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 have been in the previous 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 as follows: Eric Alm (Civil and Environmental Engineering), Mark Bathe [Mechanical Engineering (MechE)], Angela Belcher [Materials Science and Engineering (MSE)], Michael Birnbaum, Paul Blainey, Edward Boyden (Brain and Cognitive Sciences, Media Lab), Laurie Boyer (Biology), Christopher Burge (Biology), Arup Chakraborty (Chemical Engineering, Chemistry), James J. Collins (Institute for Medical Engineering and Science), Peter Dedon, C. Forbes Dewey (MechE), 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), Amy Keating (Biology), Alexander Klibanov (Chemistry), Angela Koehler, Robert Langer (Chemical Engineering), Douglas Lauffenburger (Biology, Chemical Engineering), Harvey Lodish (Biology), Timothy K. Lu (EECS), 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), 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 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 $76 million. This figure includes sponsored projects formally administered by the department (more than $42 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, the

Center for Environmental Health Sciences, the Computational and Systems Biology Initiative, the Division of Comparative Medicine, the Broad Institute, the Institute for Medical Engineering and Science, 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. A special highlight of this past year was the 13th Annual BE retreat. More than 170 faculty members, graduate students, and staff gathered in the Media Lab 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. There were 47 graduating seniors in June 2016, and the program now has approximately 48 rising seniors, 48 rising juniors, and 51 rising sophomores for the 2016–2017 academic year. There is no similar undergraduate degree program elsewhere in the United States 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). Judging from the initial cohort of graduates, we expect that MIT's uniquely educated Course 20 students will 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. Our current enrollment is 130, with 24 PhD and two MEng incoming students for the 2016–2017 academic year. The student population in both our undergraduate and graduate programs represents women and men in roughly equal numbers. In June 2016, the department graduated 20 PhD students with the breakdown as follows: 20 doctor of philosophy degrees, one master of engineering degree, and one master of science in toxicology degree.

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

The Department of Biological Engineering is also grateful for other generous financial support toward important departmental initiatives, including major gifts from Andrew Viterbi, Cliff Reid, David R. Fett, and Pfizer Inc.

Douglas A. Lauffenburger
Department Head
Ford Professor of Engineering