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Prepzy

Tissues in Action

Introduction to Tissues

Life begins with a single cell that divides repeatedly to form many cells. These cells group together to form tissues, which perform specific functions in plants and animals. In multicellular organisms, cells of similar type and function form tissues, which then combine to form organs and organ systems. This division of labour increases efficiency and allows complex life processes.

Differences Between Plant and Animal Tissues

Plant and animal tissues differ due to their structure and functions. Plants are generally fixed and require support, so their cells have rigid cell walls. Animals are mobile and have flexible cells without cell walls. Plants have tissues for photosynthesis and transport of water and food, while animals have tissues for digestion and movement. Growth patterns also differ due to different types of growth tissues.

Meristematic Tissues in Plants

Meristematic tissues are regions of actively dividing cells responsible for plant growth. There are three types:

- **Apical meristem:** Located at root and shoot tips, responsible for lengthwise growth.
- **Lateral meristem:** Found along the stem circumference, responsible for girth increase.
- **Intercalary meristem:** Located at the base of internodes, helps in regrowth after cutting.

Permanent Tissues in Plants

Permanent tissues are formed from meristematic tissues that have differentiated and lost the ability to divide. They are classified as simple or complex:

- **Simple permanent tissues:** Parenchyma (storage and photosynthesis), Collenchyma (support and flexibility), Sclerenchyma (rigid support).
- **Complex permanent tissues:** Xylem (transports water and minerals) and Phloem (transports food).

Animal Tissues

Animal tissues are mainly four types:

- **Epithelial tissue:** Covers body surfaces and lines organs, providing protection and absorption.
- **Connective tissue:** Connects and supports other tissues; includes blood, bones, cartilage, tendons, and ligaments.
- **Muscular tissue:** Produces voluntary and involuntary movements; includes skeletal, smooth, and cardiac muscles.
- **Nervous tissue:** Composed of neurons that transmit signals for control and coordination.

Musculoskeletal System

The musculoskeletal system consists of bones, muscles, joints, cartilage, tendons, and ligaments. Bones provide support and protection, muscles enable movement, and joints allow flexibility. Tendons connect muscles to bones, and ligaments connect bones to bones. This system works under nervous system control.

Types of Joints

- **Ball and socket joint:** Allows movement in many directions (e.g., shoulder).
- **Hinge joint:** Allows movement in one direction (e.g., elbow, knee).
- **Pivot joint:** Allows rotational movement (e.g., neck).
- **Fixed joints:** No movement, provide protection (e.g., skull).

Stem Cells and Regeneration

Stem cells have the ability to divide and differentiate into various cell types. In plants, totipotent cells can regenerate a whole plant from a single cell. In animals, stem cells in bone marrow are used in treatments like bone marrow transplants.

Summary

Tissues are groups of similar cells performing specific functions. Plant tissues include meristematic and permanent tissues, while animal tissues include epithelial, connective, muscular, and nervous tissues. The musculoskeletal system enables movement and support, controlled by the nervous system.

Solved Examples

Example 1: Explain how the apical meristem contributes to plant growth.

Solution: The apical meristem is located at the tips of roots and shoots. It contains actively dividing cells that increase the length of the plant by producing new cells. This results in the elongation of roots and shoots, allowing the plant to grow taller and roots to grow deeper.

Example 2: Differentiate between xylem and phloem.

Solution: Xylem transports water and minerals from roots to other parts of the plant and provides structural support. It consists of vessels, tracheids, xylem parenchyma, and

fibres. Phloem transports food (sugars) from leaves to other parts and consists of sieve tubes, companion cells, phloem parenchyma, and fibres. Xylem cells are mostly dead, while phloem cells are mostly living.

Example 3: Describe the structure and function of skeletal muscle.

Solution: Skeletal muscles are attached to bones and are responsible for voluntary movements. They are composed of long, cylindrical, multinucleate, and striated muscle fibres. These muscles contract to move bones and enable actions like walking and lifting.

Practice Set

Conceptual Questions

- **Level 1:** What is the main function of meristematic tissue in plants?
- **Level 2:** How do connective tissues differ from muscular tissues in animals?

Application-based Question

- **Level 3:** A gardener cuts the tips of a plant's roots and shoots. Predict and explain the effect on the plant's growth.

Answer Key

Conceptual Questions

- **Level 1:** Meristematic tissue is responsible for the growth of plants by producing new cells through continuous division.

- **Level 2:** Connective tissues connect and support other tissues and organs, while muscular tissues are responsible for movement by contracting and relaxing.

Application-based Question

- **Level 3:** Cutting the tips of roots and shoots removes the apical meristem, stopping lengthwise growth. The plant will not grow taller or roots will not grow deeper until new meristematic regions develop.

Quick Reference Table

Plant Tissues:

- Meristematic Tissue: Apical (length growth), Lateral (girth growth), Intercalary (regrowth)
- Permanent Tissue: Simple (Parenchyma, Collenchyma, Sclerenchyma), Complex (Xylem, Phloem)

Animal Tissues:

- Epithelial: Protection and lining
- Connective: Support and connection (blood, bone, cartilage)
- Muscular: Movement (skeletal, smooth, cardiac)
- Nervous: Control and coordination

Joints: Ball and socket, Hinge, Pivot, Fixed

Common Mistakes and Misconceptions

- Confusing meristematic tissue with permanent tissue; meristematic tissues actively divide, permanent tissues do not.
- Assuming all plant cells have rigid walls; animal cells lack cell walls and are flexible.
- Believing all muscles are voluntary; smooth and cardiac muscles are involuntary.
- Thinking joints move bones by themselves; muscles contract to move bones at joints.

Glossary

- **Apical Meristem:** Growth region at tips of roots and shoots.
- **Collenchyma:** Plant tissue providing flexible support.
- **Connective Tissue:** Tissue that connects and supports other tissues.
- **Intercalary Meristem:** Growth tissue at base of internodes in plants.
- **Lateral Meristem:** Tissue responsible for increase in girth of plants.
- **Meristematic Tissue:** Plant tissue with actively dividing cells.
- **Phloem:** Plant tissue that transports food.
- **Sclerenchyma:** Plant tissue with thick, lignified walls for support.
- **Skeletal Muscle:** Voluntary muscle attached to bones.
- **Xylem:** Plant tissue that transports water and minerals.