MASS Transfer

News from Chemical and Biomolecular Engineering at Illinois

Spring/Summer 2021

MASS Transfer

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The Colors of Fall

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Presented is a cross-polarized microscopy image of a crystallized polymeric material that is used to fabricate organic solar cells using solution printing. With increasing concentration of polymer solution, molecules start to aggregate and eventually form these crystalline aggregates that look like branches of a tree upon solvent evaporation.

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From the Department Head's Desk

Greetings from Illinois!

As I write this message, the first spring flowers are beginning to emerge, and so too, it feels like our community is beginning to reemerge one year after we went into lockdown. Vaccines are now widely distributed across campus and Champaign-Urbana, and we greatly anticipate resuming more in-person departmental activities back on campus this fall.

In the meantime, like all of you, we have adapted to this new, virtual world and are excited to have so much good news to share since our last edition of Mass Transfer. The silver lining has been more opportunities to connect online with alumni, friends, and potential students across the globe.

Thanks to our graduate recruitment committee, led by assistant professor **Ying Diao**, we look forward to welcoming a talented, international cohort this fall. We used a combination of Slack, Zoom, and Gather.Town to share information and resources, host virtual recruitment activities, and connect with prospective students worldwide.

In April, we held a virtual Undergraduate Research Symposium, featuring posters from nine students that were judged by **Corey Correnti** (BS '85), **Tom Tulig** (BS '78), and **Jim Morris** (BS '81), who's also featured on pages 18-19 for his efforts to create a new professional master's program. Afterwards, we recognized the symposium winners and the department's scholarship recipients at the Undergraduate Scholarship & Awards Ceremony (read more on pages 11-12). We held a virtual convocation ceremony for our December graduates with remarks from **Marchoe Dill Northern** (BS '97), a senior vice president and global home care brand franchise leader at Procter & Gamble. Our Spring convocation ceremony, also held on Zoom, celebrated almost 110 undergraduates and 10 graduate students with remarks from **Alex Vogel** (BS '63). Both sets of remarks are highlighted on page 10. Thank you to all our alumni and friends who make these events and recognitions possible each year.

We are especially grateful to **Kenneth Jaconetty** (BS '82) for endowing a new scholarship program to support students from backgrounds that are underserved in chemical engineering. Read more about how the Black Lives Matter movement inspired him to give back on pages 20-21. On pages 16-17, meet our new assistant professor **Alex Mironenko**, and learn more about his work on force fields (no, not the Star Trek kind).

To prepare for future generations of ChBE students, we are modernizing our junior/senior lab courses and planning for a major upgrade and relocation of the associated lab spaces. We are pleased to welcome specialized teaching faculty **Joachim Floess** and **Uzoma Monye** (see opposite page) to oversee this endeavor. We are excited to share an update in the next edition of Mass Transfer.

Until then, you can stay in touch with us through multiple social media platforms including our brand-new YouTube channel and LinkedIn Page—we are transitioning from a private LinkedIn Group to a public page that is more accessible to our community.

Thank you for your continued support.

Paul Kenis

Paul Kenis
Elio E. Tarika Chair in Chemical Engineering and Department Head

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Uzoma Monye joins ChBE's teaching faculty

The Department of Chemical and Biomolecular Engineering is excited to welcome **Uzoma Monye.**

In August 2020, Monye joined the department as a teaching assistant professor during an unprecedented time with the COVID-19 pandemic.

"The University of Illinois has a reputation for producing solid graduates who impact various fields in engineering and technology," Monye said. "The university also seems to value its members and its academic work for undergraduates. When I heard about the position, I knew that it would be a good fit for me to join this exceptional institution."

Despite the times, she has already begun to make her mark on the undergraduate program.

Right off, she adapted coursework to be delivered online and adopted best practices so students could return to the laboratory for hands-on, physically distanced educational experiences. She has also taught an additional section online to allow for those students not able to come to campus to still complete the Unit Operations Lab course using items from a kit sent to them wherever they were around the world.

"We are grateful for Monye, whose efforts ensured that we did not sacrifice the educational opportunities or safety of our students during this time," said department head **Paul Kenis**, the Elio Eliakim Tarika Endowed Chair. "She is a shining example of an educator who puts her students first. We are lucky to have her here."

Monye champions opportunities to improve engineering education. She believes in providing support and motivation to help retain undergraduate students. She is also an advocate for increasing STEM engagement to encourage students to choose—and succeed in—engineering careers.

She currently teaches the Unit Operations Laboratory, focusing on experiments and computation in fluid mechanics, heat transfer, mass transfer, and chemical reaction engineering. She is also the instructor of Introduction to the Engineering Profession and other courses.

Teaching assistant professor Uzoma Monye inspects the liquid-liquid extraction column that students use to investigate the removal of t-butyl alcohol from mineral oil.

"I enjoy working with the students," Monye said. "They are bright and eager to learn."

Along with fellow teaching faculty member **Joachim Floess**, Monye is instituting the department's cross-curricular design to incorporate team-based design projects throughout the undergraduate coursework. Read more about how Phillips 66 is supporting this effort on page 12.

> "I have the freedom to contribute my ideas. I like the level of support I receive from my colleagues and the departmental administration. I look forward to seeing how the program evolves."
>
> **Uzoma Monye**

They are also leading a new campaign to revitalize the undergraduate laboratory facilities and capstone laboratory courses: Chemical Engineering Laboratory Fundamentals for juniors and Unit Operations in Chemical Engineering for seniors. Stay tuned for more information about this effort in the next newsletter.

"I have the freedom to contribute my ideas," Monye said. "I like the level of support I receive from my colleagues and the departmental administration. I look forward to seeing how the program evolves."

Monye graduated from Columbia University with a bachelor's degree in chemical engineering.

She went on to earn her master's degree and a doctorate in chemical and biomolecular engineering from the University of Pennsylvania, where she studied blood coagulation on matrix protein microarrays under venous and arterial flow.

Previously, Monye was an assistant professor at the American University of Nigeria and lectured at other Nigerian institutions before returning to the U.S. as a postdoctoral research associate at North Carolina Agricultural and Technical State University, where she was recruited to join Illinois.

Faculty Awards and Recognition

Guironnet named Center for Advanced Study fellow


Damien Guironnet

The University of Illinois Center for Advanced Study announced that assistant professor **Damien Guironnet** is among eleven elected fellows for 2021-2022. The center identifies the top scholars on campus and provides one semester of release-time from teaching duties for fellows to concentrate on creative work.

During his fellowship year, Guironnet's group will further advance the design-to-synthesis strategy protocols that he has pioneered. This strategy enables the conversion of a hand drawing of a polymer's shape or molecular weight distribution into an actual sample.

"Our most ambitious goal is to use the shape of the macromolecules to create supramolecular assemblies that can mimic the unique catalytic activity achieved by enzymes," Guironnet said. "It is a privilege to join the ranks of so many distinguished scholars and also to have the opportunity to pursue research that will lay the foundation to open a new era in polymer synthesis."

Harley earns Clemson Award from the Society For Biomaterials

The Society For Biomaterials awarded the 2021 Clemson Award for Basic Research to Robert W. Schaefer Professor **Brendan Harley** for his advances to regenerate tissues with biomaterials.

This award recognizes an individual who has made an original contribution to the basic knowledge and understanding of the interaction between materials and tissue.


Brendan Harley

"As a highlight of a recent paper, Brendan's group published a beautiful study in Science Advances on a scaffold design containing osseous and tendinous tissue compartments connected through a PEG hydrogel to dissipate strain," said University of Pennsylvania professor Jason Burdick in his recommendation letter. "This is an important contribution where biomaterials may play a significant role to address a clinical concern."

College of LAS honors Sing and Diao with named scholar positions


Charles Sing

The College of Liberal Arts & Sciences named associate professor **Charles Sing** a 2020-2021 Helen Corley Petit Scholar, followed by assistant professor **Ying Diao** who was designated as a 2021-2022 I.C. Gunsalus Scholar.

"These named scholars have been chosen for their energy, creativity, and potential in teaching and research in the College of LAS," said Feng Sheng Hu, former Harry E. Preble Dean of the College of LAS in last year's announcement. "They are incredible examples of the level of effort we apply to achieving academic excellence."

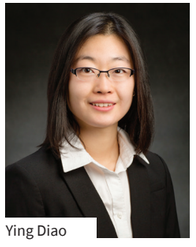
Helen Corley Petit, an alumna of the College of Liberal Arts & Sciences, provided an endowment for the development of the scholarship and teaching of early career faculty members in the college. Petit scholars are selected on the basis of superb records of achievement, as presented in promotion and tenure dossiers.

Sing's research focuses on polymer physics to inform the design of advanced materials for energy, biotechnology, consumer products, and medicine. He joined the University of Illinois in 2014.

Professor Emeritus I.C. Gunsalus established an endowment in his name to support the scholarship and teaching of young faculty members in the physical and life sciences. The distinction includes the use of the title for the next academic year and a stipend to support research and teaching.

Diao's research pursues the fundamental understanding and control of multiscale molecular assembly processes to achieve sustainable manufacturing of electronic materials, energy devices, and therapeutic products. She joined Illinois in 2015.

College of LAS recognizes Diao for her research and teaching


Ying Diao

In February 2020, assistant professor **Ying Diao** was one of six early-career professors selected to be a Lincoln Excellence for Assistant Professors (LEAP) Scholar for outstanding contributions and potential in research and teaching.

The LEAP award is granted to faculty early in their career based on scholarly productivity and contributions to the educational mission of their departments and the College of Liberal Arts & Sciences. Scholars hold the title for two years and receive discretionary research funding.

"This year's LEAP Scholars demonstrate the amazing potential that continues to emerge from the College of LAS," said Feng Sheng Hu, former Harry E. Preble Dean of the College of LAS. "They are positioned to become leaders in their fields for years to come, and we are proud to have them on campus."

Shukla receives Journal of Physical Chemistry Lectureship Award


Diwakar Shukla

The Journal of Physical Chemistry and the American Chemical Society Physical Chemistry Division recognized assistant professor **Diwakar Shukla** with the Journal of Physical Chemistry and PHYS Division Lectureship Award for his contributions to the field of physical chemistry.

"It is a special honor for me because The Journal of Physical Chemistry has been my preferred place for publishing fundamental, mechanistic, and methodological papers," said Shukla, a Blue Waters professor. "The award not only recognizes my efforts but also contributions from numerous co-authors over the years, especially students, mentors, and collaborators."

Shukla's research is at the intersection of physical chemistry and plant biology. His team develops physics-based simulations that provide detailed information about the structure and dynamics of molecular machinery in plants to fill in gaps that are required for modeling.

The Grainger College of Engineering honors Shukla's research

Blue Waters assistant professor **Diwakar Shukla** was chosen to receive a 2020 Dean's Award for Excellence in Research from The Grainger College of Engineering.

The awards were established to honor faculty for outstanding research. Four assistant professors are chosen by their peers based on who has conducted the most outstanding research during the past academic year. In addition, four associate professors are chosen for their outstanding research over the past five academic years.

Schweizer elected to the American Academy of Arts and Sciences

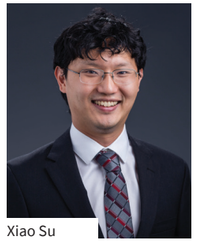

Kenneth Schweizer

Morris Professor of Materials Science & Engineering **Kenneth Schweizer** was among 252 new members elected to the American Academy of Arts and Sciences, one of the oldest honor societies in the nation.

"We are honoring the excellence of these individuals, celebrating what they have achieved so far and imagining what they will continue to accomplish," said David Oxtoby, the president of the American Academy. "The past year has been replete with evidence of how things can get worse; this is an opportunity to illuminate the importance of art, ideas, knowledge and leadership that can make a better world."

The overarching goal of Schweizer's research is to develop novel molecular-scale statistical mechanical theories of the equilibrium and dynamic properties of polymers, colloids, nanocomposites, elastomers, gels, glasses, and other forms of soft matter, and apply them to understand experiments and assist in the design of new soft materials.

American Chemical Society honors Su with Victor K. LaMer Award


Xiao Su

Assistant professor **Xiao Su** received the 2020 Victor K. LaMer Award from the American Chemical Society Division of Colloid & Surface Chemistry for his dissertation on "Organometallic Redox-Interfaces for Selective Electrochemical Separations."

He joined the University of Illinois faculty in January 2019. His research program pursues the molecular engineering of electrochemical interfaces for advanced separations and process intensification.

Hammack's dedication to outreach and public service recognized by trio of awards

William H. and Janet G. Lycan Professor **Bill Hammack** has been honored by three awards recognizing his efforts to enhance public understanding and engagement with science and engineering. He is the recipient of the 2020 Hoover Medal, the 2020 Ralph Coats Roe Medal from the American Society of Mechanical Engineers (ASME), and most recently, the 2021 Public Service Award from the National Science Board (NSB).

"I love science and opening people to the amazing engineering feats that fill our everyday lives is a passion for me," said Hammack in the NSB award announcement. "To be awarded for doing something that I love this much is really wonderful."

His contributions to science communications include his popular YouTube channel "engineerguy" that has attained over a million subscribers and nearly seventy million views since its start in 2011. He has hosted more than 200 public radio segments that describe what, why, and how engineers do what they do. He has also authored a number of non-fiction works that include: "Why Engineers Need to Grow a Long Tail," "How Engineers Create the World," "Eight Amazing Engineering Stories," and "Albert Michelson's Harmonic Analyzer. "

Hoover Medal

The Hoover Medal is named for its first recipient, U.S. President Herbert Hoover, who was an engineer by profession. Established in 1929, the prize commemorates the civic and humanitarian achievements of an engineer whose professional and personal endeavors have advanced the well-being of humankind.

"I am thrilled with the recognition by this award of the importance of reaching out to the public—to explain to them science and engineering," Hammack said. "With this understanding, the public can better exercise the civic responsibility of shaping the technological forces that shape our lives."

This award is administered by a board representing five engineering organizations: the American Society of Mechanical Engineers; the American Society of Civil Engineers; the American Institute of Chemical Engineers; the American Institute of Mining, Metallurgical and Petroleum Engineers; and the Institute of Electrical and Electronics Engineers.

ASME Ralph Coats Roe Medal

The American Society of Mechanical Engineers recognized Hammack with the 2020 Ralph Coats Roe Medal for his pioneering use of new media to present engineering as a creative profession essential to our modern world, particularly through internet-delivered videos that highlight how engineers think, how they use science, and the role of manufacturing in design.

The Roe Medal, established in 1972, recognizes an outstanding contribution toward a better public understanding and appreciation of the engineer's worth to contemporary society. Ralph Coats Roe was a pioneer and innovator in the design and construction of highly efficient power plants and advanced desalting processes. The Roe award includes an honorarium and gold medal.

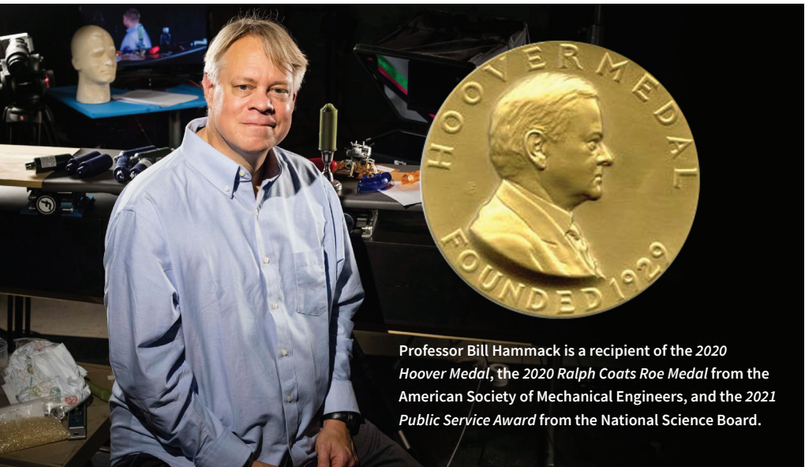
NSB Public Service Award

The National Science Board awarded Hammack the 2021 Public Service Award in recognition of his outstanding skills as a communicator. The award is granted to individuals and groups who have contributed substantially to increasing public understanding of science and engineering.

"Dr. Hammack is one of the world's polymaths," said Maureen Condic, chair of the NSB Honorary Awards Subcommittee. "He is both a gifted scientist and a gifted educator who knows how to entertain and inform a wide variety of people on incredibly technical topics. He opens a window into understanding for those who are not engineers or scientists, and he seems to have a lot of fun doing it. Getting the public interested in science this way is a huge public service."

Hammack's work has been credited with helping a new generation experience and understand engineering as a creative profession. He uses clear, accessible but technically accurate language to excite audiences about topics as mundane and miraculous as disposable diapers, microwave ovens, and tape dispensers.

These three awards join a long list of recognitions acknowledging Hammack's dedication to both research and science communications. He has also earned what is sometimes called the "trifecta" of science journalism awards: The Science in Society Award from the National Association of Science Writers (2002); the Grady-Stack Award from the American Chemical Society (2004); and the Science Writing Award from the American Institute of Physics (2004). In 2019, he received the Council of Scientific Society Presidents' Carl Sagan Award for the Public Appreciation of Science.



Professor Bill Hammack is a recipient of the *2020 Hoover Medal*, the *2020 Ralph Coats Roe Medal* from the American Society of Mechanical Engineers, and the *2021 Public Service Award* from the National Science Board.

Faculty Research Grants

Diao to help astronauts grow veggies in space through NASA Early Career Award

When in space, astronauts typically eat dehydrated, nutrient-dense food, but when it comes to longer space missions, that can become a problem as they'll eventually lack nutrients from fresh vegetables. Assistant professor **Ying Diao** received a NASA Early Career Faculty Award to improve the growth of plants in space.

This project will develop wearable sensors for plants to monitor their health and stress levels autonomously. A "smart" plant chamber will provide a growing environment that reduces stressors. Diao also plans to develop a sensor that continuously monitors growth over the plant's lifetime.

Scientists receive $2 million to develop ways to use renewable energy

A $2 million grant from the National Science Foundation will help a team from the University of Illinois develop ways to use renewable energy to remediate carbon dioxide emissions and generate chemical building blocks and liquid fuels.

The new effort includes associate professor **David Flaherty** and department head **Paul Kenis**, the Elio E. Tarika Endowed Chair, who will help reimagine the manufacturing of chemicals and fuels as society shifts from using petroleum to renewable sources. Their concept uses energy from solar or wind power to power an electrochemical reactor that drives two reactions simultaneously to reduce carbon dioxide and biomass into useful molecules.

$3 million NCI award supports advances in brain cancer research

Several University of Illinois researchers are joining forces with scientists from the Mayo Clinic and Georgetown University on an expansive project targeting improved treatment for glioblastoma (GBM), the most aggressive form of brain cancer. The team, led by Robert W. Schaefer Professor **Brendan Harley**, received a $3 million grant from the National Cancer Institute (NCI).

An expert in tissue microenvironments, Harley uses bioengineering techniques to recreate brain tissue. His lab is partnering with the Mayo Clinic and Georgetown professor Rebecca Riggins to provide cell lines engineered to be resistant to temozolomide, the primary chemotherapy used to treat GBM today.

Kong awarded grants for new research in neurotechnology

Two new grants will fund interdisciplinary neurotechnology research led by Robert W. Schaefer Professor **Hyunjoon Kong**. They include a project on how neurons and muscle cells communicate with each other, funded by the National Science Foundation, and the development of a drug delivery system for treatment of Alzheimer's disease, funded by the Alzheimer's Foundation.

The first grant will improve their understanding of how to facilitate the innervation of the neurons into the muscle, working toward their goal to engineer functional muscle and use it to assemble autonomous bioactuator systems. The second grant will focus on synthesizing nano-sized drug carriers that can target the tau protein, which causes Alzheimer's disease along with β-amyloid proteins.

Water recycling efforts supported by 2021 iSEE seed-funds

The University of Illinois Institute for Sustainability, Energy, and Environment (iSEE) has provided seed funding to establish a fully renewable system to recover excess nitrogen from polluted waterways for upcycling into value-added products like ammonia, with a view toward encouraging sustainable land management and energy-efficient nutrient reuse.

Led by assistant professor **Xiao Su**, the project will use a sophisticated, electrically powered nitrogen-selective separation process to remove the chemical from polluted water.

Su joins inaugural Scialog initiative, investigates negative emissions science

Assistant professor **Xiao Su** is part of the inaugural initiative "Scialog: Negative Emissions Science," co-sponsored by the Research Corporation for Science Advancement and the Alfred P. Sloan Foundation. Su joins one of eight teams investigating novel approaches to tackle greenhouse gases.

The goal of the project is to mitigate global warming by reducing carbon dioxide levels in the atmosphere. Su developed the proposal with Scialog Fellows Burcu Gurkan from Case Western Reserve University and Shaama Mallikarjun from the University of Southern California.

$20 million NSF grant launches new artificial intelligence institute for molecule synthesis

A team led by Steven L. Miller Chair Professor **Huimin Zhao** was awarded a five-year $20 million grant from the National Science Foundation to establish the Artificial Intelligence (AI) Institute for Molecular Discovery, Synthetic Strategy and Manufacturing, known as the Molecule Maker Lab Institute or MMLI.

The MMLI focuses on the development of new AI-enabled tools, such as AlphaSynthesis, to accelerate automated chemical synthesis and advance the discovery and manufacture of novel materials and bioactive compounds. The institute includes chemical and biomolecular engineering professors **Ying Diao**, **Charles Schroeder**, and **Diwakar Shukla**.

Mysterious organic scum boosts chemical reaction efficiency, may reduce chemical waste

Chemical manufacturers frequently use toxic solvents such as alcohols and benzene to make products like pharmaceuticals and plastics. Combining the right solvents and metal nanoparticles accelerates many chemical reactions and helps maximize yield and profit margins for the chemical industry.

However, many solvents are toxic and difficult to safely dispose of. Water works, too, but it is not nearly as efficient or reliable as organic solvents. A team led by University of Illinois associate professor **David Flaherty** explored irregularities in experimental data to understand these differences. The study was published in the journal Science.

The team ran experiments to analyze the reduction of oxygen to hydrogen peroxide—one set using water, another with methanol, and others with water and methanol mixtures. All experiments used palladium nanoparticles.

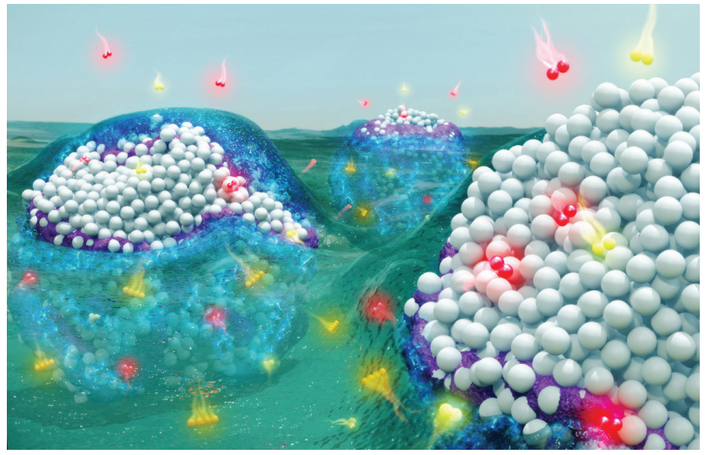
"In experiments with methanol, we observed spontaneous decomposition of the solvent that leaves an organic residue, or scum, on the surface of the nanoparticles," Flaherty said. "In some cases, the scum-like residue clings to the nanoparticles and increases reaction rates and the amount of hydrogen peroxide formed instead of hampering the reaction. This observation made us wonder how it could be helping."

The team found that the residue, or surface redox mediator, includes a key component: hydroxymethyl. It accumulates on the palladium nanoparticles' surface and opens new chemical reaction pathways.

Redox mediators effectively transfer both protons and electrons to reactants, whereas reactions in pure water transfer protons easily, but not electrons. These mediators also alter the nanoparticles' surface in a way that lowers the energy barrier to be overcome for proton and electron transfer.

"Our research suggests that for some situations, chemical manufacturers could form the surface redox mediators by adding small amounts of an additive to pure water instead of pumping thousands of gallons of organic solvents through these reactors," Flaherty said.

The Energy & Biosciences Institute and the National Science Foundation supported this research.



Solvents spontaneously react with metal nanoparticles to form reactive complexes that can improve catalyst performance and reduce the environmental impact of chemical manufacturing. Graphic courtesy of Alex Jerez of the Beckman Institute Imaging Technology Group

Researchers shed light on new enzymatic reaction

Researchers have identified key ingredients for producing high-value chemical compounds in an environmentally friendly fashion: repurposed enzymes, curiosity, and a little bit of light.

A paper published in Nature describes a study led by University of Illinois Steven L. Miller Chair Professor **Huimin Zhao** and postdoctoral researcher **Xiaoqiang Huang**.

Catalysts are substances used to speed up chemical reactions; in living organisms, protein molecules called enzymes catalyze reactions through biocatalysis, which is rapidly emerging as a nuanced, agile way to synthesize valuable compounds.

Biocatalytic reactions can be highly selective, acting on specific substrates to create target products.

Enzymatic reactions are also highly sustainable as they are relatively inexpensive, consume low levels of energy, and do minimal damage to the environment. While chemical catalysts typically require organic solvents, heat, and high pressure to function, biocatalysts work in aqueous solutions, operating at room-temperature and in normal-pressure conditions.

However, the reactions that enzymes can catalyze are limited to those found in nature; this means that scientists often struggle to track down the perfect biocatalyst to meet their need.

The research team developed a solution: a visible-light-induced reaction that uses the enzyme family ene-reductase (ER) as a biocatalyst that can produce high yields of valuable chiral carbonyl compounds.

These "repurposed" enzymatic reactions are not only economically and environmentally efficient, but highly desirable: chiral carbonyl compounds have potential applications in the pharmaceutical industry to be used for drug production.

Octopus-inspired sucker transfers thin, delicate tissue grafts and biosensors

Thin tissue grafts and flexible electronics have a host of applications for wound healing, regenerative medicine, and biosensing. A new device inspired by an octopus's sucker rapidly transfers delicate tissue or electronic sheets to the patient, overcoming a key barrier to clinical application, according to a study in Science Advances.

"For the last few decades, cell or tissue sheets have been increasingly used to treat injured or diseased tissues. A crucial aspect of tissue transplantation surgery, such as corneal tissue transplantation surgery, is surgical gripping and safe transplantation of soft tissues. However, handling these living substances remains a grand challenge because they are fragile and easily crumple when picking them up from the culture media," said study leader **Hyunjoon Kong**, Robert W. Schaefer Professor at the University of Illinois.

Current methods of transferring the sheets involve growing them on a temperature-sensitive soft polymer that, once transferred, shrinks and releases the thin film. However, this process takes 30 to 60 minutes to transfer a single sheet, requires skilled technicians, and runs the risk of tearing or wrinkling.

Seeing the way an octopus or squid can pick up both wet and dry objects of all shapes with small pressure changes in their muscle-powered suction cups gave the researchers an idea.

They designed a manipulator made of a temperature-responsive layer of soft hydrogel attached to an electric heater. To pick up a thin sheet, the researchers gently heat the hydrogel to shrink it, then press it to the sheet and turn off the heat. The hydrogel expands slightly, creating suction with the soft tissue or flexible electronic film so it can be lifted and transferred. Then they gently place the thin film on the target and turn the heater back on, shrinking the hydrogel and releasing the sheet. The entire process takes about 10 seconds.

The National Science Foundation, the National Institutes of Health, the Department of Defense Vision Research Program, and the Jump Applied Research in Community Health through Engineering and Simulation endowment supported this work.

Postdoctoral researcher Byoungsoo Kim and professor Hyunjoon Kong led a team that developed an octopus-inspired device for transferring fragile, thin sheets of tissue or flexible electronics.

Copolymer helps remove pervasive PFAS toxins from the environment

Researchers have demonstrated that they can attract, capture, and destroy PFAS—a group of federally regulated substances found in everything from nonstick coatings to shampoo and nicknamed "the forever chemicals" due to their persistence in the natural environment.

Using a tunable copolymer electrode, engineers from the University of Illinois captured and destroyed perfluoroalkyl and polyfluoroalkyl substances present in water using electrochemical reactions. The proof-of-concept study is the first to show that copolymers can drive electrochemical environmental applications, the researchers said.

The results of the study are published in the journal Advanced Functional Materials.

"Exposure to PFAS has gained intense attention recently due to their widespread occurrence in natural bodies of water, contaminated soil, and drinking water," said University of Illinois assistant professor **Xiao Su**, who led the study in collaboration with civil and environmental engineering professors Yujie Men and Roland Cusick.

PFAS are typically present in low concentrations, and devices or methods designed to remove them must be highly selective toward them over other compounds found in natural waters. PFAS are electrically charged, held together by highly stable bonds, and are water-resistant, making them difficult to destroy using traditional waste-disposal methods.

"We have found a way to tune a copolymer electrode to attract and adsorb—or capture—PFAS from water," Su said. "The process not only removes these dangerous contaminants, but also destroys them simultaneously using electrochemical reactions at the opposite electrode, making the overall system highly energy-efficient."

To evaluate the method, the team used various water samples that included municipal wastewater, all spiked with either a low or moderate concentration of PFAS. Within three hours, they saw a 93% reduction of samples with the low-PFAS concentration and an 82.5% reduction in the moderately contaminated samples.

Postdoctoral researcher **Kwiyong Kim** and graduate student **Paola Baldaguez Medina** are the lead authors of the study. Postdoctoral researchers **Johannes Elbert** and **Emmanuel Kayiwa** also contributed to the work, which was supported by the National Science Foundation, the Illinois Water Resources Center, and Illinois.

ChBE honors graduates with virtual convocation ceremonies

The Department of Chemical and Biomolecular Engineering held virtual winter and spring convocation ceremonies via Zoom to celebrate more than 160 bachelor's, master's, and doctoral graduates.

Department head **Paul Kenis**, the Elio Eliakim Tarika Endowed Chair, presided over each ceremony. In December, remarks were given by the College of Liberal Arts & Sciences associate dean **Matthew Ando** and **Marchoe Dill Northern** (BS '97), a senior vice president and global home care brand franchise leader at Procter & Gamble. Her message to the graduating class: to access your destiny, you must affirm your gifts, build relationships, and impact the world in an area of personal passion.

"It's 2020, certainly not the year, or graduation, you envisioned at the start of your time at U of I," Dill Northern said in her remarks.

She described how the COVID-19 crisis has changed life as we know it, stalled industries, and exposed racial, educational, socioeconomic, urban/rural, and age inequities.

She asked students, "How will this experience shape your narrative?" and invited them to flip their circumstances into opportunities. "Will you take the protests that so many of us participated in over the summer, and the passion that led to a record turn out at the ballot box in the fall, to create a world that we are all counting on you to lead?"

Dill Northern said her time at Illinois was a controlled experiment designed to help her build the skills that have propelled her into the future. She told students to remember that complications are rocket fuel.

"I believe in you, I am inspired by you, and most of all, I am connected to you. This day and for the ages, we are alumni of the greatest proving ground on the planet—the University of Illinois."

For the May 2021 convocation, remarks were given by Ando and **Alex Vogel** (BS '63), former global director of process research & development at Dow AgroSciences.

Ando said that he is profoundly impressed and grateful to all the graduates for navigating the pandemic. "Standing here, and looking back at the way we were, and the way we did in 2019, what have we learned?"

His answer: the time that we get to spend with each other is truly precious.

"You're engineers, and you've learned how to design solutions to problems," Ando said. "As you go forward, and design the post-pandemic world, design it so that you stay in touch with each other and stay in touch with us."

Next, the May graduates heard from Vogel who shared "The Case of the Giant Flask and the Lost Platinum" and "The Case of the Weekend Process Design."

"What are the lessons from this experience?" Vogel said, referencing the first story. "Always consider an out-of-the-box solution, because you might come up with something much better than just the incremental solution."

He told the graduates that the key to a successful career is to love your job, and that motivation is what makes the difference, he added. "I'm talking about motivation to make an impact, something that gets you out of bed in the morning to make a difference—to be excited about discovering something new or solving an important problem."

Vogel ended his remarks with the Jewish word "nachas" that describes the feelings of pride, joy, and reward.

"My years at the University of Illinois' chemical engineering department brought me nachas, and most significantly, I was fortunate to have plenty of it in my career as well," he said. "And my wish to all the graduates, is that you will enjoy a good helping of nachas in your careers as well. Congratulations and good luck."

At the end of each ceremony, Kenis asked the graduates to move their tassels—real or imaginary—to the left. He also reminded them that they have joined an elite rank of 5,000 departmental alumni who have graduated since 1901.

"We hope that we have provided you with the education that will help you succeed, and we wish you the best of luck in your professional and personal lives," Kenis said in his May closing remarks. "In years to come, we hope to see many of you back on campus to share your achievements with us, just as Alex Vogel did today."

Marchoe Dill Northern

Alex Vogel

2021 Undergraduate Research Symposium

The Department of Chemical and Biomolecular Engineering held the 2021 Undergraduate Research Symposium virtually on April 9, 2021. This year, nine undergraduates presented research from eight labs.

"Each year, I am impressed by the challenges that our students are tackling," said department head **Paul Kenis**, the Elio Eliakim Tarika Endowed Chair. "These posters represent far more than an extra set of hands in the lab. They are pursuing their own projects, employing cutting-edge techniques to address research questions head-on, from water remediation to bone repair and beyond."

The poster presentations were judged by **Corey Correnti** (BS '85), former senior vice president of marketing, sales and supply at BP, who is currently a senior advisor for Marakon; **Jim Morris** (BS '81), former chief facilities engineer for ExxonMobil, who is currently assisting with the development of ChBE's professional master's program; and **Tom Tulig** (BS '78), the former vice president of novel processes and new energies technology and the general manager of process development at Shell.

Rachel Park won first prize with her poster, "Metal Oxide Supports for Molybdenum Carbide Nanocatalysts in the Reverse Water Gas Shift Reaction." Park is advised by **Hong Yang**, the Richard C. Alkire Chair in Chemical Engineering.

Maxwell Polanek placed second with his poster, "Incorporating Placental-Derived Membrane Matrix and Soluble Factors in Mineralized Collagen Scaffolds for Improved Bone Repair." Polanek is advised by **Brendan Harley**, Robert W. Schaefer Professor.

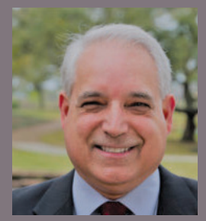
Devin Schinski took third place with his poster, "Polyethylene Encapsulation of Metal-Bound Nanoparticles." Schinski is advised by assistant professor **Damien Guironnet**.

The winning poster presenters were recognized later on at the virtual Undergraduate Scholarship and Awards Ceremony, which also recognized the department's scholarship recipients listed on page 12.

2021 Symposium Judges

Corey Correnti (BS '85) is a senior advisor providing energy sector expertise and strategic support to Marakon, a global corporate strategy firm. Previously, he held several senior leadership roles at BP. His most recent position was senior vice president of marketing, sales and supply for BP's U.S. Downstream business. Correnti started his career in refining engineering with Amoco and later worked in various refining operations management and commercial roles. He also led a global chemical feedstock business before moving into U.S. Supply & Trading operations at BP. His career has included postings in the U.K. and U.S. He also holds an MBA from the University of Chicago.

Jim Morris (BS '81) joined Exxon after graduating from the University of Illinois. Over the years, he held a variety of positions with Exxon and ExxonMobil. He worked on projects throughout the Gulf Coast and around the world, including offshore production operations in Nigeria and a liquified natural gas project in Qatar. As chief facilities engineer for ExxonMobil Upstream, he was responsible for the global application of facilities technologies, career development for engineers, and planning key strategic initiatives. He retired from ExxonMobil in 2019, and he is currently working with Illinois' Department of Chemical and Biomolecular Engineering on the development of a new Master of Engineering program. Check out his alumni profile on pages 18-19.



Tom Tulig (BS '78) spent his entire career working for the Royal Dutch Shell Group of Companies in research and development, project development, technical support, and operations. He began in the Reaction Engineering Department at Shell's Westhollow Technology Center in Houston. Prior to retirement in 2018, he served as the vice president for novel processes and new energies technology and as the general manager of process development in Shell's Projects and Technology organization. Tom has always prioritized university relations, serving as a recruiter and campus visitor for the Shell Oil Foundation and as a member of the University of Illinois Engineering Advisory Committee. He earned a doctorate in chemical engineering from the University of Minnesota.

Would you like to be a judge for one of our student research symposiums? The Graduate Research Symposium will be held on Friday, Oct. 8, 2021, and the next Undergraduate Research Symposium will be held on Friday, April 1, 2022. Please email the department at chbe@illinois.edu if you're interested!

Longtime Phillips 66 support helps students thrive in and out of class

For more than 15 years, Phillips 66 has partnered with the Department of Chemical and Biomolecular Engineering at the University of Illinois to equip students with the support and educational opportunities to prosper in college and beyond.

“We greatly appreciate the continued support of Phillips 66,” said department head **Paul Kenis**, the Elio Eliakim Tarika Endowed Chair. “Their contribution to a variety of programs allows us to deliver on our commitment to our students’ success.”

In 2017, Phillips 66 created a merit-based scholarship program to support high-achieving women and students who identify as Black, Indigenous, and People of Color (BIPOC). They have awarded 15 scholarships so far, including six recipients just this year.

"This scholarship served as a great financial relief for my preparation and relocation to my upcoming co-op, where I'll be able to learn and gain hands-on experiences about practical chemical processes,” said 2021 recipient **Anh Nguyen**, a junior in ChBE. “I really appreciate Phillips 66's generosity in making this scholarship available."

“I am so honored to have been selected as a recipient of the Phillips 66 scholarship,” said **Megan Shamsi**, another 2021 recipient and ChBE sophomore. “This award will help me over the course of my studies while serving as a reminder that I am capable of success in ChBE.”

Phillips 66 is also investing in the department’s cross curricular design, a concept where team-based engineering design projects are threaded through several courses: Principles of Chemical Engineering; Chemical Engineering Thermodynamics; Momentum and Heat Transfer; and Chemical Reaction Engineering.

Through these team-based projects, students learn how to apply fundamental concepts and how to cooperate and delegate to solve problems and create successful designs—even in challenging circumstances—much like they will in industry.

“We can’t underestimate the value of teamwork, leadership, and communication skills that are just as vital as their understanding of chemistry or mathematics to be successful,” said **Uzoma Monye**, a teaching assistant professor who is implementing design projects in several courses in the department.

Students have reported increased confidence in their engineering, design, and teamwork skills.

Unrestricted support from Phillips 66 allows the department to allocate funds to timely needs and forward-thinking projects. Their contribution is kick-starting a new campaign to revamp the department’s undergraduate laboratory facilities and capstone lab-based courses.

Part of the Phillips 66 gift also supports the student chapter of the American Institute of Chemical Engineers (AIChE) at Illinois.

“We are thankful for what Phillips 66 has done for Illinois AIChE,” said **Jonathan Gong**, a ChBE senior currently serving as AIChE president. “Illinois AIChE aims to prepare students for their chemical engineering careers, and the contributions of Phillips 66 have gone a long way toward helping us facilitate that goal.”

2020-2021 Department Scholarship Recipients

Thanks to our generous donors, the Department of Chemical and Biomolecular Engineering was able to award scholarships to another group of outstanding undergraduate students this year. Congratulations to all the winners!

John Martin Ankenbauer Memorial Scholarship
Thomas Sheehan

Franklin A. Boyle Scholarship
Joel Klecka

Burcham and Gumble Family Scholarship
Ethan Miller
Sera Trigo

Corn Family Scholarship
Andrea Mejia

Mary S. and Dr. Howard W. Cox Jr. Scholarship in Chemical Engineering
Jonathan Hartanto

Donald E. Eisele Memorial Award
Jonathan Gong

ExxonMobil Foundation Scholarship
Rachel Park

Robert S. Frye Chemical Engineering Scholarship
Daniel Azmoodeh

Clarence G. Gerhold Memorial Scholarship
William Lyon

Dr. Joseph and Donna Glas Scholarship in Memory of Professor James Westwater
Zachary De Leon

James K. Grant Chemical Engineering Scholarship
Isabel Hughes

Chester W. Hannum Scholarship
Nathan Avalos
Briana Sobecks

Dr. Jerrod A. Henderson Scholarship
Kingsley Okeke

Donald B. Keyes Award in Chemical Engineering
Jacob Milo

John W. Latchum Jr. Scholarship
Joseph Cangialosi

Dr. Ray A. Mentzer Scholarship
Beth Born

Kirk Nass and Michael Gillespie Scholarship
Giorgio Graziano

Marchoe Dill Northern Scholarship
Christina Braker
Jared Buabeng

Raymond M. Pasteris Scholarship
Yazeed Alfawaz

Phillips 66 Scholarship
Sophia Belvedere
Meher Jain
Melissa Manetsch
Anh Nguyen
Sanjna Shah
Megan Shamsi

Worth Huff Rodebush Scholarship
Devin Schinski

Rebekah Schiff-Berger Memorial Scholarship
Kaitlin Wixted

Roger and Ruth Schmitz Scholarship
John Ito

Ronald and Janet Van Mynen Chemical Engineering Scholarship
Nicholas Cys

Alex J. Vogel Scholarship
Siddhartha Peri

Bruno H. Wojcik Scholarship
Arzam Harris

ChBE graduate students join newly expanded Colman Inclusive Leadership Program

The Colman Inclusive Leadership Program (CILP) invites 30 to 40 graduate students for an immersive three-day program focused on providing doctoral research students with skills and knowledge that will support their development as leaders in graduate school and beyond.

The Colman Program began at Cornell University with an endowment from John and Jane Colman and expanded in 2021 with support from the Alfred P. Sloan Foundation to include doctoral students affiliated with its University Centers for Exemplary Mentoring and Sloan Indigenous Graduate Partnership programs across the nation.

Danielle Harrier and **Chris Torres**, two graduate students from the Department of Chemical and Biomolecular Engineering at the Univsersity of Illinois, virtually participated in the program held January 12-14, 2021.

“An Inclusive Leader is an authentic commitment to understand and promote diversity and cultural intelligence while fostering an environment where each individual feels respected, confident, valued, and inspired,” said Harrier, who is advised by assistant professor **Damien Guironnet** and department head **Paul Kenis**, the Elio Eliakim Tarika Endowed Chair.

“Inclusive Leadership is enabling those without a strong voice to contribute as much as those who would typically dominate a discussion—allowing all members to participate equally,” said Torres, who is advised by associate professor **David Flaherty**.

The CILP introduced Harrier and Torres to practical skills, leadership theory, and special topics. The program’s varied format included readings, interactive group activities, case studies, and discussions that explore topics such as emotional intelligence, inclusion and belonging, leadership frameworks, conflict management, culture, and more.

They highly recommend the program to other students. The application opens mid-November with rolling admissions through December 15. Apply online at go.chbe.illinois.edu/ColmanProgram.

Danielle Harrier operating the droplet-based microfluidic device she designed and optimized in the Guironnet Lab. She has recently reported a water-sensitive catalyst encapsulation yielding biodegradable polymer particles dispersed in water.

Chris Torres manages and operates a Vertex-70 FTIR spectroscope in the Flaherty Lab. He couples modern and classic chemical engineering principles to investigate solid-liquid interactions on zeolite materials to inform sustainable catalyst design.

Potts to improve epoxidation reactions through National Science Foundation Fellowship

The National Science Foundation awarded a three-year fellowship to graduate student **David Potts**, who is working with associate professor **David Flaherty**, to reduce the cost and environmental impact of epoxidation reactions that produce epoxides used to manufacture plastics, pharmaceuticals, and more.

“I’m honored to be selected for this fellowship to help develop a better method of epoxide production for the industry and the environment,” Potts said. “Millions of tons of epoxides are produced each year, meaning that even modest improvements could have a huge impact.”

Potts is studying epoxidation reactions in liquid solvent using porous catalysts called zeolites. He wants to find out how catalyst performance is influenced by the solvent’s molecular structure and interactions with reactants, including oxidants that drive this reaction.

“It is really interesting to explore what’s happening on the molecular scale, such as how the environment in these zeolite pores changes during the reaction, and how all of these molecules—both the reactants and the solvents—interact with each other,” Potts said.

David Potts

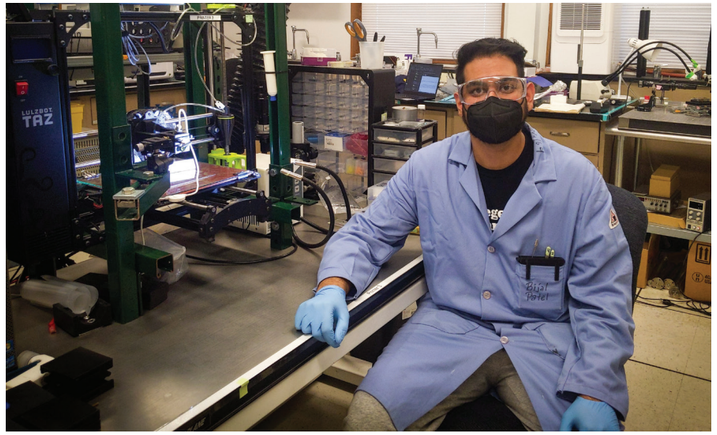
Industrial epoxidation reactions rely on costly organic solvents and oxidants that have a massive carbon footprint and are difficult to discard. Through this fellowship, Potts will explore how to replace a fraction of these organic solvents with water, while maintaining the reaction’s efficiency.

Previously, the Flaherty team has shown that adding a small amount of water can increase this reaction’s performance by several orders of magnitude. Now Potts hopes to uncover how rates change when adding larger amounts of water and why this happens fundamentally in hopes of one day ensuring that epoxides are produced more sustainably.

“We are grateful for this support that not only advances David’s educational opportunities but also helps close the funding gap for basic, long-term research,” Flaherty said. “We are excited to get to work on these questions that have the potential to benefit manufacturers, consumers, and our planet.”

David Potts pipettes acetonitrile, an organic solvent that he uses for epoxidation reactions.

Patel earns NRC postdoctoral fellowship to join NIST



Bijal Patel works with a modified 3D printer that he developed to study processing-property relationships in exotic optical/electronic polymer solutions and melts.

Graduate student **Bijal Patel** never imagined that he would become a postdoctoral researcher when he arrived at the University of Illinois five years ago.

Patel graduated from the University of Texas at Austin and joined the lab of assistant professor **Ying Diao** to investigate a relatively new group of functional polymers, known as bottlebrush block copolymers, that have important optical and electronic properties.

He expected that he would move on to a career in industry, likely working on fabricating computer chips. But as he neared the end of graduate school, he began to think about what he really wanted to work on.

“When you’re an undergraduate, or just starting your Ph.D., you don’t necessarily realize what you value,” Patel said. “But after working for a while, you realize what’s important, and you start to really care about the goals of your research.”

During his tenure at Illinois, Patel gained first-hand experience working with nearby Argonne National Laboratory researchers and witnessed the broad impact that national laboratories have in pursuing applied research and supporting the broader scientific community with access to specialized equipment, resources, and information.

Recently, Patel was awarded a postdoctoral fellowship through the National Research Council Research Associateship Program (RAP) to explore how polymers assemble into complicated nanostructures at the National Institute of Standards and Technology.

“This fellowship is prestigious and highly competitive,” Diao said. “I am delighted to see Bijal Patel apply his background in polymer self-assembly established here at Illinois to advance polymer additive manufacturing and develop state-of-the-art metrology critical to photonics, wearable electronics, transparent solar cells, and beyond.”

Administered through the National Academies of Sciences, Engineering, and Medicine, the RAP promotes excellence in scientific and technological research conducted by the U.S. government by supporting fellows to pursue research opportunities—alongside an advisor—at federal laboratories and affiliated institutions.

Patel will be advised by Dean DeLongchamp, who leads NIST’s Polymers Processing Group that develops measurement methods, data, standards, and science for the processing and manufacturing of materials into functional forms such as thin films, nanostructures, and shaped bulk solids.

“This award helps us develop skilled scientists and engineers into cutting-edge materials measurement experts,” DeLongchamp said. “It also connects the latest university research results and techniques with NIST scientific programs, increasing the impact of our new measurements by creating the potential for Bijal Patel to apply them to the exciting new materials and processing approaches he will bring from the Diao Lab.”

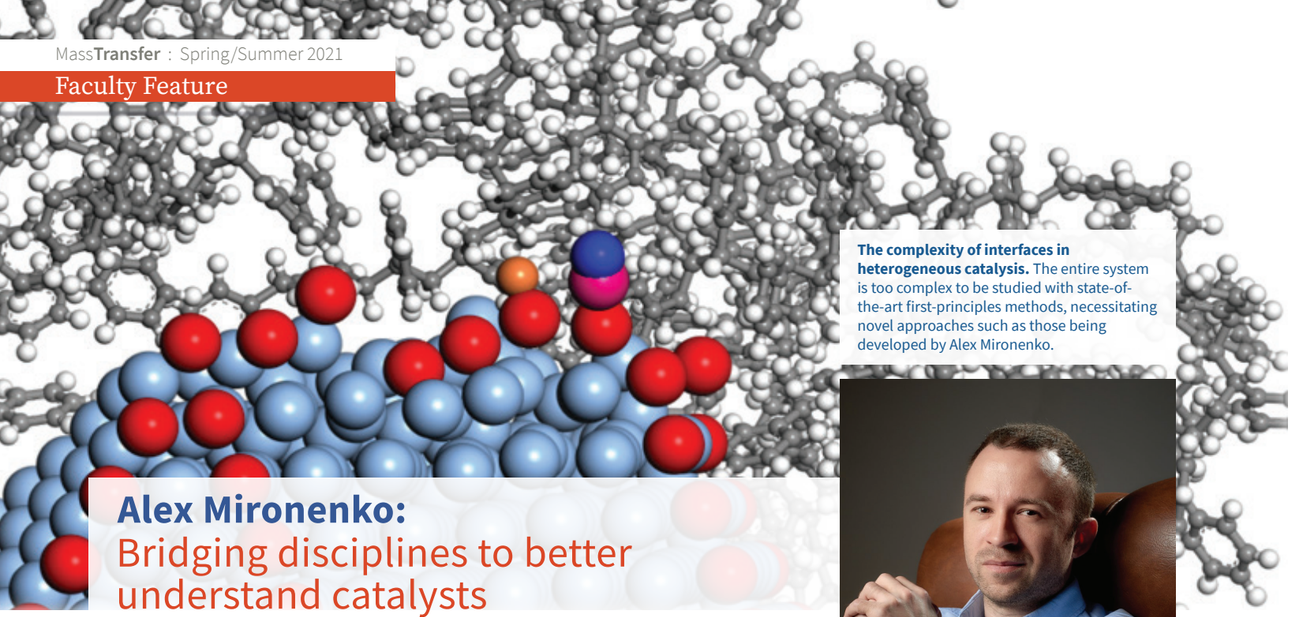
For Patel, this research opportunity at NIST combines the intellectual freedom found in academia with the industry’s focus on delivering products.

“I am interested in advancing research that has meaningful and practical applications,” Patel said. “Developing metrology for the interest of the nation is a motivational mission to me. Polymer self-assembly has huge promise for transitioning towards less wasteful and more energy-efficient manufacturing.”

Beyond polymers, Patel cares about the climate and is interested in science policy. “Growing up in Texas, you can’t escape the fact that we use a lot of energy just to survive—especially when it’s more than 100 degrees outside,” he said. “Climate change is the major scientific problem of my lifetime.”

Addressing this problem is what first drew Patel to research. For his sixth-grade science fair project, he studied the influence of windmill shape on energy generation.

True to this start in science, Patel has returned to understanding the shape of materials as a means to address a scientific question. The scale and application may be very different, but his motivation to advance meaningful research remains the same.



The complexity of interfaces in heterogeneous catalysis. The entire system is too complex to be studied with state-of-the-art first-principles methods, necessitating novel approaches such as those being developed by Alex Mironenko.

Alex Mironenko: Bridging disciplines to better understand catalysts

Much like the molecules he studies, Alex Mironenko is interested in building bonds to accelerate progress—by bridging disciplines and creating collaborations.

Mironenko joined the Department of Chemical and Biomolecular Engineering as an assistant professor in August 2020—but not physically.

In June 2020, he returned to Russia to sort out a visa and was not able to return to the U.S. until April 2021 due to COVID-19-related travel restrictions and consulate closures. For the past eight months, he has been juggling new job responsibilities and the 11-hour time difference.

Mironenko always had an affinity for chemistry. His aptitude for the field was confirmed when he was one of 16 high school students in his home country of Russia who received a 100/100 score on the standardized chemistry test (SAT analog).

A man of many talents and interests, he realized early on that chemical engineering would allow him to pursue many disciplines: chemistry, physics, math, and even software engineering.

Today, his research brings together these fields to determine the best catalysts to speed up critical chemical reactions using a computer as an emerging alternative to traditional trial-and-error experimental approaches.

"To make first-principles predictions in catalysis, material science, or chemistry, we need to compute the energy of molecules as a function of the positions of all atoms within the molecule," Mironenko said. "If you want to predict new catalysts or materials, you first of all need to figure out how to obtain this crucial piece of information."

Currently, predictive modeling of catalysts and chemical reactions requires supercomputers and some patience—computations require weeks or even months to determine the structures and energies of all hypothesized reaction intermediates.

"We are working to make these energy calculations significantly faster, which would allow us to do these calculations on a laptop, or on a supercomputer in a shorter amount of time, or to screen many more catalyst candidates, ultimately facilitating scientific progress," he said.

His career was catalyzed by a Fulbright Fellowship that brought him to the U.S. to earn his master's degree and study bio-oil model compounds under the direction of professor Bala Subramaniam at the University of Kansas. "That research was very different from what I do now," Mironenko said. "I have fond memories of my time in the lab—it was an important step forward."

Mironenko moved on to pursue his doctorate on catalytic biomass conversion with professor Dionisios Vlachos at the University of Delaware, which is where Mironenko first hatched his hypothesis that would lay the foundation for his research efforts today.

Alex Mironenko

A collaboration between Vlachos and University of Pennsylvania professors Raymond Gorte and Christopher Murray on hydrodeoxygenation of a biomass-derived platform chemical hydroxymethylfurfural yielded an unexpected result: the computational data could not explain why one catalyst was more active than another.

"My colleague couldn't explain it with this assumption that the catalyst was a bimetallic alloy," Mironenko said. "I came up with this hypothesis that maybe it's not a metallic alloy, maybe it has a metallic core with a metal oxide shell on the surface."

With this assumption, they built a computational model that turned out to be fully consistent with all the available experimental information.

But they still did not have a way to find out the structure of these metal oxide shells outside of controlled experiments in a vacuum, which do not necessarily translate to experimental conditions. The only two available options were to either carry out extensive quantum mechanical calculations, which were prohibitively expensive, or develop new empirical reactive force field models.

Force fields are empirical "energy calculators" that take the positions of atoms within molecules as an input and then yield energy and the forces of a molecule as an output.

Force fields can calculate the effect of stretching a chemical bond by a little bit, for example, in methane molecules, whereas it is the reactive force fields that can calculate bond breaking and formation, and thus are suitable for screening metal oxide configurations and computing chemical reaction barriers.

However, these reactive force fields require large datasets and extensive parameter tuning. Unfortunately, the fine-tuned parameters developed for a subset of molecules or materials are not transferable to new applications and systems, like his colleagues' metal oxide shells.

Instead of applying this empirical platform in an ad hoc manner, and trying various energy expressions until he came across the one that magically worked, Mironenko's idea was to carry out reactive force field development in the most systematic way possible, beginning with fundamental quantum mechanical principles.

He proposed to simplify the Kohn-Sham equations of the density functional theory to arrive at a reactive force field model that would be free of arbitrary energy expressions with the fewest number of parameters.

It wasn't until Mironenko became a Kadanoff-Rice Postdoctoral Scholar at the University of Chicago that he was able to explore this idea of developing non-empirical force fields—thanks to this fellowship and the creative freedom granted by his advisor, professor Gregory Voth.

Building on two seminal, but long forgotten 1968/1969 articles on localized atomic orbitals, written by a 1977 Physics Nobel Laureate **Philip W. Anderson** (who grew up in Urbana, Illinois, and passed away last year at the age of 96)—Mironenko finally realized his vision for bottom-up computational approaches to construct reactive force fields.

"Unlike methods that are currently available, our method doesn't have any parameters," he said. "It is all physics-based, which is a huge advantage."

This spring, his graduate student **Lanie Leung** replicated his original proof-of-concept results to show that this method works on the simplest chemically bonded structure: a hydrogen molecule.

"It's thrilling to have a second person in the world who can verify the original idea and who can also share the excitement about the method matching much more expensive calculations," he said.

Mironenko's lab is continuing this fundamental research to develop simplified, non-empirical force field simulations. The goal is to apply this method to hydrocarbons, oxygenates, and ultimately, to traditional metal-based catalysts to identify the optimal structure and composition of catalysts for specific reactions that are relevant to renewable energy and chemicals production.

Of course, he also plans to apply this new force field method to finally understand the structure of those metal oxide shells that spurred his original hypothesis.

Mironenko is pursuing other applied research projects related to catalysis by zeolites, metal carbides, and selective carbon-carbon bond formation.

He is collaborating with associate professor **David Flaherty** to develop computational models of catalytic sites inside zeolite pores, filled with a solvent, which would be consistent with high-precision calorimetry and reaction rate measurements—something which has not been done before.

"Accurate atomistic models of a catalytic site and its environment, validated by experiments, provide crucial fundamental insights into catalyst behavior that will guide new experiments, and ultimately, pave a way toward more active, selective, and stable catalysts," Mironenko said.

He is also working with Richard C. Alkire Chair Professor **Hong Yang** to use computational approaches to explain the formation and activity of unique molybdenum carbide nanoclusters that catalyze electrooxidation of organic molecules for fuel cell applications.

Another primary interest of the Mironenko Lab is to bridge quantum mechanics with coarse-grained molecular dynamics.

Quantum mechanics is too computationally expensive to be used to describe the entire surface of a catalyst and model all the atoms in the system. Instead, Mironenko is working toward describing one part of the surface using quantum mechanics and then filling in the rest of the puzzle with a simplified version using the method of bottom-up coarse-graining.

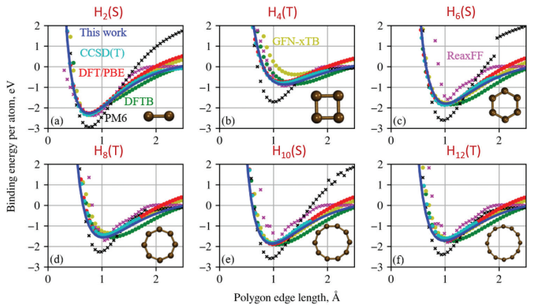
"Effectively, we replace groups of atoms with fewer coarse-grained beads," Mironenko said. "With fewer particles, we can run the model more efficiently and in a shorter amount of time."

Mironenko is not intimidated by quantum mechanics, coarse-grained molecular dynamics, or force fields. Instead, he says, his greatest challenge is tackling teaching for the first time.

Luckily, he has his wife **Olga Mironenko**, a teaching assistant professor in the Department of Electrical and Computer Engineering, to show him the ropes. They are thrilled to finally be reunited in Champaign-Urbana after spending so much of the past year apart.

This fall, he taught Chemical Engineering Thermodynamics for the first time from the same desk in his parent's house in Russia where he studied for his own undergraduate chemical engineering exams at Omsk F.M. Dostoevsky State University, where he completed his bachelor's degree.

"It's a bit surreal," he said. "The fact that I was able to converge the activities that I have been interested in for so long—like chemistry, math, physics, and programming—into my research program is quite fascinating. I feel that I'm doing exactly what I'm supposed to do."



Proof of concept for the novel reactive force field: Binding energy curves of simplest model molecules show that energy predictions made by the non-empirical reactive force field, developed by Alex Mironenko (solid blue lines), agree with expensive "gold-standard" CCSD(T) calculations (cyan circles). The new method's accuracy exceeds that of semiempirical methods (also shown).

Jim Morris:
A leader helping develop leaders in engineering

Jim Morris (BS '81) grew up on a small farm in Maple Park, Illinois. He learned early on that everyone is just trying to do the best they can, and if you're in a position to help—you do.

"My dad would tell me that if the neighbor was sick, and it was time to plant or harvest, you did it no questions asked," he said.

It is these fundamental values of hard work, mutual respect, and giving back to others that has carried Morris far beyond his humble roots.

He knew that he wanted to address problems with global and societal impact. The oil embargo and energy shortages "added intrigue" to starting a career at Exxon after he graduated from the University of Illinois in 1981.

He married his high school sweetheart, Karen, and moved to Houston, Texas, to join Exxon's research and engineering team. "That's where the adventure really got started," he said.

His career at Exxon, and later at ExxonMobil, would span four decades and multiple continents.

In Nigeria, he served as the engineering manager for an offshore production operation, where he helped mentor Nigerian engineers who are now running the show.

"My time in Nigeria was one of the most rewarding assignments that I had," he said. "I encourage people to take international assignments to gain a different perspective about the world. You get the chance to develop some really close friendships and work on some pretty challenging problems."

He also served as the technical manager of a large liquified natural gas project in Qatar. This job had many unique responsibilities, including serving as the technical expert to the finance committee that secured funding from international lenders for the multi-billion dollar project. There, he had to adapt to different protocols, hierarchies, and expectations. He found a lot of business is not conducted in meetings but over a cup of coffee.

"It was all about relationship building—and you better build them before you need them," he said. "If you're already in a crisis, or if you're in a disagreement with someone, that's not the time to start. The better versed you are at establishing mutual respect and trust, the more rewarding your career will be."

Jim Morris with the Qatar company CEO at the startup celebration of the liquified natural gas plant in 2009.

Pictured far left: Jim Morris has returned to his roots in retirement—here he is at his country property in Texas.

Pictured left: Exxon's engineering team in 1994 at an Exxon plant in Alabama. Jim Morris (second from the right) was the process engineer during the design and operating phases of the project.

Sure, there were cultural differences, but Morris was reminded of a lesson he learned back on the farm in Maple Park: everyone is just trying to do the best they can. At the core, we're all the same.

Eventually, he returned to Houston to become the chief facilities engineer for ExxonMobil Upstream, the pinnacle of his career from a technical standpoint.

"It was a strategic position," he said. "You're not as involved in the day-to-day operations, instead you're looking forward at the direction of the company—what's next, where's the industry going."

He stewarded technology for the production facilities for both offshore and onshore operations, but he also stewarded the careers of engineers. "I developed a passion for leadership and helping develop engineers became really important to me," he said.

Morris retired in 2019, and just celebrated his 40th wedding anniversary with Karen back in Texas, where their adventure began. They decided to return to their roots and moved to the country about 80 miles from Houston, where they enjoy gardening and the peace and quiet of their hilltop property. They are looking forward to resuming their tour of all the major league baseball stadiums; eighteen down and twelve to go!

As he reflects back on his career, there are a lot of lessons that he would like to pass on to the next generation of engineering professionals. "I always tell younger folks there's a lot of things that I wish I had known 40 years ago," he said.

True to his roots, if you're in a position to help—you do.

Today, Morris is continuing to foster engineers through the development of a new professional master's program in the Department of Chemical and Biomolecular Engineering. Due to the pandemic, he hasn't been able to visit Champaign-Urbana to discuss plans over a cup of coffee—yet.

This program is the culmination of what he's learned it takes to blossom, no matter where you're planted.

He says he graduated from Illinois with all the technical skills that he needed to be successful, but soon discovered that he had a lot to learn about leadership and business acumen. Sometimes, he learned those lessons the hard way.

"I needed an understanding of the business: how the company makes money, what's important to the company, how decisions are made, how do you identify value—those were all things that I had to learn on the fly," he said.

Jim and Karen Morris are checking out every major league baseball stadium in the country. Here they are at one of their stadium stops in Cleveland.

It is this understanding that differentiates engineers over the course of their careers, he said.

"I've seen people solve some really fascinating technical problems that no one cared about," he said. "It has to have some value to an organization, otherwise it's a problem that's not worth solving. Some people have a really hard time grasping the concept that there's no market for what they're selling."

To Morris, a career is more the development of skills than the building of a resume. These days, there's no correct sequence of jobs to attain a certain position.

"That may have been true 40 years ago, but it's not true today—the world changes way too fast," he said. "Instead, think about what are the skills that I can learn to position me to work with a problem, product, or company that doesn't even exist today."

In other words, engineers need to build their "skill portfolios" that comprise the technical, leadership, and business skills required to be successful. If you think of these three skill sets as overlapping circles, the area where the three intersect represents high-value opportunities.

"In the new master's program, we hope to teach engineers that integrating those skills allows them to identify and execute opportunities that deliver a lot of value, both economically and to society," Morris said. "There's a lot of really intriguing and interesting problems to solve today, but it's going to take a combination of those skills—and no problem ever gets solved on your own."

Most problems are too complicated and things change too quickly to accomplish anything on your own, he said. Big problems get solved by multidisciplinary teams with people from different cultures. He would know.

Thanks to this new program, countless engineers will be better prepared to address problems with global and societal impact—just like he did.

Kenneth Jaconetty covers up "Hall" on the Engineering Hall sign; the photo was staged by his friend and fellow Illinois graduate Scott Reed.

Kenneth Jaconetty:
An investment in the system

Kenneth Jaconetty (BS '82) was drawn to the high reputation and low in-state tuition at the University of Illinois. A first-generation college student, Jaconetty turned to his guidance counselor Randy Rayborn to help choose his major: chemical engineering.

"You'll always get a job," Rayborn said.

Four and half years later, in 1982, Jaconetty graduated from the department in the midst of a massive economic recession. The petrochemical industry—like most industries—wasn't hiring.

Jaconetty briefly considered graduate school until longtime chemical and biomolecular engineering professor Thomas Hanratty asked him, "Do you think it would be fun?"

Hanratty's advice: If you don't think you'll enjoy it, don't do it.

Jaconetty moved back home to the Chicago suburbs and started sending out his resume. It would take him almost one year to get the response that his high school counselor promised: the U.S. Patent and Trademark Office offered him a position as a patent examiner—sight unseen.

His new degree, apparently, spoke for itself. The USPTO was hiring recent graduates in scientific fields to speed up the patent application review process.

Kenneth Jaconetty

There, Jaconetty had the opportunity to work on the latest technology that incorporated some elements of chemistry and engineering: cassette tapes.

But reviewing patents wasn't what he wanted to do forever. **If you don't think you'll enjoy it, don't do it.**

"Examining patent applications was my entrée to becoming a patent attorney," Jaconetty said. "The U.S. Patent Office was very generous with giving financial support for patent examiners who wanted to go to law school."

It was an investment in their future whether employees stayed or moved on to file better patents in private practice, Jaconetty said. "The system works best when you've got good attorneys who know what they're doing and know how the Patent Office works."

Jaconetty soon moved on to clerk for a law firm that would pay for him to pursue his law degree in an evening program. He graduated debt-free from George Washington University (GW) with his Juris Doctor.

Today he is helping students graduate with less debt through two new endowments at his alma maters, Illinois and GW.

Much like the USPTO's investment in higher education to create a better patent system, Jaconetty is investing in higher education to combat institutional racism and create a more inclusive system.

"The Black Lives Matter movement reminds us that society works best when people from diverse backgrounds are empowered to lead and to contribute to it," Jaconetty said. "This is one small way that I could help address some long-standing issues in this country."

In 2020, he committed $2.25 million through estate-planning to establish the Kenneth E. Jaconetty Scholarship Fund that specifically supports students who identify as BIPOC, which stands for Black, Indigenous, and People of Color. The income of this endowment could cover the tuition of five students each year.

"Being able to provide our chemical engineering education to a diverse student body is crucial for our state, nation, and industry," said department head Paul Kenis, the Elio Eliakim Tarika Endowed Chair. "Endowments like the Jaconetty Scholarship Fund help us achieve this goal by supporting BIPOC students who might not otherwise be able to attend Illinois."

Jaconetty also made a planned gift of $2 million to create another endowed scholarship that provides need-based funding for second- and third-year GW Law students who are active members of the Black Law Students Association or enrolled members of a Native American tribe with an interest in intellectual property law.

2020 was a confluence of events that prompted him to make these gifts. The pandemic was a stark reminder that he was guilty of not having a will. A shoemaker's children wear no shoes.

"It's similar for lawyers, and I certainly was living up to the reputation," Jaconetty said. "You don't want to leave your descendants in a bind—that's the worst. I knew I needed to do it."

When he began to consider his options, the social justice movement and murder of George Floyd helped him realize how he wanted to allocate his wealth, but still, there were a lot of worthy charities to consider. Jaconetty found himself at a loss.

A trusted friend (whom he met at Illinois) asked him what enabled him to achieve the financial success to make such a gift? "Clearly it was my two degrees," he said.

To Jaconetty, creating a will is like any big undertaking that you've never done before—in the beginning, it is intimidating. He hired a good estate attorney (of course) and worked with the University of Illinois Foundation, which organized the paperwork and streamlined the process for him.

"When you know how much money you need to make it to the end of your life, and where it's going to come from, you see a lot of latitude on what you can give away even now," Jaconetty said. "It's a huge relief—it's like another degree of freedom to carry out your charitable intentions."

The immediate payoff for Jaconetty was unexpected: really inspiring conversations.

> "Being able to provide our chemical engineering education to a diverse student body is crucial for our state, nation, and industry. Endowments like the Jaconetty Scholarship Fund help us achieve this goal by supporting BIPOC students who might not otherwise be able to attend Illinois."
>
> **Paul Kenis**, Department Head

He's met with department heads, deans, and even the president of GW—all of whom have reinforced the real need for endowments like his. His advice to others is don't wait to give because it's actually a pretty fun, not to mention rewarding, experience.

But for Jaconetty giving back extends beyond finances. He says people "who have lived life and learned a thing or two" should become mentors and give their time and wisdom to help guide the next generation. He has been a volunteer with the Big Brothers Big Sisters program.

"One of the best resources young people can have is someone to talk to," he said.

In a way, Jaconetty's endowment originated from conversations with his own mentors, including his guidance counselor Randy Rayborn and ChBE professor Thomas Hanratty.

If you don't think you'll enjoy it, don't do it.

Now generations of students will benefit from his generosity, a selfless act of giving that Jaconetty has discovered is something he truly enjoys.

Kenneth Jaconetty (right) works on a project in the Roger Adams Laboratory with classmate and friend Joe Horn (left).

ChBE Alumni Awards

The Department of Chemical and Biomolecular Engineering Alumni Awards recognize outstanding graduates for their professional achievements and contributions to the department and society. The program began in 2019, but was postponed in 2020 due to the pandemic. We are excited to once again recognize the accomplishments of our alumni in 2021.

Distinguished Alumni Achievement Award
This award honors ChBE graduates for their professional/technical achievements, dedication and advocacy for the department, or service/contributions to society.

Young Alumni Achievement Award
This award honors the same qualities and achievements listed above but recognizes alumni who graduated within the previous 15 years.

Nominations for these awards are solicited annually at go.chbe.illinois.edu/AlumniAwards. The deadline to submit a nomination is **July 1, 2021**. The 2021 Alumni Awards will be presented at the Fall Awards Ceremony on **October 8, 2021**.

For more information, please contact the department at chbe@illinois.edu.

Braden Shain
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Giving to Chemical and Biomolecular Engineering

Alumni and friends play a vital role in the success of the Department of Chemical and Biomolecular Engineering at the University of Illinois.

Your investment supports our students with fellowships and scholarships, it supports world-renowned faculty and their innovative research and teaching, and it funds essential upgrades to laboratories, classrooms, and technologies.

You can make a gift online, by phone, or by using the enclosed envelope in this magazine. In addition to outright gifts, you can support the department as part of your overall financial, tax, and estate planning with deferred gifts such as bequests, charitable trusts and annuities, pooled income funds, retained life estates, retirement accounts, and life insurance.

We will work with you to arrange options that are most suitable to you. If you are interested in learning more about these or other gift options, please contact our major gift officer Braden Shain.

P.S. If you take the standard deduction on your taxes, the Consolidated Appropriations Act allows for an adjustment up to $600 in cash gifts to qualified charities, effectively raising your standard deduction by the amount of your gift. Visit https://go.illinois.edu/CCAinfo for more information.

Class Notes

Henderson earns national educational leadership award

University of Houston professor **Jerrod Henderson** (MS '07, PhD '10) earned the Black Engineer of the Year (BEYA) Educational Leadership – College-Level Promotion of Education Award for his work to provide unique learning experiences for students, building upon efforts he began during his time at the University of Illinois.

The award is presented by the Career Communications Group's U.S. Black Engineer and Information Technology magazine and the Council of Engineering Deans of the Historically Black Colleges and Universities. Henderson was notified of the honor in early December 2020.

"My immediate reaction was an overwhelming sense of joy, appreciation, and gratitude," he said. "It's nice to be recognized for simply doing what you love doing—teaching, mentoring, and providing leadership, academic, and engagement opportunities for students. This recognition is full circle for me. My first time attending a BEYA conference was as a sixth grade student in the MENTOR Program, founded by Mr. Nathaniel Vause in Kinston, North Carolina, now here I am earning a BEYA award."

In 2016, Henderson joined UH and became the director of the Program for Mastery in Engineering Studies (PROMES) in 2017. He is also an instructional associate professor in the William A. Brookshire Department of Chemical and Biomolecular Engineering within the Cullen College of Engineering.

"I am a part of a team that is planning to develop an Engineering Education Department at UH, which is my research area, and I'm excited that we have administrative support to make this happen," he said.

According to the magazine's editor, "Dr. Henderson's achievements in STEM stood out among the hundreds of nominations that were evaluated by the BEYA Selection Panel."

Henderson co-founded the St. Elmo Brady STEM Academy that works with elementary students from backgrounds that are underrepresented in STEM to show them their promise to enter these fields. The program was launched at Illinois when Henderson was a lecturer in the Department of Chemical and Biomolecular Engineering; ChBE has recently started a new campaign to help fund the continuation of the academy.

Henderson has brought the St. Elmo Brady program to three schools in Houston, in addition to many other efforts to encourage and support students to pursue engineering careers.

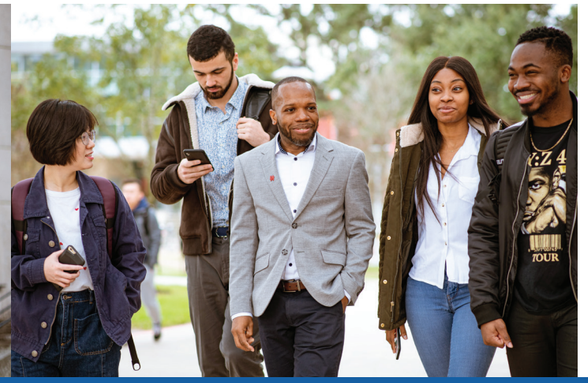
"We've been able to provide paid opportunities for engineering students to conduct engineering education research," he said. "I'm proud of being the director of the Program for Mastery in Engineering Studies, our amazing PROMES Scholars, and the things we've been able to accomplish in just three years."

He is working on growing the PROMES program from 400 to 600 scholars in the next year, as well as branching into new programs.

"I'm excited that this is recognized on our campus as a viable area of scholarship," he said. "We've also developed a support program for PROMES Scholars who are interested in graduate school. We look forward to sending at least five PROMES Scholars per year over the next five years to graduate school."

A special thanks to Jerrod Henderson for volunteering to be a panelist on April 7, 2021, at the LAS Alumni Career Panels: Science and Medicine Careers, where alumni shared how they navigated the twists and turns that come with building a career after graduation with current undergraduate students. You can check out the recording at go.chbe.illinois.edu/AlumniCareerPanel21.

Jerrod Henderson with his students at UH.



Call for submissions!

We look forward to featuring your accomplishments in our next issue of Mass Transfer. Please let us know what you've been up to at chbe@illinois.edu.

Celebrating the life of Krista Roth

Krista Roth, a senior in the Department of Chemical and Biomolecular Engineering, had a bright and optimistic outlook, a witty and dry sense of humor, and a devotion to helping others and the planet that she called home for 21 years.

For Roth, a bachelor's degree in chemical engineering was her ticket to make a positive impact.

"My passions for math, physics, problem-solving, and chemistry led me to chemical engineering," she wrote on her personal website. "I would like to combine my education and passions to help others and make the world a better place."

Roth planned to graduate in May 2021. Her parents, Tom and Jenni Roth, treated her to an early graduation present, a vacation in Costa Rica to visit her "adopted" Costa Rican brother Felix Fonseca. Tragically, she died on the Atlantic coast of Costa Rica on January 20, 2021.

"Incredibly full, yet incredibly short, describes the life of Kristina Grace Roth, of El Paso, Illinois," reads the first line of her obituary.

She was a 4-year member of the Marching Illini, where she served as a trumpet section leader. She was also extremely creative. She began working part-time at age nine for her parents' photography and videography business, Heirloom. Her high school lab safety video—co-created with her friend Sydney Butikofer, who also majored in chemical engineering at the University of Illinois—is legendary.

“I am incredibly fortunate to have gone into chemical engineering with Krista,” Butikofer said. “As a student, she was very clearly organized, responsible, and hardworking—I would often rely on her to remind me of deadlines and exams.”

Butikofer said she was lucky to experience Roth’s immense curiosity and passion for learning about science, which was contagious.

“Krista loved learning and talking about chemistry, outer space, and physics,” Butikofer said. “I already miss these discussions dearly—I wish I could ask her if she liked learning about process controls or electrochemistry. If anything, I want to carry her passion for learning with me as I finish out our senior year and into my future career."

ChBE classmate Jonathan Gong described Roth as unbelievably welcoming and kind. He said she had an enormous impact on his time at Illinois, where they shared many friends, classes, and registered student organizations; both served on the officer board of the the American Institute of Chemical Engineers (AIChE).

“The fundraisers and philanthropy programs that Krista organized for AIChE were well put together and allowed us to give back to our community,” Gong said. “Krista’s legacy spans far and wide; although her loss is a terrible tragedy, she has positively impacted many lives, including my own. I am honored to have known and worked with her.”

Roth applied her passion, creativity, and background in chemical engineering to positively impact lives by addressing energy and water crises.

Krista Roth was a member of the American Institute of Chemical Engineers (AIChE) and served as the chair of the philanthropy committee, where she created a water filtration demo to teach over 150 students about chemical engineering and the global water crisis.

Krista Roth was a member of the Marching Illini, where she served as a trumpet section leader, she said being a part of this 375-person team was one of the most valuable parts of her college experience.

In the summer of 2020, she was an engineering intern at Water Mission, a Christian engineering non-profit that builds safe water, sanitation, and hygiene solutions in developing countries and disaster areas.

She also worked as an undergraduate researcher in the lab of assistant professor **Xiao Su** on electrochemical separation to create and test molecularly selective electrodes to remove toxic contaminants and recover valuable catalysts and other materials from water.

Her passion for providing safe water sources was inspired by Can Do Kids International (CDK), a Christian non-profit co-founded by her mother Jenni Roth that works in partnership with rural communities and their schools in Kenya to provide water systems that harvest, store, and dispense large quantities of water. Upon graduation, she planned to work with CDK on water projects in Africa before starting her first engineering job.

The department was honored to award Roth's bachelor's degree posthumously; she graduated with a departmental distinction for her noteworthy GPA. Roth was recognized along with her chemical engineering friends and peers during our May 2021 convocation ceremony.

Her friends in ChBE and the Marching Illini held a virtual service celebrating Roth’s incredibly full life on March 9, 2021, followed by an in-person candlelight vigil on what would have been her golden birthday, April 22, 2021, which was notably Earth Day.

"Krista Roth began her undergraduate studies in 2017 and proved her merits to be among our best students," said department head Paul Kenis, the Elio Eliakim Tarika Endowed Chair. "She illustrates how ChBE students go above and beyond. We can all derive inspiration from her efforts to actively combat global water security issues, a noble pursuit that continues on in her memory."

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So far, more than $171,000 has been raised through CDK in celebration of Krista’s life, honoring her legacy and efforts to supply others with safe water. Already, eight systems are constructed or under construction in Kenya, and construction will begin on six more systems this summer. These funds will also support long-term ministry projects in the Ukraine and Philippines.

Friends and family came together on Roth’s Earth Day golden birthday to support her childhood dream to save the rainforest. “Krista’s Rainforest Sanctuary” has been established in the Monteverde Cloud Forest in Costa Rica. This project will reforest several acres of land and serve as a conservation, research, and education site. A Facebook page will be created to show the progress of the project; the link will be posted on Krista’s webpage (link below) in the future. The project kicked off in May with ground preparation, and in June, Costa Rican friends and volunteers will plant several hundred trees.

Contributions in celebration of Roth's life can be made at www.candokidsinternational.org/krista.

Alumnus Jack Welch, former chairman & CEO of GE, dies at 84

John Francis "Jack" Welch Jr. (MS '59, PhD '61), the former CEO and chairman of General Electric Co., died on March 1, 2020.

Welch went to work as a chemical engineer at GE immediately after completing his doctorate at the University of Illinois. He started in its plastics division and quickly gained prominence in the company, becoming a vice president in 1972 and vice chairman and executive officer in 1979. He was named chairman and CEO in 1981 at the age of 45. He remained at the helm for the next 20 years.

In 1983, he was elected to the National Academy of Engineering for his "leadership in developing engineered plastics and for increasing national recognition of the importance of technology and innovation."

Welch oversaw two decades of prosperity at GE and was lauded for his aggressive approach that slashed tens of thousands of jobs, bought and sold a variety of businesses, and moved the company into financial services and consulting. According to CNBC, the company's market value rose from $12 billion to $410 billion during his tenure.

After retiring from GE in 2001, Welch worked as a consultant and speaker, and also taught at the Massachusetts Institute of Technology's Sloan School of Management.

Welch and fellow students at Illinois were great supporters of their former adviser, James Westwater, and together helped establish the James W. Westwater Professorship in Chemical Engineering in 1986.

Welch is survived by four children, Katherine Welch, John Welch III, Anne Welch and Mark Welch; two former wives, Carolyn Carson and Jane Beasley Welch; and his third wife, the former Suzy Wetlaufer, whom he married in 2004.

Heat Transfer Research Group at the University of Illinois, circa 1958. Top row: E. Ray Hosler, Jim E. Benjamin, Professor James Westwater, L. Jack Thomas, R.F. Gaertner. Bottom: Don E. Westerheide, John "Jack" F. Welch, A. Orell, Tom Dunskus. Photo courtesy Ray Hosler.

ChBE alumnus and MRI pioneer Walt Robb dies

Walt Robb (MS '49, PhD '51), a retired executive with GE who led the company's medical technology business, passed away of COVID-19 on March 23, 2020, in Schenectady, New York, at the age of 92.

At the University of Illinois, Robb studied under professor Harry Drickamer and earned his doctorate in three years in 1951. He joined GE after graduating and had a long career with the company.

As the CT scanning revolution got underway and MRI technology took off, Robb oversaw GE's struggling medical imaging business, expanding it from a break-even, $100 million business to a highly profitable and growing enterprise.

He recruited a fellow alumnus, the late Jack Welch, and the two would work together for decades.

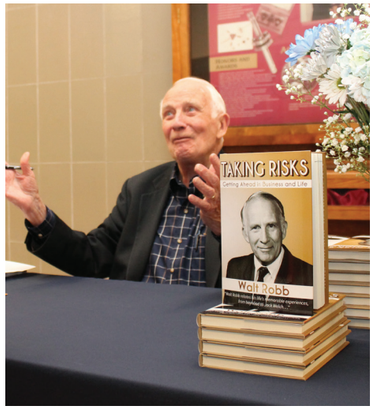
In 1993, President Bill Clinton presented Robb with a National Medal of Technology and Innovation for his foresight and leadership in the MRI and CT imaging industry.

Robb's last visit to the Illinois campus was in 2015, when he met with undergraduate and graduate students, faculty and staff, and toured labs. The department hosted a book signing and reception for Robb, who wrote about his life and career in the book, "Taking Risks: Getting Ahead in Business and Life."

During that visit, Robb spoke about how Drickamer constantly challenged him and other students. He recalled working 72 hours a week on his thesis and doing whatever it took to gather the data, including sleeping on a cot in the lab.

Robb retired from GE in 1993 and established Vantage Management. He served on the boards of several companies and also owned two professional sports teams in New York. Robb and his wife, Anne, were great supporters of higher education institutions, including Illinois and Penn State, his undergraduate alma mater. He also established a camp in New York for children with life-threatening illnesses.

Robb is a recipient of the University of Illinois Alumni Achievement Award and the President's Medallion. He is also a recipient of a 2019 Department of Chemical and Biomolecular Engineering Distinguished Alumni Award.



Alumnus Walt Robb signs copies of his book for students in Roger Adams Laboratory in 2015.

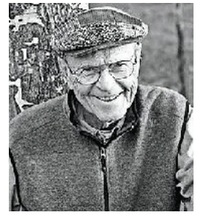
In Memoriam

James "Jim" Bernhard Anderson (MS '58) passed away on January 14, 2021, at the age of 85. Anderson earned a bachelor's degree from Pennsylvania State University, a master's degree from the University of Illinois, and a Master of Arts and doctorate from Princeton University. He served as an engineer with Shell Chemical Company, a professor of chemical engineering at Princeton University, and a professor of engineering at Yale University. Anderson joined the faculty at Penn State in 1974 as a professor of chemistry and physics, and was named an Evan Pugh Professor in 1995. He retired in 2014 after 40 years. Anderson pioneered the development of the quantum Monte Carlo method of simulating the Schrödinger equation. He also specialized in the molecular dynamics of reactive collisions. Anderson was a fellow of the American Association for the Advancement of Science, a fellow of the American Physical Society, a recipient of the Alexander von Humboldt Foundation Senior Research Award, and a recipient of the Penn State Faculty Scholar Medal and the Evan Pugh Medal. His creativity made him both a successful academic and inspiring mentor and teacher. Outside of the lab, Anderson enjoyed traveling with his family, including his wife Nancy, and outdoor activities like swimming, biking, squash, and scuba diving.

Eugene J. Antas (BS '65) passed away peacefully May 4, 2020, at the age of 78. Eugene was a resident of Elmhurst, Illinois, for over 20 years, and previously lived in Oglesby and Park Forest, Illinois. He was a proud graduate of the University of Illinois and a devoted fan of Illini sports (especially football). He retired from Amoco Oil Corporation (later BP) where he was a chemical engineer for over 35 years. He was a devoted parishioner of Visitation Parish Catholic Church.

Norbert Barr (BS '52) passed away peacefully on the morning of September 10, 2020. He graduated from the University of Illinois, where he was a member of the Delta Phi Fraternity. After graduating, he began his career of 38 years with Shell Chemical Company, where he retired in 1990. He served our country in both the U.S. Army and Navy during the Korean War. Norb played a Kawai baby grand piano and made beautiful music with his wife Joan, who played a Lowrey organ. They traveled extensively throughout the country in their RV.

Philip "Phil" Beelendorf (BS '91) of Keokuk, Iowa, died on November 7, 2020, at the age of 60. He was born in Sterling, Illinois. Phil had been employed by Roquette in Keokuk since 2003. He was a member of the Keokuk Nazarene Church. He loved the outdoors and especially enjoyed fishing and pheasant and quail hunting. Phil liked working out at the gym and playing softball with the church league.



John "Jack" Charles Besperka (BS '48) died on December 18, 2020, at the age 94. He graduated high school in 1944 and then started college, but he was drafted into military service in support of World War II. He entered the U.S. Navy as an Electronics Technicians Mate, Third Class, and was one of the first to operate the then-Top Secret RADAR and SONAR technology. He was honorably discharged on June 24, 1946, one year following Germany's surrender, having received the Victory Medal. After the war, Jack returned to college and graduated from the University of Illinois in 1948. He worked at DuPont in Delaware, where he met his wife Doris. He remained with DuPont for his entire career, working his way up the ranks to become general director of manufacturing and oversaw the construction and operation of polymer plants all over the world. Jack was an avid golfer and wood turner. He enjoyed traveling the world and loved America's National Parks. He leaves behind a legacy of financial responsibility, personal accountability, artistry in his woodworking, and dedication to his family.

Dr. Juh Wah Chen (MS '57, PhD '59) of Murphysboro, Illinois, died peacefully at his home on February 6, 2021, at the age of 92. Born in Shanghai, China, Dr. Chen earned his bachelor's degree in chemical engineering from Taiwan College of Engineering in 1953. Soon after, he came to the U.S. to continue his education at the University of Illinois. Following graduation, he accepted a position at Bucknell University as an assistant professor. Dr. Chen held varying positions over his 34-year-long tenure at Southern Illinois University. After joining the faculty as an associate professor, he rose to the rank of full professor, before becoming the chair of the Department of Thermal and Environmental Engineering in 1972. He served as the associate dean of the College of Engineering, and later in 1989, became the dean of the College of Engineering until his retirement in 1999. Dr. Chen was a dedicated and skilled duplicate bridge player, attaining the rank of Life Master. He and his wife, Han Lin, competed in bridge tournaments. He was a member of the Lions Club and enjoyed flipping pancakes on Pancake Day.

Gerald Cook (MS '67, PhD '70) passed away on July 17, 2020, at the age of 78 after a long battle with cancer. Gerald attended St. Patrick's grade school, Gonzaga Prep, and Gonzaga University where he received a bachelor's degree in chemical engineering before earning a doctorate from the University of Illinois. In his final year at Illinois, he married Patricia Ballway of Syracuse, New York, his smartest move ever. Gerald

joined the Chevron Corporation in 1969 at Chevron Oilfield Research in La Habra, California, and spent 10 years in research and development optimizing oil recovery. He spent eight years in London working on various aspects of North Sea Oil. In 1987, Gerald took a position in San Ramon, California, working in various financial aspects of Chevron Overseas Petroleum. In 1991, Gerald returned to Chevron Oilfield Research at La Habra, California, and worked mainly as a petroleum engineering consultant to Chevron operating companies around the world. In 2000, he retired and began a new life of golf, bridge, travel, and many other activities.

Edmund "Ed" Dale Heerdt (BS '65) passed away peacefully on February 15, 2021, at the age of 79. Ed graduated from Arthur High School as valedictorian in 1960. Ed attended the University of Illinois and earned his doctorate in chemical engineering from the University of Minnesota in 1969. While attending graduate school, he met his future wife Sally when she cleaned his teeth during a dental appointment. Ed refused to leave the dental chair until she agreed to go out with him. They moved to Alameda, California, when he accepted a position with Shell Development and Shell Oil Companies. Ed remained with Shell for 30 years in research management (including a relocation to Houston, Texas, in 1973) and retired as research director in 1998. Upon retirement, Ed and Sally returned to their midwestern roots and settled in Bloomington, Illinois. Ed was a strong advocate of education and established a ChBE scholarship. Ed also enjoyed traveling, reading, playing Sudoku, and watching basketball and football (especially his beloved Illini and the Green Bay Packers).

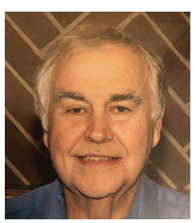
Robert Leo Hughes (BS '44) died on November 22, 2019, at the age of 95. He began active duty in the U.S. Navy in the V-12 program at the University of Illinois as a commissioned ensign (1945). Bob served on USS Eldridge (DE-173) in the Pacific in

World War II, and he was recalled to serve as lieutenant senior grade for the U.S. Navy Reserves in the Korean War on the USS Hanna (DE-449). In 1952, Bob was employed by Spencer Chemical Company (later acquired by Gulf Oil Corporation) as a manager in the technical department where he oversaw product development of polyethylene and nylon in plastics applications, such as packaging films and plastic milk bottles. He was active in Boy Scouts of America and enjoyed hiking, jogging, and playing golf; he exercised daily well into his 90s. Bob will be remembered for his integrity, his interest in his children's careers, and a great smile.

Robert L. "Hutch" Hutchison (BS '79) died peacefully on November 4, 2020, at the age of 64. He was a graduate of the University of Illinois and earned an MBA from Lehigh University. Robert was a chemical engineer and senior project manager at Air Products for 35 years, retiring in 2014. He began working for Universal Compressed Air in 2015 as a general manager and, most recently, as the chief operating officer. He was also committee chair for the Boy Scouts of America. Robert was well known for always having a positive outlook and being ready to offer a lending hand at a moment's notice.

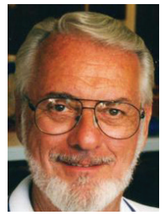
Thomas Ahrens Jerrell Jr. (BS '73) died January 26, 2020, at the age of 68. He graduated from the University of Illinois and later received his MBA from Purdue. Tom enjoyed working on home improvement projects, large and small. He loved his Newfoundland dogs. Tom liked going out to eat with his family, including his loving wife Susan, and would always bring home treats for his pups. He was known as Pop-pop to his grandchildren and loved watching cartoons with them and reading them books. He was a World War II history buff and was fond of playing board and video games. Tom was also an active member of the United Methodist Church and enjoyed volunteering his time.

John "Jack" Hoppe Kalivoda (BS '48) died on February 1, 2021, at the age of 93. He attended the University of Illinois and graduated in three years. When he went home for Thanksgiving, he told his folks that, in the chemistry lab, he had met the girl (Isabell Helen Holmgren) who he was going to marry. They graduated together but did not marry until 1950 because he wanted to earn his master's degree from the Massachusetts Institute of Technology and establish his career. He worked his entire professional career for Shell Oil Company, starting at the Wood River Refinery (near St Louis) and moving to New York City, The Hague (Netherlands), and finishing his 35-year career at the Martinez Refinery in 1985. He loved music and was a member of the Marching Illini (clarinet) and Men's Glee Club at the U of I. The outdoors was a major joy in his life. He was a 50-year member of the Masons. When his beloved wife Izzy was diagnosed with ALS (Lou Gehrig's disease), he cared for her and sought therapies to slow the disease. Later, he married Phyllis Switzer Herrold, and they enjoyed many trips and concerts together.



William Alan Kibikas (BS '73) passed away on May 5, 2020, at the age of 69. Bill was born in Highland, Illinois. After graduating from the University of Illinois, Bill went to work for the Monsanto Company in Pensacola, Florida. While living in Pensacola, Bill earned his MBA from the University of West Florida. In 1983, Bill transferred to the Monsanto Chocolate Bayou site in Alvin, Texas. Bill retired from Monsanto/Solutia as a fellow in December 2001. Bill spent his retirement years volunteering as an AARP tax aide and playing duplicate bridge, earning the Life Master rank.

Eugene "Gene" C. MacMullan (BS '55) passed away June 7, 2020, at the age of 90, after a brief illness. Gene and his twin brother, Edward, enlisted in the U.S. Navy right after graduating from Cardinal Hayes High School. He served two separate times: once at the end of World War II, and later, during the Korean War. After graduating from the University of Illinois, Gene worked for the Exxon Corporation. His career took him far and wide. He was based in New Jersey, but worked in France, Aruba, Venezuela, Sicily, and Curacao. He retired to Connecticut in the 1990s. He enjoyed a second "career" working on rare book restoration. Gene's hobbies included sailing, swimming, and woodworking.



Leland "Lee" Bishop Miller Jr. (BS '54, MS 55) passed away peacefully on October 26, 2019, at the age of 88. Lee graduated as salutatorian in 1949 from University High in Bloomington, Illinois. He received his bachelor's and master's degrees and an MBA from the University of Illinois. He pursued a doctoral thesis at Purdue University prior to accepting a research engineering position at Exxon in New Jersey. Later, he taught management courses at Harvard Graduate School of Business and the University of Illinois. Lee was the corporate treasurer and a vice president of A.E. Staley Manufacturing Co., later Staley Continental, where he helped grow the business into the second-largest food service distribution company in the world. Following his career with Staley, Lee was elected vice president/chief financial officer of MultiFresh Systems Inc. Lee proudly served in the U.S. Army as a first lieutenant in the 501st Army Security Agency stationed in Korea and Fort Devens, Massachusetts, from 1955-1957 and continued in the Army Reserves until 1962. Among his many affiliations, he was a member of the American Institute of Chemical Engineers. Lee was an avid storyteller, voracious reader, and excellent trivia partner. His favorite ski and golf spot was Telluride, Colorado, where he and his wife, Alice P. Elder-Miller, spent many weeks with family and friends. He was an avid Illini fan and always supported all Illinois teams.

Edward Barton Parrish (BS '59) died on January 11, 2021, at the age of 83. Ed graduated from the University of Illinois and earned an advanced degree in chemical engineering at Carnegie Mellon University in Pittsburgh, Pennsylvania. Following completion of his military obligation in the U.S. Army Ordinance Corps, he started a multi-year career with Sun Oil Company (Sunoco). Ed held positions in Refinery Operations, Research and Development, Finance, and a number of management assignments. He was director of marketing of Sun Information Services, and president of Weiland Computer Group, which provided banking operations to more than 100 banks from Ohio to Iowa. After Sun, Ed was an executive management consultant on information as an asset and the uses of information technology in business strategy. He then joined the senior management of Johnson & Johnson as corporate vice president of information management. In retirement, Ed and his wife Susan moved to Hilton Head Island with a second home in the historic seaside town of Cape May, New Jersey. He served as president of the Taxpayers Association and also served on the board of the Hilton Head Symphony and the board of The Lean Ensemble Theater. He supported his colleagues and employees to become their best selves; and respected and cherished his wife and life mate Susan.

Douglas LeRoy Relyea (MS '63, PhD '65) passed away at the age of 80 on October 3, 2020, after a courageous battle with cancer. He was a high school valedictorian and earned a bachelor's degree from Princeton University. At the University of Illinois, where he earned his master's degree and doctorate, he was a member of Alpha Chi Sigma professional chemistry fraternity and helped organize the annual lobster dinner that continues to this day. He began his 35-year career with ExxonMobil (then Humble Oil and Refining Company) at the Baytown Refinery in July 1965. At ExxonMobil, he was a project manager, engineering associate, and the plant utilities specialist. After his retirement in 2000, he went back to work for SNC-Lavalin (then GDS Engineers) and worked for ExxonMobil. He volunteered for Habitat for Humanity, Big Brothers and Big Sisters, the Boy Scouts, and he served on the vestry as treasurer for All Saints Episcopal Church. He valued education, and he helped more than a dozen people attend college. Douglas was intelligent, kind, generous, hardworking, honest, moral, and he lived a humble life.

William H. "Bill" Severns, Jr. (BS '44) died March 19, 2021, at the age of 97. He was born in Champaign to William H. Severns, a professor of mechanical engineering at the University of Illinois and Mary E. Severns, a librarian. He graduated from Urbana High School in 1941 and went on to attend the University of Illinois. During World War II, Bill served his country in the U.S. Navy from 1944 to 1946. After being honorably discharged, he returned to earn his degree. In 1948, he married Mary Reeser and went on to earn his doctorate from the University of Delaware in 1950. Bill spent his entire career working for the DuPont Company at both the Experimental Station and the Newport plant. Shortly after the Newport plant was sold to Ciba-Geigy, he retired. Always civic-minded, he was president of the Sherwood Park Civic Association and of the Green Hills Lions Club. He was passionate about education; he funded scholarships and endowed the William H. Severns Jr. Faculty Support Fund and the William H. Severns Jr. Distinguished Chair of Chemical Engineering at Delaware. After he was widowed, Bill found love again with a high school friend, Jacqueline Scott Cobb. During their 32-year marriage, they traveled the world and oversaw philanthropic projects with an educational focus.

Henry A. Snyder (BS '48) passed away on July 25, 2020, at the age of 93. He served two years in the U.S. Navy in World War II

and later in the Army Reserves. Together with his brother-in-law, he founded Interstate Chemical Products Co. in 1949 in Kansas City, which was bought by West Chemical Co. in New York City in 1965. Henry became president of West in 1974. In 1978, Henry became general manager of the Klenzade Division of Ecolab in St. Paul. He officially retired in 1987 as corporate executive vice president. Henry was very active in religious committees and various fundraising efforts in the Jewish community and other nonprofits. He was a consummate bridge player and enjoyed countless hours with his wife Janice, who was his equally consummate partner. He also loved reading nonfiction and working crossword puzzles. Henry recited the often quirky poems of Ogden Nash, as well as his own compositions, and his sense of humor remained to the end.

Paul Joseph Tamas (BS '11), passed away March 23, 2020, at the age of 31, due to heart failure attributed to Crohn's Disease and cancer. He was born in Zweibruecken, Germany. After graduating from the University of Illinois, he worked for Foster Wheeler in Houston, Texas, as a chemical engineer. He had recently attained a professional engineer license, which he was very proud to receive. Paul was a video gamer in his spare time. He thoroughly enjoyed the competition and camaraderie within the gaming community. Paul was also a lifetime member of the First United Presbyterian Church, and he loved his church family.

Jack D. Tinkler (BS '58) died peacefully on February 5, 2020, at the age of 83. He was the beloved husband of Pleasants.

Edwin S. Troscinski (BS '51), age 91, was an air Force Veteran and a 30-year employee of Nalco Chemical Co., holding 11 patents. He graduated from Gage Park High School, located southwest of Chicago. He lettered in baseball and was a member of the National Athletic Scholarship Society and Phi Eta Sigma, the National Honor Society. Later in life, he was a member of the American Institute of Chemical Engineers and the National Association of Corrosion Engineers.

Kenneth Ray Walston (BS '50) died April 19, 2020, at the age 92. He was born in Noble, Illinois, and enlisted in the Army, serving in the Army Chemical Corp during the Korean War. He went on to attend the University of Illinois, graduating cum laude. He spent the bulk of his career working for ExxonMobil as a corrosion specialist. Kenneth traveled to most of the oil-rich countries of the world and was assigned to posts in the Netherlands, Great Britain, and Aruba. He wrote several books on corrosion and was a popular speaker on the subject, even testifying as a subject matter expert during the Exxon Valdez trial. He loved basketball, traveling, fishing, and had an avid interest in politics. He was a member of the United Methodist Church. He was a soft-spoken, dignified man, a true gentleman in every sense.

Dr. Donald Westerheide (MS '60), 83, passed away on December 8, 2019. He graduated from the University of Dayton with a bachelor's degree in chemical engineering, a master's degree from the University of Illinois, a doctorate from Iowa State University, and a MBA from the University of Texas at Arlington. Don published 23 scientific and engineering articles and contributed to two major textbooks. He worked at General Dynamics and Lockheed Martin where he retired as vice president of Enterprise Integration, Aeronautics Sector after 35 years of service. He worked on the Saturn Five, fly-by-wire technology in the F16, and stealth technology flying undetected by radar. Most of his work was classified under the Skunk Works programs. He was a pioneer in military defense systems and programs. After his retirement, he joined the ISX Corporation as president and CEO, board member, and consultant until acquired by Lockheed Martin. Don was a member of Tau Beta Pi, the American Chemical Society for 60 years, and the Sports Car Club of America for 58 years where he raced cars and officiated. He served as chairman on several domestic and international boards including Nexprise, International CALS Congress, Association for Enterprise Integration, and U.S. CALS Industry Steering Group. Don had an adventurous and curious soul, and he could never sit still. Don and his wife Joan traveled to all seven continents. Don's hobbies also included water sports, bicycling, jogging, and gardening.

William Nelson Zartman (BS '56) died on January 17, 2021, at the age of 86. Bill graduated from the University of Illinois and went on to earn a doctorate from the University of Michigan in 1960, where he met his wife Nedra Ann Glass. Bill retired from ExxonMobil in July 1990, after 30 years, including 20 years at the Baton Rouge Refinery where he contributed to the development of computer control of numerous refinery processes. Before that, he was at Exxon's Benicia, California, refinery for three years and the Baytown Refinery, Texas, for seven years. He was an ordained elder at Broadmoor Presbyterian Church. He enjoyed playing tennis and golf as well as traveling with his wife Nedra. His favorite hobby was financial planning.

Remember When

We're sad to report that the gnarly tree that stood in front of the Roger Adams Lab for over 70 years is no more. On a bright sunny day in August 2020, a large limb came crashing down onto the sidewalk—luckily no people or cars were injured or impacted by the fall. One of the tree's major branches (found to be hollow!) was also cracked and about to come down, necessitating the tree's removal. A local tree enthusiast suggests it was a common hackberry tree.

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UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Our activities looked a little different this year! Pictured ChBE senior Angelique Klimek (top), graduate student Liliana Bello Fernández (middle), and assistant professor Damien Guironnet (bottom) work from home in the spring 2021.