CDB SEMINAR

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16:00~17:00 A7F Seminar Room

Order from chaos: rules and self-organizing properties of division patterns in plants

Summary
Plants form new organs with patterned tissue organization throughout their lifespan. As plants cells are encaged in a rigid cell wall cell migration is impossible. In consequence, plants rely on oriented cell divisions and anisotropic growth to shape their organs and precisely organise their tissues. It is unknown if this robust post-embryonic organ formation results from stereotypic dynamic processes, in which the arrangement of cells follows rigid rules. We combined modelling with empirical observations of whole organ development to identify the principles governing lateral root formation in Arabidopsis. Lateral roots derive from a small pool of founder cells, in which some take a dominant role as seen by lineage tracing. The first division of the founders is asymmetric, tightly regulated, and determines the formation of a layered structure. While the pattern of subsequent cell divisions is not stereotypic between different samples, it is characterized by a regular switch in division plane orientation. This switch is also necessary for the appearance of patterned layers as a result of the apical growth of the primordium. Our data suggest that lateral root morphogenesis is based on a limited set of rules. They determine cells growth and division orientation. The organ-level coupling of the cell behaviour ensures the emergence of the lateral root's characteristic features. We propose that self-organizing, non-deterministic modes of development account for the robustness of plant organ morphogenesis.

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