

# BIOLOGICAL ENGINEERING

## COURSE 20

### CONTACT

BE Academic Office, Undergraduate Programs, [be-sb@mit.edu](mailto:be-sb@mit.edu)

### DESCRIPTION

Biological engineering increases understanding of how biological systems function as both physical and chemical mechanisms; how they respond when perturbed by factors such as medical therapeutics, environmental agents, and genetic variation; and how to manipulate and construct them toward beneficial use. Biological engineering builds on molecular biology and genomic biology to identify and manipulate the mechanistic components of living systems and to accelerate the rate of analysis.

### INSIDE [COURSE 20](#)

20 Biological Engineering

Undergraduates: 170

### INTRODUCTORY CLASSES

SP.247 **Exploring Majors at the Intersection of Engineering, Life Sciences, and Medicine (SPRING and IAP)**

and SP.247A Interactive introduction to the several majors at MIT that offer curricula bridging engineering and life sciences, through presentations by faculty, current students, and alumni. Representatives of these departments (Courses 1, 2, 3, 5, 6, 6-7, 7, 9, 10, and 20, as well as the BME minor) cover aptitudes of typical students, culture, class offerings and roadmaps, and unique opportunities. Provides first-year students practical advice about how to select, prepare for and thrive in each major. Students taking 3-unit version of **SP.247** complete reflection papers outside of class. Subject can count toward the 6-unit discovery-focused credit limit for first year students.

20.010 **Introduction to Experimentation in BE**

Teaches students to ask research questions and use the steps in the experimental method to test hypotheses. Introduces best practices in basic data analysis and interpretation. Additional topics include exploring experimental failures, unexpected results, and troubleshooting. Goal is to prepare students for undergraduate research opportunities and laboratory-based coursework. This is a discussion-based subject and is dependent on group participation. Preference to first- and second-year students.

20.110 **Thermodynamics of Biomolecular Systems**

Equilibrium properties of macroscopic and microscopic systems. Basic thermodynamics: state of a system, state variables. Work, heat, first law of thermodynamics, thermochemistry. Second and third law of thermodynamics: entropy and its statistical basis, Gibbs function. Chemical equilibrium of reactions in gas and solution phase. Macromolecular structure and interactions in solution. Driving forces for molecular self-assembly. Binding cooperativity, solvation, titration of macromolecules

## COURSE 20-FRIENDLY RESEARCH AREAS/ [LABS](#)

Koch Institute for Integrated Cancer Research  
Health Sciences and Technology (HST)  
Broad Institute  
MIT Synthetic Biology Center

## GET INVOLVED WITH COURSE 20

Biological Engineering	HST Student Community
Undergraduate Student Board	
Biotechnology Group	Pre-Medical Society
GlobeMed	The BioMakers Group
Hacking Medicine	Undergraduate Biochemistry Association

## SKILLS

Prepare project plans for equipment or facility improvements (project management)  
Adapt or design computer hardware or software for medical science uses  
Lead studies to examine or recommend changes in process sequences or protocols.  
Research new materials to be used for products, such as implanted artificial organs

## POSSIBLE FUTURE POSITIONS

- **Research and development engineer:** Develop new products and improve existing products for groundbreaking medical device equipment.
- **Regulatory affairs specialist:** Coordinate and document internal regulatory processes, such as internal audits, inspections, license renewals, or registrations. Prepare submissions and obtain approval for products and therapies to markets worldwide.
- **Bioprocessing/food engineer:** Integrate biology and engineering to design sustainable systems that produce high quality food, renewable energy, and biomaterials for consumers while protecting the environment.

## CAREER INDUSTRY EXAMPLES

Environmental engineering	Materials Handling	Pharmaceuticals
Government	Medicine	Research
Management	Medical Technology	Zoology

## SAMPLE EMPLOYERS

AthenaHealth	CRISPR Therapeutics	Motif FoodWorks
Biogen	Diagnostic Biochips	NIH
Broad Institute	Illumina	Vertex

