

## 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 cutting-edge research programs that advance its mission of fostering MIT education and research fusing 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 biological engineering 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 Biological Engineering faculty members (with other MIT academic unit affiliations noted in parentheses) are as follows: Eric Alm (Civil and Environmental Engineering), Mark Bathe (Mechanical Engineering), Angela Belcher (Materials Science and Engineering), Michael Birnbaum, Paul Blainey, Ed Boyden (Brain and Cognitive Sciences, Media Arts and Sciences), Laurie Boyer (Biology), Bryan Bryson, Jim Collins (Institute for Medical Engineering and Science), Peter Dedon, Bevin Engelward, John Essigmann (Chemistry), James Fox, Ernest Fraenkel, David Gifford (Electrical Engineering and Computer Science [EECS]), Linda Griffith (Mechanical Engineering), Alan Grodzinsky (EECS, Mechanical Engineering), Jongyoon Han (EECS), Darrell Irvine (Materials Science and Engineering), Alan Jasanoff (Brain and Cognitive Sciences), Roger Kamm (Mechanical Engineering), 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 (Mechanical Engineering), Jacquin Niles, Katharina Ribbeck, Ram Sasisekharan, Peter So (Mechanical Engineering), Steven Tannanbaum, William Thilly, Bruce Tidor (EECS), Krystyn Van Vliet (Materials Science and Engineering), Christopher Voigt, Ron Weiss (EECS), Forest White, Dane Wittrup (Chemical Engineering), Michael Yaffe (Biology), Feng Zhang (Brain and Cognitive Sciences). In 2019, we identified Anders Hansen (University of California, Berkeley) to join the department as an assistant professor, and his appointment started February 1, 2020.

Douglas Lauffenburger continued as head of the Department of Biological Engineering until end June 2019, with Angela Belcher as associate head. Belcher took over as department head on July 1, 2019. Paul Blainey and Katharina Ribbeck were named co-chairs of the BE graduate program, and Michael Birnbaum and Forest White were named co-chairs of the BE undergraduate program. Rolanda Dudley-Cowans is our administrative officer, and Dalia Fares is our academic administrator.

### Research

During fiscal year 2020, the total amount of sponsored research volume supervised by BE faculty members was approximately \$63.8 million. This figure includes sponsored projects formally administered by the department (more than \$32.6 million), as well

as projects directed by BE faculty members 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, the Institute for Medical Engineering and Science, and the Koch Institute for Integrated Cancer Research. Major research areas within Biological Engineering 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 highlight of this past year, as usual, was the annual BE retreat. More than 180 faculty, graduate students, postdocs, and staff gathered at the Hotel Commonwealth in October for a stimulating and enjoyable day of research, education, 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 49 graduating seniors in AY2020 and have approximately 48 rising seniors, 50 rising juniors, and 55 rising sophomores for AY2021. To our knowledge, there is no other undergraduate degree program nationally that is centered on genetics, biochemistry, molecular biology, and cell biology as its science foundation and 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 cohort 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—biomedical engineering, and toxicology and environmental health. In addition, we administer a five-year master’s of engineering (MEng) program in a biomedical engineering, bioengineering track.

### **Graduate Education**

Our current enrollment is 143 graduate students, predominantly in the PhD program. The department graduated 13 PhD students and three MEng for AY2020. Similar to the BE undergraduate programs, our graduate student population represents women and men in roughly equal numbers.

### **Resource Development**

The Biological Engineering Department is grateful for generous gifts toward important aspects of our ongoing program growth, including major gifts from Pearl Huang and Peter Hobb for the BE Biomaker Space and Fellowships, as well as from John Begg (gynepathology research), the Huiying Memorial Foundation (Chromosomes to Society Project Fund), and Susan Whithead (fellowships).

**Angela M. Belcher**  
**Department Head**  
**Ford Professor of Engineering**