Mass Transfer

News from Chemical and Biomolecular Engineering at Illinois

Spring/Summer 2013

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Last week we completed the academic year of 2012-2013 with our commencement ceremony. Keith Reese (B.S. ’79), a former Vice President at Intel, delivered a wonderful speech to our graduates. In the past year, more than 100 students received their bachelor’s degree and 18 received their Ph.D. As I have stated in previous editions of Mass Transfer, the job market for our graduates remains strong, despite the slow economy.

This fall we expect to welcome our largest incoming class ever with more than 200 freshmen. This will bring our total enrollment to well over 600. To teach all these students we continue to pursue new faculty hires. I am pleased to report that Dr. Charles Schroeder, who received his Ph.D. from MIT, will join us at the end of 2014 as an Assistant Professor, after completing his postdoc at Northwestern. His research program will focus on studying the dynamics of polymer systems through computational methods. Gifts by you, our alumni and friends, are crucial in being able to offer competitive startup packages to new hires like Dr. Singh!

Summer is always a time of transition. We will say goodbye to our Dean of Liberal Arts & Sciences, Ruth Watkins, who will become Vice President for Academic Affairs at the University of Utah. We thank her for the support the College has given us. Brian Ross, our current Associate Dean, will serve as the Interim Dean. And, later this summer, a new Dean will be named for the College of Engineering.

This has been a very productive semester for our students and faculty. Undergraduates put on an impressive showing at the annual Engineering Open House and an undergraduate team won the BP Ultimate Field Trip in Houston, Texas; they will travel overseas in July to represent the department. And, Assistant Professors Brendan Harley and Charles Schroeder each won a NSF CAREER award. We hope you will enjoy reading about Professor Ed Seebauer being back in the classroom and his efforts as a Provost Fellow for international programs. This issue also features Professor Mary Kraft, who talks about her research on unraveling the chemical composition of cell membranes using advanced imaging and image analysis methods.

Looking ahead to the fall, I hope many of you will be able to join us at our Homecoming Tailgate during the weekend of October 26. We’ll have a tent, food and drinks, and free tickets to the football game for the first 50 RSVPs. More information will be forthcoming.

Enjoy this spring/summer 2013 newsletter! I encourage you to share your feedback with us and submit your memories, photos, and updates so we can tell your stories. This issue features stories from alumni and friends including Eryn Finke, B.S. ’09. And, become a “fan” of ChBE at Illinois on our new Facebook page to stay up-to-date on department news, upcoming events, and view photos from student and alumni events.

I wish you all a happy and productive summer!

Best Regards,

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Schroeder wins
NSF CAREER Award

Assistant Professor Charles Schroeder from Chemical and Biomolecular Engineering received a five-year National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award, which will allow Schroeder and his research team to push into uncharted territory with molecular-level studies of branched polymer chains using new single molecule tools.

These tools will be developed as part of Schroeder’s project “Molecular Rheology of Architecturally Complex Polymers” that will help carry out new and cutting-edge research on branched polymers.

During the past few years, Schroeder has worked to address many of the steps in polymer processing such as design and synthesis of materials and detailed studies of the flow processing of polymers, all of which help his research group to attack problems in materials design at the molecular level.

“Taken together, our research has the potential to enable the coupled synthesis and characterization of polymers that will ultimately enable the targeted molecular design of new, advanced materials with desired processing properties and function,” he said.

These polymers are the basis for many technologies ranging from consumer plastics to electronics. Schroeder says it has been more than 50 years since the rapid growth of synthetic materials spurred the mass production of polymers on an industrial scale.

“Despite tremendous progress in the field, we still lack a full understanding of the flow properties of entangled polymer solutions,” he says. “A major challenge in polymer processing arises from the unusually complex flow properties of branched polymers, wherein molecular topology ultimately determines macroscopic material response. To overcome these challenges, a molecular approach to probe dynamics is required.”

The goal of my CAREER program is to provide the first single molecule study of branched polymer dynamics in flow using well-characterized materials.”

Schroeder said this research focuses on developing a detailed understanding of single molecule processes that will produce bulk viscoelasticity. “This aim is of paramount importance to a wide-array of technologies, because the flow processing of polymers generally underlies many industrial processes,” he said. “Our work will provide crucial insight into the improved processibility of branched polymers.”

Schroeder said he is honored to earn the award and ready to begin this project.

“I am elated to have received the NSF CAREER Award,” Schroeder said. “I am very happy that my work was recognized in the field as being current, relevant, important, and rigorous. We are taking the field of molecular rheology and polymer dynamics in new directions, and I was quite happy to know that our work is recognized by other experts in the field.”

Department Head Paul J. A. Kenis, who also was awarded a CAREER grant in 2004, said Schroeder is a leader with his research. “Charles’ research on the dynamic properties of novel polymer architectures is at the forefront of the field,” Kenis said. “Him receiving this award, as well as the substantial federal research grant that goes with it, is a well-deserved honor.”

Schroeder earned his B.S. in chemical engineering from Carnegie Mellon University and his M.S. and Ph.D. in chemical engineering from Stanford University. He was a postdoctoral fellow at Harvard University and the University of California, Berkeley before joining the faculty at Illinois in 2008.

The CAREER grants are the most prestigious awards given to the best young university faculty in a highly competitive annual program. These teacher-scholars are recognized for their outstanding research, excellent education, and the lifelong integration of education and research.

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Paul J. A. Kenis, Department Head
New look at cell membrane reveals surprising organization

Sight would dramatically alter a blind man’s understanding of an elephant, according to the old story. Now, a look directly at a cell surface is changing our understanding of cell membrane organization.

Using a completely new approach to imaging cell membranes, a study by researchers from the University of Illinois, Lawrence Livermore National Laboratory, and the National Institutes of Health revealed some surprising relationships among molecules within cell membranes.

Led by Mary Kraft, a University of Illinois Laboratory, and the National Institutes of Health revealed some surprising relationships among molecules within cell membranes. Red and yellow colors indicate local elevations in the sphingolipid abundance. Photo by Kevin Carpenter

Researchers found that a class of molecules called sphingolipids congregate in large patches in the cell membrane. Researchers found that a class of molecules called sphingolipids congregate in large patches in the cell membrane. Red and yellow colors indicate local elevations in the sphingolipid abundance. Photo by Kevin Carpenter

By Mary Kraft, a University of Illinois assistant professor of chemical and biomolecular engineering, the team published its findings in the Proceedings of the National Academy of Sciences.

Cells are enveloped in semi-permeable membranes that act as a barrier between the inside and outside of the cell. The membrane is mainly composed of a class of molecules called lipids, studded with proteins that help regulate how the cell responds to its environment.

“Lipids have multiple functions serving as both membrane structure and signaling molecules, so they regulate other functions inside the cell,” Kraft said. “Therefore, understanding how they’re organized is important. You need to know where they are to figure out how they’re doing these regulatory functions.”

One widely held belief among cell biologists is that lipids in the membrane assemble into patches, called domains, that differ in composition. However, research into how lipids are organized in the membrane, and how that organization affects cell function, has been hampered by the lack of direct observation. Although the cell membrane is heavily studied, the imaging techniques used infer the locations of certain molecules based on assumed associations with other molecules.

In the new study, Kraft’s team used an advanced, molecule-specific imaging method that allowed the researchers to look at the membrane itself and map a particular type of lipid on mouse cell membranes. The researchers fed lipids labeled with rare stable isotopes to the cells and then imaged the distribution of the isotopes with high-resolution imaging mass spectrometry.

Called sphingolipids, these molecules are thought to associate with cholesterol to form small domains about 200 nanometers across. The direct imaging method revealed that sphingolipids do indeed form domains, but not in the way the researchers expected.

The domains were much bigger than suggested by prior experiments. The 200-nanometer domains clustered together in conjunction with other more conventional methods, such as fluorescence, to further determine the organization of different kinds of molecules in the membrane, their interactions and how they affect the cell’s function. They plan to begin by targeting cholesterol.

“Cholesterol abundance is important,” Kraft said. “You change that, you tremendously change cell function. How is it organized? Is it also in domains? That’s related to the question, what’s the mechanism responsible for these structures and what are they doing?”

The National Institutes of Health, Lawrence Livermore National Laboratory, the National Science Foundation, and the Burroughs Wellcome Fund supported this work.

“We found that the presence of domains was somewhat affected by cholesterol but was more affected by the cytoskeleton – the protein network underneath the membrane,” Kraft said. “The central issue is that the data are suggesting that the mechanism that’s responsible for these domains is much more complicated than initially expected.”

In addition, the new study found that sphingolipid domains were incompletely associated with a marker protein that researchers have long assumed dwelled where sphingolipids congregated. This means that data collected with imaging techniques that target this protein are not as accurate in representing sphingolipid distribution as previously thought.

“Our data are showing that if you want to know where sphingolipids are, look at the lipid, don’t infer where it is based on other molecules, and now there’s a way to directly image them,” said Kraft, who also is affiliated with the department of chemistry at the U. of I.

Next, the researchers plan to use the direct-imaging method in conjunction with other more conventional methods, such as fluorescence, to further determine the organization of different kinds of molecules in the membrane, their interactions and how they affect the cell’s function. They plan to begin by targeting cholesterol.

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Paul J. A. Kenis, Department Head and Professor of Chemical and Biomolecular Engineering (at left), presents a framed picture to Nicholas A. Peppas from the University of Texas at Austin, in honor of being the lecturer for the Samuel W. Parr Lecture on April 25 at Regor Adams Laboratory. His talk was entitled, “New Frontiers in the Pharmaceutical and Medical Sciences: Advanced Intelligent Hydrogels for Protein Delivery.” Peppas is a world leader in biomaterials, polymer physics, drug delivery, and bionanotechnology. The lecture is named after the founder of the department.
Assistant Professor Brendan Harley earns NSF CAREER Award

Assistant Professor Brendan Harley from Chemical and Biomolecular Engineering at Illinois was awarded a five-year National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award, which will allow Harley and his research team to develop a synthetic bone marrow biomaterial to aid the study of hematopoiesis and hematopoietic diseases.

“We are working to develop a scalable bone-marrow-on-a-chip that acts as a rheostat to control the growth and behavior of hematopoietic stem cells from the bone marrow,” Harley said. “Hematopoiesis is the process where all blood and immune cells are generated from a small number of hematopoietic stem cells. Even though some hematopoietic cells are already used clinically to treat diseases such as leukemia, their rarity within the bone marrow makes it difficult to study these events inside the body. One of the major bottlenecks in the development of artificial bone marrow, Harley says, is that it remains unclear how combinations of signals from the marrow impacts hematopoiesis.

“To overcome this challenge, new biomaterials systems are needed,” he said.

With the funding through the NSF CAREER award, Harley and his team will build upon a bone marrow microchip platform that they have recently created in the laboratory. “This approach allows us to reduce the complexity of the native bone marrow to a manageable series of discrete signals within a 3-D biomaterial,” he said. “We have identified an approach to generate libraries of unique, optically-transparent biomaterials that contain overlapping patterns of marrow-inspired signals.”

During the next five years, Harley will chart how the combinations of three important classes of signals—the structural make-up of the bone marrow, the local presence of supportive niche cells from the marrow, and the diffusion of nutrients—impact hematopoietic stem cell growth.

“Our long-term goal is to build an artificial bone marrow platform that provides the correct sequence of niche signals to grow hematopoietic cells in the laboratory,” he said. “This work will provide critical insight into the design of more complex biomaterial systems to control all phases of hematopoiesis.”

“An engineered platform to study and control their behavior outside the body would open up a range of exciting new research avenues such as producing patient-specific blood and immune cells or evaluating the initiation, growth, and treatment of a wide range of hematopoietic diseases,” Harley said.

Harley says he is extremely excited to receive an NSF CAREER award to pursue a research platform that is a departure from traditional biomaterial science.

“My goal from the beginning at Illinois has been to establish a synthetic bone marrow on-a-chip that functions as a rheostat to control the growth and behavior of hematopoietic stem cells from the bone marrow,” Harley said. Hematopoiesis is the process where all blood and immune cells are generated from a small number of hematopoietic stem cells.

Schroeder wins 2013 College of Engineering Dean’s Award for Excellence in Research

Assistant Professor Charles Schroeder in Chemical and Biomolecular Engineering was granted a 2013 College of Engineering Dean’s Award for Excellence in Research.

Schroeder, who was nominated for the award by Professor Humin Zhao, was recognized for his research on using molecular engineering to study the dynamics of soft materials and to develop new techniques for biological imaging.

Schroeder’s research relies on manipulating and measuring the properties of single molecules, including single polymers and proteins, in order to discover new physical and biological phenomena.

He says he is honored and humbled to receive the award that recognizes his research program.

“The award is a reflection of the supportive environment that fosters excellence in research at Illinois,” he said. “This campus is an ideal place for high-quality research and teaching, with top-notch facilities and outstanding colleagues across the fields of engineering and natural sciences. I look forward to continuing our work at Illinois.”

Schroeder earned his B.S. in chemical engineering from Carnegie Mellon University and his M.S. and Ph.D. in chemical engineering from Stanford University. He was a postdoctoral fellow at Harvard University and the University of California, Berkeley before joining the faculty at Illinois in 2008.

He says the success of his research program is a direct consequence of the supportive culture.

“The cutting edge of chemical science research lies in the manipulation and measurement of single molecules,” Schroeder said. “Molecular processes hold the key to understanding and optimizing cellular function and for developing advanced materials with desired functionality. Major challenges in molecular engineering include imaging single molecule events such as sub-cellular chemical reactions and bridging the gap between molecular phenomena and bulk-scale behavior.”

Schroeder’s research directly addresses these issues by pioneering a unique and powerful brand of molecular engineering that allows for the control and manipulation of single molecules. The ability to engineer molecular properties characterizes three areas of his research program: ultra-resolution imaging of cellular events, molecular rheology, and microfluidic nanoparticle trapping.

This prestigious award is given annually to four assistant professors in the College of Engineering, in recognition of their outstanding research conducted during the previous year. Schroeder received his award on April 29 at the Engineering at Illinois Faculty Awards Ceremony.
Chemical engineering students showcase projects at annual Engineering Open House

More than 140 Chemical Engineering students participated in this year’s University of Illinois College of Engineering Open House. This annual two-day event took place in early March and featured 250 exhibits and attracted more than 20,000 visitors to the campus.

Chemical engineering students showcased 27 projects at this year’s open house. From energy to safety to key engineering principles and processes, students demonstrated various aspects of chemical engineering, including showing the extrusion process by using Play-Doh. From a light-up model of an oil refinery to show where fuel for vehicles comes from to demonstrating the synthesis of algae-based biofuels to showing how hydrogen can be an alternative energy source, all were highlighted.

“You feel the value of your education when you have the opportunity to share some of your knowledge with other people,” Gibbons said. “It is especially rewarding to answer the questions of young audience members who are eager to learn about science and engineering.”

Gibbons and Richards say they chose chemical engineering as a field of study because they were strongly influenced by chemistry and math teachers in high school. They said they wanted “a major that would allow us to apply our knowledge to impact the world in a positive way.”

“Chemical engineering opens a world of opportunities, including future potential to get involved with the business and management side of industry,” Gibbons said.

Richards said he chose the University of Illinois initially because of its prestige and rankings. But when he visited the school, he noticed so much more. “The Chemical Engineering program had the feel of a small department, with the ability to work on real projects as an undergraduate,” he said. “The student body seemed energetic, and I like the pairing of orange and blue. And most of all, I really wanted to spend my breaks from class sitting on the quad—an iconic collegiate scene.”

Richards said his career goals are to work in the petrochemical industry with plans to work abroad. Gibbons said she wants to work in the energy industry and “develop solutions to global energy problems with other engineers around the world.”

Both students said they agree that being part of the engineering open house is a great experience. “We learn how to explain chemical engineering principles to a general audience and get to meet other students within the department,” Richards said.

Several chemical and biomolecular engineering undergraduates and members of the Illinois AIChE group competed in the ChemE car competition regionals in March at the University of Cincinnati. The goal of the ChemE car competition is to run and stop a car using chemical reactions. The Illinois team placed sixth out of 14 schools. This is the first time in more than 10 years since a team from Illinois has competed. The team also received third place in the poster competition.

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For chemical engineering sophomores Claire Gibbons and Michael Richards, participating in this year’s open house was a great team event and a way to grow in leadership. “EOH provides a unique opportunity to work in a team on a project that explores chemical engineering outside the classroom,” they said.

Sharing their passion for engineering with high school visitors, families, and the public was an exciting opportunity for the students.

Several chemical and biomolecular engineering students received awards at this year’s Engineering Open House. (Pictured to the left, from left to right)

First Place, Best Kickoff to Engineering Open House
Lit Up Oil by Paul Schochat, Nick Connolly, Sean Kelly, Lily Chen, and Alia Khan
A 3-D light up model of an oil refinery to show how the process works.

Second Place, Best Kickoff to Engineering Open House
Benchtop to Bioreactor: Scaling Up Biomolecular Engineering by Stav Caplan, Marissa Castner, and Annmaria Vincent
A display on drug delivery and pharmaceutical development stages where students made pill coatings and tested them.

Third Place, Real World
Catalytic Cracking by Grant Blazina, Aristotelis Economou, Ted Papadopoulos, and Tom Schulz
Students demonstrated how catalytic cracking works for refineries and the oil industry.
2012-2013 Scholarship Awards in Chemical and Biomolecular Engineering

More than $46,000 in scholarships and awards were distributed to undergraduate students at the Department of Chemical and Biomolecular Engineering’s annual awards ceremony that took place in April. The awards were presented by lecturers Dr. Jerrod A. Henderson and Dr. Troy J. Vogel. Professor and Department Head Paul J. A. Kenis thanked the alumni who gave gifts to the department to use as scholarships for the students. “Thank you to our alumni who are giving to future alumni to make these scholarships possible,” he said.

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American Institute of Chemical Engineers Awards
Morgan M. Bakies
Sahil H. Patel

Bestik, Inc. Award
Ryan P. McGowan

Franklin A. Boyle Award

Bostik, Inc. Award

Awards

American Institute of Chemical Engineers

Chemical Engineering Awards

Alumni Award

Phi Lambda Upsilon Awards

Eugene F. Swisher
Alia Khan

Robert S. Frye Awards
Seong-Min Kim
James T. Lang

Clarence G. Gerhold Memorial Award
Paul A. Jankins

Joseph and Donna Glass in Memory of Professor James Westwater Award
Zachary A. Dookeran

Chester W. Hannum Scholarships

Paul S. Anderson
Kevin Erning
Joshua A. Walker
Kevin B. Weyant

Earp F. Jennings Award
Shayta Roy

Donald B. Keyes Award
Alaina J. Fuller

DuPont Awards
Philip C. Dejarld
Martin Enem
Amanda M. Pritchard
Thomas J. Smith

Robert S. Frye Awards
Seong-Min Kim
James T. Lang

Clarence G. Gerhold Memorial Award
Paul A. Jankins

Dr. Joseph and Donna Glass in Memory of Professor James Westwater Award
Zachary A. Dookeran

Chester W. Hannum Scholarships

Paul S. Anderson
Kevin Erning
Joshua A. Walker
Kevin B. Weyant

Earp F. Jennings Award
Shayta Roy

Donald B. Keyes Award
Alaina J. Fuller

DuPont Award recipients (l to r): Thomas J. Smith, Department Head and Professor Paul Kenis, Phillip C. Dejarld, and Amanda M. Pritchard (Martin Enem, not pictured)

Kimberly-Clark Corporate Award
Elizabeth M. Gauen

John W. Latchum, Jr. Award
Cornelius E. Lawson

R. J. Van Mylen Award
Ruja Wang

Worth-Huff Rodebush Award
John M. Winters

Rohm & Haas Chemical Engineering Award
Chotitath Sanpitakseree

Thomas R. and Yolanda Stein Awards
Benjamin D. Kanovsky
Amelia Su Xia Witcoski

Glenn E. and Barbara R. Utey Awards
See Woe Choi
Shern Xuan Lu Lim

Grant Blazina and Sarah Huang, both juniors studying chemical engineering, received the 2013 Illinois Club of “Make a Difference” scholarship which recognizes students who are making a difference on campus or in their communities. Nine students were honored with this scholarship.

Grant Blazina, a junior in chemical engineering, who also is minoring in earth, society, and environment, is the lead coordinator for the Girl Scouts Program, part of the REACT Outreach Program on campus. More than 250 student volunteers from REACT visit third grade classrooms in elementary schools within 30 miles of campus.

Making a difference

Improving cook stoves for people in Haiti and teaching science experiments to local Girl Scouts and students are two ways that University of Illinois chemical engineering students are making a difference.

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In July, Connolly, Richards, and Moradia will join the winning teams from the United Kingdom and Trinidad & Tobago for a two-week field trip at the BP operational hub for North Sea oil and gas exploration and production in Norway and the Shetland Islands, north of Scotland.

The students were asked to address the growing demand for energy by developing an innovation to reduce the cost of miles per gallon per capita in their country by 2030. The Illinois team developed a modular compressed natural gas fueling system called the “UniPump” to be used at American retail gas stations. The team estimates that consumers could save roughly $1.83 per gallon of gasoline equivalent, or $5,000 over the lifetime of a vehicle from the cheaper fuel costs.

“Together we made a great team, always pushing each other to do our best and think in the most creative ways to develop our solution to the fullest,” Richards said.

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Organizing visits to Camp Kiwanis, a local Girl Scout camp, is one of Blazina’s ways to bring science to youth locally. “At these events, we do all kinds of fun and interesting chemistry experiments and demonstrations to try to interest the next generation of girls in science and chemistry,” he said. “It’s hard not to get excited about liquid nitrogen ice cream.”

Sarah Huang, a junior studying chemical engineering, is president of an interdisciplinary project called Haiti Clean Stove, the group designs and implements improved cook stoves to replace charcoal and open fire cooking in Haiti.

To make a more sustainable cooking stove for Haitians, Huang said members traveled to Haiti and conducted usability testing to determine what would work best.

“We believe this project will introduce to Haiti the concept of sustainability, and also provide pilot data for the clean cook stove community worldwide,” Huang said. “Receiving this scholarship is a significant recognition for my accomplishments and encourages me to continue pursuing my career in the field of engineering.”

Chemical Engineering student team wins BP challenge

Engineering at Illinois sophomores (from left to right) Michael Richards, Nicholas Connolly, and senior Akash Moradia won the BP Ultimate Field Trip in Houston in April, beating out other finalist teams from MIT, University of California-Berkeley, and the Georgia Institute of Technology.

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“Together we made a great team, always pushing each other to do our best and think in the most creative ways to develop our solution to the fullest,” Richards said.
Developing new reactive adsorbent materials to remove sulfur from the fuel during production was the focus of University of Illinois researchers, including a Chemical and Biomolecular Engineering graduate student.

Mayank Behl, a chemical engineering graduate student, worked with University of Illinois researchers to develop scalable mats of metal oxide nanofibers that scrub sulfur from fuels better than traditional materials. Sulfur is found in raw fuels such as natural gas and coal and is poisonous to catalysts and corrosive to metals and needs to be removed.

The researchers’ findings were recently published in the December 2012 Nature Nanotechnology in an article titled, "A regenerable oxide-based H2S adsorbent with nanofibrous morphology." The findings from the study highlights that, apart from sorbent composition, morphology plays an equally important role in influencing sorbent activity and regenerability.

Behl was one of the authors of the paper and says the research shows that these nanofibers could help lower costs and improve performance of catalysts used in fuel refining, toxic gas removal, gas sensing, and other advanced energy applications.

The work in the paper was conceptualized while Behl was working with Professor Mark Shannon of Mechanical Science and Engineering, who passed away earlier this year. Behl now is part of Chemistry Professor Prashant Jain’s research group, where he is studying the underlying workings of photocatalysts. He wants to develop experimental methods that assist in correlating site-specific structure and electronic properties of semiconducting oxides with their photocactivity.

While studying chemical engineering as an undergraduate at the Indian Institute of Technology in Delhi, Behl said that to have a better understanding of his research area in heterogeneous catalysis, he wanted to have multidisciplinary training that combined basic and applied research. He found that at Chemical and Biomolecular Engineering at Illinois.

"Emphasis on multi-disciplinary research and frequent industrial collaboration makes CHBE at U of I very distinctive," he says. "In addition, the extensive materials characterization and fabrication facilities available here are well-known around the world."

Behl, who was selected as a Dow Chemical Company Graduate Fellow, says the financial support helped him to complete his research for the sulfur adsorbent project. In 2011, Dow Chemical pledged a gift to establish the Dow Chemical Company Graduate Fellows in Chemical Engineering; 12 graduate students were named fellows in the inaugural class.

He says academia-industry collaboration is much needed today. "Dow Chemical Company’s recent initiative in this direction is highly commendable," he says. "This approach promises to be more efficient in solving many of our real-world challenges.”

In May 2013, Behl and the team of researchers from the University of Illinois launched a startup company, Aim2Sorb, that is licensed to commercialize the sulfur adsorbent technology.

Graduate students in Chemical and Biomolecular Engineering at Illinois gave back to the community and helped to make affordable housing happen for Champaign County residents.

Through the Champaign County Habitat for Humanity, the Chemical Engineering Graduate Student Advisory Council organized two weekends for graduate students to help on the house in February and March.

Joseph Whittenberg, a graduate student at Chemical Engineering in Professor and Department Head Paul Kenis’ lab, said being able to volunteer helps him to have a positive attitude and contribute to the local community.

"Habitat for Humanity offered an excellent opportunity to provide a service to our local community by constructing affordable houses," he said. "As engineers who build contraptions in the lab on a daily basis, this provided an ideal way to use our strengths to benefit Champaign County."

Danielle Mai, a graduate student in Professor Charles Schroeder’s lab, said she helped install baseboards, door trims and interior doors when she volunteered. She says giving back helps to create “an atmosphere of service and generosity toward the community.”

Besides volunteering with Habitat for Humanity, the graduate council has organized a food drive where they collected more than 1,800 pounds of food, conducted a raffle for Toys for Tots to raise more than $350, and participated in science outreach events at Urbana Middle School and the St. Louis Science Center.

Whittenberg says he came to the University because of the research opportunities available to graduate students. He said being able to volunteer has enhanced his time at Illinois. "I’m advancing my educational experience and solidifying connections with fellow graduate students and forming new connections with community members," he said.
Danielle Mai awarded NSF Graduate Research Fellowship

Chemical Engineering graduate student Danielle Mai is a 2013 National Science Foundation (NSF) Graduate Research Fellowship recipient. Mai, who is a member of Assistant Professor Charles Schroeder’s research group, said the fellowship will help to fund research in fundamental polymer engineering, specifically with branched polymers, which are frequently found in packaging and consumer products.

“In Professor Schroeder’s lab, we are developing techniques to better observe and understand branched polymers in flow,” she said. “This research could provide crucial insight toward designing polymers with desirable processing responses and improve the manufacturing of everyday materials.”

Schroeder said he believes Mai has proposed a particularly challenging and interesting research project that focuses on a molecular understanding of branched polymer dynamics.

“She’s holding the potential to fundamentally enhance our understanding of complex fluids engineering, which could lead to improved methods of processing materials at the industrial scale,” he said. “Danielle is an outstanding student with strong leadership potential in the field of chemical engineering.”

Leadership is one of the criteria that NSF looks for when selecting graduate students in NSF-supported science, technology, engineering, and mathematics programs who are pursuing research-based master’s and doctoral degrees.

“This fellowship recognizes Mai’s potential for success as an academic researcher,” Schroeder says. “The NSF is investing in her future, as a leader in the field, and the fellowship will enable her to achieve success in research.”

Mai says being selected to receive the fellowship is an honor and one that will help move her education and career forward. “I want to communicate scientific ideas that will spark innovative research and positively impact the general public,” she said. “I am fascinated by working on the cutting-edge of science.”

She says working with mentors helped her early in her educational career. She says she credits Dr. John Boudie at the Kalamazoo Area Mathematics and Science Center for introducing her to research while in high school and the late Professor John Daida at the University of Michigan who “sparked my passion for mentoring, teaching, and bettering the world through engineering.”

She also noted her current advisor, Professor Schroeder, who she says “has played an instrumental role in my research and in supporting various pursuits of mine, from authoring a review article to presiding over this year’s GSAC board.”

She says her passion for research, teaching, and mentorship are leading her to consider a career in academia but for now, she’s keeping her options open and is ready to begin her NSF Fellowship. “It’s an honor to join the ranks of phenomenal researchers,” she said.

Student receives Fulbright Scholarship

Chemical Engineering student Brian Rosen is embarking on new journey to foster international research collaborations as the recipient of a Postdoctoral Research Fellowship from the J. William Fulbright Scholar Program.

Rosen, who will travel to Israel later this year to do postdoctorate work at Tel Aviv University, will work on a joint project with the U.S. Air Force and the Israeli Air Force to investigate new materials to help prevent corrosion in military jet engines.

Being selected as a Fulbright Scholar is an honor for Rosen. “I have been planning to do my postdoctoral work abroad in Israel for several years,” he said. “My future advisers at Tel Aviv University and I decided to apply for the award because we agreed that the work we were proposing, along with my relationship to the USA and Israel, fell in line with the goals of the Fulbright Scholar program.”

The internationally recognized program helps to increase mutual understanding between the people of the United States and the people of the more than 150 countries that participate in the Fulbright Program.

The Delaware native, who earned his bachelor’s degree in chemical engineering from the University of Delaware and master’s in chemical engineering from the University of Illinois in 2010; graduated this spring from Illinois with his Ph.D. in chemical engineering. He says he chose the University of Illinois because of the quality of its engineering programs.

“Not only was the Department of Chemical Engineering doing exciting and novel research, but the infrastructure, shared research facilities, and libraries have provided me with many resources necessary for me to be a successful Ph.D. student,” he said.

Rosen says being at the department under the guidance of his advisors Professor Richard Masel (who is now retired) and Professor and Department Head Paul Kenis have helped him to be a creative, independent, and productive researcher.

“Without the guidance from my advisors and fellow graduate students, I would feel completely unprepared to tackle this next stage in my career,” he said.
Bringing international education and study abroad programs to students across the globe is one way the Department of Chemical and Biomolecular Engineering is serving a global society.

Faculty member Ed Seebauer, who is the James W. Westwater Professor of Chemical and Biomolecular Engineering and a Provost Fellow for International Academic Programs, is helping to lead the way.

"We are witnessing the emergence of the global comprehensive public research university," Seebauer says. "In education, this emergence is driven partly by student desires for broader sets of experiences that go beyond national borders — both in order to make themselves more employable in a globalized workplace and also to develop an appreciation of the diversity of experiences the world has to offer."

Higher education also is seeing the increased demands for international study driven by companies, who are seeking a hirable workforce with global experience, he notes.

"Multinational corporations enhance their competitiveness through access to potential employees who can readily navigate a globalized technical environment," said Seebauer, who served as department head from 2006 to 2011. "Alumni indirectly enjoy those benefits, and also remain part of an Illinois family whose scope and geographical reach is growing rapidly. For example, this campus enjoys extraordinary name recognition and prestige in the Far East, with alumni chapters already active in several locations."

To increase international education at Illinois, Seebauer was instrumental in helping to form the University of Illinois-National University of Singapore Joint Ph.D. Degree Program. Students in the program receive a degree that is jointly issued by the two universities, and spend half of their time in the states and the remaining time in Singapore.

"The department is a leader in developing international programs," Seebauer said. "We are a trailblazer for campus and among our peers. If we want to keep a serious foot in the...
door and recruit good students to those areas that are the core to chemical engineering, going abroad makes sense to do that. And, we maintain a diversified research portfolio and balance for the department.”

The graduate student experience

Gavin Chua, a student in the joint-degree Ph.D. program with the National University of Singapore, says he decided to enroll because of the research and the opportunity to work with two renowned public research universities across different continents. He is expected to complete his doctorate this year.

“I have worked in two universities with different research cultures, thereby enabling the garnering of different perspectives,” he said.

His interdisciplinary research includes semiconductor engineering, gas catalysis, and materials application. “My research involves the intentional modification of semiconduc-
tor support to tune the catalytic properties of overlying metal catalysts,” he said. “It is through the demonstration of such an effect that we seek to further apply it in gas catalysis and also further in gas sensors.”

Singapore has the third largest petrochemical operation in the world, which means students have access to facilities that are sometimes more difficult to replicate here in the United States, Seebauer said. “They have certain kinds of equipment and support staff who are readily available, and we can access that equipment with almost no barriers,” he said.

Another international program with chemical engineering presence is the A*STAR-University of Illinois Partnership (UIP) Ph.D. program. This four-year program consists of two years of Ph.D. study at Illinois and two years at a research institute of the Agency for Science, Technology and Research (A*STAR) in Singapore, with students receiving a doctorate from Illinois.

Daniel Ong, who is enrolled in the A*STAR University of Illinois Partnership, plans to complete his Ph.D. this year. “I wanted to pursue a Ph.D. and the program struck a good balance among financial remuneration, prestige, and future job security,” he said. “I have been exposed to a broad research experience.”

Ong’s research in photocatalysts includes work to improve solar cells, gas sensors and enhancing advanced oxidative processes for environmental remediation. He says after completing his doctoral work, he wants to branch out into research with environmental remediation or into renewable energy through biomass conversion.

Both programs are blazing a new trail in graduate education and research. “Chemical Engineering at Illinois is at the forefront,” Seebauer said.

Trailblazing undergraduate research program

As a Provost Fellow, Seebauer is working to develop an overseas undergraduate research program for the University. Currently, more than half of the 500 plus undergraduate chemical engineering students at Illinois seek participation in undergraduate research. However, there are not always enough open spots for these students to take part in research with faculty and graduate students.

“The combination of strong demand for STEM (science, technology, engineering, and mathematics) undergraduate experience and study abroad experiences, coupled with insufficient capacity on the Illinois campus to provide research experiences, implies a pressing need for expanded ways for these students to engage in research experiences overseas,” Seebauer wrote in an early description of the program in November 2012.

Seebauer and Professor Paul Diehl, who is the director of the Office of Undergraduate Research, and others across campus are launching a pilot program that will make it possible for undergraduates to conduct research in foreign countries and receive Illinois credit.

“I recognized there are two itches that this campus needs to scratch, especially with regards to STEM undergraduates,” Seebauer said. “One of them is to provide a broader diversity and more kinds of study abroad experiences. The second is that there are more undergraduates who want to do research than there are faculty who can possibly fulfill that demand. My thought was to see if we couldn’t harness those drivers in some way and do it at scale.”

While the program still is in its infancy stages, it will be tested by two students in the College of Liberal Arts and Sciences. These students will partner with research and study abroad opportunities in KTH and Stockholm University in Sweden for a six-week undergraduate research program this summer.

“This is healthy for undergraduate education,” Seebauer said. “Because we are a global comprehensive public research university, offering this opportunity has benefits for global society and allows research for undergrads.”

Right now about 25 percent of all undergraduates at Illinois participate in the study abroad program; Seebauer said the campus wants to increase that number, and he hopes this program will help to do that. His estimate is that up to 250 students might participate in this program, once up and running.

To pay for the overseas undergraduate research experience, tuition and fees would be paid for by the participating students, with the possibility of additional funding from corporate-sponsored experiences and scholarships.

“We have too many undergraduates who want to do research, and there is not enough faculty capacity to accommodate that,” he said. “We want to improve opportunities for experience overseas in ways that expand our capacity to participate for undergraduate research.” Seebauer says as far as he knows there is no equivalent program at peer institutions that are operating at the scale envisioned for Illinois.

In the classroom

Seebauer also returned to the large lecture hall this spring, and is again teaching the first class he ever taught on campus. “This semester I’m teaching thermodynamics again for the first time in nearly two decades,” he said. “Certainly the laws of thermodynamics have not changed, but the class size is larger, and the students are much more accustomed to the use of technology in the large lecture room.”

He also continues to maintain a research group with students, completed a book about charged semiconductor defects while he was department head, and writes occasional articles and book chapters on engineering ethics. He says his research has shifted in focus from “silicon semiconductor processing for microelectronics to metal oxide semiconduc-
tor processing for catalysis. We still examine methods by which atomic-scale defects can be manipulated in beneficial ways, but the applications have changed.”

“One of them is to provide a broader diversity and more kinds of study abroad experiences. The second is that there are more undergraduates who want to do research than there are faculty who can possibly fulfill that demand. My thought was to see if we couldn’t harness those drivers in some way and do it at scale.”
I was in awe when he took personal interest in my time at Illinois. He came to campus to accept an alumni achievement award. Finke says some of her favorite memories at Illinois are snow days. Since she now lives in Houston, Texas where the snow doesn’t fly she remembers the blowing snow with fondness. “I haven’t come close to losing contact with the best friends I made at Illinois,” she says. “There was so much else about the college experience that I cherish over the books.”

When Finke began her career at ExxonMobil, she sought a position where she could apply chemical engineering principles like thermodynamics and process flow. “The collaboration that was engrained at Illinois helps me work with diverse groups on endless troubleshooting initiatives,” she says. “Always being pushed to the fullest in school and extracurricular activities taught me to prioritize, which now helps me identify and accomplish the efforts most important in one of the world’s largest organizations.”

And, she says returning to campus to recruit Illinois students is an exciting opportunity. “It allows me to let students know about ExxonMobil, help hone interview skills, and place students in positions that I know will fulfill their Illinois degree,” she said. “It’s also a way to stay in touch with the Chemical Engineering department and the changes constantly occurring at the University. Of course, we also think Illinois students make fantastic candidates.”

Finke’s giving doesn’t stop with her recruiting role. As an ExxonMobil employee, she takes part in the company’s employee matching gift program. For every $1 that an employee donates, ExxonMobil donates $3. For Finke, this makes donating back to the department much easier and more rewarding knowing that her funds compound.

“Without the matching program, I would not be able to have the impact I envisioned at the University, but now I feel like I’m having a noticeable impact year after year,” she said.

As a young alumna she is excited to give back to the department.

“Starting early is crucial since it is just another method to stay connected to the University, and directly apply even small amounts of money to the programs that got you where you are,” Finke said. “With yearly donations, I know that I made at Illinois,“ she says. “Was there so much else about the college experience that I cherish over the books.”

Being a member of student organizations helped Finke gain skills outside of the classroom. “These organizations taught me about the world of business, networking, teamwork, and diversity,” she said. “Each of these skills is equally crucial in a global organization and helped teach me invaluable skills that you can learn in a classroom.”

Finke says she’s interested in the Illinois alumnus donor and says once married gifts to the University will be from the couple.

The Department of Chemical and Biomolecular Engineering thanks our donors for their continued and generous support. The list of donors includes individuals whose gifts to the department were dated between July 1, 2011 and April 15, 2013.

We check the list carefully, but if we have overlooked you or if you wish to be removed from the list and not have your name published, please contact us at (217) 244-9214 or chemeng@illinois.edu so that we can correct our records.

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**Deceased**
Ralph J. Andermann Jr., of Oak Ridge, Tennessee, passed away in January 2013. He was born on April 28, 1944 in New Jersey. Andermann grew up in LaGrange, Illinois. He graduated from Illinois State University with a B.S. in chemical engineering and earned a M.S. in chemical engineering from Purdue University. He served in the U.S. Army and did postgraduate work at the University of Massachusetts. He worked at the Oak Ridge National Laboratory in Oak Ridge, Tennessee until he retired several years ago.

Robert J. Baechle, 89, of Savannah, Georgia, passed away on March 3, 2013. Baechle was born on December 24, 1923, in Belleville, Illinois. He was a veteran of World War II, an active duty from 1944 to 1945, serving in the U.S. Army as a bombardier in a B-26 bomber. He received a degree in chemical engineering from the University of Illinois in 1949, he worked at Standard Oil (Amoco) from 1951 until his retirement in 1989, in positions ranging from chemical engineer to refinery general manager. He enjoyed fishing, boating, bridge, and world travel. He was a lifelong fan of the University of Illinois Fighting Illini and the St. Louis Cardinals. Baechle is survived by his wife of 64 years, Nona (Kunz) Baechle.

Richard E. Cocks, 95, a retired chemical engineer, passed on December 21, 2012, in Elkhart, Michigan. He was born August 1, 1917, in Coldwater, Michigan. He married Anna Pearl Rhodes June 28, 1943. Cocks retired from Bayer (Miles) in 1982. He started as a chemical engineer in the engineering department of Miles and was promoted through management positions and retired as manager of corporate real estate and facilities planning. He earned a Life Certificate for teaching and a Bachelor of Arts degree from what is now Western Michigan University. He went on to the University of Illinois where he received his Bachelor of Science in chemical engineering.

Dr. Charles Cupit, 82, passed away March 25, 2013. Born in New Orleans, Louisiana, Cupit was one of 13 graduates at Union Church High School in Mississippi. He worked his way through school at Mississippi State University earning his master’s degree in chemical engineering and continued on to the University of Illinois to complete his doctorate. Cupit worked in Houston, Texas for 12 years and then moved to Wichita, Kansas to take a job with Vulcan Chemicals. Cupit worked in Houston, Texas for 12 years and then moved his master’s degree in chemical engineering from Cornell University and the University of Illinois, with honors. He served in the U.S. Army for two years as a paratrooper. He began his 39 year career with 3M in 1953, and rose to the position of division vice president. Huddleston wrestled and ran track in high school, and had a lifelong love of skiing, tennis, and golf. As accomplished as he was in work and sports, Huddleston always kept family and friends at the center of his life. Huddleston is survived by his wife, Mary Ann Huddleston.

Jack Gordon Huddleston, 83, passed away January 19, 2013. Huddleston was born July 31, 1929 in Nevada, Iowa. He graduated second in his class from Culver Military Academy, and earned his B.S. in chemical engineering from Cornell University and the University of Illinois, with honors. He served in the U.S. Army for two years as a paratrooper. He began his 39 year career with 3M in 1953, and rose to the position of division vice president. Huddleston wrestled and ran track in high school, and had a lifelong love of skiing, tennis, and golf. As accomplished as he was in work and sports, Huddleston always kept family and friends at the center of his life. Huddleston is survived by his wife, Mary Ann Huddleston.

Raymond Allen Kaligian III, 28, of Houston, Texas and formerly from Raynham, Massachusetts and Geneva, Illinois died unexpectedly on February 17, 2013. His dog, Willie, died at the same time by his side. Kaligian went to the University of Illinois and graduated in 2007 with a degree in chemical engineering. He was a member of the Tau Kappa Epsilon (TKE) fraternity and the professional chemical fraternity, Alpha Chi Sigma. He was hired in January 2008 by the Phillips 66 Company. He was promoted during the summer of 2012 to become director of base oil sales located in Houston, Texas. Kaligian’s creative talents and his determination to always be the best at whatever he tried to do led him to master the guitar. He loved classic rock and his guitar interpretations were special. He also enjoyed mountain biking and white water river rafting with his close college buddies. He was the only child of Ray and Bobbie (Barron) Kaligian.

Dunn Mizell, of Crystal Lake, Illinois, passed away April 14, 2013. He was born February 25, 1946, at Mildenhall Air Force Base in Suffolk, England, and lived most of his life in Crystal Lake. He graduated from the University of Illinois with a Bachelor of Science in chemical engineering and became an A-320 captain with United Airlines. He was the catcher on the 1976 Little League team (coached by his father) that won the city championship with an undefeated season. He loved spending time in Mexico with his wife and family.

William Leipold was born in Streator, Illinois, grew up in Ottawa, Illinois, raised his family in northern New Jersey, spent the last 40 years of his life in the Denver area, and quietly passed away at home at age 92. Leipold proceeded in death by his wife of 67 years. In 1942, after earning a degree in chemical engineering at the University of Illinois, he served in World War II. Upon his return to civilian life, he jumped into corporate life with a focus on cutting-edge plastics technology. As an entrepreneur, he pioneered in the development of technology to manufacture plastic bags and he invented the first ribbed-plastic floor runner material used in new and model homes. He was best known as one of the four founders and technical genius of what is now called Bubble Wrap. He retired in 1969 at the age of 49 after selling Rantan Plastics and its division, Patti Plastics, the company he named for his wife, Patricia.

Robert R. Pitt Sr., 89, of Lawrenceville, Georgia, passed away December 4, 2012. Pitt is preceded in death by his wife of 47 years, Ruth Weigert Pitt. Pitt was an Army veteran serving as one of two personal private Army secretaries to General Dwight D. Eisenhower in World War II. He attended the University of Illinois and studied chemical engineering and became a textile chemist. Pitt was a New York actor. After a career as senior vice president of Granville McComb & Co. and senior vice president for Ruget Textiles, he retired at the age of 64.

Dr. Edmond S. Perry, 100, passed away on December 14, 2012. He was born in 1912 in New York City and grew up in Chicago, Illinois, a first generation U.S. citizen. He was a graduate of the University of Illinois with a degree in chemical engineering. He then earned his Ph.D. in physical chemistry from the University of Wisconsin. In 1939, he married June E. Warner, whom he met while attending the University of Wisconsin. They then moved to Rochester, New York where he worked for Eastman Kodak Company. Perry received many promotions and honors while working at Eastman Kodak and was promoted to assistant to the head of the research department, where he worked until his retirement.

Floyd Ramp, B.S. ’45, was born on March 6, 1923 in Newman, Illinois and passed away on December 10, 2012. He attended the University of Illinois and, in his junior year, he enlisted in the Navy. He was sent back to the University of Illinois to complete his degree in chemical engineering, graduating Phi Beta Kappa in 1945. Commissioned as an ensign, he served in the Pacific. There he witnessed testing of the atomic bomb. In Japan he saw the devastation that resulted from World War II and became committed to efforts to promote peace in the world. In 1950, he received a Ph.D. in organic chemistry from the University of Minnesota, followed in 1951 by postdoctorate work at Massachusetts Institute of Technology. He was a research chemist with B.F. Goodrich from 1952 to 1955. Ramp holds more than 12 patents including the original patent for CPCV commonly used today for hot water plumbing pipes.
Alumnus named scholar in computational science

Chemical and Biomolecular Engineering alumnus Ashlee Ford Versypt, M.S. ’09, Ph.D. ’12, has been named the 2013 Frederick A. Howes Scholar in Computational Science.

The award honors recent doctoral graduates of the Department of Energy Computational Science Graduate Fellowship program for outstanding technical achievements. It also recognizes exceptional leadership, integrity, and character.

Ford Versypt is a postdoctoral research associate in the MIT chemical engineering department. Her work centers on the modeling, simulation, and design of controlled-release medications, specifically models to predict the behavior of biodegradable polymers used to encapsulate drugs. Scientists using Ford Versypt’s models could more quickly and inexpensively find the chemical combinations to release just the right amounts of medication at the right times.

Ford Versypt’s dedication to science and engineering extends beyond her research. At Illinois, she organized a symposium on modeling and control in biomedical engineering and tutored and supervised undergraduate students doing research. At MIT, she’s continued her outreach by planning a faculty workshop for female graduate students and postdocs.

Class Notes

Rondo Estaban Turner, B.S. ’88, works as an operations engineer for the Jazan Refinery and Terminal Project, located in the New Jazan Economic City in Saudi Arabia. The project is currently in the design phase with start-up planned for 2017.

Charles Hoover, B.S. ’08, is working for Sigma-Aldrich at the company’s Urbana, Illinois site. He was married on June 16, 2012 to his wife, Sarah. She is a Library and Information Sciences graduate student at the University of Illinois.

Steve E. Golombieski, B.S. ’10, lives in Houston, Texas and works for ExxonMobil as the turnaround coordinator/manager of King’s Ranch Gas Plant in southern Texas.

Submit your class note. Use the attached card in this newsletter or fill out our online form at go.illinois.edu/chbe_alumni_form

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