

Graduate School Event

Thesis Defense: Mechanisms of auxin-mediated early embryogenesis in Arabidopsis thaliana

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Arabidopsis embryo has long served as a model system for understanding how plant body patterning and axis establishment arise. Previous work established that auxin flows, directed by polar transport and reinforced by local biosynthesis, underpin axes formation, while recent studies suggest that maternal tissue, membrane composition and surface receptor signaling add further regulatory layers. In this thesis, we dissect the layers of auxin-mediated processes which guide plant embryonic and post-embryonic development. We review methodological advances that allow the embryo to be imaged and studied. These tools offer exciting venues for future addressing of outstanding research questions. Furthermore, we dissect the contribution of maternal auxin for early embryo patterning. Targeted auxin scavenging in the integuments lowers the hormone reaching the proembryo, destabilizes PIN7 in the suspensor and weakens the initial apical maximum. The resulting deficit dampens downstream embryonic auxin biosynthesis, as well as auxin flow towards the root pole, indicating that maternally provided auxin controls auxin flows in the embryos on a larger scale than previously understood. Intriguingly, we uncover a prolonged gametophytic maternal effect mediated by the receptor-like kinases TMK1 and TMK4. Reciprocal crosses and promoter-reporter analyses show that these genes are transcribed preferentially from the maternal genome in both embryos and seedlings. Loss of maternal TMK activity arrests embryos, affects seedling development and persists into adult growth, indicating that parental imprinting shapes development beyond fertilization and early embryogenesis. Finally, we describe the role of very-long-chain fatty acids and membrane composition on PIN proteins and their auxin-induced relocalization. Disruption in this lipid metabolism triggers widespread patterning errors.Together, these results reposition early plant patterning as a hierarchical cascade that begins with maternal auxin, gets amplified by auxin transport and biosynthesis, potentially modulated by maternal receptor signaling and could ultimately be gated by the biophysical properties of the membrane. By integrating auxin supply, genetic imprinting and lipid-dependent trafficking into a single narrative, this thesis helps shifting the approach of viewing the embryo as an autonomous unit to regarding it as a dynamic system, continuously sculpted by its maternal context.

Monday, September 1, 2025 01:00pm - 02:00pm
Sunstone Bldg / Ground floor / Big Seminar Room B / 63 seats (I23.EG.102)

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