Unit Operations in New Koffolt Laboratories

INSIDE:

- L.-S. Fan wins new DOE funding
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Dear Alumni and Friends,

The 2016-2017 academic year is off to a great start. L.-S. Fan and Andrew Tong won two Department of Energy awards: $1.7M to apply Fan’s chemical looping process to biomass gasification, and Tong recently won another $1.5M DOE award to investigate heat integration optimization and dynamic modeling for advancing the coal direct chemical looping process. In other faculty news, David Wood won The Ohio State University College of Engineering Lumley Research Award, and Jessica Winter was recognized by the College of Engineering Faculty Diversity Excellence Award.

We are grateful that new faculty Li-Chiang Lin, Katelyn Swindle-Reilly, and Ilham El-Monier joined us this fall. The department is currently searching for additional faculty. It would be a great help to the department if you could please visit the CBE website and refer candidates!

On the student front, enrollment is at an all-time high, with nearly 1,000 undergraduates enrolled. However, as our enrollment has grown, so has the demand from industry, so students continue to get good jobs.

To add even further to that dimension, CBE is excited to announce the return of the petroleum engineering minor. The first class will be offered this spring by Dr. El-Monier and the plan is to begin offering a formal minor in the fall of 2017.

We are very pleased to report that our students continue to perform exceptionally well, coming into the program with an average ACT a little over 30. Undergraduate student Lagnajit Pattanaik won a Barry M. Goldwater Scholarship, and recently, three CBE undergrads had the opportunity to perform research at the world-renowned CERN Lab in Geneva, Switzerland. Read these and other intriguing undergraduate research stories in our special report beginning on page 10.

Alumni continue to engage with the department in a variety of important ways. Just recently the newly-convened CBE Advisory Board, led by chairman Richard Schwarz, ’73, gathered on campus for a full day of invigorating discussion. The Board will meet again in the spring to follow up on key issues. The National Campaign for New Koffolt Laboratories, led by department namesake Bill Lowrie, ’66, has continued to meet as the Koffolt Committee, working to find ways to increase economic support for the department.

One bit of late-breaking news that did not make it into this issue is that alumnus Doug Baughman, ’82, was named a College of Engineering Distinguished Alumnus. Congratulations, Doug!

Go Bucks!

Andre F. Palmer

100 free ☕️’s @ #DonutsWithTheDean

This past spring, Dean Manderscheid and Chairman Palmer, left, greeted students at #Donuts with the Dean, a fun social media event.

“...Tweet #5 – Did someone say free donuts!? Join us along w/ @ASCatOSU at 2:45 pm in the CBEC atrium for #DonutsWithTheDean!”

More on page 17.
L.-S. Fan, who pioneered coal-direct chemical looping, the leading clean-coal technology in the United States, received a $1.7 million Department of Energy grant to apply a similar process for the thermochemical conversion of biomass to methanol. He and Research Assistant Professor Andrew Tong will lead the “Biomass Gasification for Chemicals Production Using Chemical Looping Techniques” project.

Chemical looping involves the delivery of oxygen from air—via a tailored iron-based oxygen carrier—to a fuel source to perform the chemical reactions. Ohio State’s approach partially oxidizes biomass -- plant-based materials such as switchgrass and corn stalks that are not used for food or feed -- to form synthesis gas consisting of carbon monoxide and hydrogen, the building blocks used in methanol production.

Tong said that the project’s goal is to prove that the biomass-to-syngas chemical looping process is a highly efficient and economical approach to substantially reduce the cost of chemicals or liquid fuels production.

“This single-step to high purity syngas from biomass process has the potential to reduce capital costs for syngas production by 44 percent,” he said.

Primarily used as a feedstock in chemical manufacturing, methanol is also an emerging energy fuel for running cars, trucks, buses and even electric turbines. This simple molecule packed with hydrogen and no carbon-to-carbon bonds burns cleaner than most energy sources and provides a viable, readily available alternative to traditional fossil fuels.

“Our goal is to optimize biomass utilization,” Tong said, “whether it’s for liquid fuels production or chemical manufacturing. We want to develop a technology that can help capitalize on the availability of this carbon-neutral source.”

He added that biomass’ relatively low energy density—compared to coal or natural gas—demands extreme efficiency in the energy conversion process in order to be cost-competitive to the traditional fossil fuel approach.

The economic assessment will be performed by project partner Nexant. Other collaborators include Shell Global Solutions, Peloton Technologies, Commercial Aviation Alternative Fuels Initiative, ZeaChem, Community Power Corporation, AdvanceBio, Gulf Process Gases, Kurtz Brothers and the Ohio Corn Market Program.

Professor Fan’s chemical looping processes for electricity, hydrogen, fuel and chemical product have been licensed and are currently being demonstrated at a pilot scale for commercial applications.
Jessica Winter received the College of Engineering’s Faculty Diversity Excellence Award for her commitment to developing future diverse leaders through mentorship, research, and teaching.

To receive the award, recipients must demonstrate excellence and success in the development and implementation of models, strategies, practices and programs that foster and enhance diversity in the College.

Dimensions of diversity recognized by this award include but are not exclusive to gender, race, ethnicity, age, sexual orientation, physical ability, socioeconomic status and political, religious and other ideological beliefs.

Winter is known for her work on magnetic quantum dots and refining breast cancer diagnostic methods using these materials. She is an elected fellow of the American Association for the Advancement of Science and was recently recognized by her peers by induction into the American Institute for Medical and Biological Engineering (AIMBE), which represents the top two percent of the medical and biological engineering community nationwide.

David Wood’s research contributions and productivity were recognized with The College of Engineering’s Lumley Research Award, which considers the last five years of a faculty member’s achievements.

Wood’s research areas focus on protein engineering for bioseparations, biosensing and drug discovery. His work seeks to develop highly useful biotechnologies through engineering proteins and enzymes for specific applications. So far, these applications include new ways to purify recombinant proteins, bacterial biosensors that incorporate human drug targets, and new capabilities in drug discovery and drug delivery.

Wood is becoming widely known for his groundbreaking research in self-cleaving affinity tag technology for the purification of recombinant proteins, which is currently being utilized in a DARPA-funded project to develop a laptop-sized “pharmacy in a briefcase” which could be utilized to produce medicines on site/on demand.

In addition to other awards, Professor Wood received the NSF CAREER Award in 2003.
Nicholas Peppas gives Lowrie Lectures

Nicholas A. Peppas is the Cockrell Family Regents Chaired Professor in the Departments of Chemical, Biomedical Engineering, Surgery and Pharmacy, and Director of the Institute of Biomaterials, Drug Delivery and Regenerative Medicine of the University of Texas at Austin. His work in biomaterials, polymer physics, drug delivery and bionanotechnology follows a multidisciplinary approach by blending modern molecular and cellular biology with engineering principles to design the next generation of medical systems and devices for patient treatment. Over the past 40 years he has set the fundamentals and rational design of drug delivery systems and developed models of drug and protein diffusion in controlled release devices and biological tissues.

In 2012 he received the Founders Award of the National Academy of Engineering (NAE), the highest recognition of the Academy, for these contributions to the field. Peppas is a member of the NAE, National Academy of Medicine, National Academy of Inventors, the National Academy of France, the Royal Academy of Spain, the Academy of Athens and the Academy of Texas. He has been recognized with awards from AIChE (Founders Award, William Walker Award, Institute Lecture, Jay Bailey Award, Bioengineering Award, Materials Award), the Biomedical Engineering Society (Distinguished Scientist Award), the American Institute of Medical and Biological Engineering (Galletti Award), the Society for Biomaterials (Founders, Clemson and Hall Awards), the Controlled Release Society (Founders, Heller and Eurand Awards) and other societies.

In 2008, AIChE named him one of the One Hundred Chemical Engineers of the Modern Era. He is President of the International Union of Societies of Biomaterials Science and Engineering, Chair of the Engineering Section of the American Association for the Advancement of Science, and Past-Chair of the Council of BME Chairs.

Previously, he served as President of SFB and the Controlled Release Society. He is a fellow of AAAS, AIChE, APS, ACS, MRS, SFB, BMES, AIMBE, CRS, AAPS, and ASEEE. He has supervised the research of more than 100 PhDs and about 180 postdocs and graduate students.

Peppas holds a Dipl. Eng. from the NTU of Athens (1971), a Sc.D. from MIT (1973), and honorary doctorates from the Universities of Ghent, Parma, Athens, Ljubljana and Patras, and an honorary professorship from Sichuan University.

Lecture 1: Advances in Protein and siRNA Delivery Through Smart Polymers

Engineering the molecular design of intelligent biomaterials by controlling structure, recognition and specificity is the first step in coordinating and duplicating complex biological and physiological processes. Recent developments in siRNA and protein delivery have been directed towards the preparation of targeted formulations for protein delivery to specific sites, use of environmentally-responsive polymers to achieve pH- or temperature-triggered delivery, usually in modulated mode, and improvement of the behavior of their mucoadhesive behavior and cell recognition. We address design and synthesis characteristics of novel crosslinked networks capable of protein release as well as artificial molecular structures capable of specific molecular recognition of biological molecules. Molecular imprinting and microimprinting techniques, which create stereo-specific three-dimensional binding cavities based on a biological compound of interest can lead to preparation of biomimetic materials for intelligent drug delivery, drug targeting, and tissue engineering. We have been successful in synthesizing novel glucose- and protein-binding molecules based on non-covalent directed interactions formed via molecular imprinting techniques within aqueous media. We have also developed structurally superior materials to serve as effective carriers for siRNA delivery to combat Crohn disease and ulcerative colitis.

Lecture 2: A Historical Perspective of Nanotechnology and Bioengineering in an Evolving Chemical Engineering World

Nanotechnology and Bioengineering have evolved out of chemical engineering because of the need to address important societal problems. Emphasis in such areas has led to the solution of complex chemical engineering problems that required non-Newtonian flows, non-ideal thermodynamics, multi-component systems, macromolecular analysis, and diagnostic/intelligent responsive systems. The introduction of these fields also created an emphasis on translational research, product engineering, development of devices/systems and processes, and an associated emphasis on applications and commercialization. An unfortunate result of these changes was a shift of Chemical Engineering from fundamentals to applied sciences. We examine the underlying reasons for this shift with emphasis on changes in societal needs in the 1970s to translational research that started in the late 1980s. We examine the impact of these changes on CheE education, including the academic shift towards applied sciences and the de-emphasis of fundamentals. We address new educational and research directions that will provide a corrective path towards convergence in chemical engineering.
Student achievements honored at Lowrie Awards Banquet

OUTSTANDING UNDERGRADUATE AWARD FOR RESEARCH EXCELLENCE:
Back Row: Chris Poore, Hussein Alkhatib, Lucas Watson, Jack Zakin, Umit Ozkan, L.-S. Fan, Nicholas Brunelli, Lagnajit Pattanaik;
Front Row: Elena Blair, Abbey Empfield, Cailin Buchanan, Nathaniel Kramer, Yaadata Abdulhalim (receiving for Mike Jindra).

OUTSTANDING GRADUATE AWARD FOR RESEARCH EXCELLENCE:

AMERICAN INSTITUTE OF CHEMISTS FOUNDATION AWARDS
Erica Brackman (AIC Outstanding Undergraduate Student); Mandar Kathe (AIC Outstanding Graduate Student); Seval Gunduz (AIC Outstanding Postdoctoral Award); L.-S. Fan, Umit Ozkan.

AIChe STUDENT AWARDS
L.-S. Fan congratulates Hussein Alkhatib for receiving the AIChe Central Ohio Section Outstanding Student Award. Not pictured is Anne McAllister, who won the Donald F. Othmer AIChe Sophomore Academic Excellence Award.

CHEMICAL HYGIENE COMMITTEE (CHYCOMM) AWARDS (at left)
Outstanding Lab Safety Award - Department Wide: Dr. Ozkan’s group;
Outstanding Lab Safety Award - Bio: Dr. Palmer’s group;
Outstanding Lab Safety Award - Traditional: Dr. Ho’s group.
Left to right: Varun Vakharia, Sreshtha Sinha Majumdar, Umit Ozkan, and Donald Belcher.

OUTSTANDING POST-DOC AWARD FOR RESEARCH EXCELLENCE
Not pictured: Zhuo Cheng (L.-S. Fan).

-Photos by Geoff Hulse.
Lowrie Banquet - Special Recognitions

Yuanxin Chen: One of four finalists for the Science & Technology Award from DSM and the American Institute of Chemical Engineering (AIChE). (Advisor: Ho)

Jeffrey Ethier: Elected delegate of the university-wide Council of Graduate Students. (Advisor: Ho)

Varsha Gopalakrishnan: International Travel Scholarship, 2015 ISIE Conference, University of Surrey, UK. (Advisor: Bakshi)

Kilho Lee: First place, Hayes Graduate Research Forum. (Advisors: Winter, Wyslouzil)

Yensil Park: American Association for Aerosol Research (AAAE), Poster Competition Winner. (Advisor: Wyslouzil)

Zi Tong: 2016 Elias Klein Founders’ Travel Supplement Award, North American Membrane Society (NAMS), (Advisor: Ho)

Varun Vakharia: North American Membrane Society (NAMS) Annual Meeting, Membrane Processes category, Third Place in the Poster Paper Competition. (Advisor: Ho)

Student Leadership

AICHE CHAPTER OFFICERS

ChemE CAR
Kevin Ikeda, Ben Heimbach, Steven Back. Not pictured: Michael Ciccone, Lauren Crall, Griffin Jenkins, Adrianna Schneider, Ben Snyder, Trevor Wendt. (Advisor: Tomasko)

CEGC OFFICERS

-Photos by Geoff Hulse.

GRADUATE RESEARCH SYMPOSIUM
Kilho Lee: Thinking big by thinking small

Using nanocomposites to enhance cancer diagnostics and therapeutics such as bio-imaging and cell separation is one of the Winter Lab’s foci. But synthesizing nanocomposites, which consist of one or more dimensions of less than 100 nanometers, has three challenges: 1) small scale operation - low throughput, 2) the time it takes to complete the process (hours or days), and 3) the use of a surfactant, which requires a downstream purification step that can be difficult to achieve.

Kilho Lee, who won first prize in the Hayes Research Forum for his project, “High-throughput, Semi-Continuous Micellar Nanocomposite Synthesis via Liquid-in-Liquid Electrospray,” is developing novel technology with his team to synthesize micellar nanocomposites - polymer aggregates that encapsulate nanoparticles with unique properties at the core in order to package nanoparticles of different functionalities for the purpose of targeting cancer cells.

The technology used to produce them is called Liquid-Liquid Electrospray (LLE). The LLE electrospray techniques widely used in aerosol science enable synthesis in a surfactant-free environment in a manner that is semi-continuous and tunable (high throughput with better controllability of the overall process).

Lee’s group believes that LLE is the first surfactant-free synthesis route among emulsion-based nanocomposite formation. Recently, LLE-synthesized nanocomposites have been characterized; and this demonstrates the feasibility of achieving quality, high-throughput synthesis.

Top picture: Liquid-Liquid Electrospray setup for high-throughput nanocomposite synthesis.
Bottom two pictures: MultiDots (nanocomposites encapsulating quantum dots) exhibit fluorescence upon UV exposure.

-Photos by Geoff Hulse.
Abbey Empfield explains her research to Professor David Tomasko.

Denman Undergraduate Research Forum winners

Four CBE students placed in the engineering category of the 21st Annual Denman Undergraduate Research Forum held in March 2016:

**Thomas Groseclose**, 2nd Place: “Evaluation of enzymatic breakers for the reduction of environmental and health hazards associated with hydraulic fracturing fluids.” (Advisor: Kurt Koelling)

**Lagnajit Pattanaik** and **Kory Sherman**, 2nd Place: “Selective biomass conversion using immobilized solvent effects.” (Advisor: Nicholas Brunelli)

**Ziwei Wang**, 3rd Place: “Settling dynamics of spherical particles in fracking fluids.” (Advisor: Kurt Koelling)

**Panayiotis Kolliopoulos**, 4th Place: “Modeling and simulation of non-isothermal gas-assisted injection modeling for viscous Newtonian fluids.” (Advisor: Kurt Koelling)

The Richard J. and Martha D. Denman Undergraduate Research Forum is a university-wide competition for research projects and creative works.

**Goldwater Scholarship for Lagnajit Pattanaik**

His nickname is “Lucky,” but luck had very little to do with Lagnajit Pattanaik winning the most prestigious undergraduate research scholarship in the country - the Barry M. Goldwater.

“I was a bit surprised to win, but Dr. Nicholas Brunelli has given me tremendous encouragement. He motivates me every day. No one is harder working than him, and we recently got our first big federal grant, which is exciting. This award is not just mine, it’s Dr. Brunelli’s and the group’s, as well -- a culmination of effort,” he said with a smile.

"It was my interest in chemistry that led me to Dr. Brunelli’s group,” said Lagnajit. “Our lab uses more organic chemistry than other chemE areas. We model catalysts after enzymes and study catalysis for biomass conversion -- converting organic molecules like fructose, glucose and eventually cellulose to 5 hydroxy methyl furfural (HMF). HMF is an intermediary material used to make other molecules found in polymers, plastics and fuels. It’s greener than using petroleum to make polymers,” Lagnajit said.

“I’ve always been a good student, but I’ve learned to be patient in research. You go in expecting 100% success and then find out that a 10% success rate is actually good,” said Lagnajit.

“I have also learned about how much preparation is needed to do good research. So much of research is reading what others have done before you, and thinking about how you can improve on it... understanding your project and what you are trying to achieve,” he added.

“What I really like is when you run an experiment and it supports your theory -- that’s a cool feeling. In chemistry, you can’t see things working, so when you can quantify that you were right, and then extend the technology so that it can make a difference in the world when applied to a larger scale, it just makes you feel very good,” he said.

"It makes you think about how we can get our technology to help other people. Because at the end of the day, that’s our goal. It’s a really big motivator for me.

-Lucky Pattanaik

COE Undergraduate Research Forum placements

**Abbey Empfield** and **Peter Sandvik**, both students in L.-S. Fan’s laboratory, won prizes in the seventh annual College of Engineering Undergraduate Research Forum competition.

Prizes were awarded to the top three presentations, and two prizes were handed out for promising new researchers.

Abbey Empfield won third place overall, and Peter Sandvik received one of the “promising new researcher” awards.

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-Lucky Pattanaik
Megan Ireland wins Undergraduate Summer Research Fellowship

Megan Ireland, a biomedical engineering undergrad and a Humanitarian Engineering Scholar, won an undergraduate research fellowship from The Ohio State University Undergraduate Research Office to work with Professor Barbara Wyslouzil's Aerosol Research Group. Ireland studied Liquid-Liquid Electrospray (LLE) to produce PLGA microspheres encapsulating therapeutic agents for targeted drug delivery.

The objective of PLGA microspheres synthesis via LLE is to show 1) high-throughput synthesis of PLGA microspheres and 2) the encapsulation efficiency of PLGA microspheres produced via LLE vs. standard techniques. Ireland also studied the effects of having different surface ligands on the nanoparticles in forming micellar nanocomposites.

She worked under the direction of second-year graduate student Kilho Lee (see page nine).

Nicholas Liesen: Research Scholar learns how to learn

Last fall, Nicholas Liesen began a research project expecting to learn how to run simulations, but in the process, he also learned how to learn.

Preparing his research proposal to the OSU Undergraduate Research Office for a Research Scholar Award involved a literature search, identifying, assessing and reading more than 30 different papers in detail. “Through this process, I not only learned about my subjects; I learned how to read research papers,” Nick wrote in a progress report for his project, “The determination of transport properties using dissipative particle dynamics: Investigation of nanofluid systems involving vapor-liquid equilibrium.”

“Reading a text book and reading research papers are very different endeavors,” he wrote. “Research papers are written for researchers in the field, so one must read the related papers and consult the source and reference materials to get the background and definitions of terms.”

After winning the award, Nick eagerly began to explore his central research question of whether thermally-driven hydrodynamic instability in nanometer scale liquid film plays a key role during a certain nanoparticle self-assembly process. Since it is unclear if classical fluid dynamics based on the continuum description of matter remains applicable at nanometer scales without any modification, Nick’s research is part of the ongoing effort to understand transport phenomena in general on the basis of statistical mechanics, and was assisted by his advisor’s new book, Statistical Mechanics for Engineers (Isamu Kusaka, 2015, Springer). The research builds on a method known as dissipative particle dynamics, a mesoscale particle-based simulation technique.

Nick determined the phase behavior of the model system, and began to explore its interfacial properties and a new set of simulations to determine transport coefficients, such as viscosity and thermal conductivity, quantities of major importance in understanding the above mentioned hydrodynamic instability.

“I have gained critical insight into how these simulations are run and to see theory in action. This experience was very valuable to me. In addition to allowing me to investigate some very interesting topics, this crucial research experience which will help me to further my long-term goals,” he said.
When Eileen Elliott was about 13 years old, a car accident changed her life...

The resulting knee surgery helped restore her mobility, but left her in chronic pain. Around the same time, her sister was looking at graduate schools for chemical engineering, and told Eileen about the incredible research being done in various programs.

One project in particular stood out:

“My sister explained that within the chemical engineering field there are professors with the ability to create live tissue, such as cartilage, which can be placed back into the human body,” Eileen said.

She thought about how she might have knee pain for the rest of her life due to the cartilage that had to be removed, and realized that chemical engineering might be able to help her.

“Chemical engineering is extremely powerful.”

-Eileen Elliott

To think that chemical engineers had the ability to remove that pain! Eileen became dedicated to studying the natural sciences, and ultimately pursued chemical engineering at The Ohio State University.

Safer, more cost-efficient MRI’s

Over the summer, Eileen participated in The Ohio State University Summer Undergraduate Research Fellowship (SURF) program. Her placement, funded by the National Institute for Standards and Technology, was at an NIST branch in Boulder, Colorado.

The mission at NIST is “to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.”

Eileen’s project sought to improve the quality of life through research on Ultra-Low Field MRIs. Ultra-Low Field MRIs operate at 100 µT, a much lower electromagnetic field than the 1.5 to 3 T fields current clinical MRI systems use. The lower electromagnetic field emissions of Ultra-Low Field MRIs would allow for a safer and more cost-efficient diagnostic tool. However, with the smaller magnetic field, the signal received is lower.

Eileen’s challenge: Instrument methods to increase the signal and contrast seen in the MRI images.

Her project: Create resonators to complete dynamic nuclear polarization experiments to increase the signal, and to then instrument magnetic nanoparticles in order to increase the contrast seen in the images.

“Obviously, this project is not one typically associated with chemical engineering,” Eileen said. “However, that is why chemical engineering is a powerful major; it can span across many different fields of science. Chemical engineering does this by combining all the natural sciences, throws in engineering courses, and creates one incredible major,” she said.

What’s next? Elliott, who has been part of biological-based research as a research assistant in the laboratory of Professor Jessica Winter for the past three years, hopes to continue similar work by pursuing a Ph.D. in tissue engineering and regenerative research.

Her goal is to help others suffering from joint problems and other issues.
Nate Olson: Reaching for the moon with nanotechnology

Many students study chemistry in high school, but not everyone takes to it. From his very first chemistry class, however, Nate Olson found a passion which ultimately led to a dream of working in chemical engineering to support space exploration.

“What I find most interesting about chemistry is the fact that it is omnipresent. There is no part of the world around us where chemistry is absent,” said Nate, who works in Professor Nicholas Brunelli’s lab.

“I already had an interest in problem solving, tinkering, and doing various building projects. These engineering-like interests and my love of chemistry made chemical engineering a perfect fit,” he explained.

“An aspect of chemical engineering I especially enjoy is that it brings together chemistry, physics, mathematics, and biology. With the chemical engineering curriculum, you get to study a wide range of fascinating science. It is a field with a huge amount of breadth. With this degree, I think you could do just about anything you want.”

In particular, Nate enjoys the challenges of research and the opportunity to make an impact on the world through discovery and innovation.

“I hope to someday do research and development for space exploration,” Nate continued. “I think nanotechnology will play a key role in expanding humanity’s reach into space due to the ability to create strong, lightweight materials, advanced electronics, and nanosensors. I hope I can be a part of my generation’s moon landing, whether it be a visit to Mars, establishment of a moon colony, or some other endeavor,” he added.

‘Green’ catalysts inspired by natural materials

One nano-scale material that holds great promise for the future Nate envisions is the nanotube – a long, hollow structure with nanometer-sized diameters. Due to the unique chemical bonds that hold the nanotube’s particles together, nanotubes exhibit extraordinary strength, thermal conductivity, and mechanical and electrical properties which have valuable applications in nanotechnology, electronics, optics, and other fields of materials science. Thinner than a hair but stronger than steel, nanotubes can be integrated with other materials such as polymers to form lightweight but extremely strong nanocomposite materials.

Imogolite, a type of inorganic, aluminosilicate nanotube that forms naturally in soils of volcanic origin, but can also be made in the lab using a low temperature, solution-phase synthesis. Nate’s work focuses on how to tune the properties, structure, and behavior of imogolite through rational changes to the synthesis.

Catalysis, separations, and sensing are three main areas where imogolite nanotubes could be applied. However, pure imogolite is inert and generally unreactive. To make imogolite useful in specific molecular recognition applications, its properties need to be modified.

Nate’s challenge: Create hybrid nanotubes to form an industrially-viable heterogeneous catalyst that could be utilized in an efficient and green process.

His project: Introduce heteroatoms into the nanotube structure to create hybrid imogolite. By including other atoms in the structure, the reactivity and structure of imogolite could be changed.

There’s another thing that Nate has learned beyond chemistry and chemical engineering: the value of communication.

“Initially, I was reluctant to distract others from their work,” Nate said, “But once I began to ask questions, I realized that everyone was always willing to help. I cannot stress how important it is to discuss your project with fellow students in the lab. The knowledge and advice that I’ve received from other students in the lab has been invaluable,” he said.

What’s next? Nate intends to pursue a doctorate in chemical engineering, focusing on nanotechnology research.
basically, we are using a fuel cell in and as a chemE— for whom process-improvement is a key skill—he has a very good chance at it.

More economical and environmentally-friendly ethylene production

Nathaniel currently works in Dr. Umit Ozkan’s lab on electrocatalysts for oxidative dehydrogenation of ethane. “Basically, we are using a fuel cell in reverse, applying a current to the cell in order to get a favorable reaction to occur,” Nathaniel explained. “We want to convert ethane—which is not very useful industrially—to ethylene, which is a significant ‘building block’ molecule for chemical syntheses. Ethylene is just two CH₂ groups attached with a double bond, so it is useful as a precursor for many organic molecules, since it can be used to form larger carbon chains or have functional groups attached to it. The most common use is for polymers,” Nathaniel said.

Nathaniel’s challenge: Current methods to produce ethylene include steam cracking, which requires high temperatures and thus large amounts of energy, while the oxidative dehydrogenation method is both less energy-intensive and more selective than steam cracking. Thus, his challenge is to find an effective catalyst for oxidative dehydrogenation of ethane to produce economic and environmental benefits.

His project: Synthesize a series of previously untested catalysts, including niobium-doped strontium titanates and lanthanum-doped strontium cobaltates. Later, he will conduct packed-bed tests of these catalysts to determine their activity, followed by conductivity tests on the most effective catalysts in order to further determine their suitability for electrocatalytic applications.

Students solve problems in Switzerland’s CERN lab

Last summer, CBE undergrads Steven Back, Bryan Gemler, and Kevin Ikeda were among the first group of undergraduates in the world to work in the IdeaSquare innovation lab of the internationally acclaimed European Organization for Nuclear Research (CERN) lab in Geneva, Switzerland.

Nineteen Ohio State students in the Integrated Business and Engineering honors program worked with some of the world’s most illustrious scientists and Nobel Peace Prize winners at CERN, the birthplace of many of the world’s top innovations of the past 60 years, including the creation of the World Wide Web, the building of antimatter and the discovery of the Higgs boson particle. They engaged regularly with Dr. Markus Nordberg, who worked on the Higgs boson project.

Reducing food waste; Off-grid energy production and storage

Challenge I: In the US alone, over a third of food ends up in a landfill.

The project: Bryan Gemler’s group developed a container that can detect when chicken spoils by studying the kinetic relationship between microbial growth during chicken spoilage and the volatile gases that the microbes produce. For more info visit go.osu.edu/foodsense.

Challenge II: Rural areas in third world countries need ways to generate and store their own power.

The project: Kevin Ikeda and Steven Back devised an ultra-efficient, economical, low-impact energy generation and storage initiative for rural hospitals in Ethiopia by using a solar collector to heat drums of water, which in turn could be used to run Stirling engines.

Bradley Schockman: A sunny future

Sophomore Bradley Schockman doesn’t mess around with penny ante goals. His goal is to change something that really matters in today’s world.

Dye-sensitized solar cells for sustainable energy

Bradley works in Dr. Yiyong Wu’s lab with graduate student Kevin Click, who is working to develop realistic energy-conservation sources such as more efficient solar cells. One project is to test an aqueous p-type dye-sensitized for a tandem cell design. The aqueous version has never been studied due to a lack of stability of the hydrophobic dye in aqueous conditions, and the cell will be the first of its kind.

The group hopes that their aqueous solar cell will lead to new discoveries and a more efficient and effective dye-sensitized solar cell for solar fuel production.

Bradley’s challenge: In addition to his work with Kevin Click, Bradley is performing his own research to optimize usage of NiO films in dye-sensitized solar cells and water-splitting devices.

His project: Develop methods to eliminate waste with dye-sensitized solar cells, which comes from using an inefficient amount of NiO. Eliminating waste would help facilitate the goal of scaling up profitable production of the cells.

What’s next? “My goal is to eventually synthesize my own dyes for the cells, which would involve a lot of organic chemistry, which I will be able to take this year as a sophomore. Until now, I’ve been self-teaching, which has been a great success as well as a great struggle at times,” he said good-humoredly, “but well worth the effort.”

Photo: Bradley Schockman sets up a water-splitting device using a dye-sensitized niO film. 
Ivan Pires: R&D for blood

Blood: our lives depend upon it. Yet voluntary, unpaid blood donations must increase rapidly in more than half the world’s countries in order to ensure a reliable supply, says the World Health Organization. How can chemical engineers help?

Creating artificial blood

Ivan Pires is worked in the laboratory of Professor Andre Palmer last summer.

“What brought me to chemical engineering was a very logical choice for me. This also explains my interest in Dr. Palmer’s research, which encompasses all those subjects,” he said.

Dr. Palmer’s laboratory engineers hemoglobin-based oxygen carriers (HBOCs) for applications in transfusion medicine and tissue engineering. In essence, he is creating artificial red blood cells (RBCs) and plasma.

While real whole blood serves many different functions, artificial RBCs are designed for the sole purpose of transporting oxygen and carbon dioxide throughout the body. HBOCs (hemoglobin-based oxygen carriers) are a class of RBC substitute that use the natural oxygen-carrying protein molecule hemoglobin (Hb) to store and transport oxygen, and could potentially be used as a short-term RBC replacement to greatly improve the care of accident victims, wounded soldiers, and RBC transfusion recipients, especially when blood is in short supply.

Palmer’s lab is also developing therapeutics to treat heme toxicity (i.e. byproduct of Hb breakdown), which results from the destruction of red blood cells in the blood. Heme is toxic to cells and organs, especially the kidneys, where it can lead to kidney failure. One such therapeutic is apohemoglobin, which has the ability to scavenge free heme in solution.

Ivan’s challenge: Explore the efficacy of using apohemoglobin to protect against heme toxicity.

His project: Develop a process to successfully scale up the production of apohemoglobin by removing heme groups from hemoglobin, and quantify its ability to bind free heme in solution.

Ivan finds his research to be extremely engaging. He has also found that the challenges of intensive research can even extend beyond the laboratory.

“What stands out for me during the last few months is that, many times, things don’t go as expected. I found this to be especially true when I once told a friend who was going to give me a ride that I would be done in 20 minutes. Five missed calls and 13 angry text messages later, I noticed that an hour had passed. What I thought was going to be straightforward five-minute procedure required three different attempts and four different modifications. However, these challenges posed opportunities to test and develop my knowledge and skills – and made the accomplishments even more rewarding,” he said.

What’s next? Ivan, who is a sophomore this fall, wants to further his academic knowledge by obtaining a master’s degree and potentially a Ph.D. “I’m not decided on a specific research area yet. What interests me the most right now is to pursue a career in research and development or bio-pharmaceutical process development/managing,” he said.

Photo, top left: Pires working on the Tangential Flow Filtration system for hemoglobin purification.

Benjamin Whiteman: CNTs

As part of the Deutscher Akademischer Austauschdienst (DAAD RISE program), Benjamin Whiteman paired up with a PhD student at Universität Heidelberg, where he worked for nearly three months testing growth conditions for small-diameter, single-walled carbon nanotubes via CVD processing.

Carbon nanotubes for ongoing research efforts

Benjamin’s challenge: The group Ben was working with focused on nanomaterials for optoelectronics and as such the carbon nanotubes he hoped to grow were intended for use in ongoing research efforts. CNTs have a number of fascinating mechanical and electrical properties which make them ideal in optoelectronics research and applications.

His project: With tens of variables to investigate and only ten weeks to get familiar with CNT growth conditions and begin testing, Ben selected a limited number of potentially interesting parameters to evaluate and was able to thoroughly test three key variables and lay the groundwork for further efforts toward the goal of selective growth of small-diameter, single-walled CNTs.

2015-16 College of Engineering Undergraduate Research Scholarship Recipients

Lucas Watson: Energized engineer

Engineers like to see how things work. They like to understand processes and the underlying forces at work in a particular system. Probably most of all, they are curious -- can they invent something new, or improve something to make it more cost-efficient? Lucas Watson, a sophomore who received an Undergraduate Summer Research Scholarship from the College of Engineering last summer, demonstrates all of these qualities and then some.

Luke, whose advisor is Jacques Zakin, worked on micelle destabilization using an electric field for heat transfer enhancement of turbulent drag reducing surfactant solutions.

"Research has been the most enjoyable thing for me in school," said Luke, who in high school self-taught for four AP exams in chemistry, government politics, calculus and history because he found classroom work too simplified. To set his curriculum, he went to forums for professors and grad students and got their recommendations for books, reading several from different sources to see how they all fit together. "Chemistry, for example, tended to either dumb down the material too much or rush over it, so having multiple sources on the subject gave me a fuller picture," he said.

Studying history, particularly his own family history, may have been one of the factors that contributed to Luke’s work ethic and values. "I think it’s selfish to say that something is too hard to even try. Our ancestors have done much more work than I’ve ever been required to do. For instance, my great-grandparents came here to farm from Germany. They started from scratch and didn’t even have electricity. My grandmother, who was orphaned at 15, supported herself and worked very hard her whole life. So who am I to sit around and play video games, when I could be trying to live up to the standard set by my family?" he mused.

Luke decided to study chemical engineering because he "likes to do everything. I like to do interesting, original things. It doesn’t do any good to just reinvent the wheel."

It’s this broader aspect of chemical engineering which attracts him. "What I like about chemical engineering is that it’s on a bigger scale. Chemistry tends to be more abstract, studying small samples and working within its own discipline. Chemical engineering has enough physics to enable you to be a mechanical engineer, plus chemistry, and process controls, which could be used in computer programming or hardware," he said.

"Things are the way they are for a reason, but they don’t have to be -- you can change things. And I do enjoy a good challenge."

-Luke Watson

In planning his college education, Luke visited a number of schools, including Ohio State because of its emphasis on undergraduate research. He visited during Easter break.

"It was getting dark, and it was cold and windy outside. I was surprised that old Koffolt Labs was even open. But I wanted to meet a professor, because I had read that was a good thing to do when choosing a school, so I went in and wandered around this deserted building with half the lights turned off until I found Professor Zakin, who was still in his office. He was so warm, gracious, and welcoming, and he was excited to share his research program with me. Clearly here was a professor who was very interested in teaching and helping people," Luke said, "and this is one of the reasons I chose to come to Ohio State."

Luke’s enthusiasm for research means that regular coursework pales in comparison. "It’s hard to focus on rote learning vs. solving real problems."

"I really enjoy Professor Kusaka’s classes, though. He’s a great professor. He poses a broad problem and you learn which assumptions are reasonable and what you need in order to solve the problem. This is in contrast with some classes that require students to blindly accept certain assumptions. Having internships and research opportunities like this is so valuable -- it’s where the real learning and knowledge acquisition take place -- not following a set procedure, but having an open-ended question with no one answer, and finding a creative way to solve the problem," he said.

"The goal of my summer project was to find a more cost-effective process to increase heat transfer in drag-reducing solutions which is also easier to retrofit to different applications. It will basically be mechanical engineering, studying how surfactants are affecting the solution. The project mixes physics, mechanical engineering, and a chemical understanding of surfactants."

"Normally, surfactants self-assemble and make these long threads that suppress turbulence. That reduction in turbulence reduces drag, but also heat transfer. Reversing that process uses a lot of energy. So if you wanted to add these to a system to make it more cost-efficient, you would need to locally disrupt the surfactant threads, do the heat transfer, allow the particles to re-assemble, and then disrupt it again. I’ll use electrophoresis, which is essentially an electrical field used to move particles in the solution. I’m hoping that with an electrical field, the self-assembly process can be interrupted," Luke explained.

Luke envisions getting a PhD and even now is getting ideas for possible focus areas. "I suggested a research project which one of our Ph.D’s is now pursuing -- a self-assembled drag reducing chemical system for organic solvents. Right now polymers are used, but they degrade," he said. "I also would like to start a project to switch Ohio State’s chilled water HVAC systems over to using these drag reducing solutions. We could save tens of thousands of dollars per year," he said with a smile.
Petroleum minor returns

More than 50 years ago, H.C. “Slip” Slider, a beloved professor who wrote one of the first textbooks on petroleum engineering, headed up a petroleum engineering minor in the chemical and biomolecular engineering department. But after Slip’s passing, enrollment declined nationally and the subject disappeared at Ohio State. Now, with plentiful shale gas reserves in Ohio and students expressing interest in the U.S. Society of Petroleum Engineering, it is set to return as a minor in CBE.

“The energy industry is a major employer of engineering graduates from Ohio State. Having the petroleum engineering minor will help students get started more quickly with energy companies, and will also provide visibility to this career path for many more students,” said Associate Dean for Undergraduate Education David Tomasko, who is also a CBE professor.

Petroleum engineering can be taught in either geology or chemical engineering, and some of the courses being offered next fall will in fact be taught by geology professors. The benefit to learning about it within chemical engineering is that students will also be able to apply their knowledge of thermodynamics, separations, and transport phenomena to the field, says Professor Stuart Cooper, the former department chair.

Current Department Chair Andre Palmer adds that “opportunities in petroleum engineering are cyclical and driven by the price of oil, but it’s a field that has legs. In the long view, having a background in it creates opportunities to expand into that area. People who are properly trained in it are worth their weight in gold. Industry representatives say that studying it as a major is not necessary.”

Petroleum engineers focus on finding and harvesting oil and gas in the safest and most efficient manner possible. This could include discovering reservoirs, estimating their size, determining the most efficient way to harvest, and designing transportation methods for getting the material to processing plants.

The minor is expected to be formalized by fall of 2017, with the first new courses offered in the spring.

New peer mentoring program enhances student success

Adjusting to life at Ohio State and starting college-level engineering studies can be daunting for freshmen, but the new CBE Peer Mentoring Program offers help. Now in its second year, the program pairs 6-10 freshmen with one of 10 juniors and seniors who serve as a resource for the undergraduates.

Academic Advisor Katie Bush-Glenn came up with the idea to help students gain access to information while connecting with their peers.

“When I was a freshman, I didn’t know anyone and felt overwhelmed,” said mentor Taylor Fitzgerald. “There were so many things to find out. For instance, I was so worried about what would happen if I didn’t make it into the major. Now I can help my peers understand their options. It feels great to be able to help others in ways that I know I would have appreciated myself,” she said.

Tatum Magill so valued her experience as a mentee that she decided to become a mentor herself. “As a new pre-chemical engineering student, I was overwhelmed at first. I really was grateful to have a mentor willing to answer any questions about the concerns I had with freshman year. I learned from an upperclassman’s experience and gained motivation from seeing the results of four years of hard work. I thought it was such a helpful resource, that I am now a peer mentor as well. I am very excited to connect with my mentees and help them in any way I can!” Tatum said.

Eddie Janini is also serving as a peer mentor. “I let students know that I’m here for questions or problems of any kind — roommate troubles, how to balance studying with recreation -- I’m a resource for whatever is needed. There was so much I didn’t know as a freshman. My favorite band came and played, but I missed it because I didn’t know how to get tickets in time!” Janini said.

“One of the things I wished I had known as a new student was that the courses you take in your first year are not necessarily what you will be doing for the duration of your career. I nearly dropped out because I didn’t enjoy calculus or general chemistry, but when I got to my second year and could take the courses I was more interested in, my enthusiasm really kicked in,” said Peter Guiguis, who is also a peer mentor.

Peer mentor Brian Kulp, who has connected with seven of his nine mentees, introduced himself to his mentees by sharing two interesting things about himself and what he was most excited about for the coming year, and asking his mentees to do the same.

“Some students are shy about connecting with their mentor, but once they realize that it is not connected to their grade or academic performance, they feel more comfortable about checking it out,” Bush-Glenn said. “The program is definitely having an effect on retention,” she said.

#Donuts with the Dean and Chairman Palmer

CBE teamed up with the College of Arts & Sciences & Chemistry last spring for a fun Twitter promotion: #Donuts with the Dean.

Four days before the event, not-so-subtle hints about FREE DONUTS began appearing on Twitter, along with emails to students encouraging them to follow go.osu.edu/CBETwitter for clues about the final time and location of the event.

Over 100 students came to get a free donut, meet Dean Menderscheid and Chairman Palmer and chat with friends.
The current Unit Operations Laboratory was built as one of the centerpieces of the new Chemical and Biomolecular Engineering and Chemistry (CBEC) building. The generous financial leadership of James and Patricia Dietz was instrumental in establishing the laboratory as a state-of-the-art facility for practical undergraduate education. While many chemical engineering departments are downsizing their laboratories, reducing the number of experiments offered to students and using smaller experiments to save cost and space, the Dietz’s leadership has reinforced OSU’s emphasis on undergraduate education for chemical engineers.

The equipment in the lab is similar in size and capabilities to equipment students will use in co-ops, internships, and in the job. Being able to learn how to safely and efficiently perform laboratory experiments in the unit operations lab offers OSU undergraduates a competitive advantage when interviewing.

The most impressive experiment in the Unit Operations Laboratory is the continuous distillation column. Spanning over twenty-five feet, the column is visible from the lobby of CBEC and provides a striking visual for visitors to CBEC. The twelve-tray bubble-cap distillation column is used to distill a mixture of water and ethanol.

An immense engineering challenge CBE faced when moving to the new CBEC building was the dismantling and reassembly of the distillation column. Since the column is glass and quite large, the risk of damage necessitated that the column be disassembled and moved piece-by-piece.

CBE staffmembers Leigh Evrard and Mike Wilson led efforts to catalog and label the individual components of the column to ensure that it could be reassembled correctly, and a professional moving company was hired to help move individual pieces.

Putting the column back together in the new location was a long and methodical process. It was critical to ensure that the components interfaced with each other to provide a leak-proof column supported by the superstructure around it.

“I lost a lot of sleep over that column,” Mike Wilson said. “We designed and measured everything very carefully in CAD, but you don’t really know until you actually build it. And when it was finally erected, it took four of us to lift the 75-pound condenser in place. That was very stressful, since the first Unit Ops class in the new building was scheduled to start that week.”

However, the massive project was a success and on September 2, 2016, the distillation column experiment was performed for the first time in the new building by students in the fall semester lab, which is held every Friday.

Automated sampling ports were added to the column based on a design by Leigh Evrard. Now, with the push of a button, students could obtain samples from each tray in the column. The column was also upgraded to automate key features, including the valve controlling the reflux ratio. Students control the system and monitor performance on a graphical user interface (GUI) screen, simulating a control room in a chemical plant.

During the experiment, the feed tray and reflux ratio are varied, and samples are obtained at different locations in the column to monitor the ethanol concentration. A refractometer is used as an indirect measure of the ethanol concentration, with a calibration curve generated to link the instrument results to the ethanol mass fraction. Students use standard distillation analysis methods to calculate the column efficiency.

“I live for Fridays,” said Mike Wilson. “Unit Ops is very trying at times, but seeing the group effort -- you just feel the energy in the air.”
“The best experience I hope I never have to repeat.”

This quote was from a student who recently completed the Unit Operations Laboratory, and it captures the essence of the course in a nutshell.

For over fifty years, CBE’s Unit Ops course was taught in a single six-week session. Today, it is taught throughout the year, partly to avoid conflicts with summer internships, but also because of a burgeoning enrollment and the switch from quarters to semesters. A secondary benefit is that short experimental summaries can be conducted to support other courses. For example, when the Separations course is reviewing the theory of liquid-liquid extraction (LLE), students can witness batch and continuous LLE in the lab.

The extremely rigorous and technically challenging nature of CBE provides an opportunity to move from theory to practice and is an invaluable component of a ChE education. Typically, students have already taken most of their core courses, so the theoretical framework for analyzing relevant, chemical engineering problems and data has been established. Some of the most important aspects of the laboratory experience involve determining the reasons why data from an experiment does not match the theory.

Students perform experiments ranging from continuous distillation, to liquid-liquid extraction, to fuel cells, to fluidization. Most of the equipment in the lab is pilot scale, giving students the opportunity to learn practical equipment and instrumentation handling skills and laboratory safety best practices.

Key goals include application of chemical engineering principles in experiments, technical report writing, and pilot scale equipment operation. Ancillary goals include enhancing soft skills with respect to group dynamics and opportunities to improve techniques related to technical presentations.

The Unit Operations Laboratory “rite of passage” continues to serve as one of the defining courses for CBE undergraduates, who often feel an immense sense of pride and accomplishment upon its completion.

Unit Operations “rite of passage” lives on in semesters

CBE Student Facts

Undergraduate Program:
• 1,045 students: 38% women and minorities;
• Departmental scholarships: 147;
• Honors program participants: 40%;
• Retention rate: 91%;
• Avg freshman ACT Composite: 30 (the National Average is 21);
• Bachelors degrees conferred: 203;
• Average starting salary for graduates: $69,538.

Graduate Program:
• 105 graduate students: 34% women and minorities;
• US News & World Report Program Ranking: 26;
• Graduate degrees conferred: 15 PhDs, 16 masters degrees.

National Scholarships (past 10 yrs):
• 16 National Science Foundation Graduate Research Fellowships;
• 5 Barry M. Goldwater scholarships;
• 2 Fulbrights;
• 1 Morris K. Udall scholarship.
Graduate Research Symposium 2016

The 5th Annual Graduate Research Symposium sponsored by Dow Chemical featured alumnus Paul Matter, CEO of pH Matter, as keynote. Dr. Matter (’01 BS, ’06 PhD) reviewed his career path from grad school to working in industry to starting up a company, comparing the various challenges / advantages of careers in academia vs. a national lab or industry.

Twenty participants from Becton Dickinson, Dow Chemical, Eli Lilly, ExxonMobil, Intel, Nalco Champion, Momentive, The Ohio State University’s College of Business and the Technology Entrepreneurship and Commercialization Institute, Owens Corning, pH Matter LLC, Procter & Gamble, Royal Bond, and Shell attended.

The poster session was held in the Cartoon Room at The Ohio Union. Event attendees found the session enjoyable and helpful. “I really appreciate your efforts in organizing this great Symposium!” said Huang Wenyi from Dow Chemical Company. “It was an enjoyable and eye-opening session.”

Ashley Morgan of Owens Corning said, “It was a wonderful event and I was excited to see all the great research being done at OSU!”

#Day in the Life

This fall, CBE hosted the “Day in the Life of a CBE Grad Student” series on social media. Shown at left is a montage of posts from the Fan Group. To see more, search #CBEGradLife on go.osu.edu/CBEfacebook and go.osu.edu/CBEtwitter!
Reorganized CBE Advisory Board meets

The CBE Advisory Board embarked on a new path on Friday, September 9 with its inaugural meeting under the direction of alumnus Richard Schwarz, ’73.

Nine of the fifteen board members met to discuss such matters as the proposed petroleum engineering minor; departmental goals; student recruitment and enrollment; placement following graduation; faculty recruitment; alumni engagement; technology licensing and commercialization; research expenditures; and rankings in U.S. News and World Report.

The board also provided input on which undergraduate learning outcomes would be most beneficial, from an industry perspective, to help ensure that CBE’s curriculum is in line with today’s needs.

The Board will meet again this spring to follow up on several key issues.

Thank you to all of our Advisory Board members for your input and regard for the department!

2016-17 CBE Advisory Board Members

Aisha Barry, ’95, Interim GM and Senior Global Marketing Director, Cardiac Rhythm and Heart Failure, Medtronic; Rich Brandon, ’83, Global Supply Chain Director, Mergers & Acquisitions, Dow Chemical Company; Linda Broadbelt, ’89, Sarah Rebecca Rowland Professor and Chair, Northwestern University Department of Chemical and Biological Engineering; Terry Chern, ’82, Director of Technology, Honeywell International; Daniel Coombs, ’78, Executive VP, Global Olefins & Polyolefins and Technology, LyondellBasell Industries; Ron Harris, ’61 BS/MS, Retired EVP, Nabisco R&D; Adjunct Professor, The Ohio State University; Lawrence Latta, ’76, PE/PMP, Sr, Project Manager, Varo Engineers; Sunil Satija, ’81 MS, ’84 PhD, Global Technology Director, Axalta Coating Systems, Inc.; Frank Schuh, ’56 BS/MS, President, Drilling Technology, Inc.; Richard Schwarz, ’73, Partner, Edgewater Capital Partners; Gary Spitznogle, ’98, Vice President, American Electric Power; Robert Tatterson, ’87, VP and Chief Technology Officer, Sealed Air Corporation; Andrew Weber, ’82, Business Director, DuPont; Michael Winfield, ’62, Retired President & CEO, UOP LLC; Leonore Witchey-Lakshmanan, ’83 BS, ’84 MS, Principal Consultant, Pharma CMC / IP.
In Memorium

1940s


Donald E. Darr, '48 BS, of Aiken, SC, retired chemical engineer at PPG Industries, passed away on 7/21/2016.

Robert E. Farison, '43 BS, of Lenanon, OH, retired chief engineer at Hydro Systems Co., passed away on 12/2/2015.

James G. Hanlin, '47 BS, of Bakersfield, CA, passed away on 7/9/2016.

Robert H. Hill, '47 MS, '52 PhD, of Pittsburgh, PA, retired senior scientist at Neville Chemical Co., passed away on 7/10/2016.

Robert H. Miller, '48 BS, of Western Springs, IL, passed away on 10/12/2015.

Howard G. Wittmer, '49 BS, of Toledo, OH, retired engineer at Owens-Illinois Inc., passed away on 10/13/2015.

1950s

Cesar B. Bautista, '59 MS, of Malabon Rizal, Philippines, ambassador, Court of Saint James, passed away on 12/9/2015.

Philip L. Fondy, '57 BS/MS, of Dayton, OH, owner of Midwest Spray Booths, passed away on 10/10/2015.

Richard G. Sudak, '52 MS, of Oceanside, CA, passed away on 11/21/15.

1960s


Oliver L. Davies, '65 BS/MS, of Montevallo, AL, retired engineer, The Southern Company, passed away on 7/11/2015.

1970s

Albert M. Gesenhues, '83 BS, of Louisville, OH, chemical engineer, Goodyear Tire & Rubber Company, passed away on 8/29/2015.

1980s

Donna M. Walter, '87 BS, of Kernersville, NC, supplier quality engineer, Tyco Electronics Corporation, passed away on 11/10/2015.

Paul E. Bates, a World War II veteran, Depression-era survivor, co-holder of two U.S. patents, civic and International Executive Service Corps volunteer and graduate of The Ohio State University ('49) who was named a Distinguished Alumnus in 1999, finished his 38-year career at Procter and Gamble as the associate director of research and development. But it was also at Procter & Gamble that he started something very special - The Paul E. and Ruth M. Bates Chemical Engineering Scholarship Fund.

Bates established the fund at P&G to help disadvantaged women and minorities who wished to study chemical engineering. Bates and his beloved wife, Ruth, who passed away in 2012, took great satisfaction in helping others, and volunteered to help educate and tutor children, build museum exhibits and refurbish computers for schools and non-profits. “Often, what you get back is much greater than what you put in,” Bates had remarked.

Since the Bates Scholarship was established, 46 students have benefitted, including Japheth Pritchett, ‘01, now a manufacturing site leader at Procter & Gamble. “Paul was an incredible mentor for me and a great friend. Both of my grandfathers had passed before I was born, so I never really had the opportunity to experience that type of relationship until I met Paul,” Pritchett said. “He was such an energetic and kind person that I miss very much.”

Watch this moving tribute to Paul and Ruth Bates as Paul explains in more detail the inspiration and mission behind the Bates Scholarship: go.osu.edu/Bates.

To donate to the Bates Scholarship Fund in memory of Paul and Ruth Bates, or to inquire about mentoring a chemical engineering student, please contact Sean Gallagher at gallagher.646@osu.edu.
WHAT WE’VE DONE TOGETHER MEANS EVERYTHING

... and not just to the student who benefitted from your support and worked to become a chemical engineer.

It means everything to the cancer survivor whose faster cancer diagnostic will mean an improved survival rate.

And everything more to people here and around the world who need access to fresh, clean water.

It might even mean everything to you, personally, should you one day find yourself in an emergency room in need of artificial blood during a national shortage.

These are just a few of the things that your donations are helping Ohio State students, faculty and researchers to achieve -- and we can’t thank you enough.

You care about others, and we hope you will be able to continue to support your Ohio State ChemE by using the form below (or the website) to make a gift.

If you are interested in gift planning options, perhaps you’d like to also consider helping someone you may not have thought about lately: yourself.

A Charitable Remainder Trust can provide you with an income stream for life; a charitable income tax deduction; and a partial bypass of capital gains -- all while establishing generous future support for your Ohio State ChemE department. Plan for the future... receive current benefits... and provide lasting support for your alma mater -- all at the same time. What’s not to like?

Whatever the size or type of gift you may make, please know this: it truly matters.

For more information contact:
Sean Gallagher, Director of Development
gallagher.646@osu.edu; 614.688-4414

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I would like to support CBE in the amount of □$250 □$500 □$1000 □$2500 □$5000 □$_______.

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□ Online: go.osu.edu/GiveToCBE

□ My company makes matching gifts. See if it does at go.osu.edu/MatchingGifts
The Homecoming Parade of 2016 marches past CBEC.