Four USU Researchers Receive Prestigious CAREER Grants

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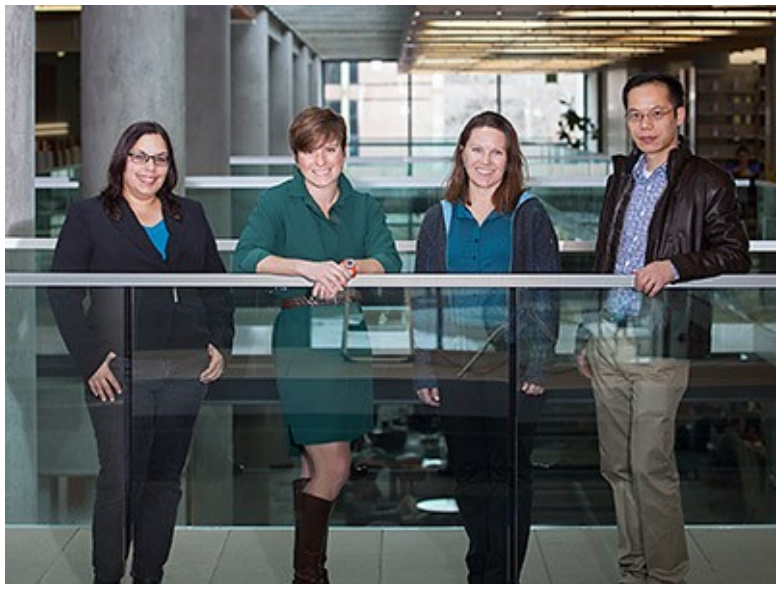
Utah State University researchers Idalis Villanueva, Alexis Ault, Yujie Sun and Sarah Null have each been awarded a National Science Foundation CAREER Grant.

The NSF CAREER award, which averages more than $500,000 over the course of five years, is one of the most prestigious awards a new faculty researcher can receive. Established in 1995, this award is given to the most promising researchers in academia to help set them up for success.



Left to right: Idalis Villanueva, Alexis Ault, Sarah Null and Yurie Sun

USU's most recent awardees are no exception. Villaneuva, Ault, Sun and Null have all proven to be among the brightest new talent USU has to offer.

Villanueva specializes in engineering education. Her CAREER grant will help fund her research on the effects of hidden curricula.

"Hidden curricula means academic rules, social norms or other knowledge that is known to dominant social actors in a particular setting, but not necessarily to individuals from diverse social or cultural backgrounds," Villanueva said.

Villanueva and her team want to better understand the reasons why underrepresented students in the undergraduate engineering program have difficulty completing their academic programs. They believe that removing hidden curricula will significantly reduce the power imbalance between majority and minority students.

"My long-term vision is to help engineering faculty and students reveal and navigate hidden curricula in engineering," Villanueva said.

While Villanueva's research is focused on post-secondary undergraduates, Ault is working with middle school students and a team of interdisciplinary experts to study the relationship between earthquakes and heat.

When earthquakes occur, the heat they produce leaves a record of each movement along the fault line. Ault's research will provide a closer look at how that heat can affect the seismic cycle and strength of the fault.

“We have a lot of science before us and this is a very real and challenging opportunity,” Ault said.

The research isn’t Ault’s only focus, however. By involving students of Perry, Utah’s Promontory School for Expeditionary Learning, Ault hopes to inspire young minds to get involved in science at an early age.

“Middle school is a time when students form their ‘STEM identity,’” Ault said. “It’s important they have role models who can instill a passion for science that will grow. Providing field and lab broadens their horizons by helping them understand how science works and the role of technology in our everyday lives.”

Ault isn’t the only one looking to the future. Sun believes his research on electrochemical water catalysis will provide a basis for more environmentally friendly energy production.

Water splitting, the separating of water molecules into oxygen and hydrogen, is involved in the current processes to harvest solar and wind energy. While this is a step in the right direction for green energy, the process is still expensive and inefficient.

“Splitting water molecules is simple on an experimental basis, but difficult and expensive on a large-scale basis,” Sun said. “We’re looking beyond current knowledge to create novel electrolyzers by employing inexpensive catalysts for hydrogen production at much lower energy input compared to those of conventional water-splitting processes.”

In order to accomplish this, Sun’s research group is looking at a new oxidative process. He hopes this innovative technique will not only make cost-effective, environmentally friendly energy tapping more viable, but also help develop a new type of material that can be used instead of the fossil-based polymers commonly used in items such as car parts, fabrics and household items.

“Imagine all the products around you that could be made from the clean and renewable energy sources like sun and wind,” Sun said.

Null, the most recent USU recipient of the CAREER award, is also looking to natural resources for inspiration. Her research team studies large-scale effects of water resource management.

“Most water resources models consider flow volume and timing, but I want to look further,” Null said. “My research aim is to explore water management effects on ecosystems and ways to improve aquatic ecosystem representation in water resources models.”

Null’s team will assemble data with a variety of parameters into mathematical models. Beyond providing the information necessary to make effective decisions regarding water resource management, Null believes this will have an even wider effect.

“We can use models to predict climate change effects on hydrology, water quality and aquatic habitat,” Null said. “Such information helps us identify promising adaptation and management strategies that are robust to change.”

The mathematical models Null creates will also be presented in a more artistic way. In collaboration with Carsten Meier of USU’s Department of Art and Design, Null will create visual versions of the data to display in both a book and a museum exhibition.

“The images are colorful, dramatic and invoke curious responses. We’re excited to engage the public with our findings,” Null said.

Villanueva, Ault, Sun and Null’s passion and dedication to their research represent USU’s focus on learning and discovery. The university strives to support research faculty with a variety of programs such as grant writing workshops, Training for Research Faculty sessions and trips to Washington, D.C. to meet with program officers from various agencies.

All four recent CAREER awardees participated in the Washington, D.C. trip where they were able to meet with NSF program officers. During these meetings, they were able to ask questions and receive advice regarding their research proposals.

“I met with two program officers in different directorates and both told me that my ideas were not a good fit for their programs,” Null said. “While frustrating at the time, it forced me to shop my idea around the programs at NSF until I found a really great fit.”

Although it is unusual for four faculty from the same university to receive CAREER awards in such a short time, USU has always had a disproportionately high number of CAREER awardees. Currently, USU faculty have 16 of the 52 active awards in Utah and USU has more active CAREER awards than 78% of CAREER-eligible universities in the nation.

“We’re pushing the intellectual and educational boundaries,” Ault said. “That’s what our mission as scientists and citizens is all about.”

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Read more:

Idalis Villanueva: https://engineering.usu.edu/news/villanueva-career
Alexis Ault: http://www.usu.edu/science/news-pages-main/_news2017/alexis-ault
Yujie Sun: http://www.usu.edu/science/news-pages-main/_news2017/yujie-sun-nsf
Sarah Null: https://www.eurekalert.org/pub_releases/2017-02/usu-use021417.php