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🌱 Part 1: Plant Tissues

A tissue is simply a group of cells with a similar structure and function that team up to perform a specific job. In plants, these are divided into two main categories based on whether they have the ability to divide: **Meristematic** and **Permanent**.

1. Meristematic Tissues (The Growth Hackers)

These are made of young, actively dividing cells that constantly multiply to form new cells.

- **Characteristics:** The cells are tightly packed with zero intercellular spaces, possess thin walls, dense protoplasm, a large central nucleus, and very small or completely absent vacuoles.
- **Types based on location (Diagram Breakdown):**
 - 📍 **Apical Meristem:** Found at the very tips of roots and shoots. **Function:** Increases the overall height/length of the plant (primary growth).
 - 📍 **Intercalary Meristem:** Found at the base of nodes, along internodes, and leaf bases (especially in monocots). **Function:** Increases the length of internodes and develops branches.
 - 📍 **Lateral Meristem:** Found on the lateral sides of stems and roots (e.g., vascular cambium). **Function:** Increases the girth or diameter of woody stems.

2. Permanent Tissues (The Specialists)

When meristematic cells mature and lose their ability to divide, they differentiate to perform specific jobs, becoming permanent tissues. They fall into two categories:

A. Simple Permanent Tissues (Made of one cell type)

- **Parenchyma:** Living, thin-walled, spherical/oval cells with obvious intercellular spaces and a large central vacuole.
 - *Function:* Synthesizes and stores food.
 - *Special features:* If it has chloroplasts, it's called **Chlorenchyma** (does photosynthesis); if it has large air cavities to help aquatic plants float, it's called **Aerenchyma**.
- **Collenchyma:** Living, elongated cells with absolutely no intercellular spaces. The cell wall corners are uniquely thickened with cellulose and pectin.
 - *Function:* Provides mechanical strength, elasticity, and flexibility to leaf stalks and stems so they can bend without breaking.
- **Sclerenchyma:** Dead cells (RIP 💀) that are tightly packed with zero intercellular spaces. Their cell walls are heavily thickened with a rigid substance called lignin.
 - *Function:* Pure mechanical strength and rigidity.
 - *Types:* **Fibres** (elongated, pointed ends, like in jute) and **Sclereids** (irregular, gritty texture found in pear pulp and seed coats).

B. Complex Permanent Tissues (Made of multiple cell types working as a unit) These are your plant's plumbing system (Vascular Tissue System).

- **Xylem:** Mostly dead cells forming continuous, hollow tube-like structures with lignified walls. Elements include tracheids and vessels.
 - *Function:* Unidirectional upward transport of water and dissolved minerals from roots to leaves.
- **Phloem:** Living, thin-walled tubular cells (main elements are sieve tubes and companion cells).
 - *Function:* Bidirectional transport of prepared dissolved food from the leaves to the rest of the plant.

(Note on Tissue Systems: **Epidermis** is the outermost protective dermal tissue that secretes a waxy cuticle to prevent drying out and contains stomata pores for gas exchange. **Ground Tissue** makes up the bulk of the plant for support and storage).

Part 2: Animal Tissues

Animal tissues are broadly classified into four main types: Epithelial, Connective, Muscular, and Nervous.

1. Epithelial Tissue (The Shield 🛡️)

- **Structure:** Tightly packed cells forming a continuous lining with no intercellular spaces.
- **Location:** Covers the external body surface (skin) and lines internal organs, body cavities, and ducts.
- **Function:** Primary defense against infection and dehydration. Also handles secretion, absorption, and sensory reception.
- *Fun fact:* Human skin contains keratin, which makes it tough and waterproof.

2. Connective Tissue (The Glue & Frame 🧱)

Connective tissues bind, support, and insulate the body. They consist of widely separated cells embedded in a non-living "matrix" that can be jelly-like, solid, or fluid.

A. Connective Tissue Proper

- **Areolar (Loose):** A loosely organized packing material containing collagen and elastic fibres. *Location:* Below the skin, binding it to underlying muscles.
- **Adipose (Loose):** Fat tissue made of cells called adipocytes. *Location:* Beneath the skin and around internal organs. *Function:* Stores energy, conserves heat, and cushions organs from mechanical trauma.
- **Tendon (Dense):** Cord-like, inelastic bundles of white fibrous tissue. *Function:* Connects skeletal **Muscle to Bone**.
- **Ligament (Dense):** Yellow fibrous tissue containing elastic fibres. *Function:* Connects **Bone to Bone** at the joints, keeping them stable during movement.

B. Supportive Connective Tissue

- **Bone:** Hard, rigid matrix rich in calcium and phosphorus. Forms the skeletal framework, helps us move, and protects delicate internal organs like the brain and lungs. Bone cells are called **osteocytes**.

- **Cartilage:** Softer and much more flexible than bone, with no direct blood supply.
Location: Nose tip, external ear, between vertebrae, and at the ends of bones.
Function: Provides cushioning at joints and flexible support. Cartilage cells are called **chondrocytes**.

C. Fluid Connective Tissue

- **Blood:** A red fluid flowing through blood vessels. Its liquid matrix is a straw-coloured fluid called **plasma** (which is 90% water). Floating in the plasma are:
 - **Red Blood Cells (Erythrocytes):** Contain the red pigment haemoglobin to carry oxygen throughout the body.
 - **White Blood Cells (Leucocytes):** The immune army that protects against disease-causing microorganisms.
 - **Platelets (Thrombocytes):** Initiate blood clotting to stop bleeding from injuries.

3. Muscular Tissue (The Movers ⚡)

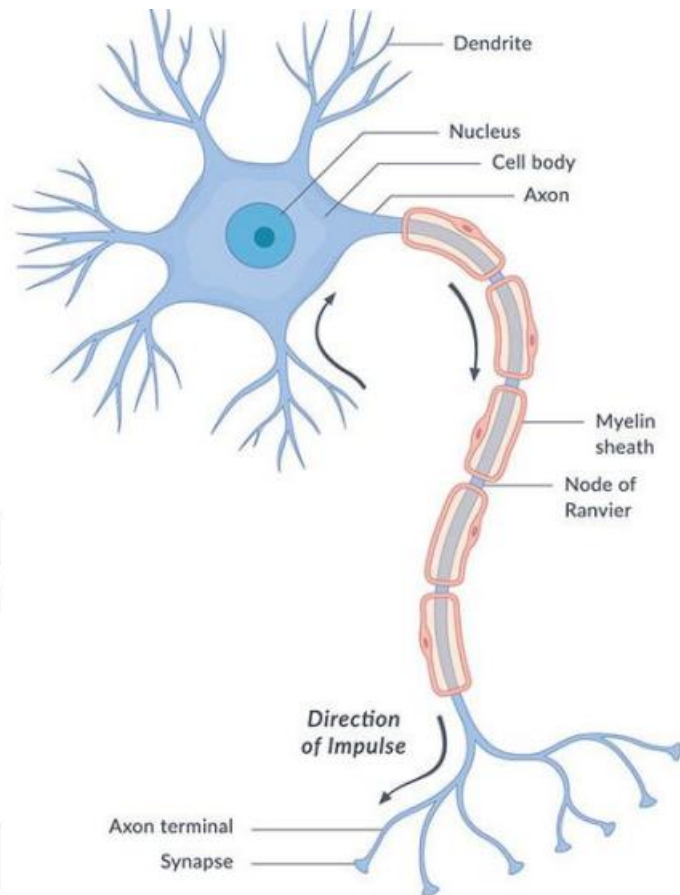
Made of elongated cells that contract and relax rhythmically to cause movement.

- **Striated (Skeletal) Muscles:** Long, cylindrical, multi-nucleated cells with distinct light and dark bands (striations). Attached to the skeleton (arms, legs) and are **voluntary** (under your conscious control).
- **Unstriated (Smooth) Muscles:** Spindle-shaped cells with a single central nucleus and absolutely no stripes. Found in the walls of the digestive tract, blood vessels, and internal organs. These are **involuntary**.
- **Cardiac Muscles:** Specialized, highly branched, cylindrical, and striated cells with a single nucleus. Found *only* in the heart. They are **involuntary** and contract rhythmically and tirelessly your entire life to pump blood.

4. Nervous Tissue (The Comm Center 🧠)

Found in the brain, spinal cord, and peripheral nerves. It is made of highly specialized cells called **Neurons** that transmit electrical impulses across the body.

Neuron Structure (Diagram Breakdown):



1. **Cell Body (Cyton):** The main mass of cytoplasm containing a central nucleus.
2. **Dendrites:** Root-like structures branching out from the cyton. They *receive* electrical signals from the axon terminals of other nerve cells.
3. **Axon:** A thin, elongated tail extending away from the cyton. It *sends* electrical signals over short and long distances.
 - It is often wrapped in an insulating **Myelin Sheath**, which makes the transmission of impulses much more efficient.
 - A bundle of axons together is what we call a nerve fibre.

NOTE: KINDLY REFER TO THE TEXTBOOK ALONG WITH THE NOTES FOR ALL TOPICS.
