New findings next step to growing drought-resistant plants

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New findings from Van Andel Research Institute (VARI) scientists could lead to environmentally-friendly sprays that help plants survive drought and other stresses in harsh environments to combat global food shortages. The study is a follow-up to findings published in *Nature* last year that were named among the top breakthroughs of 2009 by *Science* magazine.

"I think that the work established the methodologies and feasibilities of finding cheap and environmentally benign chemicals for agricultural application to improve the water use efficiency and drought tolerance of crops," said Jian-Kang Zhu, Professor of Botany and Presidential Chair of Botany & Plant Sciences at the University of California, Riverside. "The work also provides a better understanding of ABA receptor function, which will help efforts in the genetic engineering of hardier crops."

In a 2009 study published in *Nature,* VARI scientists determined precisely how the plant hormone abscisic acid (ABA) works at the molecular level to help plants respond to environmental stresses such as drought and cold. These findings could help engineer crops that thrive in harsh environments.

One of ABA's effects is to cause plant pores to close when plants are stressed so that they can retain water. In the new study, researchers identified several synthetic compounds that fit well with ABA's many receptors, or cellular "docking stations," to have the same effect. By

finding compounds that can close these pores, researchers' findings could lead to sprays that use a plant's natural defenses to help it survive harsh environmental conditions.

"Sprays would allow plants to be much more adaptable than if we genetically engineered them," said Karsten Melcher, Ph.D., one of the lead authors of the study and research scientist in the VARI Laboratory of Structural Biology led by Distinguished Scientific Investigator H. Eric Xu. "You could spray plants to close the pores only when drought or other harsh conditions threaten the plant."

The lab originally began studying ABA because a proposed ABA receptor was reported to be a member of a group of proteins that the lab studies, which are targeted by more than 50% of all drugs on the market. It was later found that the receptor was not part of this group of proteins, but Xu's lab continued its' studies.

The findings appear in Nature Structural & Molecular Biology alongside a companion paper from authors Francis C. Peterson (first author), Brian Volkman, Davin R. Jensen, and Joshua J. Weiner from the Medical College of Wisconsin, Sean Cutler, Sang-Youl Park and Chia-An Chang from University of California, Riverside (UCR), and Sethe Burgie, Craig A. Bingman, and George Phillips, Jr., from the University of Wisconsin-Madison. A third parallel study has also been reported by Dr. Nieng Yan's group in the Journal of Biological Chemistry.

"Last year Dr. Xu and his lab offered the plant community the long-awaited key to creating drought-resistant crops," said VARI President and Research Director Dr. Jeffrey Trent. "Only a few short months later, and they already have taken huge strides further toward the ultimate goal of helping combat world hunger."

Provided by Van Andel Research Institute