Chemical Engineering at UCSB

2021 Newsletter

CHEMICAL ENGINEERING
UC SANTA BARBARA

A LETTER FROM THE CHAIR

Professor Rachel A. Segalman, Chemical Engineering Department Chair

Dear friends and colleagues,

It has been so wonderful to see the campus full of students again now that classes have begun fully in person! While the campus was quiet over the last year and a half, our research laboratories and offices were buzzing. As you'll read in this Newsletter, Mellichamp Sustainability Chairs, Scott and Abu-Omar have made significant progress in addressing the problem of recycling in plastics by upcycling polyethylene into high value molecules. Many members of the department are also playing leading roles in the new NSF Materials Innovation Platform on BioPolymers, Automated Cellular Infrastructure, Flow, and Integrated Chemistry (BioPACIFIC MIP). We're also thrilled to highlight alumnus, donor, and External Advisory Board member Michael Costello and alumna Tawni Koutchesfahani.

In addition to these accomplishments, the department is celebrating a banner year of recognitions! We are particularly proud to report that Professor Glenn Fredrickson was elected to the National Academy of Science and I was elected to the National Academy of Engineering. Election to the National Academies is considered to be among the highest recognitions in science or engineering-related fields and recognizes a lifetime's worth of accomplishments. We are also thrilled that Michelle O'Malley is the 2021 AIChE Colburn Award winner. This is the highest prize given by the AIChE to an early career chemical engineer and recognizes significant contributions to the literature. Phil Christopher is the 2022 ACS Ipatieff Prize winner which recognizes seminal contributions by a young scientist in the catalysis field. Even more recognitions are highlighted in the newsletter!

Now that campus is open, please drop by Engineering II to say hi! In the meantime, we hope you enjoy these and other updates within the Newsletter.

Rachel

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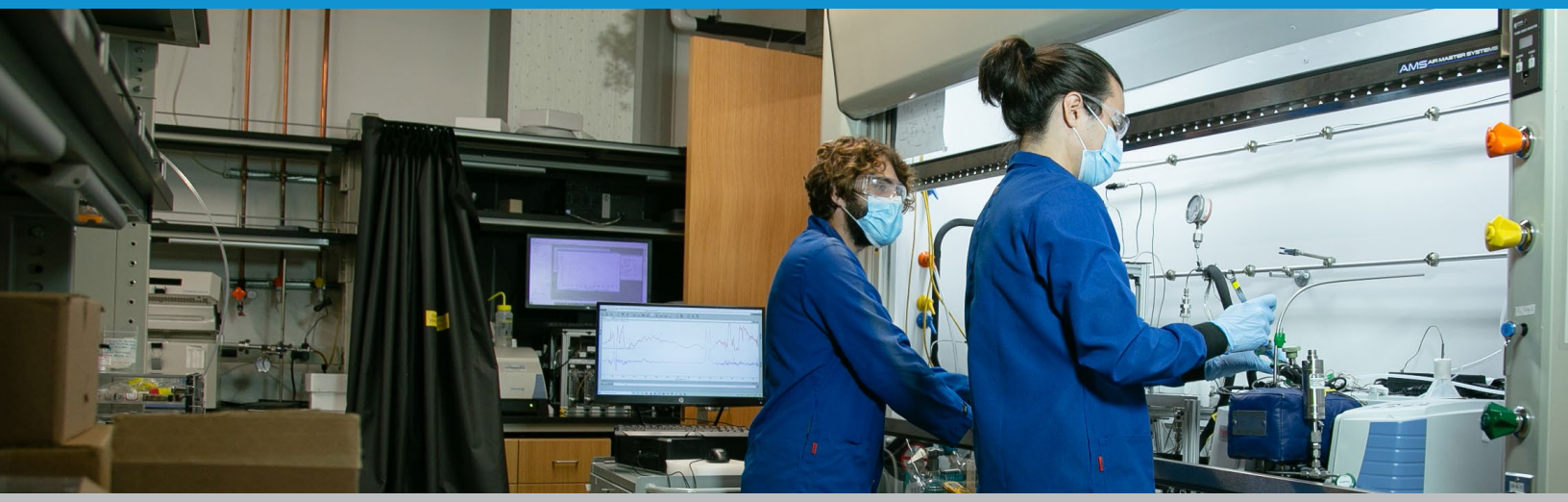


ON THE COVER:

An artist's interpretation of what it means to upcycle polyethelene plastics into clean energy sources and products. PhD researchers Jiakai Sun and Yu-Hsuan Lee of the Susannah Scott and Mahdi Abu-Omar group worked with CoE artist Lilli McKinney to develop this concept.

Read more about this in our Research Focus section on page 8

FACULTY AWARDS

RACHEL SEGALMAN

Elected to National Academy of Engineering

Professor Rachel A. Segalman, Warren G. and Katherine S. Schlinger Distinguished Professor of Chemical Engineering, Edward Noble Kramer Professor of Materials, and Chemical Engineering Department Chair, was one of 129 members worldwide elected to the National Academy of Engineering (NAE) for 2021. Professor Segalman, joins the 106 American and 23 foreign engineers honored this year, and was recognized "for contributions to semiconducting block polymers, polymeric ionic liquids, and hybrid thermoelectric materials." Election to the NAE is among the highest professional distinctions accorded to an engineer.

With particular interests in energy, efficiency, sustainability, and materials and interfaces, Segalman's research focuses on controlling self-assembly, structure, and the properties in functional polymers. Structural control over soft matter through microscopic length scales is an essential tool to optimize properties for applications ranging from solar and thermal energy to biomaterials. Her work paves the way for the development of sophisticated materials for energy application such as photovoltaics, fuel cells, and thermoelectrics.

The Segalman group collaborates with numerous research groups at UCSB through the Materials Research Laboratory, the Mitsubishi Chemical Center for Advanced Materials, and the Institute for Collaborative Biotechnologies. Her research group also partners with researchers at UCSB and other institutions through Synthetic Control Across Length-Scales for Advancing Rechargeables (SCALAR), the Center for Materials for Water and Energy Systems (M-WET), and the BioPolymers, Automated Cellular Infrastrucutre, Flow and Integrated Chemistry Materials Innovation Platform (BioPACIFIC MIP).

Individuals in the newly elected class were formally inducted during the NAE's annual meeting on October 3, 2021.

"The perception is that this is an individual honor, but I see it as a recognition for the university and the decades of wonderful people who I've been able to work with."

—Rachel Segalman

FACULTY AWARDS

GLENN FREDRICKSON

Elected to National Academy of Sciences

Professor Glenn Fredrickson, Mitsubishi Chemical Professor, has been elected to the National Academy of Sciences in recognition of his distinguished and continuing achievements in original research. Membership in the NAS is one of the highest honors given to a scientist or engineer in the United States. This year, the academy elected 120 US members and 30 international members.

Fredrickson, the Mitsubishi Chemical Chair in Functional Materials, was honored by the NAS for his contributions to soft-matter theory. He pioneered computational field theory techniques that revolutionized the study of soft materials and complex fluids, most notably in self-assembling polymers and block copolymers. Known as field-theoretic simulations (FTS), his techniques have a number of advantages relative to traditional simulation techniques for studying the equilibrium structure and thermodynamic properties of complex fluids and polymers. Unlike particle-based simulations, his method becomes more efficient as the density of the system increases, or as the polymers become longer. Fredrickson's techniques are significant not only for their importance to molecular thermodynamics, but also for their engineering impact on directed self-assembly, an important technology for manufacturing semiconductor devices. His research spans soft-condensed matter physics, theoretical and computational chemistry, materials science, and chemical engineering.

Those elected this year bring the total number of active NAS members to 2,461 and the total number of international members to 511. The NAS is a private nonprofit institution established in 1863 by a congressional charter signed by President Abraham Lincoln. It recognizes achievement in science by election to membership, and with the National Academy of Engineering and the National Academy of Medicine, provides science, engineering, and health policy advice to the federal government and other organizations. Professor Fredrickson is also a member of the National Academy of Engineering since 2003.

"Election to the NAS is the highest recognition for scientists in the U.S., so I am thrilled and humbled that my research has been honored in this manner."

—Glenn Fredrickson

FACULTY AWARDS

MICHELLE O'MALLEY

AIChE Allan P. Colburn Award for Excellence in Publications by a Young Member of the Institute

Professor Michelle O'Malley was named the recipient of the American Institute of Chemical Engineers (AIChE) 2021 Allan P. Colburn Award. The award, named for a legendary professor who founded the University of Delaware chemical engineering department, recognizes significant contributions to chemical engineering through publications by younger members of the institute.

O'Malley's ongoing work focuses on the fact that biomass digestion is generally performed by consortia of microbes, and she is now developing systems-level tools to evaluate and direct microbial interactions. She and her students have recently pioneered new approaches to isolate not only fungi, but also their dependent bacteria and methanogens, to create a simplified system to model their interactions. Her group's research set the foundation for engineering microbial interactions in anaerobes to accelerate biomass breakdown, and serves as a unique spring board to study and engineer how microbes "partner" in nature and in bioreactors.

PHILLIP CHRISTOPHER

2022 ACS Ipatieff Prize

Professor Phillip Christopher received the 2022 Ipatieff Prize, and was nationally recognized for his significant contributions to chemistry by the American Chemical Society (ACS) National Awards Program. The Ipatieff Prize is a triennial award that recognizes an individual, who is not over forty years of age, for outstanding chemical experimental work in the field of catalysis or high pressure. Christopher's research focuses on developing new ways to understand and design catalytic processes, the chemical reactions driven and expedited by a material known as a catalyst. Converting oil to gasoline, and turning natural gas and nitrogen into fertilizer are just two important processes that rely on catalysis.

The ACS will honor its 2022 recipients at an awards ceremony during its national conference next March.

SONGI HAN

Award for Outstanding Achievements in Magnetic Resonance, Eastern Analytical Symposium

Professor Songi Han, professor of Chemical Engineering and Chemistry has won the 2021 Eastern Analytical Symposium (EAS) Award for Outstanding Achievements in Magnetic Resonance. She will receive the award at the EAS Symposium, which takes place November 15–17, 2021, in Plainsboro, New Jersey. The annual EAS awards honor analytical chemists who have distinguished career achievements and who have advanced their fields by superior work in developing theory, techniques, or instrumentation.

ARNAB MUKHERJEE

NIH Imaging - Science Track Award for Research Transition (I/START)

Professor Arnab Mukherjee received the I/START Award from the National Institute of Health. The I/START is a unique mechanism used by the NIH to facilitate investigators entering the area of brain neuroimaging. A major goal of this program is to foster and advance innovative research in the area of drug abuse, especially on how addictive drugs affect the central nervous system at a molecular level. This particular award will allow the Mukherjee lab to collaborate with the Kippin lab (Psychology and Brain Sciences) to create noninvasive imaging tools for tracking brain function in living animals and ultimately apply these in animal models of addiction and neuropsychiatric disease.

JOE CHADA

Outstanding Chemical Engineering Faculty Award 2019-20 & 2020-21

Assistant Teaching Professor Joseph Chada received the Outstanding Chemical Engineering Faculty Award for the second straight year. The end-of-the-year award from UCSB's College of Engineering is selected by graduating Seniors. Chada's primary focus is to design and construct experiments for students that reflect the latest in the chemical engineering field. The goal behind the experiments, which are conducted in the Robert G. Rinker Lab, are to reinforce fundamental chemical engineering principles, expose students to industrially relevant situations, provide hands-on training on modern equipment, and enhance opportunities for students. With the help of dedicated teaching assistants and Lab Manager Adrian Cortez, Chada adapted much of their course content during the pandemic to work better online, creating more engaging content and lower-stress assessments.

FACULTY AWARDS

CHRISTOPHER BATES

Camille Dreyfus Teacher-Scholar Award

Materials Department Professor Christopher Bates, and by courtesy Chemical Engineering, is one of 16 junior faculty nationwide to receive a 2021 Camille Dreyfus Teacher-Scholar Award. Managed by the Camille and Henry Dreyfus Foundation, the awards program supports junior faculty who have demonstrated leadership in research and education. Bates will receive $100,000 in unrestricted research funding to support his work to study the self-assembly of bottlebrush copolymers. The Camille and Henry Dreyfus Foundation supports the advancement of chemistry, chemical engineering, and related sciences as a means of improving human relations and circumstances around the world in biosciences.

SONGI HAN AND M. SCOTT SHELL

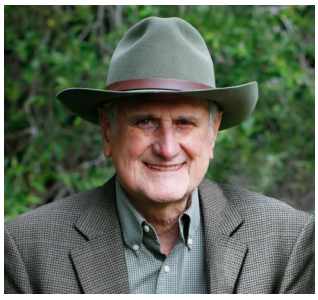
W. M. Keck Foundation Award

Professors Songi Han and M. Scott Shell received the W. M. Keck Foundation Award. This Keck-supported project addresses the critical problem of how to generate a dynamic and molecular view of pathological tau protein aggregation. Tau aggregation into different fibrillar shapes is implicated in a wide range of neurodegenerative diseases, including Alzheimer's disease and Chronic Traumatic Encephalopathy. While decades of research has focused on characterizing the fibrillar structures at the end of aggregation pathways, it has become clear that a dynamic, time-resolved view of the aggregation process is critical to achieve the replication of pathological tau aggregation in the laboratory, which is an elusive goal, but a necessary step to enable therapeutic developments. Such insight is critical and missing for many other protein aggregation based diseases. By combining state of the art spectroscopy, biochemistry, and simulation methods, the Han and Shell groups are now uniquely positioned to study such dynamic aggregation pathways, at molecular resolution, which will provide first-in-kind insights into the molecular mechanisms underlying tau pathology.

SIDDDARTH DEY

Potter Lecture

Professor Sid Dey, Assistant Professor of Chemical Engineering, was recently invited to deliver the Potter Lecture in the Division of Developmental Biology at the Cincinnati Children's Hospital Medical Center. This endowed lecture series is in honor of Dr. Potter, who over the course of the last 35 years introduced many cutting edge technologies spanning from transgenic animal production to single-cell RNA sequencing methodologies. Professor Dey delivered this lecture on August 25, 2021. This lecture features researchers that have made significant contributions to new technological innovations in biosciences.



DUNCAN MELLICHAMP

Inducted into Control Process Automation Hall of Fame

Duncan Mellichamp, professor emeritus and a founding faculty member of UC Santa Barbara's Chemical Engineering Department, has been inducted into the Control Process Automation Hall of Fame. Inductees were nominated and selected by existing Hall of Fame members, based on their excellence, diligence, and influence to the process control industry.

Mellichamp was one of six founding faculty members of the Chemical Engineering Department, where he started the process control program. Today, the department is considered among the best in the world, tabbed by U.S. News and World Report as the fifth best graduate program among public universities and eighth overall in the 2021 rankings. Mellichamp, who earned his bachelor's degree from Georgia Tech and his PhD from Purdue University, both in chemical engineering, authored more than one hundred research publications on process modeling, large-scale systems analysis, and computer control. During his career, he mentored more than fifty graduate students to degrees, including the first PhD granted in chemical engineering at UCSB and the first granted to a female student in the entire College of Engineering.

DALE SEBORG

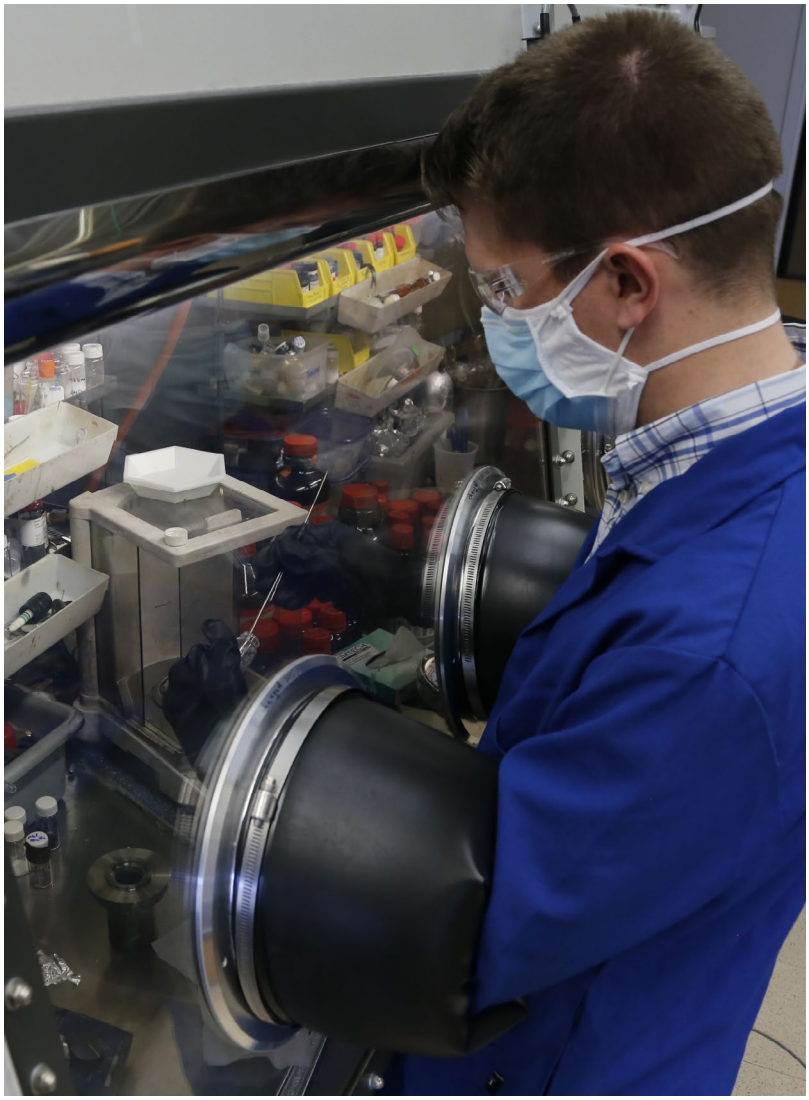
Recognition for Highly Cited Publications

Dale Seborg is the senior author of a 2008 journal article on controls strategies for the Artificial Pancreas (AP). In a recent survey in the J. of Diabetes Science and Technology, it was the second most-cited AP article during the past 20 years. He is also the senior author of a Journal of Process Control article that was selected as one of its 25 "milestone papers" during the past 25 years.

RESEARCH FOCUS

PLASTICS: A SOURCE OF RECYCLED CARBON

UCSB researchers delve into new ways to "close the loop" on a major source of pollution



Above: Garrett Strong, a third year Chemical Engineering graduate student from the Scott group, packs a reaction in the glovebox.

Last October, an article in SCIENCE by UC Santa Barbara researchers Susannah Scott and Mahdi Abu-Omar described a one-pot, low-temperature catalytic method that upcycles polyethylene into high-value alkylaromatic molecules. Polyethylene represents about a third of all plastics, which have a global value of about $200 billion annually.

Scott described the findings as "a demonstration of what can be done, one of an increasing number of possible measures that can be taken to turn the wasteful, linear plastic economy into a more sustainable, circular one."

The paper found widespread interest around the world, and Scott and Abu-Omar, both of whom have appointments in chemistry and chemical engineering, are in the process of proposing to industry the idea of using the alkylaromatic molecules to make biodegradable anionic surfactants, which are used in laundry detergents, soaps, shampoos, toothpaste, dishwashing liquid, and spray cleaners. "You can imagine a company saying, 'We can sell you a bottle of shampoo in which both the bottle and its contents are made from recycled carbon,'" Scott says. "This is feeding into a larger idea of a circular carbon economy."

While the more conventional approach to addressing the increasing problem of plastic waste was "circular plastics" — making new plastics out of used plastics, including the mechanical recycling that is practiced currently — Scott, who holds UCSB's Mellichamp Chair in Sustainable Catalytic Processing, and Abu-Omar, who specializes in energy catalysis and holds the Mellichamp Chair in Green Chemistry, are thinking of how to turn used plastics into new forms of carbon by disassembling the macromolecules.

"The idea of circular plastics falls short on a number of levels," Scott says. "It's very desirable when it does work, but it works only rarely. When the plastics are mechanically recycled, the properties of the recycled material are almost always worse than those of the original polymers. And they're much more expensive, so you get the same or worse properties for a much higher price, and there's just no way to easily make that a broad strategy for dealing with the plastics problem."

Their approach has a broader goal. "We're trying to keep carbon in use, to preserve the value of that reduced carbon, for as long as possible, because that has energy implications," Scott explains. "In the future, we'll be turning CO_2 into carbon-based products, but that is an energy-intensive process, one you certainly do not want to do with every carbon atom every time you use it."

In as yet unpublished work, Scott and Abu-Omar are examining uses for other molecules obtained directly from polyethylene, in addition to alkylaromatics. They describe what they've done so far as a small-scale proof-of-concept demonstration. "The question

then is, how do you turn that into something that you can scale up to deal with the magnitude of the plastic waste problem? It's not at all straightforward," Scott notes.

"We've seen that with the biomass industry, which was supposed to be the solution to everything — providing renewable carbon — but so far has turned out to be the solution to very little," she adds. "The problems are many, and some are similar to the plastics problems. One is that you're dealing with a highly dispersed, highly heterogeneous material that you have to collect, separate, refine, and purify, and you have to get this solid into your reactor so that you can process it. If you want to use it for anything more than simply burning it for energy, just the handling of the solids starts to get pretty tricky."

Another challenge in biomass conversion is selectivity. "You might have a mixture of a hundred individually valuable compounds that have no value — because they are a mixture," Scott says. "Making molecules selectively from biomass is a big challenge. We have the same issues with plastics: how do we collect this highly dispersed, highly heterogeneous material and make molecules selectively from it?"

Abu-Omar sees hope for biomass in the fact that some companies, including Dow Chemical, have demonstrated an ability to make polyolefins (polymerized olefins, such as polyethylene) from renewable ethylene that comes from non-food biomass."The price difference between that and using fossil fuels is a factor of two, not ten. That allows you in the future, when we have renewable sources to make these carbons and plastics that are important for modern life, to have a more perfect cycle. You have a renewable carbon source that becomes waste but is not treated as waste, but rather as a new type of feedstock. We can make useful molecules and chemicals from a renewable carbon feedstock that completes the cycle. That is a very new realization.

"All these polyethylene and polypropylene plastics are a problem, for society and for the environment," he continues. "We're saying, think about this plastic as a feedstock instead of digging a hole in the ground and harvesting petroleum and using that to make all the different things we use in modern life."

While, according to Scott, "It is desirable to make sure that the carbon used to make plastic is reused several times before it returns to the environment," she adds, "The idea of a perfect cycle in which carbon is recycled an infinite number of times defies thermodynamics. You can't actually do that. But it's a legitimate question to ask how many times it is desirable to recycle before you are better off just starting again. When things get so contaminated and dispersed, it takes more energy to collect and purify them than to let them decompose and start the chemical transformations again.

"While turning petroleum into ethylene to make polymers is a highly energy-intensive process," Scott says, "there is, thermodynamically, potentially a way to turn a polymer into another polymer — another form of carbon —without investing a lot of energy. That's why I think this circular-carbon idea is a really cool one."

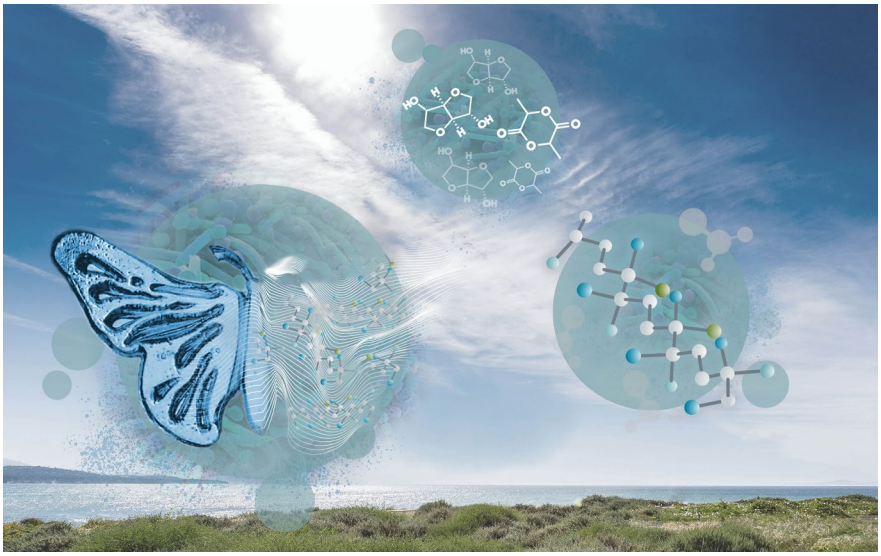
At some point, when the carbon that is used to make the plastics comes from a renewable source, that will close the cycle, even if the end use of the molecules obtained from waste plastics ends up being biodegradable detergents or jet fuels that we end up burning. They become CO_2 and that CO_2 will be used to make the plastics again.

"It's really about getting into those plastics," says Abu-Omar, "because the other choice is, we stop using plastic. That might have some benefits, but there will also be a lot of harm, because plastics have made things we use in the medical field, in safety, in hygiene much more accessible. But we're heading towards a colossal problem with the waste, and we want find a solution to that, and mining the plastic waste as a feedstock for chemicals, fuels, etc. I think, is the solution, and that's what we're advocating for in the work we're doing."

"Traditionally, people who are passionate about sustainability talk about creating new regulations or new economic incentives," says Scott. "And, of course, those are all part of the strategy, but they're not enough. It's clear that they're not enough. Technology is needed. New ways of looking at the material basis of the things we use are needed. It has to be a combination of those things."

PhD researcher Danny Zheng observes properties of the polyethelene byproduct in the Abu-Omar and Scott lab

RESEARCH PARTNERS



BIOPACIFIC MIP

Everyday polymers — think plastic and its chemical cousins — are among the foundations of modern life. The ubiquity of such petroleum-based materials has everything to do with their combination of strength, flexibility and chemical inertness, the last being a characteristic that also makes them durable. Given the environmental impact of plastics and the fact that petroleum deposits are finite, one grand challenge is to develop new sustainable bio-based, high-performance alternatives to petroleum-based polymers.

To support such an effort, the National Science Foundation (NSF) has named UC Santa Barbara and UCLA joint partners in the BioPolymers, Automated Cellular Infrastructure, Flow, and Integrated Chemistry: Materials Innovation Platform (BioPACIFIC MIP). The five-year, $23.7 million collaboration is part of the NSF Materials Innovation Platforms (MIP) Program which aims to develop new materials "twice as fast at a fraction of the cost."

The BioPACIFIC MIP leverages the facilities, expertise, and experience of UCSB and UCLA, partners since 2000 in the California NanoSystems Institute (CNSI). It includes faculty and affiliates — thirteen from UCSB, including UCSB Chemical Engineering Professors Glenn Fredrickson, Songi Han, Matt Helgeson, Michelle O'Malley, Rachel Segalman, and Scott Shell, and seven from UCLA, supported by seven scientific staff. BioPACIFIC MIP will impact a large number of students and researchers at UCSB, UCLA, and across the country in the fields of materials science, biology, chemistry, and engineering.

The project aims to develop bio-based materials having properties superior to those of existing petroleum-based polymeric materials. It is envisioned as a closed-loop scientific enterprise, from discovery of microorganisms that can be used as biological "factories" to generate building blocks for polymers, through simulation, design, building, testing, and learning, with feedback loops built into the system. UCSB Chemical Engineering students, postdocs and faculty are involved in all aspects of this project, and to accomplish these goals, the scientific mission of the BioPACIFIC MIP is organized into the following four interconnected elements:

Element 1: Synthetic Biology and Living Bioreactors

Synthetic biology lies at the heart of the BioPACIFIC MIP. Researchers in Element 1 will focus on identifying and developing promising biomolecule building blocks and new cell-based polymerization methods. They will explore and expand the chemical space of monomers accessible through synthetic biology and engineer cells to serve as production and polymerization "chassis" for bioderived polymers.

"Biology makes a lot of cool little building blocks in the form of molecules, peptides, and proteins, and often, we look at the chemistry of those building blocks and don't know how useful they are," says UCSB chemical engineer Michelle O'Malley, who is part of the Element 1 team. "That is mostly because people who have the expertise to make them are often not the people who look at them through the lens of a materials scientist. This effort is bringing people together to make that translation."

At the heart of the Element 1 research will be a high-throughput living bioreactor platform system developed to conduct automated experiments in synthetic biology. As the first user-facility in the nation to link automation and high-throughput experimentation across both synthetic biology and material synthesis, BioPACIFIC MIP will reduce lab times dramatically, accelerating the design-build-test learn cycle from yielding one sample per week to more than five hundred per week.

Element 2: Automated Synthesis/Materials

The BioPACIFIC MIP will exploit nature in two ways. The first is to take advantage of bacteria and nature's other cellular factories to make existing materials much more efficiently. The second is to prepare complex, multifunctional molecules and direct that machinery to new designer materials that synthetic chemists cannot prepare using traditional techniques.

Part of Element 2 is Rachel Segalman, chair of the Chemical Engineering Department at UCSB, who will be working closely with researchers in both Element 1 and Element 2. In her work, she examines how hierarchical polymer structure affects the thermodynamics of self-assembly and macroscopic properties. That fits in Element 1, but she also has significant expertise in

RESEARCH PARTNERS

producing bioinspired polymers via robotic synthesis, which leans toward Element 2. Like Element 1, Element 2 will employ a high-throughput system to scale up processes. "We may do ten polymerizations at once in a flow system, so that you set up the system, and it directs the components to the ten different reaction systems, and you get your ten products," says BioPACIFIC MIP co-director and UCSB professor of chemistry and biochemistry Javier Read de Alaniz. The goal will be to prepare the number of polymers in a week that previously took more than half a year using robotic handling and automation of synthesis and purification steps.

Element 3: Hierarchical Computational Tools

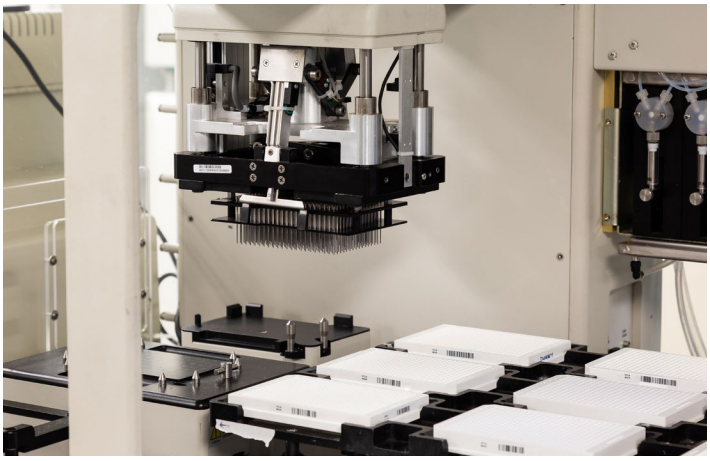
Processing and profiling the properties of new biomaterials are time- and labor-intensive processes, and that is without exploring the nearly limitless design space enabled by rapid-throughput development of new biomolecules. Element 3 researchers will use computational tools, including simulation and machine learning, to characterize new monomers and polymers, improve existing ones, identify and specify desirable material properties, and suggest appropriate chemistries and processes to achieve desired form and function or to improve the effectiveness of the living bioreactors used to produce targeted biomaterials.

Two members of Element 3 at UCSB — chemical engineering professors Glenn Fredrickson and M. Scott Shell — have collaborated to produce a hierarchy of computational tools and simulations that will be valuable to the project. Fredrickson has developed field-theoretic computer simulation models that enable studies of structure and thermodynamics across a wide range of complex fluids and soft materials at large, supramolecular length and time scales. Shell has developed molecular simulation methods for detailed, atomistic-resolution modeling of bio-based and synthetic soft materials, complex interfaces, and water-mediated and hydrophobic interactions that underly many material self-assembly processes. By combining these two approaches to predict properties from the atomistic to macroscopic scales, Fredrickson and Shell provide a powerful framework enabling the BioPACIFIC MIP to generate molecular insight and predictive materials modeling across scales. Finally, broadly accessible databases overlaid with machine-learning algorithms using both simulation and experimental data of structure-property relationships will be integrated to help close the design loop, optimize materials design, and provide feedback among explorations of the design space and desirable material properties.

Element 4: Characterization/Structure-Property Relationship Determination

Once new engineered microorganisms, monomers, and polymers are discovered, they need to be characterized to determine whether their chemical structure and resulting properties are as expected or as needed to inform further material development or refinement. Element 4 researchers will overlap significantly with Elements 1 and 3 to develop a predictive and mechanistic understanding of how composition influences structure and properties to improve the synthesis and formulation.

UCSB chemistry and chemical engineering professor Songi Han brings expertise in developing novel techniques in electron paramagnetic, nuclear magnetic resonance, and dynamic nuclear polarization that enable the study of biomolecular structure, dynamics, and interaction with unprecedented sensitivity, resolution, and information content. Similarly, chemical engineering associate professor Matthew Helgeson, who brings expertise in the structure and the dynamics of complex soft matter, including biomaterials, surfactants, polymers, and gels. Helgeson and his colleagues are developing a rapid-screening tool for micro rheology, a process used to examine flow and plasticity characteristics at extremely small scales. UCSB will have a state-of-the-art x-ray scattering instrument for that work, providing an unparalleled fifty-fold increase in speed and sensitivity compared to existing non-synchrotron-based systems. Overall, the BioPACIFIC MIP will develop new tools, new processes, and new materials to meet the needs of diverse applications, and to bolster the biomaterials community across the nation and the world.

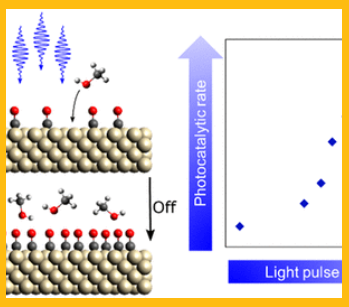


RESEARCH HIGHLIGHTS

Abu-Omar Lab

A heterogeneous pt-reox/c catalyst for making renewable adipates in one step from sugar acids
ACS Catal., 2021

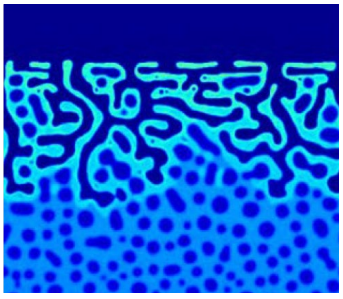
In this paper, the Abu-Omar and Christopher groups demonstrated a reusable bifunctional catalyst for the conversion of renewable sugar acids in one step to monomers of nylon, opening the door for the valorization of biomass to make renewable polymers.



Christopher Lab

Dynamic control of elementary step energetics via pulsed illumination enhances photocatalysis on metal nanoparticles
ACS Energy Lett., 2020

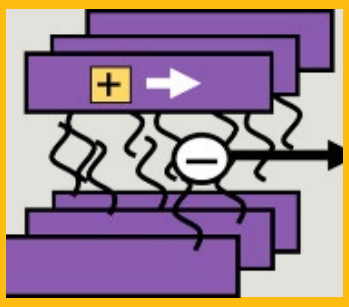
In this paper, the Christopher group demonstrated that photocatalysis can be more efficient using pulsed light, rather than continuous illumination, by matching the light pulsing frequency with the kinetic time scales.



Fredrickson Lab

Mechanisms of asymmetric membrane formation in nonsolvent-induced phase separation
ACS Macro Lett., 2020

In this paper, the Fredrickson group developed a phase field model that reveals how mass-transfer-induced phase separation, structural arrest by vitrification, and thermal fluctuations conspire to create asymmetric polymer membranes of importance in water purification processes.



Segalman Lab

Li+ and oxidant addition to control ionic and electronic conduction in ionic liquid functionalized conjugated polymers
Chem. Mater., 2021

In this work, the Segalman group developed a novel polymer for solid state lithium-ion battery electrodes that forms electron conducting domains and lithium conducting domains, allowing for simultaneous ionic and electronic conduction.

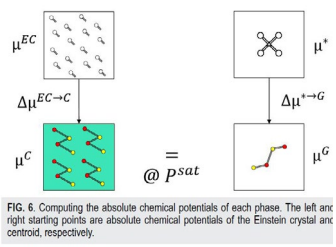


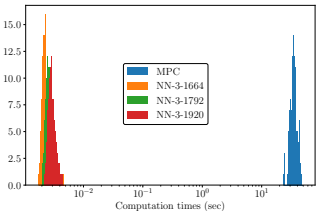
FIG. 6. Computing the absolute chemical potentials of each phase. The left and right starting points are absolute chemical potentials of the Einstein crystal and centroid, respectively.

Doherty Lab

Absolute chemical potentials for complex molecules in fluid phases: a centroid reference for predicting phase equilibria
J. Chem. Phys., 2020

In this work, the Doherty group has invented a method to avoid the solid-to-fluid transformation step by starting with absolute chemical potentials for two reference systems, one for the fluid phase and one for the solid phase. For the solid, the Doherty group started from the Einstein crystal and transformed to the fully interacting molecular crystal. For the fluid phase, a new reference system is introduced, called the "centroid," and then transformed to gas phase molecules. The new calculations are illustrated by predicting the sublimation vapor pressure of succinic acid in the temperature range of 300 K–350 K.

RESEARCH HIGHLIGHTS



Rawlings Lab

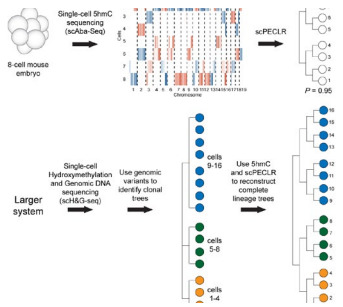
Industrial, large-scale model predictive control with structured neural networks
Comput. Chem. Eng., 2021

In this paper, the Rawlings group demonstrates the ability of neural networks to approximate model predictive control (MPC) laws for fast online execution of MPC, and for treating large-scale applications that may be out of reach with quadratic programming solvers.

Shell Lab

Affinity of small-molecule solutes to hydrophobic, hydrophilic, and chemically patterned interfaces in aqueous solution
Proc. Natl. Acad. Sci. U.S.A., 2021

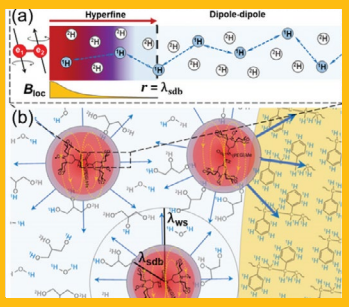
In this paper, the Shell group used molecular simulations to develop a fundamental understanding of and to in-silico design membrane-solute interactions, as a framework to inform engineering of next-generation water purification membrane systems.



Dey Lab

A probabilistic framework for cellular lineage reconstruction using integrated single-cell 5-hydroxymethylcytosine and genomic DNA sequencing
Cell Rep. Methods, 2021

In this work, the Dey group developed a probabilistic algorithm and a multiomics single-cell sequencing technology to reconstruct lineage trees at an individual cell division resolution, thereby providing fundamental insights into mammalian tissue development.



Chmelka Lab

Scaling analyses for hyperpolarization transfer across a spin-diffusion barrier and into bulk solid media
Phys. Chem. Chem. Phys., 2021

In this paper, the Chmelka group developed dimensional scaling analyses that bridge quantum mechanical and classical transport phenomena. The analyses lead to spin-polarization analogues of dimensionless Biot, Thiele, and Damköhler numbers that quantify and predict the accumulation, propagation, and dissipation of magnetization and which enable sensitive analyses of heterogeneous engineering materials, especially at surfaces.

O'Malley Lab

Anaerobic gut fungi are an untapped reservoir of natural products
Proc. Natl. Acad. Sci. U.S.A., 2021

In this paper, the O'Malley lab discovered that anaerobic gut fungi (resident to large herbivores) make natural products that likely regulate the gut microbiome and may serve as novel antibiotics.

DONOR SPOTLIGHT

LOVING THE LAB

UC Santa Barbara chemical engineering alumnus Michael Costello's $50,000 gift provided an important boost in creating the $1 million endowment to modernize the newly renamed Robert G. Rinker Chemical Engineering Teaching Laboratory. It was, he says, his way of giving back to the place where he built the foundation of his success. Costello fondly remembers Rinker, the first chemical engineering faculty member hired at UCSB, and professors such as Duncan Mellichamp, for having "forced us to do our best work, to try harder, to take on the hardest project. Nobody coddled you, but you came out with a great education."

Costello retired from Clorox in October 2020, 32 years to the day after he began working there in 1988, a few months after receiving his BS in chemical engineering from UCSB. For someone who spent his entire career at just one company, Costello got around. "What I tell people," he says, "is that I had eleven three-year careers that all just happened to be at the same company."

Costello's peripatetic childhood — his father was a salesman who often changed territories — echoed through his globe-trotting career at Clorox. As a chemical engineer, he relocated frequently while working on everything from detergents and charcoal to cat litter, bleach, trash bags, and plastic wrap, before eventually moving into marketing roles that had him hopscotching from Saõ Paolo, Brazil, to San Francisco, Miami, and back, eventually becoming general manager for all territories outside the U.S. He retired as a member of the company's Executive Committee and General Manager of the Better Health brands at Clorox.

A self-described "continual learner" who has three children, one of whom is an environmental studies major at UCSB, Costello took all the lower-division economics courses while at UCSB and could have double-majored, but would have needed another semester to finish and was anxious to begin his career. He later took classes in marketing at UC Berkeley and found that his chemical engineering background prepared him well for the core business roles he would assume at Clorox. "ChemE teaches you how to think in terms of processes and to problem-solve, and as a general manager, you problem-solve all day," he says.


Michael Costello

He serves on the UCSB Chemical Engineering Department's External Advisory Board, a role he assumed just before COVID shut down the campus, having initially turned down the offer. "I said that I'm not a chemical engineer anymore, because I've been in business so long," he recalls. "To its credit, the department didn't give up. They like the fact that I'm different, that I've been in industry, that I have a daughter here. They're looking for diversity in thought."

Like many wise people before him, Costello claims to be "clearly the dumbest person in the room" at board meetings, adding, "That's always a good place to be, because you learn so much from everyone else. The folks on the board are all highly accomplished chemical engineers who have done and continue to do amazing things. What I'm able to do is to bridge the gap between what folks are thinking from a very scientific, chemical engineering view to a broader world view."

Costello was especially happy to contribute to the Rinker lab renovation, for which an October 14th dedication ceremony is tentatively planned, circumstances permitting. "I remember ChemE 180 which was taught in those labs. It's the pinnacle of learning ChemE," he says. "You study books for a long time, and then you show up in 180 and work on equipment and work on things and mess things up, and you learn. I loved the fact that having a teaching professor [Joseph Chada] there who is really thinking about the lab and getting the right equipment would impact lots of people.

"When we first moved into Engineering II, it was a brand-new building, and the lab had brand-new equipment. I was a junior. Now, the building has been around for thirty years. Science has changed just a little bit in that time, and the lab still had the same equipment. The need to change made sense to me, in terms of preparing the students and also as an homage to Robert Rinker, who was a fantastic professor. The combination of my own experiences in the lab, the problems they were talking about, the fact that they wanted to rename it, and their vision of making it more about continual learning fit my vision and felt right. I've been very fortunate but a lot of my success is the result of what I learned at UCSB and, specifically, in ChemE 180.

"Science causes problems and solves problems, and chemical engineers are here to solve the next group of problems that show up," he continues. "I'm one hundred percent an optimist, and I believe that we can solve all the current problems, but it's going to take thinking outside the box and thinking with a scientific and process view of the world to do it. Having a bunch of really thoughtful, well-educated engineers out there is going to lead to solutions. If you want to solve a really hard problem, give it to a chemical engineer."

And, he adds, give it to increasingly diverse engineers. "I know that one piece they're working on at UCSB is to try to bring more people of color into the department. I would like to see increasing focus on trying to figure that out. The more engineers we have with different points of view, the better," he says, noting that the current department leadership is poised to do that. "Rachel Segalman [department chair] is awesome. I continue to donate, because I think she's done a fantastic job developing a vision for the department. She hears all the perspectives that people give her, and she incorporates them into her thinking. I cannot wait to see what the future brings under the current ChemE leadership, who continue to carry the torch that Robert Rinker so ingeniously ignited."

POST DOC PROFILE

HOSSEIN ROBATJAZI

Hossein Robatjazi earned a B.S. in Applied Chemistry and a M.SC in Analytical Chemistry (focusing on synthesis and applications of plasmonic nanoparticles) in Iran prior to starting the Ph.D. program at Rice University in Electrical and Computer Engineering. "I joined Rice ECE for PhD to further nurture my interest in nanophotonics and plasmonics; specifically, how light-matter interactions in optically active metal nanoparticles can be utilized to direct photon energies for chemical bond activations." At Rice, he worked broadly at heterogeneous photocatalysis, developing efficient and sustainable metal photocatalysts that enable chemical reactions to proceed at milder conditions under light illumination than that typify conventional thermal catalysis. Together with fundamental mechanistic studies, Hossein demonstrated the potential of those photocatalysts for driving several environmentally and energetically critical chemical transformations.

Hossein was awarded the 2019 Arnold O. Beckman Postdoctoral Fellowship Award in chemical science, which gave him the opportunity to secure a post-doctoral scholar position at UCSB with Professor Phil Christopher. "For my postdoc, I shifted my focus to a deeper understanding of surface phenomena governing catalytic processes at the atomic scale, focusing on atomically dispersed catalysts and metal-support interactions. Developing such insights is also critical to the future design of novel metal photocatalysts with improved functionalities for more efficient and controllable heterogeneous photocatalysis." Robatjazi said. "Phil is an expert in the field of heterogeneous catalysis and an excellent mentor. This, combined with his research direction, was what motivated me to join his group." Hossein said, "I have known Phil for several years and worked with him on a number of joint projects before joining his group. Also, joining UCSB Chemical Engineering has been an excellent complement to my background in chemistry and ECE."

Hossein's work is a part of a disruptive technology developed in Naomi Halas' lab at Rice University and is in the process of being commercialized by Syzygy Plasmonics Inc., a Houston-based start-up, where he currently works as a lead scientist in addition to holding a position as Adjunct Professor of Chemistry at Rice University. "We are developing transformative and sustainable photocatalytic platforms that run at renewable electricity for distributed on-demand production of clean fuel under very mild conditions against extreme operating conditions in conventional heat-powered reactors. The technology has shown great promise for revolutionizing the future of chemical and energy industries through reducing the overall energy consumption and CO_2 emission associated with burning petroleum and fossil fuels in current chemical industries." Robatjazi said. As the lead scientist at Syzygy, Hossein contributes to various aspects of technology development and runs a catalyst R&D team focused on developing innovative photocatalysts for new and improved chemical conversion. As an Adjunct Professor, Hossein is actively involved in various research projects, providing mentorship to graduate students and participating in other departmental activities.

"The technology has shown great promise for revolutionizing the future of chemical and energy industries"

—Robatjazi, on the sustainable photocatalytic platforms technology he researches and develops

AICHE NEWS

The UCSB chapter of the American Institute of Chemical Engineers (AIChE) is one of the most active professional societies on campus. They run industry information sessions, alumni panels, technical workshops, projects, research seminars, and social events for the chemical engineering community at UCSB. By facilitating interactions between students, faculty, and company representatives, AIChE at UCSB strives for the technical and professional development of every future chemical engineer.

Professional Development

AIChE UCSB partners with numerous industries to create an environment where industry representatives can interact with and recruit directly from the chemical engineering student body. They host, co-host, and promote over a dozen events with companies ranging from small start-ups to global corporations. The organization also holds strong ties with Clorox, the main sponsor, which has continued to support AIChE UCSB and recruit multiple interns and full-time graduates each fall. Beyond recruitment, they began a series of virtual alumni panels over Zoom, where UCSB ChE alumni in diverse fields spoke about their career pathways. Students benefited from learning about the many types of roles chemical engineers can hold in industry and research. These opportunities were great chances to learn more about the department, various paths to graduate school, and even what professors do outside of office hours. These events are valuable opportunities to build students' network and connect speakers with talented undergraduate students.

Technical Workshops

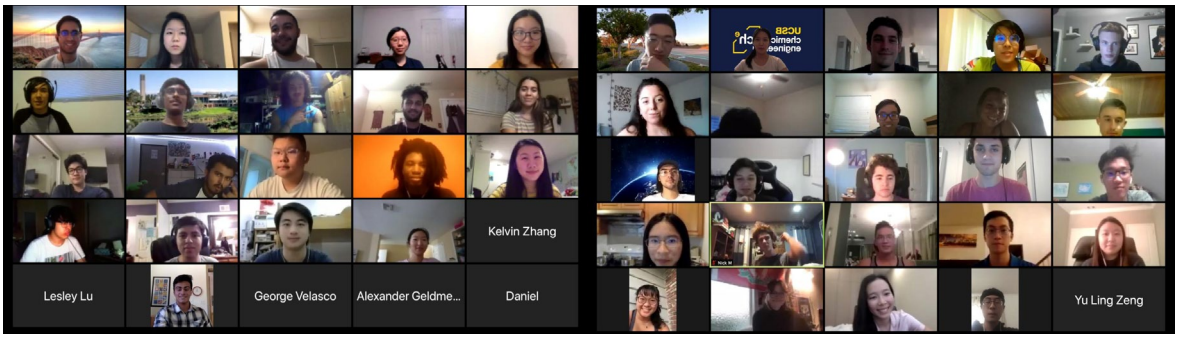
This year, AIChE UCSB started its first technical workshop series. They created lessons for SolidWorks and Arduino, mailed participants kits, and taught interested students the basics of using each platform during interactive sessions. These tutorials culminated in the construction of a plant pot that uses an ultrasonic sensor to detect when it needs to be watered. Students also had the opportunity to design battery cells in teams for the Chem-E-Car Competition, a contest for building small vehicles powered only by chemical means. AIChE UCSB's newly established and continuing programs provide undergraduates with a space to learn key technical skills beyond the classroom.

Social Events

Despite the virtual format of all these events, They continued to foster community within the UCSB Chemical Engineering department. AIChE continued the tradition of quarterly Trivia Nights, where undergraduates, graduate students, and faculty teamed up to answer trivia about chemical engineering and pop culture. The first Club Cook-off in the spring found members of AIChE "cheffing it up" with participants from other science and engineering organizations. The competition for prizes was coupled with getting to know people in the department and in the broader UCSB STEM community, across all class years. Other successful events included game nights and weekly study room calls over Discord. Students came to finish homework and chat with each other for the interaction lacking in most virtual seminars.

Future Plans

This academic year, AIChE will strive to uphold its previous agenda and expand its current impact. Focal points of fall quarter will be to onboard freshmen and expose students to industry careers. With this come social events that develop a tight-knit community, various mentorship programs, and community outreach opportunities. During the winter, they will begin to shift their focus towards research and academic development. They will host their annual Chemical Engineering Research Symposium, where undergraduates can interact with graduate students, learn about the different projects students are working on, and perhaps, even join a research group. AIChE's alumni panel series from last year will continue, introducing students to various research and industry careers through the lens of those who walked in the same shoes as members. Finally, in spring quarter, they will welcome graduate school exposure, networking, and social events. From Lunch with Faculty, to graduate school panel, to Trivia Night, they ensure that members have the necessary connections to plan opportunities for their summer or simply end the year with a bang. Throughout the year, AIChE will be working on projects such as the Chem-E-Car, which serve as excellent opportunities for students to learn and apply technical skills towards a capstone project. They aspire to strengthen and expand the connections between UCSB and industry, promote early involvement of underclassmen in extracurricular experience, and provide students with the tools to be excellent engineers.



Visit AIChE UCSB's website at www.ucsbaiche.com for event updates and schedules, video panels with alumni, info sessions with industry and academia professionals, and more!

ALUMNI PROFILE

TAWNI KOUTCHESFAHANI

Tawni Koutchesfahani is part of the upcoming wave of chemical engineers paving the way in biotech. She is a seasoned executive in the field, and becoming the new face of bio-manufacturing, where she specifically is working on scaling products from the lab to large scale manufacturing. Her life purpose has been to work on process development and manufacturing of life sustaining treatments. She developed her passion for helping others at a very young age having experienced a loved one's horrific battle with cancer. She knew she had to step in, and make a difference in the world.

Tawni earned her B.S. in Chemical Engineering from UC Santa Barbara in 2004 and followed up by earning her Master's in Product Development in Chemical Engineering from UC Berkeley. Since then Tawni has been a key manufacturing leader at Baxalta (spin off company from Baxter) manufacturing network for its BioSciences Division as well as Baxter's BioSurgery division. At Baxter Healthcare she managed an organization of 100 reports for a commercial and clinical manufacturing unit before she turned 30, which is a testament to her strong work ethic. Tawni has led across different organizations within Baxter Healthcare between Southern and Northern California in different parts of the business unit.

From 2016-2018, Tawni was the Director of Supply Chain, and Manufacturing Strategy at Relpysa working closely with Relypsa's global contract manufacturing sites. Shortly after Relpysa's acquisition by Galenica, she was recruited to join Catalyst Bioscience where she served as the Executive Director, Drug Product Manufacturing.

Currently, Tawni serves as the Executive Director of Manufacturing for Nkarta, pushing boundaries and enabling the power of manufacturing for a CAR NK (chimeric antigen receptor natural killer) therapy. This cutting edge technology is a form of cell therapy defined as a new approach that uses immune cells to attack tumors. The technology has emerged as one of the most promising breakthroughs in cancer treatments. She now works with world class leaders to address limitations through the application of next generation technologies. Her passion, built into her work, is drawn to never take health for granted, and Tawni feels grateful to use her time to serve this purpose.

Tawni is not only focused to be part of change at work, but she is paving the way as an Iranian-American in Silicon Valley as the Executive Director of Manufacturing. There aren't many women in this sector, and she wants to pave the way for other women, as well as influencing her community of future Iranian-American women. She represents the future of women breaking stereotypes, while breaking glass ceilings at a young age. During her off time, Tawni is actively working with women of color to provide help to those who need strong mentorship. She is a co-founder of the "MedTech Club" on the platform called Clubhouse where she hosts workshops on female leadership and fostering discussions on how to increase inclusion and access within STEM communities.

Tawni, like many, sees hope for 2021. She is a strong believer that science will move life forward and is hopeful for a better future, as she believes in the global scale of science fighters.

STUDENT AWARDS


CHELSEA EDWARDS


GEORGE DEGEN


MIKE SCHMITHORST


KEVIN MAUGE

Chelsea Edwards Receives the Fiona and Michael Goodchild Award from the UCSB Graduate Division

Chelsea Edwards received the Fiona and Michael Goodchild Award from the Graduate Division to recognize her activities as a research supervisor and mentor of undergraduate students.

Edwards began mentoring two chemical engineering undergraduates, Vedika Shenoy and Kareem Lakkis, during her first summer at UCSB. Advised by Chemical Engineering Associate Professor Matt Helgeson, Edwards studies the evolving structures that form when charged polymers phase separate out of salt water into coacervate droplets. Her previous awards include a four-year National Defense Science and Engineering (NDSEG) Fellowship and first place in the 2020 American Institute of Chemical Engineers (AIChE) Materials Division poster competition.

George Degen Receives the University Award of Distinction from UCSB Academic Senate

George Degen received a University Award of Distinction from UC Santa Barbara's Academic Senate in recognition of his unselfish and dedicated service to the university and the community. Degen, a sixth-year chemical engineering PhD student, was honored with a University Award of Distinction after participating in scientific outreach through the Materials Research Laboratory (MRL).

Degen's previous awards include the UC President's Dissertation Year Fellowship, the Chemical Engineering Department's Schlinger Fellowship, and the National Science Foundation's Graduate Research Fellowship. Co-advised by Joan-Emma Shea, a Professor of Chemistry and Biochemistry, and Materials Assistant Professor Angela Pitenis, Degen defended his dissertation June 2021, and will start a postdoctoral position at MIT in the fall.

PhD Student Mike Schmithorst, and Graduating Senior Kevin Mauge Receive Awards from UC Santa Barbara's College of Engineering

PhD student Mike Schmithorst, and graduating senior Kevin Mauge have received end-of-the-year awards from UC Santa Barbara's College of Engineering.

Graduating seniors selected Mike Schmithorst, a third-year PhD student, the Chemical Engineering Department's Outstanding Teaching Assistant for 2020-21. He worked as a TA this past year for the course Chemical Reaction Engineering (ChE 140B). Schmithorst was extra attentive with emails and more accommodating this year, since there has been no in-person interaction during the pandemic. Advised by Professor Brad Chmelka, Schmithorst's research focuses on understanding the distributions of active sites in zeolite catalysts for a variety of applications, including the mitigation of automobile pollution.

Mauge, who earned a cumulative 3.98 grade point average, received the Chemical Engineering Department's 2021 Outstanding Senior Award. The College of Engineering bestows the honor on the graduating senior who has the highest cumulative GPA in each degree program. During his time at UCSB, Mauge conducted undergraduate research under Professor Michael Gordon on the design of atmospheric pressure plasma jet and dielectric barrier discharge systems for processing multi-functional surfaces.

Mauge will intern this summer at Raytheon Vision Systems, where he will work on epitaxial growth of semiconductor materials for infrared photodetectors. He will return to campus in the fall to complete the fifth-year BS/MS program in materials with an emphasis in electronic and photonic devices. After earning his master's degree, he hopes to enter the semiconductor device industry.

PhD Student Jordan Finzel Receives Prestigious DOE Fellowship

Jordan Finzel, a third-year PhD student in the Chemical Engineering Department, and member of the Christopher group, has been awarded a prestigious fellowship from the U.S. Department of Energy (DOE). He was among seventy-eight graduate students from across the nation selected for the DOE's Office of Science Graduate Student Research (SCGSR) program. Awardees receive supplemental funding and an opportunity to advance their doctoral research and training by conducting research at a DOE laboratory. Students work on research projects that are of significant importance to the Office of Science, because they address societal challenges at the national and international scale.

Finzel will work with Simon Bare's group at the SLAC National Accelerator Lab in Menlo Park, California. Bare serves as co-director of the Chemistry and Catalysis Division at the lab's Stanford Synchrotron Radiation Lightsource (SSRL).

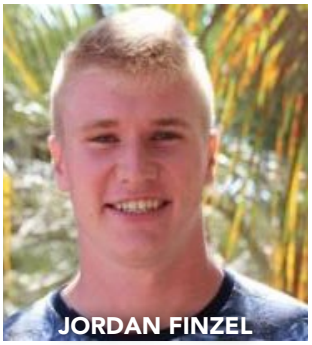
Awardees were selected from a diverse pool of graduate applications based on merit peer review by external scientific experts. Since 2014, the SCGSR program has provided more than seven hundred graduate students with supplemental funds to conduct part of their research at a host DOE laboratory in collaboration with a DOE laboratory scientist.

STUDENT AWARDS

ChE Grad Students Daniel Arnold, Kevin Modica, and Phong Nguyen Honored with Prestigious NSF Graduate Fellowships

UC Santa Barbara Department of Chemical Engineering Graduate students Daniel Arnold (Takatori Lab) Kevin Modica (Takatori Lab) and Phong Nguyen (Segalman and Chabinyc Labs) were awarded NSF Graduate Research Fellowships this year.

The GRFP is the nation's oldest fellowship program that recognizes and supports outstanding graduate students pursuing research-based graduate degrees in science, technology, engineering, and mathematics (STEM) disciplines. The program is intended to ensure the vitality and diversity of the nation's scientific and engineering workforce, inspiring future contributions to research, teaching, and scientific innovation. Students can apply to the program before beginning or early in their graduate studies. On average, about 13,000 students submit applications each year. N. Isaac Zakaria, who earned his bachelor's degree in chemical engineering from UCSB, was also offered a 2021 fellowship. Zakaria is now a graduate student at UC Berkeley.


JORDAN FINZEL

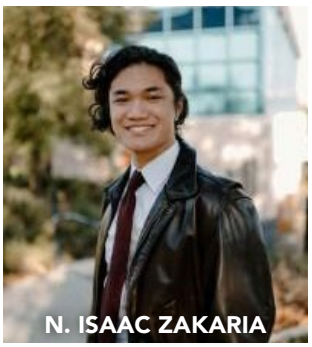

DANIEL ARNOLD


KEVIN MODICA


PHONG NGUYEN

Clarke Palmer Receives Schlinger Fellowship for 2020-21

The 2020-21 Schlinger Fellowship for Excellence in Chemical Engineering Research has been awarded by the faculty of the Department of Chemical Engineering to Clarke Palmer. Established through a generous gift from Warren and Katharine Schlinger, the award recognizes a fourth- or fifth-year doctoral student in the department who has made outstanding progress in research projects, demonstrated by publications, submitted manuscripts, and other measures of impact. Palmer is a member of Professor Eric McFarland's research group, which couples fundamental processes with novel material systems in order to allow for the cost-effective production and use of energy and energy-related chemicals. Palmer graduated in spring 2021, and hopes to work on disruptive energy technologies for a large energy company, a career path similar to Warren Schlinger, who spent nearly fifty years at Texaco.


N. ISAAC ZAKARIA


CLARKE PALMER

Chelsea Edwards, Sally Jiao, and Varun Hegde Awarded CSP Technologies Teacher- Scholar Fellowships for 2021-22

Department of Chemical Engineering graduate students, Chelsea Edwards (Helgeson Lab) Sally Jiao (Shell Lab) and Varun Hegde (Doherty and Squires Labs) have been awarded a CSP Technologies Teacher-Scholar Fellowship for 2021-22. "As a part of the award each CSP Fellow co-teaches an undergraduate course with a faculty mentor." said Scott Shell, Professor and Vice Chair of Graduate Affairs. "Congratulations, Chelsea, Sally and Varun. .We look forward to your contributions to our department pedagogy, and wish you the highest success in your teaching experiences as well as in your research."


SALLY JIAO


VARUN HEGDE

Alex Chialastri Receives Connie Frank Fellowship for 2020-2021

PhD student Alex Chialastri (Dey Lab) received the Connie Frank Fellowship for 2020-21. The Connie Frank Fellowship is an award that was established at UCSB in 2015 by Connie Frank, a philanthropist in the Los Angeles area. The fellowship was set up to help support graduate students conducting biomedical research that has applications to advance human health and well-being. Prospective awardees are nominated by their department before being chosen based on the fit of their research to the awards mission statement as well as their publications, submitted manuscripts, and other measures of impact. Alex received this award for his work on developing single-cell techniques to profile epigenetic changes in primordial germ cells. In addition to the financial award, Alex and the other awardees were afforded the opportunity to meet with Connie Frank and discuss the impact of their research.


ALEX CHIALASTRI

ALUMNI UPDATES

STEPHEN LANTIN *(B.S. 2019)*

Stephen, now a NASA Space Technology Graduate Researcher, develops new methods to automate food production for space habitats and controlled environments on Earth. He will be working at a NASA Center next summer. Stephen is concurrently pursuing his Ph.D. studies (Ag & Bio Eng) at the University of Florida, leveraging his ChE background for crop modeling and vertical farm design

SYDNEY HOLLINGSHEAD *(B.S. 2013)*

Now a Development Engineer at Cook Biotech Inc., Sydney has received the Indiana Conexus Rising 30 award. At Cook, Sydney helped to scale up production processes, led or partnered on five new-product-development programs, submitted 13 invention disclosures, and contributed to 2 provisional patents. After receiving a B.S. in chemical engineering at UCSB, Sydney went on to earn a Ph.D. in chemical engineering at Purdue University.

SAHGER LAD *(B.S. 2015)*

Sahger is a software engineer at Wells Fargo under the Technology division, specifically working in AI. Sahger's current focus, in his four years in Data Science, is on model deployment and operationalization. His team recently submitted an AI patent to decrease time to deploy AI models with software engineering best practices built into the tool. Outside of work, he performs stand-up comedy and enjoys playing beach volleyball.

MICHAEL GAURON *(B.S. 1981)*

After graduating, Michael Gauron took a position as a Navy civilian Nuclear Engineer at Pearl Harbor Naval Shipyards until he was accepted to the Navy Flight School and commissioned as an officer in Pensacola, FL. Midway through flight school, Michael decided to go to the military's medical school (Uniformed Services University of the Health Sciences, in Bethesda, MD) where he earned his MD. He completed his Family Medicine Residency at Naval Hospital Camp Pendleton, CA. After many tours in the Middle East with the Marine Corps, Michael transferred to the Air Force. He retired from the Air Force in 2015 as a Colonel. Following retirement he has worked for United Health Care, the Veterans Administration, and he is currently at Nellis Air Force Base in Las Vegas, NV as a staff physician double boarded in Family and Obesity Medicine.

ALUMNI UPDATES

JEFFREY LU *(B.S. 2016)*

Jeffrey worked for several years in sales and process engineering roles in both membrane and semiconductor industries before deciding to move to a more patient-oriented career. Currently a 1st year medical student at the Carle Illinois College of Medicine, where he hopes to combine both his interests in medicine and engineering to innovate new solutions and treat patients. He is interested in rehabilitation medicine, ophthalmology, and sports/family medicine.

HOLLY HIRCHERT *(B.S. 1983)*

In December 2019, Holly (Nony) Hirchert retired from her position as an Environmental Protection Engineer for the Illinois Environmental Protection Agency. Her duties involved inspecting wastewater treatment plants and helping the operators comply with state issued discharge permits. In retirement, Holly delivers food to families from her church's food pantry and sings in the chancel choir. She is also an Election Judge for Champaign County in Champaign, Illinois. Her hobbies include reading, collecting postage stamps, and traveling to visit friends/family.

KAT CAMACHO *(PhD 2015)*

Since UCSB, Kat has continued her passion in advancing therapies for cancer treatments while growing her career in process development. After first gaining experience in small molecules drug substance process development at Bristol-Myers Squibb, she transitioned into cell therapy, where her current role is Associate Director of Viral Vector Process Development. Kat recently got married in a Covid minimony to another UCSB alum Louis Jones (ChE Ph.D 2014), who is now a Senior Systems Engineer at Millennium Space Systems. They currently reside in the South Bay Area.

JULIA DOUGLAS *(B.S. 2013)*

Julia Douglas is a mother to two boys, Oliver and Andrew, and lives in Apex, NC with her husband, fellow UCSB alumnus Geoffrey Douglas (MS CompSci, Class of '14). Now a full-time stay-at-home mom and homeschooler, Julia endeavors to instill her love for learning and an appreciation for the natural wonders of this world in her children every day as they read and explore the outdoors. This year, she has embarked on a challenge to spend 1000 hours outside, and she is well on her way to exceeding that goal.

PHD GRADS

Patrick Corona
Helgeson/Leal
Probing nanostructure and rheology of complex fluids in complex flow histories using small angle scattering

Chung-ta Han
Han
Investigations of the structure-function relationship of transmembrane proteins by studies of proteorhodopsin

Kartik Kamat
Peters
Extending methods for relative stability of polymorphs: A diabat approach

Nathan Prisco
Chmelka
Correlated structure-property relationships in cementitious solids via unconventional spin polarization transfer

St. Elmo Wilken
O'Malley/Petzold
Developing a systems biology framework to engineer anaerobic gut fungi

Jan Garcia
Fredrickson
Understanding membrane formation in nonsolvent-induced phase separation

Clarke Palmer
McFarland
Catalytic methane chemistry in high-temperature molten environments

Candice Swift
O'Malley
Deciphering the functions of natural products from anaerobic fungi for applications in biotechnology

Beihang Yu
Segalman
Polypeptoid chain conformation and its role in block copolymer self-assembly

Chithra Asokan
Christopher
Oxide supported rh catalysts in automotive no reduction chemistry: the roles of atomically dispersed rh, support, water, and dynamic restructuring

Jun Hee Jang
Abu-Omar
Heterogeneous monometallic and bimetallic catalysts for deoxydehydration and catalytic transfer hydrogenation: valorization of sugar alcohols and acids

Pavel Shapturenka
Gordon
Photonic & epitaxial design of bio-inspired, structured surfaces for optoelectronic materials and devices

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And, Chemical Engineering faculty attend the Senior Send-off to congratulate the class of 2021

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