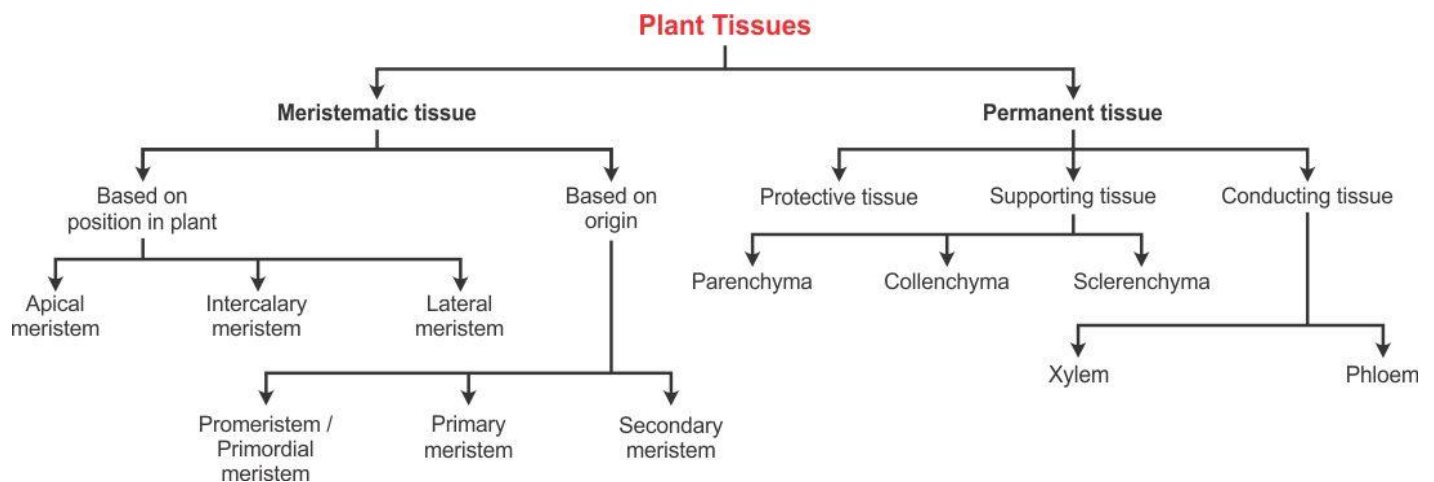


Tissues: Plant and Animal Tissues

- **Cell:** A cell is the basic structural and functional unit of a living organism. Example: Nerve cell.
- **Tissue:** A tissue is a group of cells having a common origin, similar structure and function and held together by a cementing substance. Example: Connective tissue.
- **Organ:** Different types of tissues working together and contributing to some specific function inside the body constitute an organ. Example: Stomach.
- **Organ system:** Different organs coordinate to perform a specific life process and form an organ system. Example: Digestive system.
- **Organism:** Various organ systems working simultaneously together constitute an organism. Example: Plants.



- Classification of plant tissues

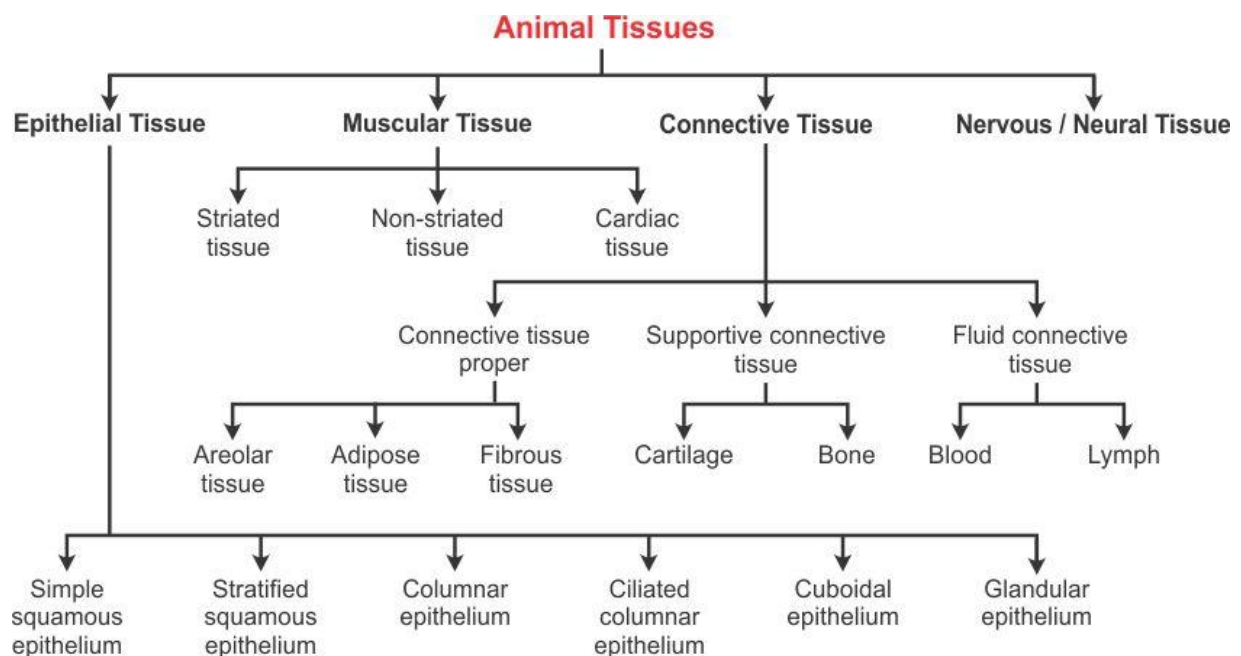
TYPE OF TISSUE	CHARACTERISTICS	LOCATION	FUNCTION
MERISTEMATIC TISSUE			
Meristematic tissue	Cells are thin-walled and made up of cellulose.	Located at the tips of the roots and stems, base of the node, base of the internode or at the base of the leaf.	The cells of meristematic tissue divide actively, resulting in growth (increase in thickness and length) of plants.

TYPES OF MERISTEMATIC TISSUE			
Apical meristem	-	Located at the growing points of the stem, roots, branches and in growing young leaves near the tips of stems and axillary buds.	Enables the root and stem to grow by increasing the length of plants.
Intercalary meristem	-	Located at the internodes or stem regions between the places at which the leaves attach, and at leaf bases, especially of certain monocotyledons.	The cells are active and continuously form a number of new cells.
Lateral meristem/Cambium	-	Present laterally (on the sides) on the roots and stem and is situated parallel to the longitudinal axis below the bark.	The girth and width/diameter/thickness of the stem or root increases due to the lateral meristem.
PERMANENT TISSUE			
Permanent tissue	Formed by the division of the meristematic tissue cells that have lost their ability to multiply.	-	-

TYPES OF PERMANENT TISSUE			
Protective tissue	• Epidermis or surface tissue. • Cells with thick walls.	• Found on the surface of the roots, stems and leaves.	• Protects the underlying cells. • Provides protection against mechanical injury or invasion by parasitic fungi.
Supporting tissue	• Provides support to the plant.	-	-
Conducting tissue	• Also called vascular tissue.	• Present in the stem, roots and leaves.	• Provides a passage for water and dissolved materials to move up and down in the plant body.
TYPES OF SUPPORTING TISSUE			
Parenchyma	• Consist of relatively non-specialised large, thin-walled living cells.	• Mainly present in the soft parts of the plant such as the central pith-containing region and outer cortical region of roots and stems.	• Provides temporary support and maintains the shape of the plant body.
Collenchyma	• Cells are living and elongated with cell walls irregularly thickened at the corners.	• Located in the non-woody plants, leaf stalks, below the epidermis of the stems and veins of leaves.	• Provides mechanical support and elasticity to the young dicotyledonous plants.
Sclerenchyma	• Consists of elongated, narrow and fibre-like cells. • Cells are dead, pointed at both the ends and thickened because of the deposition of lignin.	• Located in the stems around the vascular bundle, in the veins of leaves and in the hard covering of the seeds and nuts.	• Provides strength and hardness to the parts of the plant.

TYPES OF CONDUCTING TISSUE			
Xylem	• Complex permanent tissue with thick-walled cells. • Most of the cells are dead.	• Present in the stem, roots and leaves.	• Provides upward movement of water and dissolved materials absorbed by the root from the soil to other parts of the plant.
Phloem	• Complex permanent tissue.	• Lies just beneath the bark of the tree.	• Provides a passage for the downward movement of food manufactured in the leaves to various parts of the plant.
COMPONENTS OF XYLEM			
Tracheids	• Made up of elongated cells with flat, tapering ends.	-	• Provide a network of hollow and connected cells for the transport of water.
Xylem vessels	• Consist of dead cells. • They are tubular structures and are much wider than tracheids.	-	• Allow free flow of water and minerals in the vertical direction from the roots to the leaves.
Xylem parenchyma	• Consists of living parenchyma cells associated with xylem.	-	• Stores food in the plant body.
Xylem fibres	• Separated by thin cross walls.	-	• Mainly support the plant.

COMPONENTS OF PHLOEM			
Sieve tubes	Tubular cells with perforated walls and arranged end to end.	-	Translocation of organic substances through perforated walls from one adjacent cell to another.
Companion cells	Cells are living and keep their nuclei and other organelles throughout their life.	-	Help to control the activity of sieve tube elements.
Phloem fibres	- Elongated, tapering and dead cells. - Cell walls are thickened.	Found particularly in the stem.	Provide mechanical strength to the plant.
Phloem parenchyma	Cells are alive and filled with cytoplasm.	-	Transports food i.e. sugars and amino acids from the leaves to other non-green parts of the plants, such as growing stems and roots.



- Classification of animal tissues

TYPE OF TISSUE	CHARACTERISTICS	LOCATION	FUNCTION
EPITHELIAL TISSUE			
Epithelial tissue	• Cells are flat, cuboidal or columnar in shape.	• Covers the whole body surface.	• Protection • Absorption • Secretion • Sensory perception
TYPES OF EPITHELIAL TISSUE			
Simple squamous epithelium	• Cells are large, extremely thin and flat.	• Situated in the lining of blood vessels, lung alveoli, oesophagus, the lining of the mouth and the inner lining of the cheek.	• Transportation of substances through selectively permeable membrane.
Stratified squamous epithelium	• Cells are arranged in a pattern of layers, resembling a brick wall.	• Located as the outer protective covering all over the body surface.	• Provides protection to underlying tissues which are subjected to continuous wear and tear.
Columnar epithelium	• Cells are tall, cylindrical and are arranged like pillars.	• Found where absorption and secretion occur, as in the inner lining of the stomach, intestines and gall bladder.	• Secrete digestive enzymes and perform the function of absorption of nutrients from the digested food.
Ciliated columnar epithelium	• Cells possess fine hair-like cilia which are capable of rapid, rhythmic, wave-like beatings in a certain direction on their free surface.	• Found in the inner lining of the wind pipe or trachea, lungs, respiratory system and buccal chambers.	• In the respiratory tract, the cilia move and their movement pushes the mucus forward to clear it.

Cuboidal epithelium	Cells are cube-shaped and are placed on a basement membrane.	Found in the lining of the kidney tubules as well as in the ducts of the salivary glands.	Helps in the absorption of useful material from the urine before it is passed out.
Glandular epithelium	It is a portion of the epithelial tissue that folds inwards to form a multicellular gland.	Present in the secretory organs. such as stomach, intestine, pancreas etc.	Capable of synthesising and secreting certain substances such as enzymes, hormones, milk, mucus, sweat, wax and saliva at the epithelial surface.
CONNECTIVE TISSUE			
Connective tissue	Consists of a matrix and the cells are embedded in it.	Found in the deeper parts of the body in between the skin and muscles.	Connects various organs and keeps them in proper place.
TYPES OF CONNECTIVE TISSUE			
Connective tissue proper/loose connective tissue	Made up of irregular cells scattered and embedded in a soft matrix.	Encompasses all the internal organs and body cavities.	Acts as a binding and supporting structure within the body.
Supportive connective tissue/dense connective tissue	Has fibres as its main matrix element.	Found in bones and cartilage.	Provides connection between different tissues.
Fluid connective tissue	Consist of fluid/liquid as the ground substance.	Present throughout the body.	- Provides nutrition. - Helps in transport of nutrients. - Gets rid of waste matter.

TYPES OF CONNECTIVE TISSUE PROPER			
Areolar tissue	Made of gelatinous matrix containing cells and irregularly arranged fibres.	Found between the skin and muscles, around the blood vessels, nerves and in the bone marrow.	Fills the space inside the organs and supports and strengthens the internal organs.
Adipose tissue	Cells are filled with fat globules, situated in a large central vacuole of a cell, pushing the cytoplasm and the nucleus to the periphery.	Found beneath the skin, around the kidneys and other internal organs such as intestines.	Acts as an insulator because of the storage of energy in the form of fats. It insulates the body and prevents the loss of heat.
Fibrous tissue	Mainly formed of fibre-forming cells which form the tendons and ligaments.	Found in the spaces between the bones and muscles.	- Tendons help to attach muscles to the bones. - Ligaments serve to hold the structures together and keep them strong and stable.
TYPES OF SUPPORTIVE CONNECTIVE TISSUE			
Cartilage	Non-porous, semi-transparent and elastic tissue.	Present in the nose, external ear, trachea, larynx, ends of the long bones and between the vertebrae.	Smoothens the bone surface at joints, allowing smooth movement of these joints.
Bone	- Hard, strong and non-flexible porous tissue. - Consists of living cells.	Forms the rigid part of the skeletal system.	- Forms the supporting framework of the body. - Gives shape and rigidity to the body.

TYPES OF FLUID CONNECTIVE TISSUE			
Blood	Contains a straw-coloured fluid matrix called blood. It consists of plasma (55%) and cellular part (45%) which contains cells, RBCs, WBCs and platelets.	Present throughout the body.	Connects different body parts and establishes continuity within the body.
Lymph	- Fluid surrounding the body cells. - Contains WBCs.	Present throughout the body.	- Transportation of nutrients. - Provides protection against diseases.
MUSCLE TISSUE			
Muscle tissue	Consists of elongated, narrow, muscle cells called muscle fibres.	Mostly attached to the bones.	Helps in contraction and relaxation, which facilitates movement of the body.
TYPES OF MUSCLE TISSUE			
Striated/skeletal/ striped/voluntary muscles	Muscle fibres are long, cylindrical, unbranched and multinucleate.	Found attached to the bones.	Help in voluntary muscle movement and locomotion.
Non-striated/ smooth/non-striped/ involuntary muscles	Muscle fibres are smooth and without striations.	Found in ureters, digestive tract, urinary bladder, iris of the eye, bronchi of the lungs and other internal organs.	Carry out the movements which cannot be carried out by our conscious will, such as movement of food in the alimentary canal, blinking of eyes, breathing etc.

Cardiac/heart muscles	• Muscle cells are short, cylindrical and have a single, centrally placed nucleus.	• Found only in the walls of the heart.	• Rhythmic contraction and relaxation of cardiac muscles help to pump and distribute the blood to various parts of the body.
NERVOUS/NEURAL TISSUE			
Nervous/neural tissue	• Made up of elongated cells called neurons. • Each neuron consists of three parts—a cell body, an axon and dendrites.	• Component of the nervous system and encompasses the brain, spinal cord and nerves.	• Nerve cells mediate the transmission of messages from the brain to different parts of the body and vice versa.