ABSTRACT

"Organelle Extensions: Uncovering new facets of subcellular behaviour for maintaining homeostasis in plants"

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Despite their inability to move away from stressful conditions, plants, in comparison to animals, have much longer life spans. How do plants manage stress while remaining 'rooted' to a spot? Perhaps, plant cells are able to respond to environmental stimuli rapidly and minimize subcellular stress levels before they become intolerable. Perhaps they do not need to move away! This fundamental thinking forms the basis for research in my lab. Using a judicious combination of molecular-genetic techniques including a wide range of targeted fluorescent protein probes, normal and mutant transgenic plants we have started uncovering the rapid sub-cellular response machinery in plants. We find that instead of dividing, many organelles extend their surfaces transiently by creating thin protrusions that can extend for considerable distances within the cell. This 'primary' membrane-aided response prevents the build up of toxic by-products within the cell. Alternatively, organelle extensions are used for metabolite dispersal and exchange, as well as for 'squeezing' past other organelles in narrow vacuole-dominated intracellular spaces. Notably, persistent stress acting on membranes does trigger molecular cascades that over a longer time scale result in division of organelles. Live-imaging of organelle extensions and their dynamic interactions challenges our view of the static plant cell built up using snapshots from fixed tissues and paves the way for a better understanding of plants and their rapid subcellular responses.