CornellEngineering
Robert Frederick Smith School of Chemical and Biomolecular Engineering

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REIMAGINING OLIN HALL TO ENHANCE RESEARCH AND EDUCATION

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MESSAGE FROM THE DIRECTOR: ABE STROOCK

DEAR ALUMNI AND FRIENDS OF THE DEPARTMENT,

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WELCOME FENGQI YOU

Fengqi You has joined the Smith School faculty as the Roxanne E. and Michael J. Zak Professor. He is also a David Croll Faculty Fellow.

"I believe that chemical engineers should be able to do everything," says You. "Society faces many issues in the areas of food, water and energy production; chemical engineers can help come up with sustainable solutions to important challenges in these areas." You's focus is on the development of novel computational models, optimization algorithms, and systems analysis and design methods to improve process manufacturing, energy systems and sustainability. His work straddles the line between operations research and chemical engineering.

"Michael Zak ('75 OR) endowed the faculty chair I am in because he believes strongly that it is essential to link the field of operations research with chemical engineering," says You. You received his undergraduate degree in chemical engineering from Tsinghua University. He earned his Ph.D. from Carnegie Mellon University. He then worked in the Mathematics and Computer Science Division at the Argonne National Laboratory for two years and taught at Northwestern University for five years before coming to Cornell in 2016.

"This position in the Smith School is really the perfect fit for me," says You. "I am excited to be at Cornell. My chemical engineering colleagues are gifted and open to collaborations. Also, I think there will be many opportunities to work with students and professors across the College of Engineering and throughout Cornell."

You's long-term goal is to create computational and modeling tools that decision makers in government and industry will be able to use to make better decisions with the idea of sustainability as a guiding factor. "We have known for a long time that people need to make better decisions about where and how we get our food, water and energy, yet our decisions are not as good as we expected. I want to develop tools that will be analogous to the tools weather forecasters use today," says You, who uses advanced mathematical, computing and optimization techniques in his work.

You believes that now is the perfect time to create these tools. "With more and more data available to researchers it is time to take that data and push the limits of sustainability analytics," says You. Processes used to manufacture biofuels, solar cells, shale gas and many other products could be made more efficient and more sustainable. With his knowledge of chemical processes and his background in operations research, You is ideally situated to take advantage of the big data available to help the world better manage its resources while at the same time helping companies save money through more efficient operations.

"Engineering is a way of thinking systematically," says You, who is teaching the capstone chemical engineering design course. "I want our students to include sustainability in the way they think about problems."

"I BELIEVE THAT CHEMICAL ENGINEERS SHOULD BE ABLE TO DO EVERYTHING. SOCIETY FACES MANY ISSUES IN THE AREAS OF FOOD, WATER AND ENERGY PRODUCTION; CHEMICAL ENGINEERS CAN HELP COME UP WITH SUSTAINABLE SOLUTIONS TO IMPORTANT CHALLENGES IN THESE AREAS."

— Fengqi You

WELCOME JEFFREY VARNER

Jeffrey Varner, professor in the Smith School, would not describe himself as artistic. "My mom has become a painter as she has gotten older," says Varner. "She has sold many of her works. They are good, I guess, but they are beyond me. They are abstract and I just don't get them."

What Varner does "get" is how to use computer code to model biological processes. "You could say that my particular artistic bent comes out in mathematics and computer code," says Varner. "I have written some of my programs as many as 10 times to make them elegant. Clear, simple code can be beautiful and powerful." The code Varner writes models the flow of signals and materials in biological signal transduction and metabolic networks. When a molecule from outside a cell activates a receptor on the cell surface, a chain of biochemical events is triggered, leading to a cellular response.

Even though cells are the basic unit of life, their biochemistry is anything but basic. Modeling the chain of reactions that takes place as a signal makes its way from the surface to the nucleus of a cell is a complex undertaking. Once the signal reaches the nucleus, the cell may change its metabolism, change its shape, alter the expression of certain genes or change in its rate of division. Understanding the flow of these signals through cells could help researchers learn how to reprogram the signal's flow in signal transduction networks. In effect, we could start to tell the cell what to do.

Varner earned his B.S., his M.S., and his Ph.D. from Purdue University. He was then a postdoctoral researcher at the Swiss Federal Institute of Technology (ETH-Zurich), where he studied signal transduction mechanisms involved in cell-death (apoptosis) under Professor Jay Bailey. Varner then went to work at Genencor-DuPont, in Palo Alto, California. During his years at Genencor, Varner worked on various projects focused on using protein therapeutics in the treatment of colorectal cancer, chronic lymphocytic leukemia and the production of proteins.

In 2005 Varner left Genencor to become a professor of chemical and biomolecular engineering at Cornell. During this first stint at Cornell, Varner continued his research into the development of physiochemical modeling tools to rationally reprogram human signal transduction architectures. He earned an NSF CAREER Award in 2009 and he was honored with the Mr. and Mrs. Richard Tucker College of Engineering Teaching Excellence Award in 2010. He is also very engaged with integrating undergraduates into research; he mentored several Merrill Scholars, Rawlings Cornell Presidential Research Scholars, and McNair Diversity Programs Undergraduate Researchers over the last 10 years.

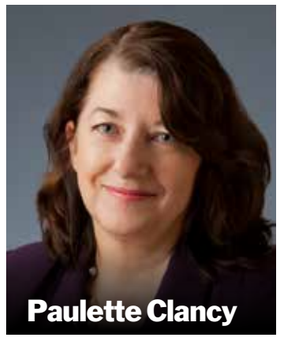
Varner spent a year at Purdue University and rejoined the Smith School at Cornell in 2016. His lab continues with its focus on metabolic and signal transduction processes important in biotechnology and human health. The many ongoing projects in the Varner Lab are joined together by the use of mathematical modeling in combination with experimental investigation to understand and then to eventually manipulate biological function.

Of particular interest to Varner has been the biochemistry of human blood. He is working to build a better understanding of the processes that occur following injury; for example, blood coagulation or infection. His eventual goal is to be able to use what he learns to create effective treatments to control hemorrhage. "Few people know that trauma is the leading cause of death for persons 36-years-old and younger, and that hemorrhage accounts for 40 percent of all trauma deaths," says Varner. "I want to understand how the body responds to trauma and how we can manage this response to save lives." Other specific areas of study for Varner are to learn more about why cancer cells make decisions. For example, why do they choose a less efficient route than other cells to make energy? Varner is also interested in how stem cells produced in bone marrow sense the world around them and make lineage decisions.

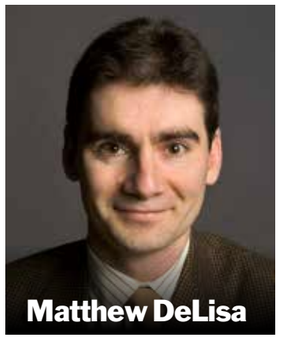
"I love the biology behind all these processes," says Varner. "But what I really bring to the table is the ability to explain the biology through mathematical modeling."

FACULTY NEWS & AWARDS


Chris Alabi


Paulette Clancy


Michael Shuler

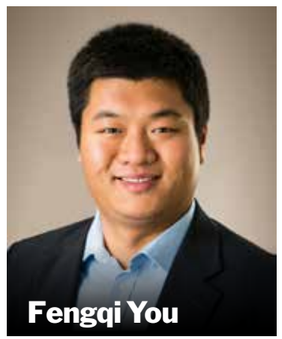

Matthew DeLisa

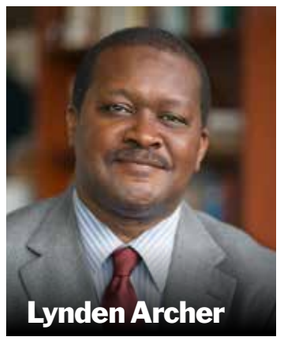

Jim Engstrom


Matthew Paszek


Abe Stroock


Jeffrey Varner


Fengqi You


Lynden Archer


Jeffrey Tester

Chris Alabi, assistant professor and the Nancy and Peter Meinig Family Investigator in the Life Sciences, was recognized in fall 2016 as a recipient of the Cornell Engineering Research Excellence Award. This award was given in recognition of Alabi's research contributions and leadership. Additionally, Tau Beta Pi Engineering Honor Society selected Alabi as the winner of the 2017 Tau Beta Pi Professor of the Year Award. The award includes a $1,500 prize that will be presented at a special dinner.

Paulette Clancy, the Samuel W. and M. Diane Bodman Professor in Chemical Engineering, received a 2016 College of Engineering Excellence in Advising Award. Clancy was also awarded a Kaplan Family Distinguished Faculty Fellowship in Service-Learning, which recognizes the importance of civic engagement in higher education. Clancy was recognized as having made significant impact on education at Cornell by involving her students in challenging community-based learning projects.

Michael Shuler, the Samuel B. Eckert Professor of Engineering, and Matthew DeLisa, the William L. Lewis Professor of Engineering, published the third edition of the book, "Bioprocess Engineering: Basic Concepts." The third edition is an extensive update of the world's leading introductory textbook on biochemical and bioprocess engineering and reflects key advances in productivity, innovation and safety. The authors review relevant fundamentals of biochemistry, microbiology and molecular biology, including enzymes, cell functions and growth, major metabolic pathways, alteration of cellular information and other key topics.

Jim Engstrom, professor, served as a guest editor for a Special Topic issue of The Journal of Chemical Physics. Working with Andy Kummel, a professor at University of California - San Diego, Engstrom developed the topic entitled: "Atomic and Molecular Layer Processing: Deposition, Pattering and Etching." Over 20 research groups world-wide contributed to the special issue, which covers thin film processing technologies that promise atomic and molecular-scale control, and have received increased interest in the past several years as traditional methods for fabrication begin to reach their fundamental limits.

Matthew DeLisa, Matthew Paszek, Abe Stroock and Jeffrey Varner are among the faculty members participating in the Center on the Physics of Cancer Metabolism—a new multi-institutional translational research unit established at Cornell with a $1.9 million National Cancer Institute grant. The goal of the center is to combine the strengths of different interdisciplinary research groups to gain unprecedented understanding of the biological and physical mechanisms regulating how tumors function and metastasize, or spread, in the human body's microenvironment.

Fengqi You, the Roxanne E. and Michael J. Zak Professor and David Croll Faculty Fellow, was recognized by AIChE Journal as having authored its two most cited papers published in 2015: "Multiobject Optimization Of Product And Process Networks: General Modeling Framework, Efficient Global Optimization Algorithm, And Case Studies On Bioconversion" and "Optimal Design And Operations Of Supply Chain Networks For Water Management In Shale Gas Production: MILFP Model And Algorithms For The Water-Energy Nexus." You was also invited to join the editorial board of ACS Sustainable Chemistry & Engineering.

Lynden Archer, the James A. Friend Family Distinguished Professor of Engineering, and Ph.D. candidate Wajdi Al Sadat were recognized on Scientific American's 2016 list of World Changing Ideas for their electrochemical cell designed to sequester carbon from the atmosphere and turn it into electricity. Archer was also named deputy editor of the high impact, multi-disciplinary journal, Science Advances.

Jeffrey Tester, the Croll Professor of Sustainable Energy Systems, and postdoctoral researcher Roy Posmanik were featured by Time Magazine for their work on converting food waste and agricultural waste into liquid fuels using hydrothermal processing. The online coverage included a video that was filmed on campus and produced by Time.

FULFILLING THE PROMISE OF "MATERIALS BY DESIGN" A CHEMICAL ENGINEER'S JOURNEY

By Paulette Clancy, Samuel W. and M. Diane Bodman Professor in Chemical Engineering

Our daily lives are full of benefits from the manufacturing of new materials with some amazing properties, from incredibly bright colors in the camera on your cell phone (thanks to quantum dots), to athletic gear (ultra, water-repellent or heat and moisture-conducting), to orthotic devices to help the disabled walk more stably (employing phase change materials to sense mechanical stress). Our imagination allows us to hope for even more amazing materials in the future: suits that will allow us to walk up vertical walls, fully functional artificial skin that can be printed, designing drugs with full control over polymorphs (and hopefully, side-effects), laptops with extended battery lives, a transparent solar cell that you could install yourself on your windows and not lose any ability to enjoy the view of your garden.

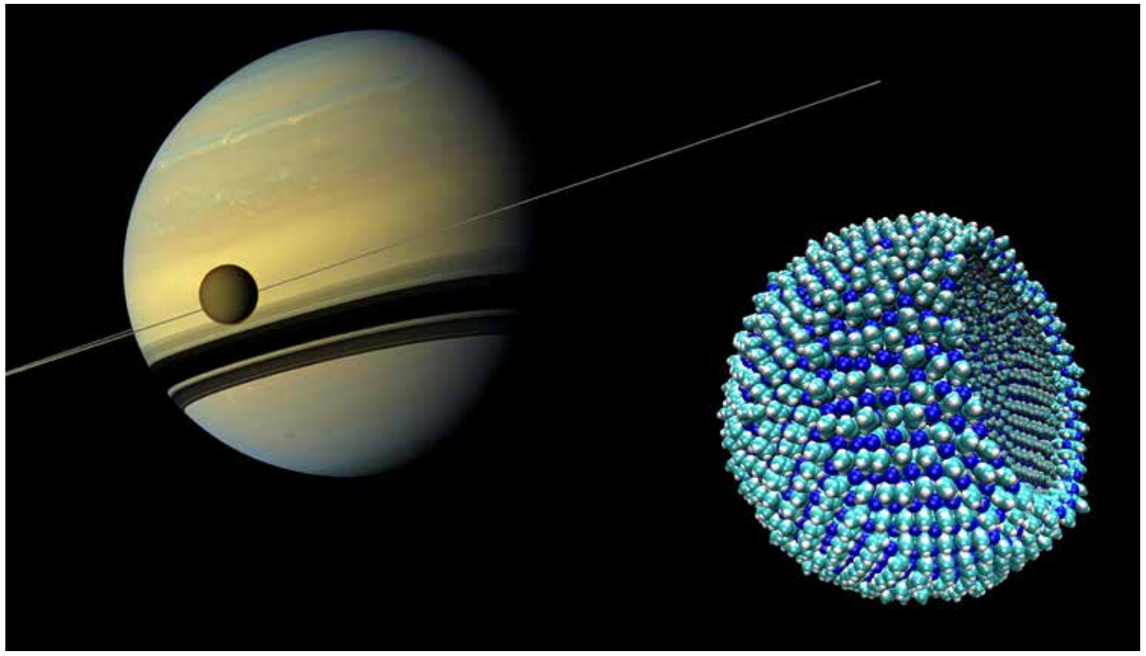
The Clancy Group wants to hasten those days too. We are currently looking at a number of exciting projects that we hope will make their way into the marketplace, the hospital or your home. We are a computational group, and we like to say that we can study any material as long as it has electrons! Fortunately that's not much of a constraint. But because we are always pushing ourselves to tackle the most challenging problems in materials modeling, we have extreme (indeed, unbounded) needs in terms of computational resources and we frequently find that we have to create our own algorithms because the calculations we want to make are not possible with standard tools.

At this point, you might ask: "What does a chemical engineer bring to these problems?" The answer is that we invariably need to understand both the thermodynamics and the kinetics of the system. Increasingly, we need to understand chemical reactions that create those materials and the "reactors" and processing conditions that allow exquisite control of the process, perhaps down to the molecular level. You also need the mathematical skills to translate these physico-chemical phenomena into code and the engineering intuition to analyze the results. These are rarely the skill sets of a computer science major, or an electrical engineer, or even a material scientist (though they come closest). In this article, we'll explore a few of the fascinating projects that the Clancy Group has undertaken in the recent past or are actively under investigation.

PROJECT 1: COULD LIFE EXIST ON TITAN? AND WHAT MIGHT IT LOOK LIKE?

This project really exemplifies one of Cornell's greatest characteristics: the ability to collaborate seamlessly across colleges. Cornell astronomer Jonathan Lunine asked us to make computer simulations of nitrogen-based molecules and assess which, if any, could self-assemble into a vesicle, as a first step towards protobiology - namely, finding shelter.

While those early ideas did not pan out, chemical engineering Ph.D. candidate James Stevenson decided to look at all the molecules identified by the Cassini spacecraft as being present in Titan's atmosphere. It's so cold on Titan that its methane seas are barely liquid and water would be as solid as a rock. This gave us a list of potential "ingredients" and we found a winner! Our atomically realistic simulations suggested that the vesicles needed for compartmentalization, a key

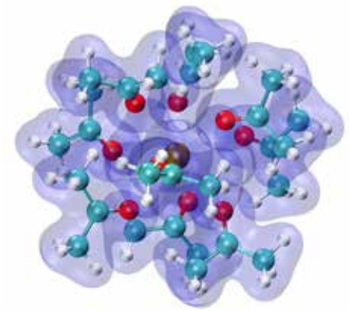


requirement for life, would be very different to those found on Earth. Rather than long-chain, nonpolar molecules that form the phospholipid membranes in our own watery world, we found that in liquid methane at cryogenic temperatures, membranes on Titan could be formed from acetonitrile molecules in the atmosphere. The polar nitrogen-rich "heads" of these short-chain molecules self-assembled into a vesicle. We called such membranes azotosomes, and found that they were, at least thermodynamically, metastable. Perhaps most fascinating of all, we found that the flexibility of the acetonitrile membranes to mechanical stress is almost the same as phospholipid membranes on Earth. Is this a pre-requisite for other protobiological lifeforms? You could imagine that a flexible membrane is important for cell division needed for growth or reproduction. We also identified a couple of other molecules, present in Titan's atmosphere, that were capable of forming vesicles. The availability of molecules with an ability to form cell membranes does not by itself demonstrate that life is possible. However, it does direct our search for exotic metabolic and reproductive chemistries that could be compatible under cryogenic conditions.

Not surprisingly, this first demonstration of possible vesicle formation in a methane-rich cryogenic world sparked a lot of public attention in the media. The BBC made a documentary about azotosomes that aired in 2016; the Cambridge Science Center in the U.K. used our images in a display about life on other planets; and children speculated on Reddit about the nature of the fish on Titan. Our next step will be to look at the options for metabolism inside such vesicles and on the nature of membranes in watery moons like Enceladus.

PROJECT 2: CAN YOU MAKE 2D MATERIALS INTO DEVICES THAT PROMISE 100X THE SPEED OF CURRENT SILICON-BASED COMPUTER CHIPS? AND GROW THE KEY COMPONENT IN A BEAKER?

The breadth of our work surrounds studies of electronic materials, especially the leading edge of electronic devices that are faster and smaller than any that currently exist. A lot of interest currently resides in two-dimensional materials, which offer



unimaginably thin (one atomic layer) materials capable of transporting electrons at speeds that are orders of magnitude faster than current silicon-based materials.

One of the leading contenders in the 2D materials world is graphene nanoribbons, which are semiconducting if the ribbons are less than 1.5 nm in diameter (less than 1/10 of the diameter of a human hair). In a recent paper in ACS Nano, we described the first experimental graphene nanoribbon devices to conduct electrons. This result belied a lot of problems that the Clancy Group worked hard to overcome. The main issue arose from the fact that these nanoribbons are incredibly sticky. Once any part of these micron-long ribbons contacts another ribbon, they "zip" together and roll up into a ball (for an analogy, think of the sugary snack Fruit by the Foot). Our organic chemist collaborator, Will Dichtel, who created the chemistry to make ribbons in solution, called them "ink blots" for the dark clumps of precipitates that formed.

Adding long chains to the ribbons' edges could probably help solubilize them in a suitable solvent, but which side-chain/solvent combination to choose? We found a metric, the enthalpy of binding, which was fast enough to calculate that it allowed us to quickly "triage" which were the best side-chain/solvent combinations to use. This proved to be very helpful in cutting down options for Dichtel's students in the lab and it provided some underlying "design rules" which gave physico-chemical insight into good choices without having to perform any simulations.

We also calculated the far more computationally free energy of aggregation because it was clear that entropy (as well as enthalpy) is important. We found that there is one very favored aggregation mechanism (sliding one ribbon over another) and one that is highly disfavored (face-to-face approach, because you have to squeeze the solvent out of the way). None of us expected the simulation-derived result that no matter how these long, flat, snake-like ribbons approach each other they always reorient to align themselves along the ribbon. But the net result of hundreds of these ribbons touching at random locations creates the "ink blot." Understanding the aggregation process allowed us to design better side-chains to lessen aggregation.

The second phase of our contributions to this project occurred when, after a heroic struggle by our Princeton ChE collaborators (Lynn Loo's group) to make a working device (albeit not a great one), we were asked to give our opinion of the reason why the electronic properties weren't as good as we expected. We used accurate quantum mechanically-based models and a lot of computational cycles to show the quantitative effect of misaligning the ribbons. We showed that stacks of ribbons, especially if their long axes weren't well aligned, had a seriously deteriorating effect on the electronic properties. This proved our collaborators' fears that you really need single, well-aligned graphene nanoribbons to have the impressive electrical properties that they promised. This effectively meant that we needed other means of fabricating the materials and depositing them on a substrate in single lines like toy soldiers. While this was disappointing, it has pointed the way forward to make better devices from these exotic materials.

And along the way, we had fruitful tightly interwoven collaborations, not only with Dichtel and Loo, but also with NSF program officers and, especially, industrial company representatives from IBM, Intel, Micron, etc., since part of the funding was provided by the Semiconductor Research Corporation. In fact, the success of projects like mine in this inaugural NSF program has encouraged a new NSF/SRC funding model that was just announced. There were other benefits too: My student (now Dr.) Jonathan Saathoff spent a summer in Lynn Loo's lab learning to make electronic devices. But he also formed friendships with the Loo team that led to other collaborations, and ultimately papers and funding. And several undergraduates and a high-school physics teacher were trained in quantum mechanical calculations of electronic properties and molecular simulation techniques. A wonderfully productive project.

PROJECT 3: HOW DO YOU SIFT THROUGH THOUSANDS OF POTENTIAL SOLAR CELL MATERIALS TO FIND THE FEW THAT HAVE BETTER EFFICIENCY THAN SILICON SOLAR CELLS AND ARE FAR MORE ENERGY CONSERVATIVE TO MAKE?

I want to conclude this article with our most ambitious study to date, one that deals with a remarkable new solar cell material that falls into a big class of crystal structures called perovskites. Actually, they are known by the unwieldy name "hybrid organic-inorganic perovskites" (HOIPs) because this perovskite sub-set involves an ABX3 structure in which "A" is a metal ion

"WE OFTEN SEEM TO ACT AS "MYTH BUSTERS" BY PROVIDING FUNDAMENTALS-BASED RESULTS THAT PROVIDES DEFINITION AND GROUNDING TO THE FIELD."

— Paulette Clancy

(usually lead, but increasingly a lead-tin mixture), B is a 'chaperone' cation whose role is unknown (this could be organic, like methylammonium ions and formamidinium ions, or inorganic like caesium) and X is a halide (could be a mix of Cl, Br, I). Also, the processing requires that you use a suitable solvent mixture of some composition. There are about a dozen solvent and additive choices that have been reported in the literature.

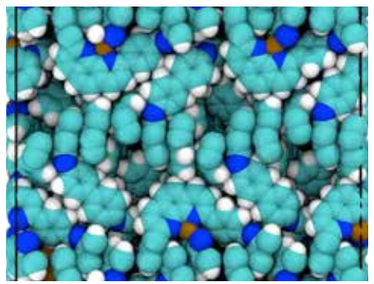
If you are keeping score, there are thousands of combinatorial options that could be investigated as potential solar cell materials. Since the solar cell efficiency of the best current prototype is comparable to that of the market-leader, silicon (around 22 percent in the lab!), research to find better choices of cations and processing is intense, with key labs working around the world to make the best device. This headlong rush has proceeded in a largely trial-and-error way, with top labs creating processing protocols that seem to work (albeit not very reproducibly). Our lab has been trying to inject some fundamental understanding into finding the best process to make the best performing material in a reliable, reproducible way.

With a large team of talented Cornell students (Ph.D., M.S., M.Eng. and undergraduates) we have used cutting-edge computational tools (ranging from quantum mechanical calculations at the level of describing electrons to molecular-scale reactive force fields to continuum level optimization methods) to understand what factors affect the solubilization of the lead cations (step 1 of the process) versus those (rather different forces) that promote aggregation of the perovskite lattice's building blocks. As validation, our calculations correctly ranked about a dozen solvents in terms of their ability to solubilize the lead cations (confirmed experimentally in Lynn Loo's group at Princeton), which gave us the confidence to predict that (and why) an additive (THTO) found by Professor Josh Choi, Ph.D. '12, would be a better solvent than any other currently used solvent. Our discovery of a quick metric for improved solubility and dative bonding (reviving a 1930's discovery by Mayer) was published in Chemistry of Materials in 2016.

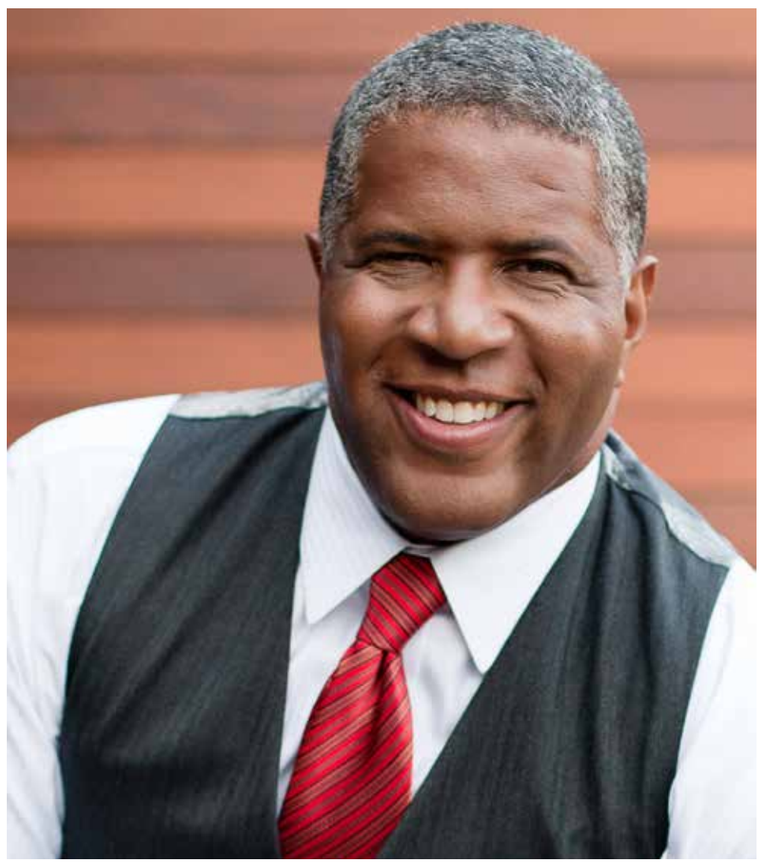
The value of such a metric goes beyond the HOIPs and has already attracted two new collaborations to our team, from University of California, Los Angeles, and University of Virginia. We are now tackling step 2 in the process, the aggregation of building blocks into the correct crystal lattice and learning why experimentalists need an "anti-solvent" at that stage. Importantly, we are tackling the otherwise overwhelming task of judging which combination of cations, halides and solvent blends work best. As a test case, we have predicted the best combination (as judged by our Mayer Bond Order metric) of cations and halide option in a choice of 10 pure solvents (72 combinations in all). We used expensive quantum mechanical calculations to determine which of all 72 was the best at solubilizing the lead cations; then we used a Bayesian search optimization to accelerate our search. This option found the best solution in only 11 tries!

We are now tackling the more complex problem of solvent blends. Our predictions of the best combination of cations, halides and solvent blends (a number far too high to tackle experimentally or computationally without the help of the Bayesian optimization) are in the works. And predictions of poor, good and best options for the pure solvent case are now being verified experimentally in Professor Lara Estroff's lab (Materials Science and Engineering, Cornell University). This fast-moving field is a challenge, but we have the chance to be one of the very few groups providing molecular-scale insight that will help shape the future progress of this material, now that the "low-hanging fruit" have been harvested.

As you've read, the Clancy Group (comprised of 15 to 20 students) is working on some very exciting projects. We often seem to act as "Myth Busters" by providing fundamentals-based results that provide definition and grounding to the field. Our strides in hastening the emerging area of physical analytics are gaining traction and will open some truly amazing opportunities for fulfilling the goal of President Obama's Materials Genome Initiative: faster, cheaper, better. We won't get there without computation shining a light on the most productive paths to take. That's where the Clancy Group intends to go.



SMITH GIFT FUNDS FIRST INITIATIVES, KEEPS CBE AT FOREFRONT OF RESEARCH AND EDUCATION



Research into the development of life-saving drugs, bioreactors to expand student learning, new curriculum to merge chemical engineering with computational optimization, and a plan to make STEM more inclusive at Cornell are among the first initiatives funded by a transformative gift from entrepreneur Robert F. Smith '85 and his Fund II Foundation.

Smith, CEO of Vista Equity Partners, made national news in 2016 when he and his foundation committed $50 million toward endowments to support chemical and biomolecular engineering at Cornell and to support students traditionally underrepresented in the STEM fields. In recognition of his support, the university named the Robert Frederick Smith School of Chemical and Biomolecular Engineering.

Smith's vision for transforming the school at all levels is now coming to fruition with CBE expanding opportunities for faculty and students through new research, equipment, curriculum and inclusion. Although the first initiatives are funded with a small portion of the gift, they're having a large impact on the school.

"The Smith gift to CBE has put the school in a strong position to define the future of our field in research, education and societal impact," said Abe Stroock, the William C. Hooey Director and Gordon L. Dibble '50 Professor of Chemical and Biomolecular Engineering. "We are investing the gift in 'Smith initiatives' proposed by faculty and students to seed new research directions, open new educational opportunities in Olin Hall and increase the diversity of students across all of our programs. The great ideas are out there in our community. The Smith gift is allowing them to blossom."

THE NEWLY FUNDED INITIATIVES ARE:

BIOREACTORS FOR BIOMOLECULAR CURRICULUM, PRODUCT DESIGN, UNIT OPERATIONS LAB

Through the Smith gift, CBE has purchased seven bioreactors that will bring a more hands-on experience to undergraduate students learning about biomolecular engineering. Four of the New Brunswick Scientific BioFlo 310 bioreactors will be used in the Unit Operations Laboratory as a fermentation experiment, and are the lab's first in many years designed to demonstrate principles of bioprocess engineering.

The bioreactors present a unique opportunity for students to learn about fermentation kinetics and how to measure bacterial growth and byproducts, according to Brad Anton, associate professor and instructor of ChemE 4320 – Chemical Engineering Laboratory. The bioreactors also make for one of the most fun experiments in the lab, as students will use them to brew beer and make hard cider. Anton has enlisted the help of Jeff Conuel '92, former brewmaster at Ithaca Beer Company, and Greg Peck, assistant professor of horticulture and Cornell's resident hard-cider specialist, in accessing supplies and designing the experiment.

The other bioreactors will first serve in ChemE 2880 – Biomolecular Engineering Fundamentals and Applications to teach the biotechnology and bioprocess involved in protein engineering. The equipment has allowed the course to evolve from a lecture-only course into one with hands-on lab sessions.

Matt Paszek, assistant professor and course instructor of ChemE 2880, says students will use the lab time to design a DNA sequence that encodes a product of interest—such as industrial enzymes, pharmaceuticals and biologics—transfect the custom DNA into a host organism, such as the bacterium E. coli, perform a fermentation in the new bioreactors, and recover their protein product for analysis. Paszek says the lab experience will be valuable to all students, but especially to those that are biomolecularly-focused and preparing for an internship in an industry such as biopharmaceuticals.

The Smith gift is also funding probes, computers, hydrometers and other accessories needed to operate the bioreactors.

CELL-FREE PROTEIN SYNTHESIS RESEARCH

Seed funding provided by the Smith gift has helped a research project blossom into a $374,000 endeavor with the potential to improve the way life-saving pharmaceutical drugs are manufactured.

A collaborative CBE research group hopes to create a microfluidic platform that can organize biological reactions in a way that mimics cellular processes. In particular, the team is using tailored biomembranes to provide the organization of protein machinery that cells use to sequence reactions when attaching complex sugar molecules to proteins, a process known as glycosylation. The group consists of Susan Daniel, associate professor; Matt DeLisa, the William L. Lewis Professor of Engineering; Matt

SMITH GIFT FUNDS FIRST INITIATIVES

Paszek, assistant professor; and Mike Shuler, the Samuel B. Eckert Professor of Engineering.

There would be several advantages to using the platform over an actual cell culture, one of which is in the manufacturing of protein-based pharmaceuticals. Such a platform would allow for cell-free protein synthesis, in which essential raw materials and biological enzymes are mixed together to produce batches of high-value biological products without the complications of keeping cells alive. Synthesizing these products without a cell culture would be transformative for in-vitro biomanufacturing and would allow production of novel compounds that might not exist in nature, but have therapeutic benefits.

The seed funding was key to establishing a proof of principle for the microfluidic biomembrane platform, and resulted in a larger grant from the National Science Foundation that will allow the research to advance.

COMPUTATIONAL OPTIMIZATION COURSE AND TEXTBOOK

The Smith gift is funding the development of a new textbook on computational optimization in chemical engineering that will be used in conjunction with a proposed senior/masters-level course on the same topic. The curriculum will broaden the Smith School's impact on operations research as well as computer informatics and data analytics, and aims to support the development of students seeking future careers in those areas.

The textbook—to be authored by Fengqi You, the Roxanne E. and Michael J. Zak Professor and David Croll Faculty Fellow—will include carefully selected optimization applications on process systems design, operations and control, and emerging applications on biochemical engineering, energy systems, sustainability, big data analytics and automated manufacturing. You says while there are a variety of textbooks on optimization theory, very few target chemical engineering applications that span across multiple scales, from molecules to global ecosystems. This textbook will help fill that gap and be a strong resource not only for undergraduate and graduate students, but also for researchers and industrial practitioners interested in applying state-of-the-art optimization algorithms and data analytics tools to various engineering applications.

The textbook will be used in conjunction with the new course ChemE 6800 – Computational Optimization, cross listed as SYSEN 6800, being offered this fall.

"THE SMITH GIFT TO CBE HAS PUT THE SCHOOL IN A STRONG POSITION TO DEFINE THE FUTURE OF OUR FIELD IN RESEARCH, EDUCATION AND SOCIETAL IMPACT."

— Abe Stroock

KEEPING EZRA'S PROMISE: ANY PERSON, ANY STUDY

In his address at the opening of Cornell University in 1868, founder Ezra Cornell articulated his hopes that he had laid the foundation for "an institution where any person can find instruction in any study." While his vision for an inclusive university lives on today, barriers still exist to improving diversity among faculty and staff, particularly in STEM-related fields.

The Smith gift is funding a key aspect to a diversity recruitment initiative led by CBE's Susan Daniel, associate professor; Paulette Clancy, the Samuel W. and M. Diane Bodman Professor in Chemical Engineering; and Chris Alabi, assistant professor and the Nancy and Peter Meinig Family Investigator in the Life Sciences. One of the initiative's aims is to improve the diversity of CBE's M.S. and Ph.D. student cohort by connecting with, and mentoring, targeted undergraduate students, particularly underrepresented minorities. Research shows that these early connections help provide a pathway and encourage students to apply to universities and programs that they may have otherwise not considered.

In order to better facilitate connections with faculty that students can identify with, faculty members from minority-rich institutions will visit Cornell for one month, give a research seminar, explore new research possibilities and provide mentoring to students. The faculty will be honored as Robert Frederick Smith Visiting Scholars, supported in part by the Smith gift. The goal is to provide inspiring role models for students, empowering and guiding them toward an academic future at Cornell or another prominent research university.

The initiative's first cohort of undergraduate students visited Cornell from the University of Puerto Rico and spent the summer working in Olin Hall.

"WE ARE INVESTING THE GIFT IN 'SMITH INITIATIVES' PROPOSED BY FACULTY AND STUDENTS TO SEED NEW RESEARCH DIRECTIONS, OPEN NEW EDUCATIONAL OPPORTUNITIES IN OLIN HALL AND INCREASE THE DIVERSITY OF STUDENTS ACROSS ALL OF OUR PROGRAMS. THE GREAT IDEAS ARE OUT THERE IN OUR COMMUNITY. THE SMITH GIFT IS ALLOWING THEM TO BLOSSOM."

— Abe Stroock

PRODUCT DESIGN CURRICULUM EVOLVES WITH INDUSTRY


Mark Hurwitz

Chemical engineering companies are increasingly relying on startup acquisitions to bring innovative new products and improvements to their business, a trend that has shifted the way the industry approaches research and development, and one that is changing the way students learn at the Smith School.

"It used to be that large corporations had very robust research and development departments where a lot of very exciting engineering and science was accomplished. That's changing," says Mark Hurwitz, an adjunct professor in the Smith School. "The large companies are more and more spending their R&D dollars on acquisitions and buying small companies," he adds, noting the approach is a lower risk model for corporations that can afford it. And even within larger corporations, "the engineer is no longer isolated amongst other engineers, solving a particular problem. They're part of a product development team, so they need to understand more about the business aspects of what the company is doing."

A long-time product developer for Pall Corporation, Hurwitz spent the latter years of his career assessing startups and small companies for acquisitions. "So I watched that transition occur, I participated in it," says Hurwitz, who now sits on the board of startup companies TeraPore Technologies and AguaClara, LLC.

Hurwitz—along with Alan Feitelberg, senior lecturer, and Tobias Hanrath, associate professor—is leading the Smith School's Product Design and Development Initiative aimed at ensuring the product design curriculum provides students with the knowledge and skills needed in today's industry. "The traditional training doesn't go away," says Hurwitz, "but we need to incorporate training that helps students understand how to operate in an entrepreneurial environment."

In 2012, the school launched ChemE 4610 – Concepts of Chemical Engineering Product Design and ChemE 4630 – Practice of Chemical Engineering Product Design. The courses were structured to inspire students to think of their role not just as technical experts, but also as entrepreneurs who must consider market analysis, patents, regulatory issues and the feasibility of a product spanning from concept to early stage development.

But until now, ChemE 4630 had mostly focused on food products, which are easier to prototype, test and refine all within a 15-week semester. The spring 2018 version of ChemE 4630 will introduce options for prototyping consumer products, something Hanrath says will help broaden student skillsets while incorporating more of the chemical engineering education they've received. "We're trying to make the product design experience similar to the capstone design experience that they already have in process design, where it's essentially like your first year in industry but in the safety net of an academic environment," says Hanrath.

"WE'RE TRYING TO MAKE THE PRODUCT DESIGN EXPERIENCE SIMILAR TO THE CAPSTONE DESIGN EXPERIENCE THAT THEY ALREADY HAVE IN PROCESS DESIGN, WHERE IT'S ESSENTIALLY LIKE YOUR FIRST YEAR IN INDUSTRY BUT IN THE SAFETY NET OF AN ACADEMIC ENVIRONMENT."
—Tobias Hanrath

To make the course truly relevant to industry, Hanrath sought corporate partnerships in which companies would provide students with real-world product design challenges. One of the first corporate challenges students will experience in the spring comes from consumer goods giant Procter & Gamble. The corporation is proposing a personal cleansing product, such as a body wash, derived from natural resources other than petroleum-based feedstocks. The design challenge is also facilitated by new benchtop bioreactors housed in the Unit Operations Laboratory thanks to a gift from from entrepreneur Robert F. Smith '85 and his Fund II Foundation.

Designing a body wash is a difficult assignment to accomplish in one semester, so Hanrath says students will be divided into two teams: one will explore the "upstream" components of making a product, such as engineering a surfactant from non-petroleum-based resources; the other team will use that component to design the final product. "So one team does the process design and one team does the product design and they have to work together, and that's similar to how they do it at Procter & Gamble," says Hanrath. And according to Hurwitz, inter-team communication is a valuable skill in today's industry: "Chemical engineers need to be able to communicate with other engineers and scientists. It's part of larger trend of engineering becoming more interdisciplinary in general."

A second partnership that has been secured for the spring semester is with Air Products and Chemicals, Inc. The company is challenging students to design a new type of balloon that, unlike today's mylar foil balloons, is biodegradable while retaining a certain helium permeability. "It's a good chemical product design problem because now you can say, 'you need to design a polymer that has this set of characteristics. Can you do it?'" says Hanrath.

The industry involvement is described as a win-win. Students will benefit not only from the learning experience, but from the opportunity to showcase their product design talent. Hanrath says partnering companies can scout potential employees by evaluating student performance—an insight that isn't possible through a traditional resume or interview.

Both the students and the companies also stand to gain ideas for new products. "One of the intended outcomes is that if the students wanted to do a startup around this, then they would be in a position in May, at the end of the semester, to do that," says Hanrath, noting a number of startup facilitators tied to Cornell. That's also the reason why ChemE 7070 and other product design studio courses within Cornell Engineering have moved to the fall semester.

The former version of ChemE 4630 that focused on food design sometimes offered glimpses of the course's potential to produce real products. In 2015, four students prototyped a unique granola bar that contained crushed avocado pits. The students eventually ran into regulatory issues while marketing the product outside of the classroom, but it demonstrated the interest undergraduate students have in entrepreneurship.

"I would like to see Cornell become a major source of new companies," says Hurwitz. "Entrepreneurship is the way technical innovation is happening. There's a few schools that have figured this out and there's no reason Cornell can't be the best of them."

OLIN HALL RENOVATIONS TO 'REIMAGINE' BUILDING, ENHANCE RESEARCH AND EDUCATION

Olin Hall is being reimagined with a proposed renovation project that will bring significant changes to how the building's interior looks and operates. A budget and timeline for the project have not been announced, but early planning is underway and school leaders have offered a vision for how the renovation can provide room for a growing school, and can strengthen research and education initiatives on the forefront of chemical and biomolecular engineering.

BUILDING A HOME

The School of Chemical Engineering at Cornell was founded in 1938. Right away, Director Fred "Dusty" Rhodes and Dean Solomon Cady Hollister began raising funds to construct a building to serve as home to the new school. Franklin Walter Olin, Class of 1886, donated $685,00 in memory of his son, Franklin W. Olin, Jr., who was a 1912 Cornell civil engineering graduate. The New York City architecture firm Shreve, Lamb, and Harmon was hired to design the building. This is the same firm that had just a few years earlier (in 1931) designed the Empire State Building. There was some grumbling when their initial design was revealed, as the building was to be made of brick. Traditionalists believed that brick construction was too modern and had no place on the Ivy League campus. The firm then added several large sections made of grey and brown stone in a nod to the critics.

Olin Hall was completed in 1941 and occupied in 1942.

75 years later Olin Hall is still home, but the school has a broader focus and a new name. In 2002, Cornell became the first college of engineering in the country to add the word "biomolecular" to its name, acknowledging the increasingly important role played by the study of biomolecules like proteins, RNA and DNA. Now, as a visitor approaches Ho Plaza on College Avenue, that new name is prominently displayed on the grey and brown stone wall of Olin for all to see: Robert Frederick Smith School of Chemical and Biomolecular Engineering (CBE). The name is in recognition of the generous support CBE alumnus Robert Frederick Smith '85 has shown the students and faculty of the school.

ADAPTING TO THE TIMES

As the school has changed and grown over the years, Olin Hall has had to change to keep pace. "When Olin was built, all of the lab space was in the context of professional practice," says Abe Stroock, William C. Hooey Director and Gordon L. Dibble '50 Professor of Chemical and Biomolecular Engineering. "Then in the 1980s we added the East Wing, which showed the school's growing commitment to research." The much-loved Unit Operations (UO) Lab has been updated and streamlined in the past few years to better reflect the equipment and processes students entering the job market might encounter.

The changes made in the UO Lab offer a glimpse of some of the guiding thoughts behind the larger changes to come in Olin. When the UO Lab renovations were completed in 2015, Associate Professor A. Brad Anton said "Chemical engineering is moving in the direction of biomedical devices, pharmaceuticals, microelectronic materials, nanomaterials and other modern technologies. We need experiments that reinforce our teaching of these new topics."

Despite these updates, Olin Hall is not yet where the Smith School, the College of Engineering and Cornell University want it to be. Which is why Olin is slated for some major renovations in the coming years. Even with recent changes, the bottom line is it is hard to do 21st century research in a mid-20th century building. The College of Engineering is in the early stages of a roughly $250 million project to make all of its buildings better suited to the kinds of research and the types of collaborations that characterize the frontiers of engineering. Anton's desire to get the UO Lab facilities out in front of what the field will require is the same underlying impetus behind the entire Olin Hall project.

"We are going to renovate Olin Hall in ways that make all of our programs

"WE ARE GOING TO RENOVATE OLIN HALL IN WAYS THAT MAKE ALL OF OUR PROGRAMS BETTER."

— Abe Stroock

better," says Stroock. "Undergrads, M.Eng. students, graduate students, postdocs, professors and staff will all see the benefits. This will be the first time since Olin opened for business that CBE will have the entire building." Currently, the ground floor of Olin also hosts the Engineering Leadership Program, Diversity Programs in Engineering, the Engineering Registrar's Office, and several programs of the Engineering Advising and Student Services Office. As part of the $250 million project, these offices and programs will move to a space across the street in the new Hollister Hall when it is renovated—and the Smith School will gain 6,000 additional square feet.

The Smith School has enjoyed steady growth since 2000. The faculty has doubled in size, as has the number of graduate researchers. Undergraduate enrollment has been at record levels, with an average of 90 students graduating in each of the past five years. "It looks like we will continue on this trajectory," says Stroock. "The things this department excels at are also areas of focus for the entire college. So much of bioengineering is chemically and molecularly focused. And CBE is also a critical hub for many of the Energy Institute activities on campus. New lab space will allow us to do everything from synthesis to characterization to incorporation into energy systems. We will be in an even better position to support Cornell Engineering's four main strategic areas of research. We are pushing well beyond the traditional definition of what a ChemE does."

IMAGINING THE FUTURE

In discussing the future of CBE at Cornell, Stroock makes it clear that Robert Smith's gift gave a huge boost to morale and momentum. "He made an investment in the school mid-way through our growth in prominence and size and that investment gave us the momentum to just keep going and tackle this major reimagining of Olin Hall." Smith's gift enabled the school to address many programmatic needs. Stroock is now encouraging donors to help the Smith School create lab, classroom, collaboration and office spaces that will allow CBE to remain one of the best schools in the country.

That word "reimagining" is entirely accurate in the case of the current plan for Olin. In many ways, the Smith School and the college are creating the adaptable building chemical engineering students and researchers will need 30 to 50 years from now. As Stroock mentioned, bioengineering and energy are two important focus areas of the college and it is clear they will continue to be important. But it will also be important for the new Olin Hall to have built-in opportunities to train undergraduates and M.Eng. students in professional practice. "Professional chemical engineering is starting to include a lot more of the 'upstream' processes," says Stroock. "Our students will need more exposure to the design process and all that entails."

Many of the changes coming to Olin Hall are designed to meet the research and professional practice needs of faculty and future students. When completed, the renovated and reconfigured Olin Hall will have hybrid lab spaces that are able to host many different sorts of activities. There will also be more space for student project teams and other student groups to work on prototypes and to think about product design. "Some of these new spaces will serve as a bridge across programs within CBE, but also to people outside the Smith School," says Stroock.

"ONCE CBE ENCOMPASSES ALL OF OLIN HALL, WE CAN CREATE SOME WELCOMING SPACES ON THE GROUND FLOOR AND GENERATE A REAL PRESENCE ON HO PLAZA. WE CAN USE THAT FIRST FLOOR SPACE TO CREATE A REAL GATEWAY TO THE DEPARTMENT."

— Abe Stroock

A particular strength of Cornell Engineering has always been the number and quality of collaborations that happen across the university with researchers from other units at Cornell. When Stroock talks about the new Olin Hall serving as a bridge to people outside of the Smith School, that is not just feel-good rhetoric. A quick glance at some of the most recent papers to come out of CBE shows co-authors from Applied and Engineering Physics, Materials Science and Engineering, Operations Research and Information Engineering, Systems Engineering, Biomedical Engineering, the College of Arts and Sciences' Department of Astronomy and the College of Veterinary Medicine. New, flexible lab spaces will serve to make these sorts of faculty collaborations more accessible.

Of course, some of what makes Olin Hall beloved to so many CBE alumni will remain. The unique raised panels depicting metallurgical equipment and chemical processes on the building's exterior will stay, as will the mural in Rhodes Lounge. The mural is a distinct feature of the school. It depicts (humorously) the students' journey through the five-year chemical engineering curriculum in place when the mural was painted in 1949. The lounge itself will double in size in order to comfortably host more Smith School events. Olin Hall currently has two of the largest lecture halls on campus and these will also remain.

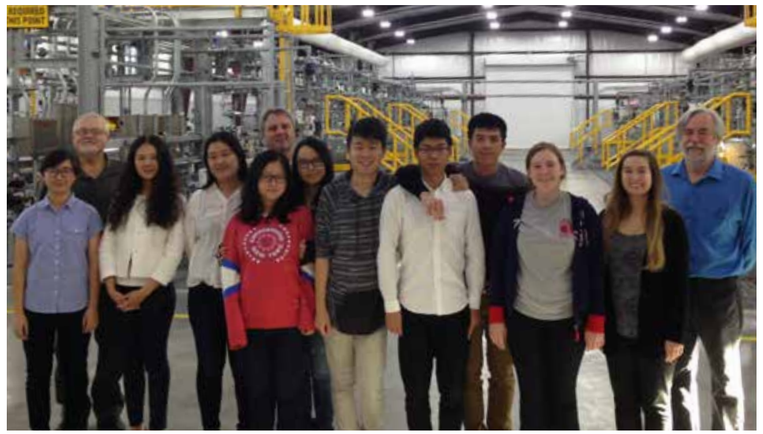
One area that will change is the basement. In its current state, the basement floor of Olin Hall serves many purposes, some of which will remain just where they are. There is the Unit Operations Lab, a machine shop, mechanical rooms, cylinder and chemical storage, and other infrastructure that would be impractical to move. But there are also several student lounges and work areas in the basement. There is a Senior Computer Lab, a Diversity Programs in Engineering Lounge, an M.Eng. Study Room, a Graduate Computer Lab, Engineering Student Groups space and the Scheele Undergraduate Lounge. While some students profess to like the windowless 75-year-old spaces in the basement, Stroock is certain they will like the new planned spaces better.

"We have never been able to take full advantage of that beautiful space that opens up onto Ho Plaza on the west side of the building," says Stroock. "Once CBE encompasses all of Olin Hall, we can create some welcoming spaces on the ground floor and generate a real presence on Ho Plaza. We can use that first floor space to create a real gateway to the department."

"Chemical engineering has a long history at Cornell," says Stroock. "There is a strong feeling of continuity, and part of that feeling comes from the fact that we have been in Olin Hall from the very beginning. These changes to Olin don't represent a severing from the past. Instead, they represent natural growth and continuity. The changes we are making are a natural outcome of the success of the school, so far."

In those two words, "so far," Stroock makes it clear that the Smith School and Cornell Engineering are looking forward, not back. The history of the school can provide the foundation for all that is to come next, but it is the future of the Smith School that is the first priority now. The support of Smith, of the university trustees and administration, of the College of Engineering and of other generous alumni have put the Smith School in a position to dream big and create the classrooms, offices, labs and collaborative spaces necessary for the school to remain one of the most innovative and well-respected schools of chemical and biomolecular engineering in the country.

SHELL EPOCH PROGRAM
A PERFECT FIT FOR CBE STUDENTS



The M.Eng. program at the Robert Frederick Smith School of Chemical and Biomolecular Engineering (CBE) has teamed up with the Shell Oil Company to offer CBE M.Eng. students and seniors a unique opportunity to experience what it might be like to work on an offshore oil and gas production platform. Shell's training facility in the town of Robert, Louisiana, hosts their Engineering, Process, Operations, Competence-Based, Hands-On Program (EPOCH) and in 2016-17 four different groups of Cornell CBE students participated in training sessions there. The simulators at the Shell training facility are fitted out with the same types of production equipment and handle the same types of fluids that employees on an actual offshore facility would encounter.

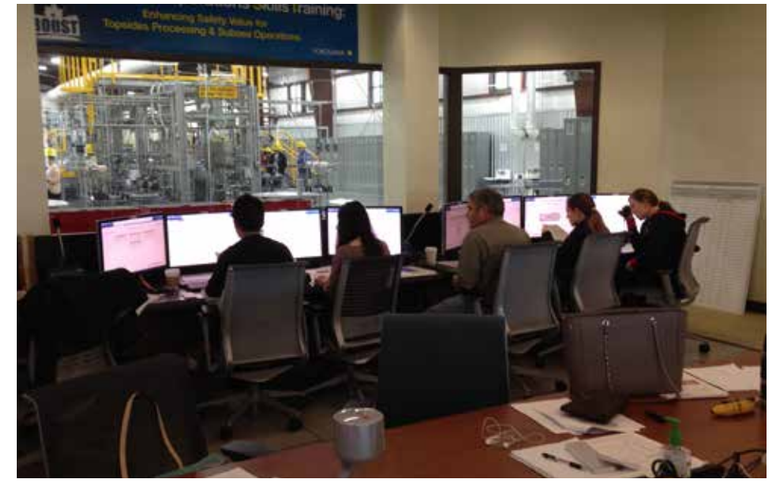
Mark Hurwitz, adjunct professor, has created a for-credit course centered on a working visit to the facility. The course includes pre-visit lectures on separation system design and performance, drafting a test run protocol, and a post-visit group report that documents the students' assessments of the system's performance. Hurwitz travels with the students in the role of group advisor during visits to the facility.

The initial group visit in January was led by Hurwitz and Al Center, professor of practice and associate director of the Master of Engineering Program at the Smith School. Since then, Hurwitz has led the program with 10 students attending during spring break at the end of March, and another 12 during fall break.

It would be very difficult for students to get on an actual offshore production facility in the Gulf of Mexico or elsewhere, so the EPOCH program is a valuable, first-hand way for them to learn about the equipment and processes they might encounter if they chose to pursue employment in the oil and gas industry.

Jianqiu Wang '17 M.Eng. spent his recent fall break at the EPOCH program. "It provided us such a fast-speed learning environment and let us gain hands-on experience," says Wang. "During the training process, we applied all the chemical engineering knowledge we learned to make assumptions, build the model and solve it. It provided us with a perfect example of how we can apply engineering to practice."

Hurwitz believes the experience is valuable not just for students considering work in the petroleum industry. "As I see it, there are four valuable aspects to the experience," says Hurwitz. "First and most obviously, the students get a brief but intense introduction to oil and gas technology, especially offshore



production. Second, they learn the basics of gravitational separation processes that are used in many industries and have the opportunity to build a predictive model and use it to understand a real process system. Third, the students have hands on experience troubleshooting and operating a process system. Fourth, each student learns how to interact productively with experienced and skilled process operators. This last aspect is especially important and will serve the students well as they start their careers in industry."

Center agrees with Hurwitz on the value of the EPOCH program to Cornell students. Center, who had a long and distinguished career in the oil and gas industry before joining the faculty at Cornell, adds, "A number of our M.Eng. students do not come to us with an undergraduate degree in chemical engineering and this experience provides them with a crash course in unit operations that very much increases their understanding of how all the descriptive equations they have been learning are applied to real equipment."

During the course of the four-day program, students first tour the facility to become familiar with the equipment and to receive direct instruction in operation of the simulator. They then work as either inside or outside operators to put into action what they have learned prior to the visit. While operating the equipment under different gas/oil/water operating condition ratios, they also evaluate equipment performance in a test run environment.

M.Eng. student Hao Su '16 does not plan to work in the oil and gas industry, but still found value in the program. "My specialization is product design," says Su, "which involves the optimization and assessment of systems. Shell EPOCH offered a great opportunity for me to understand how a system works and also how to operate it."

A program like this is valuable to any chemical engineering M.Eng. student with an interest in the process industries, including oil and gas, chemical, energy, water or agriculture. As with any program involving travel and extensive and complex technological systems, participation in the EPOCH program requires a significant financial investment. The three visits to the Shell training facility this year have all been sponsored by the generous support of CBE alumni, most notably, Michael A. Gibson '65, M.Eng. '66, Ph.D. '73, and Center '65, M.Eng. '66. If you are interested in helping to ensure that Cornell students continue to have this valuable opportunity, please contact June Losurdo at jml235@cornell.edu or 607.254.1643.

ALUMNI NEWS


David T. Allen


Lydia Contreras


Marshall Frank


Rosanna Frank


Julie Goddard


Bob Langer


Ann Lee


Robert F. Smith


Lisa Skeete-Tatum


Qiuming Yu

David T. Allen '79, was elected to the National Academy of Engineering. Allen is professor in the McKetta Department of Chemical Engineering at The University of Texas of Austin. Election to the academy is among the highest professional distinctions bestowed upon an engineer. Membership honors those who have made outstanding contributions to engineering research and practice, including pioneering new and developing areas of technology and making major advancements in the engineering field and profession. The election citation for Allen states: "For contributions to improving air quality and for developments in the education and practice of sustainable engineering." Allen was the 2016 J.C. Smith Lecturer at Cornell in 2016.

Lydia Contreras Ph.D. '08, was recently promoted to associate professor in chemical engineering at the University of Texas at Austin. Professor Contreras was awarded a Ph.D. from Cornell in the DeLisa Group. Her current research focuses on biomolecular engineering, genetic studies and computational modeling to understand molecular features that lead to the specific recognition and interaction of RNAs and proteins.

Marshall Frank '61, and Rosanna Frank, '61, were awarded the William "Bill" Vanneman '31 Outstanding Class Leader Award. The award, named in honor of William "Bill" Vanneman, who served his class for over 75 years tirelessly, was established by the Cornell Association of Class Officers in January 2005. The award continues to recognize alumni who, in their capacity as class officers, have provided long-term exemplary service to the university and to their individual classes.

Julie Goddard '99, joined Cornell University's food science faculty in July 2016 as an associate professor with tenure. Her research focuses on biomaterials and biointerfaces in food and agriculture.

Bob Langer '70, received the 2016 Hoover Medal, which honors civic and humanitarian achievements of engineers. Langer, the David H. Koch Institute Professor at the Massachusetts Institute of Technology, was recognized for his numerous technical accomplishments in biomedical engineering, his unparalleled productivity as an inventor, and his success as a mentor and entrepreneur.

Ann Lee '83, presented the 2016 D.I.C. Wang Award Lecture for Excellence in Biochemical Engineering at the annual meeting of the AIChE. Lee is senior vice president of Genentech and global head of pharma technical development for Roche. Her lecture was entitled, "How Goliath Beats David: Leveraging Learnings and Knowledge to Out Sling the Start-ups."

Robert F. Smith '85, was named Cornell Entrepreneur of the Year 2017. Smith's company, Vista Equity Partners, manages equity capital of more than $26 billion and oversees a portfolio of more than 35 software companies that employ more than 42,000 people worldwide. Under his leadership, Vista has exclusively focused on enterprise software, data and technology-enabled solutions.

Smith earned his bachelor's degree in chemical engineering at Cornell and his MBA from Columbia Business School. He worked at Kraft General Foods, where he earned two United States and two European patents. In 1994, he joined Goldman Sachs in tech investment banking, first in New York and then in Silicon Valley.

In 2016 he, together with the foundation of which he is a founding director, gave $50 million combined to support chemical and biomolecular engineering and African-American and female students in the College of Engineering. It also created a fellowship program at Cornell Tech that strengthens ties to Cornell Engineering. The Robert Frederick Smith School of Chemical and Biomolecular Engineering was named in recognition of Smith's philanthropy.

Lisa Skeete-Tatum '89, was featured in BBC News in an online article titled, "The career crisis that sparked a 'Linkedin for women.'" Skeete-Tatum had worked in venture capital for 11 years, but also sat on the boards of many non-profit companies. She wanted to do something with more social impact but didn't know how to go about making her next move. So she launched Landit, together with a friend she met while studying at business school.

Lisa will also present the 2017 Raymond G. Thorpe Lecture in the school on Monday, Oct. 23.

Qiuming Yu, Ph.D. '95, was recently promoted to research professor at the University of Washington in chemical engineering.

Professor Yu was awarded a Ph.D. from Cornell in the Clancy Group where she worked on rapid solidification in SiGe alloys, both experimentally and computationally. After a postdoc at NASA/JPL, she joined the faculty at University of Washington's chemical engineering department. She is also a former associate director of University of Washington's nanofabrication facility.

Her current research focuses on photonics, plasmonic biosensors and nanostructured materials. Both of her children are currently Cornell undergraduates.

IN MEMORIAM

E. Firth Perryman	B.S. ChemE, 1943	Batavia	NY	5/14/2017
Richard W. Poinsett	B.S. ChemE, 1967	Estero	FL	5/5/2017
Richard Lee McQueen	B.S. ChemE, 1969	Oklahoma City	OK	3/25/2017
Erwine T. Buckenmaier	B.S. ChemE, 1955	Oceanside	NY	3/24/2017
Richard C. Lofberg	B.S. ChemE, 1953	Rochelle Park	NJ	3/21/2017
Robert H. Morrow	B.S. ChemE, 1953	Medford	NJ	3/10/2017
Frederick S. Frei	B.S. ChemE, 1968	Washington	DC	2/25/2017
William H. Abraham	B.S. ChemE, 1951	Ames	IA	12/28/2016
Herbert T. Kaplan	B.S. ChemE, 1960	Broomfield	CO	12/8/2016
Clarence T. Shoch	B.S. ChemE, 1951	Coatesville	PA	12/5/2016
Paul S. Nix	B.S. ChemE, 1951	Basking Ridge	NJ	11/24/2016
William C. Hagel	B.S. ChemE, 1951	Ann Arbor	MI	11/5/2016
Charles R. Yoh	B.S. ChemE, 1959	Hollister	MO	11/2/2016
Sparsh Bhargava	B.S. ChemE, 2007	New York	NY	10/28/2016
William W. Wallis	B.S. ChemE, 1963	Scotch Plains	NJ	10/23/2016
Edward L. Hoffman	B.S. ChemE, 1960	Greenwich	CT	10/13/2016

CornellEngineering SAFETY Olinpics August 26

Recognizing the value of a strong safety culture is an important aspect of work in Olin Hall and beyond.

To promote awareness of safety actions, attitudes and behaviors, the School of Chemical and Biomolecular Engineering (CBE) Safety Committee organized the 1st Annual CBE Safety Olinpics as an entertaining educational initiative to promote a strong safety culture within the department.

The committee—which includes CBE professors Brad Anton, Tobias Hanrath, Matthew Paszek and Roseanna Zia, lab safety officers from all research groups and representatives from Cornell's Environmental Health and Safety Office (EH&S)—organized a number of engaging safety disciplines including first responder CPR training, waste disposal and personal protective equipment.

"THE GRADUATE STUDENTS SPENT SIGNIFICANT TIME PLANNING THE SAFETY OLINPICS TO INCLUDE SAFETY AND COMPLIANCE TOPICS THAT WILL STAY WITH THEM WHILE AT CORNELL AND BEYOND."

— Brenda Coolbaugh

"The graduate students spent significant time planning the Safety Olinpics to include safety and compliance topics that will stay with them while at Cornell and beyond. This was an impressive event and we were excited to be invited to participate," said Brenda Coolbaugh, chemical hygiene officer with EH&S.

The event kicked off with a talk from Dan Vaughn, manager of external technology collaborations and intellectual assets at Corning, Inc., about value-based safety culture. The closing ceremony was marked by a departmental mixer which included a jeopardy-style safety quiz and an award ceremony for winning teams. The event was made possible by the generous support of external sponsors including Corning, Inc., and VWR International.

EH&S specialist Alan Bitar commented, "I was impressed with the high level of engagement among the graduate students while they were creating activities for the Safety Olinpics. Also, as a safety instructor I was delighted to witness them having fun while leading the activities on the day of the event."

Overall, the inaugural CBE Safety Olinpics was a great success and the organizers are eagerly preparing for the 2017 event.

DISTINGUISHED LECTURES

THE 2016 RAYMOND G. THORPE LECTURE WAS PRESENTED BY HARVEY STENGER, B.S. '79, ON MONDAY, OCT. 17.

His talk titled, "Higher Education: Challenges and Opportunities from an Engineering Perspective," was well received by faculty, students and colleagues from across campus.

Harvey Stenger is a native of upstate New York, was appointed as president at Binghamton University in November 2011 and assumed his duties Jan. 1, 2012. Prior to Binghamton, he served as interim provost at the University of Buffalo (UB), where he had been dean of the School of Engineering and Applied Sciences since 2006. A chemical engineer by training, he earned his bachelor's degree in chemical engineering from Cornell University in 1979 and his doctorate in the same discipline from Massachusetts Institute of Technology in 1983.

Prior to joining the administration at UB, Stenger was a professor at Lehigh University's College of Engineering and Applied Science, where he also served as dean for six years and served terms as co-chair of the Department of Chemical Engineering and director of the Environmental Studies Center.

Since his arrival at Binghamton, he launched the "Road Map to Premier" strategic planning process, involving more than 400 students, faculty, staff, alumni, community members and business leaders. With a focus on academic excellence, operational excellence and university growth, the university is moving forward on its journey to becoming the premier public university.

THE 2017 JULIAN C. SMITH LECTURES WERE PRESENTED BY EMILY CARTER OF PRINCETON UNIVERSITY ON THURSDAY, APRIL 13, AND FRIDAY, APRIL 14.

Faculty, students and colleagues from across campus gathered to hear her talks titled, "Sustainable Production of Fuels and Chemicals From First Principles," and "How Quantum Mechanics Helps Discover Materials for Sustainable Energy."

Emily A. Carter is the dean of the School of Engineering and Applied Science and the Gerhard R. Andlinger Professor in Energy and the Environment, as well as a professor in the Department of Mechanical and Aerospace Engineering and the Program in Applied and Computational Mathematics at Princeton University. She is an associated faculty member in Chemistry, Chemical and Biological Engineering, the Princeton Institute for Computational Science and Engineering, the Princeton Environmental Institute, the Princeton Institute for the Science and Technology of Materials, and the Andlinger Center for Energy and the Environment. She was the founding director of the Andlinger Center from 2010-2016.

Dean Carter's research spans the fields of chemistry, physics, applied mathematics and engineering and has included creating quantum mechanical tools for understanding and analyzing the behaviors of large numbers of atoms and electrons in materials. This highly influential work led in recent years to her research on creating effective fuel cells, using sunlight to generate electricity and make liquid fuels from carbon dioxide and water, and investigating lightweight metal alloys for vehicles and fusion reactor walls.

REUNION 2017

On June 10, 2017, classes from years ending in 7 and 2 gathered on Cornell's campus. In keeping with tradition, the Robert Frederick Smith School of Chemical and Biomolecular Engineering welcomed close to 100 alumni for breakfast. Ranging from 1942 to 2017, classmates shared reminiscences of beloved faculty and fun times with classmates, and learned what's new in the school.

William C. Hooey Director Abe Stroock welcomed the group. Other faculty who were present to welcome our honored returnees included Associate Professor T. Michael Duncan, Professor of Practice Al Center '65, Professor Lynden Archer and Emeritus Professor Peter Harriott. Professors Stroock and Archer provided interested alumni a tour of the newly renovated Unit Operations (UO) Laboratory.

STAFF NEWS


Polly Marion

Marion receives 2016 William C. Hooey Outstanding Staff Award

Polly Marion has received the 2016 William C. Hooey Outstanding Staff Award. The award was established in 2011 by the Smith School of Chemical and Biomolecular Engineering (CBE) to recognize a member of the staff who goes "above and beyond" their job responsibilities in helping the school and its faculty execute all aspects of CBE's mission.

CBE has been the beneficiary of Marion's professional skillset since 2009, which she developed during her 34 year career at Cornell. She is the administrative lead in the Cornell Energy Institute and ably juggles a myriad of responsibilities and priorities, always putting forth her absolute best. She effectively supports a significant and diverse set of needs and provides thoughtful strategic advice on matters large and small, which has been beneficial in moving the institute forward in overcoming challenges as well as pursuing opportunities. She is valued as a colleague and her day-to-day management of ongoing initiatives clearly exemplifies her dedication to excellence, support for both research and teaching programs, and her concern about the welfare of faculty, students and visitors.


Bailey Kline Colvin


Tamesha M. Muhammad


Matthew D. Pitcher


Fred M. Broome

Welcome Bailey, Tamesha, Matt and Fred

Tamesha M. Muhammad and Matthew D. Pitcher were hired into Account Representative V positions on May 8, 2017, and June 22, 2017, respectively. Muhammad came to CBE from Materials Science and Engineering where she was actively ramping up in the role of supporting faculty with account management. She is originally from North Carolina and earned her bachelor's degree in accounting from Guilford College in 2013. Pitcher earned his bachelor's and master's degree in accounting with a tax concentration from Binghamton University's School of Management and prior to that his associates degree in business administration and sports management from Tompkins Cortland Community College. He taught in the Groton Central School District and was a staff accountant at Mengel Metzger Barr CPA & Co., LLP prior to coming to Cornell.

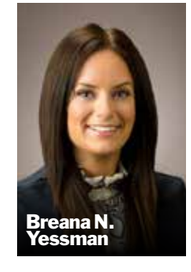
Bailey Kline Colvin joined the Cornell Energy Institute on August 23, 2016, as an administrative assistant. She earned her master's degree in teaching from SUNY Cortland in 2008 and her bachelor's degree in Italian with a concentration in international relations from Cornell University in 2006. She has held various positions since graduating from Cornell, most recently teaching Italian at the high school and college levels before returning to Cornell and to living in Ithaca with her family.

Fred M. Broome provides IT support to CBE faculty, staff and students. He joined the College of Engineering IT Service Group on June 15, 2017, and came from a similar position at Stanford University. In addition to desktop support, Broome has been working with Cornell's new encryption initiative, software usage monitoring in the computer labs, and supported distance learning between Cornell University and the Cornell Tech campus. His experience from Stanford has proven valuable to the whole IT Service Group.

Years of Service

We recognize and sincerely appreciate the dedicated staff in CBE and at Cornell. Our research support specialist, Glenn Swan, has been at Cornell for 35 years and in the department for 18. Our director's assistant, Breana N. Yessman, has been at Cornell 10 years and in CBE for seven. Both have been recipients of the William C. Hooey Outstanding Staff Awards and their efforts are highly valued in the department.


Glenn Swan


Breana N. Yessman


Candice Johnson

Congratulations

The Smith School of Chemical and Biomolecular Engineering thanks our student colleague, Candice Johnson, for her contributions to CBE throughout her undergraduate years at Cornell, especially her efforts on the CBE WOMEN and M.Eng. projects. We congratulate her on her May 2017 graduation.

STAFF RETIREMENT


Sally Carland

Sally Carland retired on June 21, 2017, after dedicating 34 years of service to Cornell, 18 of which were with CBE. Throughout that time, she remained a key player during times of transition, helping to shape many of the administrative tools and processes used by the department today. Her efforts were also held in high regard by faculty she supported in her lead finance role.

Carland was first hired by Cornell's Department of Neurobiology and Behavior in 1983, and remembers processing procurements on a typewriter with carbon sets at the time. Years later, she was part of a staff team that piloted an online form for procurement, paving the way for other departments to adopt the more efficient process. After stints in the Departments of Earth and Atmospheric Sciences and of Mechanical and Aerospace Engineering, she arrived at CBE where she helped to pilot and streamline several other services as Cornell moved to a model of centralized transactions, human resources and proposal development. She was also instrumental in helping Biomedical Engineering transition financially from a CBE program to its own department, prior to it becoming a school.

"Sally was thorough, responsive, knowledgeable, detail oriented and committed to serving faculty at a very high level," said Celia Szczepura-McLean, director of administration. "She was always willing to step up and assist the department and faculty, and was a great resource on many fronts to many people within CBE, the college and the university."

Before retiring, Carland said she would miss the collaborative team environment at Cornell as well as her fellow co-workers, who she likened to family members. Her husband Rich will be retiring later this year and the two are looking forward to doing more gardening, camping and traveling. They plan to travel the country to visit their three children and two grandchildren more often, and look for potential places to call their new home.

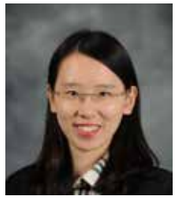
"SALLY WAS THOROUGH, RESPONSIVE, KNOWLEDGEABLE, DETAIL ORIENTED AND COMMITTED TO SERVING FACULTY AT A VERY HIGH LEVEL."

— Celia Szczepura-McLean

FLEMING SCHOLAR AWARD

The Fleming Scholar award in the Robert Frederick Smith School of Chemical and Biomolecular Engineering (CBE) was established in 2015 by a generous gift from CBE alumnus Samuel C. Fleming '62 and his wife Nancy Fleming to recognize 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 of pioneering new areas of study that advance biomolecular engineering science.

Nominations for the award are solicited annually and typically come from a student's thesis advisor or from someone knowledgeable about the nominee's scholarship and potential. Although the Fleming Scholar award recognition will be bestowed annually, 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 2017 awardees are:



Zhu Cheng

Cheng's research focuses on elucidating how mechanical properties of biomaterials can regulate cellular functions, with the aim of programming complex biological processes and tissue assembly through biomaterial design. Cells physically probe their extracellular environment to inform decision making related to cell proliferation, differentiation, migration and other critical processes. In addition to biochemical signals, physical properties of the extracellular matrix, including its stiffness, are key regulators for cell behaviors. Recent studies have illustrated that solid surface stresses can have a dominant role in the mechanical behaviors of soft materials with vanishingly small elasticity. Cheng experimentally shows that cells interacting with soft materials with appreciable surface stresses primarily sense and respond to the surface stresses and not the bulk moduli of the materials. This study unveils the role of solid surface stresses in physically directing cellular behaviors. Cheng hopes that her work will help to better understand cell-matrix interactions and aid in the design of biomaterial scaffolds for cell and tissue growth.

Kevin Weyant

Outer membrane vesicles (OMVs) are liposomes of variable size (20-300 nM) that are produced constitutively by Gram-negative bacteria. Previous studies have shown that OMVs can be engineered to express recombinant protein or carbohydrate antigens. These OMVs can then be administered in mice to generate protective immune responses. However, frequent difficulties expressing complex antigens on OMVs limits their utility. Moreover, immune responses to recombinant OMV vaccines are not sufficient for some pathogens. Weyant aims to enhance the versatility of OMV vaccines both by facilitating the display of multiple antigens for broader protection and by targeting OMVs to specific cell types to modulate immune responses. Specifically, he is engineering a system in which purified antigens or receptor-binding molecules can be bound to a protein scaffold on OMVs. His work may provide tools that will facilitate the production of a wide range of vaccines for infectious diseases and cancer.

CBE WOMEN GROUP REMAINS ACTIVE AS IT APPROACHES TENTH YEAR

The Chemical and Biomolecular Engineering Graduate Women's Group (CBE Women) has remained active as it approaches its tenth year at Cornell, expanding opportunities for members and earning national accolades in 2017.

Since 2008, CBE Women has been providing key professional development and outreach activities to the graduate student body, and fostering fellowship within CBE. Through this programming, CBE Women supports the dual mission of addressing issues pertinent to the women of the department and encouraging young girls to enter engineering through outreach.

In the 2016-17 school year, CBE Women organized several events, including professional development workshops, the welcome dessert social and the WOMEN outreach event, which welcomes tenth-grade girls and their parents from rural areas to Cornell. The WOMEN event aims to equip participants with the inspiration and the tools to seek out engineering education and careers, and was recognized this year with the 2017 WEPAN Women in Engineering Initiative Award from the Women in Engineering ProActive Network.

To strengthen the Olin Hall network and provide more contact between the graduate students and alumni, CBE Women partners with Chemical Engineering Graduate Student Association to invite Ph.D. alumni in industry careers back to campus for career seminar series. The series offers a unique educational and networking opportunity for students interested in industry careers. During spring and summer 2017, three alumni shared their industry experience with graduate students: Dr. Rebecca Stehle Ph.D. '11 (Clancy Group) from ExxonMobil; Dr. Bernardo Aguilera Ph.D. '12 (Escobedo Group) from Proctor & Gamble; and Dr. Geoffrey Genesky Ph.D. '09 (Cohen Group) from Kiehl's Since 1851. In addition to discussing the technical aspects of their work in industry, the speakers discussed the soft skills needed for success, industry career paths and advice for current graduate students.

CBE Women has also been able to expand professional development activities thanks to a generous gift from CBE alumna Lisa Walker '86. During the 2016-17 school year, CBE Women began offering the Lisa Walker Travel Grant. The grant is designed to provide funding for women graduate students who demonstrate the need to travel to specific conferences, workshops and classes that directly enhance their careers prospects.

In 2018, CBE Women will be entering its tenth year. It plans to continue fostering an engaging and encouraging community while promoting CBE's culture of recognizing the strength and contributions of all graduate students.

LISA WALKER '86 FUNDS TRAVEL GRANT FOR CBE WOMEN

In 2016, CBE alumna Lisa Walker '86 gave a gift of $25,000 to the CBE Women group to enhance the professional development of women. The members of CBE Women used the gift to create the Lisa Walker Travel Grant.

In deciding to use the gift to fund travel opportunities, CBE Women acknowledged the fact that networking experiences can be key to building a career. Susan Daniel, associate professor and advisor to the CBE Women, explained, "when students get out to visit labs and go to conferences they might not normally go to, some really valuable connections get made. Funding travel is an effective way to reach Lisa Walker's goal of enhancing the professional development of our female grad students."

Lakshmi Nathan, a student in the Daniel Group, agrees wholeheartedly. "The Lisa Walker Travel Grant enabled me to attend the 2017 Gordon Research Conference on Physical Virology in Barga, Italy," says Nathan. "This conference emphasizes networking and I was able to meet researchers from all over the world who work in my field. Many only hire postdocs they have networked with in person, so without this conference those opportunities would have remained closed to me." In addition, Nathan has been invited to be a student chair of the next Gordon Conference, "which is a great professional development opportunity and an important step toward achieving my goal of becoming a professor," says Nathan.

Siyu Zhu, Ph.D. student in the Stroock Group, used her Walker Travel Grant to advance the work of her group. "I got an opportunity to travel to U.C. Davis and U.C. Berkeley to test our newly developed water stress sensor, called a micro-tensiometer, with our collaborators," says Zhu. "In Berkeley, I got my first chance to install the sensors into the redwoods, the world's tallest trees! This travel has pushed forward our in-plant testing of the micro-tensiometer, and brought us closer to the study of climate change on crops and forests."

In 2017, Ph.D. student Laura Sinclair from the Tester and Thompson Groups will use her Walker Travel Grant to observe a pilot copper mining operation in Florence, Arizona. Blaire Sorenson, from the Clancy Group, will attend the Perovskite Solar Cells and Optoelectronics (PSCO) Conference in Oxford, U.K., in September.

Walker's grant is expected to fund travel opportunities for several CBE Women in each of the next three years.

CBE GRADUATE STUDENT ASSOCIATION GROWS ITS FOOTPRINT

The 2016-17 academic year was an excellent one for the Chemical & Biomolecular Engineering Graduate Student Association (ChEGSA), as it introduced new programming and expanded the annual CBE Graduate Symposium.

ChEGSA serves as the primary graduate student organizational unit within CBE. Its mission is to promote fellowship within the department, enable professional development opportunities, run community outreach events and help showcase graduate student research achievements.

ChEGSA has a long tradition of programming social events in the department, with key events including the Thanksgiving and Halloween mixers, the weekly coffee hour, a wine-tasting mixer in collaboration with CBE Women, and intramural sports teams. This year the association fielded teams in soccer, football, basketball, inner-tube water polo and golf, and won the Cornell intramural softball championship.

The association also introduced events to cater to different student populations within CBE, such as a board game mixer and a bake-off, which were hugely successful in bringing together new groups of students. And ChEGSA board members continue to play a large role in new student orientation by assisting with recruitment events, and serving as peer mentors to better acquaint new students to the department when they arrive.

ChEGSA participates in several community outreach events as well. It provides many of the volunteers for the award-winning WOMEN Event, a one-day event hosted by CBE Women for female high school sophomores to explore the world of science and engineering. ChEGSA also continued its annual food drive this year, where members of CBE collected over 1,000 items for the Ithaca Kitchen Cupboard, with the Varner, Archer and Joo Groups making the largest contributions.

ChEGSA board members helped plan and ran the CBE Graduate Symposium. This is an annual research symposium that features posters and presentations from graduate students in CBE. This year the planning committee focused on improving CBE's visibility to industry, and invited representatives from select industrial sponsors to attend. New this year was a post-symposium dinner, which included an awards presentation and TED-style talks from select speakers. ChEGSA hopes to continue to improve upon the department's signature research event of the year.

Finally, ChEGSA helps to promote professional development through contact with industry. This year a number of graduate students were able to visit a manufacturing facility through a ChEGSA-coordinated tour of Corning, Inc.'s production facility. Other events included a career seminar series, co-hosted with CBE Women. This seminar series invites CBE alumni back to Cornell to give insight on their experiences after finishing their degrees. The association hopes to continue this successful series in the future.

2015-16 AUSTIN HOOEY AWARDS

RESEARCH INTO NANOPARTICLE PROPERTIES, DOPANT ACTIVATION EARNS STUDENTS HOOEY AWARD

The Austin Hooey Graduate Research Excellence Recognition Award is the highest award given to a graduate student by the Smith School of Chemical and Biomolecular Engineering. It recognizes outstanding contributions to scholarship and research towards a Ph.D, and was established in 2005 by Professor Lynden Archer, then director of graduate studies, in honor of the late Austin O. Hooey (1922–2004). Her father, William Hooey, earned his degree in chemical engineering in 1912. Both deeply valued higher education and Cornell University.

To date, 24 CBE graduate students have been recognized with the award. The latest recipients are Akanksha Agrawal of the Archer Group and Victoria Sorg of the Clancy Group. Both delivered oral presentations on their research as part of the department's seminar series and received a monetary award and certificate. No awards were distributed in spring 2017.

AKANKSHA AGRAWAL, ARCHER RESEARCH GROUP

Structure, Rheology, and Transport Properties of Self-Suspended Nanoparticle Fluids

Polymer grafted nanoparticles have been of increasing scientific interest due to their potential applications in numerous fields. They have emerged as model systems to understand the structure, dynamics and phase stability of molecular and atomic liquids. One such class of polymer-tethered nanoparticles are the self-suspended hairy nanoparticles. Created by densely grafting polymer chains on the surface of inorganic nanoparticles, these particles are uniformly dispersed even in the absence of a solvent. These self-suspended hairy nanoparticles are shown to have interesting structural and mechanical properties, which vary with the core size, corona size, corona chemistry and temperature.

Agrawal's research aims to systematically study how these different variables influence the dynamics, transport and mechanical properties of the hairy nanoparticles. The present work looks at the jamming, yielding and flow transition of self-suspended silica nanoparticles and aims to explain the molecular origins of these transitions using various experimental techniques supported by theoretical analysis. Specifically, it is found that the grafted polymer chains affect the mechanical and dynamical properties of these materials by varying their degree of inter-penetration. The stronger the inter-penetration of the tethered corona chain, the more jammed the material tends to be with slower dynamics. These trends are observed not only by varying the core size and the temperature, but also by utilizing the differences in enthalpic attraction of the polymer chains with different chemistries.

Furthermore, the fundamental knowledge of tuning the mechanical properties of these hairy nanoparticles is utilized in enhancing ion transport in them when they are used as electrolytes for lithium metal batteries. A binary blend

of these hairy nanoparticles exhibits a high ionic conductivity, low flammability and stabilizes the surface of a lithium metal electrode, which makes them an immensely viable candidate as electrolytes for improving the capacity and lifetime of a rechargeable lithium metal battery.

VICTORIA SORG, CLANCY RESEARCH GROUP

Dopant Activation of III-V and III-N Materials Using Laser Spike Annealing

For the past 50 years, the electronics industry has profited from its ability to follow Moore's Law, doubling the performance of the computer chip approximately every two years. Traditionally, these improvements came from reducing the size of the logic switches, or transistors, so that more could fit in a given sized computer chip. However, the electronics industry has hit a roadblock where merely shrinking components no longer improves the performance. To overcome this hurdle, manufacturers are beginning to implement non-traditional device structures and materials into computer chips.

Compound semiconductors are strong candidates for materials to replace silicon based on their improved speed and efficiency with, importantly, lower power requirements. III-V materials, like InGaAs and InAs, are promising candidates to replace silicon in areas in the transistor that require high conductivity semiconductors. Low-power device architectures can be realized with GaN and other III-N materials. Although charge-carrying electrons can move much faster in these materials, a fundamental issue is getting enough free electrons into the materials through a process called doping, hence limiting the conductivity that can be achieved. This is the problem Sorg's work

addresses—studying how fast thermal processing affects the electrical properties of doped III-V and III-N materials.

Using sub-millisecond to millisecond laser spike annealing (LSA), Sorg can transiently reach high annealing temperatures, and in this way, improve conductivity by achieving high active concentrations of dopants in these materials. She has broadly characterized LSA for III-V and III-N materials with a high-throughput, combinatorial processing method. With this method, she explored kinetically limited states that are inaccessible using typical heating approaches like furnace and rapid thermal annealing (RTA). Sorg found that LSA increased the activation of high-dose implanted dopants in InGaAs to a peak concentration beyond a previously established thermodynamic limit, improving dopant activation by 29 percent.

In contrast to longer timescale anneals, like those from furnace anneals or RTA, no deactivation is observed during LSA processing for InGaAs samples with dopants grown in to active positions. The research group's latest LSA studies of GaN resulted in nearly 100 percent activation of dopants. In these millisecond time frames, LSA is effective for ion-implantation dopant activation and for retention of metastable as-grown dopant concentrations. The work shows that this kind of metastable processing will be critical to future device applications that use III-V and III-N materials.

UNDERGRADUATE PROFILES

Meghan Barton '17

WHY CORNELL?

When considering a major as a senior in high school, I chose to pursue engineering because I like to help people and solve problems. I chose chemical engineering because I enjoy and excel at chemistry. With this decision in mind, I decided on Cornell University because I knew that Cornell would provide a great engineering education. I knew of Cornell's chemical and biomolecular engineering reputation for high standards, and my respect for the program and its professors has only grown through the years. In hindsight, I am especially glad that I chose Cornell because I appreciate the ability to combine biological and chemical engineering knowledge, which is not common to all chemical engineering curriculums.

LEADERSHIP POSITIONS HELD AT CORNELL:

The first formal leadership position I held at Cornell was as an AIChE class representative during my junior year. During senior year, I was a teaching assistant for Chemical Engineering Thermodynamics. However, to many of my classmates I am probably best known as the student most likely to ask questions (along with Meghan Pierson!).

MAJOR ACCOMPLISHMENTS AS A LEADER:

As an AIChE class representative, I was mindful not to simply be a bystander in the executive board meetings. I represented my class with ideas and suggestions of course, but also with feedback about practical limitations of junior and sophomore schedules with AIChE events. This was something I felt was lacking prior to my attention, because most executive positions were held by seniors.

By far, the most challenging leadership position was as a Thermo teaching assistant. I was well prepared to explain correct answers to the juniors as I had taken the course only one year prior and understood the material well. However, I was unprepared to explain why some of their incorrect answers were wrong. It was definitely a different way of looking at Thermo! I needed to prepare myself by considering how I would do problems correctly, then determine how to explain where it went wrong.

Personally, I believe I accomplished most as the class questioner. It certainly helped me to learn and understand the material better, but apparently it helped others too! I determined this during junior year, after multiple people independently thanked me after a Process Dynamics and Control lecture for asking some clarifying questions.

ADVICE FOR FUTURE STUDENT LEADERS:

Find a balance! If you're at Cornell, you're an overachiever. If you're in the Smith School of Chemical and Biomolecular Engineering, you're a super overachiever. Plan for the future, but not at the cost of all present happiness. You made it this far, so you are smart and capable. Hold yourself accountable for your performance, because you will get out of your education what you put into it. But don't make yourself unhappy to meet someone else's expectations.

Don't wait for someone to appoint you as a leader. Lead even without recognition. Ask questions.

POST-GRADUATION GOALS:

Immediately, I plan to travel some this summer. I already have plans to hang out with my Senior Design group in Washington, D.C., and I will go to Cuba later this summer with my family. I'm very excited!

After this summer of fun, I intend to work in the pharmaceutical industry. I have focused on biological applications of chemical engineering during my undergraduate career, and have completed research in the DeLisa Lab which I enjoyed. I hope to be able to continue research which will improve healthcare.

FAVORITE OLIN HALL/CHEME MEMORY:

There are so many to choose from! Some of the most memorable include: Bananagrams in the Undergrad Lounge with Carol Casler, wings over a late night problem set (also in the lounge), casino night, ice cream at Purity with my Senior Design group, the CBE Holiday Party and senior year Holi.

UNDERGRADUATE PROFILES

Jorge Guevara '17

WHY CORNELL?

The second I stepped foot on this campus, something clicked. Out of the 17 universities I had seen, I had never felt more at home and welcome than on Cornell's campus. With its beautiful Botanical Gardens, incredible McGraw Clock Tower, and magnificent view of Cayuga Lake, how could I not fall in love with Cornell? I also chose Cornell Engineering because I wanted to be able to major in chemical engineering while still being able to pursue my passion in the arts, specifically in dancing, singing and acting. I knew I would have the proper resources and networks that would allow me to flourish in both the ChemE and theatre worlds. Also, having Cornell Dairy ice cream in the dining halls was a major plus.

LEADERSHIP POSITIONS HELD AT CORNELL:

Manager of both the Melodramatics and Flexible Theatre Companies, sub-team leader of the AguaClara Project Team, Engineering Ambassador.

MAJOR ACCOMPLISHMENTS AS A LEADER:

Major accomplishments include uniting the Ithaca community by putting on musical productions that were relevant to modern-day political and socioeconomic issues, as well as performing within 15 productions in Ithaca during the past four years. Also, being able to provide my fellow ChemEs with theatre activities that helped enhance their presentation and people skills.

ADVICE FOR FUTURE STUDENT LEADERS:

Be fearless, be bold, be relentless. Change will not happen unless you are pushing for it. You will be faced with adversity and it will not be easy, but if you persevere and focus on your purpose, you will shine brighter than any star. Be informed and inform those who need it, but be humble. Utilize the resources available to you as soon as you step foot on this campus and set up meetings with the administration and the student groups you want to speak with as to make the most of these four years. They will go by faster than you know.

POST-GRADUATION GOALS:

I want to ensure that more people from the Latinx community become affiliated with majors in the STEM field, especially with chemical engineering. The fact that I can count the number of Latinx students within my senior class with both my hands worries me. Additionally, when I begin working for Johnson & Johnson, I want to lead projects that will challenge me intellectually, as well as create projects that will enhance the quality of life for all. Also, I will win a Tony Award for Best Performance by an Actor in a Leading Role in either a play or a musical and be invited to MET Gala.

FAVORITE OLIN HALL/CHEME MEMORY:

On senior awards night, I had a moment in time where I felt that all my hard work and dedication in both the engineering world and the theatre world were being recognized. It was when Professor Paulette Clancy awarded me with the Outstanding Service Award on behalf of the Robert Frederick Smith School of Chemical and Biomolecular Engineering. This moment was monumental for me because it was a moment where my 24-hours-per-week dedicated to rehearsal were more than worth it, where my countless caffeinated teas and endless nights on problem sets were more than worth it, where my weekends in the lab for AguaClara were more than worth it, where my bruised legs and bad knees were more than worth it. I came to Cornell to leave my mark in both the engineering and theatre fields and in that exact moment, I felt that I had.

Stwart Pena '17

WHY CORNELL?

To be honest, I fell in love with the campus at first sight. From the beautiful scenery to the peaceful locations one can go to relax, I truly felt at home on this campus. While visiting for my first time, every student was so friendly and the administration was so approachable and always ready to help. In addition to having one of the best engineering colleges in the world, there was no doubt in my mind that Cornell was truly meant for me.

LEADERSHIP POSITIONS HELD AT CORNELL:

ChemE Car Finance/Business Team executive, senior member of Cornell Cheerleading, junior officer for Skiing and Snowboarding Club.

MAJOR ACCOMPLISHMENTS AS A LEADER:

Accomplishments for the ChemE Car Team include winning the AIChE 2015 National Competition; Cornell Cheerleading won its first Ivy Classic title; and the Skiing and Snowboarding Club went farther than ever for club trips, organizing events in Switzerland and obtaining major sponsorship from companies.

ADVICE FOR FUTURE STUDENT LEADERS:

My one piece of advice is to never be afraid to make a name for yourself, despite the risk of making mistakes. In order to succeed, you have to let the world know who you are. If you make mistakes along the way, learn from them. Those errors are what will make you a wiser person and will truly teach you how to become a better leader.

POST-GRADUATION GOALS:

I will be heading to Houston to work as a process designer for ExxonMobil. Once I obtain the necessary experience and networks, I desire to become an entrepreneur in the renewable energy field.

FAVORITE OLIN HALL/CHEME MEMORY:

Although the last 4 years were rather difficult in Olin Hall, there is not a singular "best" memory I can recall. What I did truly enjoy were the countless conversations and bonds formed at 3:00 a.m. in the Scheele Undergrad Lounge, as we were all trying to finish our problem sets. I will truly miss this place.

UNDERGRADUATE AWARDS

STUDENT AWARDS & HONORS 2016-2017

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS OTHMER SOPHOMORE ACADEMIC EXCELLENCE AWARD

Natalie Goh '17
This award was established by the AIChE to recognize undergraduate academic excellence. Left to right: Professor Duncan and Natalie Goh

GOLDWATER SCHOLARSHIP

Robert Lee '17
Recognizing intellectual curiosity and excellence in mathematics and engineering. Left to right: Aravind Natarajan and Robert Lee

GOLDWATER SCHOLARSHIP

Charles Wan '17
Recognizing intellectual curiosity and excellence in mathematics and engineering. Left to right: Professor Duncan and Charles Wan

GENENTECH AND GEORGE SCHEELE OUTSTANDING JUNIOR AWARD

Robert Lee '17
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. Left to right: Professor Anton and Robert Lee

NATIONAL SCIENCE FOUNDATION GRADUATE FELLOWSHIP

Charles Wan '17
Recognizing high scholarship, extracurricular contributions, unusual promise of substantial achievement and a program that advances the engineering profession. Left to right: Professor Stroock and Charles Wan

QUILL & DAGGER SOCIETY INDUCTION

Jorge Guevara '17
A prominent and legendary Cornell University senior honor society recognizing exemplary undergraduates who have shown leadership, character and dedication to service. Left to right: Professor Stroock and Jorge Guevara

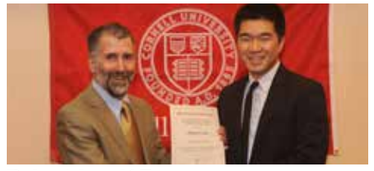
DIVERSITY PROGRAMS IN ENGINEERING OUTSTANDING STUDENT OF THE YEAR

Stwart Peña '17
Left to right: Professor Duncan, Stwart Peña and Professor Al Center

DIVERSITY PROGRAMS IN ENGINEERING'S ZELLMAN WARHAFT COMMITMENT TO DIVERSITY UNDERGRADUATE AWARD

Paola C. Torres '17
Left to right: Professor Stroock and Paola Torres

MERRILL PRESIDENTIAL SCHOLAR



Robert Lee '17
This Cornell program honors outstanding seniors and their academic mentors who most inspired their scholastic development from high school and a Cornell faculty member who most significantly contributed to their college experience. Left to right: Professor Duncan and Robert Lee

MERRILL PRESIDENTIAL SCHOLAR

Charles Wan '17
This Cornell program honors outstanding seniors and their academic mentors who most inspired their scholastic development from high school and a Cornell faculty member who most significantly contributed to their college experience. Left to right: Professor Duncan and Charles Wan

PHILLIPS 66 UNDERGRADUATE SCHOLARSHIP

Natalie Goh '17
Recognizing exceptional academic achievement with professional potential in the oil and energy industry. Left to right: Professor Stroock and Natalie Goh

PHILLIPS 66 UNDERGRADUATE SCHOLARSHIP

Jason Herritt '17
Recognizing exceptional academic achievement with professional potential in the oil and energy industry. Left to right: Professor Stroock and Jason Herritt

PHILLIPS 66 UNDERGRADUATE SCHOLARSHIP

Alyssa Restauro '17
Recognizing exceptional academic achievement with professional potential in the oil and energy industry. Left to right: Professor Stroock and Alyssa Restauro

AWARD FOR OUTSTANDING SERVICE TO THE SCHOOL

Jorge Guevara '17
Recognizing outstanding service to improve the professional and social culture of the school. Left to right: Professor Clancy and Jorge Guevara

OUTSTANDING UNDERGRADUATE TEACHING ASSISTANT OF THE YEAR AWARD

Jennifer Bushnell '17
Chosen by the faculty for outstanding teaching by an undergraduate assistant and contributions to fluid mechanics, mass and energy balances and analysis of separation processes. Left to right: Professor Anton and Jennifer Bushnell

CHEMICAL ENGINEERING OUTSTANDING SCHOLAR AWARD

Oliver Lake '17
This award recognizes outstanding scholarship, mastery of chemical engineering fundamentals, demonstrated application in the capstone laboratory and design courses and professional promise. Left to right: Professor Duncan and Oliver Lake

FERDINAND RODRIGUEZ OUTSTANDING STUDENT AWARD IN POLYMERS AND ELECTRONIC MATERIALS

Grace He '17
Honoring Professor Rodriguez and recognizing outstanding achievements in academics and in the professional community. Sponsored by the Xerox Foundation. Left to right: Professor Alabi and Grace He

OUTSTANDING CHEMICAL ENGINEERING UNDERGRADUATE RESEARCH AWARD

Aron Coraor '17
Recognizing a demonstrated record of ability, indication of leadership and professional promise. Left to right: Professor Clancy and Aron Coraor

TWO CBE STUDENTS NAMED MERRILL PRESIDENTIAL SCHOLARS

Each year, Cornell recognizes a select group of seniors as Merrill Presidential Scholars—one of the highest honors for undergraduates at Cornell.

Merrill Scholars rank among the top one percent of the class in their respective colleges and only 33 students were chosen in 2017. The program also recognizing the educators who have played a significant role in ensuring their success. Each scholar is given an opportunity to recognize the high school teacher who most inspired his or her scholastic development and the Cornell faculty member who most significantly contributed to his or her college experience.

The outstanding seniors were recognized by Cornell President Martha E. Pollack at the 29th annual Merrill Presidential Scholars Convocation luncheon on May 24.

MERRILL SCHOLAR: ROBERT LEE '17

Robert Lee performs research with Aravind Natarajan (Ph.D. candidate, microbiology) in the lab of Professor Matthew DeLisa and is a co-author on a recent publication in the journal ACS Synthetic Biology. He has served as a co-lead facilitator for the Academic Excellence Workshop program, a teaching assistant for classes in chemical engineering and is a member of the Engineering World Health project team. He interned at DuPont Industrial Biosciences and Genentech, and is a member of the Cornell chapters of Tau Beta Pi and the American Institute of Chemical Engineers.

Lee has received scholarships from the Goldwater Foundation, the Rawlings Cornell Presidential Research Scholarship program, Genentech and Tau Beta Pi. He has begun a Ph.D. program in chemical engineering since graduation.

High School Teacher: Jack Bungarden, Palo Alto High School, California

Mr. John Bungarden is the reason AP U.S. history was my most difficult class in high school. As I analyzed historical documents and parsed arguments of professional historians, I found myself scared of Mr. Bungarden's responses to my positions, well-founded and insightful rejoinders that occasionally made me feel foolish. Nevertheless, this refusal to accept less than the best forced me to better defend my conclusions. Being challenged every day helped me begin to grow my strengths: thinking about cause and effect, critiquing arguments and holding myself to the highest standard.

Cornell Faculty Member: Matthew DeLisa

Professor Matthew DeLisa helped me find a research and career path. I entered Cornell unsure whether I could merge my interests in biology with chemical engineering. After getting involved in Professor DeLisa's lab, I realized that there are many opportunities for me to grow in both fields. Just as impactful was being able to see what a career in research looks like on a day-to-day basis. Professor DeLisa balanced countless responsibilities and still found time to champion me, nurture my development as a researcher and even stay updated with my progress outside of lab. He and his group gave me a place to flourish and set me on my path toward a Ph.D.

MERRILL SCHOLAR: CHARLES WAN ’17

Wan received a 2016 Goldwater Scholarship for his research on Li-O2 batteries in the Archer Group. His research resulted in an upcoming first-author publication to *Science Advances*. He interned at UC Berkeley and ExxonMobil, filing a patent memorandum with the latter. In addition to research, Wan has been a member of the national champion Cornell ChemE Car Team since freshman year, and had assumed the role of senior captain. He held teaching assistant positions for three core ChemE classes: Fluid Mechanics, Thermodynamics, and Chemical Kinetics and Reactor Design. After graduation, Wan will be pursuing a Ph.D. in chemical engineering, funded by the National Science Foundation Graduate Research Fellowship Program.

High School Teacher: Jennifer Vibber, Penfield High School, Rochester, New York

When I found out I could invite a high school teacher, Mrs. Vibber came to my mind as the first and obvious choice. I took two advanced calculus math classes with her, and she advised the Math League team I was a part of. What I remember about her class, first and foremost, was the open and welcoming environment she facilitated, in which students collaborated and put heads together to master new concepts and overcome tough problems. Mrs. Vibber’s style was engaging, and her enthusiasm unmatched. She gave a part of herself to every student she taught, because teaching was not only her profession, but also her passion. I did not choose to follow a career in pure mathematics, but I can trace the roots of my academic career to her classroom, where I discovered an interest for applying math to real-world situations and learned tools essential to becoming a successful engineer. Mrs. Vibber is largely responsible for where I am today, pursuing my passions in chemical engineering.

Cornell Faculty Member: Lynden Archer

I had the good fortune of getting acquainted with Professor Lynden Archer early on as an undergraduate researcher in his group, by which I mean Professor Archer was willing to take a chance on a shameless freshman banging on the CBE director’s door asking for research. From the start, Professor Archer stressed the importance of approaching problems using scientific first-principles and focusing on practical research that would lend itself to an important cause. He treated me with respect as if I were one of his graduate students, finding time in his busy schedule for weekly meetings. He is always full of new ideas, and carries himself with an infectious energy. Chemical engineers often have attractive job options right after undergrad, and so I wasn’t always set on graduate school. But seeing the ground-breaking research Professor Archer does on a daily basis and his impact on the scientific education of others influenced my career path. I strive to one day be the role model for others that he has been for me.

CONGRATULATIONS TO THE CLASS OF 2017!

Class of 2017

1 Brielle Hohne
2 Q. Linnette Teo
3 Rosa Zhang
4 Hannah McFetridge
5 Katherine Dao
6 Kristen Fawole
7 Ngan (Sophie) Le
8 Alyssa Restauro
9 Grace He
10 Justine Lee
11 Allee Vito
12 Yoo-Jung Yang
13 Brooke Cohen
14 Bianca Piccione
15 Amy Penick
16 Emily Mendelsohn
17 Sueyeon Kim
18 Soomin You
19 Sharon Chiu
20 Angely Liang
21 Jorge Guevara
22 Yan Zhang
23 Jenny Bushnell
24 Meghan Barton
25 Gregory Bielat
26 Jason Herritt
27 Christina Urban
28 Kyle Wheeler
29 Jada Murray
30 Kayla Kemler
31 Meghan Pierson
32 Christine Leu
33 Olumide (Baba) Sosan
34 Robert Lee
35 Thomas Cohn
36 Jeancarlo Vélez
37 Kevin Wan
38 Caitlin Gee
39 Melissa Duan
40 James Dong
41 Ileana D'Aloisio
42 Kristin Hirsch
43 Bethany Buck
44 Makayla Mellas
45 Natalie Goh
46 Alex Schwab
47 Caroline Ladley
48 Kate Dick
49 Joseph Diaz
50 Aron Coraor
51 Dan Harianja
52 Aditya Misra
53 Ed Kang
54 Raychie Tang
55 Max Renaud
56 Jackie Cheong
57 Dan Jun
58 Mohyeddine (Dine) Algui
59 Will Borchert
60 Will Knutson
61 Olivia Adams
62 Colleen Garrigan
63 Sarah Blythe
64 Matt Schofield
65 Tyler Fitzpatrick
66 Jake Grist
67 Byung Hee (Brian) Ko
68 Stwart Peña
69 Liz Durand
70 Nick Shebek
71 Evan Chou
72 Justin Love
73 Brittany Ward
74 Xintong (Shay) An
75 Shawn James
76 Oliver Lake
77 Tom Ricciardulli
78 Charles Wan
79 Mason Montgomery
80 Michael Lu
81 Alex Marzilli
82 Paola Torres

Not pictured:
Maddie Baehre
Maria Blechl
Yoonsik (Shane) Chung
Jon Kibel
Yang (Kate) Peng
Tiffany Tate
Paul Varga

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 AND EDUCATION

First Floor Shared Space

As part of the reimagined and fully renovated Olin Hall (see Page X), the school aims to create, for the first time, a space on the first floor to serve as the home-base of its programs. This "heart" of CBE would provide shared space for work in small teams, student-faculty interactions, studying (late into the night) and social activities. It would strengthen the community and provide a window into CBE's vibrant programs from Ho Plaza.

Gifts can be made in support of this shared space, and naming opportunities exist for many sub-spaces including a student center, break-out rooms and lounges, and the administrative suite.

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

ENHANCE THE STUDENT EXPERIENCE

Graduate Fellowships

Attracting talented graduate students to the school is a key goal in CBE's 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.

Professional Masters Fellowships

The school's Master of Engineering (M.Eng.) program has grown significantly in size and vibrancy over the past decade, welcoming more than 40 students a year in five specializations:

Computational Informatics—Data science and data analytics in the context of problems of interest to chemical engineering; Energy Economics and Engineering—Energy-related technology, management, and public policy; Food Science—Process and product design relevant to the food industry; Medical and Industrial Biotechnology—Engineering and life sciences for biotechnology industries including manufacturing of pharmaceuticals, diagnostics, tissue culture, agricultural products, and new food and energy sources; Product Design—Product design principals as they apply to chemicals, devices and systems.

Students come to the school's M.Eng. program from a diversity of educational backgrounds, across the U.S. and around the world, to acquire valuable skills in chemical and biomolecular engineering. The ability of the school to provide financial support to students in this program allows for increased selectivity and opportunities for students with insufficient financial means.

ATTRACT TALENTED FACULTY

Endow a Professor of Practice

Industrial Practitioners (IPs) are chemical engineers with considerable practical experience who return to Cornell to serve as lecturers. Since the mid 1990s, CBE undergraduates have benefitted greatly from continuous service of IPs in our capstone Chemical Process Design Course and Unit Operations Laboratory. More recently, IPs have played a central role in the development of new components of our curriculum in Product Design and Energy Economics.

A naming gift to endow a professor of practice position to support a long-term IP would have major impact on the school's ability attract and retain the highest quality individuals on its faculty.

Endow a Named Chair in Biomolecular Engineering

Gifts to this fund will support salary and research startup costs for hiring a member of the faculty who will facilitate growth of biomolecular engineering.

Faculty Startup Funds, Faculty Renewal

Current use gifts to support the hiring of faculty in CBE.

CURRENT USE NEEDS UNDER $100,000

Support for undergraduates and master's degree students to participate in off-campus learning experiences. Current programs include a one-week training program with faculty mentorship at Shell Oil's offshore operations simulator in Louisiana and summer unit operations and pilot plant laboratory course at Imperial College London. Gifts will make these opportunities financially accessible to all interested students.

Startup funds for new student project teams.

Support for the CBE WOMEN (Women in Engineering) group to provide professional development to women leaders in CBE.

Support industrial field experience and international opportunities for students.

CBE DISCRETIONARY FUND

Unrestricted gifts of any amount may be directed to CBE and will provide the director with flexibility to support the priorities listed above, aggressively recruit and retain junior faculty, seize other opportunities and address challenges at his discretion.

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

June Losurdo, Director of Development
jml235@cornell.edu
607-254-1643

https://www.cheme.cornell.edu/alumni/giving.cfm

Cornell Engineering

Robert Frederick Smith School of Chemical and Biomolecular Engineering