MECHANOSIGNALLING

Tickling plant

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The natural environment is not a green house. Wind, rain, interactions with diverse organisms and other mechanical stimuli will trigger the activation and responses of the sophisticated plant signalling system. Recently, the Ning Li group at the Hong Kong University of Science and Technology, Hong Kong, China, reported a high-throughput analysis of touch-induced alternations of protein phosphorylation in *Arabidopsis*. The yielded phosphoproteomic profile includes a number of enzymes that are known to be involved in protein phosphorylation or cell signalling. More interestingly, it revealed a group of eight TOUCH-REGULATED PHOSPHOPROTEINS (TREPHs) of unknown function.

Touch treatments on the leaf surface of 12–14 day-old *Arabidopsis* plants, using cotton swabs, gloved fingers or an automated machine equipped with human-hair brush, all result in growth and developmental changes, such as delayed bolting. The authors used this phenotype as a plant readout of successful perception and signalling of external forces throughout the study. To profile the gentle force-induced changes of phosphoproteome, they applied the stable isotope labelling in *Arabidopsis* (SILIA)-based quantitative post-translational modification (PTM) proteomic approach onto both the control and touch-treated plants. The total number of phosphopeptides increased in seconds in the touch-treated group, suggesting that protein phosphorylation is induced by touch and could play a role in plant mechanosignalling. Among the 23 touch-enhanced phosphoproteins identified, MAP KINASE KINASE1/2 (MKK1/2) and TREPH1 were selected for immune-blot analysis to confirm that they are rapidly phosphorylated after touch. MKK1/2 are well-known stress-activated kinases, while TREPH1 is previously predicted to be a cytoskeleton component involved in organelle movement. In a *treph1* T-DNA insertion mutant, touch treatments did not cause delayed blotting. Moreover, mutagenesis and complementation assays suggest that the specific S625 phosphorylation of TREPH1 is indispensable for TREPH1-regulated touch responses. The researchers propose that TREPH1 is a force-signalling protein required for plant developmental changes in response to mechanical stimuli. To figure out more details of its regulatory role, they compared the transcriptomic changes in the wild type versus *treph1* mutant and found that the *treph1* mutation blocks the touch-induced alterations of gene expression in *Arabidopsis*.

Although many questions remain to be answered following this study, such as what upstream and downstream factors interact with TREPH1 to pass on the mechanical signals, this study demonstrates an inspiring approach and platform for future research on plant mechanosignalling and possibly other cell signalling problems.

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