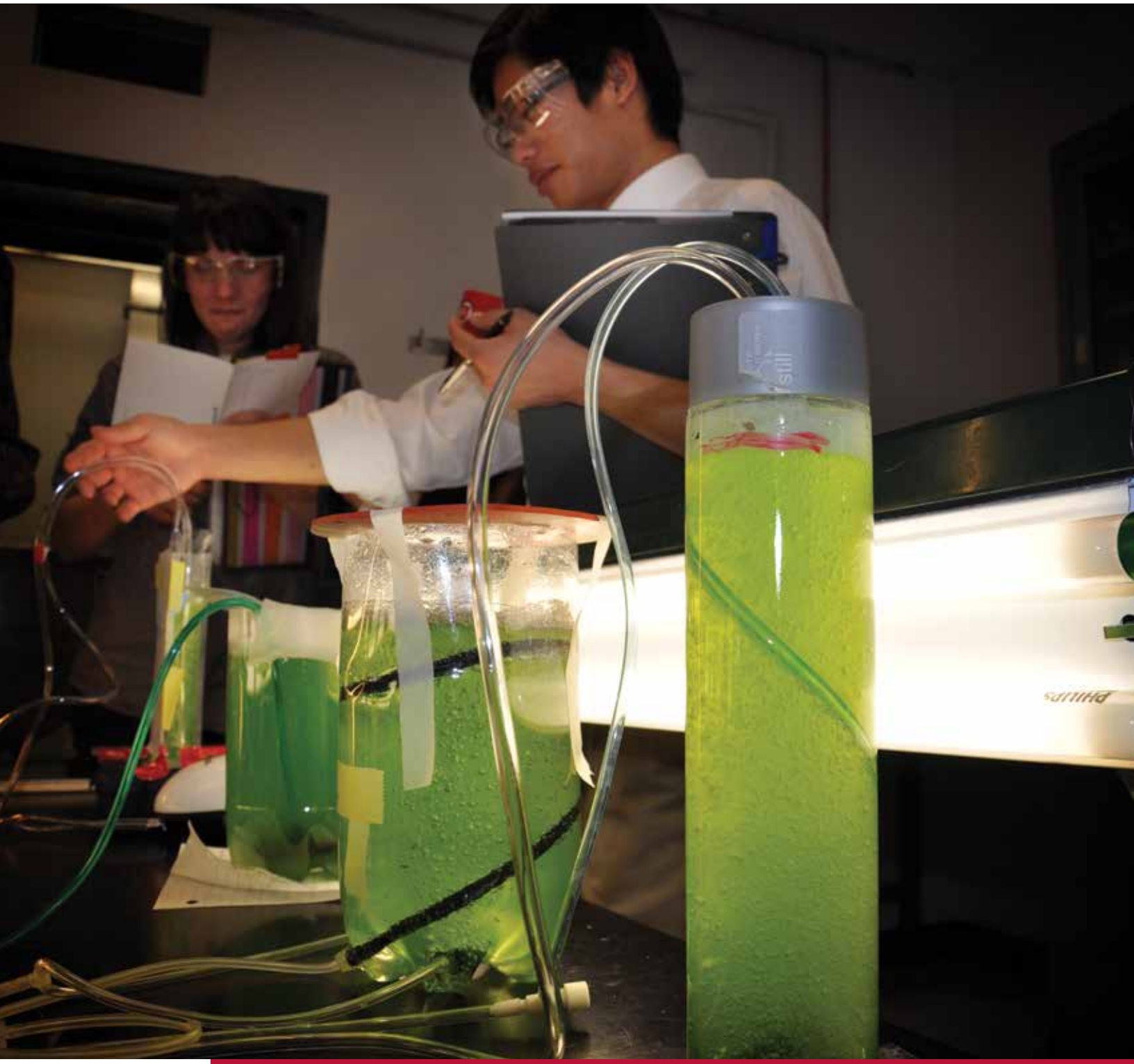
THE MIXING CUP

FOR THE UNIVERSITY OF UTAH ALUMNI & FRIENDS



THE UNIVERSITY OF UTAH

DEPARTMENT OF CHEMICAL ENGINEERING

FALL 2013

WELCOME FROM THE CHAIR

It's been a dynamic year for the Department of Chemical Engineering. Professor JoAnn Lighty completed six productive years as Department Chair. We were pleased to wish good luck to 55 Bachelor of Science graduates this spring — the largest class yet. We saw our faculty in the Institute for Clean and Secure Energy secure a $16M grant to establish a new research center, we launched a new program and updated our laboratories.

The Master of Science in Petroleum Engineering program launched this fall. Beyond essentials, this 33-credit hour program touches midstream and downstream aspects of petroleum engineering and includes a course on energy and society. It is delivered by our faculty in cooperation with faculty from the Energy and Geoscience Institute and the Department of Geology and Geophysics.

Our research remains strong and diverse — 2011–2012 research expenditures exceeded $11M and continue growing. The National Nuclear Security Administration awarded Professor Phil Smith and his team a $16M grant as part of the Predictive Science Academic Alliance Program. This research will cement our leadership in high-performance computing, simulation and predictive science with a number of key applications, such as carbon capture and emission control.

Process safety has become an important component of a chemical education. We are delighted to welcome Daniel Crowl, a professor of chemical engineering at Michigan Tech, as the 2013–2014 W.W. Clyde Chair Visiting Professor. Crowl, a world-recognized expert in process safety, will teach a special process safety course and help embed safety modules within a number of our other courses.

Graduation and enrollment numbers reflect our objective of graduating 50–60 high-quality undergraduates annually. In addition to our spring graduates, 12 Ph.D. students graduated last academic year from our equally strong graduate program. We credit innovative courses with keeping all students engaged and our goals on track. A highlight is spring 2013's freshman laboratory class, developed by Professor Tony Butterfield. The course's hands-on activities and interaction with senior students made it extraordinarily successful and helped earn him the College of Engineering Outstanding Teacher Award.

We would like to acknowledge Opto 22 for modernizing our laboratories with a significant equipment grant. Support from our donors and alumni is vital in keeping us competitive. We invite you to visit and see first-hand the exciting new developments in Chemical Engineering at the University of Utah.

Milind D. Deo
Department Chair, Chemical Engineering

JoANN S. LIGHTY SERVING
NATIONAL SCIENCE FOUNDATION

Professor JoAnn Lighty has begun her tenure with the National Science Foundation as Division Director of Chemical, Bioengineering, Environmental and Transport Systems in the Directorate for Engineering. Her assignment will range from two-to-four years.

JoAnn has a strong research program that currently includes studying chemical looping and fine particles. She will maintain that research while away by collaborating with Kevin Whitty (chemical looping) and Kerry Kelly (fine particles). We hope the research will bring her back for occasional visits.

JoAnn's outstanding contributions to Chemical Engineering included serving as Chair for more than six years. During that time, she placed the department on a great financial footing, modernized the Senior Lab through successful fundraising and secured the Meldrum Professorship (a department first). She also successfully lobbied to establish a petroleum engineering master's degree, connected with alumni, established the Industrial Advisory Board and held regular meetings with the IAB to strengthen the department. We wish JoAnn the best on her new adventure.

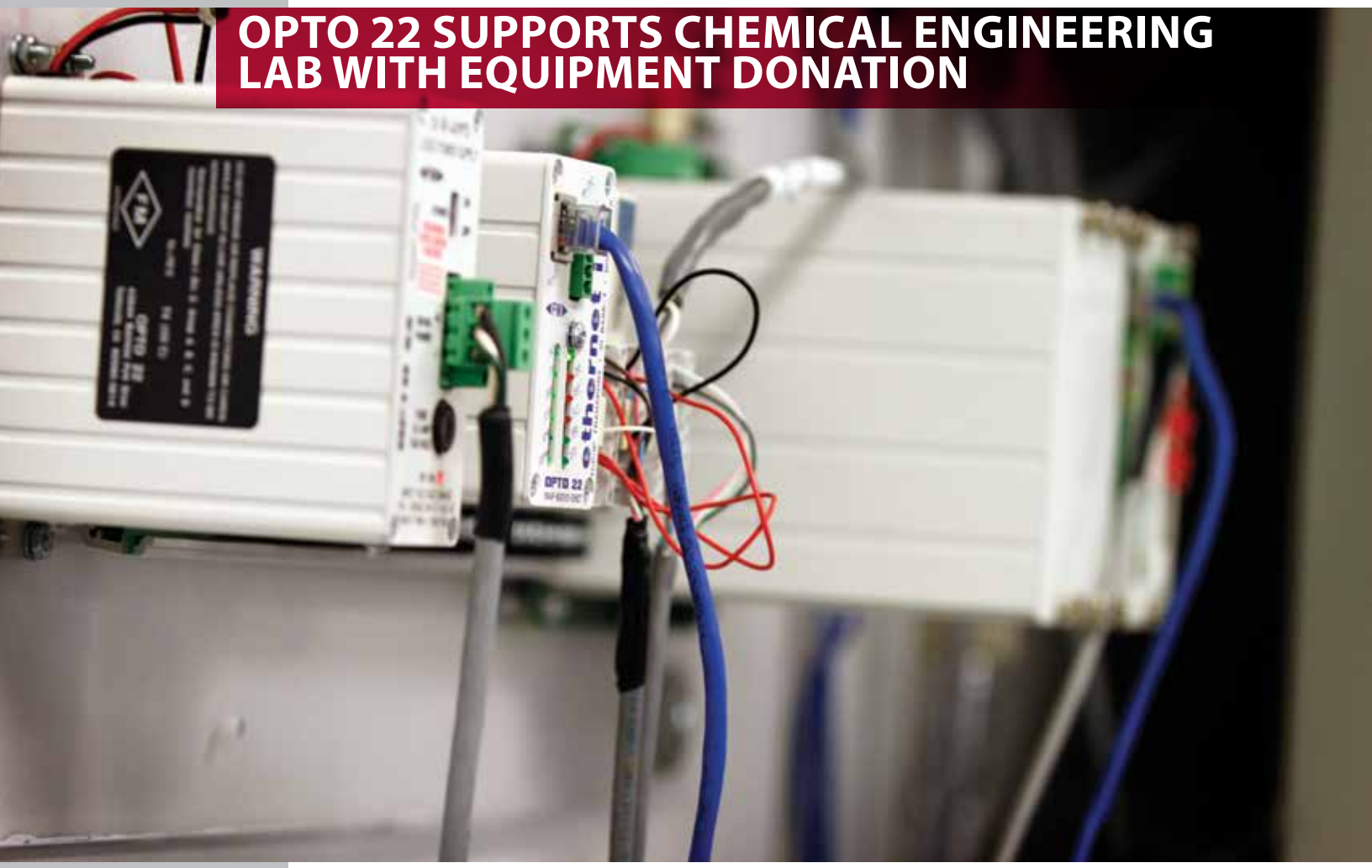
ANTHONY BUTTERFIELD RECEIVES
OUTSTANDING TEACHER AWARD

The Department of Chemical Engineering proudly announces that Assistant Professor (Lecturer) Anthony (Tony) Butterfield earned the 2013 Outstanding Teacher Award from the College of Engineering. During the past few years, Tony has taught senior projects laboratory courses and enthusiastically led development of our new freshman course, Design and Innovation in Chemical Engineering. This course, which introduces hands-on learning early in the curriculum, has become a great success based on evaluations and student comments.

Tony's teaching excellence is reflected in his teaching evaluations, which rank in the top 15% of college evaluations in every semester he has taught. These typical student comments, taken from his 2013 spring evaluations, corroborate these high numerical rankings while highlighting Tony's special qualities:

- Energy/enthusiasm coupled with organization makes Dr. Butterfield one of the best professors available.
- Always available inside and outside of the lab. Never hesitated to drop what he was doing to help.

OPTO 22 SUPPORTS CHEMICAL ENGINEERING LAB WITH EQUIPMENT DONATION



The Department of Chemical Engineering has received $108,000 in state-of-the-art control system tools and software from industrial automation company Opto 22. This generosity is the most recent example of the company's ongoing support of chemical engineering students in their laboratory courses.

Opto 22 develops and manufactures hardware and software for applications involving industrial automation and control, energy management, remote monitoring and data acquisition. The company, founded in 1974 by University of Utah engineering alumnus Robert Engman, is highly regarded in the automation and control industry for innovative, modern solid-state relays and programmable controllers. Engman's pioneering work in solid-state relay development first enabled communication between industrial equipment and computers using standard, commercially available technologies.

As part of a senior design capstone course, approximately 70 chemical engineering students will conduct experiments or examine a process with Opto 22 instrumentation each year. This exposure provides students with a unique opportunity to understand industrial-grade data acquisition and control in a laboratory setting before entering the workforce.

"The experiments students perform using Opto 22 equipment greatly enhance the presentation of a wide variety of chemical engineering principles, including separations, heat transfer and process control," says Milind Deo, professor and chair of chemical engineering. "Most students cite this class as the most important part of their curriculum — it's clear these educational experiences make a long-lasting impact on our students and serve them throughout their careers."

Graduate students also benefit from a pilot-scale combustion and gasification facility that is fully automated with Opto 22 hardware and software.

"At Opto 22, we think it's important to support science, technology, engineering and math (STEM) curriculum in our schools. A great way we can do this is to provide our made-in-the-USA, advanced automation electronics and software to the University of Utah's Department of Chemical Engineering," says Mark Engman, CEO and President of Opto 22. "We want to see today's young engineers use these tools to develop the next generation of processing and manufacturing systems for the U.S. And we think they'll especially like our new Groov product, which makes it easy — and fun — to build mobile control interfaces."

NEW FACULTY

The Department of Chemical Engineering announces the appointment of Dr. Michael Hoepfner as Assistant Professor of Chemical Engineering. Dr. Hoepfner received a B.S. in Chemical Engineering from the University of Utah, and an M.S. and Ph.D. in Chemical Engineering from the University of Michigan in 2013. His research focuses on elucidating the fundamental behavior of complex systems, with an emphasis on petroleum. Dr. Hoepfner is currently investigating the structure and behavior of compounds called asphaltenes, a petroleum fraction complicating crude oil production. The efficient and environmentally friendly extraction of oil reserves, including oil sands and bitumen, are highly dependent on the understanding of asphaltene behavior. Dr. Hoepfner's other research interests include the application of scattering techniques for structural analysis, deposition and aggregation processes and modeling-based studies.

The Department of Chemical Engineering welcomes Dr. Hitesh Bindra as Assistant Professor of Chemical Engineering. Dr. Bindra will be affiliated with the Utah Nuclear Engineering Program (UNEP). His research focuses on understanding multiphase transport processes and developing computational methods for nuclear systems, their environmental interaction and next-generation energy systems. The fundamental studies of colloidal deposition near the evaporating interfaces, basic elements of boiling phenomena and large scale thermal-hydraulic analysis will help design safer nuclear fuels and efficient energy systems. Dr. Bindra will employ computational research on the inherently coupled Lattice Boltzmann method for radiation and material transport in preparing next-generation nuclear safety codes, and design optimization of novel energy devices.

SELECTED FACULTY HONORS

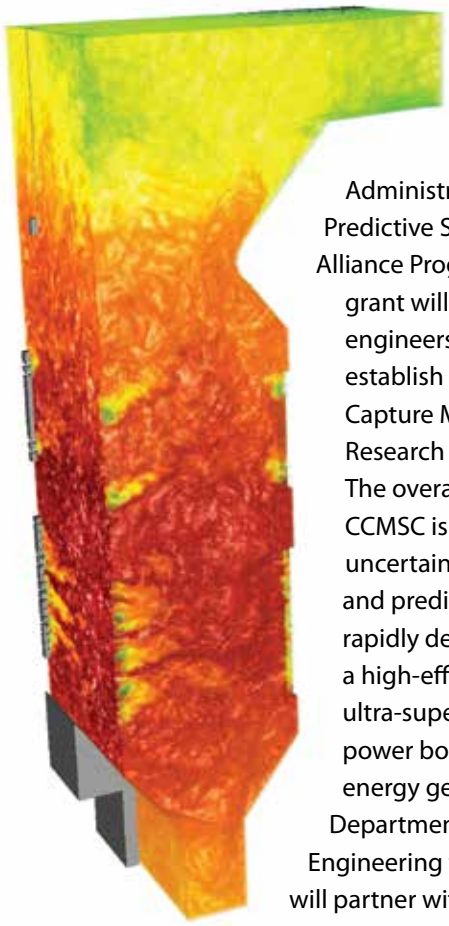
Edward Trujillo –Elected Fellow of the American Institute of Chemical Engineers (AIChE)

John McLennan –Inducted Fellow of the American Rock Mechanics Association

Kevin Whitty –Selected Leader of International Energy Agency (IEA) Bioenergy Task 33: Thermal Gasification of Biomass

SUPERCOMPUTER-BASED PREDICTIVE SCIENCE TO MAKE ENERGY CLEANER, MORE ECONOMICAL

A $16M grant will enable Department of Chemical Engineering, School of Computing and Institute for Clean and Secure Energy (ICSE) researchers to make coal-based energy cleaner and more economical. The multidisciplinary effort will keep Chemical Engineering at the forefront of high-performance computing and simulation and predictive science in a number of key applications, such as carbon capture and emission control. Congratulations to Professor Phil Smith and his team at ICSE for this achievement.



The five-to-ten-year National Nuclear Security Administration's (NNSA) Predictive Science Academic Alliance Program (PSAAP) grant will help ICSE-affiliated engineers and scientists establish the Carbon-Capture Multidisciplinary Research Center (CCMSC). The overall goal of CCMSC is using exascale uncertainty quantification and predictive science to rapidly design and deploy a high-efficiency, advanced ultra-supercritical oxy-coal power boiler for secure electric energy generation. The U's Department of Chemical Engineering faculty and students will partner with colleagues from the University of California, Berkeley and Brigham Young University.

One of just three NNSA multidisciplinary academic research facilities, the CCMSC will enable supercomputer-based simulation, prediction and uncertainty validation of performance for a proposed 350 MWe Oxy-Fired Pulverized Coal Boiler System. This unique design captures carbon dioxide released during power generation. The research will expedite deployment of low-cost, low-emissions power to an estimated 1.2 billion people without energy in developing nations, while lowering the carbon footprint of industrialized ones. It will also establish the U as a hub of predictive science.

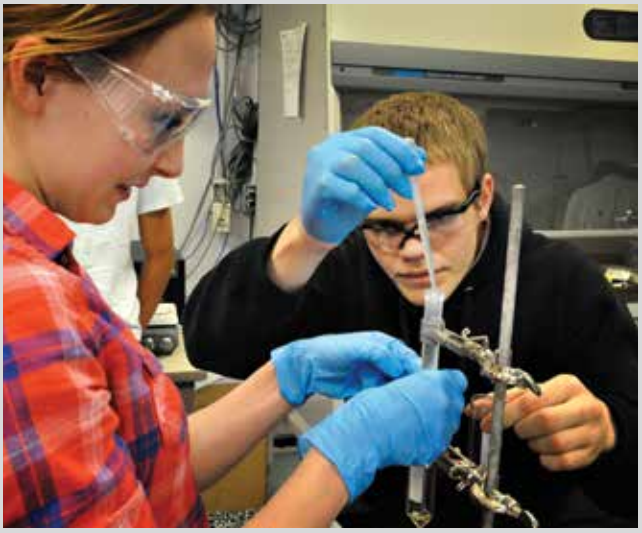
To achieve its objectives, the CCMSC has established a collaborative agreement with Alstom Power to jointly use exascale computing technology for the design and development of the oxy-coal boiler. CCMSC will produce exascale computing software, verification-validation and uncertainty quantification tools for use in other large applications while advancing computational fluid mechanics, multiphase reacting flow and radiative heat transfer. A new generation of graduate students will be educated in exascale predictive science. We are proud to be part of this new and exciting project!

TEACHING INNOVATIONS

We have made great strides to remain at the forefront of chemical engineering education. This year, we introduced a one-of-a-kind freshmen design laboratory into our curriculum, Design and Innovation in Chemical Engineering. Recent research on engineering students shows learning is most effective and retention is greater in active and collaborative learning environments.

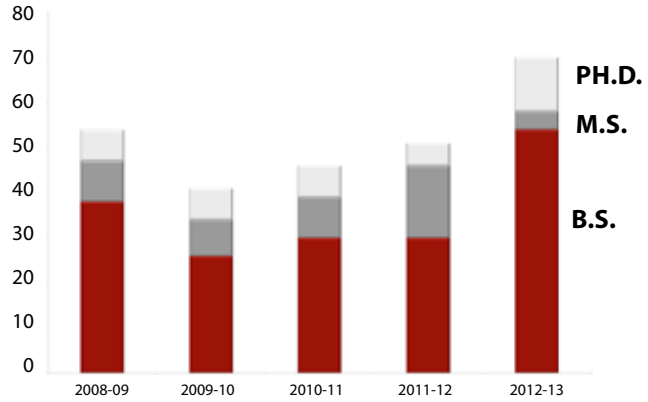
This course engages students with hands-on design projects, replacing traditional lectures and homework to introduce core engineering concepts and provide real-world experiences within a variety of chemical engineering areas. Student teams design spectrometers and use them to characterize a reaction, create a process for the manufacture of a drug delivery product, build and operate photobioreactors and much more.

Of special note, this freshmen lab brings our curriculum full circle in a collaborative project with our senior capstone lab. Freshmen hone their resumes and can apply for a role on senior design projects. This gives the freshmen valuable insight into their academic futures, while giving seniors equally valuable managerial experience. Our freshmen have thrived in the laboratory, meeting the significant challenges of this new course with great enthusiasm.

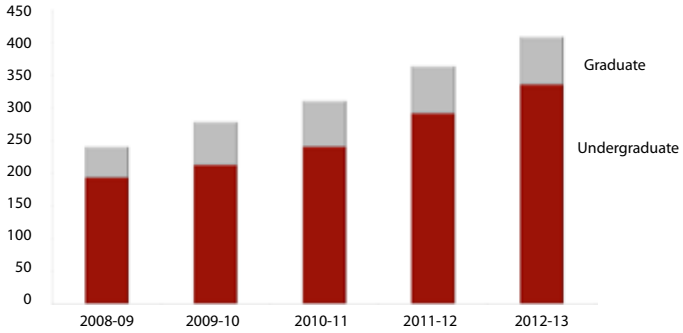


BY THE NUMBERS

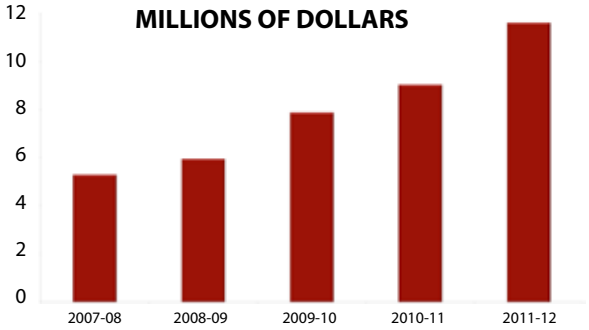
GRADUATES



ENROLLED MAJORS



EXPENDITURES IN MILLIONS OF DOLLARS



TENURE-TRACK

We have 18 tenured or tenure track faculty, three lecturing faculty and six research faculty in the department.

THE UNIVERSITY OF UTAH

DEPARTMENT OF CHEMICAL ENGINEERING
50 South Central Campus Drive, MEB Room 3290
Salt Lake City, Utah 84112

DISTINGUISHED LECTURE SERIES

SUCCESSFUL FALL 2013 ENGAGEMENTS

September 3, 2013: Peter Kilpatrick,
University of Notre Dame
"Petroleum Science and Engineering: The Role of Asphaltenes"

September 24, 2013: Clayton J. Radke,
University of California, Berkeley
"Are Your Eyes Dry? Meet Helen."

UPCOMING SPRING 2014 ENGAGEMENTS

February 4, 2014: Marjorie L. Longo,
University of California, Davis
"Engineering of Biological Membranes: From Winemaking to Nanopatterning"

March 4, 2014: Lance L. Lobban,
University of Oklahoma
"Thermal Treatment and Catalytic Upgrading of Lignocellulosic Biomass to Hydrocarbon Fuels"

February 11, 2014: Chung K. Law,
Princeton University
Adel F. Sarofim Distinguished Lecture
"Some Fundamental Combustion Problems of Terrestrial and Extraterrestrial Interest"

April 15, 2014: Michael Doherty,
University of California, Santa Barbara
"From Form to Function: Crystal Engineering for Organic Molecules"