ABSTRACT

"Auxin regulates pattern formation in a self-organizing and hierarchical manner in the Arabidopsis leaf epidermis"

Prof Zhenbiao Yang
Center for Plant Cell Biology
Department of Botany and Plant Sciences
University of California
Riverside
USA

Auxin regulates the formation of various developmental and morphogenetic patterns in plants, but the molecular and cellular mechanisms for the auxin actions are not well understood. We investigate these mechanisms using Arabidopsis leaf epidermal pavement cells (PCs) as a model system, which form the jigsaw puzzle cell pattern with interdigitated lobes and indentation. We have shown that pavement cell interdigitation is controlled by localized ROP GTPase signaling, which impinges on the organization of cortical actin microfilaments and microtubules to generate interdigitating lobes and indentations[1,2]. Our recent studies indicate that auxin is a localized signal that activates pavement cell polarization to form lobes and coordinates lobe formation with indentation formation by activating ROP GTPase signaling through an Auxin-Binding Protein 1 (ABP1) dependent auxin perception system[3]. This cytoplasmic auxin signaling system, which is distinct from the well-established TIR1-dependent nuclear auxin signaling system that regulates gene transcription, modulates local coordination of lobe and indentation formation within a PC and between adjacent PCs through its modulation of PIN protein polarization[3]. Our recent work suggests that auxin also globally coordinates the formation of the interdigitated PC pattern in the entire leaf through a transient leaf tip- and margin-high accumulation of auxin. The global coordination and the auxin accumulation require the TIR1-based auxin-signaling pathway that regulates gene transcription. Our findings support the hypothesis that auxin acts as a self-organizing and hierarchical signal in the regulation of pattern formation in the leaf epidermis.

References

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