

Plant Development

How plant zygotes become embryos.

How embryos are packaged in seeds.

How fruits develop.

How seeds germinate and embryos grow.



Double fertilization forms zygote (2N) and endosperm (3N)

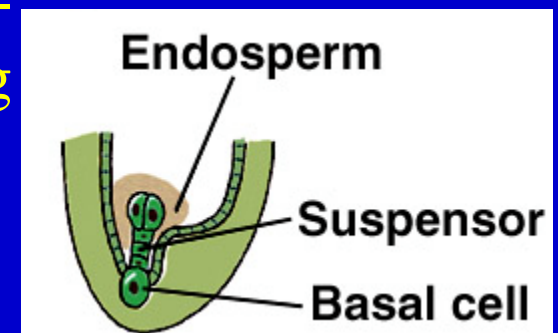
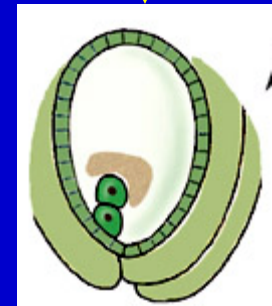
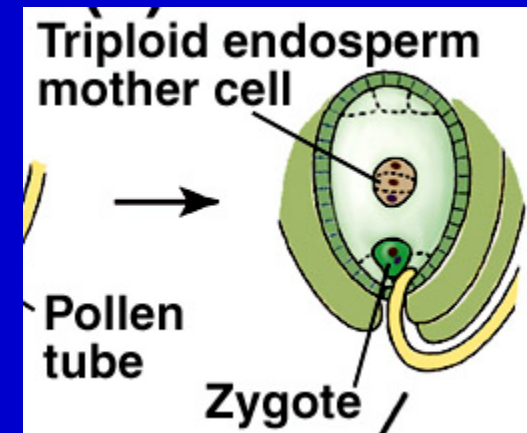
Zygote and endosperm go through mitosis to become many cells

Both cell types derive nutrition from sporophyte parent during development

Differentiation begins at first division of the zygote

upper cell will become embryo

lower cell becomes suspensor and basal cell - each helps provide nutrients to developing embryo



Proembryo consists of three cell types -

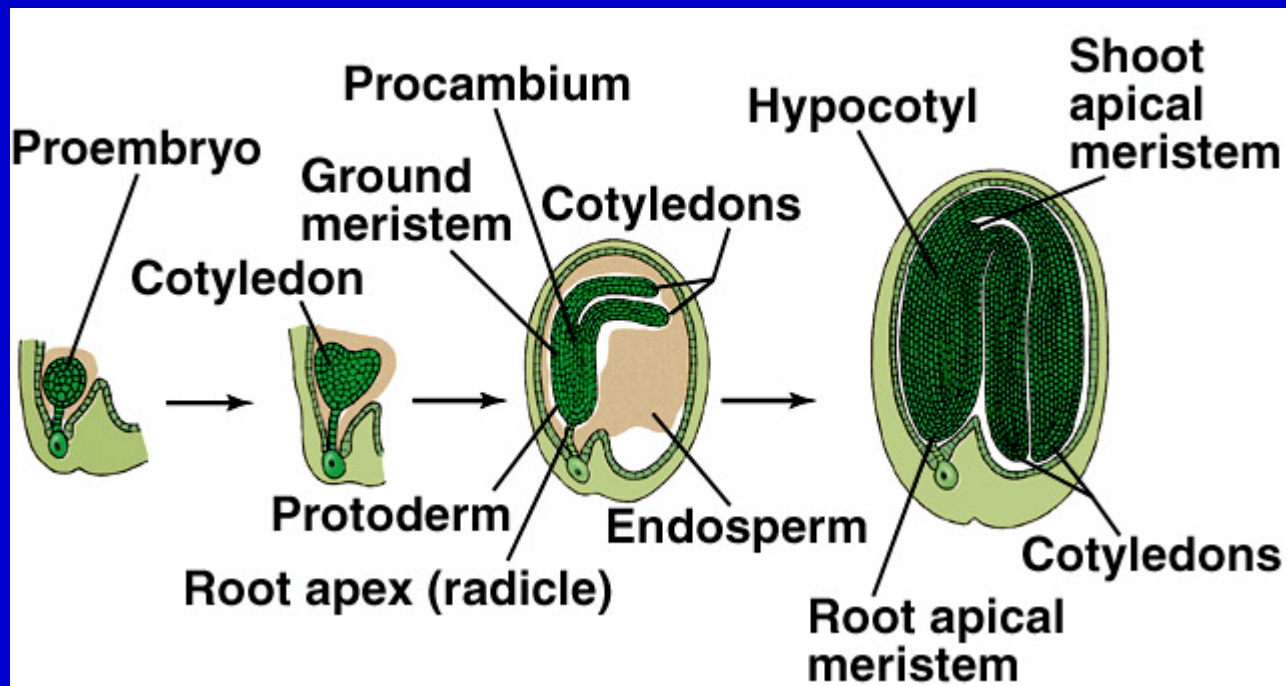
protoderm - becomes protective dermal tissue

procambium - gives rise to vascular tissue

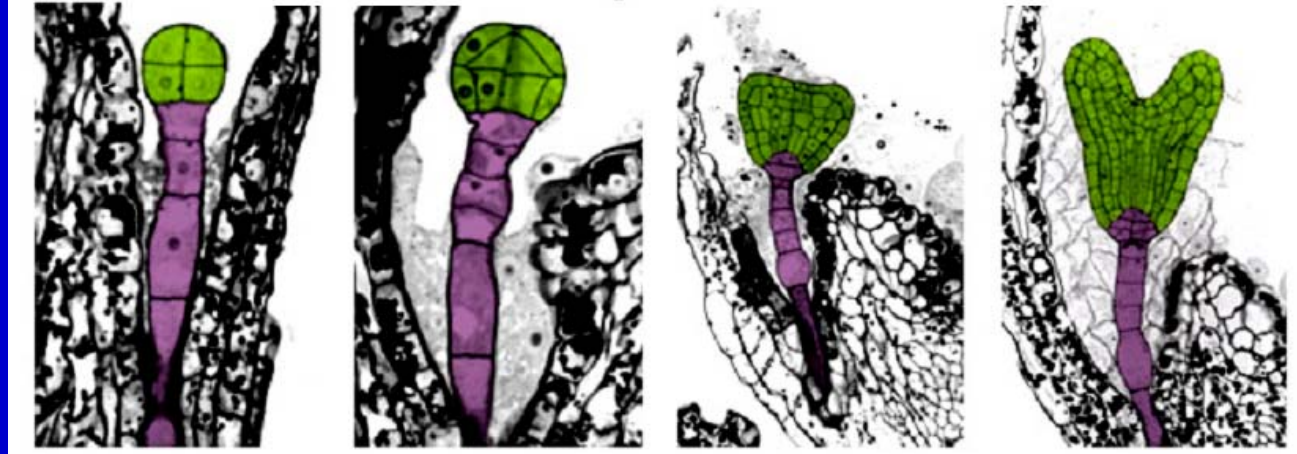
ground meristem - gives rise to ground tissue - for food and water storage

Ground meristem also gives rise to shoot and root apical meristems which establish the root-shoot axis

Embryonic cells give rise to cotyledons - “seed leaves”



Early Developmental Stages of *Arabidopsis thaliana*



Root and shoot formation

established during globular stage of development
formation of each controlled independently

Morphogenesis

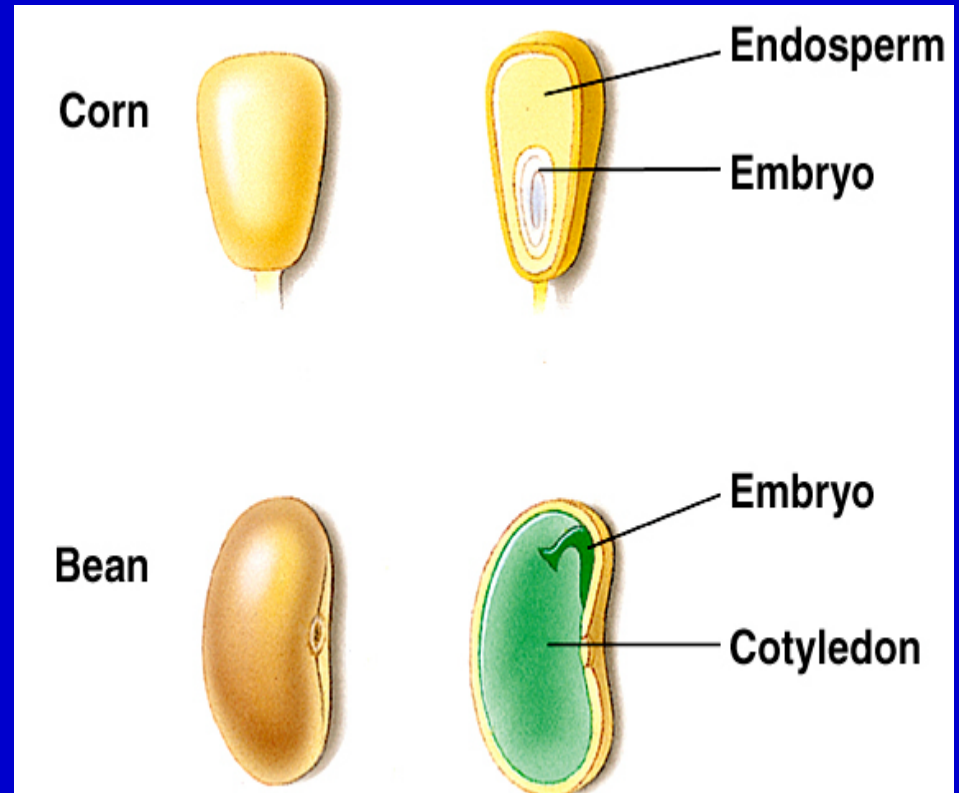
globular stage gives rise to heart-shaped embryo with cotyledons
produced by embryonic cells

Endosperm becomes loaded with nutrients - carbohydrates, lipids, and proteins

nutrients are transferred to embryo through suspensor

In monocots, endosperm remains in the mature seed

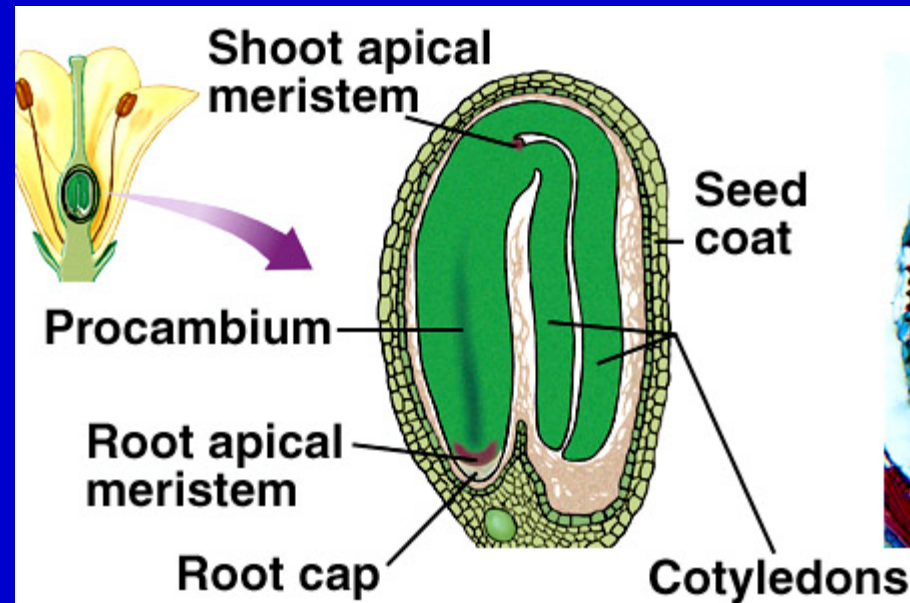
In dicots, the nutrition of the endosperm is transferred to the cells of the cotyledons and stored there. The mature dicot seed has little or no endosperm.



The integuments of the ovule become the protective seed coat.

A seed is a dormant resting stage with very little metabolic activity

Mature seeds have very little moisture within them (< 20%)



Some seeds can remain dormant for many years - soils commonly contain a “seed bank” - a store of dormant seeds from many seasons

Germination often requires specific environmental cues

a specific amount of water, sunlight of proper wavelength, heat
some seeds have germination inhibitors that must be washed away

some seeds require fire for germination

some seeds require a period of cool temperatures prior to germination - “stratification”

Fruits are derived from ovarian tissues



Germination begins with the absorption of water, and increase in metabolic activity, and the cracking of the seed coat

The root emerges first to anchor plant.

Elongation of the hypocotyl extends the shoot above ground.

Cotyledons may be photosynthetic or remain below ground.

