

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 our mission of fostering education and research fusing engineering with molecular life sciences. Our central objective is to define and lead a new biology-based engineering discipline that we term 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 [ChemE], Chemistry), Peter Dedon, Edward DeLong (CEE), Bevin Engelward, John Essigmann (Chemistry), James Fox, Ernest Fraenkel, Linda Griffith (MechE), Alan Grodzinsky (Electrical Engineering and Computer Science [EECS], MechE), Jongyoon Han (EECS), Darrell Irvine (MSE), Alan Jasanoff (Brain and Cognitive Sciences), Roger Kamm (MechE), Alexander Klibanov (Chemistry), Robert Langer (ChemE), Douglas Lauffenburger (Biology, ChemE), 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 (ChemE), Michael Yaffe (Biology), 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 cochairs of the BE graduate program and Scott Manalis is chair of the BE undergraduate program. Rolanda Dudley-Cowans is our administrative officer, and Dalia Fares is our academic administrator.

Research

During FY2012, the total sponsored research volume supervised by BE faculty members was more than \$54 million. This figure includes sponsored projects formally administered by the department (more than \$24 million) as well as projects directed by BE faculty members supervised administratively within other departments and centers, including the Center for Biomedical Engineering, Center for Environmental Health Sciences, Computational and Systems Biology Initiative, Division of Comparative Medicine, Broad Institute, and 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. The 11th annual BE retreat was a special highlight of this past year. More than 170 faculty, graduate students, and staff gathered at a conference center in Randolph, MA, for a stimulating and enjoyable day of research, education, and ethics discussions and social interactions away from campus.

Undergraduate Education

We are excited about the continuing growth of our pioneering Course 20 SB major program. We had 32 graduating seniors in June 2012 and now have approximately 55 rising seniors, 62 rising juniors, and 92 rising sophomores for the forthcoming 2012–2013 academic year. From our perspective, there is no similar undergraduate degree program elsewhere nationally that is centered 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, transport, fields, instrumentation, and computation), including two hands-on laboratory subjects. Judging from our initial cohorts of graduates, we expect that our uniquely educated 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, in biomedical engineering and toxicology and environmental health. In addition, we administer a five-year MEng program in biomedical engineering with a bioengineering track.

Graduate Education

BE continues to administer a PhD in biological engineering with two intimately integrated tracks, one in bioengineering and one in applied bioscience. Our current enrollment is 127, with 68 students in the bioengineering track, 32 students in the applied biosciences track, and 27 incoming students who have not yet designated their track. Similarly to the BE undergraduate programs, our graduate student population represents women and men in roughly equal numbers. The department graduated 20 PhD students in June 2012, with 16 in the bioengineering track and 4 in the applied biosciences track.

We are deeply appreciative of 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 Momenta Pharmaceuticals.

BE is also grateful for other generous gifts toward significant aspects of our ongoing program growth, including major gifts from Andrew Viterbi, Cliff Reid, and Pfizer Inc. for important departmental initiatives.

Douglas A. Lauffenburger
Department Head
Ford Professor of Engineering