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"Choreography of plastidial retrograde signaling"

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Being sessile, plants have evolved complex and intricate response networks to biotic and abiotic stresses. Identification of the signaling networks regulating general components of these stress responses has been a challenge.

We have identified a novel retrograde stress-sensor methylerythritol cyclodiphosphate (MEcPP), previously known solely as an intermediate in the isoprenoid biosynthetic pathway, as a stress sensor that communicates environmental perturbations sensed by plastids back to the nucleus. MEcPP specifically coordinates expression of key stress-responsive nuclear genes encoding plastid-localized proteins.

To identify the underlying molecular mechanism of the MEcPP-mediated stress responses, we have performed a multi-omics approach. These studies have led to identification of a transcriptional hub activated by MEcPP, and have established a previously unrecognized link between this plastidial retrograde signal and transcriptional reprogramming of endoplasmic reticulum genes critical for readjustment of protein-folding capacity in stressed cells, and further provided an understanding of the molecular mechanism by which MEcPP regulates plant growth and development in response to stress.

In conclusion, I will outline our current understanding of a functional module concept of biological organization and regulation by MEcPP, the plastidial retrograde signaling metabolite.