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Strength in Diversity

Javier Read de Alaniz is going home, in a matter of speaking. The UC Santa Barbara professor of chemistry and biochemistry will collaborate with his undergraduate alma mater, New Mexico Highlands University, in a high-stakes effort to create biopolymers to replace plastics. Thanks to a Partnerships for Research and Education in Materials (PREM) award from the National Science Foundation, NMHU, UCSB and UCLA materials scientists will leverage their research, technological prowess and strength in diversity to the problem of petroleum-based polymers.

“I grew up in Las Vegas, New Mexico, went to the local public schools and started my undergraduate education at NMHU,” said Read de Alaniz, who directs the NSF-supported BioPolymers, Automated Cellular Infrastructure, Flow, and Integrated Chemistry: Materials Innovation Platform (BioPACIFIC MIP), located at UCSB and UCLA. When he learned that NMHU was awarded the NSF-PREM Southwest Pacific Collaboration in Machine Learning, Design, Synthesis and Applications of Metalorganic Hybrid Biomaterials, it was a cause for celebration.

“This is a huge win for BioPACIFIC MIP,” Read de Alaniz said. “This award will broadly impact researchers underrepresented in STEM, mainly Hispanic or Latinx. NMHU plays a vital role in educating Hispanic students pursuing a college degree and through this partnership it will enable BioPACIFIC MIP to deliver on its promise to make biomaterial discovery resources available to a broad and diverse national user base.”

“We’re very excited,” said Gil Gallegos, principal investigator and director of the NMHU-led PREM. “The research is one part synthesis and analysis, and the other part is the design, which is going to be machine learning- and AI-informed. That’s the missing element that BioPACIFIC MIP has been looking for in their laboratories over the past few years.”

The joint effort “will focus on machine learning, materials synthesis, high-throughput automated chemistry/biosynthesis, and organic-inorganic materials applications.”

More Is Better

Aiming to develop new materials with all the advantages of petroleum-based polymers (lightweight, versatile, inert), but with none of their drawbacks (non-biodegradable, made from finite resources), the engineers and scientists of BioPACIFIC MIP have a noble challenge ahead, as they seek to fundamentally change how plastics are made. The goal is to discover and characterize, develop and scale pathways by which yeast, fungi and bacteria can be made to produce molecular building blocks which can then be converted into “next generation polymers with properties and performance far exceeding those currently available in materials produced through traditional petrochemical methods.”

To accomplish this lofty goal, BioPACIFIC MIP harnesses the skills and expertise of researchers from multiple disciplines at UC Santa Barbara and UCLA, through the California NanoSystems Institute (CNSI), which has headquarters at both campuses. User facilities at CNSI will be hubs of biopolymer research and innovation, welcoming researchers from all over the country who want to join the effort to develop sophisticated, sustainable, earth-friendly polymers.

However, building a new polymer ecosystem from basic research with the intention of future deployment will not only require some of the finest minds in materials science, it also will need creative input from a diversity of disciplines, and will involve training the next generation of researchers and technologists.

“The NMHU-BioPACIFIC MIP collaboration in design, synthesis and application of metal-organic hybrid biomaterials will enable continuing success in materials science research, research training and education at NMHU, and will provide unique opportunities to Hispanic students in Northern New Mexico,” Read de Alaniz said. “The research scope of the partnership will leverage research strengths in machine

learning, crystal engineering and characterization of materials with magnetic and thermal properties at NMHU with expertise, high-throughput synthesis and characterization at BioPACIFIC MIP."

"I am very excited that the NSF awarded NMHU and BioPACIFIC MIP this PREM," said UCLA chemistry/biochemistry professor and BioPACIFIC MIP co-director Heather Maynard. "UCSB, UCLA and NMHU are ideal partners for many reasons. Not only is our research complimentary, but we also are all excellent training grounds for students from diverse backgrounds. This PREM is going to strengthen all three institutions."

Leveraging NMHU's existing prowess with both machine learning and metalorganic frameworks, students began by learning about BioPACIFIC MIP's biomaterials project during a virtual summer school Aug. 2-5. Another component of the PREM program involves community outreach, in which the students conduct educational activities for K-12 kids in Las Vegas, N.M. — an effort to get younger students interested in biomaterials and machine learning.

"We want to create a pipeline that goes from kindergarten all the way up through to the Ph.D. level," Gallegos said. "So we'll go to the local schools and demonstrate, with graduate students or undergraduate students, some of the technologies we have."

In the process, the PREM partnership will bring researchers and students together to share resources, brainpower and, in accordance with the objectives of both partners, to bring STEM research opportunities to underrepresented minorities.

"On a personal level, this award symbolizes more than just a scientific partnership," Read de Alaniz said. "To have the opportunity to return home and leverage our PREM partnership to help implement strategic goals to improve recruitment, retainment and degree completion that will have long-lasting implications on the local community is truly special."

Since its start in 2004, PREM has successfully diversified research faculty and improved the likelihood that underrepresented students and students from underserved communities pursued and completed a doctorate in materials research. The initiative, anchored in research, has produced a wide range of results, from new materials for quantum devices and electronics, to live-cell imaging. PREM has trained more than 125 postdocs, and has helped more than 1,500 students graduate

with a bachelor’s, master’s or doctoral degree – most from underrepresented minority groups.

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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.