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Opening Lecture

Polarity and patterning in plants development

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In plants, more than in other eukaryotes, establishment of cell polarity is one of the major developmental themes. 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. Auxin is a prominent intercellular signal in plants and acts as a versatile trigger of developmental change in multitude of processes. Directional, active transport between cells mediates differential auxin distributions within tissues (so called auxin gradients) that are underlying many patterning processes, including apical-basal axis formation during embryogenesis, organogenesis, vascular tissue formation and tropisms. Environmental and endogenous signals can be integrated into changes in auxin distribution through their effects on auxin transport, specifically on the cellular distribution of PIN auxin transporters. Differentially expressed PIN proteins, each with specific polar, subcellular localization form a network mediating directional auxin fluxes through different tissues for formation of auxin activity gradients. Within cell, PIN proteins undergo constitutively cycles of a clathrin-dependent endocytosis and ARF GEF-dependent recycling. Various endogenous and external signals can regulate this subcellular dynamics, thus changing polarity of PIN localization and controlling their directional activity. In this view, the PIN-dependent auxin transport network, whose directional throughput is modulated by both endogenous and exogenous signals, provides one of the mechanisms underlying the plasticity and adaptability of plant development.