ABSTRACT

"How cells make a plant: role for cell polarity and endocytic trafficking"

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In plants, more than in other eukaryotes, establishment of cell polarity is one of the major developmental themes. Even fully specified plant cells often retain potential to re-define their polarity which is utilized during organ formation, tissue regeneration and multiple other patterning events. The process of tissue polarization inevitably encompasses *de novo* specification of individual cell polarities in cells within a polarizing tissue. The connection between cellular polarizing events and macroscopic manifestation of polarity such as specification of different cell types along the axis, depend on an action of the signalling molecule auxin and its intercellular directional movement. Auxin is a prominent intercellular signal in plants and its polar cell-to-cell transport is required for various developmental processes including apical-basal axis formation, organogenesis and tropisms. The prominent molecular components of polar auxin transport are auxin efflux transporters of the PIN family, each with specific polar, subcellular localization, which determines direction of auxin flow. Despite critical importance of polar PIN localisation for plant development, little is known about how it is decided to which side of cell PIN proteins will be (re)targeted. Available data suggest existence of sequence-specific polar targeting signals and cell type-specific determinants. Here we will present cellular mechanisms for cell polarity establishment and maintenance and novel molecular components of apical/basal targeting along with possible general mechanisms of cell polarity in plants. The emerging data provide a conceptual framework explaining some of important mechanisms behind astonishing flexibility and adaptability of plant development.