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, medical and dental insurance, and paid health insurance premiums for eligible dependent children and spouses unable to work in the US, including dental and vision.   Students are encouraged to apply for individual fellowships from the National Science Foundation and for NRSA awards from the NIH.

Admission

The application deadline for the School of Medicine Biomedical Engineering PhD program is **December 1** of each year. We typically recruit students in seven broad areas that match the research strengths within the BME department: Biomedical Data Science, Computational Medicine, Genomics and Systems Biology, Imaging and Medical Devices, Immunoengineering, Neuroengineering, and Translational Cell and Tissue Engineering. Applicants do not have to fit into one of these areas, and much of the best research comes from interdisciplinary work. However, these areas help students identify faculty who match their research interests and form part of their community after they matriculate.

BME students come from a wide variety of academic and research backgrounds, but a typical BME thesis project involves applying engineering or quantitative approaches to address biological or health-related questions. Therefore, students who apply to our program should have a strong background in engineering, physics, or mathematics as well as a sufficient experience in chemistry and biology.

The admission process is led by committees organized by the seven focus areas listed above. Applicants should specify the area (or areas) in which they are most interested, and describe their future research goals. Each application is reviewed holistically, with emphasis placed on research experience, the personal statement, letters of recommendation, and how well the candidate's goals and interests fit with those of the program. 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 admissions committee following the interview process.

Applications must be submitted and complete by the application deadline. To be considered for review, a complete application must include:

- A complete and submitted online application (https://www.bme.jhu.edu/johns-hopkins-biomedical-engieering/apply/).
- **Transcripts from each college or university attended**—Applicants may upload unofficial 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 the School of Medicine's Office of Graduate Biomedical Education via mail or email (gradadmissions@jhmi.edu).
- **Three letters of recommendation**—Letters of recommendation should come from faculty members who are acquainted with the applicant's academic work and/or research. These letters should include comments on the applicant's aptitude and promise for independent research.
- **Personal Statement**—A typewritten personal statement (one page maximum) indicating the basis of the applicant's interest in graduate study and their career objectives. Applicants should include discussion of any previous research and mention which faculty they would be most interested in working with and why. A separate personal statement describing how the applicant's life experiences or identity shaped their goals is optional.
- **C.V.**—A current C.V. summarizing the applicant's academic, professional, and research experience.
- **TOEFL scores**—For international students only; the TOEFL requirement is waived for applicants who completed their degree at an institution that used English as the primary language of instruction.
- **Application fee**—Information on requesting a fee waiver can be found on the School of Medicine website (https://www.hopkinsmedicine.org/som/education-programs/graduate-programs/admissions/on-campus-programs/): .

GRE scores are now optional. Read more about our application requirements and GRE policy here (https://www.bme.jhu.edu/academics/graduate/phd-program/apply-to-the-phd-program/).

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 (for students interested in the Immunoengineering or Translational Cell & Tissue Engineering research areas)
- Sufficient mathematical training, typically including differential equations

Students interested in applying who do not have the prerequisite course experience may want to include in their application an explanatory note indicating any plans to fulfill the prerequisites before the start of the PhD program should their application be accepted. 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 Master's degree is not required for admission to our program.

Interviews

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 in January and interviews will be conducted in January or early February. Selected students will be invited to an in-person campus visit in late February or early March to meet current faculty and graduate students, as well as learn more about the program and the Hopkins BME environment.

Offers and Acceptance

Applicants will be notified via email in March, or earlier if possible, with the outcome of their application. The BME PhD program extends two types of offers: rotation offers and direct-match offers. The only difference between the offer types is how the student chooses their thesis lab; all other aspects of the program are the same for all BME students. Students who receive a direct-match offer typically join a specific research lab from day one, while students who receive a rotation offer are able to rotate in their choice of labs before selecting a thesis lab by the end of their first year.

A full offer of admission to the program will include a yearly stipend, full tuition, matriculation fee, medical and dental insurance and paid health insurance premiums for eligible dependent children and spouses unable to work in the US, including dental and vision. This applies to all admitted students regardless of citizenship or offer type. The deadline to accept an offer of admission is April 15.

Program Requirements

During their first two years in the program, BME PhD students take advanced courses in engineering and biomedical science. Students must complete a minimum of 30 credits, with at least twelve credits in engineering or the quantitative sciences and at least twelve credits in the life sciences or medicine. In addition, at least three credits must include substantial theory content. The program does not require specific courses to fulfill these 30 credits, but students should work with their faculty advisor to choose appropriate courses based on their research interests. Students also complete required ethics and seminar-based courses in their first year, and at least one teaching or teaching assistant experience in later years. Following completion of their course requirements, or no later than the end of the second year, students must pass a Doctoral Board Oral exam (DBO).

BME PhD students also begin working in one or more research laboratories during their first year, either through a series of lab rotations or by joining a thesis lab directly upon matriculation. All students should choose a thesis lab by the end of their first year. By the beginning of their third year, students should start original research leading to a dissertation. Though students may continue to take courses or teach in their third year and beyond, the majority of their time should be spent

on their thesis research. Following a series of annual thesis committee meetings, students describe their research in a dissertation and present their work in a public defense in order to graduate. The program typically takes five to six years to complete.

Integrated M.D./Ph.D. Program

Students interested in clinical research, health care delivery, or applications in hospital systems may wish to pursue both MD and PhD degrees. To complete both degrees jointly, students must apply directly to the School of Medicine Medical Scientist Training Program (MSTP). The combined MD-PhD program takes, on average, seven or eight years to complete, and applicants must have good preparation in biology and chemistry, as well as mathematics, engineering, and the physical sciences. MD-PhD students fulfill their life science course requirements through the first-year medical curriculum in the School of Medicine.

Admissions requirements and procedures for the MSTP program can be found here (https://mdphd.johnshopkins.edu/admissions/). Applications are reviewed by the MD-PhD admissions committee and accepted applications are passed to the Biomedical Engineering PhD program admissions committee for review. If an applicant is not accepted into the MSTP program and wishes to be considered for the BME PhD program, they must submit a written request to have their application forwarded to the BME PhD program office for review.