

Biomedical Engineering

BME

Biomedical engineering represents an application field of any engineering discipline to problems in medicine and human health broadly. It has a long and productive history nationally and at MIT, and in fact MIT has played a leading role in the field for almost a half-century. In the most recent decade, the role of fundamental biological science – especially molecular cell biology – has become of increasing importance in enhancing biomedical engineering efforts, and a new discipline of biological engineering has begun to emerge in which molecular cell biology is central to engineering analysis and design efforts related to biology-based technologies. At the same time, contributions from the full range of traditional disciplines to biomedical engineering applications continue to be of great importance to the health care industry. Examples of current areas of active research in laboratories across the MIT Schools of Engineering and Science include: tissue engineering for applications including replacement of living tissues (cartilage, bone, liver, skin); cell engineering to understand and modulate the complex biochemical sequences occurring in normal cell function; molecular engineering to develop innovative new drugs and materials; biological and medical imaging; instrumentation, especially at the microscale for biomolecular and cellular analytics; and quantitative physiology across the hierarchy from molecules to organ systems.

Undergraduate Program

MIT does not offer an undergraduate major in biomedical engineering, but instead provides an option for an undergraduate minor in BME through the Biological Engineering Division. The underlying philosophy of this minor program is that for a broad application field, such as biomedical engineering, in which a wide spectrum of fundamental disciplines can contribute, education that combines bio/medical sciences with a fundamental engineering discipline is especially effective at the undergraduate level. It is important that students interested in biomedical

engineering have solid preparation in physics, chemistry, and mathematics prior to beginning their engineering subjects; as noted above, molecular cell biology is now additionally of growing importance to the science base for this field.

Undergraduate BME classes at MIT introduce relevant biological and medical information, but tend to be broad in engineering content. Students interested in biomedical engineering enroll in one of the engineering departments and then have one of two options: a) use elective time to take a mix of biomedical engineering subjects and to do UROP research or, b) enroll in and take subjects including UROP research for the BME minor. UROP is the acronym for MIT's Undergraduate Research Opportunities Program. It provides research experience with faculty members as well as academic credit or wages. It is one of the most important mechanisms available for learning about biomedical engineering.

Research

Undergraduates at MIT have many opportunities to conduct research in biomedical engineering, often in one of several inter-departmental labs, including the Center for Biomedical Engineering, Center for Environmental Health Sciences, Bio-Instrumentation Laboratory, and the David H. Koch Institute for Integrative Cancer Research. Many of these research projects are conducted in close collaboration with colleagues at the Whitehead Institute for Biomedical Research, Harvard Medical School, Boston University Medical School, and other medical institutions in the area. Also, collaborative projects with medical device, biomaterials, pharmaceutical, and biotechnology industry are common.

In summary, there are abundant opportunities for undergraduates to pursue BME at MIT, in virtually every department and in many laboratories and centers. The undergraduate foundation in engineering can be

directed toward a career in biomedical engineering research, industry, or in medicine.

Contact Information

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Detailed lists of research areas in Biomedical Engineering can be found on the following web pages:

- Biological Engineering
<http://web.mit.edu/be/>
- The Center for Biomedical Engineering
<http://web.mit.edu/cbe/www/>
- Health Sciences and Technology
<http://hst.mit.edu>

The MIT Bulletin, Courses and Degree Programs Issue, contains further information on the Institute, including all graduate and undergraduate courses and programs. For details on ordering the course catalogue, please visit the MIT Press Bookstore website at <http://mitpress.mit.edu/bookstore/bulletin.html>.