Arabidopsis early embryo development

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Zygote

Basal cell

Divides and gives Suspensor

Upper cell turns into Hypophysis

Columella

Quiescent center

Apical cell

1st longitudinal division

2 Cells

2nd longitudinal division

4 cells

Transverse division

8 Cells

Upper tier

Lower tier

Outer layer (protoderm)

(precursor of epidermis)

Inner layer

(precursor of ground and vascular tissue)

Upper tier

Lower tier

Vascular initials

Ground tissue precursor

Daughter cells of Vascular initials

Daughter cells of Ground tissue precursor

Cotyledons

Shoot Apical meristem

1 - Cell

2 - Cell

4 - Cell

8 - Cell

16 - Cell Dermatogen

Early globular

Late globular

Heart stage

Arabidopsis early embryo development

During plant embryogenesis, the formation of an axial-radial pattern ultimately determines the developmental fates of the embryo (Capron et al. 2009). In Arabidopsis, it starts with the asymmetrical zygotic division that generates a small apical cell (purple) and a basal cell (grey). After two rounds of longitudinal divisions and one round of transverse division, the apical cell converts into an octant stage embryo (8-celled). The basal cell divides anticlinally. It produces six to nine suspensor cells that help in connecting the embryo to the vascular system of the plant for nutritional purposes (Capron et al. 2009). The eight-celled embryo has two domains, an upper tier (green) and a lower tier (orange/yellow). The upper tier domain of the embryo proper, corresponding to the apical domain, gives rise to the shoot apical meristem (SAM) and the cotyledons (embryonic leaves). The lower tier will generate the embryonic root and hypocotyl (ground, and vascular tissues). The 8-cell embryo divides radially, to generate the outer layer (protoderm), the precursor of the epidermis, forming a 16-cell (dermatogen) embryo. At the globular stage, the upper suspensor cell, the hypophysis, divides asymmetrically to contribute to the formation of the root apical meristem (RAM). Divisions of the inner cells, aligned with the apical-basal axis, will form the vascular tissues, surrounded by ground tissue cells that will generate endodermis and cortical cell types. The development of cotyledons marks the end of the globular stage, thus giving the embryo a bilateral symmetry and a heart shaped appearance.

Verma et al., 2020. An essential function for auxin in embryo development. CSHL Perspectives in Biology.

Capron, A. et al., 2009. Embryogenesis: pattern formation from a single cell. The Arabidopsis Book, 7, p.e0126.

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