

**OVERVIEW:** Your objective in this assignment should be to understand

1. ...the development of the plant body from the embryo and subsequent terminal and lateral meristems (*i.e.* groups of cells which behave like “stem cells” so much in the news these days).
2. ...the role of three primary meristems (*i.e.* *protoderm*, *procambium*, and *ground meristem* which arise from the terminal meristems and which are responsible for the development of *dermal*, *vascular tissue* and *ground tissue*).

**PROCEDURE:** We have already studied most of Chapter 4, but have not included the beginning section entitled “Meristematic Tissues.” Please read these two pages. Then, use Chapter 5, pp 65-68 and Chapter 6, pages 86-89 for additional support. The STUDY OUTLINE ties these concepts together to provide a logical flow of the concept of meristems and plant growth.

**THEMES:** Plant meristems are responsible for producing healthy, new cells which differentiate in an orderly manner to establish regions of dermal, ground, and vascular tissue in the growing plant body.

**LECTURE DISCUSSION QUESTIONS:**

1. What is the relationship between the primary meristems and the tissues such as dermal, vascular, and ground tissue during plant development?
2. Consult your study of the *Capsella* embryo from Laboratory Ex. #10, along with Figure 6.2, (Chapter 6) to explain the development of the plant stem axis following seed germination.
3. What is *growth*? How would you distinguish growth from *development*?

**STUDY OUTLINE:** MERISTEMS and PLANT GROWTH

I. INTRODUCTION -- How do plant cells organize into a multicellular plant body?

A. PLANTS ARE COMPOSED OF MANY DIFFERENT TISSUES – See SA #27

B. TISSUES, IN TURN, FORM THE ORGANIZATION OF ORGANS

1. Three plant organs – leaf, stem, root
2. Each organ has three *tissue regions* – dermal, vascular, ground tissue

II. VASCULAR PLANT DEVELOPMENT

A. Zygote  $\xrightarrow{\text{Mitosis + Cytokinesis + Differentiaton}}$  Embryo

B. SEED = embryo + food reserve [cotyledon or endosperm]

1. LEAF PRIMORDIA already in seed
2. MERISTEMS = region where undifferentiated cells divide

### III. MERISTEMS -- areas where plant growth is possible – *i.e.* like “stem cells” in animals

#### A. PLANT *versus* ANIMAL

1. Animal: Determinant growth -- short period of embryonic growth during which all body parts are formed – henceforth, increase in size only
2. Plant: Indeterminant growth -- meristems, continually embryonic cells, remain active throughout life – produce additional organs (*e.g.* leaves, flowers)

#### B. FUNCTIONS OF MERISTEMS

1. Primary meristems establish growth patterns for tissues and organs
2. Produce genetically healthy cells

### IV. TYPES OF MERISTEMS

#### A. APICAL MERISTEMS -- two types: root apical and shoot apical (tip) meristem

#### B. LATERAL MERISTEMS -- produce secondary growth (girth)

#### C. INTERCALARY MERISTEMS -- growth between mature tissues (*e.g.* grasses)

#### D. PRIMARY MERISTEMS -- meristems *derived* from apical meristems; produce primary (I°) growth by which plant stems and roots increase in length (elongation)

##### 1. PROTODERM

- a. Formed from *anticlinal division* of surface apical cells
- b. In turn, develops into epidermis

##### 2. PROCAMBIUM -- develops into vascular tissue

##### 3. GROUND MERISTEM -- develops into core tissues (cortex and pith)

### V. APICAL MERISTEMS – or “From where do new cells originate in a growing plant?”

#### A. SHOOT APICAL MERISTEM – *e.g.* *Coleus* (x-section) Figure 6.2, Ch. 6.

1. TUNICA -- outermost layer or two; divides anticlinally to --> protoderm
2. CORPUS -- inner layers; divide in all planes; consist of:
  - a. Peripheral Meristem – along with protoderm and procambium, produces leaf primordia
  - b. Pith-rib meristem -- produces vertical files of pith cells -> expand internodes]
  - c. Central Mother Cells -- supplies cells to peripheral and rib-meristems

#### B. ROOT APICAL MERISTEM

1. Divides to produce *root cap* as protection
2. Produces all root tissues toward shoot of plant
3. *Quiescent center* -- inner core of non-dividing cells; rebuilds damaged meristem

### VI. LATERAL MERISTEMS – or “What keeps woody plants from “bursting their bark?”

#### A. Vascular cambium -- originates from latent procambium; produces both II° xylem and II° phloem

#### B. Phellogen -- produces *periderm*, the outer bark consisting of phellem (cork) and phelloderm

GROWTH = an irreversible increase in size of an organism resulting from

1. Cell division -- more cells
2. Cell enlargement -- cell wall loosening and stretching via turgor