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. A 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. A central theme for BE 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), Angela Koehler, 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), Fatih Yanik (EECS), Feng Zhang (Brain and Cognitive Sciences).

Douglas Lauffenburger continues as head of BE and Leona Samson assists him as associate head. Forest White and Chris Voigt 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 academic administrator.

Research Activities

During fiscal year 2014, the total amount of sponsored research volume supervised by BE faculty members was more than $63 million. This figure includes sponsored projects formally administered by the department (more than $35 million), as well as projects that were directed by BE faculty members and supervised administratively within other departments and centers, including but not limited to 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.

A special highlight of this past year was the 13th annual BE retreat. 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.

Undergraduate Education

Biological Engineering had 42 graduating seniors in June 2014, and now has approximately 46 rising seniors, 63 rising juniors, and 58 rising sophomores for the 2014–2015 academic year. 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 the initial cohort of graduates, we expect that the uniquely educated Course 20 students will continue to find attractive career opportunities across a spectrum of industrial, academic, and professional areas. The department also continues to administer two SB minor programs in biomedical engineering and in toxicology and environmental health. In addition, we administer a five-year MEng program in a biomedical engineering, with a bioengineering track.

Graduate Education

BE continues to administer a PhD program in biological engineering with two intimately integrated tracks—one in bioengineering and one in applied bioscience. Current enrollment is 138, with 77 students in the bioengineering track, 37 in the applied biosciences track, and 24 incoming students who have not yet designated their track. As is the case in the BE undergraduate programs, our graduate student population represents women and men in roughly equal numbers. The department graduated 18 PhD students in June 2014, with 10 in the bioengineering track and eight in the applied biosciences track.

We are deeply appreciative of the generous gifts for graduate student fellowships, most notably from Andrew and Erna Viterbi, Susan Whitehead, Diane Green, Cynthia Leaf, and Merrimack Pharmaceuticals. Additionally, we have received financial support for campus-administered graduate fellowships from the MIT Energy Initiative and Momenta Pharmaceuticals.

BE is also grateful for additional generous gifts given to support important aspects of our ongoing programs, including major gifts from Andrew Viterbi, Cliff Reid, and Pfizer Inc. for important departmental initiatives.

Douglas A. Lauffenburger
Department Head
Ford Professor of Engineering