Department of Biological Engineering

The Department of Biological Engineering (BE) continues to grow in attracting world-class faculty and students, offering innovative educational programs, and conducting leading research programs in pursuit of its mission of fostering MIT education and conducting research that fuses engineering with molecular life sciences. The department's central objective is to define and lead the new biology-based engineering discipline that is called biological engineering. The founding 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 were in the past one. 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. The department's 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 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), Jim Collins (Institute for Medical Engineering and Science), 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), 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; Scott Manalis is chair of the BE undergraduate program. Rolanda Dudley-Cowans is the department's administrative officer and Dalia Fares is the academic administrator.

Research

During fiscal year 2015, 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 directed by BE faculty members 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. 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 12th annual BE retreat. More than 170 faculty, graduate students, and staff gathered at a conference center in Randolph, Massachusetts, for a stimulating and enjoyable day of research, education, and ethics discussions and social interactions away from campus.

Undergraduate Education

The department is excited about the continuing growth of its pioneering Course 20 SB major program. There were 58 graduating seniors in June 2015, and the program now has approximately 51 rising seniors, 48 rising juniors, and 51 rising sophomores for the forthcoming 2015–2016 academic year. There is no similar undergraduate degree program elsewhere 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 group of graduates, it can be expected that MIT's 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, BE administers a five-year MEng program in a biomedical engineering, bioengineering track.

Graduate Education

The department now has a single-track biological engineering PhD curriculum. The current enrollment is 139, with 17 incoming students. As is the case with the BE undergraduate programs, the department's graduate student population represents women and men in roughly equal numbers. In AY2015, the department graduated 14 PhD students (one in September 2014, four in February 2015, and nine in June 2015) and one MEng student (June 2015).

The department is deeply appreciative of wonderfully generous gifts for graduate student fellowships, most notably from Andrew and Erna Viterbi, Susan Whitehead, Diane Green, Cynthia Leaf, and Merrimack Pharmaceuticals. Additionally, BE has received financial support for campus-administered graduate fellowships from the MIT Energy Initiative and Momenta Pharmaceuticals.

BE is further grateful for other generous gifts toward important aspects of its 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