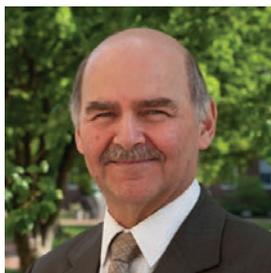


UNIVERSITY *of* DELAWARE

CHEMICAL AND BIOMOLECULAR ENGINEERING **NEWS**

2016





DEAR FRIENDS AND COLLEAGUES,

It is our pleasure to provide you with our annual update on people and events in Colburn Lab and beyond. Although we try to provide a rounded picture of who we are and what we do, it isn't always possible to provide a complete picture. Discrete noteworthy events such as major awards to students or faculty are step changes that certainly capture our attention, but much of what we do is manifested in a finite derivative that may not capture much attention until we integrate over a semester or a year to determine the Δ . We hope that these cumulative impacts are apparent to some degree as well, although perhaps not as definitively as the cumulative impact of a year in a student's life in our program.

Indeed, our mission is centered on our students, and a privilege of being a faculty member in our department is the opportunity to know and to work with young people with so much talent and character. Every class defines its own distinctive traits, and the Class of 2016 set the bar especially high in its leadership, particularly in the AIChE Student Chapter. Elsewhere in this issue you can read of their organization of the 2016 AIChE Mid-Atlantic Student Regional Conference, but this was only the most visible of their many initiatives and consistent involvement, entraining many of their peers along the way. The current crop of students has also enthusiastically built a team to compete in Chem-E-Car, an AIChE-hosted national event; the UD team is shown on the cover competing at the Regional Conference.

Although with students of this caliber one might be tempted to say "the more the merrier," we remain sensitive to the potential impact of class size on the quality of the education that we can provide. It is important not to overlook the amount of individual or small-group instruction that is essential in engineering, especially in lab and design courses. We are therefore pleased to have been able to stabilize the size of our incoming classes, albeit at a level that we expect still to give us of order 80 graduates each year. As always we appreciate the internship and employment opportunities that many of you continue to provide to our students; please contact us directly or work with the Career Services Center if your organization is hiring.

Not to be outdone, our graduate students also continue to excel, in leadership, academics and research. As usual, you can read in this issue of numerous awards that our students have won and of their groups' research accomplishments. The Colburn Club continues to provide outstanding leadership, and its role is particularly indispensable in recruiting for our Ph.D. program. The Ph.D. program remains the pivotal confluence of generation and propagation of knowledge in our department, but other graduate offerings in the department are significant too. Our dual-degree masters program with the Katholieke Universiteit Leuven in Belgium is now well-established, and our innovative masters program in particle technology (MEPT) has just graduated its second class. The MEPT program is now also offering a certificate program that can help place the opportunities in this area of critical industrial importance within reach for those already in the workforce.

Of course, none of this would be possible without our outstanding faculty, some of whose accomplishments are also described in this issue. That our research expenditures exceeded \$16 million in the fiscal year just ended is a tribute to their creativity and hard work, and this impressive number does not reflect the various broadly collaborative efforts that our faculty are leading to build nationwide consortia that can transform the academic-industrial interface in years to come. As always, however, undergraduate education remains a high priority for us, and the reflections of our students as they graduate continue to echo those of earlier generations in recognizing the high level of faculty engagement.

It's always a pleasure to see those of you from these earlier generations as well as our many friends, so please let us know if you're going to be in or around Newark—we would love to see you. We'd also be delighted to meet up with you on your home turf, so please get in touch if there is a group of alumni with whom I or others among the faculty might meet on our travels. And we can of course meet on neutral ground as well, an excellent opportunity being our reception at the AIChE Annual Meeting in San Francisco. The event will be held in the Franciscan C room at the Hilton San Francisco Union Square on Monday, November 14, starting at 7 p.m. I hope to see you there!

Best wishes,

Abraham Lenhoff

Allan P. Colburn Professor and Chair

2016
**Chemical and
Biomolecular
Engineering
News**



CHEMICAL AND BIOMOLECULAR ENGINEERING

NEWS

2016

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CHEN HONORED FOR EXCELLENCE IN BIOCHEMICAL ENGINEERING



WILFRED CHEN, Gore Professor of Chemical Engineering, won the American Institute of Chemical Engineers (AIChE) 2015 D.I.C. Wang Award for Excellence in Biochemical Engineering and delivered the named lecture for the award at the professional organization's annual meeting in Salt Lake City last November.

Chen was cited for the creative application of molecular techniques in engineering proteins and microbes to perform an extraordinary range of biotechnological tasks for bioremediation, biocatalysis, biofuel production, bioseparation and biosensing.

Named for one of the pioneers of chemical engineering, the Wang award recognizes the MIT professor's contributions to education and research in biochemical engineering, as well as his technological innovations in bioprocessing. It is presented to a distinguished biochemical engineer and biotechnologist by the Biochemical Technology Division of the American Chemical Society and by the Food, Pharmaceuticals and Bioengineering Division of AIChE.

"Dr. Chen's distinguished accomplishments are clearly worthy and deserving of national recognition and are a source of pride for our entire Blue Hen community," said Provost **DOMENICO GRASSO**, who praised Chen's contributions to education and research in biochemical engineering, as well as his technological innovations in bioprocessing.

Chen is the second CBE faculty member to win the award, joining **TERRY PAPOUTSAKIS**, the Eugene du Pont Professor of Chemical and Biomolecular Engineering, who was honored in 2013. ■

See page 10 for Chen's modular platform for biosensor assembly offering promise for cancer prevention and patient monitoring during treatment.



**Epps
promoted
to professor,
honored
with Dillon
Medal and
Early Career
Award**

THOMAS H. EPPS III, the Thomas and Kipp Gutshall Associate Professor of Chemical and Biomolecular Engineering, was awarded the American Physical Society's 2016 John H. Dillon Medal for significant advances in the control, characterization and understanding of polymer nanoscale structure and energetics.

The medal recognizes outstanding research accomplishments by young polymer physicists who demonstrate exceptional research promise early in their careers.

In nominating Epps for the award, **DARRIN POCHAN**, chair of the Department of Materials Science and Engineering, cited Epps' successful employment of a variety of approaches to precisely control the nanoscale structure of self-assembling block copolymers. "His work in this area has the potential to address society's most pressing problems in energy, health and the environment," said Pochan, who won the Dillon Medal himself in 2007.

Epps joined UD in 2006 with joint appointments in chemical and biomolecular engineering and materials science and engineering. He completed a sabbatical year at MIT as the Martin Luther King, Jr. Visiting Professor of Chemistry in 2012–13 and, in 2015, was awarded the Owens Corning Early Career Award by the American Institute of Chemical Engineers. In May, the Board of Trustees approved his promotion to professor, effective September 2016. ■

Faculty Highlights

Alumna Bhatia returns as faculty

SUJATA BHATIA, who earned both bachelor's and master's degrees from the department between 1999 and 2003, has returned to UD as a continuing track professor in chemical and biomolecular engineering and biomedical engineering. A licensed professional engineer, physician and former Harvard professor, she is widely regarded for her work to improve human health through the application of engineering analysis.

Specializing in medical device and biotechnology product development, clinical trials and intellectual property, her academic approach includes hands-on clinical immersion experiences allowing students to use chemical engineering, biomedical engineering and mathematical modeling to identify unmet clinical needs, predict human disease patterns and prevent, treat and cure illness.

Orazov to join department in 2018

MARAT ORAZOV, who completed his Ph.D. in chemical engineering at the California Institute of Technology, is slated to join the department as an assistant professor in the fall of 2018. Orazov did his dissertation research working with Mark Davis at Caltech, where his work included participation in the Catalysis Center for Energy Innovation, which is led by **DION VLACHOS**. His research seminar was titled "Valorizing Biomass: New Possibilities Enabled by Lewis Acid Molecular Sieve Catalysts."

Orazov is currently performing catalysis research as a postdoctoral fellow in chemical engineering at Stanford. ■

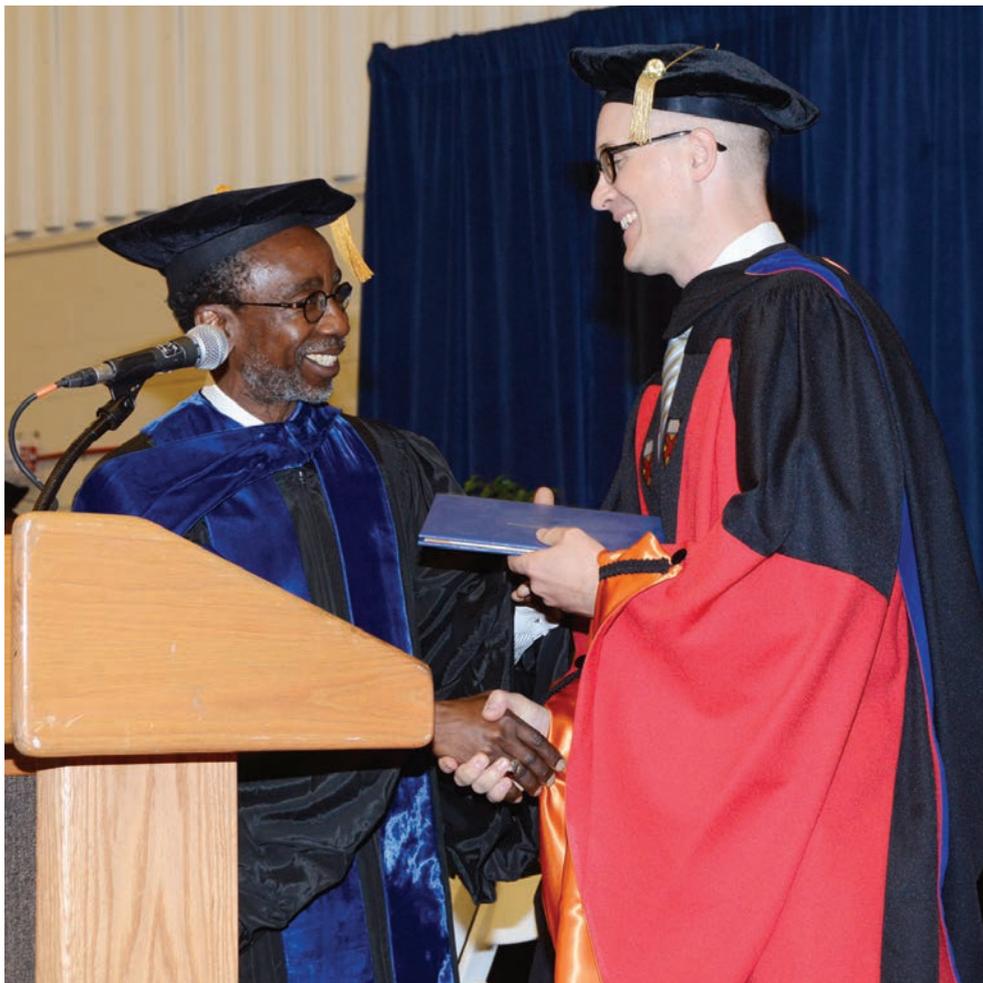


NORMAN WAGNER, above center, the Robert Pigford Chaired Professor of Chemical and Biomolecular Engineering, who is noted for developing the super-hero materials called shear thickening fluids used in liquid body armor, was inducted a Fellow in the National Academy of Inventors in a spring ceremony at the United States Patent and Trademark Office in Alexandria, Virginia. He also received the Neutron Scattering Society of America's Service Award for his work on the executive committee and long-standing efforts to raise funding for students, post docs and young scientists to attend the meeting.

YUN LIU, a research associate professor with the Center for Neutron Science, was honored with the 2016 Science Prize at the 8th American Conference on Neutron Scattering last summer in California. Liu holds an affiliated research professorship in the Department of Physics and Astronomy and is a beamline scientist at the National Institute for Standards and Technology (NIST) Center for Neutron Research.

Associate professor **ARTHI JAYARAMAN**, whose research focuses on molecular theory and simulations to elucidate microscopic phenomena governing macroscopic properties in polymers, was selected as Princeton University's Saville Lecturer for 2015–16.

ERIC FURST, below right, professor and director of the Center for Molecular & Engineering Thermodynamics, received the College of Engineering Excellence in Teaching Award.

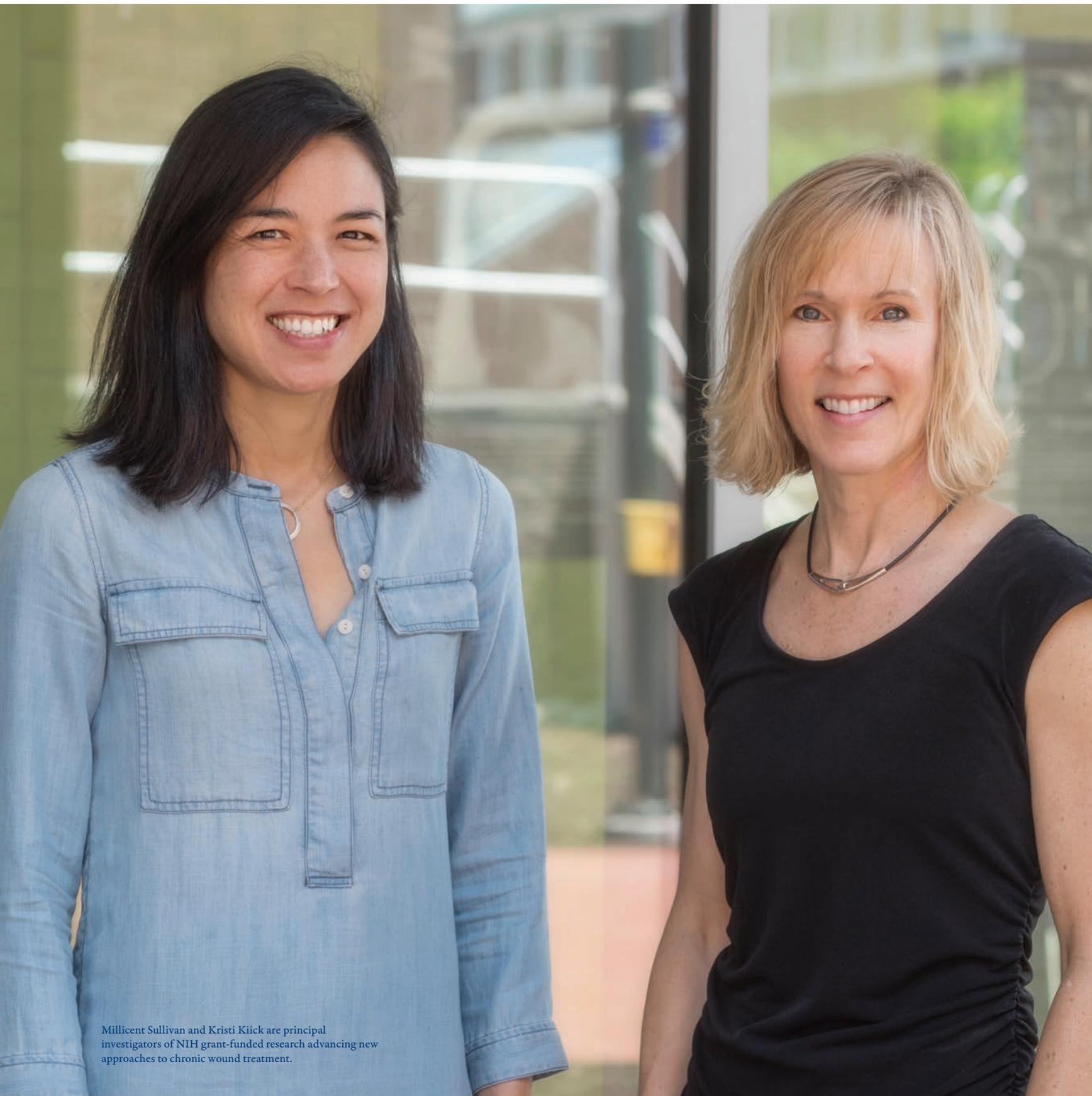


DION VLACHOS, Elizabeth Inez Kelley Professor and director of the Catalysis Center for Energy Innovation, won the 2016 Catalysis Club of Philadelphia Award. Vlachos was recognized for his extraordinary theoretical and experimental contributions to advancing the understanding of the molecular basis of heterogeneous catalysis of complex systems and to discovering and improving catalysts. Various companies have employed his reaction mechanisms for commercial processes.



ANTHONY BERIS, above, the Arthur B. Metzner Professor of Chemical Engineering, has been elected a fellow of the Society of Rheology. Beris was recognized for more than 30 years of service to the society, as well as to the field of rheology in general, including co-organizing the annual meetings in 1994 and 2006, several international workshops in the fields of nonequilibrium thermodynamics and numerical methods of non-Newtonian flows, and numerous sessions at national and international conferences. A specific contribution to the Society of Rheology was his advocacy leading to the correction of a spelling error on the Society's logo!

PRASAD DHURJATI is serving as president of the UD Faculty Senate for 2016–17.



Millicent Sullivan and Kristi Kiick are principal investigators of NIH grant-funded research advancing new approaches to chronic wound treatment.

NIH GRANT ADVANCES BIOMATERIAL RESEARCH FOR CHRONIC WOUND TREATMENT

A \$1.4 million grant from the National Institutes of Health will advance research by **MILLICENT SULLIVAN** and **KRISTI KIICK** toward a new treatment approach for chronic wounds.

Gene delivery and materials design experts Millicent Sullivan and Kristi Kiick are collaborating with David Margolis of the University of Pennsylvania's Perelman School of Medicine on the four-year project, "Collagen Turnover-Stimulated Gene Delivery to Enhance Chronic Wound Repair."

Chronic wounds cause nearly 80,000 lower leg amputations annually in the U.S. alone and are associated with an increased likelihood of death. While the body generally repairs acute wounds in a predictable series of steps, this process can be disrupted by trauma, medications, foreign objects and systemic problems such as diabetes, malnutrition and immune deficiencies.

"Effective strategies to improve chronic wound repair would impact both quality of life and mortality rates, but standard therapies continue to produce very limited healing incidences," said Sullivan.

Promising therapeutic alternatives include the application of topical growth factors, combination wound dressings or cellular scaffolds, which provide structural support for cell attachment and the tissue development that follows.

"However, even with these methods, the incidence of full wound closure remains strikingly low, and growth factor delivery methods fail to provide enough growth factor to stimulate the cells appropriately," said

Sullivan, associate professor. "New strategies to promote efficient and localized production of growth factor by the cells involved in active tissue repair could overcome these issues."

One of the most important aspects of healing is remodeling of the extracellular matrix (ECM), which provides the scaffolding for the cellular constituents in all tissues and organs. Sullivan and Kiick's strategy is to harness ECM remodeling to stimulate growth factor gene release and expression.

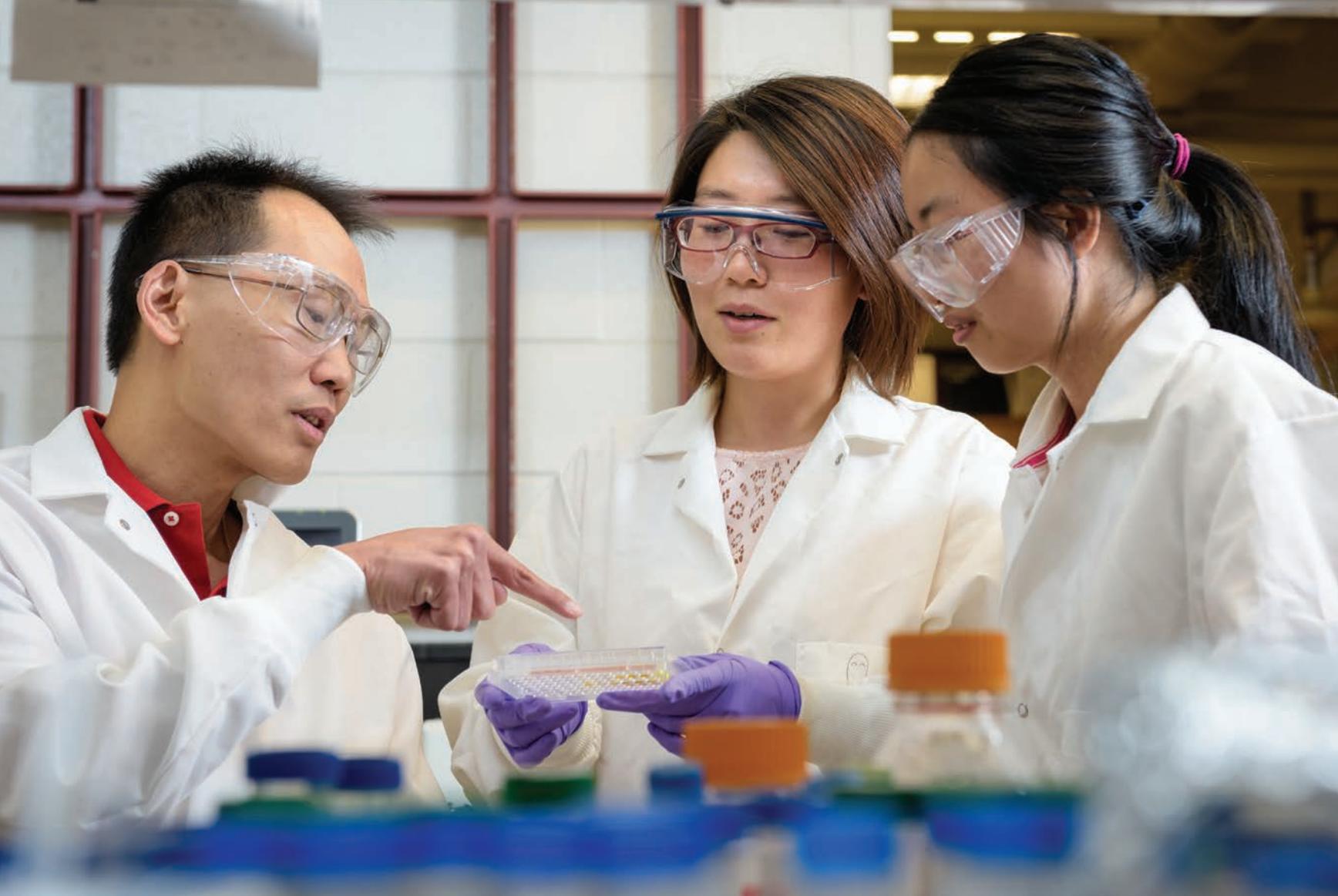
In particular, they are using peptide-based methods employed by Kiick to decorate nanostructures studied by Sullivan, with a target of localizing delivery vehicles directly in a wound. This can be accomplished by modifying the body's collagen, a protein that provides strength and structure to the bones, muscles, skin and tendons. These collagen-integrated nanostructures can then prompt growth factor expression in coordination with tissue repair kinetics.

"Our goal is to be able to 'tune' the duration of growth factor expression for periods ranging from a few days to several weeks and to coordinate this expression with the body's needs," said Kiick, who holds joint appointments in the departments of materials science and engineering and biomedical engineering and is also deputy dean of the College of Engineering and associate dean for external relations. "This tunability, or on-demand release and expression, should be ideally suited to the uncoordinated repair processes that are a hallmark of the chronic wound environment."

The researchers hope their approach will ultimately be useful as a versatile biomaterials platform applicable to healing chronic wounds and a variety of regenerative medicine applications. ■

"Effective strategies to improve chronic wound repair would impact both quality of life and mortality rates, but standard therapies continue to produce very limited healing incidences."

—MILLICENT SULLIVAN
Associate Professor



ACS NANO FEATURES CHEN TEAM'S MODULAR PLATFORM FOR BIOSENSOR ASSEMBLY

A research group led by **WILFRED CHEN**, Gore Professor of Chemical Engineering, has created a modular biosensor assembly platform analogous to a Lego® kit that offers great promise both for early cancer detection and for monitoring patients during cancer treatment. They reported their approach to system modularity, good signal amplification and easy purification this summer in *ACS Nano*.

“The sensor components can be assembled in a variety of ways, which enables us to tailor the search for specific markers,” said **QING SUN**, one of Chen’s doctoral candidates. Sun served as lead author of the paper, working with Chen and **DANIEL BLACKSTOCK**, D’16, who recently completed his doctorate and is now a scientist in the vaccine production program at the National Institutes of Health.

“Because the system is modular, we can put any antibody, fluorescent dye

or enzyme on the particles for cancer detection,” Sun said. “And every time the target changes, we can change how our sensors are assembled.”

Signal amplification provides accurate information about the amount of a marker present, which Chen’s team understands is especially significant during treatment to show clinicians whether or not a particular anti-cancer therapy is working. The team has also discovered a way to purify bio-nanoparticles in a relatively short period of time (within just one hour) under relatively mild conditions, overcoming what was once a time-consuming and tedious nanofabrication process.

“Our platform overcomes the disadvantages of many current technologies,” said Sun. “This system is also very flexible so we can expand the modularity, and we can think about using it for other applications, like drug delivery.” ■

Energy researchers discover new structure for bimetallic catalysts, address uncertainties in mathematical models

In the world of catalytic science and technology, the hunt is always on for catalysts that are inexpensive, highly active and environmentally friendly.

Recent efforts have focused on combining two metals, often in a structure where a core of one metal is surrounded by an atom-thick layer of a second one.

The properties and performance of these bimetallic core-shell catalysts can be superior to those of either of the constituent metals, but determining how to take advantage of this synergy can be challenging.

DION VLACHOS, who directs the Catalysis Center for Energy Innovation, uses computational techniques to predict how these nanoscale materials will behave, and he recently made a surprising discovery about the structure of bimetallic catalysts.

“We thought that the shell had to form a perfect concentric circle around the core,” he said. “It turns out that the apparent imperfection of a patched surface actually offers better performance and ease of synthesis.”

Vlachos documented results of the work, which was done with postdoctoral researcher **WEI GUO**, visiting scholar at the center, in a paper published last fall in *Nature Communications*.

Vlachos and Guo performed multi-scale simulations of the decomposition of ammonia on various nickel-platinum catalysts and found that patches of the “guest metal”—in this case, nickel—were very effective at creating and sustaining dual active sites.

“What we have is bifunctional activity, where flat nickel ‘terraces’ catalyze the breaking of nitrogen-hydrogen bonds, and nickel ‘edges’

drive the pairing of nitrogen atoms,” said Vlachos, who is also the Elizabeth Inez Kelley Professor of Chemical and Biomolecular Engineering.

He explains that the decomposition of ammonia is often used as a representative reaction for predicting new catalytic materials and understanding why some reactions are sensitive on a particular material’s structure.

Other advantages of studying this reaction include the need to find less-energy-intensive catalysts to break down ammonia, which is the primary constituent of most fertilizers, as well as ammonia’s ability to serve as a carbon-free energy carrier for fuel cells.

Future work will investigate the feasibility of patched surfaces for additional bimetallic catalysts and other reactions, and Vlachos is optimistic about the potential of the approach.

“What we thought of as a ‘defective’ catalyst was actually two to three orders of magnitude better than the so-called ‘perfect catalyst,’” he said. “This finding opens up broad new horizons for materials design.”

“Determining that the patched structure offers dual active sites means that we can ‘tune’ catalysts to various chemistries and metals,” he said. “Also, with just patches of the guest metal, rather than full coverage of the core, we can use less material, which could translate into reduced cost.”

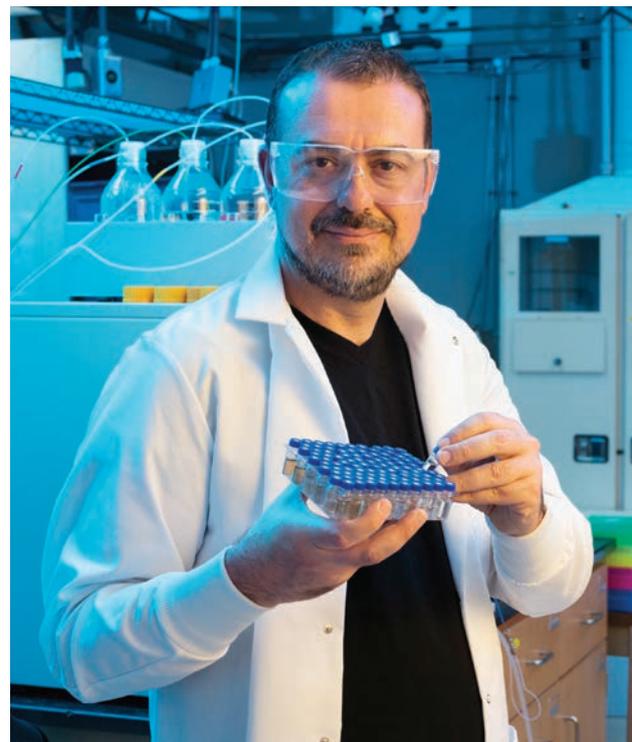
New approach to inherent uncertainties

Vlachos and Guo also teamed up on a second paper published in *Nature Chemistry*, this one addressing the uncertainties inherent in predictive mathematical models.

Working with **JONATHAN E. SUTTON**, D’14, and Markos A. Katsoulakis of the University of Massachusetts, Amherst, they looked at the effects of correlated parameters

in documenting their work on predicting the collective behavior of reaction networks to improve chemical transformations in catalysis.

All mathematical models include a number of parameters, small errors in which can cause model predictions to veer off course. In evaluating the effects of such errors, researchers have traditionally assessed each of them separately and then “added them up,” which, as it turns out, can lead to overestimation.



Dion Vlachos, director of the Catalysis Center for Energy Innovation.

“When we looked at correlations among parameters and their dependence on each other, we realized that the errors were not nearly as large as we thought they were,” said Vlachos.

“Models are more robust and reliable than we thought they were,” he said. “It makes sense that the parameters are interdependent and that you can’t change one without affecting the others, whether you’re talking about global warming or wastewater treatment.” ■

RESEARCH TEAM DOCUMENTS

DESIGN OF WOOD-BASED POLYMERS

The late **RICHARD WOOL**'s systematic description of the chemistry and manufacture of bio-based polymers and composites derived from plants was the inspiration for **THOMAS H. EPPS III** to use trees—specifically waste from the pulp and paper industry—as a source for new polymers and plastics with “tunable” thermal and flow properties.

Epps, who is the Thomas and Kipp Gutshall Associate Professor of Chemical and Biomolecular Engineering, recently demonstrated the design of softwood lignin-based polymers—softwood materials can be obtained from sources such as pine, cedar, spruce, and cypress trees—with potential application as alternatives to petroleum-based polystyrene. His work, funded by the National Science Foundation and created with several co-authors, including **ANGELA HOLMBERG**, D'16, appeared earlier this year in the American Chemical Society's journal *Macromolecules*.

Wool, who died in 2015, was a chemical engineering professor and pioneer in green engineering who authored the first book to systematically describe the chemistry and manufacture of bio-based polymers and composites derived from plants. Epps also credits Wool's former Ph.D. student **JOE STANZIONE**, D'13, now an assistant professor in the Henry M. Rowan College of Engineering at Rowan University, with engaging in initial discussions regarding the utility of lignin-based monomers and polymers.

“The two key drivers in the adoption of bio-based materials as replacements for petroleum-derived polymers are cost and properties,” said Epps. “The cost of the bio-based alternatives has to be the same or less, and the properties have to be the same or better.”

The lignin-based polymers developed in the study are components of viscoelastic materials. Like Silly Putty, they combine the characteristics of a viscous fluid and an elastic solid, offering some “give” and cushioning while also holding their shape. Such materials have potential use in applications in tires, running shoes, gaskets, seals and O-rings.

Previous efforts to polymerize lignin-based bio-oils have generally employed only one or two chemically distinct monomers. Epps' team discovered that by building multicomponent polymers from mixtures of various bio-based molecules, they could eliminate separation costs while also unlocking the ability to tailor the polymer properties.

“The diversity of molecules that come from trees—not only from different types of trees but even from the same type of tree grown in two different locations—offers the opportunity for a ‘mix-and-match’ approach to designing low-cost, high-performance bio-based viscoelastic materials tailored to specific uses,” he said. ■

Yan research team reports success with low-cost nickel-based catalyst

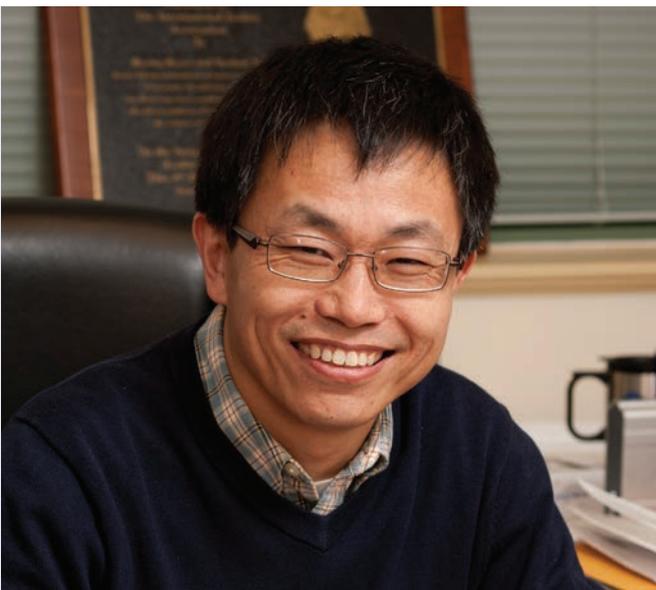
A breakthrough by **YUSHAN YAN**, Distinguished Engineering Professor, and team promises to bring down the cost of hydrogen fuel cells by replacing expensive platinum catalysts with cheaper ones made from metals, such as nickel.

Both fuel cells, which convert the chemical energy of hydrogen to electricity, and rechargeable batteries are promising, environmentally friendly candidates to address America's burgeoning energy use.

“Both fuel cells and batteries are clean technologies that have their own sets of challenges for commercialization,” said Yan.

“The key difference, however, is that the problems facing battery cars, such as short driving range and long battery charging time, are left with the customers. By contrast, fuel cell cars demand almost no change in customer experience because they can be charged in less than 5 minutes and be driven for more than 300 miles in one charge. And these challenges, such as hydrogen production and transportation, lie with the engineers.”

In a paper published last winter in *Nature Communications*, Yan and colleagues reported how they switched the operating environment from acidic to basic, and found that nickel matched the activity of platinum. Co-authors included Zhongbin Zhuang at the Beijing University of Chemical Technology and, from UD, graduate student **STEPHEN GILES**; postdoctoral scholars **GLEN JENNESS** and **JIE ZHENG**, D'16; **DION VLACHOS**, Elizabeth Inez Kelley Professor and director



of the Catalysis Center for Energy Innovation (CCEI); and **STAVROS CARATZOULAS**, associate director of computational chemistry with the CCEI.

The nation's transportation sector currently accounts for about 20 percent of America's energy use, mostly in the form of fossil fuels, driving the urgency of this team's research.

"This new hydroxide exchange membrane fuel cell can offer high performance at an unprecedented low cost," Yan said.

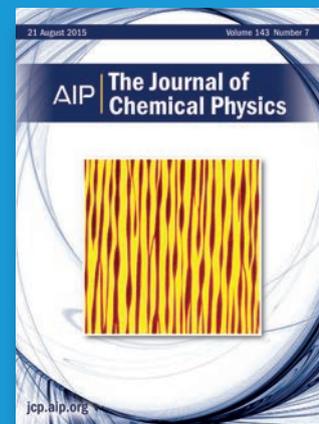
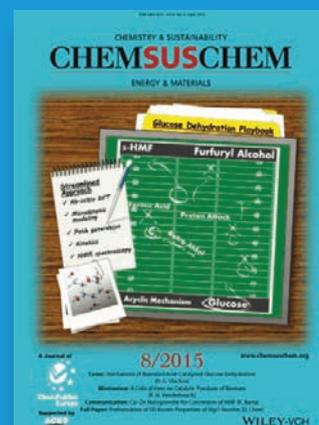
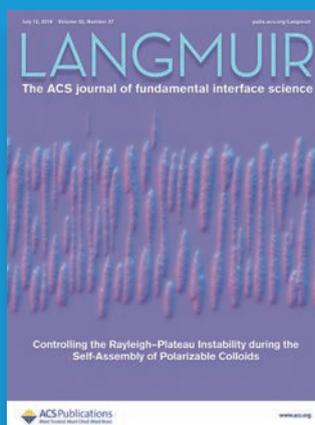
"Our real hope is that we can put hydroxide exchange membrane fuel cells into cars and make them truly affordable—maybe \$23,000 for a Toyota Mirai. Once the cars themselves are more affordable, that will drive development of the infrastructure to support the hydrogen economy." ■

"This new hydroxide exchange membrane fuel cell can offer high performance at an unprecedented low cost."

–YUSHAN YAN
Distinguished Engineering Professor

BOOKS, MONOGRAPHS AND JOURNAL ARTICLES

Research by CBE faculty, staff and students was featured in more than 200 publications this past year.





CONGRATULATIONS TO THE CLASS OF 2016!

Maan Al Balushi
 Abdulmajid Almutairi
 Omar Alsubhi
 Stephanie Anderson
 Ilana Attadgie
 Sultan Basheikh
 Yining Bei
 Kevin Bichoupan
 Mackenzie Binder
 Seth Brynien
 George Buckbee
 Benjamin Carberry
 Haopeng Chen
 Nathan Clark
 Daphne Collias
 James DeChiara
 Michael DiBenedetto
 John Fillenwarth
 Jonathan Galarraga
 Claire Griffiths
 Jason Gulbinski
 Dakota Hanemann-Rawlings
 Emily Harvan
 Tyler Haznedar
 Ruiming He
 Nathan Heckroth

Michael Karavolias
 Zachary Keenan
 John Kerr
 Joseph Kerridge
 Kyle Kokjohn
 Ryan Laske
 Nikifar Lazouski
 Michael Letterio
 Xin Liu
 Kyle Lusignea
 Nickolas Martin
 Alexander Martinelli
 John McCarron
 Charles McCutcheon
 Ryan McDonough
 Kati McLaughlin
 Robert McNew
 Kelsea Meadows
 Cameron Mengel
 Alex Moore
 Richard Murray
 Michael Palmer
 Justin Paloni
 Xueqi Pang
 Angela Pereda
 Nikhil Rao

Cody Reeves
 Sean Rivera
 Douglas Scott
 Tom Sharp
 Dylan Shea
 Zach Sheffield
 Richard Sherrer
 Taylor Shields
 Eric Shockey
 Ben Smith
 Daniel Sweetser
 Alexander Tooley
 Ryan Van Manen
 Carlos Velez
 Stephanie Verk
 Danielle Vozzo
 Stacey Wallace
 Christopher Wecht
 Eric Wiscourt
 James Woeckener
 Matthew Wong
 Fei Xu
 Mingrui Yang
 Kelsey Yeager
 Jacob Zerby
 Zhaonan Zhang

WHERE DID THEY GO?

Graduate school

Johns Hopkins University
 Massachusetts Institute of Technology (MIT)
 North Carolina State University
 Princeton University
 University of Colorado Boulder
 University of Delaware
 University of Minnesota
 University of Pennsylvania
 University of Virginia School of Law
 University of Washington

Industry

Advanced Materials Technology
 Applied Control Engineering
 Arkema | AstraZeneca | Braskem
 Deloitte | Doosan Fuel Cell America
 Frito Lay (PepsiCo) | KBR
 Merck | Peace Corps
 Regeneron Pharmaceuticals | SABIC
 Suez | W.L. Gore and Associates

PhD graduates

James Angelo
 Alex Apostolidis
 Matthew Armstrong
 Gregory Barnett
 Jonathan Bauer
 Colin Cwalina
 Kyle Doolan
 Robert Forest
 Paul Godfrin
 Ke Gong
 Angela Holmberg
 Scott Horton
 Gregory Hutchings

Robert Kaspar
 Wei-Fan Kuan
 Jason Loiland
 Elizabeth Mahoney
 Myat Noe Zin Myint
 Jonathan Rosen
 Nikki Ross
 Hao Shen
 Qing Sun
 Theodore Swift
 Zachary Whiteman
 Ke Xiong
 Bryan Yonemoto
 Qi Zheng

MChE

Marco Armenante
 Thomas Bollen
 Joshua Bullock
 Josephine Chiu
 Ryan Friedrich
 Vincent Van Dessel
 Harry Zechman
 Yan Zhang

MEPT

Qi Feng
 Runru Liu
 Nishant Lodha
 Xintian Su
 Yuan Wei



Below: Ph.D. graduates after the doctoral hooding ceremony. Graduates (L to R): Jonathan Rosen, Angela Holmberg, Bryan Yonemoto, Bahar Ipek, Greg Hutchings, Jennifer Au, Jim Angelo, Scott Horton, Colin Cwalina. Faculty (back row, L to R): Feng Jiao, Raul Lobo, Bramie Lenhoff, Maciek Antoniewicz, Norman Wagner, Mike Klein.

Jim Angelo (left) with his father Mike Angelo, D'81, after the doctoral hooding ceremony in May. As far as we can tell, this is the first instance of two generations of the same family receiving Ph.D. degrees from the department. If we have overlooked other cases, please let us know!



AIChE student chapter rises to the occasion

The AIChE student chapter has been exceptionally active over the past year or two, even judged by the very high standards to which the chapter and the department are accustomed. Under outstanding leadership, the chapter engaged a large fraction of the undergraduate students in the department and made its mark on campus, as well as regionally and nationally. That the 2014–15 leadership included several juniors who were therefore still active during 2015–16 was a key factor in the substantial impact that the chapter had in the past year.

The highlight of the chapter's accomplishments was the great success of the 2016 AIChE Mid-Atlantic Student Regional Conference that the chapter hosted in Newark in April. The chapter bid successfully to host the conference at the 2015 event at the University of Maryland—a significant accomplishment in itself.

More than 450 chemical engineering students and professionals from as far south as Virginia and as far north as Canada came together in Newark for the 2016 conference. Participants networked with fellow chemical engineering majors and professionals, learned about promising research, explored graduate programs and gained valuable career advice—all while discovering the great UD campus.

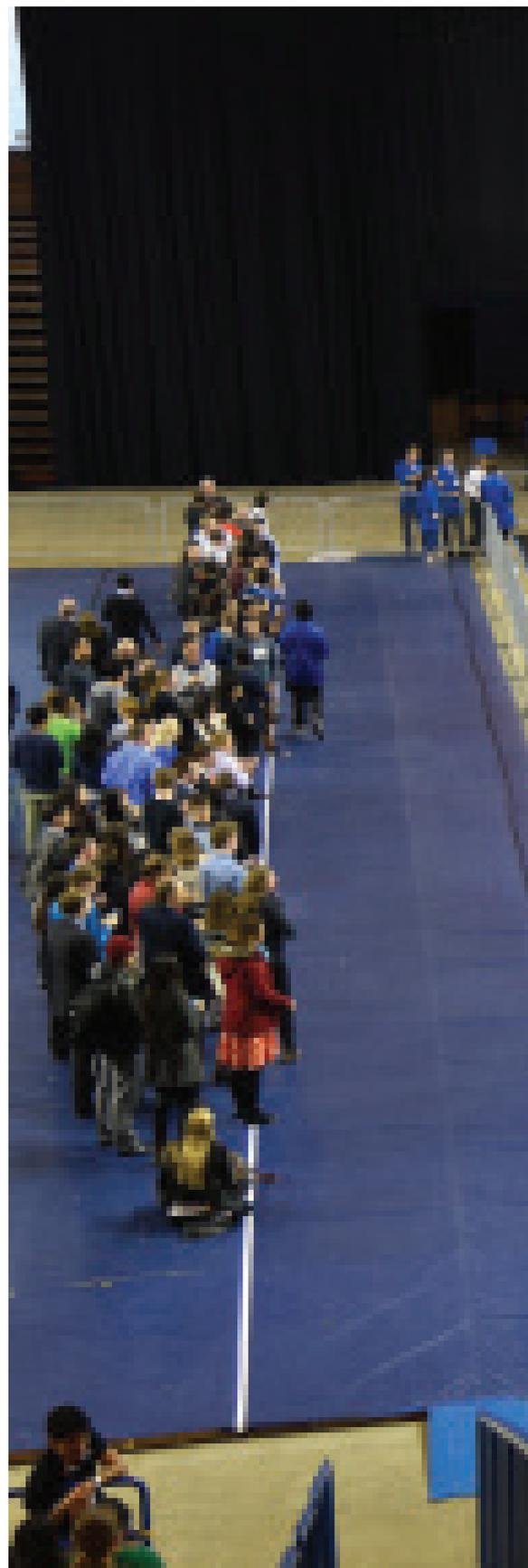
A highlight of the conference was the ever-popular Chem-E-Car competition, in which 29 student teams built small cars that are driven by chemical reactions—the largest regional competition of its kind, to date! This event was held at the Bob Carpenter Center with careful consideration of appropriate lab safety practices.

Two notable chemical engineering alumnae—**LINDA MYRICK**, '77, program director

CONTINUED ON PAGE 18



At the conference banquet, Nick Martin and Jon Galarraga (second and fourth from left respectively) are seen with faculty members (L-R) Bramie Lenhoff, Sujata Bhatia (keynote speaker) and Josh Enszer.





AIChE student chapter CONTINUED FROM PAGE 16

at Air Liquide, and **SUJATA BHATIA**, '99 M'99, a current UD faculty member—shared insights into today's research and career opportunities in the field.

Coordinating an event of the scope of the regional conference required a very large team effort and excellent coordination and leadership. The role of the conference chair, **JONATHAN GALARRAGA**, '16, was critical, in addition to participation across the chapter, not least from president **NICKOLAS MARTIN**, '16. The key players, shown in the photograph below, included student participants from all years.

As usual, the chapter also organized numerous other local events. An innovative highlight this year was the opportunity for students to gain invaluable career advice from a panel of four DuPont Fellows. These accomplished scientists and engineers—considered at the forefront of defining brand-new technologies and directions of research and inspiring the

scientific community—shared sage advice with students eager to launch their own careers in chemical engineering.

Fellows **JIM TILTON**, '81 M'82, an expert on transport phenomena; Ken Leffew and Linda Ankrom, experts on polymer reaction engineering; and **ART ETCHELLS**, D'70, an expert on mixing, solids handling and crystallization, encouraged students to be open to trying various jobs within chemical engineering to find their fit; to have a strong sense of purpose and a desire to make a difference; and to assess their own strengths and weaknesses early and often in their jobs.

“It was a neat experience to have such a diverse group of technical experts in the same room to talk about their experiences and provide valuable advice on our chemical engineering futures,” said **VICTORIA MUIR**, now a junior and vice-president of the AIChE student chapter. “It is certainly an event I would like to host again next year as our chapter vice-

president, and I hope to expand the event to bring in more fellows and attendees.”

The critical role of chapter leadership was recognized in the feature that ChEnected—AIChE's online site where chemical engineers “mix it up”—presented on UD Chapter President Nick Martin as its March 2016 student of the month. Nick was also regional chair of the Mid-Atlantic Region, supervising seven regional liaisons, and vice-chair for AIChE's executive student committee, working with more than 200 domestic and 50 international student chapters.

Nick, who researched solar energy and biomass transformation and took several classes related to sustainable energy technology and green engineering while an undergrad at UD, is now chief operating officer for InstaSolar Energy LLC, creating solar solutions for the modern market and bringing clean energy and clean water technology to sub-Saharan Africa. ■

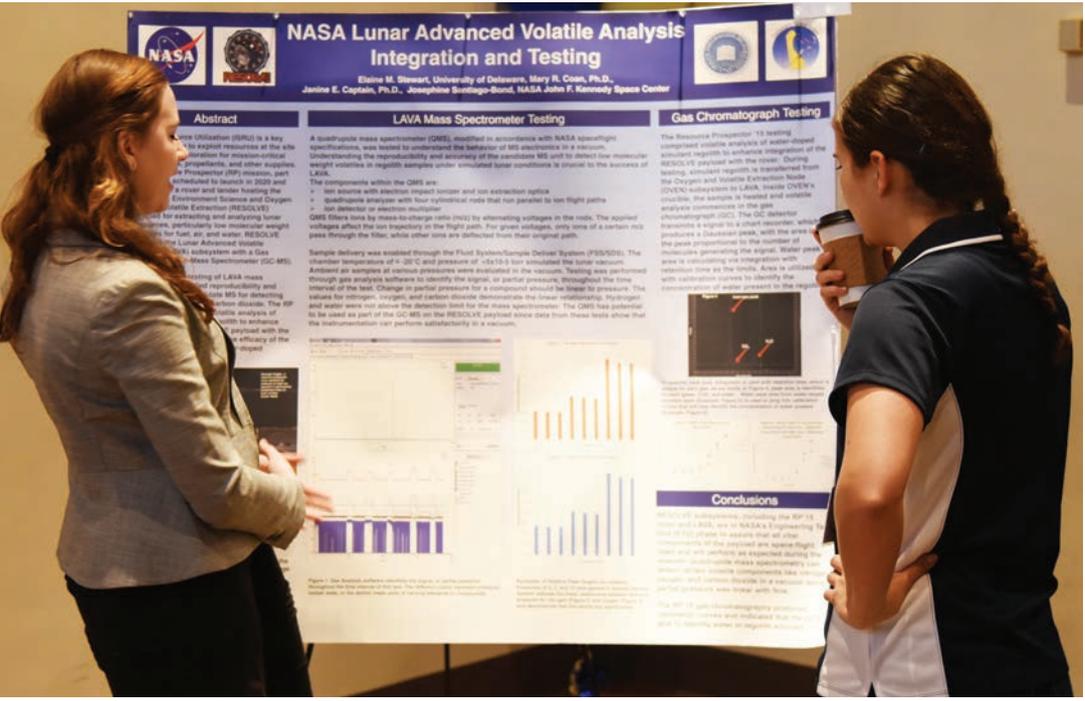
“AIChE can make any chemical engineer—student or professional—a more well-rounded individual who sees the profession as a chance to make a difference.”

—**NICK MARTIN**, '16



Kenzie Tsaousis

Basking in the success of the 2016 Regional Conference: front row (L-R): Sarah Gross, Elaine Stewart, Stephanie Verk, Kati McLaughlin, Rebecca Sassone, Victoria Muir. Back row (L-R): Jon Galarraga, Justin Caccavale, Kyle Lennon, Ben Carberry, Nick Martin, Matt Criscuolo, Cyrus Cao, Sam Schmidt, Robert Pifer.



Below: Keynote speaker Linda Myrick. Left: Sophomore Elaine Stewart presenting her research from her time at NASA.



Above: Kyle Lusigna speaking on behalf of Engineers without Borders at the student conference. Left: Crowds cheer and watch nervously during the competition.

“We were really challenged on what it would be like to work on a project that has the potential to make a difference in the world.”

– JONATHAN GALARRAGA, '16



Photo courtesy of Centers for Disease Control and Prevention

UDEFEND: Seniors challenged to develop vaccine and diagnostic test for Zika virus

Zika virus was first discovered in 1947, but for more than six decades it was regarded as more of a nuisance than a public health emergency—the illness is usually mild, with symptoms lasting a few days to a week after the victim is bitten by an infected mosquito.

But 2015 witnessed an alarming connection between the virus and birth defects in children born to infected women, and the quest was on for a test to diagnose the disease and a vaccine to prevent it.

In capstone course CHEG432, Chemical Process Analysis, chemical engineering seniors working on one of the design projects were told that the World Health Organization and the Centers for Disease Control and Prevention had engaged the leaders of major biopharma companies—including one called UDefend, a fictitious manufacturer of biologic vaccines and diagnostics—to combat the Zika virus outbreak. Representing UDefend, the students were charged with evaluating the challenges and opportunities associated with the introduction of both a vaccine and an associated rapid diagnostic test.

“The Zika virus has heartbreaking consequences for individuals with neurological complications, for pregnant women and for new mothers with affected babies,” said **SUJATA BHATIA**, professor of chemical and biomolecular engineering, who co-advised five student teams with DuPont researcher Steve Lustig. “Yet there is no available vaccine or therapy for Zika virus, and there is no reliable diagnostic test to track the spread of the virus. This seemed like the perfect real-world challenge for our students.”

Each team conducted a feasibility study, considering technical and business feasibility, as well as social factors, and then made a recommendation as to whether UDefend should pursue the production of the vaccine and test. With the decision to move forward, they then suggested prices for the products and identified public policies for distributing them to the global community.

In a 20-minute presentation highlighting their comprehensive 73-page report, Team T members **BRENDAN BUCKBEE**, **DAPHNE COLLIAS** and **JONATHAN GALARRAGA**, all now 2016 graduates, covered project requirements, market challenges and barriers to entry, value-chain

assessment, manufacturing, profitability analysis, and recommended action. They finished with four seconds to spare, recommending that UDefend proceed, with initial prices of \$50 for the vaccine and \$7 for the diagnostic test.

One of their more interesting recommendations was that the manufacturing plant be constructed in Brazil, the epicenter of the Zika outbreak.

“Even though we knew that we were just pretending to be a large company with significant assets, going through the entire thought exercise taught us a lot about how products are developed and then disseminated to meet customer needs,” said Galarraga. “We were really challenged on what it would be like to work on a project that has the potential to make a difference in the world.”

Bhatia and Lustig said each of the five UDefend teams took a unique technical approach to the Zika threat, with the students learning an amazing amount about vaccines, epidemics, clinical trials, regulations, global health, economics and manufacturing in just two months. ■

Student Awards

MUIR NAMED GOLDWATER SCHOLAR



Honors student McCarron joins Peace Corps following graduation with distinction

Within two short days this past spring, chemical engineering major **JOHN MCCARRON**, '16, received his honors degree with distinction, walked in UD's commencement, attended convocation and departed for Ghana as a Peace Corps volunteer teaching math to middle school students. McCarron looks at the program as a way of giving back before moving on to his career in medicine.

As he settles into his new community this fall, he is looking for opportunities to branch out—perhaps tutoring students in science and practicing new language skills with his host family and friends. “To try new things is the goal,” he said. ■

VICTORIA MUIR—an Honors Program student with a double major in chemical engineering and biological sciences with a concentration in cellular and molecular biology and genetics—earned a scholarship from the Barry M. Goldwater Scholarship and Excellence in Education Foundation. Considered the premier undergraduate award of its kind, the scholarship program honors the late senator from Arizona by fostering and encouraging outstanding students to pursue careers in the fields of mathematics, the natural sciences and engineering.

Muir is also a Eugene du Pont Distinguished Memorial Scholar, funded by the Unidel Foundation.

Now a junior, she plans to earn a doctorate in chemical engineering and complete a post-doctoral fellowship at a biomedical

institution, such as the National Institutes of Health, ultimately becoming a professor in the field. Her research will focus on nanocarriers for drug delivery, specifically options for personalized cancer treatment.

She also took second place for Excellence in Undergraduate Polymer Research at the national meeting of the American Chemical Society.

“My research aims are to optimize the polymer composition of siRNA (short interfering) nanocarriers and create an optimized dosing schedule for siRNA delivery,” Muir said. “This is done by combining laboratory experiments with mass action kinetic modeling of the polymer system.”

Muir is advised by **THOMAS H. EPPS, III**, the Thomas and Kipp Gutshall Associate Professor of Chemical and Biomolecular Engineering with a joint appointment in materials science and engineering, and by **MILLCENT O. SULLIVAN**, associate professor of chemical and biomolecular engineering.

Muir was also selected this year as the first recipient of the David Buck Scholarship, in memory of undergraduate student **DAVID BUCK**, who passed away in 2010 after a brave struggle with cancer. The Honors Day ceremony in May at which Victoria received the scholarship was attended by David's parents, Gene and Lori Buck. ■



Student Awards

Rosen honored by ACS I&EC; wins Allan P. Colburn Prize in Engineering and Mathematical Sciences

JONATHAN ROSEN, D'16, who investigated novel electrochemical systems for sustainable fuels production under assistant professor **FENG JIAO**, won first place among seven finalists at the 2015 graduate student award symposium hosted by the American Chemical Society Industrial & Engineering Chemistry (ACS I & EC) division, and was selected for UD's Allan P. Colburn Prize in Engineering and Mathematical Sciences during the 2016 Doctoral Hooding Convocation.

Rosen's graduate research focused on the development of novel electrocatalyst for selective CO₂ conversion to valuable chemicals and the design of a continuous flow reactor system for CO₂ electrolysis. He was part of a team lead by Jiao to develop an advanced oxygen recovery system for NASA.

Jiao, who described Rosen as by far the best student he has had at UD, said Rosen has clearly demonstrated his extraordinary research capability and skills by publishing nine papers in top-tier, peer-reviewed scientific journals, including four first-author papers.

"Finding ways to convert greenhouse gas carbon dioxide emissions from fossil fuel use into other chemicals and fuels is a central vein of clean energy research," said Jiao. "Jonathan's breakthrough work in developing a selective and efficient catalyst for carbon dioxide reduction is an important contribution to this research field."

Rosen is continuing his research at Exxon Mobil Research and Development. ■



Galarraga receives the Alexander J. Taylor Sr. Award

JONATHAN GALARRAGA, '16, who graduated this spring with an honors degree with distinction in chemical engineering, was honored by the UD Alumni Association with the Alexander J. Taylor Sr. Award.

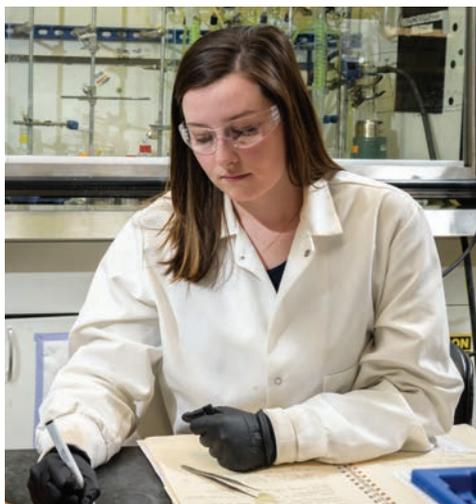
Galarraga was a Eugene du Pont Distinguished Memorial Scholar, funded by the Unidel Foundation, and, between 2014 and 2015, was endorsed for the Truman, Rhodes and Marshall scholarships. He held leadership roles in organizations such as the Hispanic Professional Engineers, the American Institute of Chemical Engineers and the Deep Roots Outreach Program. As an undergraduate, he led an independent research project related to tissue engineering and drug delivery.

"Before meeting Jonathan, I would have said that a freshman needs more training before they can handle the research environment," said **CHRISTOPHER J. KLOXIN**, assistant professor of materials science and engineering and of chemical and biomolecular engineering, who was Jonathan's research advisor. "Jonathan persuaded me, though, which ultimately prevented me from missing out on the opportunity to work with such a talented individual."

Now working on his doctorate at the University of Pennsylvania, Galarraga described winning the award as "very humbling, a great honor and a celebration of my activities."



Doctoral candidate **MELISSA GORDON**, below, won an Excellence in Graduate Polymer Research Award from the American Chemical Society (ACS) and was invited to present her research, which focuses on developing novel stimuli-triggered polymer networks for self-healing applications, at the 12th annual Excellence in Polymer Graduate Research Symposium hosted last spring in San Diego by the ACS Division of Polymer Chemistry.



Ph.D. candidate **STEPHEN MA** was awarded the DSM Science & Technology Award Americas 2015 for development of a highly original wrinkling technique to make patterns on the surface of a polymer. The award was bestowed this year in collaboration with the American Institute of Chemical Engineers Process Development Division, Particle Technology Forum and Catalysis and Reaction Engineering Division. In presenting the award, Eric Grolman, of DSM said, “Adding nature-inspired functionality to the surface of polymers with the technique presented by Stephan Ma could be the next leap forward in the use of polymers in a variety of applications.”

Graduate student **JIM ANGELO** was honored with EMD Millipore’s 2015 Life Science Award for excellence in bioseparations and won best poster at the 28th International Symposium on Preparative and Process Chromatography.

DOUGLAS GODFRIN, D’15, won the 2016 Prize for Outstanding Student Research from the Neutron Scattering Society of America at the 8th American Conference on Neutron Scattering this summer in California.

Graduate student **TAMÁS PRILESZKY** won the poster award at the 90th ACS Colloid and Surface Science Symposium held this summer at Harvard. Prileszky is advised by Eric Furst, professor and director of the Center for Molecular & Engineering Thermodynamics.

Ph.D. student **MICHELLE CALABRESE** won one of four student poster prizes at the 8th American Conference on Neutron Scattering for her work on understanding the effects of branching on the flow of self-assembled surfactants.

Congratulations to the following students for their accomplishments at the AIChE Annual Meeting Poster Session

MICHAEL PALMER (senior)
1st Place: Food, Pharmaceuticals and Biotechnology Division

DOUGLAS SCOTT (senior)
1st Place: Materials Engineering and Science Division

ELAINE STEWART (sophomore)
3rd Place: Materials Engineering and Science Division

The Alexander J. Taylor Sr. Award, presented along with the Emalea Pusey Warner Award to a stellar female senior, singles out outstanding men and women from the graduating class who truly exemplify what it means to be a Blue Hen. Taylor entered Delaware College in 1889 and graduated in 1893 as class valedictorian with a baccalaureate degree in civil engineering. He served on the Board of Trustees in the 1920s and 30s. UD’s Taylor Hall is named in his honor. ■



ALUMNUS RAKESH JAIN WINS NATIONAL MEDAL OF SCIENCE

President Barack Obama presented the National Medal of Science—the nation’s highest honor for achievement and leadership in advancing the fields of science and technology—to **RAKESH JAIN**, M’74, D’76, at a special White House ceremony in May.

“Science and technology are fundamental to solving some of our nation’s biggest challenges,” said Obama in a White House press release. “The knowledge produced by these Americans today will carry our country’s legacy of innovation forward and continue to help countless others around the world. Their work is a testament to American ingenuity.”

Jain, who is director of the Edwin L. Steele Laboratory for Tumor Biology in the

Department of Radiation Oncology at Massachusetts General Hospital, has dedicated his career to studying the microenvironment of cancerous tumors in the laboratory and in human trials. He is known for his ability to combine knowledge from the fields of engineering, biology and medicine to reveal mechanisms of resistance to drug delivery and efficacy for his innovative approaches to overcome this resistance, and for taking his approaches from bench to bedside and back.

He is most celebrated for proposing and validating the hypothesis that “normalizing the tumor vasculature” can improve the treatment outcome and survival of cancer patients. This concept also offers opportunities to improve treatment of vascular disorders that afflict some 500 million people worldwide.

“I feel very grateful for my family and mentors who introduced me to this area of research,” said Jain. “I also feel enormously grateful to the hundreds of patients who participated in more than 25 clinical trials that our laboratory has collaborated in, and who have made it possible for future patients to benefit from their efforts. Lastly, I am extremely grateful for research grants from the federal agencies and private foundations, as well as philanthropic support, especially from the Cook and Steele families.”

This is one of many accolades that Jain has received in his distinguished career, including election to all three branches of the National Academies: the National Academy of Science, National Academy of Engineering and National Academy of Medicine (formerly the Institute of Medicine). ■

Alumnus Arup Chakraborty elected to NAS

ARUP CHAKRABORTY, D'88, has been elected to the National Academy of Sciences in recognition of his distinguished and continuing achievements in original research.

Chakraborty is now the Robert T. Haslam Professor of Chemical Engineering, Physics, and Chemistry at the Massachusetts Institute of Technology, where he is also founding director of the Institute for Medical Engineering and Science.

His entire career has been focused on research at the interface of disciplines. After a successful early career working on molecular engineering of catalysts and polymers, in 2000 he turned his attention to immunology.

The central theme of his research since then has been the development and application of theoretical and computational approaches, rooted in physics and engineering, to aid the quest for mechanistic principles in immunology and then to harness this understanding to aid the design of vaccines against mutable pathogens—for example, HIV.

In 2004, Chakraborty was elected to the National Academy of Engineering for his

accomplishments in applying theoretical chemistry to practical problems in polymer interfaces, sensor technology and catalysis.

He has received a number of additional honors, including a National Institutes of Health Director's Pioneer Award, the E.O. Lawrence Memorial Award for Life Sciences, the Allan P. Colburn and Professional Progress awards of the American Institute of Chemical Engineers, a Camille Dreyfus Teacher-Scholar award, a Miller Research Professorship, and a National Young Investigator award. He is also a fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science, and he serves on the U.S. Defense Science Board.

In 2005, Chakraborty received UD's Presidential Citation for Outstanding Achievement, an honor bestowed upon graduates of the past 20 years who "exhibit great promise in their professional and public service activities."

"I registered as a student at the University of Delaware two days after coming to this country," Chakraborty, from India, said after receiving the UD citation. "The University not only taught me about science and engineering, but also about America and the principles that make this nation great. Today, as a proud American, I look back on the four years at Delaware with fondness and gratitude for teaching me about our country and instilling in me the desire to strive for excellence." ■



"UD not only taught me about science and engineering, but also about America and the principles that make this nation great. I look back on the four years at Delaware with fondness and gratitude for instilling in me the desire to strive for excellence."

– ARUP CHAKRABORTY, D'88

Helgeson wins 2016 Unilever Award for colloid science

MATTHEW E. HELGESON, D'09, is the 2016 Unilever Award winner for fundamental work in colloid or surfactant science carried out in North America by researchers in the early stages of their careers.

Helgeson is an assistant professor of chemical engineering and faculty member of the Materials Research Laboratory at the University of California, Santa Barbara. His research is devoted to the design and processing of complex fluids and colloidal soft matter with well-specified mesostructure. His research group uses a combination of molecular self-assembly and flow to guide the interactions and assembly of colloidal species (nanoparticles, emulsions, proteins, etc.) into emergent structures. To complement this research, the Helgeson lab develops experimental tools using scattering and microscopy to monitor the multi-scale microstructure and dynamics of these fluids, ultimately to inform their molecular-level design. Current topics of interest include the engineering of colloidal particulates and gels for applications in biotechnology, advanced separations and energy conversion.

Helgeson also earned early career awards from the National Science Foundation and the Department of Energy, the inaugural Distinguished Young Rheologist Award from TA Instruments, a Northrup Grumman Excellence in Teaching Award, and the Victor K. LaMer Award from the ACS Division of Colloid & Surface Chemistry. ■



TWO ALUMNI ELECTED TO NAE

Two chemical engineering alumni are among 80 new U.S. members of the National Academy of Engineering.

MORTON COLLINS, '58, above, was cited for accomplishments as a builder and manager of technology-based companies and as an adviser to government and universities. He is managing partner at Battelle Ventures LLC in Ewing, NJ. In 1968, he founded Data Science Ventures, a pioneering venture-capital firm specializing in early-stage financing of high-technology companies—now Cardinal Partners. He chaired President Ronald Reagan's Task Force on Innovation and Entrepreneurship and served as technology policy adviser to President George H.W. Bush.

For more than 30 years, Collins has been a member of the Department of Chemical and Biomolecular Engineering Advisory Council, serving as chair from 1984–2010. He also serves as a member of the President's Leadership Council. A beneficent supporter of the department, he has pledged \$10 million toward first-year graduate fellowships and has made generous gifts to the Class of 1958 Scholarship and toward renovations to Colburn Lab. In recognition of his many achievements, Collins was awarded the 1989 University of Delaware Medal of Distinction.

TEH HO, D'77, was recognized for contributions to catalytic removal of sulfur and nitrogen compounds from hydrocarbon fuels. A retired senior research associate at ExxonMobil Research and Engineering Company in Bridgewater, NJ, he previously worked at Halcon Research and Development Corporation and was also a platoon leader with the Taiwan Marine Corps.

He is a co-inventor on more than 40 patents and the recipient of the R. H. Wilhelm Award in Chemical Reaction Engineering from the American Institute of Chemical Engineers.

Ho's wife, Wei Wei H. Ho, is also a UD graduate, receiving a degree in 1976. The couple supports a variety of initiatives on campus including the renovation of Colburn Laboratory, the construction of Harker Laboratory, the departments of Chemical and Biomolecular Engineering and Plant and Soil Sciences, and the Art Metzner Professorship.

TWO CBE ALUMNI WIN PRESIDENTIAL HONORS

Two CBE alumni—**WILLIAM TISDALE**, '05, and **MICHELLE O'MALLEY**, D'09—are among an elite group of researchers to receive Presidential Early Career Awards for Scientists and Engineers (PECASE), the highest honor bestowed by the United States government on science and engineering professionals in the early stages of their independent research careers.

Tisdale, whose award includes research funding from the Department of Energy, is the Charles and Hilda Roddey Career Development Professor in Chemical Engineering at the Massachusetts Institute of Technology. He joined the MIT faculty in 2012 and received a Department of Energy Early Career Award in 2013. He also received MIT's student-nominated 2014 Baker Award for Excellence in Undergraduate Teaching. His research focuses broadly on understanding and controlling the movement of energy in nanostructured materials.

O'Malley is an assistant professor at the University of California, Santa Barbara, where her lab engineers protein synthesis and manipulates cellular behavior for biomedical and environmental applications. She received a 2016 National Science Foundation Faculty Early Career Development Award, and in 2015 she was named one of 35 Innovators Under 35 by *MIT Technology Review*.

In May, O'Malley returned to campus to deliver the Allan P. Colburn Memorial Lecture, which recognizes young faculty who exemplify Colburn's scholarly abilities. Her PECASE award is funded through the Department of Energy.

Previous PECASE winners include department faculty members **ANNE ROBINSON** and **THOMAS H. EPPS, III**, now the Thomas and Kipp Gutshall Associate Professor of Chemical and Biomolecular Engineering, who was honored in 2010. ■



Photo courtesy of Sonia Fernandez/UCSB

Former adjunct professor Mark Shiflett named Foundation Distinguished Professor at University of Kansas

MARK SHIFLETT, M'98, D'02, formerly an UD adjunct professor of chemical and biomolecular engineering and a prominent chemical engineer who helped create a top refrigerant that is safe for the Earth's ozone layer, joined the University of Kansas this summer as a Foundation Distinguished Professor in the Department of Chemical and Petroleum Engineering. He will also conduct research at the university's Center for Environmentally Beneficial Catalysis.

The Foundation Distinguished Professor initiative is a unique partnership between the university and the state of Kansas to attract a dozen eminent scholars who support one or

more of the university's four strategic initiative themes.

Shiflett's research interests, which center on separations, ionic liquids and green chemistry, have led to the development of three environmentally safe refrigerant mixtures for DuPont, one of which has generated more than \$1 billion in revenue. He holds 44 patents and has several patent applications pending. He has published more than 70 scholarly articles and is a reviewer for a number of chemical engineering research journals. He is a frequent presenter and invited lecturer at conferences and has appeared across the United States and in Canada, Germany, Spain, China, Austria, Ireland and Japan.

In addition to his research-intensive career, Shiflett was an in-demand adjunct professor at the University of Delaware since 2011, with a stellar reputation for teaching chemical engineering laboratory classes, as well as junior- and senior-level research courses.

He is active in both the American Chemical Society and the American Institute of Chemical Engineers. In 2006, he was awarded the ACS Heroes of Chemistry Award, and in 2005, he received DuPont's Bolton/Carothers Innovative Science Award for advances in environmental science. He was awarded Fellow status in AIChE in 2014 and in the ACS Industrial and Engineering Chemistry Division in 2015. ■

Alumni News

Send us your updates!

All in the department take great pleasure in hearing what our alumni are doing, and especially, of course, hearing of their personal and professional successes. The updates on the following pages are based on information sent to us by individuals, news items gleaned from the media and elsewhere, and information obtained by direct contacts with individuals. We have also enjoyed having small get-togethers with even a handful of alumni when one of our faculty has the opportunity on visits around the country. Please send news and updates to Bramie Lenhoff (lenhoff@udel.edu), and also let him know if you'd be interested in a local reunion when one or more of our faculty are in your area.

Please join us for the

AIChE DELAWARE ALUMNI RECEPTION

Monday, November 14, 2016

7:00 - 9:30 p.m.

Hilton San Francisco Union Square
San Francisco, Cal.
Franciscan C Room

1950s

It was a delightful privilege for us this year to be reunited with our first-ever female graduate, **KAY KREEMER CULVER, '56**. Kay's abilities in and enjoyment of math and science in high school made chemical engineering a natural discipline for her, and she recalls visiting Allan Colburn with her parents and entering the chemical engineering program with his support and encouragement. Kay says that she felt fully at home among the male students in her class, but the workplace was less welcoming and she ultimately became a patent examiner at the U.S. Patent Office. She and her husband moved to west Texas after retiring, and after her husband passed away, she moved to Hilton Head, SC, to be closer to her daughter. As described in our department history, written by Reggie Blasczyk and published in 2014, another early female student, **ANNE DAVIS CANNON, '57**, also had difficulty finding employment as a chemical engineer. We admire the dedication and courage of these early female graduates, and are pleased to note that our current undergraduate classes are close to one-third female and all career options are open to all graduates.

1960s

STAN HEARN, '66, was a farm boy from Laurel, in lower Delaware, with family members who worked at the DuPont nylon plant in Seaford and an uncle who had studied chemical engineering at UD. With science and math as his favorite subjects, the latter path attracted him and he was awarded an H. Fletcher Brown Fund Scholarship to attend UD. Stan writes, "I was blessed to have Dr. Jack Gerster as an advisor and Dr. Russell as senior project advisor. These, along with Drs. Olson and Metzner, did their best to have me understand the principles of chem eng. All were great mentors, gave tough exams (I still remember several questions that I sweated through to get a few points on the curve), but were quite fair in their final grades." Stan began his career with a slide rule and retired with a PC, with the road including a job with Shell Chem in Woodbury, NJ, a research assignment following being drafted by the U.S. Army at Edgewood Arsenal, an MBA at the University of Washington, and 30 years with Hooker Chem/Oxy Chem/Pioneer in Tacoma, WA, where he had titles of chem eng, project eng, plant eng, technical manager and environmental manager. Stan is now retired but had a wonderful life and work in engineering, and feels that "What I learned at UD was that I had the confidence and ability to solve problems, find answers from handbooks and experts in given fields, and that my work in the chemical engineering department and its degree opened doors along the way so that I could continue to learn the needed skills."

1970s

BRUCE FLEMING, '77, has been named executive vice president of Strategy and Growth at Calumet Specialty Products Partners, L.P., a leading independent producer of specialty hydrocarbon and fuels products. Bruce has more than 30 years of experience leading internal growth initiatives, business development and strategic acquisition advisory services for global energy companies. For the past 10 years, he has served as the vice president of mergers and acquisitions at Tesoro Corporation; among his other accomplishments in this role was his leadership of Tesoro's acquisition of \$2.5 billion in assets from BP. Earlier in his career he held senior business development and planning roles with Amoco Oil and Orient Refining.

1980s

ERIK FYRWALD, '81, has extended his long list of career accomplishments by his appointment as CEO of Syngenta, Inc. Erik spent 27 years at DuPont where he held positions of increasing responsibility in technology, manufacturing, sales and marketing, strategic planning and regional and global business unit leadership, including four years in Asia. In 2003, he was named group vice president of DuPont Agriculture and Nutrition and also served as chairman of Crop Life International for two years. In 2008, he was named chairman, president and CEO of Nalco, a leading global provider of water treatment and oil and gas products and services, and then president of EcoLab after it acquired Nalco. Since 2012, he has been CEO of Univar, a global distributor of chemical products and provider of related services. Erik serves on the boards of Eli Lilly and Company and the Society of Chemical Industry.

BRIAN MCCUDDEN, '81, spent the first 10 years of his career in the chemical industry, mostly in Baltimore, with a short stint in Oklahoma City, but has been in pharmaceuticals since moving to Boulder, Colo., in 1991. He worked primarily in operations, other than three years in strategy and procurement during a stint in the Chicago headquarters. He is currently president of Corden Pharma Colorado, which is a pharmaceutical contract development and manufacturing organization in Boulder. Brian's wife Laura is also a UD graduate (BSN 1985). They have three sons, all college graduates and living on their own! Sean is also a chemical engineer (from Rice) who works for Merck outside of Philadelphia; Greg is a geologist in San Francisco; and Paul is in ecotourism in Colorado.



Clockwise from lower left: Linda Gort-Walton, Brigid McVaugh, Jack McVaugh, Leonard Walton, Blue shirt is Tim O'Brien, Linda O'Brien on the end, Bob Taggart, Bob's children Nathan and Ashley, Dariece Rau, Chuck Rau, Jay Williams and Anna Williams.

A GROUP FROM THE CLASS OF 1971

gathered in late April in their 45th year since graduation, to enjoy a few dinners and a day of activity in the Brandywine Valley. The group hopes to reprise the weekend of reminiscence and good times in the near future and plans to work to have as many of the Class of 1971 meet for a full reunion for their 50th. The alumni participating were:

- **JACK MACVAUGH** manages his own environmental, health and safety consulting practice, which he has had for the last 22 years after 14 years in the chemical industry.
- **BILL MARRAZZO** is president of WHYY public television and radio after starting in the Philadelphia Water Department. He rose to water commissioner of Philadelphia and then city managing director, before he was CEO of the Weston Corporation. He was also a founding member of our department's Advisory Council in the 1980s.
- **TIM O'BRIEN** left industry as the global innovation leader for the filaments division of AstenJohnson, with a career that included nine U.S. patents and management roles in manufacturing and R&D at three companies. Tim and his wife Linda Rose O'Brien, '74, returned to Delaware after 30 years in Annapolis, Md., Charleston, SC, and Burlington, Vt., and are now retired in Middletown, Del. They have four children and three grandchildren.
- **CHUCK RAU** is still active at ExxonMobil.
- **WAYNE STARKEY** is retired after a career mostly at Playtex.
- **BOB TAGGART** is retired after a career in the chemical industry.
- **LENNY WALTON** is retired after years with Armstrong in Lancaster, Penn.
- **JOHN WELDY** is retired after a long career with Kodak.
- **JAY WILLIAMS** is still a part-time anesthesiologist in the University of Pennsylvania Health System after a career in academic anesthesia at the University of Pennsylvania and Thomas Jefferson University.

We in the department are very sorry to have missed this event, but would be delighted to welcome any groups like this back to UD.

Alumni News

STEVEN DAVEY, '81, was a roommate of Brian McCudden's (above) after college but they have since lost touch. However, Steve has also had a very successful career. He started at a specialty chemicals firm in a traditional process engineering role that taught him a lot about production and plant operations, but his subsequent career path led him away from traditional ChE roles. Today he is president of Fiberight LLC, an early-stage company that is transforming municipal solid waste and other organic feedstocks into next-generation renewable biofuels and biobased chemicals. With some luck, their first facility will be operational in 2018. He also moonlights as entrepreneur in residence at Harbor Launch, an incubator located under the U of MD system. Steve says that despite his varied career path, he has always relied on the foundation of problem-solving skills that he developed at UD. "I was fortunate to have been taught by many of the ChE department legends at UD, a list that includes Drs. Pigford, Russell, Sandler, Olson and Metzner. It was a pleasure to catch up with both Dr. Russell and Dr. Sandler at the recent alumni weekend Colburn reception." Most importantly, Steve has been married to Terri for 31 years and they have two terrific children, Nicholas and Marissa. Nicholas is at Washington State pursuing a Ph.D. in psychology and Marissa plans to become a ChE.



DAVID BUTTNER, '86, has been a patent examiner at the U.S. Patent and Trademark Office in Alexandria, Vir., since 1987, along with several other alumni of ours. David's technology area is polymeric compositions, specifically polycarbonate compositions and, for the last 15 years, golf ball materials. As a federal employee, retirement in four years is a real possibility for David, and he thinks of scaling back to part time. All in all, David feels that he may have been lucky not to find a position in industry immediately after graduation.

SHARON WATKINS, '86, moved to Charlotte, NC, after graduation to become a process engineer at Celanese in their industrial fibers division, but homesickness drew her back to the Northeast the next year to join Sunoco, Inc., where she spent 25 years in a variety of refining and corporate positions. Along the way, she also returned to UD to earn her MBA. In 2012, as Sunoco was leaving the refining business, she joined Monroe Energy, LLC, a wholly-owned refining subsidiary of Delta Air Lines. After spending the first three years assisting in the set-up of the new venture as the commercial operations leader, she is now the technical and logistics leader at Monroe and

a vice president of the pipeline subsidiary, MIPC. Sharon is the very proud parent of two wonderful girls. Alyssa is a rising senior studying chemical engineering at Lehigh who shares Sharon's passion for refining, and Jenna is entering her third year at West Chester University studying occupational therapy, with plans to work with children upon completion of her master's degree.

DEEPAK DORAISWAMY, M'86, D'88, says that it's hard to imagine that three decades have passed since he first spotted the metallic sculpture of the UD chicken in front of Colburn Lab, and since Art Metzner commented at their first encounter that "the next time I entered his office I would be sweating from all the hard work." Deepak did his Ph.D. with Art and recalls his keen insights—personal and professional—infectious enthusiasm and advice. These were instrumental throughout his career at DuPont, National Starch (ICI), SABIC Innovative Plastics (formerly GE Plastics), and his current position with GE Aviation in Newark. The need to reduce complex problems to the basic physics with the help of simple (e.g., dimensional) analysis has often been a key element to finding solutions in his career, thanks to his training at UD. Deepak recalls graduate school experiences both deep and not so deep: discussions with colleagues and cops at the Dunkin' Donuts during late-night respites from the Colburn basement; driving a beat-up '76 Nova with only one functional door; reading a wide range of books that broadened his interests in evolution and history; making deep, sustained friendships. Deepak adds personal notes: "I lost my mother during graduate school and the experience left me devastated for a while—I will always be grateful to Art for being 'firm' with me and getting me back on 'the rails.' I recently lost my father [a distinguished professor of chemical engineering], whose memories continue to inspire me every single day. On a happier note, I considered myself a confirmed bachelor . . . until I got married relatively late in life to Kelly—I now have a seven-year-old daughter, Maya, who is my pride and joy, and helps keep me young!" Deepak hopes it will be possible for students to cultivate their free time to explore new interests and develop synergies between unrelated disciplines to satisfy both personal questions and the needs of an increasingly borderless world.

RON FORSYTHE, '89, has been appointed CEO of Quality Health Strategies (QHS), where he was previously president and COO. After graduating from UD, Ron completed master's and Ph.D. degrees at Maryland—College Park and then worked in a sequence of leadership positions at the University of Maryland Eastern Shore. He joined QHS, based in Easton, Md., in 2012.

1990s

RALPH LANDAU, D'91, is amazed that his own children are close to the age of our recent graduates. He and his wife, Janelle, whom he met at UD, have a daughter, Rachel, who just completed her first year of engineering at Northeastern University, and a son, Mitchel, who will be a sophomore in high school. Ralph began his career at Merck in 1990 within and then leading a reaction engineering group, then moved to Sandoz (now Novartis) and ran a pilot plant. By five-to-seven years after graduation, much of his time was spent on non-engineering activity, and in the late 90s he undertook a rotation in a global project management role at the Novartis headquarters in Basel, Switzerland. He led product teams that had representatives from every major function from R&D through commercial and learned very quickly that commercial, legal and regulatory implications drove everything. After leaving Novartis, Ralph moved through several companies, mostly through acquisition, and gained a lot of useful business experience from those acquisitions, filling leadership positions including vice president of R&D, chief scientific officer and senior vice president of business development. For about a year, he also ran the commercial division of a dermatology company. In the last few years, he, several former colleagues and a private equity firm have become owners of a pharmaceutical company, Vertice, that acquires small to mid-sized generic pharma companies. Ralph oversees all of the manufacturing facilities and associated supply-chain operations.

Although Ralph doesn't do much chemical engineering anymore, he feels that all the difficult technical assignments during his studies taught him to deal with complex problems by breaking them down into smaller ones that he knew how to solve. While that was the biggest lesson he learned in chemical engineering, Ralph has plenty of advice for students and alumni early in their careers. He feels that the absolute most important thing is to understand what you really want, to think about what your resumé needs to look like to be a possible candidate for that role and to pursue positions that will build that profile. Crystallize career goals and start executing on key, initial steps, but no matter where you are in the process, remember that a lot will happen after that first job, and it is up to you to manage that. Think of your career as a project that needs critical engineering optimization! If your aspirations are to lead at a high level, Ralph can't stress enough the importance of a broad understanding of the business you work in. On a different note, no one who ever succeeded did it starting their day at 10 a.m. (which was Ralph's normal starting time in graduate school). But, he says in closing, have some fun along the way!

JOE ZOBOROWSKI, M'91, has been employed at 3M Corporation since graduating, working in the area of new product development with polymer films and coatings. His training under Prof. Cos Denson has been invaluable in his 3M career, not only for the solid background in polymer fundamentals and processing, but also for the professional network to tap into during Joe's job search. Joe and his wife, Holly,

are almost empty nesters, with one daughter in high school and two children attending the University of Wisconsin–Madison, one in EE and the other in ChE. Joe says that he and Holly enjoyed their time in Delaware and wish the department continued success in educating the next generation of engineers.

ANDREW LUK, D'96, moved to northern California after graduation, working in the life science, pharmaceutical and medical device sector. He is currently the senior director of program management at CooperVision, overseeing front-end research and early development activities, where he is constantly exposed to the convergence of different technical areas. Andy and Lily have three children, Rory (19), Chloe (17) and Emma (13), and live in Pleasanton, 45 minutes southeast of San Francisco. Andy hasn't had much opportunity to visit the East Coast lately, but adds that "although I do not miss the snow, I still remember those happy hours in the Deer Park Tavern."

Like Andy Luk (above), **KATE LUSVARDI, D'96**, completed her Ph.D. in 1996 with Eric Kaler, but she has remained local; in fact she has held various R&D positions within the same company, but through a succession of name changes (Hercules, Aqualon, Ashland, and now Solenis). Kate says that "I have thoroughly enjoyed learning and working in many different areas from cellulose derivatization and rheology modifiers to my current position investigating dry strength polymers for paper applications." In the same household, **VICTOR LUSVARDI, D'97**, recently completed 10 years with W. L. Gore and Associates in Elkton, Md. Kate and Victor have three daughters, twins aged 14 and an 11 year old, who keep them active and busy. "We keep moving forward but every now and then we look back on our UD days with many fond memories of good friends, hard work, accessible professors, and the camaraderie of a tight-knit research group."

JAMES JARIWALA, '98, was named a 2015 Engineering Leader Under 40 by *Plant Engineering*. James joined Applied Control Engineering (ACE) in its Newark office straight out of UD and transitioned to be a senior technical resource for the Chesapeake Region office in 2010. James' expertise includes not only classic control systems including human-machine interfaces (HMIs) and programmable logic controllers (PLCs), but also broad knowledge of plant historians, database schemas, reporting applications and custom programming applications. He is the FIRST chair of the Baltimore/Washington section of the International Society of Automation (ISA) and is a licensed PE in Delaware. For the past five years, he has volunteered as a mentor for the FIRST Robotics Competition, and he mentors an all-girls robotics team from Western High School in Baltimore. ACE has been a popular destination for a number of our alumni who got "turned on" by process control in their senior year, including **KIM FLEMING FAKE, '94**, **MIKE LENNON, '95**, **CHRIS HUDSON '11**, **MEREDITH STEENKAMER, '15**, **ERIC PETERS, '15** and **BEN SMITH, '16**.

Alumni News

2000s

BIBIANA AGOSTINI, '01, moved back to New York after graduation, as a food process engineer at Kraft Foods. After four years in R&D, she grew weary of cereal extrusion and enrobing technology and accepted an international assignment in Munich, Germany, that included travel to more than 35 countries and supplier factories in a single year. Next she spent two years in Chicago before moving back to Munich in a permanent procurement role, where she sourced innovation and technical development services for European and eventually global chocolate brands. (She refrained from commenting on the hardship of work with chocolate.) In 2011, she moved to her current home of Zurich, Switzerland, first managing a contract manufacturing team for European biscuits, gum and candy products and then leading flavors sourcing globally. 2016 marks the 15th and final year of her career at Mondelez-Kraft as she recently accepted a new challenge with a top flavors and fragrances industry company that will include her and her partner Mårten relocating to Manhattan in early 2017. They are both avid scuba divers and skiers, but most hobbies are presently on temporary hold as they are expecting their first child in late August. Bibiana says she is very grateful to UD and to the chemical engineering faculty for their support and for the strong technical foundation her undergraduate degree provided. She looks forward to improved possibilities to reconnect at alumni events upon returning from Europe next year.

RYAN SNYDER, '01, recently received tenure and is now an associate professor of Chemical Engineering at Bucknell University. Bucknell has no Ph.D. program, so Ryan's research group typically consists of about half a dozen undergraduates and a master's student. Their recent publications have investigated phase behavior and particle morphology for model pharmaceutical compounds, as well as predictive modeling work on the performance of solid oxide fuel cell electrodes. Ryan is also starting some work in college athletics performance monitoring. He has been married to Elise for eight years and they have two children, Kalyra (5) and Charles (1). As a professor primarily teaching undergraduates, Ryan says that he often draws from his experiences at UD to better understand his students' experience. He adds, "Our [UD] senior banquet was way better, and I haven't brought myself to try to institute Friday night Thermodynamics exams."

CHIA-CHI HO, D'01, who is a professor of biomedical, chemical and environmental engineering at the University of Cincinnati, was named a Fellow of The American Council on Education (ACE) for the academic year 2016–17. Chia-Chi has received several awards, including a 3M Non-Tenured Faculty Award (2005–07) and appointment as a Fulbright Scholar (2011–12). ACE Fellows are selected based on their potential for senior positions in university administration.

MATT PANZER, '02, continues to thrive in his faculty position in chemical and biological engineering at Tufts University. He was promoted to associate professor with tenure in 2015 and spent time in the UK and in Melbourne, Australia, on sabbatical leave that fall. Matt has received several recent teaching/advising awards at Tufts, including the Recognition of Undergraduate Teaching Excellence Award (2014), the Henry and Madeline Fischer Award (2015) and the Lillian and Joseph Leibner Award for Distinguished Teaching and Advising (2016).

KATIE WHITEHEAD, '02, has been named one of *Popular Science's* annual "Brilliant 10," a group of the 10 brightest young minds who are reshaping science, engineering and the world. Katie has been an assistant professor of chemical engineering and biomedical engineering at Carnegie-Mellon since 2012, after completing her Ph.D. with Samir Mitragotri at UC–Santa Barbara and a postdoc with Bob Langer at MIT. Katie's research is focused on developing delivery systems for small interfering RNAs (siRNAs), which can be used to treat a variety of diseases. The work for which she was honored involved generation and testing of more than 5,000 different nanoparticle delivery systems for siRNAs. Her group is now testing their technology in treating non-Hodgkin lymphoma.

CHIRAG RAVAL, '05, joined a joint IGERT Ph.D. program (NSF) at the Levich Institute of Soft Materials at City College and the department of chemical engineering at Columbia University, where he investigated how a membrane protein, aquaporin-1, influences atherosclerosis in large arteries. He also was a New York Life Graduate Fellow and public health advocate at the Colin Powell School for Civic and Global Leadership in 2010. After completing his Ph.D. in 2012, he stayed on at City College as a postdoc with Prof. David Rumschitzki in chemical engineering, working on the function of aquaporin-1 in hypertension. He is now a fellow at Harlem Biospace, partnering with local biotech startups in the NYC ecosystem to develop new medical therapeutics. He is also an adjunct assistant professor in the City University of New York lecturing in biology and public health.

BRYAN BERGER, D'05, has been selected to receive the Class of 1961 Professorship in the Department of Chemical and Biomolecular Engineering at Lehigh University. This professorship recognizes recently promoted associate professors for distinction in research, teaching and service. Bryan also received Lehigh's Alfred Noble Robinson Award, and his and his collaborators' work on quantum dots was published in the *Proceedings of National Academy of Sciences* and featured in the *New York Times* science section, and also described in a Youtube video. In the same department, **KELLY SCHULTZ, D'11**, has been appointed a P. C. Rossin Assistant Professor, which is awarded to "outstanding assistant professors early in their career to recognize high potential for

establishing a successful academic career through the integration of teaching and research.” Kelly has received a new three-year NIH grant to study the interactions of mesenchymal stem cells with their environment. The Lehigh department obviously shows excellent judgment in hiring UD alumni, the others being **BILL LUYBEN, M’62 D’63**, **TONY MCHUGH, M’70 D’72**, and **MARK SNYDER D’06**.

After graduating, **ERICH BOZENHARDT, ’06**, took a job with BE&K, an engineering firm in Newark, along with several UD classmates, with projects primarily for DuPont. During this time, Erich also did an MBA at UD. He then moved to North Carolina to work in pharmaceuticals and received his NC PE license in 2011 and subsequently licenses in California and Florida to support various projects. He is currently the process manager for the NC office of Integrated Project Services (IPS). In 2012, Erich married Emily Colby, whose brother David is on our faculty. They have two girls Anna (2½ years) and newborn Erika.

GABRIELLA SANTONICOLA, D’06, did two postdocs in Europe after leaving UD—at the Max Planck Institute for Polymer Research in Germany and at the University of Twente in the Netherlands—working on surface functionalization for development of bioassays involving lipid membranes and membrane proteins. In 2010, she returned to her native Italy, first as a team leader at the Italian Institute of Technology and then in 2012 as an assistant professor at Sapienza University in Rome on a Montalcini Grant. She teaches in the MS degree program in biomedical engineering and does research with a group of Ph.D. and MS students, with a focus on active polymeric materials and surfaces for biotechnology applications. After doing research in four different countries, Gabriella enjoys teaching in Rome and living there with her family. However, we all have favorites, and she adds, “I can safely say that UD was the best place where I worked in the past 15 years, for both research and work atmosphere. I always remember the relaxed group beers and barbecues, and also the long scattering nights at NIST with Eric [Kaler]’s group searching for good coffee.”

2010s

JULIE ALBERT, D’11, now an assistant professor at Tulane University, has received a prestigious NSF CAREER Award.

JEONG JAE (JJ) WIE, D’13, has been appointed an assistant professor in the department of polymer science and engineering at Inha University, Korea. JJ completed postdocs at the Air Force Research Lab and at MIT before his return to Korea.



When employers keep coming back to hire more of our graduates, we know that we’re doing something right. Thanks to Jean Tom for sharing this photo of UD alumni in the chemical and synthetics development group in R&D at Bristol-Myers Squibb in New Brunswick, NJ. Standing: **ROBERT FOREST, D’15**, **MICHAEL DUMMELDINGER, ’14**, **JOSHUA SELEKMAN, ’08**, **CHESTER MARKWALTER, ’12**, **ALAN BRAEM, ’96**. Front: **DIMITRI SKLIAR, D’08**. There are also numerous other UD alumni in other departments and at other sites in BMS. We’d be happy to receive similar photos of alumni in other companies.



Department friend **JOHN "JACK" WEIKART** died March 6, 2016, in Hockessin, Del. Jack earned bachelor's degrees in chemistry in 1941 and in chemical engineering in

1942 from Cornell University. He began his professional career in 1942 with Standard Oil Development Co., continuing to work for Esso Research and Engineering Co., Exxon Research and Engineering Co., and Exxon Corporation until he retired in 1982. As a recruiter for Exxon, he came to know the chemical engineering community remarkably well and graciously hosted academics in the Exxon suite at the AIChE Annual Meeting every year. Jack developed many long-lasting friendships in the chemical engineering community, and our department benefitted from this when Jack became our alumni liaison after his retirement from Exxon, despite not being a UD alumnus himself. He masterfully tracked down many alumni before the internet made this less of a challenge and kept faculty informed of the whereabouts and successes of former students. He is survived by three sons, two of them UD alumni—his son David ('75) in chemical engineering—and three grandchildren.

MARK ALLAN APPLGATE, '85, an engineer and financial analyst, died March 18, 2016, in San Diego at the age of 52. He earned his bachelor of science in the chemical engineering program at UD, where he performed summer internships for two years at Dow Jones and two years at Mobil Oil. Upon graduation, he received a Dow Chemical Scholarship and a prestigious Hertz Foundation Fellowship full scholarship to complete a Ph.D. in biochemical engineering at MIT. In his career, he directed scientific teams to scale-up and commercialize a wide range of biotechnology products, including microbial fermentation-derived food and industrial chemicals at Merck & Co., Inc., the first living tissue implants to replace donor

organ transplants at Advanced Tissue Sciences, Inc., a revolutionary personalized medicine immunotherapy to treat non-Hodgkin's lymphoma at Favril, Inc., and a gene therapy product line to treat multiple cancers and serve as DNA vaccines at Vical, Inc.

WENDEL RICHARD CASSEL, M'67, died March 11, 2016, in Newark, Del., at the age of 75. After receiving his master of chemical engineering from UD, he began a 35-year career with the DuPont Company. He was awarded four patents, received the AIChE Thomas H. Chilton Award for Outstanding Contributions to Management of Chemical Engineering Technology in 1992 and numerous awards from the DuPont Company, where he was a critical member of the team that received the 2003 President's National Medal of Technology for developing CFC alternatives. Upon his retirement in 1998, he became an active and honored volunteer and traveled extensively throughout Europe, the U.S., and South and Central America.

JOHN J. KEYES JR., D'52, age 90, died Oct. 12, 2015, in Oak Ridge, Tenn. John was drafted into the U.S. Army at age 19 while in his third year of engineering school at Carnegie Institute of Technology. In 1945, he was assigned to the Army Special Engineering Detachment in Oak Ridge to work in the K-25 Laboratory Division. In 1946, he went on to finish his undergraduate work, obtain a M.S. degree at the University of Michigan and a Ph.D. from UD, both in chemical engineering. He worked again for K-25, then at Oak Ridge National Laboratory until his retirement in 1990. His fulltime work career covered a total of 39 years in engineering research and development, and 15 post-retirement years in engineering consulting, primarily in the nuclear energy field for PAI Corp. and DeltaM Corp. He authored numerous published technical articles and held two patents.

THOMAS LENNOX, '57, age 80 of Nashville, Tenn., died Jan. 22, 2016. Ten years after earning his degree in chemical engineering

from UD, he graduated from Temple Law School, moved to Cherry Hill, NJ, and began an engineering career with Rohm and Haas. He began a private law practice in 1975 and retired to Tennessee in 1996. Tom chaired the University of Delaware Alumni Association in 1968.

ROBERT EARL MILLAR, '52, died Sept. 24, 2015, in Arlee, Mont., at the age of 87. Following service in the United States Marine Corps, Bob graduated with a degree in chemical engineering from UD, where he was a member of the engineering honor society Tau Beta Pi. He had an international career with Exxon, beginning in 1952 with Esso at the Baltimore Refinery. Assignments took his family to Houston, New York, Iran, Libya, Rome and London before he retired from Esso Thailand in 1986. In his retirement, he was a champion sailor, a naturalist and a man of many passions, including fishing, birding, reading, stargazing, botany and spending time with family. He was an avid ham radio operator.

KEVIN THOMAS MINER of Warrington, Penn., a former chemical engineering student who was able to complete the fall 2014 semester while facing a courageous two-year battle with brain cancer, died Nov. 11, 2015, at the age of 21. **RAUL LOBO**, Claire D. LeClaire Professor of Chemical and Biomolecular Engineering and Kevin's adviser, said, "I remember what a delight it was to meet him for advising since he was so enthusiastic about being at the University of Delaware and about all of the new things he was learning at UD. He really enjoyed being a college student. He took his illness stoically and kept challenging himself with a demanding academic load."

Gifts in memory of former faculty members or alumni may be made online at www.che.udel.edu/makeagift, or by contacting Barbara Maylath at 302-831-7273.

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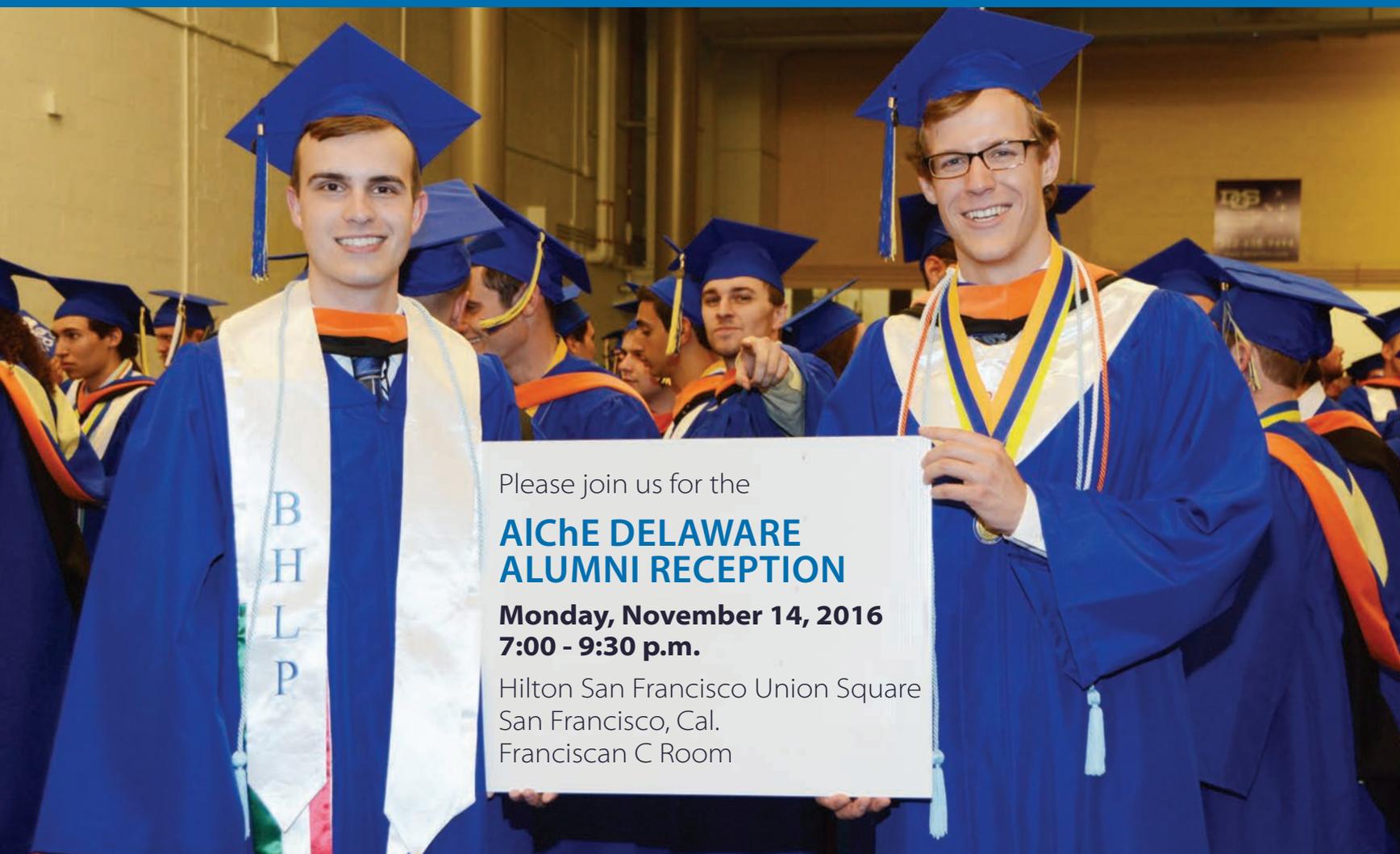
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