UC SANTA BARBARA

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Peer Recognition

Three professors from the UC Santa Barbara College of Engineering and one from the Department of Molecular, Cellular and Developmental Biology (MCDB) have been named Fellows of the prestigious American Institute for Medical and Biological Engineering (AIMBE), recognizing their interdisciplinary achievements.

Nominated by their peers, fellows represent the top 2% of the medical and biological engineering community.

Mechanical engineers Linda Petzold, Sumita Pennathur and Megan Valentine, and MCDB's Dennis Clegg, are among this year's 174 new AIMBE fellows. Members are nominated by their peers and represent the top two percent of the medical and biological engineering community, having made transformational contributions to the medical and biological engineering (MBE) community in academia, industry, government and education.

"We are extremely proud to have four UC Santa Barbara faculty members selected as AIMBE Fellows for 2021," said Rod Alferness, dean of the UCSB College of Engineering. "Being named an AIMBE Fellow is a particularly notable achievement, first, because it is highly competitive and second, and perhaps more importantly, because it recognizes achievements at the intersection of science and engineering, which may have life-changing impacts. We offer our most sincere congratulations to Linda Petzold, Sumita Pennathur, Megan Valentine and Dennis Clegg on this significant achievement."

“I congratulate all four professors from UC Santa Barbara on this honor,” said Pierre Wiltzius, the Susan & Bruce Worster Dean of Science in the College of Letters & Science. “AIMBE Fellows are known foremost for their transformative interdisciplinary research, which is something we champion on this campus. Our faculty have a long and fruitful history of integrating science and engineering, and I couldn’t be happier to see the work of these leading scholars recognized.”

Linda Petzold, also a professor of computer science, has been widely recognized for her impactful work on mathematical modeling and computational simulation in a variety of disciplines and applications. Her breakthrough 1982 paper “Differential-Algebraic Equations (DAEs) are not ODEs [ordinary differential equations]” opened up a new subfield in computational mathematics, and her public-domain software DASSL has enabled the simulation of countless systems in engineering and science.

“It is a pleasure for me to receive this recognition from the AIMBE community for my work in medical and biological engineering,” she said. “I greatly enjoy working in this area, as it allows me the opportunity to address challenges and further understanding in a variety of diverse subject areas.”

Petzold’s algorithm and software (LSODA), described in a 1983 paper, has been used extensively and remains in widespread use, in particular as part of Mathematica (a modern and widely applied technical computing system), as well as in the chemical and pharmaceutical industries. More recently, her work has focused on algorithms and software for discrete stochastic systems, motivated by the need to model the inherent randomness of biochemical reactions in the cell. In this work, she and her collaborators have developed algorithms and the public-domain software StochSS for discrete stochastic simulation of biochemical systems. Her work on mathematical modeling of biological systems has elucidated a mechanism for the onset of coagulopathy, revealed the role of stochasticity in cell polarization, derived the network structure of neurons involved in Circadian Rhythm, and contributed in numerous other areas.

Petzold, a member of the National Academy of Engineering, has contributed extensively to the profession and to diversity in the sciences. She serves on the Board of Directors of the Society for Industrial and Applied Mathematics (SIAM), in 2016 receiving the SIAM Prize for Distinguished Service to the Profession. Committed to promoting and supporting diversity in the profession, she has served as director of the UCSB Institute for Collaborative Biotechnologies Diversity Program, focused

on underrepresented students with a special emphasis on women in science.

Sumita Pennathur, a pioneer in nanofluidics, interfacial science and biological engineering, has a longstanding commitment to advancing human health through innovative science and engineering. Her seminal work has revealed unique physics at the nanoscale, making it possible to model, predict and, ultimately, control fluids and the molecules they contain. Researchers in the Pennathur laboratory invent, design and build nanoscale devices to measure key fluidic parameters with unprecedented accuracy and precision via a tight integration of theory, modeling and reduction to practice.

Pennathur has applied her discoveries to develop novel biomedical technologies, leading her to found three startup companies: Asta Fluidics, for rapid diagnosis of potentially lethal complications during pregnancy; Alveo Technologies, which is developing an in-home diagnostic for COVID-19; and Laxmi Therapeutic Devices, a microneedle based continuous glucose monitoring company.

“I am honored to be recognized alongside a cohort of amazing biomedical engineers and innovators,” Pennathur said. “I fully support the AIMBE mission to advance medicine and bioengineering innovations and commend the society of their impact in funding for medical science and education.”

For her early academic research accomplishments, Pennathur in 2010 received a coveted PECASE award (Presidential Early Career Awards for Scientists and Engineers) from President Obama. She also was awarded the Defense Advanced Research Programs Administration (DARPA) Young Faculty Award in 2008, the UC Regents Junior Faculty Fellowship in 2009, and the ADA Pathway to Stop Diabetes Visionary Award in 2017.

Megan Valentine is an internationally recognized leader in biomaterials science, cellular mechanics and mechanotransduction. Her pioneering research establishes how forces are generated, transmitted and sensed in soft living matter, and how to capture the properties of living systems in synthetic materials. Her innovative approaches bridge length scales from molecular to macroscopic and combine her significant biological expertise with innovative tool development and a deep understanding of physical phenomena to impact multiple areas of biomedical engineering.

“It's an honor to be selected as an AIMBE Fellow and a testament to the collaborative and interdisciplinary nature of both my work and UC Santa Barbara,” Valentine said. “I’ve dedicated my career to working across disciplines: my undergraduate and graduate degrees are in physics, I completed a post-doc in biological sciences and am a professor of mechanical engineering. Each specialty has its own jargon and culture, and I am proud that my ability to innovate across boundaries has been recognized. I am eager to continue working with doctors, scientists and engineers from diverse communities to address pressing societal needs.”

Valentine’s groundbreaking studies have provided a critically important understanding of the molecular mechanisms underlying normal cell division. Her work has established the use of microrheology for unprecedented measurements of the interplay among structure, mechanics and dynamics of complex biomaterials, such as cytoplasm.

By developing innovative imaging methods and mechanical testing devices, she has established the role of mechanosensation in regulating vascular growth dynamics, as well as the response of cells to high strain and high strain-rate impacts, providing novel insight into vascular regeneration and traumatic brain injury, respectively.

Finally, Valentine has become a leader in the area of bio-inspired materials, with an emphasis on developing high-performance adhesives and load-bearing composites. She established the nonlinear elastic and fracture behavior of natural materials, and is developing new classes of strong stimuli-responsive polymeric materials, with applications to healthcare, packaging and robotics.

Valentine is a devoted advocate for women and underrepresented minority students both at UCSB and in the broader bioengineering community. Particularly invested in engaging student veterans in hands-on research, she has developed two NSF-supported programs to support their summer internships at UCSB.

She is an active organizer in the American Physical Society March Meeting, and recently completed a three-year term on the Executive Committee of the Division of Biological Physics. She has served as a member of the Early Careers Committee of the Biophysical Society, where she led efforts in advocacy, training and professional development for graduate students and postdoctoral scholars. An AIMBE fellowship will provide her with new avenues of engagement and new opportunities to work for

the betterment of our community and society.

Valentine is a co-director of the California NanoSystems Institute (CNSI) at UCSB and a fellow of the American Physical Society. She received a Career Award at the Scientific Interface (CASI) from the Burroughs Wellcome Fund, a UC Regents Junior Faculty Fellowship, a Hellman Family Faculty Fund Fellowship, a CAREER award from the National Science Foundation, and a Fulbright Scholar Award from the U.S. Department of State.

Dennis Clegg, a pioneer in translational regenerative medicine, achieved world renown for developing a bioengineered implant consisting of stem-cell-derived retinal cells on a synthetic parylene membrane. The technology is now in clinical trials for the treatment of dry age-related macular degeneration (AMD), a leading cause of blindness.

Clegg’s lab discovered methods to differentiate pluripotent stem cells into retinal pigmented epithelial (RPE) cells, which degenerate in AMD. His group was the first to report that bona fide RPE cells could be derived from induced pluripotent stem cells (iPS). He established and is co-PI of the California Project to Cure Blindness, a multidisciplinary team comprising stem cell biologists, engineers and surgeons who developed the RPE implant and devised a surgical delivery strategy. Their Phase I trial has generated promising results for the dry form of AMD, a blinding condition with no treatment.

“This is a great honor; it underscores the importance of thinking outside the disciplinary box, and collaboration between biologists and engineers,” Clegg said of this election as an AIMBE Fellow. “UCSB has provided a fertile ground for cutting-edge work, which will continue to thrive, resulting in advances in biomedical engineering.”

Clegg has made impactful contributions to our understanding of cell-extracellular matrix interactions during ocular development. These studies informed further research of novel bio-mimetic materials that support survival and differentiation of stem cells. Clegg has navigated these discoveries all the way to clinical application.

Chair of MCDB from 2004-2009, and founder and co-director, since 2008, of the Center for Stem Cell Biology and Engineering, Clegg has served on the Chancellor’s Committee on Diversity, as director of an HHMI Undergraduate Program, and as director of two graduate training programs aimed at promoting underrepresented

minorities and women in science. He was a speaker at the California Graduate Diversity Forum (2006-2014) and currently serves on Scientific Advisory Boards for biotechnology programs at California State University Channel Islands, which, like UCSB, is a Hispanic-Serving Institution.

Clegg also is noted for his ability to communicate complex science to general audiences, as evidenced in his 2012 TedX talk and in his extensive public outreach, particularly in educational activities related to stem cell biology and regenerative medicine.

All 160 members of the AIMBE College of Fellows Class of 2021 will be inducted at a ceremony to be held remotely March 26.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.