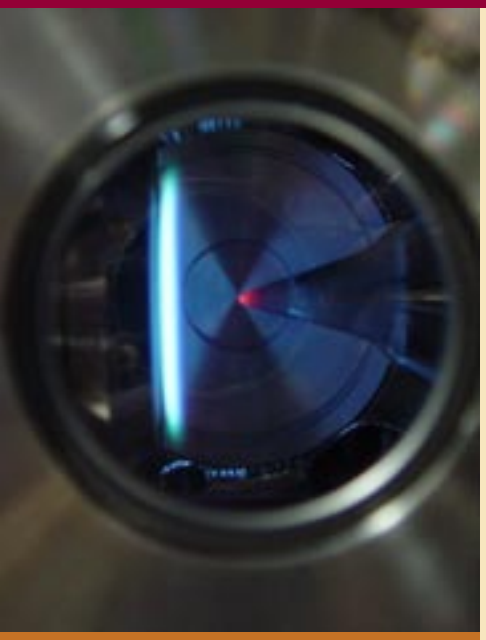
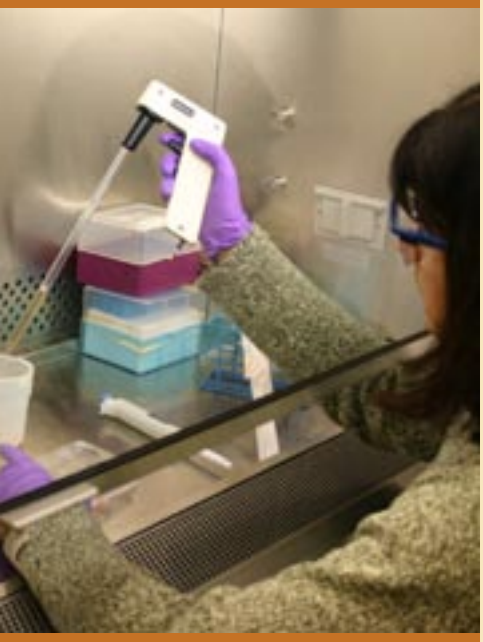
University of Massachusetts Amherst



Graduate Program

Chemical Engineering

The Graduate Program in Chemical Engineering (ChE) at the University of Massachusetts Amherst was initiated in 1959. Since then, the Program has graduated more than 240 M.S. and 250 Ph.D. students. The Program consists of 15 full-time faculty members and approximately 60 students pursuing advanced degrees in ChE. The ChE faculty's achievements are reflected in the prestigious awards that the ChE faculty members have won, ranging from numerous young investigator awards, such as NSF CAREER and Camille Dreyfus Teacher-Scholar Awards, to national awards by scientific and professional societies, to professional society fellowships and memberships in the National Academy of Engineering. Our ChE Graduate Program enjoys an excellent national reputation and is regularly ranked in the top quartile of the nation by US News & World Report. The Program was ranked at No. 21 in the most recent (1995) National Research Council (NRC) rankings.



Facilities

The ChE Department occupies instructional, research, and administrative space within three buildings in close proximity to each other: the Goessmann Laboratory, the Conte National Center for Polymer Research, and the Engineering Laboratory II (ELab II). In addition, the ChE Alumni Classroom in the Lederle Graduate Research Tower is a state-of-the-art computer classroom of major importance to the ChE graduate teaching and research seminars. The ChE Graduate Program features brand new laboratory facilities in the 57,000-sq-ft, $25-million ELab II, including:

A Process Laboratory for understanding and using chemical kinetics at a molecular scale for technological applications in combustion, polymer stability and degradation, plasma processing in microelectronics, environmental protection, and industrial chemistry.

Materials Engineering Laboratories for research over a broad range of materials classes, from catalytic and electronic materials, to polymers and complex fluids, including synthesis of electronic and photonic materials with controlled nanostructure and development of polymeric materials for biomedical applications.

Bioengineering Laboratories with various focuses, including plant metabolic engineering, yeast cell population dynamics, drug delivery applications, cancer therapy, and directed evolution for enzyme engineering.

Photo provide courtesy of Ellenzweig Associates Inc. Architects; Photography by Sam Gray

Research

The Chemical Engineering Department currently receives research support at a level of approximately $3 million per year through external research grants. Graduate students can expect to participate in projects falling into the following areas of faculty research.

Systems Design and Control: Current research activities in this area include design, synthesis, and control of separation and reaction-separation systems; process design and control for polymer production and batch processing; nonlinear modeling and control of biochemical reactors; design and operation strategies for manufacturing pharmaceutical emulsions; and nonlinear process control theory.

Materials Science and Engineering: Current research work in this very broad area includes characterization of catalytic materials; design of new catalytic materials for the polymerization and environmental industries; microwave engineering of catalytic materials; improvement of inorganic-organic functionalized mesoporous materials; high-throughput testing of new catalytic materials for biomass conversion; fundamental surface science studies on catalytic and electronic materials; synthesis of nanostructured electronic and photonic materials; development of sensors for clinical diagnostics; epitaxial growth and plasma deposition of semiconductor thin films and

confined quantum structures; mechanical behavior and reliability of thin-film and nanostructured materials for microelectronics; polymeric materials processing; transport properties and reaction kinetics in polymeric materials; studies of thermal decomposition pathways for fire-safe polymers; rheology and phase behavior of polymers and complex fluids; development of polymeric materials for cell encapsulation applications; and solubilization of bioactive molecules in surfactant mesophases.

Molecular, Cellular, and Metabolic Bioengineering: Specific research activities in this area focus on plant metabolic engineering for the production of medicinals via plant cell cultures; design and utilization of mammalian cell in vitro systems to develop novel cell encapsulation systems and to study cellular function; targeted bacteriolytic therapy; localized quantification of tumor metabolism; bacterial migration and segregation in solid tumors; evolutionary enzyme engineering for bioconversion reactions; assembling biochemical pathways to synthesize biologically significant small molecules; systems biology applied to microbial and mammalian systems; and genetic circuit design to control biological systems.

Molecular and Multiscale Modeling & Simulation: Current activities in this broad research field include computational quantum chemistry for chemical reaction kinetic analysis; applications of molecular modeling in nanotechnology; modeling of molecular-level behavior of fluids confined in porous materials; computational statistical-mechanics studies of solid-fluid phase equilibria; molecular-to-reactor scale modeling of combustion of various fuels; molecular-to-reactor scale modeling of transport-reaction processes in nanostructured materials synthesis; computational semiconductor surface science; atomistic-to-continuum scale modeling of defect dynamics, structural transitions, and failure mechanisms in thin films and nanostructured materials; multiscale modeling of semiconductor thin-film growth; modeling of driven surface morphological evolution in solid materials; development of coarse time-stepper-based methods for system-level analysis using deterministic and stochastic atomic-scale simulators; development of cyber infrastructure for studies of rheological behavior of complex fluids; modeling of interfacial fluid dynamics and free-surface flows; hydrodynamic stability analysis; fluid-dynamics modeling for microfluidic applications; and modeling of gas-particle flows and granular flows.

Financial Assistance

It is the goal of ChE Department to provide assistantships and/or fellowships to every graduate student whose degree will culminate with the completion of a research project and the successful defense of a thesis or dissertation. Currently, ChE graduate students are supported by departmental fellowships for the first few months of their residence. Subsequently, after joining a research group, they are supported by assistantships through faculty research grants. Tuition waivers and health-care benefits are part of the assistantship contract. All ChE graduate students are expected to serve as teaching assistants for a few semesters during their residence in the Graduate Program.

Employment

Alumni of the ChE Graduate Program enjoy successful careers in industry, academia, and government. Accomplished alumni from the ChE Department serve as prototypes for the kinds of careers available to our graduates. That list includes: Michael Malone, Dean of the UMass Amherst College of Engineering and Isenberg Professor of Engineering; Matthew Tirrell, Dean of Engineering at the University of California Santa Barbara; Marv Schlanger, Chair and CEO of Resolution Performance Products and former CEO of ARCO Chemical; Jack Drosdick, Chairman, CEO, and President of Sunoco, Inc.; Robert Querido, President of Endo-Therapeutics; Jack Welch, former CEO of General Electric; and business and technical leaders throughout the world.

Location

The University of Massachusetts is the state university of the Commonwealth. It was founded in 1863 under the provisions of the Morrill Land Grant Act, which was passed by the United States Congress one year earlier. Situated in one of the most picturesque sections of the state, UMass Amherst joins with its academic neighbors – Amherst, Smith, Mount Holyoke, and Hampshire colleges – in the Five College Consortium, which helps maintain the rich tradition of educational benefits (including cross-registration for coursework) and cultural activity (numerous concerts, Broadway shows, plays, readings, entertainers of every kind, and dance performances) associated with the Connecticut Valley. Amherst is also located within easy access to New York, Boston, and Montreal, and has a reputation throughout New England for its numerous outdoor activities, which can all be easily accessed through the UMass Amherst Outing Club.

Contact

Applications for admission and financial assistance can be obtained from the Graduate School at **http://www. umass.edu/gradschool** and following the links at **http://www.ecs.umass.edu/che/umass-form-test.html** or by writing to:

Professor Jeffrey M. Davis, *Graduate Program Director*,
Department of Chemical Engineering, 159 Goessmann Laboratory,
University of Massachusetts, Amherst, Amherst, MA 01003-3110

The ChE Website is **http://www.ecs.umass.edu/che/**