Faculty Q&A

RACHEL SEGALMAN

The department chair shares her thoughts on community, collaboration, and diversifying the chemical engineering field

Rachel Segalman, *professor and chair in the Chemical Engineering Department at UC Santa Barbara, is a global leader in materials and chemical engineering, having made major contributions to the design of conductive polymers, as well as bio-inspired polymer assembly. She applies that knowledge in developing functional polymers having applications in sustainability, water, and energy. Segalman has received many of the top awards and recognitions in the field. Most recently, she was named a Fellow of the National Academy of Engineering and received the Ernest O. Lawrence Award from the U.S. Department of Energy, and the Andreas Acrivos Award for Professional Progress in Chemical Engineering from the AIChE. We spoke with Professor Segalman in April.*

Convergence: *You have been department chair since 2015. How has it been serving in that role while pursuing a full research agenda?*

Rachel Segalman: I moved to UCSB in 2014 largely because I was so inspired by the community and the collaborative environment here. When the Chemical Engineering Department needed a new chair shortly after I arrived, it was an opportunity to help build on this tradition. I have been honored to continue to be a part of the department's evolution, which includes a universal commitment by our faculty to world-leading research, interdisciplinary inspiration, and sustaining a wonderful community where people support each other and truly enjoy each other's company.

Moving my research group from Berkeley to UCSB was a wonderfully entropic event for my research group, presenting us with many scientific opportunities that we had not previously considered. Even though my major draw in terms of moving to UCSB was the community of collaborators, it is still amazing to realize just how inspired by our neighbors and collaborators we have been in the past nine years. I am also so grateful for the generation of talented graduate students and postdocs I've had the privilege of working with during this time. I've always said that if I'm doing my job right, in their fourth year, graduate students should be working on things I never would have dreamed of, and I should be "panic-reading" to keep up. My chairship has perhaps increased the panic level, but it has been tremendous fun.

C: *Looking back on your time as chair, can you mention a few changes or advances that please you most?*

RS: It has certainly been an eventful eight years. I am most proud of the way the faculty of the ChemE Department has evolved over this time. We have had some amazing colleagues join our ranks — **Professors James Rawlings, Phil Christopher, Arnab Mukherjee, Siddarth Dey, Joe Chada, Sho Takatori, Tyler Mefford** — and there are a couple more I hope will join before I step down in the coming months.

I am further thrilled by a number of substantial changes that have occurred during my tenure as chair. We have built a strong relationship with the new

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Biological Engineering program, with many shared strategic goals and joint-appointed faculty. We now have two fully endowed undergraduate laboratories, the endowments ensuring continuous modernization of those facilities. Finally, the department is prepared for a new generation of leadership to sustain our vision into the future.

C: *What are your thoughts about the team efforts it took to complete those two lab endowments?*

RS: The endowment of the Rober G. Rinker Chemical Engineering Teaching Lab began as an alumni tribute to commemorate the 40th anniversary of the ChemE Department. For the department’s 50th anniversary, a grassroots effort engaging alumnus **Darryl McCall** (’78), **Professor Emeritus Duncan Mellichamp, Professor Mike Doherty,** and many others completed the endowment. In this fully endowed lab, we can now give chemical engineers a modern, updated hands-on experience in their junior and senior years.

The Asbury Discovery Laboratory grew out of an idea presented by **Professor Joe Chada** about the value of a freshman hands-on experience, particularly for diverse and first-generation students. I then discussed this idea with another alum, **Doug Asbury,** who provided major funding and was so excited that the laboratory was endowed and built within two years.

C: *You have demonstrated dedication to addressing issues around diversity, equity, and inclusion. Can you share your take on where we are and where we might need to be*?

RS: Advances in science are accelerated when addressed by teams having diverse backgrounds and unique perspectives. While the national engineering community has made significant efforts in both educating and hiring such diverse teams, over the past twenty years, we have barely moved the needle in terms of representation of women and Black people, Indigenous people, and people of color (BIPOC). UCSB is a Hispanic Serving Institution, and 40 percent of our undergraduate body and 15 percent of our graduate student body are the first members of their families to attend college. As a result, we have a unique opportunity and responsibility to rethink, at every level, who gets to be an engineer. We have tried hard to do this in Chemical Engineering, particularly in rethinking how students discover chemical engineering.

As I mentioned earlier, I am thrilled with the Asbury Discovery Laboratory Experience that Professor Chada is designing for freshmen, to be offered both to our majors and to students across campus. Via this experiential course, in which freshman will perform chemical engineering processes and discover the connections among chemical engineering, biology, sustainability, and consumer products, we hope to open the doors to freshmen who may not have had the privilege of prior exposure. We are similarly excited to be expanding our reach at the graduate- and faculty-recruitment levels as well.

As a scientific community, we need more role models for diverse faculty, a better community of support, and, on a community level, better knowledge of who is in the pipeline. Amid all the chaos and difficulties of 2020, something special happened: the virtual platforms that rose in prominence combined with the community’s heightened awareness of a need to change the way we had been approaching these issues. It was in this context that I helped found a national Zoom seminar highlighting future diverse leaders in chemical engineering. The idea was to create an opportunity for current graduate students and postdocs to present their work and be mentored by senior leaders in the field. The audience is made up of both faculty from around the country who may be in search committees, as well as other students who would like to see some diverse role models or simply attend some great talks about chemical engineering.

C: *Academic research is an endeavor of continuous change and evolution. What are you most excited about going into the next phase of your career?*

RS: This is a bit like choosing a favorite child. I am very excited about the work we are doing as part of the Center for Materials for Water and Energy Systems (MWET), which combines UCSB’s expertise in polymer chemistry and physics with the University of Texas’s leadership in water chemistry and membrane science. Together, we are gaining fundamental knowledge about the interactions between water and polymers, which will be used to design new membrane materials to efficiently purify water.

Recently, students working with myself and materials professors **Michael Chabinyc** and **Raphaële Clément** have developed new battery components, including electrolytes and binders. This work is particularly exciting, because we’ve both discovered new fundamental phenomena (for example, *superionicity* in polymer electrolytes) and then, how to use these insights to make robust, highly efficient batteries.

On a fundamental level, we’re also having a lot of fun working with BioPACIFIC MIP [BioPolymers, Automated Cellular Infrastructure, Flow, and Integrated Chemistry Materials Innovation Platform], particularly to understand how the sequence of monomers in a polymer (like the sequence of amino acids in a protein) determines its structure and properties.

C: *You took part in writing the long-term vision document for the chemical engineering field. What do you see as the most pressing issue facing your field moving forward*?

RS: Chemical Engineering advances are critical to societal challenges, including the transition away from carbon energy sources and making food and water more efficiently. Specifically, we need new technologies to assist in decarbonizing the U.S. economy and mitigating climate change. While chemical engineers have always played a critical role in the energy value chain (both generation and use), the production and use of energy, food, water, and air are inextricably linked. Work at this nexus is something that I hope we can inspire the next generation of chemical engineers to tackle.