

DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING

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More Information: <http://engineering.case.edu/eche/>

The Department of Chemical and Biomolecular Engineering offers Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degree programs. The department has eleven full-time faculty members, all of whom lead active research programs in advanced and emerging areas of chemical and biomolecular engineering.

Mission

The Department of Chemical and Biomolecular Engineering inspires learning and the pursuit of scholarly activities in chemical and biological engineering and related science and engineering disciplines. The Department offers educational programs and a research environment that enable our graduates to succeed in an evolving workplace, provides opportunities for students and faculty to advance knowledge at the highest levels of the profession, and addresses technological and personnel needs of industry, governments, and society.

Background

The profession of chemical engineering involves the analysis, design, operation, and control of processes that convert matter and energy to more useful forms, encompassing processes at all scales from the molecular to the megascale. Traditionally, chemical engineers are responsible for the production of basic chemicals, plastics, and fibers. However, today's chemical engineers are also involved in food and fertilizer production, synthesis of semiconductor electronic materials, power generation and storage, CO₂ capture and waste recycling. Chemical engineers also develop new materials (ceramic composites and electronic chips, for example) as well as biochemicals and pharmaceuticals. The breadth of training in engineering and the sciences gives chemical engineers a particularly wide spectrum of career opportunities. Chemical engineers work in the chemical, energy, and materials-related industries, in government, and are accepted by graduate schools in engineering, chemistry, medicine, and law.

Research

Research in the department is sponsored by a variety of state and federal agencies, by private industry, and by foundations. Current active research topics include:

Energy

- Novel energy storage systems for transportation, grid storage applications, and portable devices
- Energy efficient extraction and processing of materials
- Fuel cells and batteries
- Novel catalysts, electrocatalysts, and plasmas for conversion of gases to fuels

- Simulation, modeling, and fundamental characterization of transport and interfacial processes in electrochemical energy storage and conversion systems

Materials

- Advanced materials for electronic and electrochemical device applications
- Simulation and theory of materials properties
- Surface properties and interfacial phenomena
- Materials processing and engineering at molecular through macro scales
- Advanced separation processes for the nuclear fuel cycle
- Synthesis of novel membranes for gas separations, wastewater treatment and radioanalytical chemistry
- Imaging and prediction of complex fluid dynamics
- Computational materials chemistry for energy conversion and storage

Biomolecular Engineering

- Biosensors
- Cell and tissue engineering
- Transport and metabolism in biological systems
- Biocatalysis and protein engineering

Chair

Harihara Baskaran, PhD
 (Pennsylvania State University)
Leonard Case Jr. Professor of Engineering
 Transport phenomena in biology and medicine, tissue/cell metabolism, cell transport, microvascular tissue engineering, cartilage tissue engineering

Faculty

Rohan N. Akolkar, PhD
 (Case Western Reserve University)
F. Alex Nason Professor
 Electrochemical phenomena in next-generation batteries, photovoltaics and semiconductor devices

Harihara Baskaran, PhD
 (Pennsylvania State University)
Leonard Case Jr. Professor of Engineering and Department Chair
 Transport phenomena in biology and medicine, tissue/cell metabolism, cell transport, microvascular tissue engineering, cartilage tissue engineering

Christine Duval, PhD
 (Clemson University)
Associate Professor
 Membranes, radiochemical separations

Donald L. Feke, PhD
 (Princeton University)
Distinguished University Professor and Vice Provost for Undergraduate Education
 Colloidal and transport phenomena, dispersive mixing, particle science and processing

Burcu Gurkan, PhD
(University of Notre Dame)
Professor

Energy storage, nonflammable electrolytes, electrode fabrication, electrochemical separation processes

Eric Kaler, PhD
(University of Minnesota)
Professor and University President

Daniel Lacks, PhD
(Harvard University)
C. Benson Branch Professor of Chemical Engineering and Associate Dean of Academics
Molecular simulation, statistical mechanics, triboelectric charging

Heidi B. Martin, PhD
(Case Western Reserve University)
Associate Professor
Conductive diamond films; electrochemical sensors; chemical modification of surfaces for electrochemical and biomedical applications; biomaterials; microfabrication of sensors and devices

Julie Renner, PhD
(Purdue University)
Associate Professor
Electrochemical engineering, protein engineering, biomimetic materials, regenerative medicine

Robert F. Savinell, PhD
(University of Pittsburgh)
Distinguished University Professor and George S. Dively Professor
Electrochemical engineering, electrochemical reactor design and simulation, electrode processes, batteries and fuel cells

Jesse S. Wainright, PhD
(Case Western Reserve University)
Research Professor
Electrochemical power sources: fuel cells, batteries, supercapacitors; biomedical applications

Robert Warburton, PhD
(Purdue University)
Assistant Professor
Computational materials science, electrochemistry, energy storage, catalysis

Christopher Wirth, PhD
(Carnegie Mellon University)
Associate Professor
Colloids, multiphase materials

Secondary Faculty

Frank Ernst, Dr. ret. nat. habil
(University of Gottingen)
Leonard Case Jr. Professor of Engineering

Ica Manas-Zloczower, DSc
(Israel Institute of Technology)
Professor

James A. Van Orman, PhD
(Massachusetts Institute of Technology)
Professor

Huichun (Judy) Zhang, PhD
(Georgia Institute of Technology)
Professor

Emeritus Faculty

John C. Angus, PhD
(University of Michigan)
Emeritus Professor

Coleman Brosilow, PhD
(Polytechnic Institute New York)
Emeritus Professor

Nelson Gardner, PhD
Emeritus Associate Professor

Uziel Landau, PhD
(University of California, Berkeley)
Emeritus Professor

Chung-Chiun Liu, PhD
(Case Institute of Technology)
Emeritus Professor

J. Adin Mann Jr., PhD
(Iowa State University)
Emeritus Professor

Syed Qutubuddin, PhD
(Carnegie Mellon University)
Emeritus Professor

Programs

- Biomolecular Engineering, Minor
- Chemical Engineering, BSE
- Chemical Engineering, Minor
- Chemical Engineering, MS
- Chemical Engineering, PhD
- Electrochemical Engineering, Minor

Dual Degrees

- Programs Toward Graduate or Professional Degrees

Facilities

The department is housed in the Albert W. Smith Building and portions of the Bingham Building on the Case Quadrangle. Professor Smith was chair of industrial chemistry at Case from 1911 to 1927. Under his leadership, a separate course of study in chemical engineering was introduced at Case in 1913. Professor Smith was also a close associate of Herbert Dow, the Case alumnus who founded Dow Chemical in 1890 with the help and support of Professor Smith. The Albert W. Smith Chemical Engineering Building contains one technology-enhanced classroom; the undergraduate Unit Operations Laboratory; an undergraduate reading room, named after Prof. Robert V. Edwards; and the normal complement of offices and research laboratories. The lobby of the A.W. Smith Building,

renovated by contributions from the James family, often serves as a formal and informal gathering place for students and faculty. The department has exceptionally strong facilities for electrochemical and energy research, microfabrication, biomolecular engineering, and for chemical vapor deposition and thin film synthesis. In addition, departmental core facilities include a full range of biochemical and electrochemical analytical and materials characterization instruments.