Structural Studies of Plant Extracellular ATP Receptor DORN1

Wenzin Zhang, Liwen Jiang and Wilson Chun Yu Lau
The Chinese University of Hong Kong, Hong Kong

Adenosine 5′-triphosphate (ATP) is an essential energy source to drive biochemical reactions in all living organisms. ATP can be released to the extracellular matrix and is served as a signal transmitter, referred to as extracellular ATP (eATP). In mammals, eATP can be perceived by P2-type purinoceptors on the plasma membrane, whose dysfunction may cause various diseases, such as rheumatoid arthritis and hypertension. A novel ATP-insensitive mutant *Does not Respond to Nucleotides 1* (DORN1) was previously identified in *Arabidopsis thaliana.* DORN1 plays an important role in response to plant pathogen defense through direct phosphorylation of the NADPH oxidase RBOHD, resulting in the production of reactive oxygen species and stomatal closure. DORN1 can also activate the intracellular signaling of the defense hormone jasmonate to maximize the defense responses. Despite the fact that DORN1 has been reported to be involved in many aspects of plant development including plant photosynthesis, water homeostasis and pathogen resistance, the molecular mechanisms of DORN1 activation are not known due to the lack of any structural knowledge for this protein family

Single-particle cryo-electron microscopy (cryo-EM) is a technique that is used to determine the structures of macromolecules at atomic resolution in their near-native conditions. Here, we aim to study the structures of the DORN1 alone and in complex with its substrates by using single-particle cryo-EM to shed light onto its underlying mechanisms in plant development and the regulation of plant defense responses.

Chen, D. , Cao, Y. , Li, H. , Kim, D. , Ahsan, N. , & Thelen, J. , et al. (2017). Extracellular atp elicits dorn1-mediated rbohd phosphorylation to regulate stomatal aperture. Nature Communications, 8(1), 2265.

Hefetz, A., Keeling, C. I., Winston, M. L., Slessor, K. N., Nielsen, J., Lanfear, R., ... Volatiles, P. (2014). Identification of a Plant Receptor for Extracellular ATP, Science, (January), 290–295.

Kasuya, G. , Yamaura, T. , Ma, X. B. , Nakamura, R. , & Nureki, O. . (2017). Structural insights into the competitive inhibition of the atp-gated p2x receptor channel. Nature Communications,8(1).

Tripathi, D. , Zhang, T. , Koo, A. J. , Stacey, G. , & Tanaka, K. . (2017). Extracellular atp acts on jasmonate signaling to reinforce plant defense. Plant Physiology, pp.01477.2017.