

Plant Development I: Tissue differentiation and function

Learning Objectives

1. Recognize relationships between plant embryonic structures and mature plant morphology
2. Describe the organization and functions of plant organs (roots, stems, and leaves), and relate morphology to function
3. Describe the features and functions of plant tissues, identify and describe cell types associated with each tissue, and relate cell and tissue morphology with function
4. Differentiate between monocot and eudicot body plan characteristics, including organization of the vascular and ground tissues in stems and roots

Plant Embryogenesis

Prior to [fertilization](#), the plant egg cell contains a gradient of a plant hormone called auxin, where one side of the egg cell has a high concentration of auxin, and the other side of the egg has a lower concentration. Auxin behaves like a [cytoplasmic determinant](#), setting up the apical/basal axis (similar to the anterior/posterior axis in animals) in the very first cell division. Following fertilization of the ovule by sperm, the plant zygote divides asymmetrically which segregates the auxin as follows:

- The apical (top) cell contains the higher concentration of auxin; this cell which will go on to become the plant embryo
- The basal (bottom) cell contains little auxin; this cell will go on to develop into a structure called the suspensor, which functions like an umbilical cord to provide nutrients from from maternal to embryonic tissue.

Through multiple rounds of cell division followed by differentiation, the apical cell ultimately gives rise to structures the cotyledons, the hypocotyl, and the radicle:

- The cotyledons, or embryonic leaves, will become the first leaves of the plants upon germination. Monocots tend to have a single cotyledon, while dicots tend to have two cotyledons (in fact, the number of cotyledons present is what gives them the prefix “mono-” or “di-“).
- The hypocotyl (“below-cotyl”) will develop into the stem as the plant matures.
- The radicle will develop into roots as the plant matures.

The images below shows the general structures and processes involved in seed germination:

