

# Annotated Diagrams: Plant Embryogenesis & Seed Anatomy

## Capsella Embryo Development Series

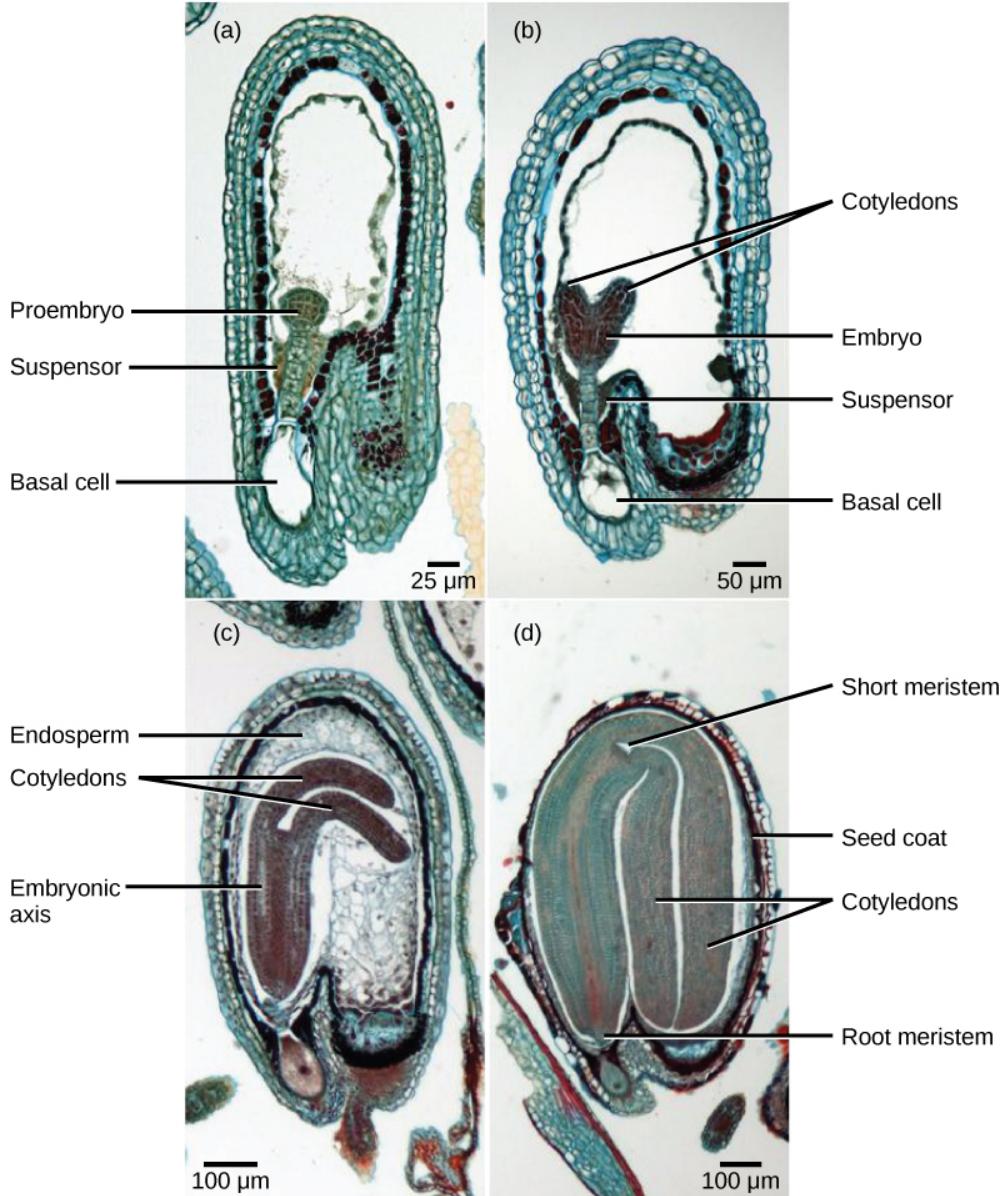


Figure 1: Developmental stages of *Capsella bursa-pastoris* embryo. Shown are the stages of embryo development in the ovule of a shepherd's purse (*Capsella bursa*). After fertilization, the zygote divides to form an upper terminal cell and a lower basal cell. (a) In the first stage of development, the terminal cell divides, forming a globular pro-embryo. The basal cell also divides, giving rise to the suspensor. (b) In the second stage, the developing embryo has a heart shape due to the presence of cotyledons. (c) In the third stage, the growing embryo runs out of room and starts to bend. (d) Eventually, it completely fills the seed. (credit: modification of work by Robert R. Wise; scale-bar data from Matt Russell)

**A. Zygote Stage:** Single cell resulting from fertilization

**B. Globular Stage:** Spherical mass of undifferentiated cells

**C. Heart Stage:** Cotyledon primordia begin to form

**D. Torpedo Stage:** Embryo elongates, tissues differentiate

**E. Mature Embryo:** Fully developed with cotyledons, epicotyl, hypocotyl, and radicle

### Dicot Seed Anatomy (*Phaseolus vulgaris* - Bean)

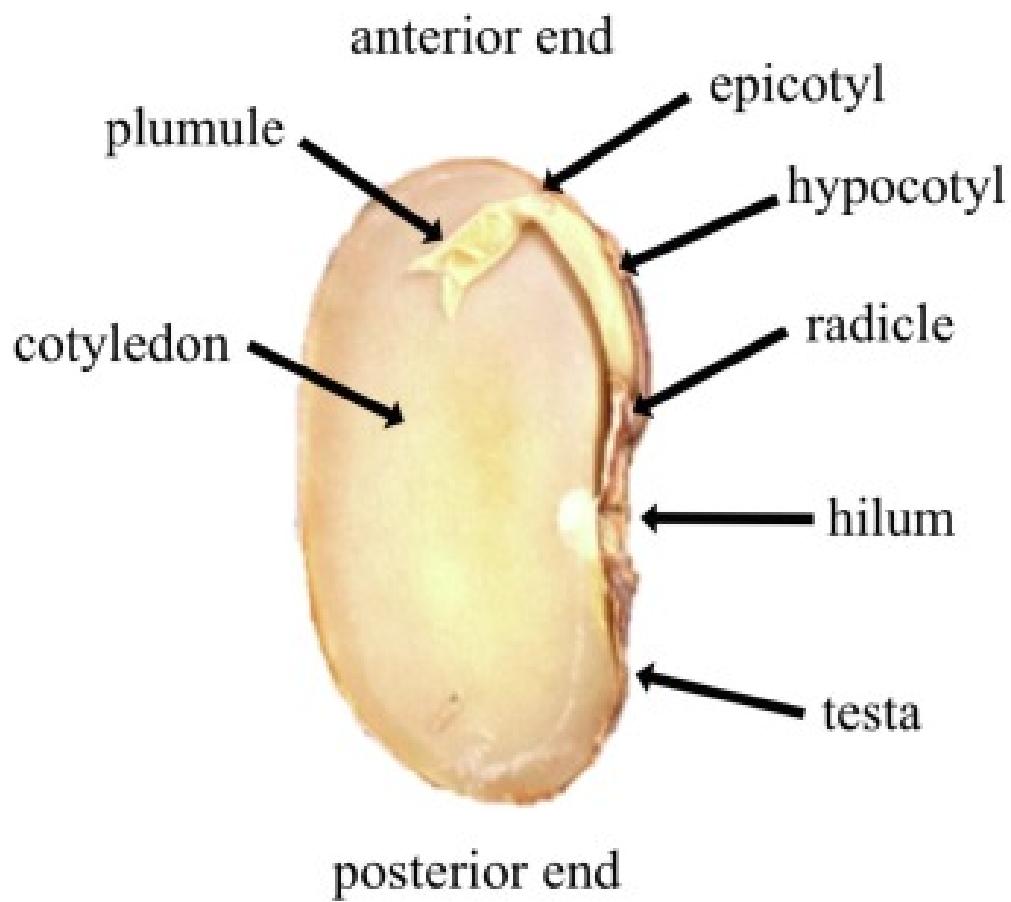


Figure 2: Longitudinal section of *Phaseolus vulgaris* (bean) seed

**Testa:** Protective seed coat

**Cotyledons (2):** Food storage organs

**Plumule:** Embryonic shoot (epicotyl + young leaves)

**Hypocotyl:** Stem region below cotyledons

**Radicle:** Embryonic root

**Hilum:** Scar from seed attachment

### Monocot Seed Anatomy (Zea mays - Corn)

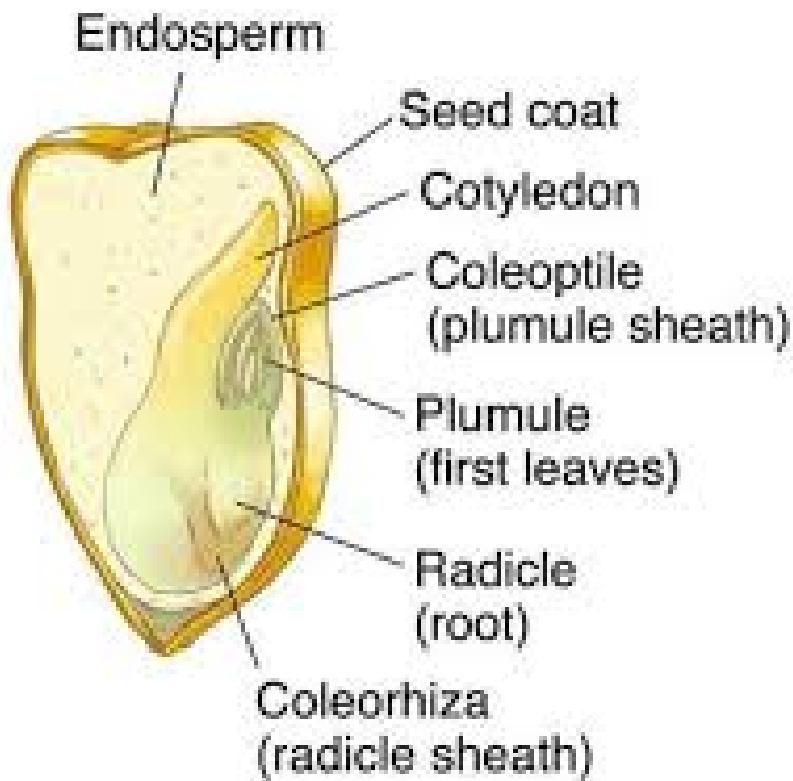


Figure 3: Longitudinal section of Zea mays (corn) kernel

**Pericarp:** Fruit wall fused with seed coat

**Endosperm:** Starchy food reserve

**Scutellum:** Single cotyledon (absorbs nutrients)

**Coleoptile:** Protective sheath around plumule

**Plumule:** Embryonic leaves and shoot

**Coleorhiza:** Protective sheath around radicle

## Radicle: Embryonic root

### Comparative Embryo Structure

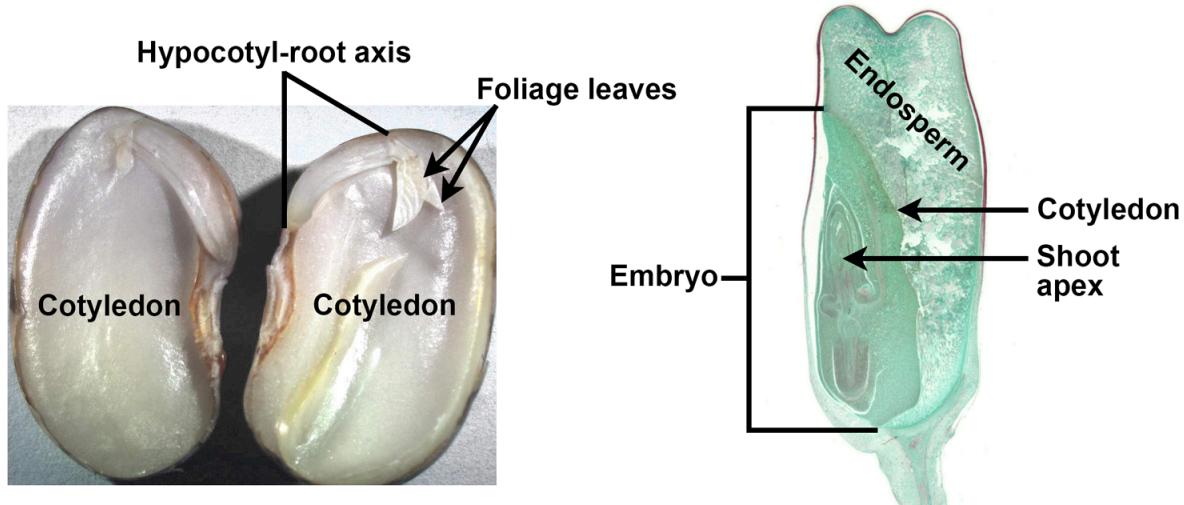


Figure 4: Comparison of dicot and monocot embryo structure

### Key Differences:

- **Cotyledon Number:** Dicot (2) vs Monocot (1)
- **Food Storage:** Cotyledons (dicot) vs Endosperm (monocot)
- **Protective Structures:** None (dicot) vs Coleoptile/Coleorhiza (monocot)
- **Endosperm:** Absent (dicot) vs Present (monocot)

### Seed Germination Sequence

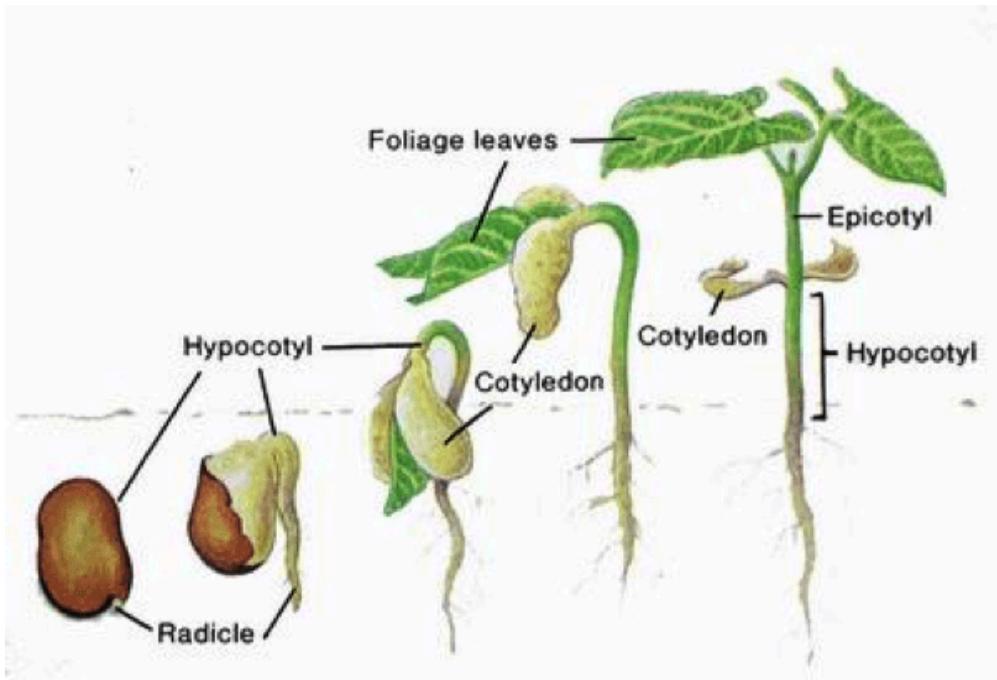


Figure 5: Sequence of bean seed germination over 7 days

**Stage 1 - Imbibition:** Seed absorbs water, swells

**Stage 2 - Radicle Emergence:** Root breaks through seed coat

**Stage 3 - Hypocotyl Elongation:** Stem grows, forms hook

**Stage 4 - Cotyledon Expansion:** Seed leaves emerge and expand

**Stage 5 - Photosynthesis Begins:** True leaves develop

Starch Test Results



Figure 6A: Bean cotyledons with Lugol's iodine

## Corn Grains



Untreated



Treated with Iodine

Figure 6B: Corn endosperm with Lugol's iodine

**Interpretation:**

- **Bean Cotyledons:** Positive starch test (blue-black color) indicates starch storage
- **Corn Endosperm:** Strong positive starch test confirms endosperm as primary storage tissue
- **Comparison:** Both seeds store starch but in different tissues (cotyledons vs endosperm)

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## GBIO 100 - Developmental Biology Laboratory

Laboratory Exercise No. 4: Reference Diagrams - Use these for your lab notebook entries