Chapter Notes

Tissues

Grade 9
1. **Tissue**
   - 1.1 Definition
   - 1.2 Levels of Organisation
   - 1.3 Plant vs Animal Tissues

2. **Plant Tissue**
   - 2.1 Classification of Plant tissues
   - 2.2 Meristematic vs Permanent Tissues

3. **Meristematic Tissue**
   - 3.1 Characteristics
   - 3.2 Types of Meristematic Tissue

4. **Permanent Tissue**
   - 4.1 Characteristics
   - 4.2 Simple Permanent Tissue
   - 4.3 Complex Permanent Tissue

5. **Animal Tissue**
   - 5.1 Classification of Animal Tissue
Epithelial Tissue
6.1 Simple Squamous
6.2 Stratified Squamous
6.3 Columnar
6.4 Ciliated Columnar
6.5 Cuboidal
6.6 Glandular

Connective Tissue
7.1 Blood
7.2 Bone
7.3 Ligament
7.4 Tendon
7.5 Cartilage
7.6 Areolar
7.7 Adipose

Muscular Tissue

Nervous Tissue
9.1 Neuron
9.2 Nerve fibre
Mind Map

- Meristematic tissue
  - Intercalary
  - Lateral
  - Apical

- Permanent tissue
  - Simple
  - Complex

Plant tissues

Tissues

Animal Tissues

Epithelial
- Simple
- Stratified
- Squamous
- Columnar
- Ciliated
- Cuboidal
- Glandular

Muscular
- Skeletal
- Smooth
- Cardiac

Connective
- Blood
- Bone
- Ligament
- Adipose
- Tendon
- Cartilage
- Areolar

Nervous
- Neuron
1.1 Definition

A group of cells that are similar in structure and work together to achieve a particular function forms a tissue.

1.2 Levels of Organisation

- A cell is the basic unit of life
- A tissue is a group of cells
- A group of tissues come together to form an organ
- Organs combine to form organ system
- Different organ systems coordinate to perform various life processes and forms an organism
### 1.3 Plant vs Animal Tissues

<table>
<thead>
<tr>
<th>Plant Tissue</th>
<th>Animal Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dead supportive tissues</strong> are more abundant as compared to living tissues.</td>
<td><strong>Living supportive tissues</strong> are more abundant as compared to dead tissues.</td>
</tr>
<tr>
<td>Growth tissues are not uniformly located, and some cells <em>divide continuously</em></td>
<td>Growth tissues are uniform and allow <em>limited growth</em> only.</td>
</tr>
<tr>
<td>Plants are <em>stationary</em> hence no muscular tissue are present.</td>
<td>Tissue organization is different as animals are <em>mobile</em> and need muscular tissue.</td>
</tr>
</tbody>
</table>

- **Meristematic Tissue**
- **Epithelial Tissue**
2. Plant Tissue

2.1. Classification of Plant Tissue

Plant tissues

- Meristematic tissue
  - Lateral
  - Apical
  - Intercalary

- Permanent tissue
  - Simple
  - Complex
    - Conducting
      - Xylem
      - Phloem
  - Supporting
    - Parenchyma
    - Collenchyma
    - Sclerenchyma

- Protective
  - Epidermis
  - Cork
### 2.2 Meristematic Tissue vs Permanent Tissue

<table>
<thead>
<tr>
<th>Meristematic Tissue</th>
<th>Permanent Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised and undifferentiated</td>
<td>Present throughout the plant and differentiated</td>
</tr>
<tr>
<td>Cells grow and divide regularly</td>
<td>Cells do not divide</td>
</tr>
<tr>
<td>Promotes growth of the plant</td>
<td>Performs various functions like protection, support, and conduction</td>
</tr>
</tbody>
</table>

### 3. Meristematic Tissue

#### 3.1 Characteristics

- Actively dividing cells
- Have dense cytoplasm and thin cellulose walls
- Have prominent nucleus and lack vacuole
- Few cells take up a specific role and lose the ability to divide to form permanent tissue
Differentiation

Process of taking up a permanent shape, size, and function

3.2 Types of Meristematic Tissues

**Apical**
- Present at shoot and root tips
- Increases length

**Intercalary**
- Present at base of leaves or internodes
- Elongates internodes

**Lateral**
- Present at lateral side
- Increases girth of the stem
4. Permanent Tissue

4.1 Characteristics

Permanent tissues are formed from meristematic tissue cells that have lost their ability to divide.

4.2 Simple Permanent Tissue

- This tissue is made of one type of cell.
- It is divided into protective and supportive tissues.

4.2 (A) Protective Tissue

- It consists of cells with thick walls.
- Epidermis is the protective tissue that undergoes changes in older plants to form cork.

Types of Protective Tissue - Epidermis

- Outer continuous layer without intercellular spaces
- Forms the cuticle layer
- Contains stomata for exchange of gases
- Function - Aids in gaseous exchange, protects the plant from water loss, mechanical injury, and parasitic invasion
Types of Protective Tissue – Cork

- Secondary meristem replaces the epidermis to form cork/bark as plants grow older.
- Cork contains dead cells and has suberin in their walls that makes them impervious to gases and water.

4.2 (B) Types of Supportive Tissue

- Unspecialised cells with thin cell walls and large intercellular spaces
- Present in soft parts of the plant and in the outer cortical region of roots and stems of plants
- Generally, stores food

- Living, elongated cells with irregular thickened corners with very few intercellular spaces.
- Usually found in stalks of leaves or flowers
- Provides mechanical support and flexibility to the plants
Sclerenchyma

- Dead, elongated cells with evenly thickened, lignified walls and no intercellular spaces
- Present in hard parts of the plant (Ex. covering of seeds and nuts)
- Provides strength and toughness to plant parts

4.2 (C) Specialised Parenchyma Cells

Chlorenchyma

- Parenchyma cells containing chloroplast
- Takes part in photosynthesis

Aerenchyma

- Parenchyma cells with air spaces between them
- Present in aquatic plants
- Provide buoyancy

Storage parenchyma

- Parenchyma cells that help in the storage of food and water
- Act as food and water reservoir
4.3 Complex Permanent Tissue

- Also called conducting or vascular tissue, made up of more than one type of cells
- Present in stems, roots, and leaves
- Two types – Xylem and Phloem

Types of Conducting Tissue – Xylem

- Complex permanent tissue with thick-walled cells
- Present in the stem, roots and leaves
- Provides upward movement of water and dissolved minerals from roots to different parts of plants

Components of Xylem

- **Xylem Fibre:** Separated by thin cross walls and has dead cells
- **Tracheid:** Consists of elongated cells with flat and tapering ends, dead cells
- **Xylem Parenchyma:** Consists of living parenchyma cells associated with xylem
- **Xylem Vessel:** Tubular structure which consists of dead cells
Types of Conducting Tissue – Phloem

- Complex permanent tissue which is composed mostly of living cells
- Provides passage for food from leaf to different parts

Components of Phloem

**Sieve tube:** Tubular cells arranged end to end

**Phloem fibre:** Elongated, tapering and dead cells with thickened cell walls

**Companion cell:** Living cell closely linked with sieve elements

**Phloem parenchyma:** Consists of living parenchyma cells associated with phloem

**Sieve cell:** Type of sieve element that performs conduction of food
5. Animal Tissue

5.1 Classification of Animal Tissue

- Animal Tissues
  - Epithelial Tissue
    - Simple Squamous
    - Stratified Squamous
    - Columnar
      - Ciliated Columnar
      - Cuboidal
      - Glandular
  - Muscular Tissue
    - Skeletal Muscle
    - Smooth Muscle
      - Cardiac Muscle
  - Connective Tissue
    - Blood
    - Bone
    - Ligament
    - Tendon
    - Cartilage
    - Areolar
    - Adipose
  - Nervous Tissue
    - Neuron
6. Epithelial Tissue

- Epithelium covers the outer body, most organs, and cavities within the body.
- Cells of epithelial tissue lie on a thin membrane called the basement membrane.

6.1 Simple Squamous

- Flat cells
- Forms the lining of alveoli, and blood vessels
- Facilitates the transportation of various substances across membranes

6.2 Stratified Squamous

- Flat cells, arranged in a pattern of layers
- Present in the skin
- Protects from wear and tear
### 6.3 Columnar
- Pillar-like cells
- Present in the lining of the small intestine
- Helps in absorption and secretion

### 6.4 Ciliated Columnar
- Columnar cells have hair-like projections called cilia
- Present in the respiratory tract
- Facilitates the movement of mucus

### 6.5 Cuboidal
- Cube-shaped cells
- Forms the lining of kidney tubules and ducts of glands
- Provides mechanical support

### 6.6 Glandular
- Epithelial cells acquire additional specialisation as gland cells
- Gland cells secrete substances at the epithelial surface
- Epithelial tissue folds inward to form a multicellular gland
7. Connective Tissue

- The cells of connective tissue are loosely spaced and embedded in an intercellular matrix.
- The matrix may be jelly-like, fluid, dense or rigid.

7.1 Blood

- Has a fluid matrix called plasma, in which RBCs, WBCs, and platelets are suspended
- Transport gases, digested food, hormones, and waste materials to different parts of the body

7.2 Bone

- Has a hard matrix composed of calcium and phosphorus compounds
- Strong and non-flexible
- Forms the framework that supports the body, anchors the muscles and supports the main organs of the body

7.3 Ligament

- Contains very little matrix
- Connects bones with bones
- Highly elastic and has considerable strength
7.4 Tendon
- Connects muscles to bones
- Fibrous and less flexible but has great strength

7.5 Cartilage
- Has a solid matrix composed of proteins and sugars
- Found in ear, nose, trachea, and joints
- Smoothens bone surfaces at joints and provides flexibility

7.6 Areolar
- Found between the skin and muscles, around blood vessels and nerves, and in the bone marrow
- Fills the space inside the organs, supports internal organs and helps in repair of tissues

7.7 Adipose
- Found below the skin and between internal organs
- Tissue cells filled with fat globules
- Acts as an insulator (controls body temperature)
Muscular tissue consists of elongated cells and is responsible for the movement in our body. It contains contractile proteins which contract and relax to cause movement.

### Types of Muscle Tissue

<table>
<thead>
<tr>
<th>Skeletal Muscle</th>
<th>Smooth Muscle</th>
<th>Cardiac Muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long, cylindrical, and unbranched cells</td>
<td>Spindle-shaped and unbranched cells</td>
<td>Cylindrical and branched cells</td>
</tr>
<tr>
<td>Multinucleate and striated</td>
<td>Uninucleate and non-striated</td>
<td>Uninucleate and striated</td>
</tr>
<tr>
<td>Voluntary muscle</td>
<td>Involuntary muscle</td>
<td>Involuntary muscles</td>
</tr>
<tr>
<td>Found in limbs</td>
<td>Found in iris, uterus, alimentary canal, bronchi</td>
<td>Found in the heart</td>
</tr>
</tbody>
</table>
9. Nervous Tissue

- Cells of the nervous tissue are highly specialised for being stimulated and then transmitting the stimulus within the body.
- The brain, spinal cord and nerves are all composed of the nervous tissue.

9.1 Neuron

- **Cell Body:** Contains nucleus and cytoplasm
- **Dendrite:** Receives information from other neurons
- **Axon:** Relays information from cell body to axon terminal
- **Axon Terminal:** Passes information to other neurons

9.2 Nerve Fibre

Connective tissues bind neurons which form nerve fibres, and nerve fibres bundle up to form a nerve.