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**FLEMING GIFT
SUPPORTS CBE
GRADUATE
FELLOWSHIPS**

MESSAGE FROM: LYNDEN A. ARCHER

DEAR ALUMNI AND FRIENDS,

I've written to you previously about the high levels of student interest in chemical engineering at Cornell. I've also written about the commensurate rise in enrollments in all of the school's programs. These trends continued in 2015 with 81 students graduating with B.S. degrees in chemical engineering this May and 96 (53 percent women) of the College of Engineering's strongest juniors choosing to affiliate with the chemical engineering major in spring 2015. Research expenditures increased by 11.4 percent year-over-year, close to the five-year average increase of 12.3 percent. Total Ph.D. student enrollments reached a new high of 119, meaning that with an average time to complete the Ph.D. degree of 5.4 years, each of the school's 20.5 faculty members is recruiting approximately one new Ph.D. student per year; an important milestone that highlights the emergence of the department as a leading national center for chemical and biomolecular engineering (CBE) research. Enrollments in the school's professional master's degree programs remained steady at 78. While it is gratifying to conclude from this snapshot that the school is vibrant and strong, the responsibility of maintaining the high standards that define a Cornell chemical engineering education continues to reveal important opportunities for redefining the school's staffing and space utilization plans for Olin Hall.

The cover story for this issue of the Olin Hall News focuses on an important new development in the graduate program. A generous gift by Sam Fleming '62 and Nancy Fleming will provide support for up to four CBE doctoral students each year. These Fleming Scholars are among the very best students in the graduate program pursuing research on biomolecular engineering themes. On page 3 we report a related story that highlights the success of our students in winning highly competitive graduate fellowships from the National Science Foundation. Along with the Fleming Scholar awards, these new fellowships are transforming the climate for graduate studies in the department. We are likewise grateful to Gordon Dibble '50 for creating the Gordon L. Dibble '50 Endowed Professorship in CBE to recognize excellence among the faculty. And, to Michael Zak '75 (ORIE) for establishing the Roxanne E. and Michael J. Zak Endowed Professorship in Energy Systems Engineering in CBE. This year we recruited Professor Fengqi You from Northwestern University as the inaugural holder of the Zak Professorship. Professor You's research lies at the important interface between chemical engineering and operations research; his presence on the CBE faculty will add an important new dimension to our education and research programs in an area of high demand among the companies that hire CBE students.

I convey my personal gratitude to the school's exceptional network of alumni and friends who continue to inspire our students and faculty with your loyalty



and generosity in supporting the school with both your time and resources. Thanks to you, the school's largest class of seniors will this fall move into a newly renovated and expanded Unit Operations (UO) Laboratory that preserves the high standards and important role of the UO Lab in the chemical engineering undergraduate experience at Cornell. I will single out Peter Wright '75 and the class of 1975, John Herslow '63, Jack Huddleston '51, Billie Nelson '49, Richard Sommer '63 and Ken Wattman '49 for their generous gifts that made the UO Laboratory Modernization Project a reality.

In closing, I draw your attention to the recent passing of our teacher, colleague, mentor and former Director

Julian C. Smith '41 at the age of 96. Julian will always hold a special place in the field for the large number of students around the world he introduced to Chemical Engineering Unit Operations via his similarly named textbook, co-authored with Peter Harriott '49. He will be remembered among the faculty for his skillful leadership of the department from 1975-83, during a period of transition from a primarily undergraduate education

focus to the research powerhouse we have become today. Thanks to the persons Julian recruited in the early days of the transition, the culture of bringing faculty research stars who are also excellent, committed teachers to Olin Hall continues to this day.

I hope you enjoy the stories we have assembled and feel informed after reading this issue of the *Olin Hall News*. If your travels bring you to the Ithaca area, please make plans to visit Olin Hall.

Sincerely,

Lynden A. Archer
William C. Hooley Director and James
A. Friend Family Distinguished
Professor of Engineering

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HONORING CLAUDE COHEN'S SCIENTIFIC ACHIEVEMENTS



Claude Cohen

Claude Cohen, the Fred H. Rhodes Professor of Engineering at Cornell University, retired this year after 38 years of outstanding research, teaching and service in the School of Chemical and Biomolecular Engineering.

Cohen earned a B.S. degree in chemistry from the American University in Cairo, Egypt, in 1966 and a Ph.D. in chemistry from Princeton in 1972. Before joining Cornell, he was a Postdoctoral Fellow at Brown University (1972-73), a Katzir-Katchalsky Fellow at the Weizmann Institute of Science (1973-75) and a Research Associate at the California Institute of Technology (1975-77). Cohen joined Cornell in 1977 as the third of seven members of the faculty hired by Julian Smith, who would go on to transform the research culture in the school. Cohen was promoted to the rank of Associate Professor in 1981 and Professor in 1987. His administrative and professional activities include service as director of the School of Chemical Engineering (1990-93), organizer of multiple technical symposiums and sessions at national meetings, consultant to various chemical companies and a member of the board of directors of C-MOLD — a successful

company devoted to plastics injection molding.

The overarching goal of Cohen's research has been to understand structure-property relationships in homopolymer networks and particle suspensions. A major part of his efforts over the last two decades concerned elucidating the effect of polymer network structure and chemistry on microstructural, swelling and dynamic properties of cross-linked polymeric materials. Cohen devised several clever schemes for synthesizing model, end-linked polydimethylsiloxane networks with well defined, controlled architectures, including systems with either uniform chain size or mixtures of precursor chain sizes. Careful measurements of the elastic, scattering and orientation relaxation characteristics of these tailored materials have provided critical insights into the role of network architecture and chemical structure on physical properties. These studies have also guided collaborations and catalyzed efforts by research groups worldwide to improve theoretical and simulation models of polymer network behavior.

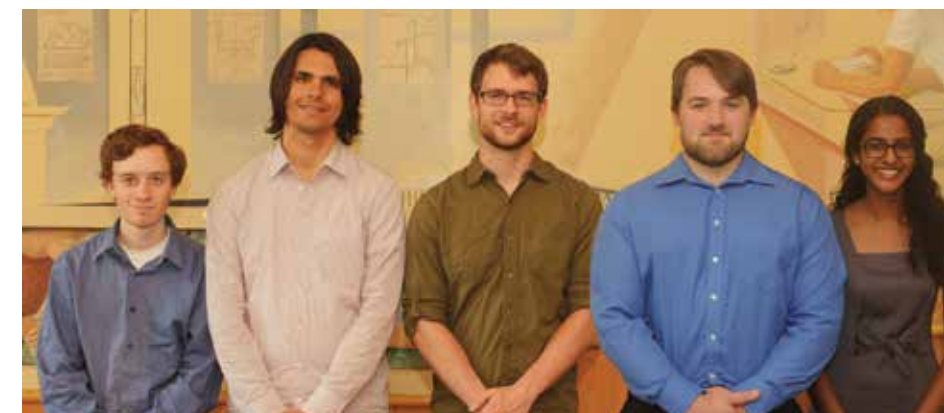
As important as Cohen's contribution to our understanding of cross-linked polymers are the advances his work has enabled in the areas of amphiphilic and ionomeric polymer networks. In a series of contributions, Cohen and his students showed that networks can be engineered with nanoscale structural features by cross-linking droplets in an oil-in-water suspension. The particles function as "nano-sponges," imparting remarkable ability for the materials to absorb hydrophobic pollutants. In soil

remediation studies, these nano-particles outperformed molecular surfactants in terms of low adsorption onto soil and greater extraction capacity.

During his 38-year career at Cornell, Cohen supervised 19 Ph.D. students, about a half-dozen postdocs and has authored 116 technical publications in refereed journals and eight publications in books and book chapters. His contributions as a mentor and teacher have been recognized by several awards, including the Merrill Presidential Scholar Mentor and the Mr. and Mrs. Richard F. Tucker Award for Excellence in Teaching. For the last fifteen years, Cohen taught and perfected a very successful Polymer Science elective course for advanced undergraduates and first-year graduate students. This course is one of CBE's most popular electives campus-wide, and has provided an excellent introduction to polymer physics, chemistry and applications to generations of Cornell graduates.

A symposium honoring Cohen was held in the Robbins Auditorium, Olin Hall, on May 21, 2015. Talks were presented by Cohen's CBE colleagues, including Don Koch, Fernando Escobedo and Lynden Archer, as well as by several leaders in the field: Ralph Colby (Penn. State), Horst Henning Winter (UMass, Amherst), Lashanda Korley (Case Western Reserve), Christopher Macosko (Univ. of Minnesota), Athanassios Panagiotopoulos (Princeton Univ.) and Michael Rubinstein (Univ. of North Carolina, Chapel Hill). The day concluded with a dinner at The Heights Café in Ithaca; one of Claude and his wife Nora's favorite restaurants.

CORNELL CHEMICAL ENGINEERING STUDENTS SHINE BRIGHTLY AMONG RECIPIENTS OF NSF GRADUATE FELLOWSHIP AWARDS



From left to right: Kevin Weyant, Cameron Glasscock, Joseph Brown, Nick Horvath, and Lakshmi Nathan

This year, students in the School of Chemical and Biomolecular Engineering (CBE) were recognized with the largest single-year number of National Science Foundation (NSF) Graduate Fellowships in the department's history, and one of the largest cohorts of NSF Graduate Fellowship winners among its peer departments nationally. "Success of CBE graduate students in winning external fellowships is not only a strategic priority for the School, but confirms what we've known for sometime, that the chemical engineering program at Cornell is attracting some of the top graduate student talent in the nation," said Lynden Archer, the William C. Hooey Director and James A. Friend Family Distinguished Professor of Engineering.

The NSF Graduate Fellowships recognize and support outstanding graduate students in science and engineering, and is one of the most highly sought after early-stage awards for graduate students pursuing doctoral studies in the sciences and engineering.

This year six graduate students and two undergraduates from CBE were recognized with these prestigious fellowships. NSF fellows have gone on to become recognized leaders in their field, with past winners including Nobel Prize-winning Secretary of Energy, Steven Chu, and Google co-founder, Sergey Brin. Winners must not only demonstrate exceptional levels of achievement in academics, but must show that their proposed doctoral work has potential for broad-based technological and societal impact beyond their immediate field of study. Below are brief vignettes that capture the strength of CBE's cohort of NSF fellowship winners.

Timothy Abbott (Lucks Group) plans to pursue research in synthetic biology and biomolecular engineering in graduate school.

Abbott recently completed his undergraduate degree at Cornell and will pursue a Ph.D. in Stanford University's Bioengineering Department this fall. In his time at Cornell, Abbott performed research in Julius Lucks' group, where he helped develop a next-generation sequencing

technique to measure RNA structure-function relationships inside *E. coli* cells. He presented this work at the 2014 American Institute of Chemical Engineers (AIChE) Annual Meeting and received the Cornell Engineering Alumni Association Undergraduate Research Award and the Ferdinand Rodriguez Outstanding Student Award. During his time at Cornell, Abbott also served as an intern for Genentech, where he showed that performance of engineered strains of *E. coli* cultures is robust across many factors. Outside of research, Abbott participated in Cornell's iGEM (international genetically engineered machines) team, a competition in which students use synthetic biology to solve real-world problems, and ChemE Car, a competition where students use chemical reactions to power and stop a car after a precise distance.

Abbott came to Cornell intent on pursuing his high-school interests in



Timothy Abbott

chemistry and physics, but his curiosity about biology and biomolecular engineering ultimately won out. After contemplating which major to choose, he decided that chemical engineering would be most conducive to a strong career,

yet he still wanted a powerful biology component in his education. Weighing these options, Cornell stood out, as the university had strong programs in both chemical and biological engineering. Additionally, the campus and scenery was reminiscent of home.

There was never a dull moment working with Kyle Watters (2015 Fleming Scholar in CBE and a 2012 NSF Graduate Fellowship winner), in Julius Lucks' lab, according to Abbott. This collaboration led to a myriad of fond memories and above all else, shaped Abbott's interest in research. He says he will never forget the ceremony for the Undergraduate Research Award or the 2014 AIChE Annual Meeting, but his fondest memory is the support, mentorship and camaraderie of all the lab members who have made the sting of failed experiments not so bad, and the experience as enjoyable as it has been.

Joseph Brown (Alabi Group) uses engineering sequence-controlled polymers to analyze the surface composition of synthetic and biologically derived nanoparticles.

I am originally from Pilot Mountain, North Carolina, and have lived in N.C. all my life before making the jump to Cornell. As a second-year graduate student in the Alabi Research Group, I am working on surface characterization of nanoparticles by measuring the adsorption of sequence-defined polymers. My current goals are to develop connections between nanoparticle surface properties and biological function.

I attended the North Carolina School of Science and Mathematics in Durham, N.C., where I broke out of my small-town shell, matured and experienced the diversity of science and engineering. Some of my favorite memories are competing in the FIRST Robotics competition, playing in symphony and orchestra, as well as

exploring the city with my friends. Of these experiences, my interest in organic and polymer chemistries and desire to help people led me toward chemical engineering.

At North Carolina State University, I earned my B.S. in Chemical Engineering, splitting my time between work, research, academics and acapella. Some of my favorite memories are singing with Acappology at acapella competitions and various venues. My research experiences shaped my interests and motivated me to pursue graduate school. I worked at Liquidia Technologies, Inc. improving roll-to-roll therapeutic nanoparticle production by creating in-line characterization of thin-films. I completed a Research Experience for Undergraduates at Columbia University improving the fabrication of nanoscale arrays for studying mechanical T-cell stimulation. And most importantly, in Professor Orlin Velev's lab, I worked on the development of antimicrobial environmentally benign nanoparticles. This work led to the formation of Benanova, Inc. where I served as a founding research member, and has also been accepted for publication in Nature Nanotechnology.

Overall, my research interest surrounds the complex interactions of therapeutic nanoparticles with biological phenomena—proteins, biological transport, et cetera—I consider myself lucky to have had such a myriad of experiences and opportunities, which has led me to give my time volunteering as much as possible. Currently, I am leading the organization for the Alabi Group's second year of hosting a 4-H Career Explorations camp for high-school students. I have and will continue to volunteer with the Expand Your Horizons Conference, the CBE Women Event and the

College Discovery Program with the Ithaca Youth Bureau.



Taha Ezzyat

Taha Ezzyat (Clancy Group) uses computational methods to study the mechanism of lead selenide nanoparticle formation.

As a New Jersey native I attended Noor-Ul-Iman High School in South Brunswick, New Jersey, which fostered a love and excitement for the physical sciences. After high school, I made the move to Chicago to obtain my B.S. in Mathematics and B.A. in Chemistry from the University of Chicago. There I gained my first research experience in the lab of Dr. Gopal Thinakaran studying the molecular and cellular mechanism of Alzheimer's disease. I was also able to take part in an Research Experiences for Undergraduates (REU) program with the Universidad de Santiago de Chile in Santiago, Chile, where I used kinetic studies to examine the antioxidant properties of synthetic vitamin E analogs.

Later in my junior year, I joined Professor Dmitri Talapin's lab to study the application of semiconductor nanoparticles in solar devices. This experience helped me identify the area of research that I most enjoyed, bridging chemistry and engineering. This led me to pursue a doctorate in chemical engineering. From the research I performed I was also able to

obtain my first publication in *Nano Letters*.

Cameron Glasscock (Lucks/DeLisa Groups) is using advanced RNA gene regulation strategies to optimize production of glycoprotein therapeutics in bacteria.

Glasscock began his career at Oregon State University where he studied biological engineering. There, he became excited about research and joined a lab to understand the important parameters in long-term storage of biological materials by cryopreservation. The summer after his junior year, Cameron also went to perform research at Northwestern University, studying the potential of graphene oxide as a material for delivering MRI contrast agents into living cells.

After graduating from Oregon State in 2013, Cameron began working on his doctorate in CBE under the joint guidance of Professors Matthew DeLisa and Julius Lucks. His research focuses on using RNA molecules to dynamically control the biosynthesis of complex carbohydrates in bacterial cells. In addition to research, Cameron spends his free time enjoying the outdoors by running, snowboarding/skiing and cycling.

Nicholas Horvath (Varner Group) will develop a dynamic genome scale model of cell-free metabolism in *E. coli*, in combination with a "cell-free factory on a chip" to produce and recover glycoproteins. This innovation will open up many applications, for example, in situ personalized production of critical glycoproteins such as coagulation factors.

I am from Morgantown, West Virginia. I spent my undergraduate career at West Virginia University where I graduated with degrees in chemical engineering and physics. I chose Cornell for its emphasis on biological research, specifically the computational efforts

of Professor Jeffrey Varner, who is now my advisor. I also had the privilege to serve as a teaching assistant for CHEME 2880, working alongside Varner and two talented undergraduate TAs.

I am honored to be awarded the NSF Graduate Fellowship, and I look forward to applying all that it offers to my research in cell-free protein synthesis.

Lakshmi Nathan (Daniel Group) is using single particle tracking to study viral entry of coronaviruses to understand how these viruses mutate and gain entry into human hosts.

From a young age, I watched my family overseas experience life without the many conveniences I took for granted in the U.S. The realization that not everyone had access to the quality of life I enjoyed became my motivation for studying engineering, so I could use my skills to develop a better world for people to live in.

I received my B.S. in chemical engineering from Texas A&M University. I worked with Dr. Arul Jayaraman to investigate the anti-inflammatory properties of tryptophan-derived bacterial metabolites. Through an NSF Research Experience for Undergraduates (REU) program, I worked with Dr. Cynthia Collins on developing a synthetic communication pathway between *E. coli* and *B. megaterium*. I completed two internships with NASA, and I was selected as a NASA Student Ambassador. One of my favorite memories is working a shift in mission control inspecting images of the space shuttle's wings for damage during the last shuttle mission.

With Texas A&M's Engineers Without Borders (EWB) chapter, I spent a week in San Juan de Penas Blancas, Costa Rica, testing water for bacteria, studying the water system, and learning about local

water-shortage problems. After I returned from my trip to Costa Rica, I began leading a team focused on educating children in the community about resource conservation and introducing them to engineering. I established and held several leadership positions and eventually became the president of our chapter. I also worked with the South Houston Professional Chapter and Engineers without Borders-Qatar. I gained further international engineering experience by spending a summer at Tianjin University in China and a semester at Texas A&M University at Qatar. While studying in Qatar, I worked as a peer writing tutor.

My research focuses on how proteases in the extracellular environment influence viral tropism. Transmissible gastroenteritis of swine and porcine respiratory coronavirus are closely-related coronaviruses with different tropisms. Both viruses can utilize a common receptor, and I suspect differences in the proteases present in the gastrointestinal tract and the respiratory tract may be responsible for the different host tissue specificities of these viruses. I will investigate the effects of protease activation of fusion proteins on the viral fusion kinetics of these coronaviruses. I will then use this information to design targeted virus-like particles that deliver material to cells when stimulated by specific proteases.

Outside of research, I am involved in the CBE Graduate Women's Group. I helped run a lab that introduced 10th grade girls to concepts in polymer science and I am currently involved in planning an engineering workshop for local Girl Scouts.

Kevin Weyant (DeLisa Group) is working on engineering bacterial outer membrane vesicles to function as delivery

vehicles for DNA vaccines.

Weyant dedicated much of his time to research and volunteering for Engineers Without Borders (EWB) while he was an undergraduate at the University of Illinois. As a researcher, he spent three and a half years characterizing and developing flavin-based fluorescent proteins for biological imaging. Although graduate school did not seem to be a feasible option at first, his confidence and interest in continuing research increased over time with the help of his graduate mentor, and, by the time he graduated, he was an author on three published papers. However, his experience with EWB has had the most profound impact on his motivations to do meaningful work and lead others. As an EWB volunteer, he struggled to sustain a water distribution system in a rural community of 3,000 people in southeastern Nigeria. He traveled to the community twice and helped lead the team at Illinois for two and a half years. Over those years, Kevin developed valuable leadership skills, the ability to think critically about complex problems with no clear answer as well as a passion for helping others. At Cornell, Weyant hopes to apply his unique perspectives to his research, support collaborations with the developing world, and continue to volunteer for EWB and similar organizations.

Bill Wheatle (Abruña Group) specializes broadly in the field of electrochemistry and is primarily concerned with developing and characterizing materials for use in energy storage and conversion technologies, such as batteries, fuel cells and supercapacitors.

I hail from Gladstone, Virginia, a very little town near Appomattox, which is where the Civil War officially ended if you remember your American history.



Bill Wheatle

Although I currently live in Gladstone, I consider myself a native of Maryland, where I spent the majority of my formative years. I was raised in a single-parent home and am also a first-generation American. Thus, like the children of other working class parents, I witnessed the struggles and sacrifices my mother made to support our family and was continually encouraged by her to pursue a higher education in a well-paying field. Because of my love for science and mathematics that I developed through my middle and high school years, I chose to pursue engineering once I matriculated at a university.

When applying to colleges, I had no idea what school would be the best for me. Obviously, I wanted to attend a school with a strong engineering program. However, I wanted to gain as much perspective as possible by interacting with students from all walks of life and with a wide variety of intellectual interests. Thus, I was also looking to go to a school that was not solely focused on engineering but had a good mixture of humanities and the liberal arts. I knew that I wanted to apply to Cornell because it met my criteria but I was not sure whether I would attend if I was accepted. That changed, however, upon attending the Diversity Hosting Weekend sponsored by Diversity Programs in Engineering. I saw the campus firsthand and met a lot of very

interesting people with whom I could see myself spending much of my time. When I got home from the weekend, I switched my application from regular to early decision and never looked back.

Upon arriving at Cornell, I knew that I had a strong, yet vaguely defined, desire to save the environment, but I had no clear idea how to accomplish this admittedly lofty goal. I actually arrived at Cornell initially intending to study environmental engineering. However, upon attending an interesting seminar on the energy landscape of the United States during my freshman year, I immediately knew that I wanted to dedicate my life's work to energy science and engineering. Environmental engineering would have most likely constrained me narrowly to studying biofuels. However, I chose to study chemical engineering as I believed, both then and now, that it would best broadly prepare me to innovate in energy engineering and pursue my environmental objectives.

I began research in the Abruña Group of the chemistry department at the beginning of my junior year. There I gained a great deal of computational and experimental knowledge and was able to develop strong relationships with the group's graduate students and Professor Abruña. It was an exciting experience to be on the cutting edge of energy research and to contribute my own findings to the field. I look forward to attending University of Texas—Austin next year to continue my journey that first began in this group as a scientist.

FLEMING GIFT SUPPORTS CBE GRADUATE FELLOWSHIPS



Sam and Nancy Fleming

In March, Trustee Emeritus Sam Fleming '62 and his wife, Nancy Fleming, made a generous \$5 million gift to create new graduate fellowships in CBE. The Fleming Scholar award recognizes the very best graduate students in CBE working on biomolecular engineering research themes. By providing early recognition to students with exceptional talent, the long-term goal of the Fleming Scholars program is to attract, educate and graduate Cornell Ph.D.s capable of leading their fields and pioneering new areas of study that advance biomolecular engineering science.

"Sam [recently] visited our department and met with faculty and graduate students working in

biomolecular engineering," said Lynden Archer, the William C. Hooey Director of the School. "By showing that he can trace with a bright line his phenomenal successes in the private sector right back to the principles he studied, and habits he developed, decades ago as a student of chemical engineering at Cornell, Sam provides a reminder to all of us that we are truly educating engineers for careerlong success and lifelong impacts."

Fleming fellowships will be awarded to four graduate students annually. Nominations for the award typically come from a student's thesis advisor or from someone knowledgeable about the nominee's scholarship and potential. Although the award will be

bestowed yearly, students receiving the recognition in any given year will hold the distinguished title Fleming Scholar in CBE for the duration of their Ph.D. The group of four inaugural awardees provide brief narratives below.



Morgan Baltz

I received my B.S. in Chemical and Biomolecular Engineering at The University of Tennessee, Knoxville. In the beginning, I originally intended to follow a more traditional chemical engineering career. I completed two co-op rotations with ExxonMobil, the first in Baytown, Texas, producing polypropylene and the second in Fairfax, Va., facilitating the marine transportation of crude oil.

My research career truly began with my internship at Oak Ridge National Laboratory where I worked in a mass spectrometry group. This experience sparked my interest in the biosciences, and led me to explore the non-traditional biomolecular side of chemical engineering. I became a founding member of UT-Knoxville's International Genetically Engineered Machineteam, which

competed against other universities with our self-designed project to standardize the use of internal ribosomal entry sites in yeast.

I was also an undergraduate research assistant with Dr. Eric Boder, studying the structural properties of hemagglutinin, a membrane fusion protein critical to the influenza virus infection mechanism. In the years I spent researching under Dr. Boder, I learned skills related to mammalian cell culture and flow cytometry. More importantly, I received great mentorship and discovered that I enjoyed the life of a researcher. Ultimately, it was this experience that inspired me to pursue my doctorate at Cornell.

I am a third-year doctoral candidate, studying targeted protein degradation under Dr. Matthew DeLisa. Protein silencing has emerged as a popular reverse genetic method for investigating the effect of a protein on the cellular phenotype. Traditional techniques like gene silencing and RNA interference, which operate on the DNA and RNA levels respectively, cannot discriminate between different protein isoforms. My group has successfully addressed this limitation by creating protein chimeras, called “ubiquibodies.” These ubiquibodies employ a binding domain to recognize the target protein and a catalytic domain, which adds a “tag” to the target. This tag then signals the cell to degrade the target using its natural machinery to degrade the target.

In addition to my research, I have participated in several outreach events through the CBE Graduate Women’s Group and the CBE Graduate Student Association, including leading the parent-student lab for the CBE Women’s Outreach Event, and the “Lip Balm and Perfume” workshop for Expanding Your Horizons.



Mengrou Shan

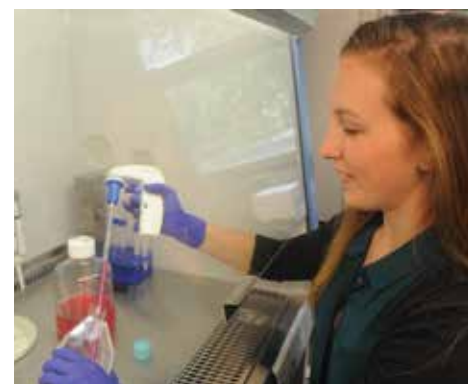
I developed a passion for science and engineering at a very young age, inspired by my father, who is also an engineer. After graduating high school, I came to the United States to study chemical engineering at Purdue University.

Alongside my coursework, I studied the spatial arrangement of nanoparticles through conjugation with nucleosomes under the guidance of Dr. Chongli Yuan. I was exposed to various measurement techniques such as UV spectrometry and obtained molecular biology training in this project. I also completed the ChemE Honor Program with an undergraduate research thesis by working with Dr. Osman Basaran investigating the drop formation of complex fluids.

As a Ph.D. student in the Stroock Group, I am studying the impact of cell metabolic behaviors on tumor survival and growth with a focus on the coupling of population dynamics, transport processes and the kinetics of metabolism. My effort involves the development of numerical, theoretical and experimental tools. These approaches, which are strongly grounded on the fundamental principles of chemical and biomolecular engineering, account for the complex ecology within tumors—many cells with multiple phenotypes interacting within an extended domain

with gradients of nutrients—while allowing for the interrogation of cellular and molecular details. I bring to this project a strong background in bioprocess engineering and expertise in molecular biology, live-imaging techniques, and the construction and characterization of complex 3-D cell culture.

Outside of research, I enjoy outdoor activities, swimming, cooking, traveling and volunteering for outreach programs.



Dana Thornlow

I first discovered the outcome of dedication to pursuing a passion through dance. From a young age, I devoted countless hours to practice and performances, and was eventually able to share my passion with young dancers as a teacher. Throughout college and into my Ph.D. work, I’ve been able to apply the same skills by pursuing research and sharing my love of scientific discoveries through mentorship.

I received my B.S. in chemical engineering from the University of Massachusetts, Amherst and conducted independent research under Dr. Neil Forbes. Dr. Forbes’ laboratory focuses on the use of bacteria as drug delivery vectors for cancer. My research focused on isolating a highly motile population of *S. typhimurium* for enhanced penetration

in tumor tissue, which culminated in a recent publication in *Biotechnology & Bioengineering* in 2015. Conducting independent research in Dr. Forbes’ lab was the real driving force in my decision to pursue my Ph.D. in chemical engineering.

Teaching and mentorship have been a large part of my academic career thus far, and have extended beyond the classroom. During my undergraduate education, I participated as an undergraduate teaching assistant for an introductory chemical engineering course, and was a mentor for new undergraduate researchers in the Forbes Lab, trying to inspire interest in the biomolecular side of chemical engineering for new students. For two years I was also a resident assistant, working with students of all disciplines to help them deal with the personal and academic issues in their own educational pursuits. Here at Cornell, I’ve used my experiences to mentor three undergraduate students, and serve as external liaison for the CBE Graduate Women’s Group (CBE Women), a group whose mission is to inspire young girls to pursue a career in engineering.

My current research under Dr. Christopher Alabi involves the development of a dual-delivery antibody conjugate system for the efficient cytosolic delivery of small interfering RNA (siRNA). RNA interference (RNAi) is a naturally occurring pathway in cells that utilizes short, double-stranded siRNA molecules to sequence—specifically, silence—gene expression at the mRNA level, and holds therapeutic potential for an extensive list of disease targets. However, inefficient cytosolic localization of delivered siRNA continues to be a key challenge in widespread RNAi therapeutic development. My goal is to use this dual-delivery strategy to uncover polymer properties that facilitate cytoplasmic

localization following endocytosis, thus improving potency and efficacy of delivered siRNA.



Kyle Watters

Before entering the world of biological sciences, Watters was deeply interested in the world of robotics, chip manufacturing and programming. Ultimately, the number of unsolved world health issues and the unmatched beauty and intricacy of biological molecules brought him to synthetic biology, the closest interface between these very different fields.

Watters received his bachelor’s degree from Rensselaer Polytechnic Institute (RPI) in 2011 with minors in biology and economics. While there, he worked on two projects in the Dordick and Bystroff Labs. The goal of the first was to engineer a green fluorescent protein biosensor to detect influenza peptides. The second project focused on the features of psychrophilic (cold-loving) enzymes that enabled them to function at low temperatures.

While at RPI, he was also involved in the general community through leadership roles in Tau Beta Pi, the Tau Epsilon Phi fraternity, and the Professional Leadership Program, among others. Along the path to discovering his passion for biology, Watters interned in a wide variety of fields including a position at what is now

SUNY Polytechnic Institute investigating off-gassing of photoresists at ultra high vacuum using mass spectrometry. He also worked at a precious metal refining company designing a portable scrubber for capturing rhenium particulate matter. However, Watters credits his internships at Wyeth Pharmaceuticals and Genentech as being the most influential. At Genentech, he focused on improving aspects of the company’s ion-exchange purification steps. There, he also learned the importance of focusing on the patient, and not just the research, which later served as a strong motivator for his participation in outreach programs.

At Cornell, Watters’ work is aimed at understanding how RNA-based biological circuitry functions at the most fundamental level. Specifically, his Ph.D. is focused on developing new RNA chemical probing tools that reveal which parts of an RNA molecule are most flexible, providing clues as to how an RNA molecule’s structure is related to its function. More recently, he is beginning to apply these new tools to design new synthetic RNA circuitry elements in a ‘smart’ way, avoiding traditionally painstaking approaches like mutagenesis.

Watters has also been heavily involved in leadership roles in the Chemical Engineering Graduate Student Association, the CBE Graduate Women’s Group, the local Tau Beta Pi chapter and other outreach opportunities. He has also served as a long-term mentor for three CBE undergraduate students, a fact Watters is very proud of. Following graduation, Watters is interested in pursuing an academic postdoc with the longer-term goal of a tenure-track faculty position.

GRADUATE STUDENT AWARDS



Yacet Acevedo (Clancy Group) won the Robert Mozia Graduate Distinguished Service Award, Diversity Programs in Engineering,

Cornell May 2015.



Akanksha Agrawal (Archer Group) and Joe Carlin (Joo Group) won a Graduate Teaching Assistant of the Year Award for their assistance in

CHEME 3240 (Heat and Mass Transfer).



Maciej Lukawski (Tester Group) won an award from the Geothermal Resources Council, 2014.



Ashley M. Macner (Steen Group) won an Austin Hooey Graduate Research Excellence Recognition Award, May 2015, and NASA

ISS Post-Graduate Award.



Bryan Rolfe (Joo Group) won a Best Image Award at the CBE Grad Research Symposium, September 2014



Victoria Sorg (Clancy Group) received an Intel Foundation/Semiconductor Research Graduate Fellowship.



James Stevenson (Clancy Group) received a national AIChE Award from the Computational Science and Engineering Forum

for Outstanding Ph.D. Research and an invited talk at the Keck Institute for Space Sciences, Caltech, as well as a plenary talk at the Jet Propulsion Laboratory, June 2015.



Melissa Takahashi (Lucks Group) won an Austin Hooey Graduate Research Excellence Recognition Award, May 2015, and received an AIChE Women's Initiatives Committee Travel

Award.



Mardochee Reveil (Clancy Group) won the Best First Year Graduate Student of the Year Award, Diversity Programs in Engineering,

Cornell May 2015.

BUILDING "INSIDE THE BOX"

Fernando Escobedo



Marjorie L. Hart Professor of Engineering, Fernando Escobedo, is known for his path-defining research aimed at using entropy to engineer polymer- and particle-based nanomaterials and their assemblies. By developing computer simulations able to accurately capture complex and subtle interactions that determine the structure of materials, Escobedo and his students have already shown that it is possible to imagine novel material designs that have not yet been made. His overarching drive is to develop simulation tools that allow one to "look inside the box" and play with the assembly of the uncountable types of new building blocks (based on polymers and nanoparticles), which can now be made routinely in chemistry laboratories.

Before joining the School of Chemical and Biomolecular Engineering in 1998, Escobedo received a B.S. degree in chemical engineering from the University of San Agustín in Peru in 1987, going on to

work for five years as an R&D engineer in a Peruvian company before coming to the U.S. for graduate studies. He then received a chemical engineering M.S. degree from the University of Nebraska-Lincoln in 1993 and a Ph.D. from the University of Wisconsin-Madison in 1997.

Attracted to Cornell for the collaborative research culture and the quality of the undergraduate and graduate students, Escobedo brought his expertise in materials physics, originally focused on polymers, to the School of Chemical and Biomolecular Engineering. His research group, currently comprised of six students and postdoctoral scientists, has been developing algorithms and utilizing computer simulation tools to broaden this influence to advance understanding of thermodynamic and structural transitions in materials created from nanomaterials and polymer-particle hybrids. They have also developed approaches for investigating mesoscale phenomena, stressing the crucial role played by small-scale heterogeneities responsible for key properties of many materials at larger length scales. Escobedo's research also aims to leverage such understanding to correlate between features of the building blocks of materials and the mesostructures that these blocks form.

According to Escobedo, "Entropy has a bad reputation due to its association with disorder and being a destructive force in nature. Entropy is prejudged to always be a bad player. When it comes to engineering materials, researchers have focused on designing the energetic interactions, while the role of entropy is often overlooked, misunderstood or even suppressed." He has summarized this idea

by saying that in materials design "energy is designed intelligently while entropy is designed accidentally." Through his group's research, Escobedo is decisively changing these prejudices. "We believe that being proactive and using the creative power of entropy to make new structures, will lead us to rediscover the helpfulness of entropy." Indeed, while entropy may be what limits the efficiency of power plants, it is also the force responsible for the elasticity of rubbers, the blending of components in a mixture, the depletion-induced precipitation of colloids, the supergluing used by mussels under water, the folding of proteins mediated by water rearrangements (hydrophobic effect), favoring many reactions with gaseous (high-entropy) products like hydrogen and (counterintuitively) the formation of many novel types of liquid crystals and crystals.

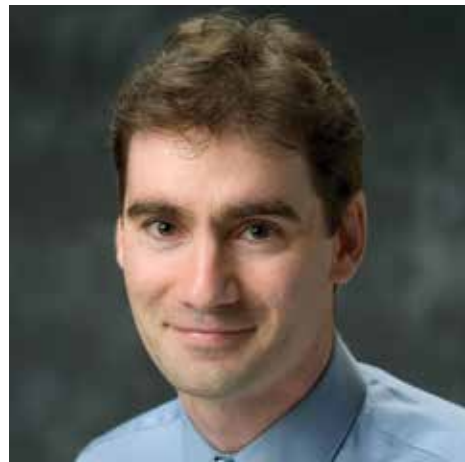
"ENERGY IS DESIGNED INTELLIGENTLY WHILE ENTROPY IS DESIGNED ACCIDENTALLY."

Escobedo's recent selected awards and honors include the Impact Award in Computational Molecular Science & Engineering in 2012 and being selected as an American Physical Society Fellow in 2014, among various others. He teaches the advanced classes on Thermodynamics and Chemical and Physical Kinetics and recently published a review of the research in his field "Engineering Entropy in Soft Matter: the Bad, the Ugly, and the Good" (*Soft Matter* 42, 8379, 2014).

Written by Alison Gabay '16.

BREAKING RULES TO REVOLUTIONIZE VACCINE PRODUCTION

Matthew DeLisa



Matthew DeLisa was not one of those kids who always knew he wanted to be an engineer. In second grade he did not take the remote control apart to see how it worked. While he enjoyed math and did well in science classes in high school, English and history were more to his liking. If there are any rules about how you become a professor in a highly-ranked College of Engineering, DeLisa broke most of them.

Just take a look at the touchstone decisions in his early academic career: Most of the colleges he applied to were strictly liberal arts schools with no engineering programs. He eventually opted for the University of Connecticut not because they offered engineering degrees but because they had a premier NCAA Division I soccer program. Sophomore year of college he looked ahead and saw that he was not going to be able to make

a living playing soccer professionally after college, so he buckled down on his coursework and graduated with a B.S. in chemical engineering. He planned to get a job and go into industry right away. But the economy was reeling from a recession and the job market had collapsed, so DeLisa applied to graduate school to, in his words, “wait things out.”

But then a funny thing happened. In a graduate chemical engineering program at the University of Maryland, DeLisa finally found his passion. “I quickly fell in love with the work I was doing,” says DeLisa. “I caught the proverbial research bug and it turned my world upside down. I was now fully committed to pursuing a career in academia.” As DeLisa tells the story, he sounds just as surprised today as he must have been back then.

It was the late 1990s and DeLisa’s advisor, Professor William Bentley, had a lab that was interested in biomanufacturing—the production of useful compounds using living organisms ranging from single-celled bacteria to intact larvae. “At the time, I was agnostic about what sort of biology I wanted to use to make things,” says DeLisa. “The ability to leverage simple E. coli bacteria as a cellular factory for producing valuable proteins such as human antibodies sounded really cool and so I opted for a project to do just that. Along the way, one of the things I quickly learned was that E. coli cells are really great at some things but not so good at others. One thing that natural E. coli bacteria cannot do, for

example, is attach complex carbohydrates to proteins.”

This process, called glycosylation, is ubiquitous in eukaryotic cells but is completely absent in most prokaryotic cells, including the E. coli that DeLisa was using. “Glycosylation is a key ingredient in many proteins, including some that are used to prevent or treat human diseases. So equipping E. coli cells with this function would be game changing for the basic understanding of this important mechanism and also for drug development,” says DeLisa. “While I had no idea at that time how this feat could be accomplished, I was convinced that it had to be possible and that somebody would eventually figure out how to reprogram E. coli to make and attach complex carbohydrates to proteins.”

To make a long and technically challenging story short, in 2012–15 years after first putting the E. coli glycosylation challenge in the back of his mind—DeLisa and his collaborators published a paper in the journal *Nature Chemical Biology* documenting their success at engineering the first eukaryotic protein glycosylation pathway in E. coli. “It felt great to finally do it,” says DeLisa. “My long-term interest is in developing next-generation therapeutic proteins and vaccines using biological machinery and this brings us a giant step closer to that goal.”

DeLisa currently has 20 graduate students and post-docs in his lab, along with 12 undergraduates, and has even hosted a large number of high-school students over the years. “The science and its applications are what drive me, but just as motivational for me is the chance to mentor the next generation of engineers,” says DeLisa. Inspiring words from someone who went to grad school simply to “wait out” the recession.



BOBBY BRINGI, PH.D. '91 INDUCTED INTO ENGINEERING ELITE FOR BIOBASED INNOVATIONS, LEADERSHIP

The American Institute for Medical and Biological Engineering (AIMBE) inducted Bobby Bringi, Ph.D. 1991, CEO of MBI to its College of Fellows at a March 16, 2015 ceremony in Washington, D.C. The College of Fellows is comprised of the top two percent of medical and biological engineers in the country.

Dr. Bringi was elected by peers and members of the College of Fellows for “the development of the plant cell fermentation process to make taxol and leadership of Michigan Biotechnology Institute.” A Lansing, Michigan-based not-for-profit biotech accelerator and a wholly owned subsidiary of the Michigan State University Foundation is pioneering the AFEX technology platform, a game-changing solution to the world’s grand challenge of feeding nine billion people by the year 2050.

Bringi has broad experience and expertise in biobased technology

development. Prior to joining MBI in December 2006, Bringi and his team developed and successfully commercialized an innovative synthesis for the anti-cancer drug Taxol, without having to harvest 100-year-old yew trees. This entrepreneurial experience allowed Bringi to conceive and champion derisking, MBI’s unique process that quickly and cost-effectively fails flawed technologies while accelerating viable ones through a rigorous innovation process. As a mission-inspired, market-driven 501(c)(3), MBI is demonstrating its multidisciplinary approach to innovation through a campaign seeking philanthropic partners for its AFEX platform. AFEX is a biobased technology that converts cellulose—the planet’s most ample organic material, found in plants and in the abundant crop residue left over from grain harvests—into a sustainable source of cattle feed and biofuels.

Bulky and unwieldy crop residues and grasses are converted into easily transported pellets, and because the crops are converted in a decentralized system of depots built where they are grown, the technology platform allows the world’s rural poor to earn more for their families. MBI’s vision is to promote AFEX worldwide on an affordable, accessible basis, maximizing the technology’s global and societal impact. Three hundred million tons of AFEX pellets could replace all grain currently fed to beef and dairy cattle, freeing up enough grain to feed one billion people. For more information on AFEX, go to mbi.org/afex.

The formal induction ceremony was held March 16 during AIMBE’s 2015 Annual Meeting at the National Academy of Sciences Great Hall in Washington, D.C. Dr. Bringi was inducted along with 151 colleagues who constitute the AIMBE

College of Fellows Class of 2015.

The most accomplished and distinguished engineering and medical school chairs, research directors, professors, innovators and successful entrepreneurs constitute the AIMBE’s College of Fellows. They are regularly recognized for their contributions in teaching, research and innovation. AIMBE Fellows have been awarded the Presidential Medal of Science and the Presidential Medal of Technology and Innovation and many also are members of the National Academy of Engineering, Institute of Medicine and the National Academy of Sciences.



BOB LANGER '70 NAMED CORNELL ENTREPRENEUR OF THE YEAR 2015

Entrepreneurship at Cornell has named Robert Langer '70, the David H. Koch Institute Professor at the Massachusetts Institute of Technology, Cornell Entrepreneur of the Year 2015. He will be honored in November 2015 during Cornell’s annual Entrepreneurship Summit in New York City.

Langer, who majored in chemical engineering at Cornell, holds nearly 1,100 patents issued or pending worldwide, which have been licensed or sublicensed to more than 300 pharmaceutical, chemical, biotechnology and medical device companies. He is the most-cited engineer in history. Langer has also founded more than 25 companies, many of which have grown into successful ventures.

He served as a member of the United States Food and Drug Administration's Science Board from 1995 to 2002 and as its chairman from 1999-2002, advising the commissioner and other officials on complex scientific and technical issues important to the FDA and its mission.

Langer is the winner of more than 220 major awards and is one of only five living individuals to have received the National Medal of Science (2006) and the National Medal of Technology and Innovation (2011). He also received the 2002 Charles Stark Draper Prize, considered the equivalent of the Nobel Prize for engineers; the 2008 Millennium Prize, the world's largest technology prize; the 2012 Priestley Medal, the highest award of the American Chemical Society; the 2013 Wolf Prize in chemistry; the 2014 Breakthrough Prize in Life Sciences; and the 2014 Kyoto Prize, Japan's highest private award for global achievement.

In 1998, he received the Lemelson-

MIT prize, the world's largest prize for invention, for being "one of history's most prolific inventors in medicine." In 1989, Langer was elected to the Institute of Medicine of the National Academy of Sciences, and in 1992 he was elected to the National Academy of Engineering and to the National Academy of Sciences.

The Cornell Entrepreneur of the Year award is given annually by Entrepreneurship at Cornell to a Cornellian who exemplifies entrepreneurial achievement, community service and high ethical standards.

PLANT DESIGN PROJECTS TACKLE FUNGAL FERMENTATION, OLEFIN CONVERSIONS, NATURAL GAS



Left to right: Apeksha Shapeti, J. Kent Carpenter, Muqtadar Quraishi, Simon Coulson, Dick Hauptfleisch, Kent Göklen, Alfred Center, and David Hurwitz

As part of the spring semester's ChemE 4620 course, better known as Plant Design, 21 student teams were assigned final projects with challenges in the areas of active pharmaceutical ingredient manufacturing,

olefin conversion, and natural gas processing.

Nine teams were assigned the GREENGENE project, which dealt with the production of a new active pharmaceutical ingredient in a submerged

fungus fermentation process. Professors Alfred Center and Alan Feitelberg split the job of directing the GREENGENE teams.

Eight teams were assigned the SPRC project, which dealt with different options for converting C3 and C4 olefins to higher value products. Each team selected a separate upgrading option so that their efficacies could be compared at the end of the semester. Professor Simon Coulson directed all of the SPRC teams.

Four teams were assigned the KHMERGAS project, which dealt with the cryogenic recovery of natural gas liquids from a raw natural gas stream. Removal of hydrogen sulfide from the gas stream and conversion to liquid sulfur was also part of the process. Professor Muqtadar Quraishi directed the KHMERGAS teams.

The final projects were then reviewed by panels comprised of faculty, TAs, and outside reviewers.

REUNION 2015



On June 6, 2015, classes from years ending in 5 and 0 gathered on Cornell's campus. In keeping with tradition, the School of Chemical and Biomolecular Engineering welcomed close to 100 alumni for breakfast. Ranging from 1950 to 2010, classmates shared reminiscences of beloved faculty and fun times

with classmates, and learned what's new in the school.

Lynden Archer, William C. Hooley Director, welcomed the group along with Lance Collins, the Joseph Silbert Dean of Engineering. Other faculty who were present to welcome our honored alumni, include Associate Professor T. Michael

Duncan, Professor of Practice, Alfred Center '65, Professor Abe Stroock and Assistant Professor Roseanna Zia. Also included were Professor Claude Cohen and Professor Jeff Tester. In brief remarks, Archer singled out Gordon Dibble '50 (top left photo, center) and Peter Wright '75 (top right photo, red shirt).



IN MEMORIAM

IN MEMORIAM

Name	Degree/Year	Date Of Death	Hometown
Julian C. Smith	M.S. ChemE, 1942	8/30/15	Ithaca, NY
Richard Eustis	B.S. ChemE, 1943	1/15/15	Lynchburg, VA
Richard Hillman	B.S. ChemE, 1944	9/17/14	Northridge, CA
B. Clifford Shaw	B.S. ChemE, 1944	8/24/14	Independence, MO
Charles McCoy	B.S. ChemE, 1944	2/23/15	Orinda, CA
H. F. Corning	B.S. ChemE, 1945	11/18/14	Cranford, NJ
William Rossi	B.S. ChemE, 1947	3/20/15	San Francisco, CA
M. Dudley Smith	B.S. ChemE, 1948	1/4/15	Camp Hill, PA
William Vosseller	B.S. ChemE, 1949	3/29/15	Green Valley, AZ
C. W. Shonnard	B.S. ChemE, 1949	1/4/15	Vergennes, VT
Donald Rowland	B.S. ChemE, 1949	2/1/15	Woodbridge, CT
Alvin Ries	B.S. ChemE, 1951	12/17/14	Highland, IN
Gordon F. Mead	B.S. ChemE, 1952	1/9/15	Winfield, WV
Harvey Schadler	B.S. ChemE, 1953	11/30/14	Schenectady, NY
Robert L. Johnson	B.S. ChemE, 1953	11/10/14	Jupiter, FL
Arlington Harman	B.S. ChemE, 1954	1/24/15	Greenwood, SC
Irwin Kaufman	B.S. ChemE, 1954	2/25/15	Washington, DC
Robert Bunting	B.S. ChemE, 1955	3/2/15	Hilton Head Island, SC
Edgar Averill	B.S. ChemE, 1957	3/10/15	La Habra Heights, CA
John R. Atwater	B.S. ChemE, 1958	2/4/15	Exeter, NH
Edward Kramer	B.S. ChemE, 1961	12/27/14	Santa Barbara, CA
Alan Rowland Goelzer	B.S. ChemE, 1963	11/23/14	Durham, NH
Philip A. Palmer	B.S. ChemE, 1963, M.Eng. 1964	4/17/15	Newark, DE
Robert A. Fisher	B.S. ChemE, 196, M.Eng. 1966	5/20/15	Irvine, CA
James Staid	M.S. ChemE, 1965, M.Eng. 1966	5/22/15	Ithaca, NY
Jeffrey F. Ellis	B.S. ChemE, 1974	4/7/15	Laytonsville, MD
Robert Matusiak	M.S. ChemE, 1971	2/25/15	Silver Spring, MD
John Harriott	B.S. ChemE, 1979	3/5/15	Winston Salem, NC
Fiona Wilcher	B.S. ChemE, 1980	10/31/14	Glencoe, IL
William C. Rippe	B.S. ChemE, 1981	7/21/15	Westport, CT

Professor Emeritus Julian Cleveland Smith, Jr. died peacefully after a short illness on Aug. 30, 2015, at Kendal Ithaca, his home for the last fifteen years.

Smith was born in Montreal, Canada on March 10, 1919; the last of four children of American parents, Julian C. Smith, Sr. and Bertha Louise Alexander Smith. He was educated at Westmount High School and Phillips Exeter Academy before studying engineering at Cornell, earning his bachelor's degree in chemistry in 1941, and master's degree of chemical engineering in 1942.

During World War II he worked for the Dupont Company in Wilmington, Del. on war work, including time on the Manhattan Project. He also met his future wife, Joan Dolores Elsen and they were married in Wilmington on June 1, 1946.

Smith was hired as an assistant professor in Chemical Engineering at Cornell in 1946. He and his new bride moved to Ithaca that year where they remained for the rest of their lives. Joan Elsen Smith died in 2003 after a marriage of 57 years. Julian Smith served as associate professor starting in 1949 and then as a full professor in 1953. He became Director of Continuing Education for the Engineering College in 1965, and Director of Engineering in 1975, returning to teaching in 1983 and finally retiring in 1986. He was a joint author of the internationally important textbook, *Unit Operations in Chemical Engineering*, and made contributions to another five books as well as authoring 50 technical articles. At the end of the last revision of the textbook, the publisher was pushing him to meet a deadline. "I am 85, you know," Smith said.

Lynden Archer, the current Director of Chemical and Biomolecular Engineering,

Julian C. Smith Jr.



March 10, 1919 - August 30, 2015

said, "Julian was a giant among educators in our field. He was also a crucial, skillful force in shaping the department into the vibrant place it has become for teaching a rising number of undergraduate students the principles of chemical engineering and for discovery of new paradigms that are defining the frontiers of the field. He defined the strong foundation, during his period as Director, for the School's balanced focus on graduate research and undergraduate teaching that frames its programs today."

Smith was a Cornell man first and last. His parents were both Cornell graduates, father Julian Smith Senior in 1900, and mother Bertha Smith in 1901. At least another ten relatives from the 1860's to the present day have attended Cornell including Julian's son, Brian Smith, and grandson, Daniel Smith.

Smith was a valued consultant to DuPont for decades, and to various government agencies. In Ithaca, he has served in leadership roles with the Ithaca Opera Association, the United Way and the Cerebral Palsy Association, to name just a few; he also was an elder of the First Presbyterian Church of Ithaca, where he sang in the choir for almost 50 years. In retirement, Smith was a member

of many committees, academic, social and charitable, including work on the redevelopment of the Reconstruction Home.

He also engaged in a number of hobbies, taking many of them to semi-professional levels. His documented land snail collection is now part of the research materials at the Paleontological Research Institution. His Canadian stamp collection won international prizes. He contributed another volume to the Smith family tradition of writing genealogical works, and, confirmed his early Puritan Smith ancestry by taking part in the Smith DNA project. He had a passion for golf which continued with watching the professionals on television long after he was too unsteady to swing a club. He was almost certainly the oldest member of the Ithaca Country Club. He wrote and published their history, *Breaking Ninety*.

Julian was a very capable musician, playing classical piano. He had a light-hearted side, being a member of the Savage Club, a social club for the performing arts, while a student and rejoining in his forties, remaining a member to the end. His humorous compositions, both words and music, in the style of Flanders and Swann, were a feature of many performances at the Savage Club.

He is survived by son Robert Elsen Smith, daughter-in-law Donna Chuzy, grandson Daniel Worthington Smith, daughter Diane Louise Brook, son-in-law David Charles Brook, granddaughters Joanna Katherine Brook and Lisa Margaret Brook, and son Brian Richard Smith, daughter-in-law Kim Kristie Veronica McClain, and granddaughter Celeste Juliana Smith. He is also survived by nephews, nieces, their families, and cousins.

FACULTY NEWS & AWARDS



Chris Alabi

Chris Alabi, Assistant Professor, was recognized with a 2014 Research Starter Award from the Pharmaceuticals Foundation (PhRMA).

The PhRMA Foundation Research Starter Award is a prestigious early career grant award designed to recognize young scientists of exceptional promise. The award is specifically intended to catalyze innovative work by young scholars in the areas of biopharmaceutics and pharmaceutical technology targeted at development of safe and effective therapeutics.

Alabi's award will support work on design and development of modular bioconjugates for enhanced cytoplasmic delivery of short interfering RNA (siRNA) therapeutics. The work will also develop engineering principles for a novel modular bioconjugate-based dual delivery strategy that decouples the requirements of drug uptake from endosomal escape, with the ultimate aim of rationally designing cell-specific therapeutics.



Lynden Archer

Lynden Archer, William C. Hooley Director, was elected the James A. Friend Family Distinguished Professor in Engineering by vote of the Board of Trustees. This distinction recognizes Archer's uniformly outstanding contributions as a researcher, educator, and most recently as director of the school.



Alfred M. Center

Senior Lecturer Alfred M. Center was promoted to the rank of Professor of Practice by unanimous vote of the

faculty. The Professor of Practice title is a new academic title ratified by the Cornell Faculty Senate to help attract, to academia, distinguished professors who have pursued careers in industry. Center's appointment is a reflection of the strong record of service he has rendered to the school, to the College of Engineering, and to Cornell over a 16-year—post industry retirement—career teaching the school's capstone Unit Operations Laboratory and Chemical Plant Design courses. As part of the evaluation process that led to Center's elevation to the title Professor of Practice, we solicited letters from former students and from external advisors for the capstone courses. Center consistently received high praise from his students and peer instructors alike for the passion with which he has approached teaching Process and Plant Design and for the innovations he has brought to teaching these subjects. Another consistent theme that defines Center's tenure on the academic staff is that he has injected a needed element of realism in the chemical engineering undergraduate curriculum that is fueling sentiments among employers of our students that Cornell Chemical and Biomolecular Engineering graduates are among the best prepared in the country.

Paulette Clancy

Paulette Clancy, Samuel W. and M. Diane Bodman Professor, and Dr. Julie Nucci (MSE) won an ICC grant to fund a collaboration that links Cornell's engineering students with Indian students on service projects related to renewable energy.

In India, the collaboration is headed by Samir Somaiya, B.S. '90, whose family founded the Somaiya Vidyavihar



educational institutions.

This project is aimed at promoting the sustainability efforts of a rural village in India by hands-on involvement in energy-related service projects. The first such project will involve the design and fabrication of a biodigester.



Claude Cohen

Claude Cohen, Fred H. Rhodes Professor, has retired after 38 years of outstanding research, teaching and service in the School of Chemical and Biomolecular Engineering. Cohen is now an emeritus professor in the school, effective July 1, 2015.



Susan Daniel

Associate Professor Susan Daniel was awarded the College of Engineering Alice H. & Constance E. Cook Award. Named in honor of the late Constance E. Cook, Cornell's first woman vice president, and the late Professor Emeritus Alice E. Cook, founding member of the Advisory Committee on the Status of Women, the Award honors individuals for their commitment to women's issues and their contributions for changing the climate for women at Cornell. Daniel's award recognizes her leadership role in the professional development and mentoring of students and postdoctoral associates in the department. Her inspired and impactful leadership of the group CBE Women was singled out for special praise.

Fernando Escobedo

Fernando Escobedo, Marjorie L. Hart Professor of Engineering, has been elected Fellow of the American Physical Society (APS). Election to fellowship in the American Physical Society is a recognition by peers for outstanding contributions to physics. Escobedo was recognized by the APS Division of Computational Physics for his path-defining work aimed



at understanding molecular scale physics of macromolecules and colloids through computer simulations. The citation for his award reads: "For the elucidation and prediction of complex phases formed by block copolymers, elastomers, and colloidal suspensions of anisotropic particles, and the advancement of novel Monte Carlo simulation methods."



Julius Lucks

Assistant Professor Julius Lucks is the recipient of a 2015 Faculty Early Career Development Award from the National Science Foundation. The Career Award is the most prestigious recognition given by

the NSF to teacher-scholars early in their academic careers.

Lucks' NSF Career proposal titled, 'Uncovering Quantitative Design Principles of RNA Regulators for Synthetic Biology,' aims to pioneer quantitative, multi-level design principles for RNA structure/function relationships.

Lucks proposes to use this knowledge to create new types of RNA-mediated genetic controls and new RNA genetic networks for tailoring gene expression logic and dynamics. The work builds upon recent efforts in his group, which led to the creation of a new RNA-based genetic regulatory mechanism which can be used to selectively activate gene expression.



Abraham D. Stroock

Abraham D. Stroock was promoted to the rank of full professor by vote of the Board of Trustees. Stroock's research uses experiment and theory to study the coupling of thermodynamics, transport phenomena and chemical kinetics in man-made and biological systems. He is widely regarded as an innovator and thought leader of the field. His scholarly contributions have been documented in research papers and invited publications in leading journals of the field, including *Journal of the American Chemical Society*, *Nature*, *Proceedings of the National Academy of Science* and *Science*. Stroock's work has also been featured in popular press pieces in *Nature News*, *C&E News*, *Los Angeles Times* and *Science Business Exchange*.



Paul Steen

Paul Steen, Maxwell M. Upson Professor, was named Associate Editor of the new *Nature* journal, *Microgravity*. Steen's selection as Associate Editor recognizes his diverse scholarly contributions to the field, including his pioneering work on capillary instabilities, osmotic pumping and nonlinear dynamics. It also recognizes his prior outstanding service as Associate Editor of the *Journal of Fluid Mechanics* during a critical 12-year period (2000-2012).

Fengqi You

Professor Fengqi You will join the CBE faculty in July 2016 as the inaugural holder of the Roxanne E. and Michael J. Zak Professorship in Energy Systems Engineering. You's research interests focus on development of novel computational models, optimization methods, and systems analysis tools for energy systems, process engineering and sustainability. You received his Ph.D. from Carnegie Mellon



University and, before joining the faculty at Northwestern University, worked at Argonne National Laboratory.



Roseanna Zia

Assistant Professor Roseanna Zia was selected to take part in the National Academy of Engineering's (NAE) 21st Annual U.S. Frontiers of Engineering symposium in Irvine, Calif., as one of the 'nation's brightest young engineers.'

Eighty-nine engineers under the age of 45 who are performing exceptional engineering research and technical work in a variety of disciplines will come together for the event. The participants—from industry, academia, and government—were nominated by fellow engineers or organizations.

CBE NEWS & EVENTS



2014 RAYMOND G. THORPE LECTURE

The 2014 Raymond G. Thorpe Lecture was delivered on Monday, October 20, 2014 in Olin Hall.

Dr. Todd C. Zion (B.S. ChemE '97) presented a lecture titled: **Chemical and Biomolecular Engineering: A Fundamental Education for Changing the World.**

In a stimulating lecture, Zion pointed out that even before Professor Thorpe's days in the School of Chemical Engineering through today's embodiment of the school, Cornell chemical engineers have spawned and profoundly influenced a seemingly disconnected but world-changing array of technical fields. He contended that throughout that time, the fundamental principles of chemical engineering have remained the same and have served as the basis from which the fields of materials science, polymer engineering, petroleum engineering, semiconductor manufacturing, alternative energy initiatives and biomedical engineering have emerged among others.



The lecture focused on one example of a Cornell chemical engineer's influence on the fields of medicine and pharmaceutical development, both of which were superficially unrelated to his areas of core expertise, but tapped into fundamental principles Zion is able to trace with a bright line to his formative years in Olin Hall.

Although Zion did not have Professor Thorpe as a teacher during his undergraduate days at Cornell, he started his journey as a product of the rich legacy Professor Thorpe's commitment to undergraduate education created in the department. He credits T. Michael Duncan, the Raymond G. Thorpe Professor in CBE for many of his formative experiences both inside the classroom and in research. After leaving Cornell, Zion spent a brief stint at Eastman Kodak and then went on to complete his Ph.D. dissertation at M.I.T. focusing on biomaterials engineering. In the process, he founded SmartCells, Inc., to develop the world's first glucose-regulated insulin (GRI) formulation for treating diabetes. GRI addresses the most important challenge for diabetes therapy:

achieving tight blood glucose control, without hypoglycemia, to significantly reduce diabetic complications which are debilitating, costly and pervasive. As president and CEO, Zion raised \$10 million over the course of six years from private investors to develop the technology and demonstrate its preclinical safety and efficacy. In 2010, Merck acquired the company for upfront and milestone payments in excess of \$500 million and is now actively commercializing the technology for the treatment of diabetes.

2015 JULIAN C. SMITH LECTURE SERIES



Frances H. Arnold of Caltech, delivered the 2015 Julian C. Smith Lecture Series on April 13 and 14, 2015. A pioneer of directed evolution of biological molecules as a strategy for engineering better enzymes, regulatory circuitry and organisms, Arnold is one of only 20 persons in history to be inducted into all three U.S. National Academies (National Academy of Engineering (NAE), National Academy of Science, Institute for Medicine). In 2011 she was also recognized with the National Medal of Technology Innovation from President Obama and with the Draper Prize from the NAE.

During her two-day lecture, Arnold presented two talks titled, **Design**

by Evolution (or “Sex and the Better Biocatalyst”) and Evolution of Novelty: Expanding Nature’s Catalytic Repertoire, in which she discussed the intrinsic value of using the one proven algorithm for biological design—evolution—to engineer biological molecules and systems to solve human problems.

Arnold described her innovation as “a powerful approach to engineering the biological world, directed evolution both circumvents and underscores our profound ignorance of how sequence encodes function.” The first lecture also explored ways to emulate evolution in order to create enzymes with desirable properties. The notion that an enzyme can take on new capabilities by accumulating beneficial mutations over a small fraction of its sequence emerged as simultaneously intuitive and brilliant. Arnold further demonstrated how structure-guided recombination can be used to advantage for generating sequences that are much more diverse, but still retain the parental fold and function.

In her second talk, Evolution of Novelty: Expanding Nature’s Catalytic Repertoire, Arnold explained how synthetic biology for biofuels production and for manufacturing chemicals has depended on reassembling existing enzymes into new biosynthetic pathways. She showed that many desired transformations fall outside the reach of known enzyme-catalyzed transformations or can be made more efficiently using synthetic chemistry. Thus, a future where metabolic engineering might produce nearly all of the organic molecules upon which society depends is still somewhat distant.

Not satisfied with nature’s vast catalytic repertoire, Arnold demonstrated how one would go about creating new enzymes to expand the range of genetically encoded chemistry. With the help of

specific examples from her work, she showed how directed evolution could be used to create new enzymes that catalyze important reactions not known in nature.

THE AUSTIN HOOEY GRADUATE RESEARCH EXCELLENCE RECOGNITION AWARD

The Austin Hooey Graduate Research Excellence Recognition Award is the highest award given to a graduate student by the School of Chemical and Biomolecular Engineering. The award recognizes outstanding contributions to scholarship and research towards a Ph.D. degree. Each student is given \$500 and the opportunity to present their research to the department. This year’s four winners are profiled below:

Fall 2014: Jason Boock and Yingying Lu

Jason Boock of the DeLisa Group presented, **Expanding the capabilities of a bacterial quality control mechanism for the engineering of enzymes:** The gram-negative bacterium *E. coli* remains the preferred host for biotechnological protein production due to its well studied and easily manipulated genetics, fast doubling times, low culture cost, and ability to grow to high density in fermentations.



Jason Boock

Even though upwards of 75 percent of heterologous proteins over the past ten years have been made in *E. coli*, protein misfolding, and thus low production, continue to plague this popular production organism. To solve this problem, we propose the use of natural protein quality control, the innate ability of a cell to recognize the folding-state of a protein, to identify protein variants that are well folded, focus protein libraries towards isolating active members and establish design principles that govern protein folding in *E. coli*.

In this work, we have created a two-tiered directed evolution strategy that enables optimization of enzyme production while maintaining high biological activity. The first tier involves a genetic selection for intracellular protein stability that is based on the folding quality control mechanism inherent to the twin-arginine translocation pathway (Tat), while the second is a semi-high-throughput screen for protein function. To demonstrate the utility of this strategy, we isolated variants of the endoglucanase Cel5A from a fungal plant pathogen whose production was increased by as much as 30-fold over the parental enzyme. Importantly, by combining the folding filter afforded by the cellular quality control with a function-based screen, we show that it is possible to enrich for variants with increased protein abundance in a manner that does not compromise catalytic activity, providing a highly soluble parent for engineering of improved or new function. Further, we have characterized several of the improved variants to begin determining which biophysical properties are enriched through the directed evolution process.

During this process, we discovered the chaperone-like activity of a component of the Tat pathway, for the first time showing its direct involvement in cellular quality control. The results of this



Yingying Lu

work are shedding light on the poorly understood Tat quality-control mechanism and guiding future protein engineering attempts that exploit this pathway.

Yingying Lu of the Archer Group presented a talk titled, **Ionic liquid-tethered hybrid materials: Science and Applications in Lithium Metal batteries.** Significant improvements in safe and stable rechargeable battery performance are needed for lithium metal batteries (LMBs) due to non-uniform electrodeposition of lithium that occurs naturally on the negative electrode. These uneven structures, loosely termed dendrites, increase the potential risk of the cell short-circuiting during operation, fading in the amount of energy stored in a single charge or even fire hazards. Lithium-ion batteries (LIBs) are designed to eliminate the dendrite problem by hosting lithium in a graphite material, but in practice a LIB can be transformed to a LMB by charging too fast or too much because the potential difference between lithium ion insertion and deposition is relatively small. Thus, solving the dendrite problem is critical for both LMBs and LIBs. Recent discoveries and advances have focused on electrolyte reconfigurations for the sake of suppressing or even eliminating dendrite formation, but these efforts have met with only limited success.

Many recent studies have

concentrated on the electrolyte formulation, aiming at reversible striping-plating lithium ions. Ionic liquid have, for instance, triggered great interest due to their low vapor pressure, non-flammability, good thermal and electrochemical stabilities. To remove the shortcomings of conventional ionic liquid such as low lithium ion transference number and low mechanical strength, we developed a family of ionic liquid-nanoparticle hybrid electrolytes (SiO₂-IL-TFSI). These hybrid electrolytes are also deliberately constructed to incorporate a supporting electrolytes (extra anions and immobile cations), which theory suggests should play a decisive role in dendrite nucleation. The presence of hard nanoparticles in the electrolytes is also expected to enhance the bulk mechanical strength and to potentially improve the dielectric properties of the electrode/electrolyte interface. The former (supporting electrolyte) feature can be shown to reduce the potential gradient caused by any inhomogeneities in ion distribution during cell polarization, which reduces the electric field near the negative electrode facilitating uniform lithium deposition. The latter effect (enhanced interfacial strength) reduces the magnitude of lithium deformation during the intercalation/deintercalation process because of the electrolyte’s high storage modulus and may also broaden the interfacial region near the electrode/electrolyte interface over which the electrode potential falls to zero.

The tethered ionic liquids are also known as the solid electrolyte interface (SEI) stabilizer probably by generating lithium fluoride. In the effort to understand the importance of SEI, we investigated the stability of lithium electrodeposition in common liquid electrolytes reinforced by halogenated lithium salts.

Spring 2015: Melissa Takahashi and Ashley Macner

Melissa Takahashi of the Lucks Group presented, **Uncovering structure-function design principles of RNA transcriptional repressors:** Synthetic biology promises to transform the fields of biotechnology and medicine by developing new technologies for the production of drugs, fuels and even cell-based therapeutics. At the heart of these applications is the ability to manipulate cellular behavior through engineering synthetic gene networks. Historically these networks were built using proteins that regulate transcription, but recently RNAs have emerged as versatile molecules that can be engineered to regulate nearly all aspects of gene expression. It has been shown that RNA transcriptional repressors derived from natural mechanisms called attenuators can be used as building blocks for both signal integration logic circuits and transcriptional cascades. In order to build more sophisticated circuitry, larger libraries of orthogonal attenuators that function independently are required, however their mechanistic complexity has made them difficult to engineer. To address this, we uncover a new structure-function design principle for attenuators that will enable the forward engineering of new RNA transcriptional repressors, and shed light onto the functioning of natural RNA gene expression regulators. Using in-cell SHAPE-Seq to characterize the structures of attenuators within *E. coli*, and molecular dynamics simulations to model attenuator structure fluctuations, we show that interior loop structures within attenuator hairpins lead to flexibility critical to function. We further show that hairpin flexibility is found in the stem loop structures of natural RNA translational repressors. Finally, we design new transcriptional attenuators in silico,



Ashley Macner and Melissa Takahashi

and observe that this 'hairpin flexibility rule' must be upheld for proper attenuator function in the cell. This work establishes a new design principle of RNA-RNA interactions relevant to both natural and synthetic RNA gene regulators. Moving forward, we anticipate that this design principle will lead to the rapid design of new synthetic RNA regulators.

Ashley Macner of the Steen Group presented, **Simulating Transient Dropwise Condensation on a Low Thermal Conductivity Substrate**: During dropwise condensation from vapor onto a cooled surface, distributions of drops evolve by nucleation, growth and coalescence. Drop surface coverage dictates the heat transfer characteristics and depends on both drop size and number of drops present on the surface at any given time. Thus, manipulating drop distributions is crucial to maximizing heat transfer. On earth, manipulation is achieved with gravity. However, in applications with small length scales or in low gravity environments, other methods of removal, such as a surface energy gradient, are required. This study examines how chemical modification of

a cooled surface affects drop growth and coalescence which, in turn, influences how a population of drops evolves. Steam is condensed onto a horizontally oriented surface that has been treated by silanization to deliver either a spatially uniform contact-angle (hydrophilic, hydrophobic) or a continuous radial gradient of contact-angles (hydrophobic to hydrophilic). The time evolution of number-density and associated drop-size distributions are measured. For a uniform surface, the shape of the drop-size distribution is unique and can be used to identify the progress of condensation. In contrast, the drop-size distribution for a gradient surface, relative to a uniform surface, shifts towards a population of small drops. The frequent sweeping of drops truncates maturation of the first generation of large drops and locks the distribution shape at the initial distribution. The absence of a shape change indicates that dropwise condensation has reached a steady state. Previous reports of heat transfer enhancement on chemical gradient surfaces can be explained by this shift towards smaller drops, from which the high heat transfer coefficients in dropwise condensation are attributed to. Terrestrial applications using gravity as the primary removal mechanism also stand to benefit from inclusion of gradient surfaces because the critical threshold size required for drop movement is reduced.

Simulation of the entire transient portion of dropwise condensation for a low thermal conductivity surface was also completed. During dropwise condensation, distributions of drop-sizes evolve primarily through coarsening by coalescence. The instantaneous heat transfer performance of a surface is dictated by the number and size of drops on the surface at any instant in time. While performance averaged over longer

times is of interest from a technology standpoint, accurate simulation of the transient state is important because steady-state dropwise condensation can be thought of as a collection of transient dropwise condensation cycles occurring in parallel. Traditional simulation of dropwise condensation has focused on making comparisons with experimental drop-size distributions at single instants in time, typically at later times, after the process has reached a statistical steady-state. Additionally, a constant temperature difference between the steam and the substrate is assumed. While this assumption is valid for metal surfaces possessing a high thermal conductivity, this assumption is not necessarily true for low thermal conductivity surfaces such as glass. We report a way to simulate the entire transient portion of dropwise condensation using a population-averaged isolated drop growth rate measured directly from experiments using single drop tracking to grow the drops. The simulation reasonably predicts the time evolution of the number density of drops, the fractional coverage, the normalized condensate volume and the median drop radius for condensation experiments performed on the underside of a horizontal hydrophobic surface exposed to a coolant temperature of 1 degree Celsius. In the case of a glass surface chemically coated with dodecyltrichlorosilane, it was found that use of a constant temperature difference grossly under predicts the heat transfer. Re-examination of the single drop heat transfer model that incorporates the thermophysical properties of the solid, shows that in the limit of low thermal conductivity, the drop growth rate is constant for large drops ($R > 78 \mu\text{m}$). In the opposite limit of infinitely high thermal conductivity, the traditional constant temperature dependence is recovered.

CBE GRADUATE WOMEN'S GROUP HOSTS THE 6TH ANNUAL WOMEN'S OUTREACH IN MATERIALS, ENERGY AND NANOTECHNOLOGY EVENT

On March 21, 2015, the CBE Graduate Women's Group hosted the 6th annual Women's Outreach in Materials, Energy and Nanobiotechnology event. Tenth grade

high school girls came to campus and participated in hands-on science activities, including DNA extraction from bananas and perfume distillation. Parents and students had a chance to learn about

college admissions and hear from current students and faculty about the process of becoming a chemical engineer. Over 40 volunteers helped to make the event a huge success.



Members of the CBE Graduate Women's Group with local high school students

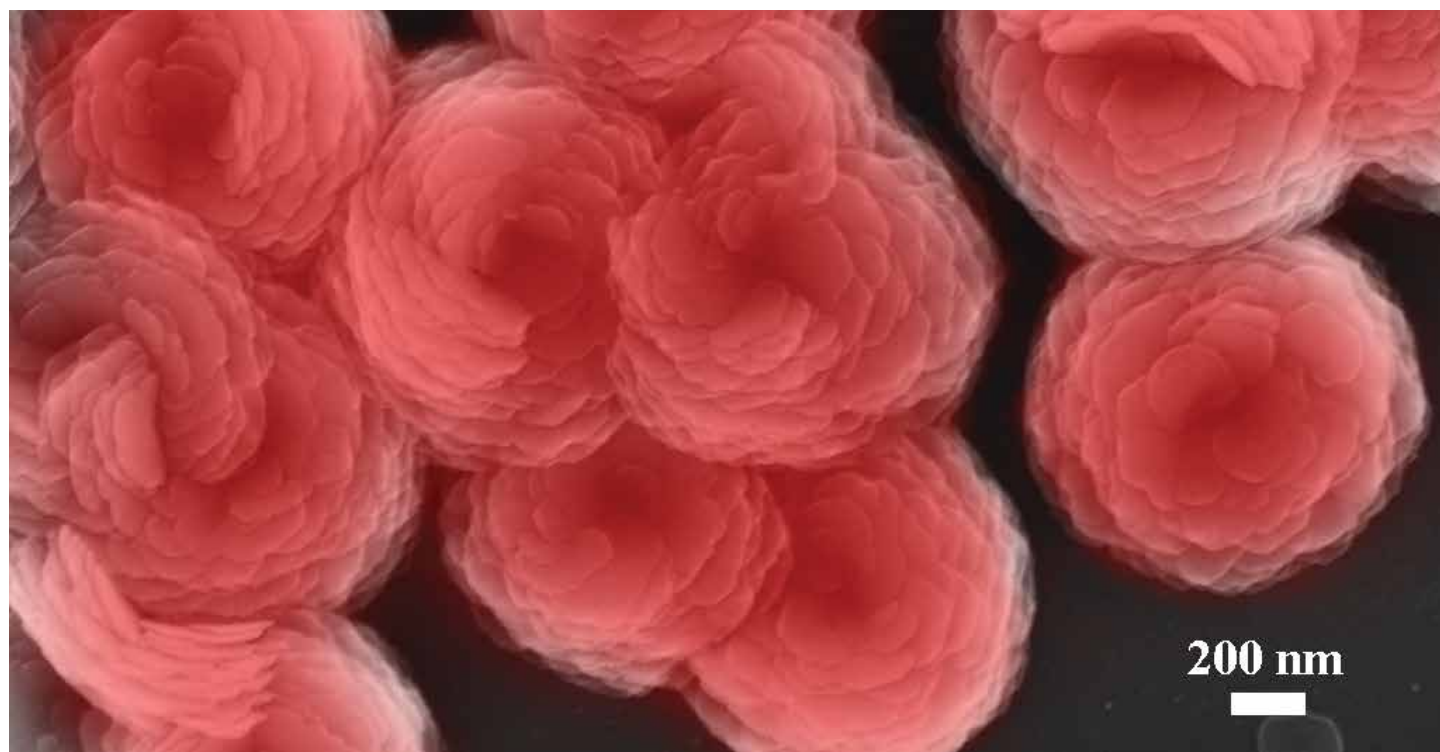
5TH ANNUAL GRADUATE STUDENT RESEARCH SYMPOSIUM

The Chemical Engineering Graduate Student Association hosted the 5th Annual Graduate Student Research Symposium, offering graduate students the opportunity to present their research to their colleagues and see the breadth of research happening in the department. The day-long event featured posters and talks by senior graduate students, as well as a keynote lecture delivered by Professor Roseanna Zia.



Submitted by Bryan Rolfe (Joo Group)

WINNING PHOTOS FROM THE PICTURE COMPETITION



Submitted by Kaifu Bian (Hanrath Group)

2014 William C. Hooley Outstanding Staff Award Carol Casler



Carol Casler

Carol Casler received the 2014 William C. Hooley Outstanding Staff Award. The award was established in 2011 by the School of Chemical and Biomolecular Engineering (CBE) to recognize a member of the staff who goes above and beyond her job responsibilities in helping the School and its faculty execute all aspects of CBE's mission. Casler has worked at Cornell since 1990 and in CBE for the last 15 years. She supports the traditional as well as evolving objectives of the undergraduate program, the teaching faculty and all prospective, current and past ChemE undergraduates. Her efforts and strategic advice have helped the School move forward overcoming challenges and pursuing opportunities. She effectively and professionally supports a significant and diverse set of needs and we congratulate her on this honor recognizing her diligent and dedicated efforts.

Years of Service Carol Casler and Celia Szczepura-McLean

We celebrate Carol Casler and Celia Szczepura-McLean's 25 and 15 years of service to Cornell, respectively. Casler began her career with Cornell in 1992 in the Bursar's Office as a Loan Account Representative. After four years with the Bursar's Office, she took a new position with Student Services in the College of Engineering's Registrar's Office. Casler's good rapport with students and faculty

in both of these positions successfully prepared her for her current position as Undergraduate Coordinator in the School of Chemical and Biomolecular Engineering. For the past 16 years, Casler has worked independently, but under the general supervision of the Director of Undergraduate Studies, T. Michael Duncan, and provides a full range of administrative support to the department's undergraduate program.



Celia Szczepura-McLean

Szczepura-McLean began her Cornell career at the S.C. Johnson School of Management overseeing the operational aspects of MBA recruiting for four years before transitioning to research and departmental administration in Crop and Soil Sciences, and then at the KAUST-Cornell Center for Energy and Sustainability before joining CBE as the Director of Administration.

Congratulations Tammy Wildenstein



Tammy Wildenstein

We want to acknowledge our appreciation for Tammy Wildenstein's efforts in grant proposal support and congratulate her as she moves into the College of Engineering centralized Research Administrative Support Center. We look forward to continuing to work with her as well as her new colleagues.

Andrew Cosachov

Andrew Cosachov, who worked with us initially as a student and then continued

on in Professor Christopher Alabi's lab and in the main office, moved on to a position at Weill Cornell under the direction of a pediatric physician.

Hunter Salem

We thank our student colleague, Hunter Salem, for his contributions to CBE and congratulate him on his May 2015 graduation.

Welcome

Stephanie Smallman



Stephanie Smallman

Stephanie Smallman was hired into the departmental Administrative Assistant position on April 13, 2015, after moving to Ithaca from Rochester, N.Y., where she worked for five years for the Monroe County Auto License Bureau. She received her B.S. in English Literature from SUNY Brockport.

Tara R. Walworth



Tara R. Walworth

Tara R. Walworth joined the Energy Institute on June 17, 2015, as an Administrative Assistant. Walworth has worked at Cornell since 2007, most recently providing administrative support to the Video Production Group in Marketing. She earned her Associate's Degree from Onondaga Community College in Communications.

THE ELVES HOLIDAY PROGRAM



Over the past year, the School of Chemical and Biomolecular Engineering (CBE) staff in Olin and Snee Halls volunteered their time to participate in both the Cornell Elves Holiday Program and the Cornell Summer Backpack Program.

The Elves Holiday Program was founded in 1989 to benefit underprivileged children in Tompkins County and the

surrounding area. The program has provided clothing, school supplies and toys to thousands of students from dozens of area schools.

CBE staff coordinated a collection of items and monetary donations from nOlin Hall residents for two deserving children. Gifts were then purchased, wrapped and delivered to the 'Elf Leader' for holiday delivery.

The Summer Backpack Program assists local students with their back-to-school needs. CBE staff coordinated a collection of school supplies and monetary donations to purchase 11 backpacks and filled them with school supplies for local elementary school children. The backpacks were delivered shortly before the school year started.



CHEME CAR COMES IN FIRST



Cornell's ChemE Car student project team traveled to Boston on March 7 and 8, 2015 to compete in the Northeast Regionals of the American Institute of Chemical Engineers (AIChE) ChemE Car Competition. The competition, hosted jointly by Northeastern University and MIT, included 15 teams from universities throughout the northeastern United States.

Cornell's ChemE Car did remarkably well, finishing in first and third place in the car competition and also coming in first in the technical poster competition. The Cornell ChemE Car team has been National Champion three times since 2008. This is the first time the Cornell ChemE Car team has taken top honors in the Poster Competition.

The ChemE Car competition is not a race. Rather, one hour before the

competition, teams are given a specific distance their car needs to travel as well as a specific weight that needs to be carried. Teams then break out their computers and crunch the numbers to figure out the technical settings for their two allowed runs.

Cornell's fuel cell-powered car finished 104 centimeters from the target distance, which was close enough for third place. Cornell's battery-powered car came to a stop a remarkable 46 centimeters from the target distance, which gave it a first place finish. With their strong showing in Boston, the team has qualified for the national finals to be held in Salt Lake City, Utah in November.

Team Lead Yechun Fu '15 says that it is not yet clear which of the two Cornell cars will travel to Salt Lake City. "Competition rules say only one car is

allowed from each university. This means that early in the fall we will have an internal car-off between our power teams to determine which is the most consistent and best candidate to compete."

The team has more than 50 members, representing six different majors. The team's Faculty Advisor is Professor Roseanna Zia. While not predicting a first place finish in the national finals, Fu is excited by Cornell's chances in November. "I feel extremely proud of all the members for working together so well and for their amazing dedication to the team. I feel that we are in a good position going into Nationals with multiple power teams ready to take on the challenge of competing against the best teams in the country," she said.

UNDERGRADUATE STUDENT PROFILES



From left to right: Assistant Dean Betsy East, Kyle Watters, Timothy Abbott, Professor Julius Lucks, and Jennifer Warner '04

TIM ABBOTT '15

Why did you decide to attend Cornell?

I decided to attend Cornell because I honestly didn't know exactly what I wanted to do. I discovered in high school that I loved chemistry, but also the medical and engineering aspects of biology. In my mind, Cornell had the best mix of strong chemical, biological and biomedical engineering. If chemical engineering, my first choice, didn't suit me, I could easily switch to another discipline. Additionally, Cornell felt like home to me. Ithaca is a very spacious and rural small town, much like my own hometown.

What leadership positions did you hold while at Cornell?

I was the Biological Systems sub team leader on the ChemE Car team.

What were your major accomplishments as a leader?

I don't have any tangible accomplishments as a leader, but I have helped our team brainstorm and test multiple projects and form a solid foundation for thorough and sound future work. I have also helped secure future generations of our team through recruiting multiple members.

What advice do you have for current student leaders or those looking to commit to leadership positions?

For those looking for future leadership positions: Never give up. You will never get the position if you don't try, so learn from your failures and move on. Whenever you are denied a position, find out why. This is a perfect opportunity to learn and improve. For those who currently hold a position, find a balance

of work and assigning tasks to others. You simply cannot take on every responsibility.

What are your goals post-graduation?

After graduation, I will be pursuing a Ph.D. at Stanford in bioengineering.

What's your favorite Olin Hall/ChemE memory?

My favorite memory is winning the Cornell Engineering Alumni Association Undergraduate Research Award (pictured left). I won't remember it, however, for the accomplishment, but rather the aggregate of all the wonderful experiences, memories, companionships and knowledge I have gained as a researcher.



KATRINA CURTISS '15

Why did you decide to attend Cornell?

I'm from California and I really wanted to experience the seasons, so I applied to schools on the East Coast. Cornell in particular stood out because of the engineering co-op program.

What leadership positions did you hold while at Cornell?

I was co-captain of the women's club water polo team. I have also served as a teaching assistant for ENGRD 2190, an orientation supervisor and a peer adviser for ENGRG 1050.

What were your major accomplishments as a leader?

I try to inspire enthusiasm in others, whether it is motivating my teammates to come to practice, trying to make new material easy to understand or welcoming new students to Cornell.

What advice do you have for current student leaders, or those looking to commit to leadership positions?

It is definitely possible to balance schoolwork and leadership. Make sure to watch out for deadlines so you don't create more work for yourself than is necessary.

What are your goals post-graduation?

I co-op'ed with Air Products during my junior year and I will be returning to work there full-time this summer.

What's your favorite Olin Hall/ChemE memory?

Overall, I love the camaraderie in our major. Although the work is hard, it's comforting to know that there's usually someone else working in the basement. I also loved performing in the senior skit at the ChemE Holiday Party.



KATHERINE FEIN '15

Why did you decide to attend Cornell?

I loved the campus from the first time I visited, and everyone I met while visiting seemed so happy here. Also, the fact that Cornell is academically strong in so many departments reassured me that no matter what classes I took and which major I chose, I would get a good education.

What leadership positions did you hold while at Cornell?

I was a Peer Advisor for three years and I have been a teaching assistant for two chemical engineering classes: Mass and Energy Balances, and Chemical Kinetics and Reactor Design.

What were your major accomplishments as a leader?

I think helping the freshman adjust to Cornell and watching them bond in the Peer Advising class through team building activities and group discussions was my best accomplishment. Also, I don't know if I can take credit, but a lot of the ChemE-intended freshmen students I met

in my Peer Advising class are affiliated now, and that makes me happy!

What advice do you have for current student leaders or those looking to commit to leadership positions?

I think Peer Advising is a great way to start, because they train you in communication skills and give you some freedom in choosing activities for your class. Also, it's really important to remember how you felt when you were in the shoes of the people you are leading. Transitioning to college can be tough and chemical engineering classes are no walk in the park, so being a good listener and providing support is critical. Finally, working with a professor whose teaching style I respect and who places emphasis on teaching the TAs to teach well had an irreplaceable impact on my leadership experience.

What are your goals post-graduation?

I am going to graduate school to pursue a Ph.D. in chemical engineering at Carnegie Mellon. I would like to study drug delivery or some other biomolecular or health application of chemical engineering. I think I want to work in research and development in the pharmaceutical industry, but I've learned the value of not making blanket statements about the future. As a freshman and sophomore I swore I would head straight to industry and not get a graduate degree, but my plans shifted as I realized how much more I wanted to learn about chemical engineering and how much I liked research. So maybe I will be a professor or teacher of some sort someday.

What's your favorite Olin Hall/ChemE memory?

I think it is the accumulation of little memories that makes me appreciate this place so much. Our class spent a lot

of hours in the Scheele Undergraduate Lounge working, and while it got really stressful sometimes, we were pretty good at making each other laugh. Also, a lot of my big “Aha!” moments happened in this building, whether they were on homework, projects or research. A bunch of great memories also come from when I got to transition from being the student to being the teacher; I loved holding office hours and helping other students understand the same concepts I worked hard to learn. Finally, all the American Institute of Chemical Engineers (AIChE) events were great, especially the picnics at the beginning and end of the year when we got to enjoy the weather and get to know each other and our professors better.



BILL WHEATLE '15

Why did you decide to attend Cornell?

I come from a fairly disadvantaged background and was raised to believe that an education was the best way to elevate me from those conditions. With that in mind, I wanted to get the best education I could and attend an institution that

would challenge me beyond what I was used to in high school. I wanted to meet people from all walks of life to broaden my perspective. Finally, I wanted to apply my passion for science and mathematics to real problems. I knew that Cornell had a rigorous engineering program, and I felt that Cornell’s size would allow me to meet a wide variety of people. As a result, I applied, was thankfully accepted and decided to come. I have never looked back.

Oddly enough, what really sealed the deal for me was Ithaca’s gorgeous weather the day I visited Cornell in the fall of my senior year of high school. In hindsight, I can’t help but think that Ithaca tricked me a bit about the weather, especially in the winter.

What leadership positions did you hold while at Cornell?

I was the president of the Cornell chapter of the American Institute of Chemical Engineers (AIChE).

What were your major accomplishments as a leader?

The chemical engineering curriculum includes a required course known as Career Perspectives, in which juniors attend lectures about industry from Cornell alumni. It’s an excellent course, however, I shared the conviction with the rest of my class that it was positioned too late in our junior year, as it was held in the spring semester. At this point, many of my classmates already secured internship positions with companies for the upcoming summer. We felt that it would have been better to gain perspectives on industry and careers in chemical engineering earlier.

Taking this to heart, the vice president and I decided to revamp the AIChE general body meetings. We coordinated with alumni who had worked in industry

to offer their own perspectives during general body meetings the following fall. Hearing their speeches gave both sophomores and juniors further understanding of engineering careers and helped them to better navigate the internship process.

What advice do you have for current student leaders or those looking to commit to leadership positions?

Be proactive. Always be aware of your responsibilities. Make sure you check in with those to whom you have delegated work.

Have energy. Nothing slows an organization like leaders who aren’t motivated.

Finally, in the words of Henry James, “Three things in human life are important. The first is to be kind. The second is to be kind. And the third is to be kind.” Respect is earned, not given. A little kindness to all members of your organization goes a long way.

What are your post-graduate goals?

I will be attending the University of Texas at Austin to obtain a Ph.D. in chemical engineering. I’m open to exploring any number of opportunities afterwards, including working in industry or in academia.

What’s your favorite Olin Hall/ChemE memory?

One of my favorite ChemE memories was a potluck that a couple of ChemEs threw together during my junior year. Despite our hectic schedules and heavy workloads, it was refreshing to get together for dinner like we did. I certainly grew closer to classmates with whom I had never spoken, and it was great to further bond with friends outside of Olin Hall.

Profiles written by Alison Gabay '16.

STUDENT AWARDS & HONORS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS OTHMER SOPHOMORE ACADEMIC EXCELLENCE AWARD



Professor Engstrom (left) and Saagar Shah (right)

Saagar Shah '15

This award was established by the AIChE to recognize undergraduate academic excellence.

AWARD FOR OUTSTANDING SERVICE TO THE SCHOOL



Professor Archer (left) and Josh Porterfield (right)

Josh Porterfield '15

This award recognizes outstanding service to the professional and social culture of the School.

CORNELL ENGINEERING ALUMNI ASSOCIATION (CEAA) UNDERGRADUATE RESEARCH AWARD

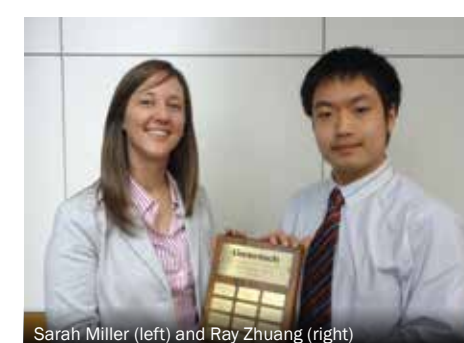


Professor Lucks (left) and Tim Abbott (right)

Tim Abbott '15

This award recognizes outstanding undergraduate research.

GENENTECH AND GEORGE SCHEELE OUTSTANDING JUNIOR AWARD



Sarah Miller (left) and Ray Zhuang (right)

Ray Zhuang '15

This award is sponsored by Genentech in memory of Professor George F. Scheele, former associate director of the school, to recognize academic excellence, and achievement in campus and professional activities.

MERCK ENGINEERING AND TECHNOLOGY FELLOWSHIP



Professor Archer (left) and Huma Haider (right)

**Huma Haider '15
Josh Porterfield '15
Ian MQueary '15**

This fellowship was established by the company to recognize undergraduate scholastic and technical excellence.

NATIONAL SCIENCE FOUNDATION GRADUATE FELLOWSHIPS



Bill Wheatle (left) and Professor Abruña (right)

**Bill Wheatle '15
Tim Abbott '15**

This award recognizes outstanding graduate students pursuing research-based degrees in STEM education.

OUTSTANDING CHEMICAL ENGINEERING UNDERGRADUATE RESEARCH AWARD



Professor Paszek (left) and Michael Hollander (right)

Michael Hollander '15

This award recognizes a demonstrated record of ability, indication of leadership, and professional promise.

OUTSTANDING UNDERGRADUATE TEACHING ASSISTANT OF THE YEAR AWARD



Professor Center (left) and Danielle LaBarbiera (right)

Emily Hsu '15 Danielle LaBarbiera '15

This award recognizes outstanding teaching by an undergraduate assistant and is chosen by the faculty.

PROCTER AND GAMBLE TECHNICAL EXCELLENCE AWARD.



Professor Zia (left) and Christine Codignotto (right)

Christine Codignotto '15

Established by the company to recognize undergraduate technical presentation skills.

FERDINAND RODRIGUEZ OUTSTANDING STUDENT AWARD IN POLYMERS AND ELECTRONIC MATERIALS



Professor Lucks (left) and Tim Abbott (right)

Tim Abbott '15

Honoring Professor Rodriguez and recognizing outstanding achievements in academics and in the professional community.

TAU BETA PI SCHOLARSHIP



Professor Zia (left) and Ruhani Arya (right)

Ruhani Arya '15

This scholarship was established by the engineering honor society to recognize exceptional senior engineering students.

SPHINX HEAD SOCIETY



Professor Duncan (left) and Daniel Petralia (right)

Daniel Petralia '15

This award recognizes Cornell seniors who have demonstrated respectable strength of character on top of a dedication to leadership and service.

CHEMICAL ENGINEERING OUTSTANDING SCHOLAR AWARD Saagar Shah '15

This award recognizes outstanding scholarship and leadership in campus, community and professional activities.

CONGRATULATIONS TO THE CLASS OF 2015!

The School awarded 81 Bachelor of Science degrees in chemical engineering in 2015. As of the middle of May, 50 percent were employed in their professional careers and 30 percent planned to continue their studies in graduate school. A dozen graduates were seeking employment, and one planned to look for work in their home country. Two were undecided about their future plans.

Our recent graduates are employed largely in the area of consulting, then chemicals and consumer products. Several

entered positions in pharmaceuticals and a few are in electronics and semiconductors, food products and petroleum products. Half of the class accepted employment among 30 companies. The largest employers were Automation and Control Specialists, Air Products and Chemicals, and Deloitte, followed by 3M, Accenture and Irwin Engineers. The median starting salary was \$73,000.

Almost one-third of the class are continuing their academic pursuits: Twelve have begun a chemical engineering

Ph.D. program, two are getting a Ph.D. in bioengineering underway, one has started a Master of Science degree in chemical engineering practice, while another has begun an industrial engineering and operations research M.Eng., nine have entered a Cornell University M.Eng. program; two in biomedical engineering, one in financial engineering, one in systems engineering and five in chemical engineering.



Class of 2015

1 Heather Barton	17 Bill Wheatle	34 Olivia Tiburzi	51 Emily Hsu	68 Ian McQueary
2 Cara Becher	18 Zach Wu	35 Jen Castor	52 Ruhani Arya	69 Tom Evanowski
3 Kaitlyn Bacon	19 Ann Lu	36 Hyesoo Ko	53 Lindsay Dougherty	70 Charles Sharkey
4 Carmen Lee	20 Bryan Malecky	37 Jessica Liu	54 Dan Petralia	71 Ian Slauch
5 Alicia Urrutia	21 Danielle LaBarbiera	38 Jaehee Shin	55 Sam Masri	72 Adrienne Scott
6 Misha Baheti	22 Bari Grossman	39 Ji Min Yang	56 Mike Hoyt	73 Tom Hittinger
7 Mishka Gidwani	23 Kaylyn Bacha	40 Jessica Grzyb	57 Michael Kemp	74 Bryan Warrington
8 Ranjita Gurijala	24 Alexandra Koza	41 Nicole Klei	58 Jeff Horner	75 Travis Wasson
9 Christine Codignotto	25 Sarah Kamal	42 Priyama Shah	59 Tim Abbott	76 Aziz Almajid
10 Athina Angel	26 Saddmun Ahsan	43 Muhammad Khan	60 Dan Kezerashvili	77 Airic Suarez
11 Eri Tomita	27 Jonathan Mares	44 Ryan Douma	61 Oliver Zixian Lu	78 Josh Porterfield
12 S. Huma Haider	28 Rebecca Chew	45 Dan Peng	62 Justin Schindler	NOT PICTURED:
13 TeAnn Nguyen	29 Jeffrey Yee	46 Michael Hollander	63 Chris Canova	Christian Choi
14 Anne Dickey	30 Kevin Hung	47 Katrina Curtiss	64 J. Carl Schultz	Chris Rogers
15 Priya Tembhekar	31 Ruize (Ray) Zhuang	48 Jing Zhang	65 David Perry	Ogbogu Ukuku
16 Kathy Fein	32 Saagar Shah	49 Mohammad Radiyat	66 Siyang Qin	Hannah Vining
	33 Noor Alam	50 Zhiwen Huang	67 Mark Filipkowski	

GIVING OPPORTUNITIES

We are grateful to the many alumni and friends of the department for their generous support of the School and its programs. Your continued generosity allows us to sustain and enhance the quality of the School's programs and its reputation for educating engineers at the top of the field. Please review the list of giving opportunities below and consider a gift that will help the school accomplish one of the following objectives.

MODERNIZING OLIN HALL INFRASTRUCTURE FOR RESEARCH & EDUCATION

Creation of a Cornell Institute for Biological Design and Manufacturing

Chemical engineers at Cornell are using the principles of biological and engineering design to harness living organisms for manufacturing chemical products. The Institute for Biological Design and Manufacturing will capitalize on this trend to catalyze progress towards a new 'biomanufacturing economy,' in which engineers develop biological systems to manufacture new products—materials, therapeutic drugs and fuels—that address some of the world's most pressing problems.

Gifts in support of the institute will allow the School to renovate and upgrade space in Olin Hall that will house the institute. Your gift will also provide annual support for research and education programs in support of the institute's mission.

Upgrade the Unit Operations Laboratory

The Unit Operations (UO) Laboratory is a capstone course taken by all Chemical and Biomolecular Engineering (CBE) students in their senior year. CBE alumni credit the UO lab for honing technical writing, teamwork and leadership skills important to their career successes in diverse fields. Key to the success of the UO lab experience is a good selection of experiments that produce reliable data.

Our effort to upgrade the laboratory is a high priority for sustaining the School's reputation for excellence in

educating students. Gifts in support of the UO lab project can be earmarked to either of the following two funds: a current-use fund, which will support addition of new experiments and upgrades to existing experiments in the laboratory; or an endowment, which will support continuous improvement of the laboratory infrastructure.

RESTORING THE OLIN HALL MURAL

The Olin Hall mural, located in the Fred H. Rhodes Lounge, has been a centerpiece in the lounge for over a half-century. The mural depicts the rigorous journey Cornell chemical engineers took in the Dusty Rhodes Era to earn their undergraduate degree. It's unvarnished and now a clearly dated account of the undergraduate experience in Olin Hall has been termed iconic by alumni and friends of the School; the wall on which it is painted is easily the most photographed surface in Olin Hall by returning alumni.

The mural was originally painted in 1949 by Elizabeth Adelaide Briggs, daughter of Professor Thomas R. Briggs, a highly respected chemistry professor. It was first restored in 1980 by David Finn, son of our late colleague Emeritus Professor Bob Finn, through the generous support of Mike Sfat B. ChE. '43, and has since been restored two additional times (in 2000 and with minor renovations in 2010).

The mural is again badly in need of restoration. With your help, we are committed to restoring the Olin Hall mural this year. A total donation of \$25,000 is needed to complete this project. Any funds raised above this amount will be held for future expected preservation and restoration of the mural.

ENHANCE THE GRADUATE EXPERIENCE

Graduate Fellowships

Attracting talented graduate students to the School is a key goal in our pursuit of excellence in research. Your gift will allow the School to meet its goal of providing competitive graduate fellowships to every first-year graduate student enrolled in the chemical engineering program.

Teaching Immersion Fellowships for Doctoral Students

The goal of CBE's teaching immersion fellowships is to facilitate the development of doctoral students committed to careers in academia. Gifts in support of these fellowships will be used to fund graduate students who serve as teaching assistants in multiple courses.

Graduate Student Research Symposium

In 2010 CBE launched an annual graduate student research symposium in which advanced graduate students present talks and junior students present research posters to an audience of their peers, faculty and guests from industry. This naming opportunity will provide endowed funds to be used to continuously support the graduate student research symposium.

Energy Economics and Engineering (EEE) Masters Fellowships

Our Energy Economics and Engineering Masters of Engineering concentration continues to provide a unique mechanism for preparing students with physical sciences and engineering backgrounds for careers in public policy, engineering management and consulting. The high cost of matriculating in the program presents a barrier to many talented applicants. Gifts will be used to provide named, competitive fellowships for select students pursuing the EEE Masters of Engineering concentration.

Product Design for Manufacturing (PDM) Masters Fellowships

Beginning in Fall 2015 the School will offer a new Masters of Engineering concentration in Chemical Product Design for Manufacturing. The program combines coursework in chemical engineering, principles and practice of product design and new business development with industrial internships to prepare chemical engineers able to innovate and lead the emerging field of product design for manufacturing. As with the EEE concentration, the high cost of matriculating in the Masters of Engineering program presents an insurmountable barrier to many talented applicants. With the specific aim of increasing the quality of the student pool enrolled in the PDM Masters of Engineering program, gifts will be used to provide named, competitive fellowships for select students pursuing the PDM concentration.

FOR MORE INFORMATION ON THESE OR ANY OTHER GIVING OPPORTUNITIES, CONTACT

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Chemical and Biomolecular Engineering

