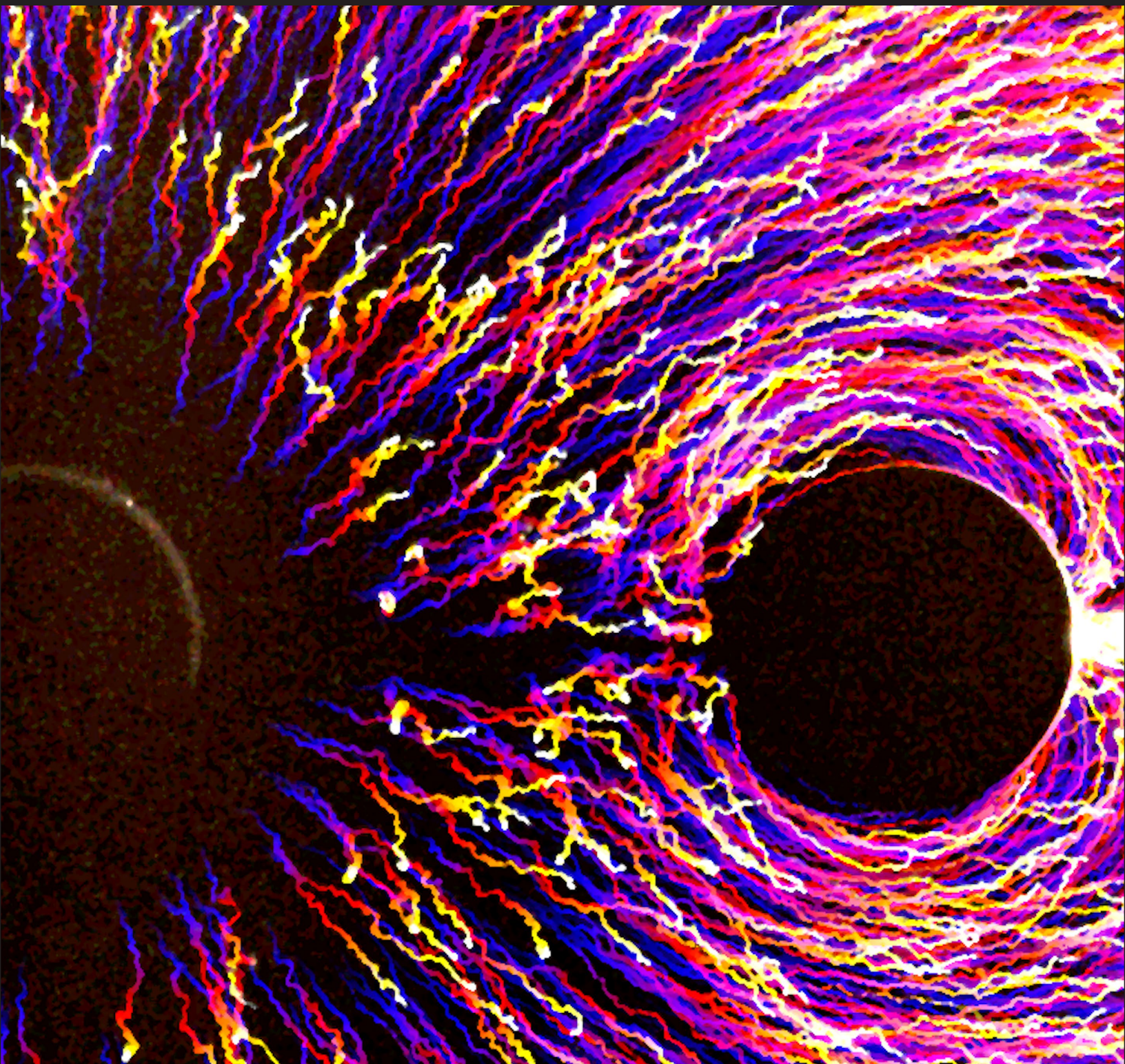


Chemical Engineering at UCSB

2018 Newsletter



CHEMICAL ENGINEERING
UC SANTA BARBARA



A LETTER FROM THE CHAIR

Dear Alumni & Friends,

Chemical Engineering at UC Santa Barbara is a family, and writing this newsletter is very much like writing a holiday card to our friends and relatives. We celebrate new additions and mourn the passing of loved ones; express our deep gratitude for your incredible support, and proudly share our achievements with you.

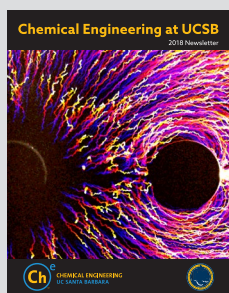


It has been a year of tremendous growth for the faculty in ChE. We are thrilled to welcome Professor James Rawlings as the Mellichamp Process Control Chair. Jim is a leader in model predictive design, and has already initiated collaborations within our department and the broader UCSB Engineering controls community (#3 worldwide in the 2017 Shanghai Rankings for “Automation & Control”). Jim had served on the faculty at the University of Wisconsin for 20 years, and we are delighted to share the Santa Barbara area with him.

Some of you may recognize a familiar face in this issue of our newsletter. Professor Phil Christopher was once an undergrad in UCSB ChE (B.S. 2005), pursued a Ph.D. at the University of Michigan, and launched his faculty career at UC Riverside. He has become a recognized leader in the design and synthesis of new catalysts, and joins us as a Mellichamp Sustainability Cluster Chair. We are also pleased to welcome new Assistant Professor Arnab Mukherjee, who specializes in engineering new ways of visualizing biological activity inside living cells. Arnab comes to UCSB after completing a postdoc at Caltech and a graduate degree at the University of Illinois.

The final new face in the ChE Hallway in Engineering II is Assistant Teaching Professor Joseph Chada. Joe’s hire is a culmination of the recent endowment of the Rinker Undergraduate Teaching Laboratory. Joe is excited to bring new innovations to teaching, both in lecture classes and in the creation of new undergraduate laboratory experiences. We look forward to many years of continuing to ensure that UCSB undergraduates have the most modern and impactful experiences in this important set of courses. See page 7 for more information on these outstanding new members of UC Santa Barbara Chemical Engineering.

We owe tremendous thanks to you, our community, as the generosity of our alumni (both student and faculty alumni!) has enabled the growth you will see throughout this year’s newsletter. As mentioned above, the Rinker Undergraduate Teaching Lab is almost fully endowed, enabling us to enter a new era of focusing on pedagogical development in undergraduate practical training. The irrepressible Professor Emeritus Duncan Mellichamp took the opportunity of his 80th birthday to announce and seed two new endowed chairs in honor of UCSB Chemical Engineering founding faculty members Bob Rinker and Jack Meyers. With support from the many admirers of Dr. Rinker and Dr. Meyers, including Duncan’s wife Suzanne and the Rinker and the Myers families, these two new Founders Chairs are now fully established. They will support the two vice chairs of the department with a goal of encouraging the development of leadership skills within the Chemical Engineering family. Duncan and Suzanne Mellichamp also endowed a new Chair in Systems Engineering to which Professor Mike Doherty has been appointed, and will be featured in a future newsletter.



ON THE COVER:

Art of Science NOW “Poles Apart” by Anirudha Banerjee (Squires Lab) that was on display at Art of Science organized by UCSB’s Schuller Lab, Center for Science and Engineering Partnerships, UCSB College of Creative Studies and the UCSB Library.

Like any family, UCSB ChE has also experienced sadness this year. Jacob Israelachvili, a dear friend, mentor and colleague on the ChE faculty for 32 years, passed away on September 20, 2018, after a long battle with cancer. We will miss him immensely, and extend our deepest condolences to his wife, Trudi Carey, his two daughters and two sons, and his large academic family. A memorium of Jacob is included on page 12 of this newsletter.

In closing, I would like to share with you a picture from a recent “family” celebration with Professor Brad Chmelka’s famous paella.

Best regards,



Rachel Segalman
ChemE Department Chair



Eric McFarland, Michael Gordon, James Rawlings, Francois Reniers, Christopher Bates, Cheryl Rawlings, Michelle O’Malley, Matt Helgeson, Morgan Schultze, chef Brad Chmelka, Rachel Segalman, Songi Han, and Tal Margalith.

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FACULTY HONORS & AWARDS

PROFESSOR BRADLEY CHMELKA Royal Swedish Academy of Engineering Sciences (IVA)

Professor Bradley Chmelka was inducted into The Royal Swedish Academy of Engineering Sciences (IVA) in Stockholm on October 27, 2017, at the 98th Annual Meeting of the IVA.

The IVA's mission is "to promote the engineering and economic sciences and the advancement of business and industry for the benefit of society." In 1919, it was the world's first engineering academy and has approximately an equal number of members from academia and industry. The IVA has a current membership of 1300, of which approximately 40 are from the United States, and Professor Chmelka is the only current member from a University of California (UC) campus. A foreign member may be appointed who has made outstanding efforts in the field of the Academy's activities and has shown particular interest in developing contacts with Swedish research and the Swedish business community.



Professor Bradley Chmelka receiving award, third from right

Election to IVA extends Professor Chmelka's already-substantial Swedish ties. In 2013, he received an honorary doctoral degree from Chalmers University of Technology in Gothenburg, where his research collaborations have led to regular research exchanges among UC Santa Barbara and Chalmers students and faculty. Since 2012 he has served on the Scientific Advisory Board of AkzoNobel's Performance Chemicals Division, and was elected as a foreign member of the Royal Swedish Academy of Sciences in 2015. He has strong scientific contacts in Gothenburg, Stockholm, and Lund.

"I'm very appreciative of this honor, particularly because it reflects positively on the impact that our atomic-level approach to engineering is having on the development and improvement of material properties for diverse energy and environmental applications," said Professor Chmelka. "I am grateful to the IVA for recognizing our research, which crosses traditional disciplinary boundaries between engineering and the sciences."



Photos courtesy IVA, and Vinger Elliot Fotografi

"I'm pleased, too, by this recognition of my group's strong interactions with Sweden, which we've helped to extend to numerous other groups in UCSB's College of Engineering through scientific workshops and research collaborations. Our scientific partnerships with Swedish universities and industry will broaden further through new opportunities opened by this link to the IVA."

Professor Chmelka and his research group work at the boundaries of chemical engineering, materials science, physical chemistry, and applied physics, with the goal of understanding, at an atomic-level, the properties of complicated engineering materials and processes to improve them. Such materials include heterogeneous catalysts for hydrocarbon conversion, chemical production, and automotive pollution reduction; structural materials for high-performance cements that have low carbon footprints; and new mesostructured materials for fuel cells, solar cells, and semiconductor devices.

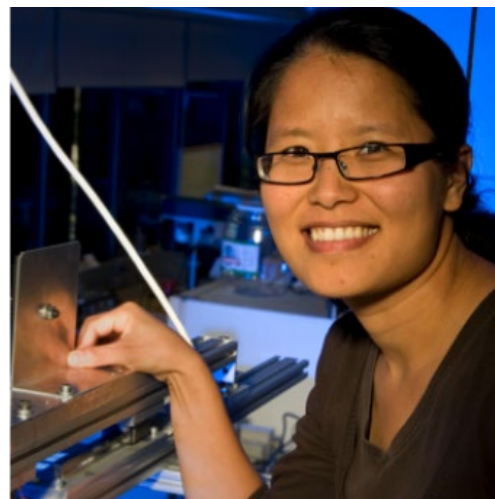
FACULTY HONORS & AWARDS

PROFESSOR SONGI HAN

2019 Biophysical Society Innovation Award

Professor Songi Han has been named the recipient of the 2019 BPS Innovation Award by the Biophysical Society. Professor Han was acknowledged for her invention of solid-state and time-domain-capable dynamic nuclear polarization (DNP) instrumentation, as well as Overhauser dynamic nuclear polarization to characterize surface water in biological and soft materials.

Her innovations enable sophisticated new probes of biological hydration, and allow surface water difference landscapes to be completely mapped around globular proteins. Additionally, her methods enable deeper understanding of binding thermodynamics, and imaging across the blood-brain barrier using hyperpolarized water. The BPS award will be presented at the Awards Committee Annual Meeting in Baltimore, Maryland, with an award presentation on March 5, 2019.



“We presented our development of Overhauser DNP to measure the water dynamics coupled to the surface of protein, and received strong approval by the community that is known to be very critical and skeptical towards new techniques,” Professor Han shared. “However, the real work is beginning now.”

PROFESSOR MICHELLE O'MALLEY

2019 ACS BIOT Young Investigators Award

ACS BIOT (Division of Biochemical Technology of the American Chemical Society) has awarded ChE Professor Michelle O'Malley with the Young Investigator Award. The BIOT Young Investigator Award, sponsored by Genentech, Inc., recognizes an outstanding contributor, 40 years of age or younger, to the field of biochemical technology.

ACS WCC Rising Star Award

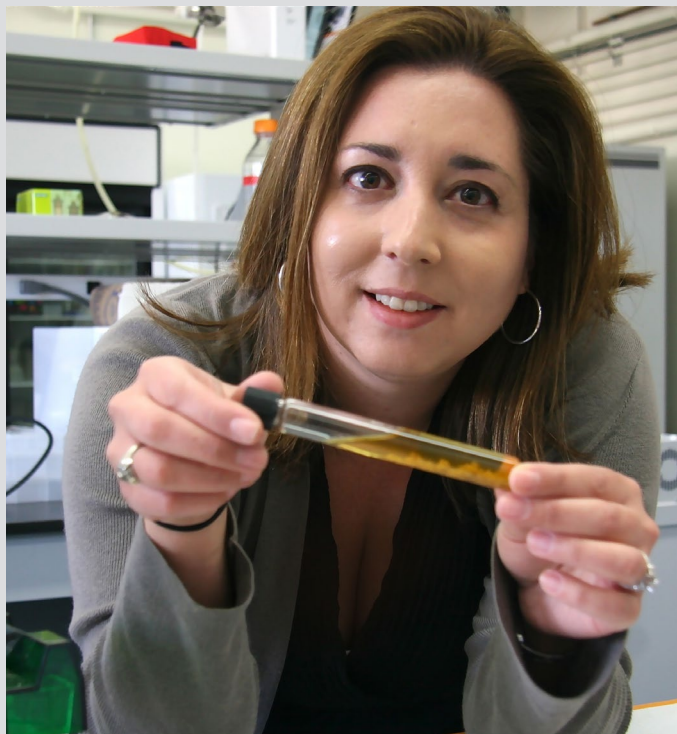
Professor O'Malley was named one of six “Rising Stars” by the Women Chemists Committee of the American Chemical Society.

“This award is meant to recognize young women who have emerged as early leaders in their field,” O'Malley shared. “I hope to continue to live up to this standard, and to leverage my position to encourage other young women to become leading chemical engineers.”

2017 Dreyfus Teacher-Scholar Award

Professor O'Malley is one of thirteen university faculty members in the United States to receive a 2017 Dreyfus Teacher-Scholar award. The awards, presented by the Camille and Henry Dreyfus Foundation, honor young professors who have created an outstanding independent body of scholarship and are deeply committed to education. Each Camille Dreyfus Teacher-Scholar receives an unrestricted research grant of \$75,000.

“I am extremely honored to be recognized by the Dreyfus Foundation, and to be counted among its elite list of teacher-scholars,” O'Malley said. “It's really special to be recognized for innovating the classroom experience. My mission is to inspire and empower undergraduates so that they can be leaders in biotechnology. This award will allow me to pilot a new program that brings biotech research to the chemical engineering classroom, which I'm really excited about.”



FACULTY HONORS & AWARDS

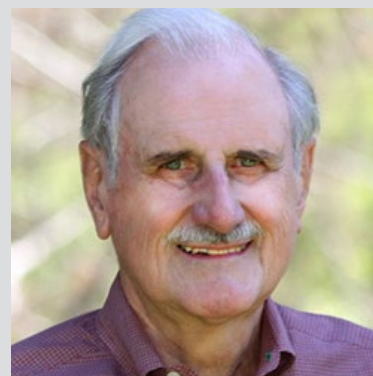
PROFESSOR EMERITUS DUNCAN MELLICHAMP

2018 Oliver Johnson Award for Distinguished Leadership

Professor Emeritus and UC Academic Senate chair Duncan Mellichamp has been awarded the 2018 Oliver Johnson Award for Distinguished Leadership in the Academic Senate. This distinguished award is presented biennially to honor an Academic Senate member, in recognition of lifetime service to the Senate, outstanding and creative contributions to faculty governance, and exceptional abilities in working with different University constituents.

“UC Academic Senate chair is a position of great responsibility, but Professor Mellichamp’s contributions are especially wide and deep,” said 2017-18 Academic Senate Chair Shane White.

“Duncan’s leadership and service to the department, college, campus, and system, not to mention discipline, for the last 50 years are not only heartily valued but something we all aspire to,” said Rachel Segalman, Edward Noble Kramer Professor and Department of Chemical Engineering Chair. “This well-deserved award demonstrates a lifetime of commitment to the University of California, and we in Chemical Engineering are honored to have Duncan as part of the team.”



PROFESSOR GLENN FREDRICKSON

2017 Materials Theory Award

The Materials Research Society (MRS) named Professor Glenn H. Fredrickson as the recipient of the 2017 Materials Theory Award for, “pioneering the development of field-theoretic computer simulation methods and their application to investigate and design self-assembling polymers and soft materials.”

“I am excited about two new classes of field-theory models that are amenable to field-theoretic simulations (FTS) – the construct for which I am being recognized by the MRS,” Fredrickson said. “The first class involves soft materials or polymers where the individual molecules or polymer segments have an intrinsic polarizability or permanent dipole in addition to an optional charge or monopole.”

The Fredrickson Group conducts a broad range of research activities in theoretical and computational polymer science, many of these aimed at understanding self-assembling polymers and complex fluids, and especially block copolymer systems. A second class of models are inspired by the structure of second quantized field theory, and work by S.F. Edwards and K. Freed that dates back to 1970.

“We have shown that this ‘coherent states’ field theory representation is a powerful way to describe supramolecular polymer systems,” Fredrickson shared. “Namely polymers containing reversibly bonding functional groups that link via supramolecular chemistry to form complex macromolecular architectures, morphologies and properties.”



PROFESSOR M. SCOTT SHELL

2017 AIChE CoMSEF Impact Award

Professor Scott Shell was named the 2017 recipient of the AIChE CoMSEF Impact Award. The Computational Molecular Science and Engineering Forum award recognizes outstanding research in computational molecular science and engineering, encompassing both methods and applications.

“It’s a tremendous honor to be recognized by this particular community of peers that knows our work so well,” said Shell.

Professor Shell was recognized, “for the development of a powerful statistical mechanical theory of coarse-graining and associated multiscale algorithms to understand complex biomolecular, liquid, and soft material systems.” He received the AIChE CoMSEF Impact award at the AIChE Annual Meeting held in Minneapolis, MN. As part of the award, Professor Shell gave an invited talk within the CoMSEF Plenary session describing his research.



Prof. M. Scott Shell, right



ASSOCIATE PROFESSOR PHILLIP CHRISTOPHER

Professor Christopher's research group focuses on heterogeneous catalysis and photocatalysis with interest in understanding fundamental aspects of active site characteristics and reaction mechanisms and applying these insights to the design of more efficient and sustainable materials and processes for chemicals and fuels production, as well as environmental protection.

"Phil provides a unique perspective on catalytic reactions by combining atomic control with theoretical insights," said Mahdi Abu-Omar, Mellichamp Cluster Chair of Green Chemistry, Departments of Chemistry and Chemical Engineering. "He also has the reaction engineering perspective covered, where the intersection of new science and potential energy applications can be realized."

His expertise is in designing new routes to decarbonize our economy, using solar energy and renewable carbon to replace the fossil fuels which currently provide most of our energy and raw materials for manufacturing. This goal requires engineers to think about how society will obtain its energy in the future, and it is a particular preoccupation of the chemical engineers who specialize in the interconversion of energy and matter.

Catalytic processes are relied upon globally for trillions of dollars per year of industry. The conversion of oil to gasoline, transformation of natural gas and nitrogen into fertilizer, and conversion of un-burnt fuels into less harmful gasses in the tail pipes of cars all rely on solid-state catalysts. Increasing demands for efficient, environmentally friendly chemical processes, in concert with the push to utilize emerging natural resources, rely on the development novel catalytic materials and processes for success.

Prof. Christopher's research group uses principles from chemical engineering, materials science, physical chemistry and solid-state physics to engineer catalytic reactions towards these goals. They develop molecular level insights into governing phenomena of catalytic reactions by coupling quantum chemical calculations with an array of experimental and characterization techniques. Mechanistic insights are utilized to guide the synthesis of catalysts with targeted geometries, compositions and architectures.

"Phil is well-positioned to train the next generation of chemical engineers to understand issues in sustainability, and to generate new manufacturing solutions that involve better management of our natural resources," said Susannah Scott, Chemical Engineering Department Professor, and Mellichamp Cluster Chair, Sustainable Catalytic Processing.



ASSISTANT PROFESSOR ARNAB MUKHERJEE

Professor Mukherjee's research focuses on engineering proteins with unusual properties (such as paramagnetism, water diffusion, and photoreception) to develop genetic reporters for imaging cell function in challenging environments – specifically, in O₂-starved milieu or deep inside living tissues.

"A great deal of what we know about how cells function hinges on our ability to directly observe the inner workings of the cell using fluorescent reporter proteins originally discovered in the jellyfish," says Mukherjee. However, these standard jellyfish proteins fail to perform when deployed in anaerobic cells (such as those comprising our gut microbiome), or deep inside live animal models of disease, injury, and therapy.

A central goal of Mukherjee's research is to illuminate this largely invisible "dark matter" of biology, by developing new genetic reporters that function in low-O₂ conditions or in the context of deep-seated tissues. To achieve this goal, the Mukherjee Lab applies protein engineering to develop new genetic reporters and sensors that enable O₂-independent fluorescence imaging or deep tissue penetrant magnetic resonance imaging (MRI). The biomolecular imaging agents developed in the Mukherjee Lab will be useful for studying a wide range of problems encompassing cancer, neurobiology, degenerative diseases, infections, anaerobic microbiology, and immunotherapy.

"As molecular imaging is an inherently multidisciplinary field, I am looking forward to leveraging UCSB's culture of interdisciplinary science, through collaborations with the Center for Bioengineering (CBE), Molecular, Cellular, and Developmental Biology (MCDB), and Psychology and Brain Sciences, to identify new and challenging avenues for applying anaerobic and deep-tissue imaging reporters," says Mukherjee. "In addition, I am really excited about training students in chemical engineering to think creatively, inclusively, and laterally, to engineer new frontiers in biomolecular engineering and molecular imaging."

NEW FACULTY



TEACHING PROFESSOR JOE CHADA

We are pleased to welcome Joseph Chada to UCSB ChE as our first tenure-track teaching professor. In his new position Joe will focus on developing an effective teaching pedagogy and continual improvement of the Rinker Undergrad Laboratory.

"It is a tremendous privilege to be a part of a department with as strong of a reputation as Chemical Engineering at UC Santa Barbara," Chada shared. "When searching for a position after my PhD, I was drawn to both the vast resources of UCSB and the collegiality of the department."

Chada received his PhD in Chemical and Biological Engineering from the University of Wisconsin-Madison, and BS in Chemical Engineering from West Virginia University.

"At WVU, I was extremely fortunate to enroll in a department which placed a high priority on undergraduate education," Chada said. "The effort put forth by the faculty to integrate each class in the curriculum to serve as a part of a large optimization and design project was an impressive achievement."

Interested in integrating undergrad coursework into more coherent programs, Chada joined a strong research group at UW-Madison that further improved his ability to apply the same fundamental analysis and problem-solving skills to the laboratory. His main research interest now is in the development of effective educational experiments and teaching techniques with an emphasis on laboratory education.

"Coming from a laboratory-intensive background at UW-Madison, I have been able to mentor a number of undergraduates throughout their first research experience," Chada said. "It is a fulfilling experience to help facilitate a student's growth as they learn how to approach open-ended problems."

Chada is excited to work with Prof. Mike Gordon in the undergraduate laboratory at UCSB to continue developing modern experiments which will allow students to experience the types of challenges faced by practicing engineers, in addition to the academic and industrial researchers of the future.



ASSISTANT PROFESSOR SHO TAKATORI TO JOIN THE DEPARTMENT IN 2019

Currently a Miller Research Fellow at UC Berkeley, Takatori received a BS in Chemical Engineering at UC Berkeley, and a PhD in Chemical Engineering with John Brady at the California Institute of Technology, where he was a NSF fellow and a Gates Millennium Scholar supported by the Bill & Melinda Gates Foundation. He spent a part of his graduate studies as a visiting scholar in Jan Vermant's soft matter and interfacial rheology group at ETH Zürich.

Takatori looks forward to teaching a variety of chemical engineering courses as a faculty member, in particular fluid mechanics and transport phenomena at the graduate and undergraduate levels. In addition to transport phenomena, he is interested in teaching special

topics courses on low-Reynolds number hydrodynamics and soft matter physics. He will strive to emphasize the nature of technical and scientific communication in all of his courses.

Takatori is interested in the statistical mechanics and fluid dynamics of biological soft matter systems. Living materials such as microbial biofilms have the ability to actively generate mechanical forces and stresses that give rise to nonequilibrium behaviors not exhibited by passive soft materials like synthetic polymer gels. In his research, he combines techniques of computational and experimental soft matter, biophysics, and synthetic biology to study how collective dynamics among individuals can give rise to emergent macroscopic properties and affect evolutionary outcomes within populations. These insights will advance fundamental understanding of living soft materials like microbial communities, and could also lead to the design of bio-inspired, adaptive complex fluids for applications in medicine, manufacturing, and biomaterials.

He is most excited to pursue collaborative and interdisciplinary work with world-renowned faculty in chemical engineering, and to leverage the unique opportunities available at the Kavli Institute for Theoretical Physics (KITP) and the Materials Research Laboratory (MRL), and "looks forward to working with students in chemical engineering to think deeply about basic fundamental problems in nonequilibrium physics, but also to develop creative engineering solutions that address global environmental and human health challenges."

PROFESSOR JAMES B. RAWLINGS

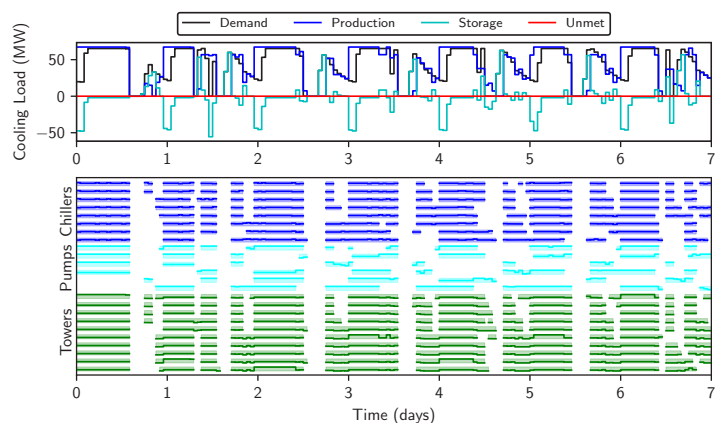
The reputation and impact of UCSB ChE continues to grow through research, teaching, service and publication, and was further enhanced on July 1, 2018, when James B. (Jim) Rawlings joined an already outstanding faculty as a Professor and the Mellichamp Chair in Process Control.

Professor Rawlings is widely regarded as the leader in the field of Process Control. He is a member of the National Academy of Engineering and the Process Automation Hall of Fame. Rawlings has been awarded the William H. Walker Award of the American Institute of Chemical Engineering (AIChE), and is a Fellow of AIChE, the Institute of Electrical and Electronics Engineers, and the International Federation of Automatic Control.

As the Mellichamp Chair in Process control, Rawlings will bridge Chemical Engineering's effort in this area with UCSB's world-leading control programs in Mechanical Engineering, Electrical Engineering and Computer Science.

Professor Rawlings's work is an ideal fit with UCSB's large investment in theory and simulation in the Chemical Engineering department, as well as our well-recognized leadership in kinetics, catalysis, and chemical engineering.

Professor Rawling's most notable contribution to the discipline of Chemical Engineering is his research in model predictive control (MPC), which has had a global impact on the fundamental understanding and industrial practice of process control. Whereas classical methods for chemical process control are based on the tuning of simple analytic feedback forms like PID control laws, MPC uses models to predict and then optimize the future behavior of the system. This optimization is repeated as measurements become available creating a feedback controller that is responsive to unexpected changes in the environment. While the chemical industry has been working toward implementation of empirical versions of MPC, Professor Rawlings developed the comprehensive theoretical foundation on which this method is based. His linear and nonlinear model-based process control strategies have led to deeper theoretical understanding of the problem, new plant control schemes, and many industrial applications. Professor Rawling's work now extends to a wide variety of problems ranging from new plant control schemes (disturbance rejection, regulation, and constraint handling) to optimization of process economics.



The graphic shows a recent collaboration with Johnson Controls that optimizes the energy consumed for the HVAC of the Stanford Canyons.



In 1985, Rawlings received his PhD in Chemical Engineering from the University of Wisconsin-Madison, followed by a Postdoctoral Fellowship at the Institute for System Dynamics and Process Control at the University of Stuttgart in Germany. One year later, he was appointed as Assistant Professor in Chemical Engineering at the University of Texas at Austin. Moving to the University of Wisconsin-Madison in 1995 as a Full Professor, Rawlings would establish and run his world-renowned research group for the next 23 years, until relocating to UCSB in the summer of 2018.

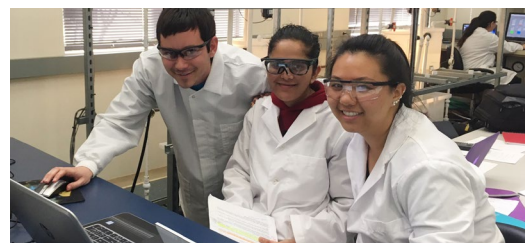
Professor Rawlings also has a remarkable reputation as a teacher, scholar and citizen to the global chemical engineering community. He has co-authored 4 textbooks that share a common thread of modernizing the chemical engineering curriculum to incorporate computation and modeling at all levels. One of these books, *Chemical Reactor Analysis and Design Fundamentals*, has been adopted broadly in required reactor design courses taught throughout chemical engineering undergraduate programs. This book is particularly notable for its use of technology, both in the form of in-classroom materials, and in allowing computing advances to reshape the way traditional subjects are taught.

Similarly, he has innovated in the teaching of mathematics to chemical engineers at the graduate level by incorporating modeling and computer-based analysis into the course material presented in his text, *Modeling and Analysis Principles for Chemical and Biological Engineers*.

The UCSB Department of Chemical Engineering is honored to have Jim Rawlings join us in Santa Barbara. Our undergraduates, graduates, and faculty are fortunate to learn from Jim and interact with him.

UNDERGRADUATE RINKER LAB

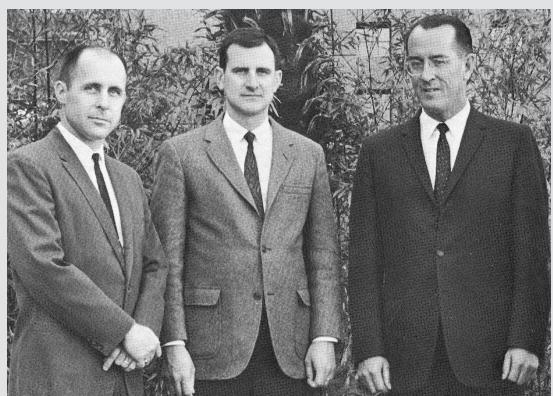
In celebration of 50 years of innovation and research, we are excited to be nearing our goal of a \$1 million endowment to keep the undergraduate chemical engineering lab at the forefront of science and engineering. Named to honor Professor Emeritus Robert Rinker, who was the department's first faculty member and former Associate Dean for Undergraduate Programs College of Engineering, only \$100,000 remains to reach our milestone to modernize the Rinker teaching lab and instructional facilities in perpetuity.



Our goals are to design and construct lab experiments that reinforce fundamental Chemical Engineering principles; expose students to industrially-relevant lab situations and provide practical training on modern, automated equipment; and create a functional, adaptable, and hands-on learning environment that will evolve with the Chemical Engineering profession.

ENDOWED FOUNDERS CHAIRS

In 1965, just 6 years after awarding its first PhD degree, UC Santa Barbara decided to build a new department in the high stakes world of Chemical Engineering. UCSB made the inspired decision to hire Dr. Robert "Bob" Rinker from California Institute of Technology, with a mandate to build a Chemical Engineering program from scratch at UCSB, while also moving and maintaining his own research program. He recruited John E. "Jack" Myers, who left Purdue University in 1966 to become UCSB ChE's second faculty member and first department chair. Together, the two "founders" recruited an entire faculty, and together developed undergraduate and graduate curricula, established the MS and PhD programs, and designed and built laboratories. By 1968, the faculty had grown to six, who graduated the first six Chemical Engineers from UCSB. Not a bad faculty to student ratio!



Bob Rinker, Duncan Mellichamp, and Jack Myers in 1967

50 years later, Duncan celebrated his 80th birthday with friends, family, and chemical engineers alike at the Mosher Alumni House. He reflected on the 61 years of service Rinker and Myers devoted to UCSB, selflessly laying the foundation for the world-class Chemical Engineering department we enjoy today. He then announced a generous gift to seed a campaign to endow two new chairs in their honor. The Mellichamps' generosity inspired students, alumni, colleagues and friends of UCSB ChE to fully endow both the Myers and Rinker Founders Chairs in Chemical Engineering.

The founders made another visionary hire, luring Dr. Duncan Mellichamp away from a higher-paying and more secure job at Dupont Textile in North Carolina.



Duncan and Suzanne Mellichamp

In addition to the significant honor an endowed chair represents for a professor, it also provides a source of valuable, 'no strings attached' funding to support research and scholarship. Sponsors' generous gifts are invested and actively managed to ensure the chair's endowment will exist in perpetuity, but also to yield a return that the chairholder can use to support students, seed exploratory research projects, purchase laboratory equipment, send students to conferences, or other research-related needs.



MICHAEL GORDON

Robert Rinker Founders Chair



M. SCOTT SHELL

John E. Myers Founders Chair

The department is proud to appoint the Robert Rinker and John E. Myers founders chairs to Vice Chairs Michael Gordon and Scott Shell – who work tirelessly to enhance the undergraduate and graduate programs, while maintaining world-renowned research groups. We are pleased to honor the effort and vision of the founders themselves, and offer deep gratitude for the extraordinary generosity of the friends, alumni, colleagues, and sponsors that enable us to do so.

NEW BIOENGINEERING BUILDING

A new BioEngineering building opened on October 19, 2017, and is now home to 15 faculty who share 17,200 square feet of laboratory space. The 45,000-square-foot glass, metal and concrete building will provide for new collaborations and cross-discipline directions in problem-solving and discovery.

Chemical Engineering's own Professor Siddarth Dey now has his office and lab in this impressive site.

"It's been exciting to set up our lab in the new Bioengineering building as this space has the necessary infrastructure to work with biological samples," said Prof. Dey. "The building is also designed as an open-plan laboratory with no walls between individual labs making it easier to access and share equipment across research groups."



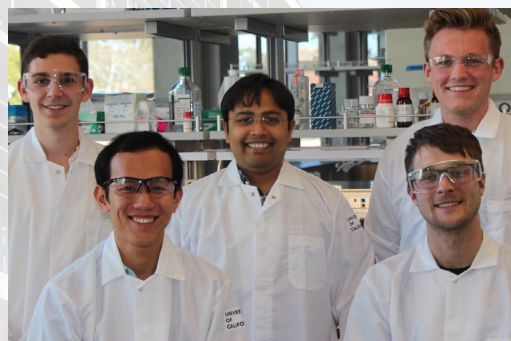
Graduate students Sam Wilson and Chad Wangsanuwat at work in the Dey Lab.

The building includes a variety of "smart" sustainability features including natural light and ventilation, as well as efficient temperature controls. A more centralized location on campus also provides increased access for collaboration.

"The new building has brought several bioengineering focused groups from across campus under a single roof that has helped initiate collaborations," Prof. Dey shared. "We are also excited to be located centrally on campus and look forward to working closely with labs affiliated with both engineering and biology."



New Bioengineering building opened fall quarter 2017



Rob Jones, Prof. Siddarth Dey, Alex Chialastri, Chad Wangsanuwat, and Sam Wilson.

M-WET: \$10.75M CENTER DEDICATED TO THE FUTURE OF WATER TREATMENT



A multidisciplinary team at UCSB has partnered with UT Austin and Lawrence Berkeley National Lab in a major effort to address critical issues for the future of water purification. The U.S. Department of Energy (through the Energy Frontiers Research Center program) has funded a \$10.75 million center dedicated to filling knowledge gaps in water science, specifically the development of new methods for the treatment of chemically contaminated water.

The Center for Materials for Water and Energy Systems (M-WET) brings together world-class researchers from UCSB, UT-Austin and Lawrence Berkeley National Lab, leveraging their expertise in polymer physics, chemistry and materials science to tackle the complex scientific and technological challenges facing the future of water treatment and management.

UCSB ChE chair Rachel Seagelman is the project's associate director and principal investigator of the UCSB team. She leads a group of 10 UCSB scientists, which includes ChE faculty Michael Doherty, Scott Shell, Todd Squires, Glenn Frederickson, Songi Han (ChE & Chemistry), Christopher Bates (ChE & Materials), Mahdi Abu-Omar (ChE & Chemistry), and Craig Hawker (Materials & Chemistry).

A LEGACY OF DISCOVERY: REMEMBERING JACOB ISRAELACHVILI

Regarded as one of the most influential chemical engineers in the modern era, Jacob Israelachvili lost his battle with cancer on September 10, 2018. Israelachvili spent more than 30 years as a professor at the University of California, Santa Barbara, with joint appointments in the chemical engineering and materials departments. He led the Interfacial Sciences Lab, and his research focused on the various interactions between molecules and surfaces, principally in a liquid environment. Israelachvili leaves a legacy of innovation, collaboration, and groundbreaking research.

"Jacob was a legend in his field, a great citizen on campus, and a strong advocate for UCSB and his students," said Rod Alferness, dean of UCSB's College of Engineering. "Thousands of his students, colleagues, and scientists are where they are today and on the brink of discovery because of him."



Professor Jacob Israelachvili, 1944-2018

Israelachvili's impact on the scientific community started nearly 50 years ago when he designed a new surface force apparatus (SFA) to measure force interactions in liquid. His device measured forces whose separation could be controlled and measured with better-than-Angstrom precision, down to the very force between two electrons separated by a nanometer.

Then in 1985, he published his textbook "Intermolecular and Surface Forces," regarded to this day as the definitive textbook in the field of intermolecular forces. He released multiple updated editions and saw his book translated into Japanese, Russian and Chinese. The American Institute of Chemical Engineers (AIChE) presented him with the William H. Walker Award for Excellence in Contributions to Chemical Engineering Literature in 2012. The AIChE later named Israelachvili one of the top "One Hundred Chemical Engineers of the Modern Era."

Matthew Tirrell worked alongside Israelachvili from 1999-2009 while serving as the dean of UCSB's College of Engineering. Tirrell, who is currently the dean of the Institute for Molecular Engineering at the University of Chicago, said his long-time friend was in a class all by himself.

"Jacob Israelachvili was sui generis in the world of interfacial science," said Tirrell, a pioneering researcher in the fields of biomolecular engineering and nanotechnology. "A builder of uniquely powerful tools, author of broadly influential articles and books, and mentor to hundreds of younger scientists, Jacob gave the world its first direct look into many aspects of interfacial structures and forces. He had a profound ability and patience to focus on his interests, whether it was the new instrument he was designing or the person he was engaging in discussion."

Cited in more than 500 scientific journals over the years, Israelachvili's research group examined and measured the fundamental forces and interactions that govern people's everyday lives. They studied how forces contributed to friction, fluidity, adhesion, lubrication, dissolution, wear, and repulsion. His team received acclaim in 2011 for developing a breakthrough equation that predicted molecular forces in hydrophobic interactions.

While at UCSB, Israelachvili embraced the collaborative atmosphere and broadened the scope of his research to span several fields of study. His group helped to solve several mysteries including: how geckos climb up vertical surfaces; the recovery of oil from the ground; the friction and lubrication of mammalian joints; and the physical mechanisms behind autoimmune diseases like multiple sclerosis.

Colleagues like Herbert Waite, a distinguished professor of biochemistry at UCSB and co-leader of the Materials Research Science and Engineering Center, praised Israelachvili for his quest for discovery and willingness to participate in multidisciplinary research. The two worked together to understand how the molecules used by mussels adhere themselves to underwater rocks.

"During my 10-year research collaboration with Jacob, he often challenged me to go beyond the nanometer length scale of processes like adhesion in living organisms," said Waite, who worked with Israelachvili to simplify bio-inspired themes for wet adhesion. "I resisted for a bit because biochemists rarely adjust their sights beyond a few hundred nanometers. However, when we bit the bullet, a font of new insights emerged. Not even he imagined what came to be, but he predicted breakthrough."

Israelachvili was a Fellow of the Royal Society of London, the oldest scientific academy in continuous existence, whose members include Charles Darwin, Isaac Newton, Albert Einstein, and Stephen Hawking. He was also a member of the U.S. National Academy of Engineering, the U.S. National Academy of Sciences; and the American Physical Society.

STUDENT AWARDS AND ACHIEVEMENTS

Anirudha Banerjee Receives Schlinger Fellowship for 2017-18



The 2017-18 Schlinger Fellowship for Excellence in Chemical Engineering Research has been awarded by the faculty of the Department of Chemical Engineering to Anirudha Banerjee. The Schlinger Fellowship is awarded based on publications, submitted manuscripts, and other measures of impact.

"The UCSB ChemE Department is known for its excellent graduate program and quality of research, and I feel honored to be recognized among such a talented group," Banerjee said. "This recognition and support definitely motivates open-ended research and encourages one to push their boundaries even further, and it will give me flexibility to explore other interesting aspects of my project and the confidence to keep pursuing my ideas!"

Banerjee is part of the Squires Research Group. His research involves novel strategies to manipulate and control particles suspended in complex fluid formulations.

Five UCSB BS Graduates Awarded NSF Graduate Research Fellowships

Michael Abramovitch, Jenna Ott, and Alexander Khechfe graduated in 2018, and will pursue PhD's at the University of Delaware, Princeton University, MIT, respectively. Sarah Maxell and Austin Graham graduated in 2016, and are currently pursuing PhD research at UC Irvine and the University of Texas at Austin.



**MICHAEL
ABRAMOVITCH**
BS 2018



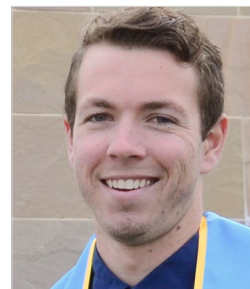
JENNA OTT
BS 2018



**ALEXANDER
KHECFE**
BS 2018



SARAH MAXEL
BS 2016



AUSTIN GRAHAM
BS 2016



SHIRI ARNON
John and Sheila Lake
Excellence Award
Seshadri Lab



ALEXANDER KHECFE
Tirrell Award for Distinction
in Undergraduate Research
McFarland Lab

Chemical Engineering Undergrads Shiri Arnon and Alexander Khechfe were presented college-wide awards at the College of Engineering commencement ceremony on June 17, 2018. College of Engineering Dean and Richard A. Uhll Professor, Rod C. Alferness (pictured at left with Arnon and Khechfe) presented the awards.

Arnon received the John and Sheila Lake Excellence Award, which is given annually by the College of Engineering to undergraduate students in recognition of outstanding service and academic scholarship. Shiri plans to return to Israel and embark upon a career in chemical engineering.

The Tirrell Award for Distinction in Undergraduate Research was awarded to Khechfe in recognition of the excellence and promise he has shown during his research pursuits. He will be attending MIT in the fall to pursue a PhD in chemical engineering, where Khechfe plans to continue working on problems that involve clean fuel generation or energy conversion.

UCSB AIChE STUDENT CHAPTER NEWS

As one of the most active professional societies on campus, UCSB AIChE is fully invested in catalyzing the professional development of our members through industry speaking events, plant tours, career building workshops, and research seminars. The goal of our organization is to create an opportunity-enriched environment in which students can fulfill their true potential.

Conventionality Belongs to Yesterday

Service to our Chemical Engineering Community is one of the core values that drive the Officers of UCSB AIChE to work to facilitate new relationships between the Department and the leading innovators of today's industry. As more and more of our graduates pursue industries traditionally unassociated with chemical engineering, AIChE stays ahead of the trend by hosting a variety of speakers ranging from SpaceX's Launch Pad Systems and Operations Manager Nate Janzen, Shell Oil's process evaluations engineer Dr. Nihar Phalak, and accomplished faculty members from UCSB.

Helping students achieve their career goals

UCSB AIChE partners with numerous industries to create an environment where industry representatives can interact and recruit from chemical engineering students. Since Fall 2015, we have hosted, co-hosted, or otherwise promoted over a dozen events with companies ranging from small start-ups to global corporations. Some notable corporate appearances include Proctor and Gamble, Amgen, Gilead, and EcoServices (formerly Solvay). We've hosted process engineers from local startups (ZPower). Our organization also holds strong ties with Clorox, our main sponsor, who has continued to return in support of UCSB AIChE and to recruit multiple interns each fall. Another one of our more popular events, Lunch with Faculty, establishes dialogue between students and professors. Not only is this a great chance to learn more about the department and possible paths to graduate school, but students can also find out what professors do outside of office hours. We value these events as an opportunity to build our network and connect speakers with our talented undergraduate students.



Information sessions go hand-in-hand with on-site plant tours

When a company comes to campus and witnesses firsthand the professional and motivated spirit of UCSB Chemical Engineering students, they often invite us on a tour of their facilities. Plant tours, such as the one pictured at Dow Chemical, give students a unique insight into the unique operations of a traditional chemical plant and what it truly means to work as an engineer. In spring 2017, students were thrilled to attend a tour at the Hyperion Water Reclamation Plant, Los Angeles's oldest and largest wastewater treatment facility.

Social and Community Outreach

It is important for us to educate and motivate the generations to come. This year, we volunteered with Your Children's Trees to help bring back and take care of Santa Barbara County's urban forests. Community service events allow us to make a positive impact while building favorable relationships with the local community.

Future Plans

This year we welcomed something entirely new to the UCSB AIChE agenda – an inaugural Chemical Engineering Research Fair, where graduate students in need of interns met face to face with potential candidates. The Chemical Engineering Research fair was an immensely successful event and the culmination of a strong relationship between UCSB AIChE and the Graduate Students Association. There are additional professional and outreach events planned, as well as the January distribution of our popular UCSB Chemical Engineering apparel.

Visit UCSB AIChE's website at www.ucsbaiiche.com for event updates and schedules, video interviews with industry and academia professionals, and more!

UC Santa Barbara AIChE Student Chapter Officers (2018-19)

Co-President: Melissa Morales

Co-President: Quentin Kim

External Vice President: Mia Zimmer

Internal Vice President: Charlotte Dai

Treasurer: Adi Menon

Industry Chair: Nikola Malinov

Sponsorship Chair: Rex Reece

Internal Department Chair: Carly Pawell

Media Chair: Isaac Zakaria

Social Chair: Ginny Wang

Outreach Coordinator: Joshua Rodriguez

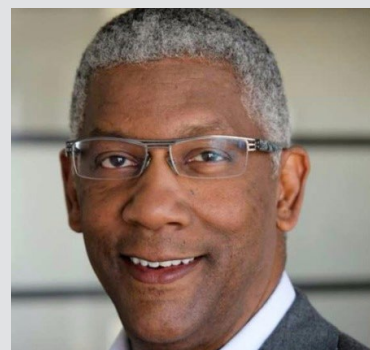
Exec. Student Committee Liaison: Jacob Brooks

Darryl T. McCall, BS 1978

After graduating from UCSB, Darryl T. McCall joined Procter & Gamble in Cincinnati, Ohio, holding numerous positions in engineering and as the general manager of the global personal cleansing care business. McCall rose to serve as vice president for product supply in the global fabric care division, leading an organization comprised of 37 manufacturing operations and 16,000 employees around the world.

In 2008, McCall retired from P&G and became the head of global supply chain and a member of the executive committee at Coty, Inc., a beauty company, in Paris, France. He helped take Coty public with an IPO in 2013, then retired from Coty in 2014. In 2016, he became President and COO of Legacy Acquisition Corp, which completed an IPO in November 2017, and he joined the Board of Directors for HCP Packaging, a portfolio company of Baring Asia Private Equity, whose headquarters are in Shanghai.

McCall renewed his relationship with UC Santa Barbara in 2005, attracted by an invitation from Professors Robert Rinker and Duncan Mellichamp to join the Chemical Engineering External Advisory Board, where he served until 2016. During his tenure, he was a steadfast advocate for the inclusion of female professors. He co-chaired the campaign to create an endowment for the Dr. Robert Rinker Chemical Engineering Undergraduate Laboratory, which he still champions. McCall became a Trustee of the UC Santa Barbara Foundation in 2018, and currently serves as its vice-chair for donor relations, and on the executive committee.



Christina M. Borgese, BS 2005

Christina M. Borgese was recognized as one of AIChE's "30 Under 30," in 2014, and was again honored four years later as one of AIChE's "35 under 35" awards. The recognition acknowledges her leadership skills, innovation, and forward-thinking methods of applying the principles of chemistry and chemical engineering to business management and technology.

Borgese is the vice president of PreProcess, Inc., a chemical engineering consulting firm for entrepreneurs she cofounded in 2010 with fellow Gaucho alumnus Marc Privitera (BS ChE 1986). "I bring the youthful enthusiasm, he brings the gray hair experience, and it all works out," Borgese explained.

Today, PreProcess works with major clients on mid-to-large scale projects ranging from hundreds of millions to billions of dollars, in an array of industries and projects from mining to foods to wastewater. "We really like working with startups, we love working on new technology, and we like applying the chemical engineering aspects to different applications in the field," she said.

Her innovative approach was honed from a bachelor's degree in chemical engineering, and experiences while earning the Technology Entrepreneurship Certificate with a team in the Technology Management Program. TMP at UC Santa Barbara provides a path for students to acquire deeper understanding of cutting-edge entrepreneurial and business practices in global-technology based companies.



photo courtesy of Christina M. Borgese

Aaron Anselmo, PhD 2015

Aaron Anselmo joined the University of North Carolina at Chapel Hill on July 31, 2017, as an assistant professor at the Eshelman School of Pharmacy, following his 2015 PhD under supervision of Prof. Samir Mitragori.

In broad terms, Anselmo aims to develop approaches to replace the pathogenic microbes in our body with therapeutic ones. His research focuses on how our microbiota composition promotes either health, or disease, in the community of fungi, viruses, and bacteria, that live within the human gastro-intestinal system.

"My research will lead to the development of next-generation cell therapies — for example, microbe/bacteria-based delivery systems — to ensure that our microbiota is in a state that promotes gastrointestinal and overall health," Anselmo said. "I will address the main challenges currently facing the delivery of therapeutic microbes to, and integration into, the gastrointestinal tract."

A separate challenge Anselmo's work faces is the delivered microbe must navigate our complex mucosal barrier to interact and displace pathogenic microbes. His efforts here will be to formulate therapeutic microbes with polymers and other biomolecules, equipping them to survive the unforgiving conditions of our gastrointestinal tract, and integrate into our existing microbiome.



**Ricky Alamillo, BS 2010**

In 2016, Ricky Alamillo received his PhD in Chemical Engineering at the University of Wisconsin-Madison, where he worked with Professor James Dumesic. Ricky has returned to Santa Barbara as a Senior Process Development Engineer at Apeel, a company whose mission is to use natural plant-based technologies to protect crops and harvested produce, helping to eliminate food spoilage and reduce reliance on chemicals. Ricky is working on the scale-up efforts of Apeel's chemical processes with a focus in reaction engineering, flow chemistry, and heterogeneous catalysis.

Brigid Ehrlich, BS 2016

Brigid Ehrlich is currently working as an Engineer at Amgen in Thousand Oaks, California, a medical company committed to unlocking the potential of biology for patients suffering from serious illnesses by discovering, developing, manufacturing and delivering innovative human therapeutics.

**Elizabeth Cisneros, BS 2014**

Elizabeth Cisneros is an Applications Engineer at PIDC (Pacific Industrial Development, Corp.) in Ann Arbor, Michigan, a specialty chemical company focusing on the development and manufacturing of alumina, rare earth, and zeolite materials. Previously she was a Process Engineer at CDTI (Clean Diesel Technologies, Inc.) in Oxnard, California, a cleantech emissions control company.

Adriane Turner, BS 2014

Adriane Turner works as a Project Engineer at ACD LLC, a leading manufacturer of reciprocating and centrifugal pumps for cryogenic liquids and turboexpanders for air separation. She was recently accepted to MIT LGO (Leaders for Global Operations), where she will earn dual masters degrees: a SM in mechanical engineering and an MBA.

**Brittany Bersano, BS 2015**

Brittany Bersano works as an Engineer/Scientist II at Thermo Fisher Scientific, a medical device company in San Francisco, California that focuses on helping customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics, deliver medicines to market and increase laboratory productivity.

Jonathan Cook, BS 2013, MS Materials 2014

Jonathan Cook started his career as a Chemical Process Engineer at Soraa, the world's leading developer of solid-state lighting technology built on pure gallium nitride substrates, commonly referred to as GaN on GaN™. He now works as a Production Manager in Goleta. He was married on October 14, 2017, in Santa Barbara to his wife, Taylor Sampanis-Cook, a local real estate agent.

**Nirala Singh, PhD 2015**

Nirala Singh began his appointment as an Assistant Professor of Chemical Engineering at the University of Michigan in January 2018. His research group focuses on energy storage, renewable fuels and waste remediation, and improving electrochemical processes to effectively use renewable electricity.

**Bryan Goldsmith, PhD 2015**

Bryan Goldsmith is an Assistant Professor at the University of Michigan Chemical Engineering Department. His research team uses computational modeling to understand catalytic systems and advanced materials for use in sustainable chemical production, pollution abatement, and energy generation.

**Sean Paradiso, PhD 2015**

Sean Paradiso joined Citrine Informatics, a materials science startup in the Bay Area, upon graduating from UCSB. He leads the Scientific Software Engineering group building machine learning infrastructure for their enterprise Citrination product.

**Debra Audus, PhD 2013**

Debra Audus is a staff scientist at the National Institute of Standards and Technology (NIST), a non-regulatory federal agency that aims to promote U.S. innovation through standards and research. Her research focuses on using simulations and theory to elucidate aspects of polymer physics, as well as using machine learning to create polymeric databases for materials discovery.



CONGRATULATIONS TO OUR 2017-18 PHD GRADUATES!

NAME	ADVISOR	DISSERTATION
Nikolai Petsev	Shell/Leal	Multiscale Modeling of Mesoscale and Interfacial Phenomena
Corinne Carpenter	Fredrickson	Computational Studies of Directed Self-Assembly of Block Copolymers for Advanced Lithography
Peng Cheng	Helgeson	Rheology, Kinematics, and Structure of Shear Banding Wormlike Micelles
Alexander Heilman	Gordon	Development of a tip-enhanced near-field optical microscope for nanoscale interrogation of surface chemistry and plasmonic phenomena
Mark Joswiak	Doherty/Peters	Nucleation and Growth at the Nanoscale
Rodrigo Nery Azevedo	Squires/Leal	Electrokinetic Phenomena in Chemically Manipulated Environments
Elizabeth Decolvenaere	Gordon	Improving Ab-Initio Simulations of Ordering Phenomena in Transition Metal Alloys
John Henske	O'Malley	Engineering Regulation in Anaerobic Gut Fungi during Lignocellulose Breakdown
Matthew Idso	Chmelka	Understanding and optimizing the interactions of functional species in mesostructured materials with diverse transport properties
Nicole Schonenbach	O'Malley	Engineering and Investigating Structural Features of Adenosine A2a Receptor Oligomers
Carl Tilbury	Doherty	Enhancing Mechanistic Crystal Growth Models
Douglas Vogus	Mitragotri	Polymeric vehicles for the optimal delivery of synergistic chemotherapeutics
Niels Zussblatt	Chmelka	Syntheses, Characterization, and Properties of Functionalized Mesoporous Carbons for Electrochemical Device Applications
Nicholas Cadirov	Israelachvili	Characterizing the Dynamic Interactions of Biological and Biologically-Inspired Surfaces and Interfaces
Geoffrey Poon	Peters	Extending classical nucleation theory: Understanding the effects of trace additives and inhomogeneous concentration distributions
Alex Schrader	Israelachvili/Han	Tuning the Hydrophilicity of Chemically and Physically Complex Surfaces: Hydration Dynamics, Adhesion, and Wettability
Arash Nowbahar	Squires	Reactions at Liquid-Liquid Interfaces
Joel Bozekowski	Daugherty	Serum antibody repertoire analysis for high-throughput epitope discovery and characterization
Thomas Farmer	Chmelka/Doherty	Polymorph selection in continuous, reactive, rate-based, precipitation systems
Jeff Frumkin	Doherty	Ultimate Targets for Chemical Process Design
Kelly Ibsen	Daugherty	Addressing challenges in Type 1 diabetes: non-invasive insulin delivery and advanced diagnosis
Anusha Pusuluri	Mitragotri/Soh	Aptamer Targeted Delivery of Synergistic Drug Combinations for Effective Cancer Therapy
Michael Paull	Daugherty	Development of bioinformatic tools to identify and characterize linear protein epitopes
Sean Gilmore	O'Malley	Engineering Synthetic Systems Inspired by Anaerobic Fungi
Jimmy Liu	Fredrickson	Complex-to-Real Mapping for Polymer Field Theories
Mengwen Zhang	Helgeson/Mitragotri	The Formation of Multicomponent Nanoemulsions for Colloidal Synthesis
Rich Hermann	Gordon	Nanoscale Chemical Interrogation of Surfaces using Tip-Enhanced Near-field Optical Microscopy (TENOM)

These graduates are already making an impact in industry and academia at the following institutions: *Ascus Biosciences, Boston Consulting Group, Corteva, D.E. Shaw Research Company, Dow Chemical, Finch Therapeutics, Harvard, Institute for Systems Biology, Intel, Kala Pharmaceuticals, Los Alamos National Laboratory, Micron Technology, MIT, NuSil, Pfizer, QSM Diagnostics, Second Measure, and Serimmune.*

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To inquire about how you can support UCSB ChE please contact Mike Best at (805) 893-4131 or mike@engineering.ucsb.edu.



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