Bioengineering

Website (https://bioe.northeastern.edu/)

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The Department of Bioengineering offers students a broad education built on fundamentals in science, mathematics, and engineering, with a focus on the biological applications of engineering. The program is designed to provide a rigorous engineering training along with a comprehensive understanding of the biological constraints intrinsic to designing artificial systems to interface with, augment, replace, repair, or monitor living systems. These constraints depend on the properties of the biological system involved and the functionality that is being created. The living system may be the human body; an ecosystem; or, more broadly, a bioreactor, tissue culture system, or any system with living components. The presence of naturally occurring biological tissue places special constraints on the design and implementation of artificial constructs and their interface to living systems. Bioengineers are engineers with comprehensive understanding of the engineering requirements intrinsic to working within a biological context.

Bioengineering is a relatively new field driven by the recognition that engineering of biological systems or systems that interface with living systems requires a multidisciplinary approach that takes into account the mechanical, electrical, chemical, and materials properties of the biological system. With that in mind, the bioengineering major has been designed to provide a rigorous engineering education that endows a broad understanding of the quantitative analysis of biological systems and a deep expertise in a focused area of bioengineering. The curriculum is structured around a core of six courses that quantitatively analyze biological systems from multiple points of view. The core provides the fundamentals of quantitative physiology, electrical engineering in the context of excitable tissues; basics of mechanical engineering in the context of the musculoskeletal system; and thermodynamics, heat transfer, and fluids mechanics within the context of physiological systems. The core curriculum culminates with a two-semester capstone course to provide experience in design and implementation of a novel bioengineering project. For bioengineering majors, students choose one of four concentrations (biomechanics and mechanobiology; biomedical devices and bioimaging; molecular, cell, and tissue engineering; and systems, synthetic, and computational bioengineering), which provides the opportunity to develop a deep level of expertise in an important area of bioengineering. In addition to the flagship bioengineering major, the Department of Bioengineering collaborates with other departments to offer combined majors in bioengineering and biochemistry, bioengineering and behavioral neuroscience, chemical engineering and bioengineering, and mechanical engineering and bioengineering.

Mission of the Department

The program is committed to providing a multidisciplinary education, making connections from the classroom and laboratory to research, co-op, and cocurricular experiences. The curriculum provides fundamentals in mathematics, physical sciences, and engineering science; laboratory experiences; as well as an emphasis on the special considerations intrinsic to design within a biological context. Through Northeastern University's general educational requirements, students gain awareness of the impact of engineering decisions in a broader societal and ethical context. The department encourages professional development through active participation and leadership in student organizations, societies, and departmental activities. As a result, the bioengineering program is designed to prepare students for success in industrial careers; graduate programs; or professional medical, law, and business schools.

Other Programmatic Features

By participating in our cooperative education program, our graduates will have an opportunity to explore what career objectives fit their own skills and interests. The goal of this component of our program is to offer students valuable professional experience and contacts that will help get them started in their professional career, as well as to develop career management skills. The co-op program parallels the academic program in level of responsibility and sophistication.

The department also offers significant research opportunities throughout all fields of bioengineering, including participating in research centers based in our department and college, as well as new interdisciplinary graduate and professional master's programs.

The bioengineering curriculum is an innovative plan that is continuously and carefully assessed and evaluated to ensure that graduates of the program are fully prepared for success as professional bioengineers and are prepared for graduate or professional school.

Programs

Bachelor of Science in Bioengineering (BSBioE)

- Bioengineering (https://catalog.northeastern.edu/undergraduate/engineering/bioengineering/bioengineering-bsbioe/) (Boston)
- Bioengineering and Biochemistry (https://catalog.northeastern.edu/undergraduate/engineering/bioengineering/bioengineering-biochemistry-bsbioe/) (Boston)
- Bioengineering and Behavioral Neuroscience (https://catalog.northeastern.edu/undergraduate/engineering/bioengineering/bioengineering-behavioral-neuroscience-bsbioe-bos/) (Boston)

Bachelor of Science in Chemical Engineering (BSChE)

- Chemical Engineering and Bioengineering (https://catalog.northeastern.edu/undergraduate/engineering/chemical/chemical-engineering-bioengineering-bsche/) (Boston)

Bachelor of Science in Mechanical Engineering (BSME)

- Mechanical Engineering and Bioengineering (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-bioengineering-bsme/) (Boston)

Minor

- Bioengineering (https://catalog.northeastern.edu/undergraduate/engineering/bioengineering/bioengineering-minor/)

Accelerated Programs

See Accelerated Bachelor/Graduate Degree Programs (https://catalog.northeastern.edu/undergraduate/engineering/accelerated-bachelor-graduate-degree-programs/#programstext)