



Professional Master
of Science in
Chemical Engineering:
Bioprocess Engineering





Image: Steve McConnell / UC Berkeley

Message from the Chair

Our bioprocess engineering master's degree is driven by the increasingly important role this field has in the world economy. Chemical engineers with expertise in biotechnology are key to the transformation of basic research results into manufacturing processes and/or commercial products. For example, microbial production of foodstuffs, specialty chemicals, biologics, pharmaceuticals, and biofuels are industrial processes that require chemical engineering development and design approaches, but practitioners must possess a strong understanding of the equipment, facilities, and methods of biochemistry and molecular biology.

Our new concentration in bioprocess engineering was designed for the student who has the basic aptitude but not the hands-on experience to step into a bioprocessing unit and begin to develop and apply real-time solutions and strategies. Our program will bridge this experience and expertise for students who wish to pursue careers in bioprocess engineering. This has been a longstanding but unmet need of many industries, for students to matriculate from top-notch programs with the skills that can be applied immediately in the workplace. Our program will now fulfill this need.

Our program is designed to provide our students with a unique opportunity to integrate their classroom learning with apprenticeship learning. We are very fortunate to have close relations with the Advanced Biofuels Process Demonstration Unit (ABPDU), a Lawrence Berkeley National Laboratory program supported by the US DOE's Bioenergy Technologies Office that also has ties to industry and other academic institutions. It is on the cutting-edge of technology and has the facilities and expertise to train you to scale up processes from the lab to commercial relevance for a range of fuel, chemical and protein products relevant to the bioeconomy.

I am personally excited about this new program. We have the ability to enable our students with invaluable tools and knowledge so as to catalyze their careers in the field of bioprocess engineering. In the context of the extraordinary stature of Berkeley's chemical engineering graduate program, our program portends an undeniable formula for student success.

Prof. Jeffrey A. Reimer
Chair, Dept. of Chemical and Biomolecular Engineering





Image: Elena Zhukova

Description

The Master of Science in Chemical Engineering with a concentration in Bioprocess Engineering (MSCEBE) will provide you upon completion of a 9-month program with an understanding and ability to apply Bioprocess Engineering to a number of key technological needs spanning multiple industries. These include ways to produce biofuels, biobased chemicals, proteins, pharmaceuticals, and other high-value biologics; how to design and/or operate appropriate unit operations (e.g., fermentation systems), mammalian-cell culture systems, and instrumentation to monitor and control biotechnological processes; and how to apply and test bioproduct separation technologies. Unlike other programs, the new program at UC Berkeley will have access to state-of-the-art bioprocessing equipment at the Advanced Biofuels Process Demonstration Unit (ABPDU), which is part of the Lawrence Berkeley National Laboratory funded by US DOE. Access to the ABPDU will afford you with an integrated didactic experience. As a result, you will be able to immediately apply hands-on knowledge and become specialized in knowing how to relate engineering concepts to biological systems and organisms.

Admissions

The deadline for applications is Friday, January 6, 2017.

Candidates are required to provide evidence of the following to be considered for the program.

- Bachelor of Science or equivalent degree in Chemical Engineering or related field
- Transcript from every post-secondary school ever attended
- GRE scores
- Minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale.
- Minimum TOEFL score of at least 90 for the Internet-based test (IBT) or 570 for the paper-based format (PBT), if appropriate

Candidates who possess other degrees such as a Bachelor of Arts in Chemistry will be required to demonstrate how their work experience or other coursework taken since graduating provides a sufficiently strong foundation to undergo the Master's program. For more information about UC Berkeley's Graduate Admission requirements, please go to: <http://grad.berkeley.edu/admissions/requirements/#graduate-record-examination-gre>.



Image: Roy Kaltschmidt

Degree Requirements

Candidates will be required to complete a minimum of 24 core units and a capstone project during the second semester with an industry partner.

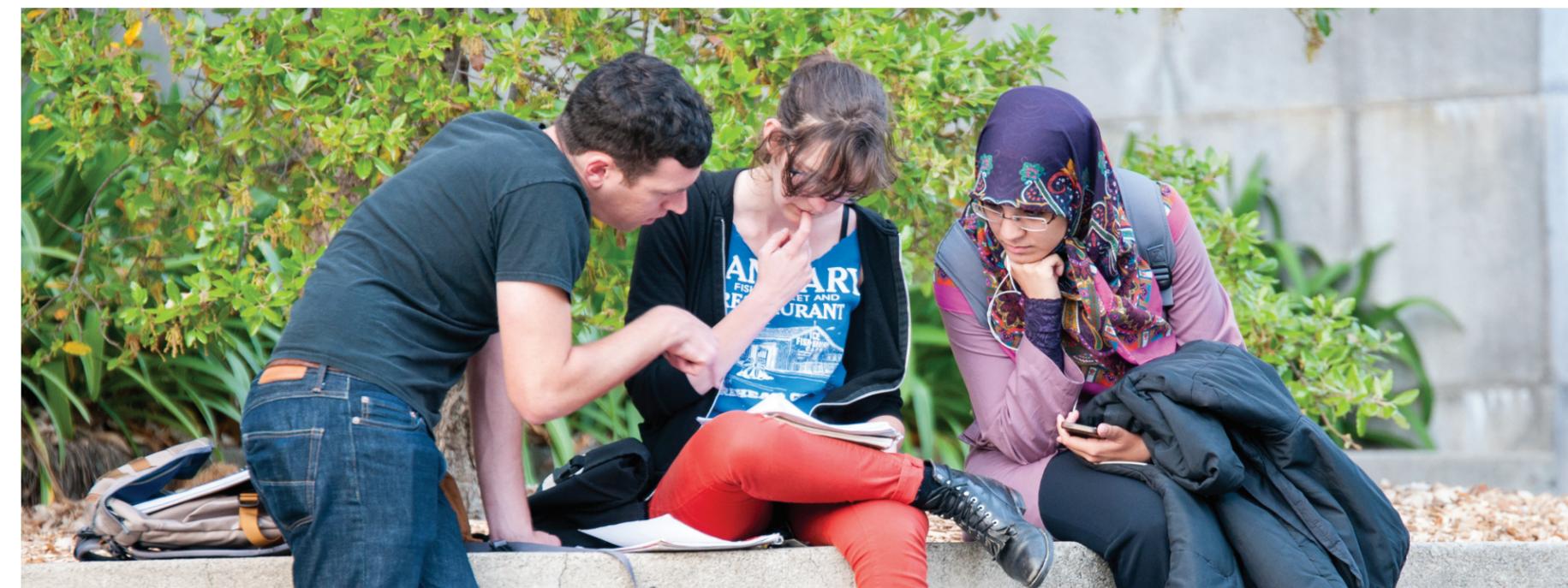
Course Description	Required	Elective
Advanced Topics in GMP and Regulatory Compliance	•	
Advanced Transport Phenomena		•
Berkeley Lectures on Energy: Energy from Biomass		•
Biochemical Engineering I <i>(may be replaced with an elective if equivalent already taken)</i>	•	
Biochemical Engineering II	•	
Biochemical Engineering Lab <i>(may be replaced with an elective if equivalent already taken)</i>	•	
Bioenergy and Sustainable Chemical Synthesis: Metabolic Engineering and Synthetic Biology Approaches		•
Biomolecular Engineering	•	
Capstone and Didactic at ABPDU	•	
Catalysis		•
Cell and Systems Biology		•
Cell and Tissue Engineering		•
Cell Culture, Formulation, Bioprocess Design and Economics	•	
Chemical Biology I-III		•
Chemical Engineering Economics		•
Fluid Mechanics of Biological Systems		•
Functional Biomaterials Development and Characterization		•
Molecular Immunology		•
Protein Chemistry		•
Protein Informatics		•
Technical Communication for Chemical Engineers		•

During the second semester, one of the courses will include ten half-days at the ABPDU where you will learn to design, conduct, and analyze/report process development experiments under real-world conditions. You will learn on both small-scale and large-scale processing and extraction equipment, which will impart skills related to biomass deconstruction and extraction, fermentation, product recovery, purification, and analytical chemistry and microbiology to produce biofuels, chemicals, proteins and other bioproducts. You will learn through hands on experience how to scale-up from lab and test conditions to pilot production, and integrate statistical, life cycle, and techno-economic analysis to facilitate the design of your experiments as well as determine the commercial feasibility of specific technologies.

The other part of the course involves working with other students in a group of five to provide consultation to an industrial partner for a bioprocess engineering problem or issue. In this capacity, you will be able to immediately apply your classroom and hands-on knowledge to develop feasible and cost-effective solutions to actual situations.

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Cover Image: Roy Kaltschmidt