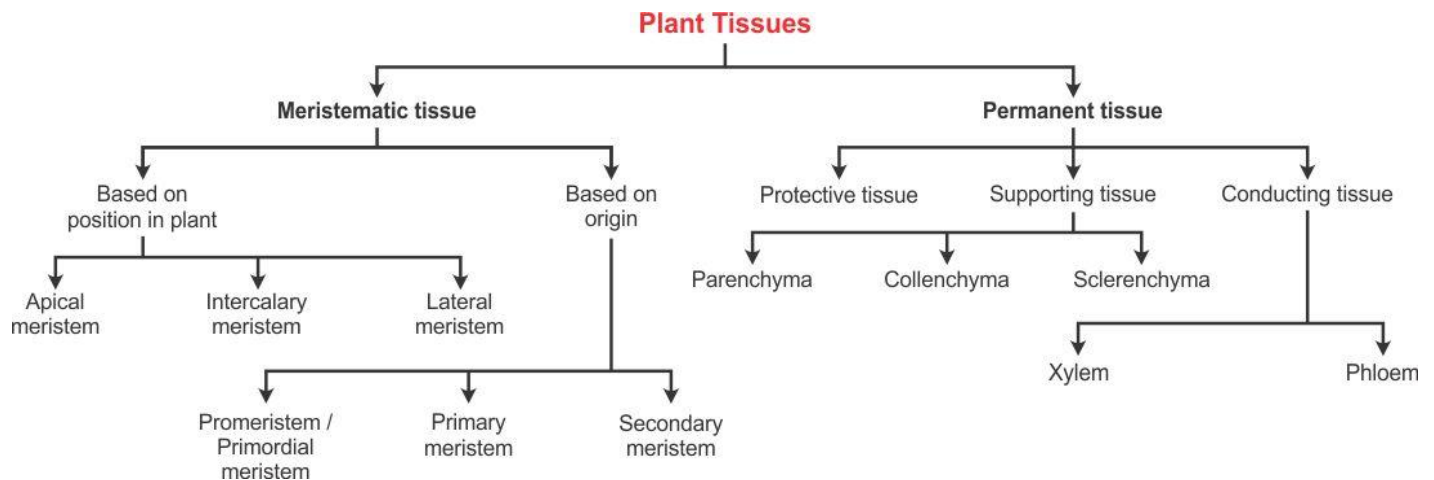


Tissues: Plant and Animal Tissues

- **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

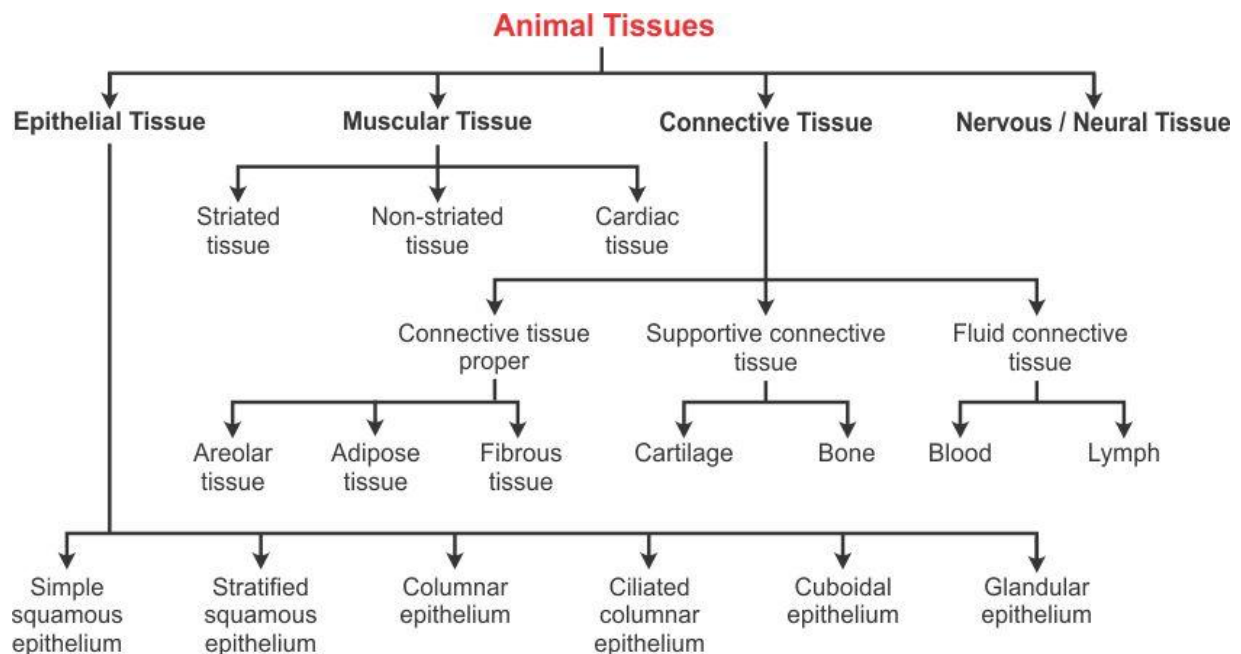
TYPE OF TISSUE	CHARACTERISTICS	LOCATION	FUNCTION
MERISTEMATIC TISSUE			
Meristematic tissue	<ul style="list-style-type: none"> Cells are thin-walled and made up of cellulose. 	<ul style="list-style-type: none"> Located at the tips of the roots and stems, base of the node, base of the internode or at the base of the leaf. 	<ul style="list-style-type: none"> The cells of meristematic tissue divide actively, resulting in growth (increase in thickness and length) of plants.

TYPES OF MERISTEMATIC TISSUE			
Apical meristem	-	<ul style="list-style-type: none"> Located at the growing points of the stem, roots, branches and in growing young leaves near the tips of stems and axillary buds. 	<ul style="list-style-type: none"> Enables the root and stem to grow by increasing the length of plants.
Intercalary meristem	-	<ul style="list-style-type: none"> Located at the internodes or stem regions between the places at which the leaves attach, and at leaf bases, especially of certain monocotyledons. 	<ul style="list-style-type: none"> The cells are active and continuously form a number of new cells.
Lateral meristem/Cambium	-	<ul style="list-style-type: none"> Present laterally (on the sides) on the roots and stem and is situated parallel to the longitudinal axis below the bark. 	<ul style="list-style-type: none"> The girth and width/diameter/thickness of the stem or root increases due to the lateral meristem.
PERMANENT TISSUE			
Permanent tissue	<ul style="list-style-type: none"> Formed by the division of the meristematic tissue cells that have lost their ability to multiply. 	-	-

TYPES OF PERMANENT TISSUE			
Protective tissue	<ul style="list-style-type: none"> • Epidermis or surface tissue. • Cells with thick walls. 	<ul style="list-style-type: none"> • Found on the surface of the roots, stems and leaves. 	<ul style="list-style-type: none"> • Protects the underlying cells. • Provides protection against mechanical injury or invasion by parasitic fungi.
Supporting tissue	<ul style="list-style-type: none"> • Provides support to the plant. 	-	-
Conducting tissue	<ul style="list-style-type: none"> • Also called vascular tissue. 	<ul style="list-style-type: none"> • Present in the stem, roots and leaves. 	<ul style="list-style-type: none"> • Provides a passage for water and dissolved materials to move up and down in the plant body.
TYPES OF SUPPORTING TISSUE			
Parenchyma	<ul style="list-style-type: none"> • Consist of relatively non-specialised large, thin-walled living cells. 	<ul style="list-style-type: none"> • Mainly present in the soft parts of the plant such as the central pith-containing region and outer cortical region of roots and stems. 	<ul style="list-style-type: none"> • Provides temporary support and maintains the shape of the plant body.
Collenchyma	<ul style="list-style-type: none"> • Cells are living and elongated with cell walls irregularly thickened at the corners. 	<ul style="list-style-type: none"> • Located in the non-woody plants, leaf stalks, below the epidermis of the stems and veins of leaves. 	<ul style="list-style-type: none"> • Provides mechanical support and elasticity to the young dicotyledonous plants.
Sclerenchyma	<ul style="list-style-type: none"> • Consists of elongated, narrow and fibre-like cells. • Cells are dead, pointed at both the ends and thickened because of the deposition of lignin. 	<ul style="list-style-type: none"> • Located in the stems around the vascular bundle, in the veins of leaves and in the hard covering of the seeds and nuts. 	<ul style="list-style-type: none"> • Provides strength and hardness to the parts of the plant.

TYPES OF CONDUCTING TISSUE			
Xylem	<ul style="list-style-type: none"> • Complex permanent tissue with thick-walled cells. • Most of the cells are dead. 	<ul style="list-style-type: none"> • Present in the stem, roots and leaves. 	<ul style="list-style-type: none"> • Provides upward movement of water and dissolved materials absorbed by the root from the soil to other parts of the plant.
Phloem	<ul style="list-style-type: none"> • Complex permanent tissue. 	<ul style="list-style-type: none"> • Lies just beneath the bark of the tree. 	<ul style="list-style-type: none"> • Provides a passage for the downward movement of food manufactured in the leaves to various parts of the plant.
COMPONENTS OF XYLEM			
Tracheids	<ul style="list-style-type: none"> • Made up of elongated cells with flat, tapering ends. 	-	<ul style="list-style-type: none"> • Provide a network of hollow and connected cells for the transport of water.
Xylem vessels	<ul style="list-style-type: none"> • Consist of dead cells. • They are tubular structures and are much wider than tracheids. 	-	<ul style="list-style-type: none"> • Allow free flow of water and minerals in the vertical direction from the roots to the leaves.
Xylem parenchyma	<ul style="list-style-type: none"> • Consists of living parenchyma cells associated with xylem. 	-	<ul style="list-style-type: none"> • Stores food in the plant body.
Xylem fibres	<ul style="list-style-type: none"> • Separated by thin cross walls. 	-	<ul style="list-style-type: none"> • Mainly support the plant.

COMPONENTS OF PHLOEM			
Sieve tubes	<ul style="list-style-type: none"> Tubular cells with perforated walls and arranged end to end. 	-	<ul style="list-style-type: none"> Translocation of organic substances through perforated walls from one adjacent cell to another.
Companion cells	<ul style="list-style-type: none"> Cells are living and keep their nuclei and other organelles throughout their life. 	-	<ul style="list-style-type: none"> Help to control the activity of sieve tube elements.
Phloem fibres	<ul style="list-style-type: none"> Elongated, tapering and dead cells. Cell walls are thickened. 	<ul style="list-style-type: none"> Found particularly in the stem. 	<ul style="list-style-type: none"> Provide mechanical strength to the plant.
Phloem parenchyma	<ul style="list-style-type: none"> Cells are alive and filled with cytoplasm. 	-	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Cells are flat, cuboidal or columnar in shape. 	<ul style="list-style-type: none"> • Covers the whole body surface. 	<ul style="list-style-type: none"> • Protection • Absorption • Secretion • Sensory perception
TYPES OF EPITHELIAL TISSUE			
Simple squamous epithelium	<ul style="list-style-type: none"> • Cells are large, extremely thin and flat. 	<ul style="list-style-type: none"> • Situated in the lining of blood vessels, lung alveoli, oesophagus, the lining of the mouth and the inner lining of the cheek. 	<ul style="list-style-type: none"> • Transportation of substances through selectively permeable membrane.
Stratified squamous epithelium	<ul style="list-style-type: none"> • Cells are arranged in a pattern of layers, resembling a brick wall. 	<ul style="list-style-type: none"> • Located as the outer protective covering all over the body surface. 	<ul style="list-style-type: none"> • Provides protection to underlying tissues which are subjected to continuous wear and tear.
Columnar epithelium	<ul style="list-style-type: none"> • Cells are tall, cylindrical and are arranged like pillars. 	<ul style="list-style-type: none"> • Found where absorption and secretion occur, as in the inner lining of the stomach, intestines and gall bladder. 	<ul style="list-style-type: none"> • Secrete digestive enzymes and perform the function of absorption of nutrients from the digested food.
Ciliated columnar epithelium	<ul style="list-style-type: none"> • Cells possess fine hair-like cilia which are capable of rapid, rhythmic, wave-like beatings in a certain direction on their free surface. 	<ul style="list-style-type: none"> • Found in the inner lining of the wind pipe or trachea, lungs, respiratory system and buccal chambers. 	<ul style="list-style-type: none"> • In the respiratory tract, the cilia move and their movement pushes the mucus forward to clear it.

Cuboidal epithelium	<ul style="list-style-type: none"> Cells are cube-shaped and are placed on a basement membrane. 	<ul style="list-style-type: none"> Found in the lining of the kidney tubules as well as in the ducts of the salivary glands. 	<ul style="list-style-type: none"> Helps in the absorption of useful material from the urine before it is passed out.
Glandular epithelium	<ul style="list-style-type: none"> It is a portion of the epithelial tissue that folds inwards to form a multicellular gland. 	<ul style="list-style-type: none"> Present in the secretory organs. such as stomach, intestine, pancreas etc. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Consists of a matrix and the cells are embedded in it. 	<ul style="list-style-type: none"> Found in the deeper parts of the body in between the skin and muscles. 	<ul style="list-style-type: none"> Connects various organs and keeps them in proper place.
TYPES OF CONNECTIVE TISSUE			
Connective tissue proper/loose connective tissue	<ul style="list-style-type: none"> Made up of irregular cells scattered and embedded in a soft matrix. 	<ul style="list-style-type: none"> Encompasses all the internal organs and body cavities. 	<ul style="list-style-type: none"> Acts as a binding and supporting structure within the body.
Supportive connective tissue/dense connective tissue	<ul style="list-style-type: none"> Has fibres as its main matrix element. 	<ul style="list-style-type: none"> Found in bones and cartilage. 	<ul style="list-style-type: none"> Provides connection between different tissues.
Fluid connective tissue	<ul style="list-style-type: none"> Consist of fluid/liquid as the ground substance. 	<ul style="list-style-type: none"> Present throughout the body. 	<ul style="list-style-type: none"> Provides nutrition. Helps in transport of nutrients. Gets rid of waste matter.

TYPES OF CONNECTIVE TISSUE PROPER			
Areolar tissue	<ul style="list-style-type: none"> Made of gelatinous matrix containing cells and irregularly arranged fibres. 	<ul style="list-style-type: none"> Found between the skin and muscles, around the blood vessels, nerves and in the bone marrow. 	<ul style="list-style-type: none"> Fills the space inside the organs and supports and strengthens the internal organs.
Adipose tissue	<ul style="list-style-type: none"> Cells are filled with fat globules, situated in a large central vacuole of a cell, pushing the cytoplasm and the nucleus to the periphery. 	<ul style="list-style-type: none"> Found beneath the skin, around the kidneys and other internal organs such as intestines. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Mainly formed of fibre-forming cells which form the tendons and ligaments. 	<ul style="list-style-type: none"> Found in the spaces between the bones and muscles. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Non-porous, semi-transparent and elastic tissue. 	<ul style="list-style-type: none"> Present in the nose, external ear, trachea, larynx, ends of the long bones and between the vertebrae. 	<ul style="list-style-type: none"> Smoothens the bone surface at joints, allowing smooth movement of these joints.
Bone	<ul style="list-style-type: none"> Hard, strong and non-flexible porous tissue. Consists of living cells. 	<ul style="list-style-type: none"> Forms the rigid part of the skeletal system. 	<ul style="list-style-type: none"> Forms the supporting framework of the body. Gives shape and rigidity to the body.

TYPES OF FLUID CONNECTIVE TISSUE			
Blood	<ul style="list-style-type: none"> Contains a straw-coloured fluid matrix called blood. It consists of plasma (55%) and cellular part (45%) which contains cells, RBCs, WBCs and platelets. 	<ul style="list-style-type: none"> Present throughout the body. 	<ul style="list-style-type: none"> Connects different body parts and establishes continuity within the body.
Lymph	<ul style="list-style-type: none"> Fluid surrounding the body cells. Contains WBCs. 	<ul style="list-style-type: none"> Present throughout the body. 	<ul style="list-style-type: none"> Transportation of nutrients. Provides protection against diseases.
MUSCLE TISSUE			
Muscle tissue	<ul style="list-style-type: none"> Consists of elongated, narrow, muscle cells called muscle fibres. 	<ul style="list-style-type: none"> Mostly attached to the bones. 	<ul style="list-style-type: none"> Helps in contraction and relaxation, which facilitates movement of the body.
TYPES OF MUSCLE TISSUE			
Striated/skeletal/ striped/voluntary muscles	<ul style="list-style-type: none"> Muscle fibres are long, cylindrical, unbranched and multinucleate. 	<ul style="list-style-type: none"> Found attached to the bones. 	<ul style="list-style-type: none"> Help in voluntary muscle movement and locomotion.
Non-striated/ smooth/non-striped/ involuntary muscles	<ul style="list-style-type: none"> Muscle fibres are smooth and without striations. 	<ul style="list-style-type: none"> Found in ureters, digestive tract, urinary bladder, iris of the eye, bronchi of the lungs and other internal organs. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Muscle cells are short, cylindrical and have a single, centrally placed nucleus. 	<ul style="list-style-type: none"> • Found only in the walls of the heart. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Made up of elongated cells called neurons. • Each neuron consists of three parts—a cell body, an axon and dendrites. 	<ul style="list-style-type: none"> • Component of the nervous system and encompasses the brain, spinal cord and nerves. 	<ul style="list-style-type: none"> • Nerve cells mediate the transmission of messages from the brain to different parts of the body and vice versa.