Vivekanand College, Kolhapur
(Autonomous)

Department of Botany

B.Sc. II

Topic : Meristem

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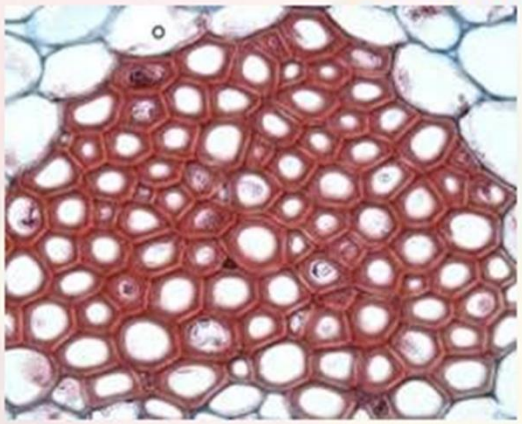
Learning objectives:

- What is Tissue?
- How Tissue is Classified?
- What is Meristematic Tissue?
- What are the Characteristics of Meristematic Cells?
- Classification of meristem:
  - Apical Meristem
  - Lateral Meristem
  - Intercalary Meristem
  - Primary Meristem
  - Secondary Meristem

TISSUE SYSTEM

What is tissue?



- A group of cells with similar **ORIGIN** and **FUNCTION**
- **Histology** – study of tissue
- Examples of plant tissues:
  - **Epidermal tissue**: forms epidermis, for protection
  - **Vascular Tissue**: vascular bundles, for conduction
  - **Ground tissue**: for photosynthesis or storage

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TISSUE SYSTEM

Classification of Tissues

- Tissue classification based on development
  - **Meristematic tissue** : continuously dividing
  - **Permanent tissue:** non-dividing and mature

- Classification based on components
  - **Simple tissue:** single type of cells (Parenchyma, Collenchyma, Sclerenchyma)
  - **Complex tissue:** many types of cells (Eg. Xylem, Phloem)
  - **Secretory tissue:** special functions (glands)

MERISTEMATIC TISSUE

What is meristem?

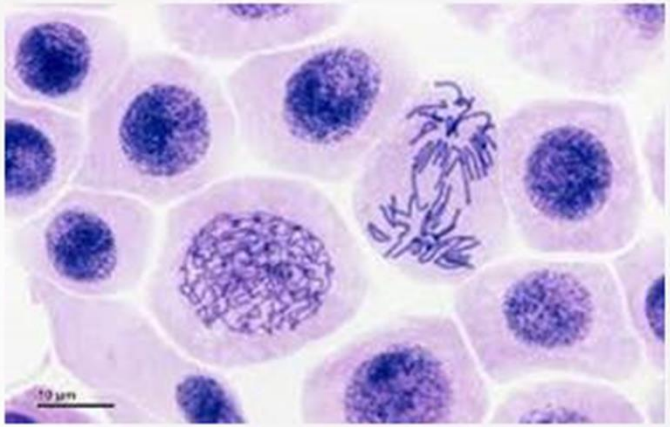
- Term proposed by **Karl Nägeli**
- **Greek** word '*merizein*' = to divide
- A plant tissue
- Composed of undifferentiated mass of cells
- Rapidly dividing
- Found in the growing region of plant
- Give rise various plant organs
- Assist in plant growth

Karl Nageli

MERISTEMATIC TISSUE

Characteristics of Meristematic Cells:

1. *Composed of rapidly dividing cells*
2. *Undifferentiated, size and shape of cells varies*
3. *Cells more or less isodiametric*
4. *Contain dense granular cytoplasm*
5. *Intercellular space generally absent*
6. *Cell wall composed of primary cell wall*
7. *Contains primary pit fields*
8. *Cells do not have ergastic substances*
9. *Limited amount of endoplasmic reticulum*
10. *Plastids in the pro-plastid stage*



Root Meristem

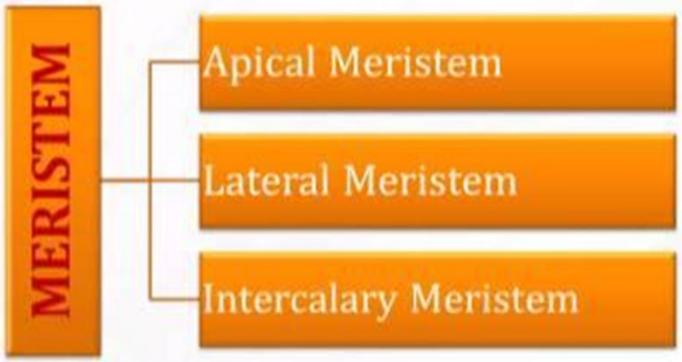
CLASSIFICATION OF MERISTEMS

MERISTEMATIC TISSUE

Classification of meristem

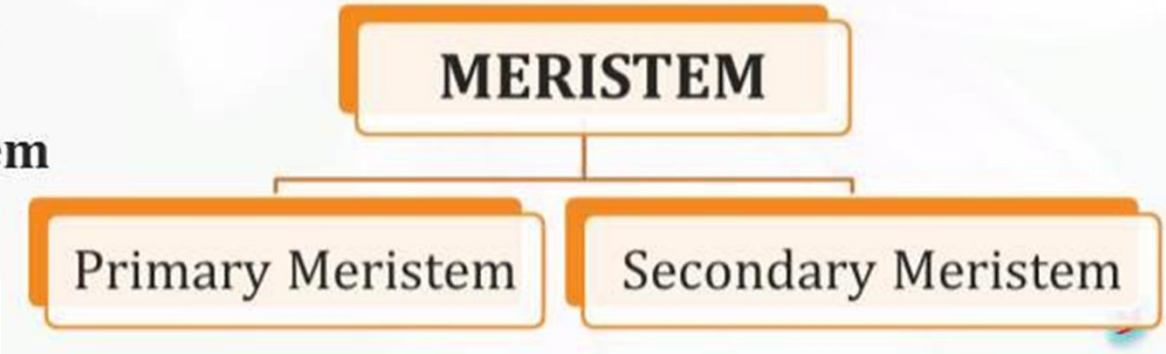
- Classification based on position in the plant body

1. **Apical meristem**
2. **Lateral meristem**
3. **Intercalary meristem**



- Classification based on nature of cell giving the meristem

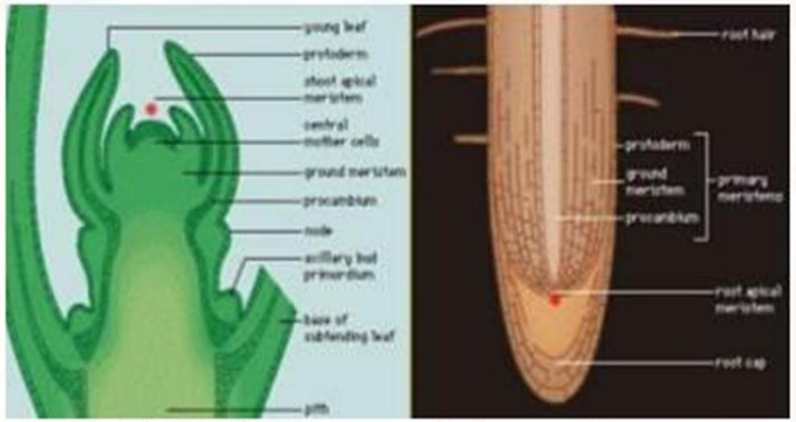
1. **Primary meristem**
2. **Secondary meristem**



MERISTEMATIC TISSUE

(1). Apical Meristem

- Occurs at the tips of stem, roots and leaves
- Composed of one or more cells
- Present in the growing tips
- Also called as **APICAL CELL** or apical initial
- Cells maintains their individuality and position
- Activity of this meristem cause increase in length
- Produces the primary structure of plants
- Apical meristem is **terminal** in stem and **sub-terminal** in roots

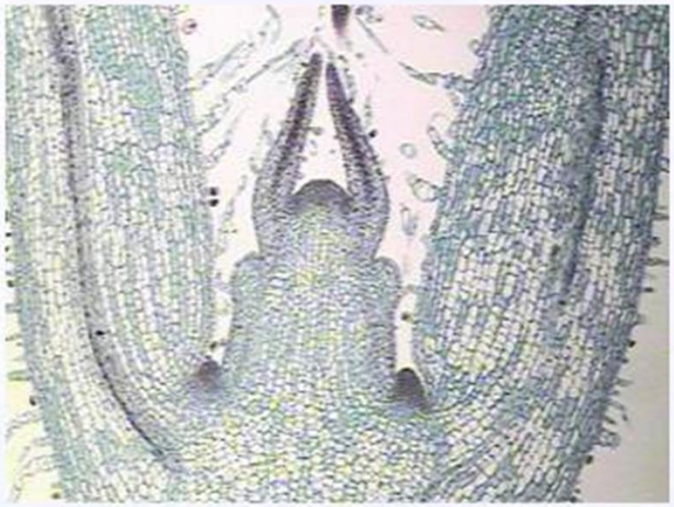


Apical Meristem (shoot & root)

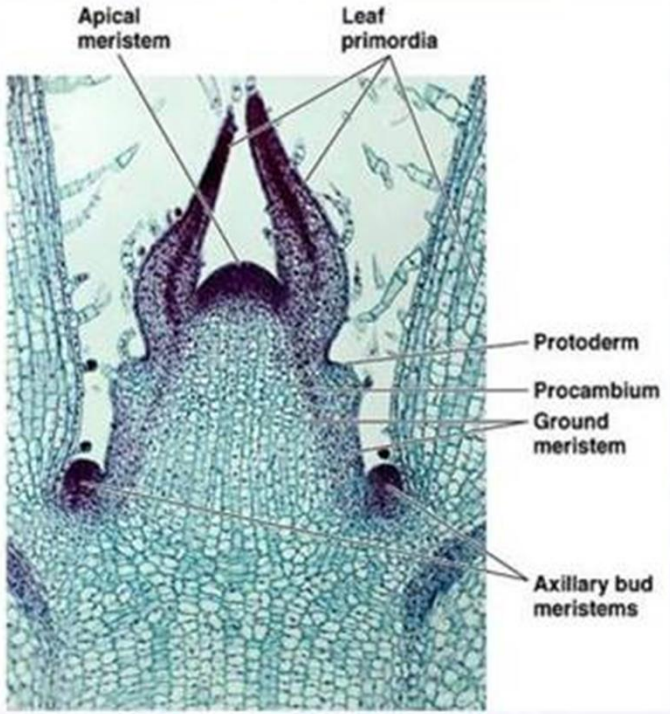
MERISTEMATIC TISSUE

(1). Apical Meristem

- Number of apical cell varies in different plant groups
- Lower plants usually have single apical cells
- Gymnosperms and Angiosperms have a group of cells



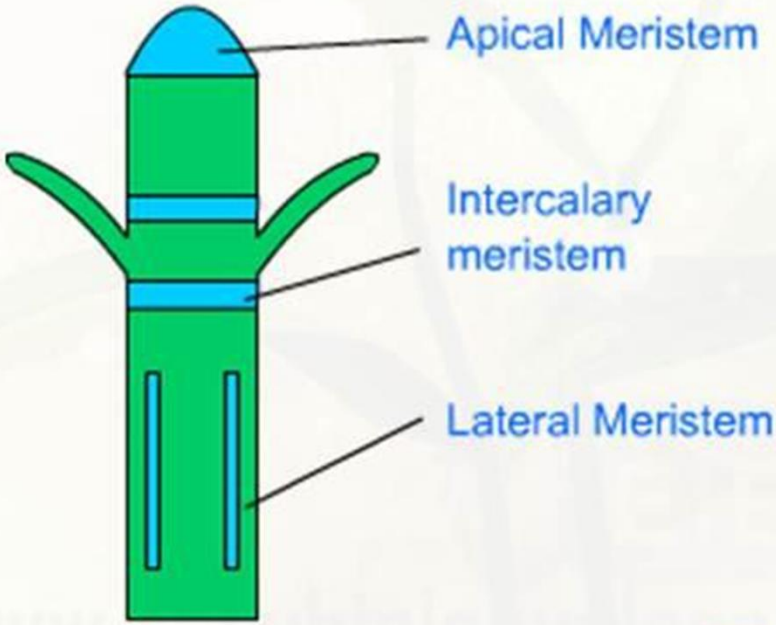
Apical Meristem (shoot)



MERISTEMATIC TISSUE

(2). Lateral Meristem

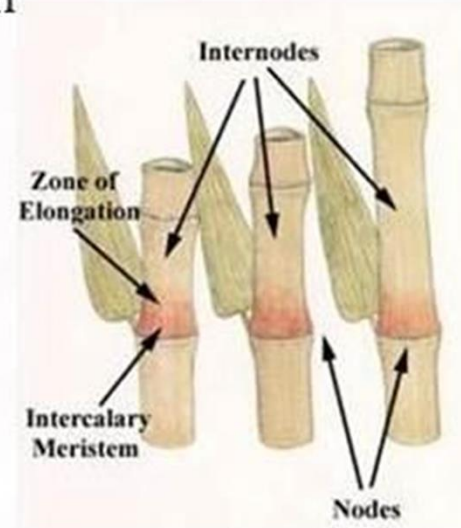
- Meristem present **parallel to the organs** in which they occurs
- Helps in increasing diameter of the plant body
- Increase diameter by adding new cells to the existing tissues
- They divide only in one plane
- The dividing plane is **periclinal** plane
- Example:
  - **Vascular cambium**
  - **Cork cambium (phellogen)**



MERISTEMATIC TISSUE

(3). Intercalary meristem

- Meristem present **between permanent** tissue regions
- They are actively growing region behind apical meristem
- They are not typical meristems
  - Commonly found in internodes of vascular plants
  - Also in leaf sheath of grasses
  - Present just above the node of *Equisetum*



- They are portions of apical meristem that were separated from the apex during development by layers of differentiated tissues

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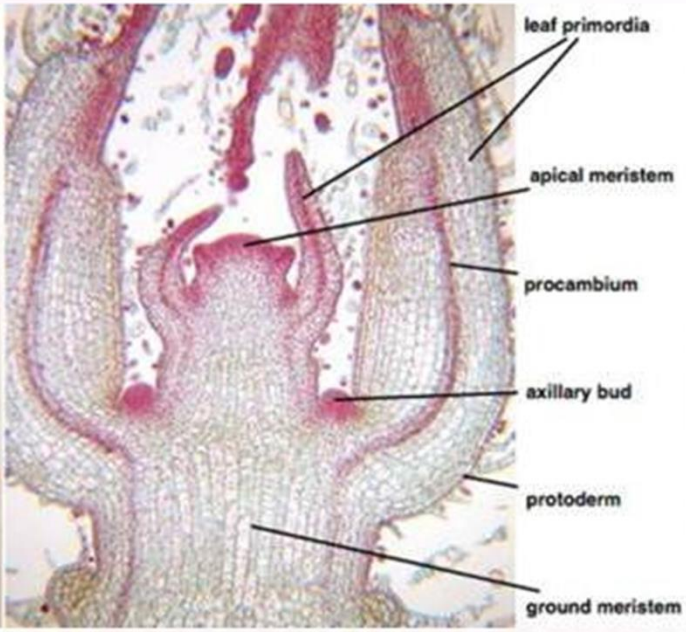
MERISTEMATIC TISSUE

Classification of meristem based on nature of cells giving the meristem:

(1). Primary meristem

- Direct descendants of embryonic cells
- Continuously involved in cell division and growth
- Apical meristems are best examples

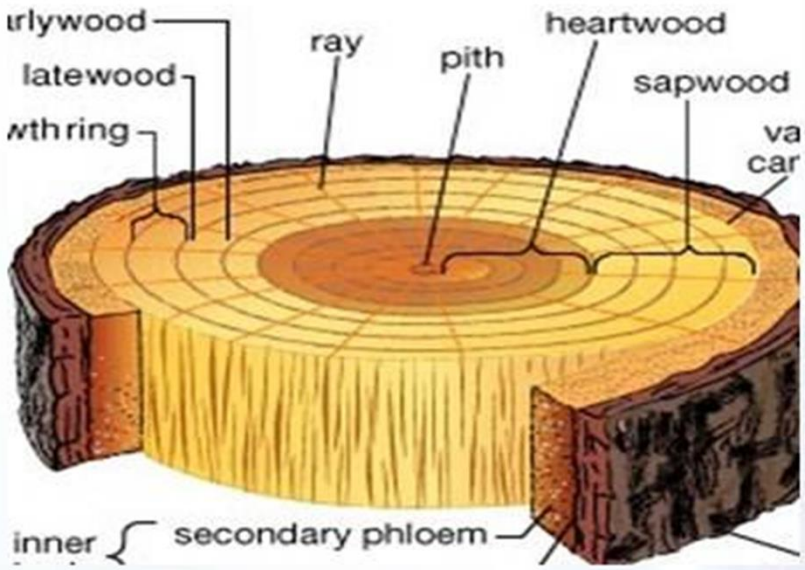


MERISTEMATIC TISSUE

Classification of meristem based on nature of cells giving the meristem:

(2). Secondary meristem

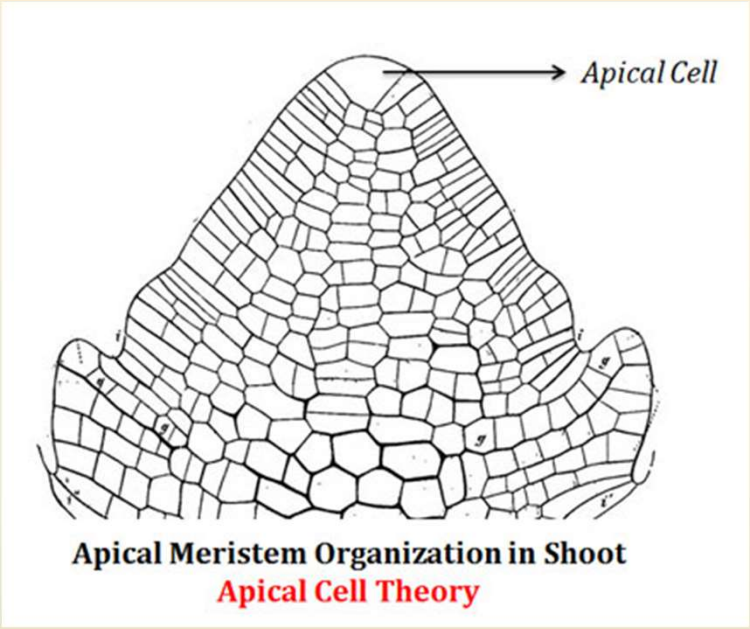
- **Meristems developed from permanent tissues**
- Example:
  - **Cork cambium**
  - **Accessory cambia**



Vascular cambium is not fall precisely in any of these two categories

Apical cell theory

- Apical cell theory was the first theory to explain the apical organization in plants.
- This theory is proposed by Nageli in 1858.
- The apical cell theory says that a single apical cell constitutes the growth point in most of the cryptogams.
- This single cell is called the 'APICAL CELL'.
- The activity of this single apical cell leads to the development of the complete plant body.
- Nageli proposed that the shoot apex of Gymnosperms and Angiosperms also consisted of a single apical cell.
- However, later studies rejected the apical cell theory because the single-celled apical organization is limited only to cryptogams (algae, fungi, bryophytes and Pteridophytes).



Apical Meristem Organization in Shoot
Apical Cell Theory