

Department of Biological Engineering

The [Department of Biological Engineering](#) (BE) continues to grow in terms of world-class faculty and students, innovative educational programs, and leading-edge research programs that advance its mission of fostering education and research that fuses engineering with molecular life sciences. Our central objective is to define and lead the new biology-based engineering discipline of biological engineering. The foundational premise of BE is that the science of biology will be as important to technology and society in the next century as physics and chemistry have been in the previous one. Therefore, to translate the revolution in modern biology into a corresponding revolution in biology-based technologies, a new biology-based discipline of bioengineering must be established. Our central theme is “Creating Biological Technologies, from Discovery to Design” or, more colloquially, “Designing the Biology, not just the Box.”

Faculty and Staff

The current BE faculty members (with other MIT academic unit affiliations noted in parentheses) are as follows: Eric Alm (Civil and Environmental Engineering [CEE]), Mark Bathe (Mechanical Engineering [MechE]), Angela Belcher (Materials Science and Engineering [MSE]), Paul Blainey, Chris Burge (Biology), Arup Chakraborty (Chemical Engineering, Chemistry), Peter Dedon, Edward DeLong (CEE), Bevin Engelward, John Essigmann (Chemistry), James Fox, Ernest Fraenkel, Linda Griffith (Mechanical Engineering), Alan Grodzinsky (Electrical Engineering and Computer Science [EECS], Mechanical Engineering), Jongyoon Han (EECS), Darrell Irvine (MSE), Alan Jasanoff (Brain and Cognitive Sciences), Roger Kamm (MechE), Alexander Klibanov (Chemistry), Robert Langer (Chemical Engineering), Douglas Lauffenburger (Biology, Chemical Engineering), Harvey Lodish (Biology), Scott Manalis (MechE), Jacquin Niles, Katharina Ribbeck, Jonathan Runstadler, Leona Samson (Biology), Ram Sasisekharan, Peter So (MechE), Steven Tannenbaum (Chemistry), William Thilly, Bruce Tidor (EECS), Krystyn Van Vliet (MSE), Christopher Voigt, Ron Weiss (EECS), Forest White, Dane Wittrup (Chemical Engineering), Michael Yaffe (Biology), Mehmet Fatih Yanik (EECS), and Feng Zhang (Brain and Cognitive Sciences).

Douglas Lauffenburger continues as head of BE and Bruce Tidor assists him as associate head. Dane Wittrup and Forest White are co-chairs of the BE graduate program and Scott Manalis is chair of the BE undergraduate program. Rolanda Dudley-Cowans is the BE administrative officer and Dalia Fares is the BE academic administrator.

Events

The annual Biological Engineering retreat was a special highlight of the past year. More than 170 faculty members, graduate students, and BE staff gathered at a conference center in Randolph, MA, for a stimulating and enjoyable day of research, education, and ethics discussions as well as social interactions away from campus.

Research

During fiscal year 2013, the total sponsored research volume supervised by BE faculty members exceeded \$58 million. This figure includes sponsored projects formally administered by the department (more than \$31 million), as well as projects that were directed by BE faculty members and supervised administratively within other departments and centers, including the Center for Biomedical Engineering, the Center for Environmental Health Sciences, the Computational and Systems Biology Initiative, the Division of Comparative Medicine, Broad Institute, and the Koch Institute for Integrative Cancer Research. Major research areas within BE include biological imaging; biomaterials; biomolecular engineering; cell and tissue engineering; computational biology and bioinformatics; discovery, design, and delivery of molecular therapeutics; molecular and cellular biophysics; infectious disease and immunology; microbial ecosystems; neurobiology and neuroengineering; biomechanics; molecular epidemiology; molecular pharmacology and toxicology; genomics, proteomics, and glycomics; systems biology; and synthetic biology.

Undergraduate Education

We are excited about the continuing growth of our pioneering Course 20 SB major program. Biological Engineering had 52 graduating seniors in June 2013 and has approximately 46 rising seniors, 65 rising juniors, and 68 rising sophomores for the 2013–2014 academic year. To our knowledge, there is no similar undergraduate degree program anywhere in the nation that centers on genetics, biochemistry, molecular biology, and cell biology as its science foundation and that fuses this science with quantitative, integrative-systems, design-oriented engineering principles and approaches (e.g., thermodynamics, kinetics, mechanics, transportation, instrumentation, and computation), including hands-on laboratory subjects. Judging by our initial cohort of graduates, we expect that Course 20 students will continue to find attractive career opportunities across a spectrum of industrial, academic, and professional areas. We also continue to administer two SB minor programs, one in biomedical engineering and the other in toxicology and environmental health. In addition, we administer a five-year MEng program in biomedical engineering with a bioengineering track.

Graduate Education

BE administers a PhD in biological engineering program with two intimately integrated tracks, one in bioengineering and the other in applied bioscience. Current enrollment is 131 students, with 72 in the bioengineering track, 36 in the applied biosciences track, and 23 incoming students who have not yet designated their track. As is the case with the BE undergraduate programs, our graduate student population represents women and men in roughly equal numbers. The department graduated 21 PhD students in June 2013, with 15 in the bioengineering track and 6 in the applied biosciences track.

We are deeply appreciative of the wonderfully generous gifts for graduate student fellowships, most notably from Andrew and Erna Viterbi for the Viterbi graduate fellowships in computational/systems biology, Gordon and Adele Binder for the Binder graduate fellowships in biotechnology, Susan Whitehead and Diane Green for the

Friends of BE graduate fellowships in biological engineering, Noubar Afeyan for the Afeyan graduate fellowships in biological engineering, and Merrimack Pharmaceuticals for the Merrimack graduate fellowships in computational/systems biology. Additionally, we have received financial support for campus-administered graduate fellowships from the MIT Energy Initiative and from Momenta Pharmaceuticals.

BE is also grateful for the generous gifts that support important departmental initiatives as well as the growth of other aspects of our ongoing programs, including major gifts from Andrew Viterbi, Cliff Reid, and Pfizer Inc.

Douglas A. Lauffenburger
Department Head
Ford Professor of Engineering