Engineering Ph.D. Program admissions committee for review. A student applying to the combined program who wishes to be considered for the straight Ph.D. program must submit a written request to have their application forwarded to the Biomedical Engineering Ph.D. Program office for admission consideration if their application is not accepted by the Medical School admissions committee.