Plant Physiology and Histology

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Overview:

1. The Flower
2. Formation of the Embryo
3. Cells and Tissues of the Plant Body
    i. Ground tissues
    ii. Vascular tissues
    iii. Dermal tissues

4. Summary Table

1 The Flower

The flower is a determinate shoot - a shoot with growth of a limited duration - that bears sporophylls, which are sporangium-bearing leaves.

- clustered n groups called **inflorescences**
- the stalk of an inflorescence or of a solitary flower is known as a **peduncle**
- the part of the flower stalk to which the flower parts are attached is termed the **receptacle**

Many flowers include two sets of sterile appendages, the sepals and petals, which are attached to the receptacle below the fertile parts of the flower, the stamens and carpels. The sepals and petals are jointly known as the perianth.

- **perfect** (bisexual): having both stamens and carpels
- **imperfect** (unisexual): either the stamen or carpels are missing
    - staminate
    - carpellate (pistillate)

Any one of the four floral whorls - sepals, petals, stamens, or carpels - may be lacking.

- **Complete**: flowers that have all four
- **Incomplete**: if any, are lacking

Thus, an imperfect flower, which is lacking either stamens or carpels, is also incomplete, but not all incomplete flowers are imperfect, because they may well have both stamens and carpels.

In terms of the points of insertion of the perianth and stamens, there are three categories.

1. **Hypogynous**: perianth and stamens are situated on the receptacle beneath the ovary and free from it (e.g Lilies)
2. **Epigynous**: perianth and stamens arise from the topi of the ovary (e.g apple blossoms)
3. **Perigynous**: stamens and petals are attached to the sepals (e.g cherry flowers)

2 The Formation of the Embryo

Embryogenesis: formation of the embryo

Embryogenesis establishes the body plan of the plant, consisting of two superimposed patterns:

1. Apical-based pattern (along the main axis)
2. Radial pattern (of concentrically arranged tissue systems

Formation of the embryo begins with the division of the zygote within the embryo sac of the ovule. In most angiosperms, the first division of the zygote is asymmetrical and transverse with regard to the long axis of the zygote.

NOTE ♪: Division → apical-basal polarity

Through an orderly progression of divisions, the embryo eventually forms a nearly spherical structure - the embryo proper - and the suspensor. Before this stage is reached, the developing embryo is referred to as the proembryo.

The Primary Meristems:

When first formed, the embryo proper consists of a mass of relatively undifferentiated cells. Soon, changes in internal structure of the embryo proper result in the initial development of tissue systems.

- **Protoderm** = the future epidermis
- **Ground meristem** = precursor of the ground tissue, surrounds the procambium
- **Procambium** = precursor of the vascular tissue

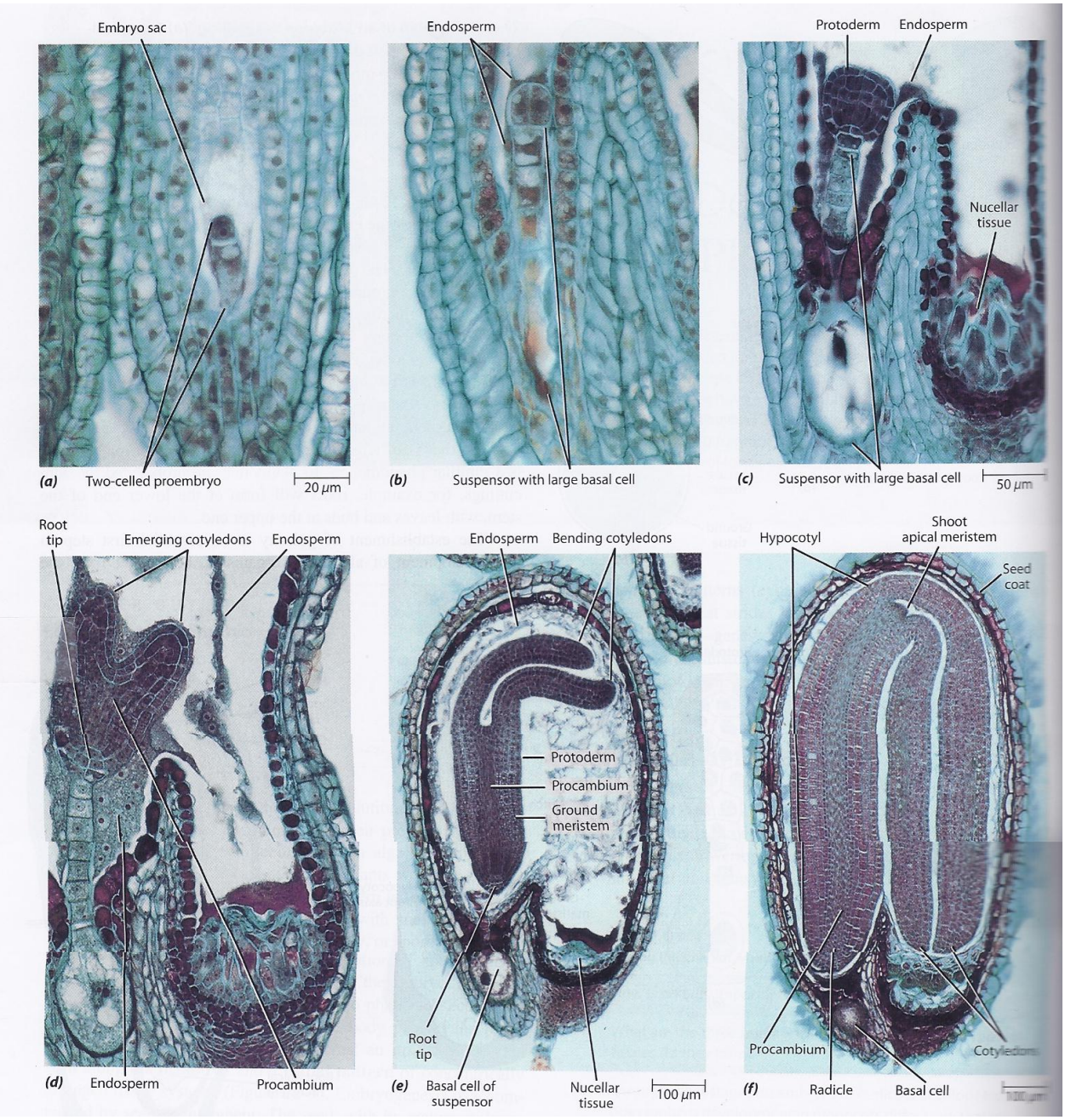
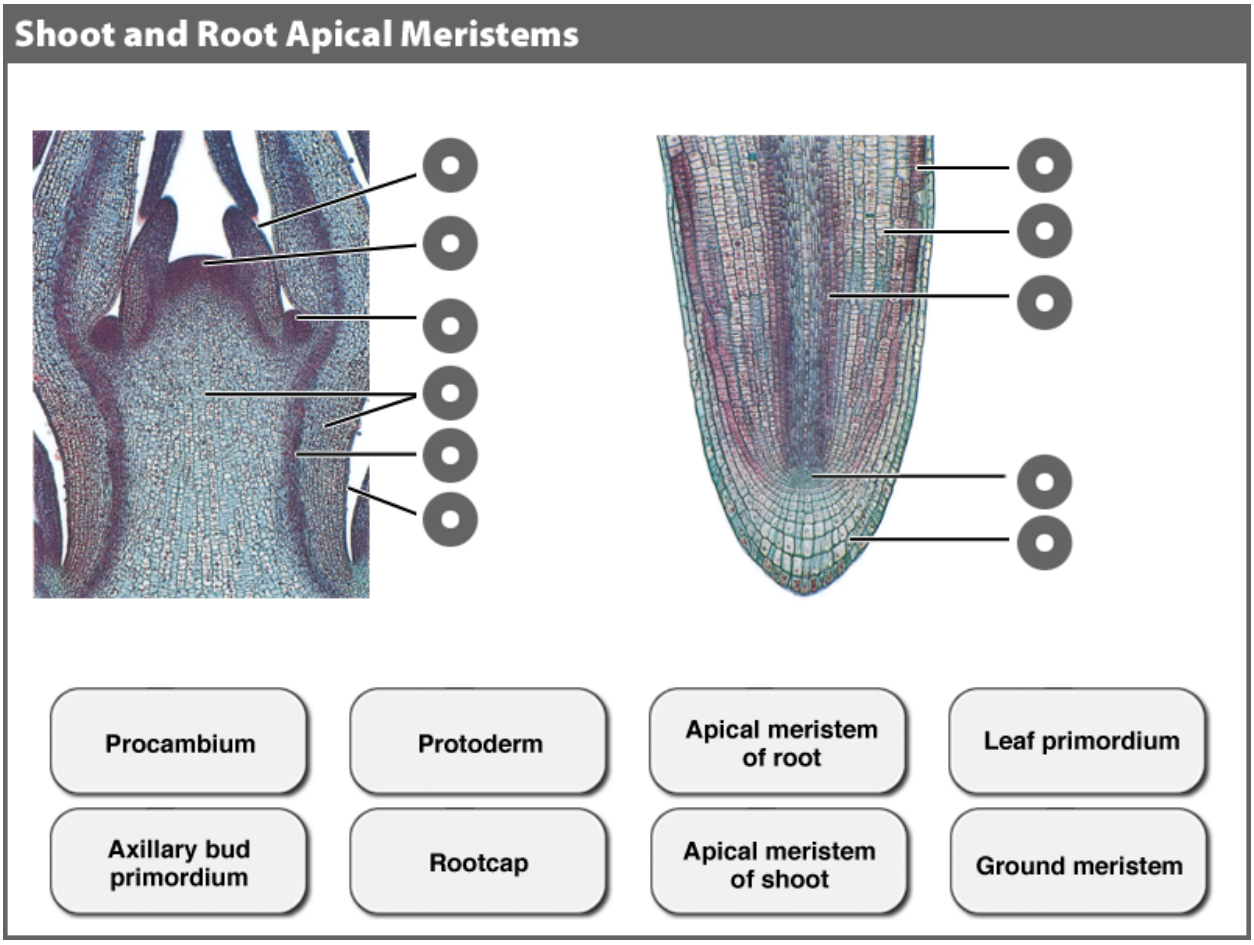


Figure 1. Development of the embryo of a eudicot, shepherd's purse (*Capsella bursa-pastoris*)

The Meristems

Most plant development occurs after embryogenesis, through the activity of meristems. These embryonic regions or populations of cells retain the potential to divide long after embryogenesis is over. With germination of the seed, the **root** and **shoot apical meristems** give rise to the roots, stems, leaves, and flowers.



Differentiation

- process by which cells with identical genetic constitution become different from one another and from the meristematic ells from which they originate.

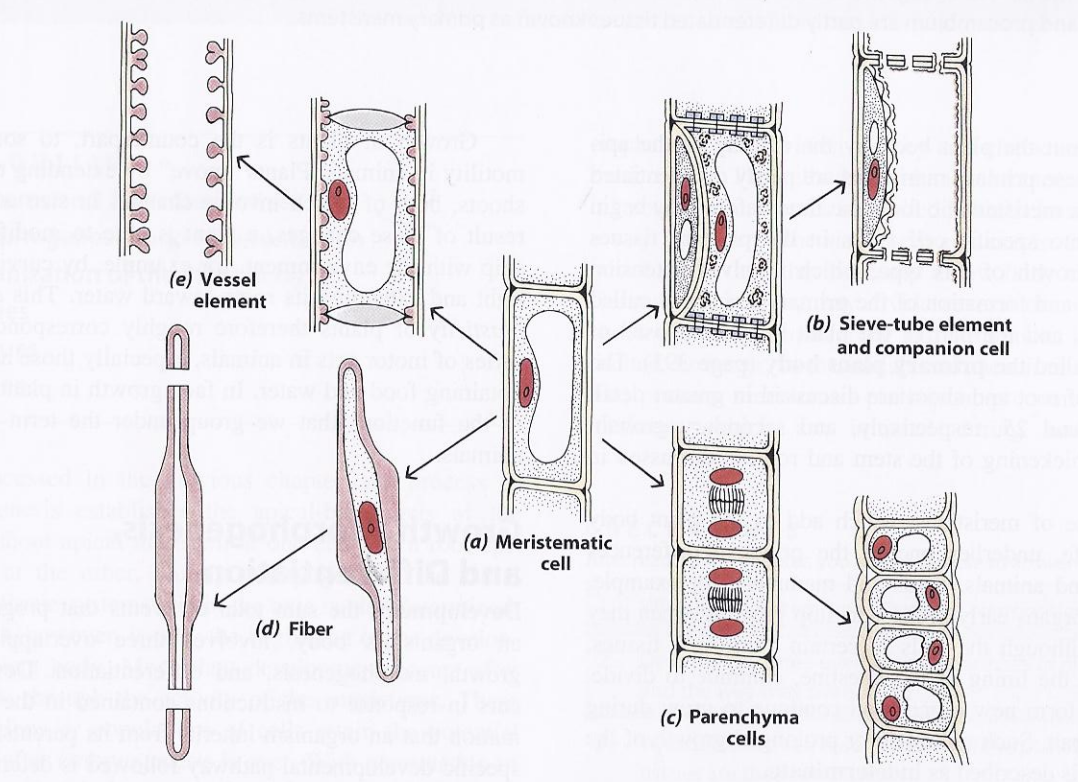


Figure 2. Differentiation of cells

3 Internal Organization of the Plant Body

Cells are organized into → tissues.

- Ground (fundamental) tissue
- Vascular tissue
- Dermal tissue

Simple v. Complex

Tissues composed of only one type of cell are called simple tissue, whereas those composed of two or more types of cells are called complex.

Simple: parenchyma, collenchyma, and sclerenchyma (the ground tissues)

Complex: xylem, phloem, epidermis, and periderm

Ground Tissue

Parenchyma:

- most numerous in the plant body
- commonly occur as continuous masses
    - in the cortex
    - in the pith of stems and roots
    - in leaf mesophyll
    - in the flesh of fruits

Because they maintain their meristematic ability, parenchyma cells having only primary walls play an important role in regeneration and wound healing.

- photosynthesis, storage, and secretion (activities dependent on living protoplasts)

Collenchyma:

- commonly occurs in discrete strands or as continuous cylinders beneath the epidermis in stems and leaf stalks
- also found bordering the veins in eudicot leaves
- typically elongated, they can continue to develop think, flexible walls
- the typical supporting tisssue of growing stems, leaves, and floral parts

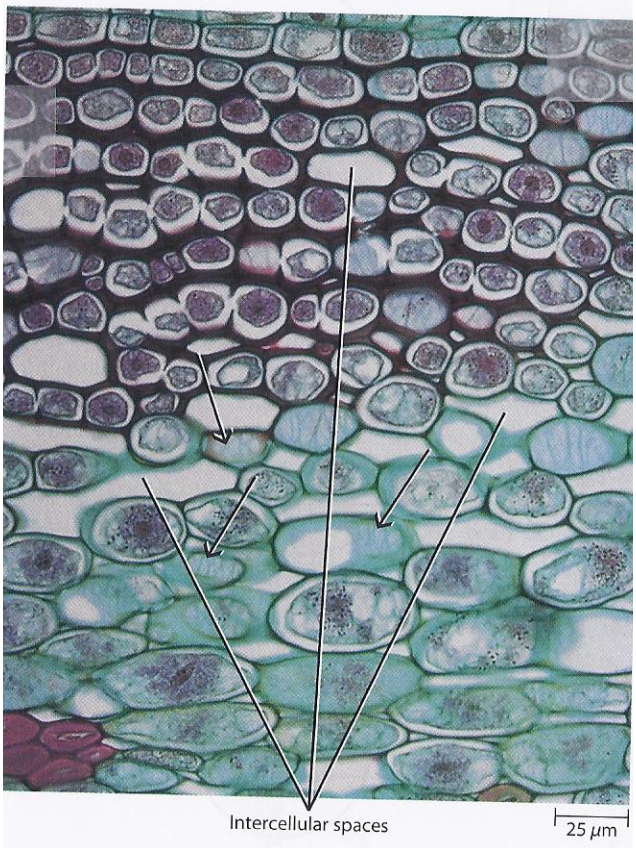


Figure 3. Parenchyma and collenchyma

Sclerenchyma:

- may form continuous masses or in small groups
- may develop in any or all parts of the primary and secondary plant bodies
- often lack protoplasts at maturity

Two types of sclerenchyma: 1. fibers 2. sclereids

- fibers: generally, long, slender cells that occur in strands or bundles
- Sclereids: variable in shape and often branched; make up the seed coats