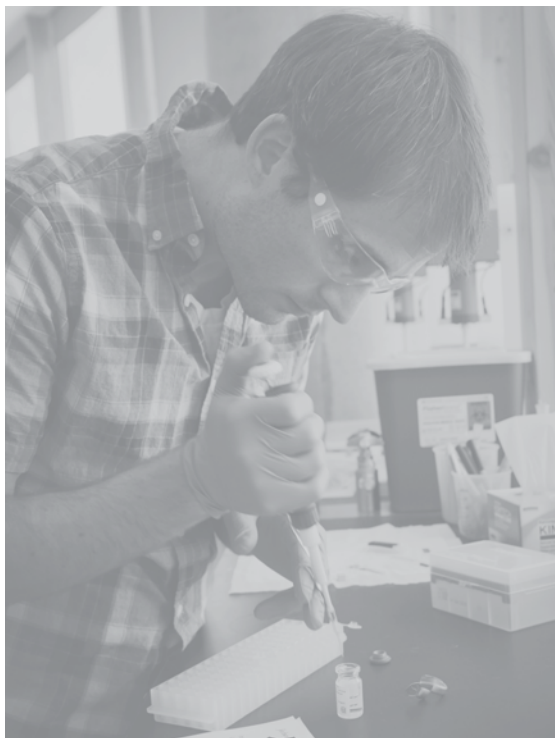
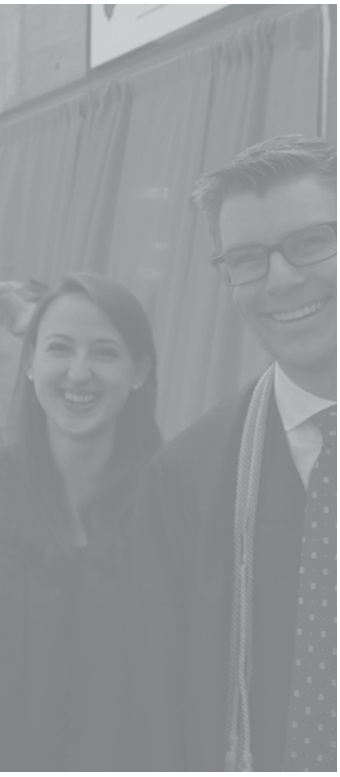
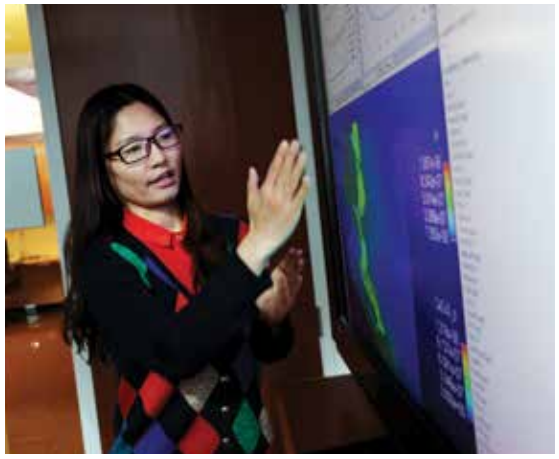
THE MIXING CUP

FOR THE UNIVERSITY OF UTAH ALUMNI & FRIENDS







THE UNIVERSITY OF UTAH

DEPARTMENT OF CHEMICAL ENGINEERING

FALL 2016

WELCOME FROM THE CHAIR

DEAR FRIENDS:

The Engineering Initiative, a State of Utah program that supports the growth of engineering programs, made it possible for us to add five new tenure-track positions to our ranks. I am delighted to report that Michael Nigra, Kody Powell, Tony Saad, Thomas Zangle and Huanan Zhang have joined our department. These new additions will bring in exciting new areas of research in catalysis, renewable energy, multi-scale simulation, implantable electronics and cancer detection.

Our faculty were successful in securing several research grants. The Energy and Geoscience Institute (EGI) at the University of Utah, in collaboration with the Utah Geological Survey, was named a Phase II finalist in the Department of Energy's FORGE (Frontier Observatory for Research in Geothermal Energy) program. The current $14 million award would allow EGI to compete to host the construction of a $130 million field laboratory for enabling commercial production of geothermal energy. John McLennan from our department is one of the co-principal investigators on the EGI team. Other notable awards are described in the newsletter.

The department awarded about 60 bachelor's degrees, 20 master's degrees and 10 Ph.D. degrees last year. I am happy to report that most of our graduate students will be moving into the newly-remodeled fourth-floor east penthouse. Work has begun on the new Meldrum Innovation Laboratory in Merrill Engineering Building. This new laboratory will be the home of the highly successful freshman course Chemical Engineering Design and Innovation. We would like to thank Peter Meldrum and Catherine Meldrum for their generous gift to create the laboratory. We would appreciate your support for this project.

I invite you to visit the department, meet the exciting new people and see the new laboratories and student spaces

A NEW GENERATION CHEMICAL ENGINEERING INNOVATIONS LABORATORY

The new $1.5 million Peter and Catherine Meldrum Innovations Laboratory in Chemical Engineering will become the premier place for students to use high-tech equipment and work on meaningful projects. But it will need your help to get started.

While the Peter and Catherine Meldrum Foundation has generously donated $500,000 to retrofit the space for the lab, the department is also looking for another $1 million to outfit it with the latest equipment. Donations of $500 and more will be recognized with a permanent display near the entrance to the laboratory. Those interested in donating can contact College of Engineering External Relations and Development Director Marilyn Davies at mdavies@coe.utah.edu.

The 2,300 square-foot lab space in the Merrill Engineering Building will be for students and faculty and house state-of-the-art equipment ranging from 3-D printers and laser cutters to design workstations. It also will feature work areas specific to different aspects of chemical engineering, from process engineering and catalysis to nanomedicine. The lab is expected to open sometime in 2017. A place for hands-on learning for students, the lab will give them the opportunity to build a permanent, tangible portfolio of creative projects as they go through the curriculum.

Meldrum, who graduated from the U in 1970 with a bachelor's in chemical engineering, became the co-founder and chief executive of Salt Lake City-based Myriad Genetics, known for being the first to identify the BRCA1 gene responsible for breast cancer.

SOLUTIONS THROUGH SIMULATIONS

As a child, James Sutherland was always interested in how things worked. During high school, he was the kind of curious student who rebuilt a 1971 Toyota Land Cruiser while also enjoying his chemistry and physics classes. So engineering was a natural choice for him for college because it gave him an understanding of how the world was built and how it can be improved upon.

Today, Sutherland, now has the privilege of helping students on that same journey of discovery as an associate professor of chemical engineering at the University of Utah.

Sutherland received his bachelor's and doctorate in chemical engineering from the University of Utah in 1999 and 2004 respectively. He was a post-doctoral researcher at Sandia National Laboratories in the computational thermal fluids department. But in 2006 he joined the University of Utah's faculty in large part because of his love of teaching.

"I believe the largest impact we have is what we do to improve others' lives, and teaching is one way that I try to help others," he says about his decision to become a professor.

Sutherland's research lies at the nexus of turbulent reacting flow, numerical analysis and high-performance computing, with applications in Large Eddy Simulation, Direct Numerical Simulation and reduced order modeling of turbulent combusting flows. Essentially, this boils down to solving really big problems on really big computers, he says.

As an example, the algorithms that Sutherland develops have been used to solve very large systems of partial differential equations on more than 200,000 processors, as well as on Titan, the U.S. Department of Energy's supercomputer with over 18,000 graphics processing units.

"By combining new modeling techniques, advanced algorithms and extreme-scale computing, we can solve problems that were intractable just a few years ago," he says.

In many cases, this allows researchers to use models in virtual experiments to gain insight into the behavior of systems where real-world experiments are too costly, dangerous or impossible to perform. It can also help guide the design of systems to reduce the number of iterations in the design cycle for complex systems.

Recent advances made by Sutherland's research group include faster and more robust algorithms for highly stiff and nonlinear sets of differential equations; simulation methodologies that allow for flexible, reconfigurable software that works on a variety of platforms from desktops to the largest supercomputers; and modeling techniques to reduce complexity in high-dimensional systems often encountered in reacting flows. These techniques allow scientists and engineers to take advantage of the tremendous increases in computing to gain better understanding of the physical processes involved in engineered and natural systems.

The outcomes of this research will help engineers to develop more efficient systems for power generation, transportation, and more by providing detailed insights into complex phenomena involving chemically reacting flows.

FUSION OF CHEMICAL ENGINEERING AND CHEMISTRY

University of Utah chemical engineering professor Marc Porter caught the science bug late in life. It wasn't until he was a freshman at Wright State University in Dayton, Ohio, that his fascination with science clicked in his freshman calculus class.

"My calculus instructor was actually a chemistry professor, and he used chemical reaction kinetics as a means to show his students the importance of mathematical analysis," Porter remembers.

The rest, as they say, is academic history for Porter. After earning his bachelor's and master's in chemistry and physical chemistry, respectively, at Wright State University, he received his doctorate at Ohio State University in analytical chemistry. He later joined the staff at Iowa State University and Arizona State University before joining the University of Utah. Today, he's a USTAR professor of chemistry, chemical engineering, bioengineering and pathology as well as director of the Nano Institute of Utah.

His research laboratory spans fundamental issues in the design, characterization and application of chemical, physical, and biological phenomena at liquid-solid interfaces. Porter is perhaps best known for work on self-assembled monolayers. His laboratory was the first to show that scanning tunneling microscopy (STM) and atomic force microscopy (AFM) can image the two-dimensional architecture of "thiols on gold," map surface composition and interfacial reactivity and detect subsurface reactions of functional groups buried under polymer thin films.

More recently, Porter and his team have focused on innovations in nanotechnology to drive breakthroughs in diagnostic tests for human and animal health. These efforts explore the use of nanoparticle labels, which when integrated with surface-enhanced Raman spectroscopy (SERS) and giant magnetoresistors (GMRs) as read-out tools, form the basis for the creation of massively multiplexed immunodiagnostics tests for tuberculosis, liver cancer, pancreas cancer.

This work also launched the development of GMR technology which begins to functionally mimic a credit card reader with the ability to detect as few as 80 binding events and is internally calibrated via the incorporation of magnetic reference addresses. This work is now moving toward the creation of a platform of personalized medicine that functions much like a credit card reader with the potential to simultaneously detect hundreds of potential serum- and urine-based indicators of human health.

In a different arena, Porter's group has teamed with scientists and engineers at NASA's Johnson Space Center in designing and testing innovative instrumentation for monitoring water quality on the International Space Station (ISS).

This project integrated novel concepts in solid phase extraction (SPE) and diffuse reflectance spectroscopy to detect biocides used in ISS potable water. After completing a series of successful flight validation tests on NASA's KC-135 microgravity flight simulator (more famously known as the "Vomit Comet"), this instrument was delivered by the Space Shuttle in August 2009, and after a six-month trial was designated permanent operational ISS hardware. Porter' hopes to have this technology considered as a means to meet the needs of future Lunar and Mars missions. Porter even flew on the KC-135 during this project.

"Microgravity is way-cool until you get motion sickness," he says.

During his career, Porter has received NSF's Special Creativity Award, a 2006 Alumni Achievement Award from Wright State University, and the 2010 Anachem Award from the Association of Analytical Chemistry and the Federation of Analytical Chemistry and Spectroscopy Societies. Meanwhile, he holds numerous patents and has co-founded several companies.

FOUR DECADES OF OUTSTANDING SERVICE

After 36 years of outstanding service to the University of Utah, chemical engineering professor Edward Trujillo will be retiring in January 2017.

During Trujillo's career at the university he had many accomplishments. However, his favorite is "being part of a group that founded Utah MESA, which is a program in the public schools that encourages women and underrepresented youth to consider careers in the STEM fields."

This involved developing a consortium of members of the Utah minority community, Utah industrial professionals, Utah universities and colleges, and the Utah public school system. All work together toward a common goal of increasing the diversity in higher education, particularly in the sciences, technological fields and in engineering.

The professor graduated with a master's degree from Caltech and a doctorate from the University of Utah and then went to work in industry. His career includes working nine years for Marathon Oil Company and one year with Kimberly-Clark Corporation. He started his academic career with the university in 1984, working in the research areas of biosorption, acid rock drainage and mammalian cell culture.

In addition to research and teaching, Trujillo was active in the American Institute of Chemical Engineers and was elected a fellow in 2013. He also received the award for AIChE's Outstanding Student Chapter Advisor, the U's Diversity Award, the Outstanding Service Award from the College of Engineering, and the President's Award from the Society of Hispanic Professional Engineers, to name just a few.

He taught 12 different chemical engineering classes at the U and was faculty advisor to six Ph.D. chemical engineering students (four completing their degree), 14 MS students, five ME students and 15 students completing a bachelor's thesis degree.

"I've been fortunate to have the support and understanding of my wife and children all these years throughout my career at the university," he said.

We'll miss him and are deeply grateful for his service at the University of Utah. Please join us in congratulating him on his retirement and wishing him well on the next phase of his journey.

NEW FACULTY

MICHAEL NIGRA

Assistant professor Michael Nigra received his bachelor's in chemical engineering and biomedical engineering from Carnegie Mellon University in Pittsburgh and his doctorate in chemical engineering from the University of California, Berkeley, in 2013. He was a graduate research assistant at Berkeley from 2007 to 2013.

His research involves performing functional nanomaterial synthesis, characterization and applications testing. The majority of these materials have applications as catalysts for chemical and biochemical processes.

KODY POWELL

Assistant professor Kody Powell received his bachelor's in chemical engineering from the University of Utah. He then earned a doctorate in chemical engineering from the University of Texas at Austin in 2013. He has worked for Fairchild Semiconductor in West Jordan as well as ExxonMobile in Texas as an engineer.

Powell's research focuses on smart energy and manufacturing systems and using real-time data to enhance their performance.

TONY SAAD

Assistant professor Tony Saad received his bachelor's in mechanical engineering from Notre Dame University in 2003, a master's in mechanical engineering from American University in Beirut, and a doctorate in mechanical engineering from the University of Tennessee Space Institute. He was a postdoctoral fellow for the U's Institute for Clean & Secure Energy.

Saad's research is focused on developing numerical methods and simulation tools for studying variable density, multiphase, turbulent reacting flows. He's also working on advancing the state of the art in analytical methods for theoretical and applied fluid dynamics using perturbation theory.

THOMAS ZANGLE

Assistant professor Thomas Zangle received his bachelor's in engineering sciences from Dartmouth College in 2005 and a master's and doctorate in mechanical engineering from Stanford University. He served a postdoctoral fellowship and was an adjunct assistant professor in bioengineering at the University of California, Los Angeles.

His research is in the development of technologies to evaluate the response of cancer cells to therapy. He also is examining mass transport within single cells and developing microfluidic devices to extend the capabilities of current cell response measurements.

HUANAN ZHANG

Assistant professor Huanan Zang received his bachelor's in chemical engineering from the Massachusetts Institute of Technology in 2008 and a master's and doctorate in chemical engineering from the University of Michigan. He formerly was a graduate research assistant in chemical engineering at Michigan and a postdoctoral scholar in the bioscience and biotechnology division of the Lawrence Livermore National Laboratory in Livermore, California.

His research is in the development in new nanomaterials for implantable electronics and designing nanobioelectronics for cellular modulation.

AWARDS

A GOOD YEAR FOR KEVIN WHITTY

You could say Kevin Whitty has had a good year.

The University of Utah chemical engineering professor has received three awards so far, including an honorary doctorate last summer from the University of Miskolc in Miskolc, Hungary.

Whitty, whose research at the U focuses on gasification, syngas processing and chemical looping combustion, was given the honorary doctorate for his achievements in the development of sustainable and environmentally-friendly energy technologies as well as for his longstanding collaboration with faculty and students in Hungary.

Earlier this year, he also was a recipient of the Celebrate U faculty achievement award along with fellow chemical engineering faculty members, JoAnn Lighty and Andrew Fry. Meanwhile, Whitty will receive a Professional Achievement Award for Innovations in Green Process Engineering from the American Institute of Chemical Engineers in November.

STUDENT AWARDS:

The 2016 undergraduate graduating class held its senior awards banquet on April 19, 2016, at Tucano's restaurant at the Gateway. The Oblad Silver Medal of Excellence was awarded to Skyler Edvik. The senior class presented two awards: one for Outstanding Senior presented to Christian Payne and Outstanding Faculty Award to Dr. Anthony Butterfield.

ALUMNI AWARDS:

The Annual Distinguished Alumni Dinner was held on April 22, 2016, at the Natural History Museum. This year we honored Rajesh Rawat, Ph.D., Director of Reaction Technology at CD-adapco, and Jason Job, B.S., CEO and President, Job Industrial Services, Inc.

RESEARCH AWARDS:

The Energy and Geoscience Institute (EGI) was named a Phase II finalist in the Department of Energy's FORGE (Frontier Observatory for Research in Geothermal Energy) program. The current $14 million award would allow EGI to compete to host the construction of a $130 million field laboratory for enabling commercial production of geothermal energy. John McLennan from our department is one of the co-principal investigators on the EGI team.

Title: Development of Enabling Technologies for Chemical Looping Combustion and CLOU
Sponsor: U.S. Department of Energy (NETL)
Investigator: Kevin J. Whitty, JoAnn Lighty
Period of Performance: Oct. 2016–Sep. 2019
Amount: $1,794,000

Title: Characterizing Impacts of Dry Coal Feeding in High Pressure Oxy-Coal Combustion
Sponsor: Reaction Engineering International (U.S. Dept. of Energy/NETL flowthrough)
Investigators: Kevin J. Whitty, Jost Wendt
Period of Performance: Oct. 2016–Sep. 2019
Amount: $812,500

Title: AIRU: Community Network to Understand Air Quality and Sensor Reliability
Sponsor: National Science Foundation
Investigators: Kerry Kelly and Anthony Butterfield
Amount: $100,000

Title: A Layered Framework of Sensors, Models, Land-Use Information and Citizens for Understanding Air Quality in Urban Environments
Sponsor: National Science Foundation
Investigator: Kerry Kelly
Amount: $800,000

Title: Production of Carbon Fiber from Coal-Derived Pitch
Sponstor: U.S. Dept. of Commerce, Economic Development Administration
Investigator: Eric Eddings
Period of Performance: Oct. 2016 – Sep. 2019
Amount: $1,583,569

Title: SusChEM: Co-Firing Biomass and Coal Under Pressurized Oxy-Fired Combustion Conditions
Sponsor: U.S. National Science Foundation
Investigator: Eric Eddings
Period of Performance: July 2016 – June 2020
Amount: $499,800

BY THE NUMBERS: DEGREES AWARDED AND EXPENDITURES

ACADEMIC YEAR	2013-14	2014-15	2015-16
BACHELOR OF SCIENCE	57	64	58
MASTER OF SCIENCE	6	8	21
Ph.D	7	7	9
RESEARCH EXPENDITURES (Millions of Dollars)	8.9 million	8.3 million	7.5 million

THE UNIVERSITY OF UTAH

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

DISTINGUISHED LECTURE SERIES

November 8, 2016
Robert J. Kee, George R. Brown Professor of Engineering
Engineering Division, Colorado School of Mines
"Process intensification in the catalytic conversion of natural gas to fuels and chemicals"

March 7, 2017
Samir Mitragotri, Professor, Chemical Engineering; Director, Center for Bioengineering University of California, Santa Barbara
"Overcoming Biological Barriers for Drug Delivery"

March 28, 2017
Angela Violi, Professor: Mechanical Engineering, Biomedical Engineering, and Chemical Engineering
University of Michigan
"Nanoparticles in the Environment: from molecular simulations to cellular uptake"

April 11, 2017
Adel F. Sarofim Distinguished Lecture
Brian Haynes, Professor, School of Chemical and Biomolecular Engineering
The University of Sydney, Australia
"p3 – Combining Process Innovation, Process Integration and Process Intensification"
Co-sponsored with Reaction Engineering International (REI)