TISSUE

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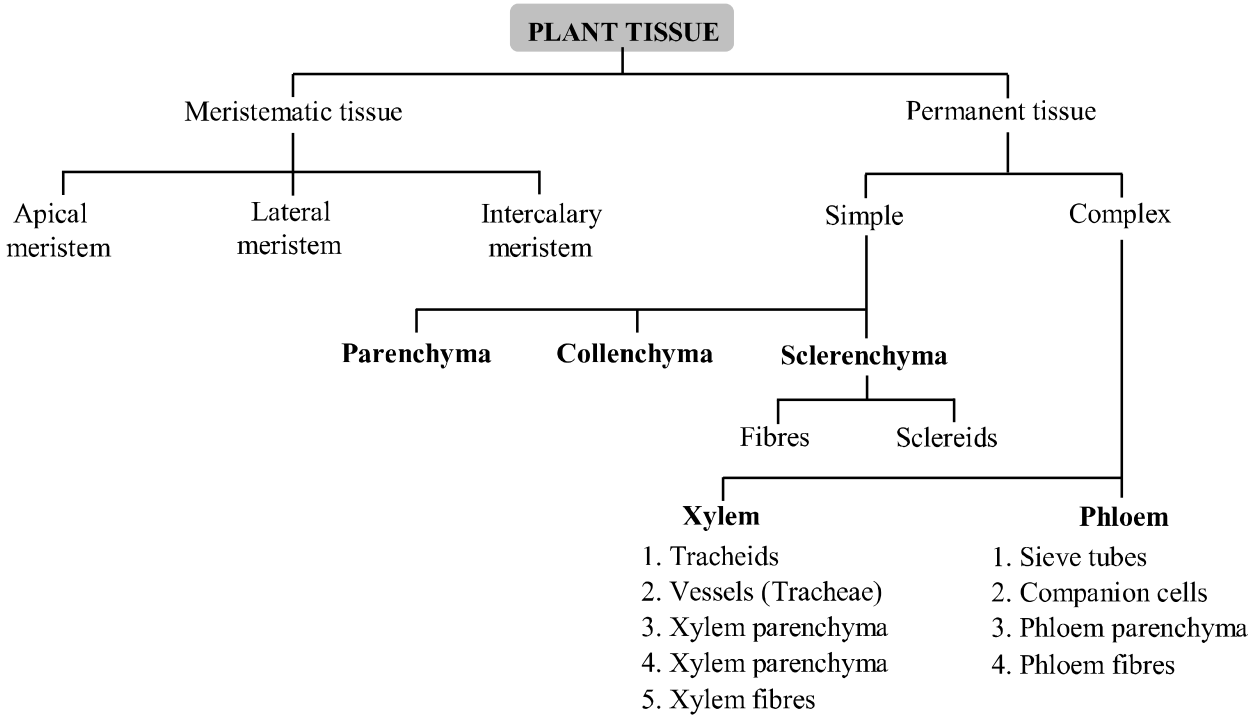
➢ TISSUE

"A tissues may be defined as a group or collection of similar or dissimilar cells that perform a common function & have a common origin."

➢ PLANT TISSUE

◈ **Classification of Plant Tissues :**



- A plant body is made up of different kinds of tissue. They are basically of two types - Meristamatic & permanent

◈ Meristematic tissue :

- Meristematic tissues may be defined as a group or collection of living cells which ar located specific locations and divide continuously to add new cells to the plant body.

◈ Characteristics of meristematic tissues :

- The cells of meristematic tissues are similar in structure and have thin and elastic primary cell walls made up of cellulose.
- These meristematic cells may be rounded, oval, polygonal or rectangular in shape.
- They are compactly arranged without intercellular spaces between them.
- Each cell contains dense or abundant cytoplasm and a large prominent nucleus.
- The dense protoplasm of meristematic cell contains few small vacuoles or no vacuoles at all.

◈ Apical meristem :

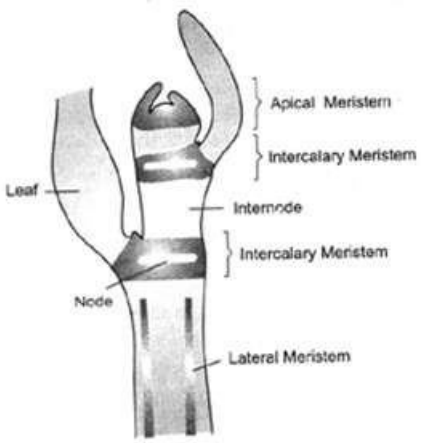
- This meristem is located at the growing apices of main and lateral shoots and roots. These cells are responsible for linear growth of an organ. Example root apical meristem and shoot apical meristem.

◈ Lateral meristem :

- This meristem consists of initials which divide mainly in one plane and cause the organ to increase in diameter and girth. The lateral meristem usually occurs on the sides both in stem and root. Lateral meristem is of two types, i.e., in the form of cork cambium and in vascular bundles of dicots in the form of vascular cambium. The activity of this cambium results in the formation of secondary growth.

◈ Intercalary meristem :

- This meristem is located in between the regions of permanent tissues. The intercalary meristem are usually persent at the base of node, base of internode or at the base of the leaf. They are responsible for growth of leaves and internodes.



◈ Permanent Tissues :

Definition :

- These tissues are derived from the meristematic tissues but their cells have lost the ability of division and have attained their different forms. They are of **these types-Simple** and **Complex.**

◈ Simple Permanent Tissues :

- These tissues are made up of cells which are structurally and functionally similar. These are of **three types -**
  Parenchyma **Collenchyma**
  Sclerenchyma
  Protective tissue

◈ Parenchyma :

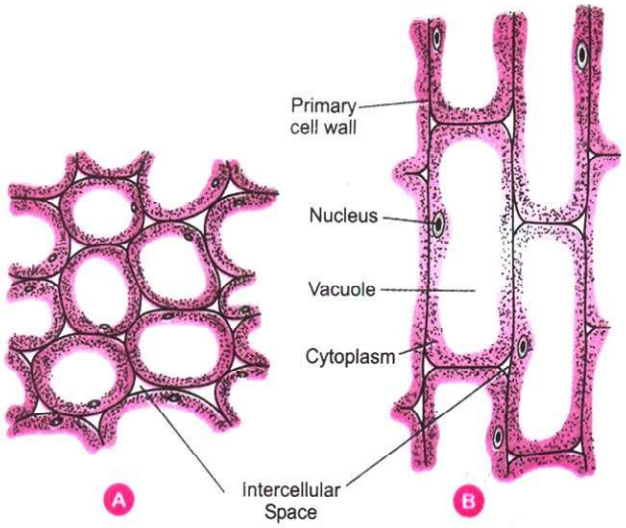


Figure : PARENCHYMA; A-TRANSVERSE SECTION B-LONGITUDINAL SECTION

- The parenchyma tissue is composed of living cells which are variable in thin morphology and physiology but generally having thin wall and a polyhedral shape and concern with vegetative activities of the plant.
- They have inter cellular spaces between them.
- They act as storage for food and water.

Types of Parenchyma :

Aerenchyma :

- In hydrophytes, the intercellular space between cells become wide & filled with air.
- Such a parenchymatous tissue having large air spaces is called Aerenchyma.
- These help in gaseous exchange and provide buoyancy to plant.

Chlorenchyma :

- When parenchyma is richly supplied with chloroplasts, it is called chlorenchyma.
- They are found in leaf mesophyll, sepals, phylloclades, phyllodes, cladodes etc. It is photosynthetic in function and posses chlorophyll.

Collenchyma :

- It was discovered and coined by schleiden (1839).
- The cells are living with intercellular space in between the cells or junctional places filled with cellulose and pectin.
- Generally they are longer than parenchyma
- Usually they are known as living mechanical tissue owing to their supportive functions.
- It provides flexibility and strength to young plant organ.

Sclerenchyma :

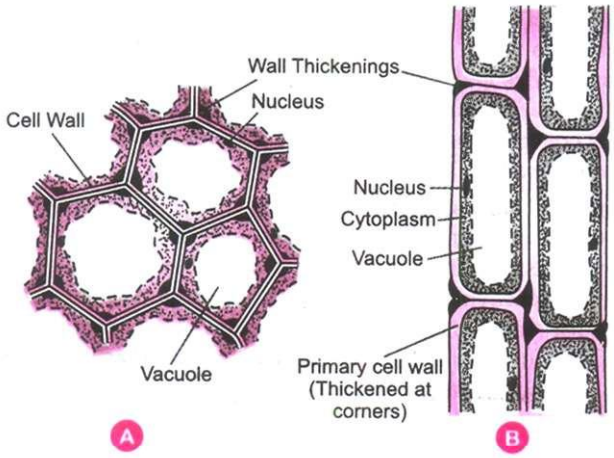


Figure : COLLENCHYMA; A-TRANSVERSE SECTION; B-LONGITUDINAL SECTION

- They were discovered and coined by **Mettenius** (1805).
- The cells are long, narrow, pointed at ends, thick walled and lignified. They are the dead cells.
- It impart hardness to plant parts and give mechanical strength.

◈ **Protective Tissue :**

- It includes epidermis and cork.

Epidermis :

- It is usually present in the outermost layer of the plant body such as leaves, flowers, stem and roots.
- Epidermis is one cell thick and is covered with cuticle.
- Cuticle is a water proof layer of a waxy substance called cutin which is secreted by epidermal cells.
- The main function of epidermis is to protect the plant from desication and infection.

◈ **Cork :**

- As roots and stem grow older with time (increase in girth), tissues at the periphery become cork cell.
- Cork cells are dead cells and they do not have any intercellular spaces.

- The walls of cork cells are heavily thickened by the deposition of an organic substance (a fatty substance), called suberin.
- Cork is protective in function. cork cells prevent desiccation (loss of water from plant body), infection and mechanical injury.
- Cork is produced by cork cambium commereially it is obtained from oak (quercus suber).
- Cork is used for making insulation boards, sports goods, bottle corks etc.

◈ Stomata :

- Epidermis of a leaf is not continuous at some places due to the presence of small pores, called stomata.
- Each stomata is bounded by a pair of specialised epidermal cells called guard cells.
- The stomata allows gaseous exchange to occur during photosynthesis and respiration.

◈ Structure of Stomata :

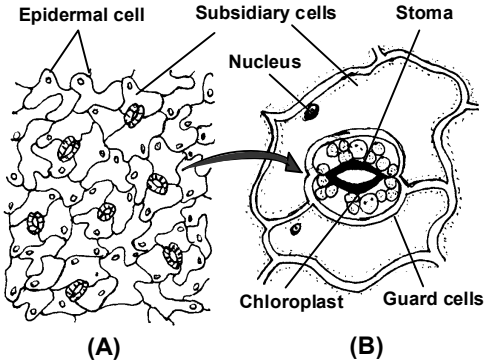


Figure : (A) LOWER EPIDERMIS OF A LEAF TO SHOW STOMATA (B) STRUCTUER OF ONE STOMATA

Opening & Closing of Stomata :

- Stomata opens in presence of light, at high temperature & at low CO_2 concentration.
- When guard cells becomes **turgid** stomatal pore **opens**, while when they becomes **flaccid** stomatal pore **closes**.
- Due to **endo-osmosis** guard cells becomes **turgid** while due to **exo-osmosis** guard cells becomes **flaccid**.
- Due to increase in the amount of osmotically active sugars in guard cells, their osmotic pressure increases and water enters inside the cells increasing the turgidity of cells and hence stomata opens.
- When amount of sugar decreases, stomata closes. Several theories have been proposed by the scientist to explain the opening and closing of stomata.

◈ Complex Permanent Tissues :

- A complex tissues can be defined as a collection of different types of cells that help in the performance of a common function.
- The important complex tissues in vascular plants are xylem and phloem. Both these together called as vascular tissues.
- Both these tissues are an assemblage of living and dead cells and may be primary or secondary, depending upon their mode of origin.
- Complex tissue transport water, mineral salts (nutrients) and food material to various parts of plant body.

Complex tissues are of following two types :

◈ Xylem :

- Its main function is conduction of water and mineral salts from root to the top of plant.
- Primary xylem elements originate from procambuim of apical meristem.
- Secondary xylem elements originate from the vascular cambium of lateral meristem.
- The xylem elements are of 4 types : xylem tracheids, vessels, fibers and parenchyma.

Xylem Tracheids :

- These are lignified and dead cells with bordered pits.
- They help in conduction of water in pteridophytes and gymnosperms and provide mechanical support plants.

Xylem Vessels :

- The cells are long and tubular with lignified cell wall.
- The cross wall (end wall) at both the ends dissolves and form a pipe like channel.
- They help in ascent of sap in angiosperms.

Xylem Fibers :

- Long and narrow sclerenchymatous fibers with tapering end. The wall is heavily lignified leaving a very narrow Lumen.
- It provides tensile strength and mechanical strength.

Xylem Parenchyma :

- They are thin walled living cells present in both primary and secondary xylem.
- They store food materials.

◈ Phloem :

- The dead matter in them is known as bast.
- Its main function is conduction of food material from leaves to other plant parts.
- The phloem elements are of four type : Sieve tubes, Companion cells, Fibres and paranchyma.

Sieve Tubes :

- These are living but lack nucleus at maturity.
- Cell wall is thin and made up of cellulose.
- The transverse walls of sieve tube form sieve plate.
- They help in conduction of food material.

Companion Cells :

- The cells are living, thin walled, narrow and found attached to the lateral side of sieve element.
- They are absent in pteridophytes and gymnosperms.
- They support the sieve tube in transport of food.
- These are living and thin walled cells.
- They are absent all monocots and some dicots.

◈ Phloem Fibers (bast fibers) :

- These are sclerenchymatous fibers having thick wall and narrow Luman.
- They provide mechanical support to the plant.

◈ Phloem Parenchyma -

- The chief function of parenchyma is to store food material and other substances like mucilage, tanins and resins.

➢ ANIMAL TISSUE

◈ Classification of Animal tissue :

◈ Epithelial tissue :

- Epithelial tissue is a simplest as a protective covering.

Function of epithelial tissue:

- Epithelial cover the body surface as an outer layer of skin and provide protection to the underlying tissues from mechanical injury, drying up, entry of germs (viral or bacterial pathogens), and harmful chemicals.
- Epithelia forms inner lining of mouth, alimentary canal and other internal organs inside the body and protect these organs.
- Epithelial lining of the intestine absorbs water and digested food.
- Epithelial tissues help in the elimination of nitrogenous and other waste products.
- Epithelial lining of the cavities give rise to glands that provide valuable secretions such as mucus, gastric juice, etc.

◈ Type of epithelial tissue :

◈ Squamous epithelium :

- Simple squamous epithelial cells are extremely thin and flat and form a delicate lining. The oesophagus and the lining of the mouth are also covered with squamous epithelium.
- The skin, which protects the body, is also made of squamous epithelium.

◈ Cuboidal epithelium :

- **Structure.** This epithelium consists of cube-like cells which are about as tall as wide. The outline of cells is polygonal in surface view and square in section.
- **Occurrence.** The cuboidal epithelium lines the small salivary ducts, pancreatic ducts, sweat glands, salivary glands and thyrid glands. It also covers the ovaries and lines the sperm-producing tubules.
- **Function.** It helps in protection , secretion, absorption, excretion and gamete formation.

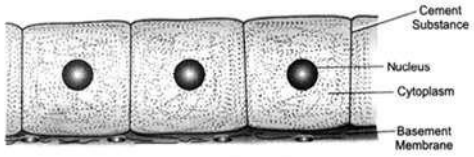


Figure : CUBOIIDAL EPITHELIUM

- Cuboidal epithelium (with cube-shaped cells) forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support.

◈ Columnar epithelium

- This epithelium consists of tall or pillar-like cells that are much taller than wide. The nuclei are generally elongated along the long axis of cells.
- **Occurrence.** The columnar epithelium lines the stomach, intestine and gall bladder. It also lines mammary gland ducts and parts of urethra.

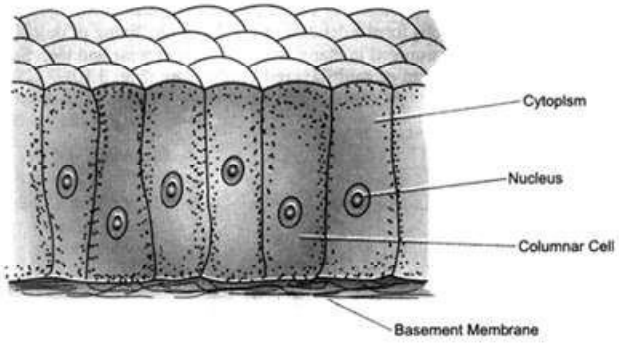


Figure : COLUMNAR EPITHELIUM

- **Function.** It helps in protection, absorption and secretion. Columnar epithelium of intestine is specialized for the absorption of water and digested food.

◈ Cilliated epithelium :

- **Structure.** This epithelium consists of cuboidal or columnar cells that bear cilia on their free surfaces. A cilium is fine, vibratile cytoplasmic outgrowth that arises from a minute basal granule.
- **Occurrence.** Cuboidal ciliated epithelium lines certain parts of urinary tubules of the kidney and sperm ducts. Columnar ciliated epithelium lines the nasal passages, oviducts (fallopian tubes), terminal bronchioles and ventricles of the brain.

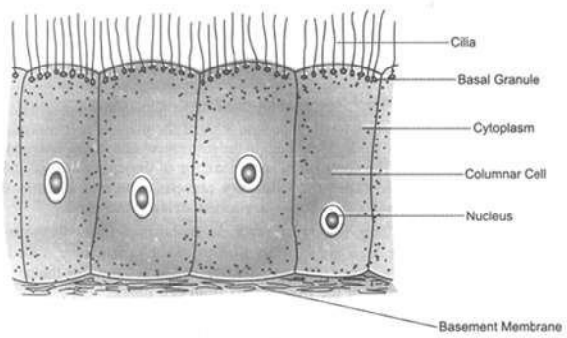


Figure : CILIATED COLUMNAR EPITHELIUM

- **Function.** This epithelium helps in the movement of mucus, urine, eggs, sperms and cerebrospinal fluid in a particular direction.

◈ Glandular epithelium :

- This epithelium consists of columnar cells modified to secrete chemicals. It lines the glands such as gastric glands, pancreatic lobules, intestinal glands, etc.

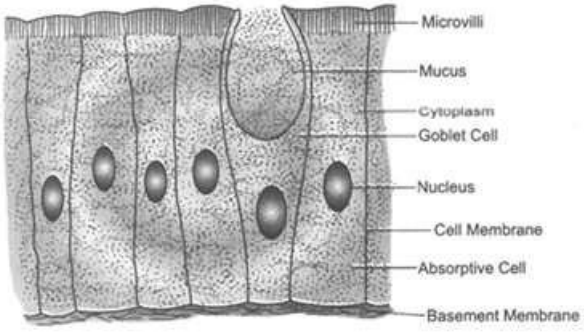


Figure : GOBLET CELLS IN COLUMNAR EPITHELIUM

◈ Nervous Tissue :

- The nervous tissue, which contains densely packed nerve cells, called **neurons** (Gk. *neuro* = nerve), is present in the brain, spinal cord and sense organs. The neurons are specialized for conduction of nerve impulses. They receive stimuli from within or outside the body and conduct impulses (signals) which travel from one neuron to another neuron. Each neuron is composed of the following three parts.

(i) Cyton or cell body. The cell body contains the major concentration of the cytoplasm and the central nucleus of the neuron. The cell body also contains **Nissl's granules**, which are groups of ribosomes and rough endoplasmic reticulum.

(ii) Dendrons. These are short much-branched and tapering projections arising from the cell body. The dendrons are further branched into dendrites. They provide a large surface area for synaptic connections with other neurons. They conduct nerve impulses towards the cell body.

(iii) Axon (Nerve fibre). The axon is a long cylindrical process of uniform diameter that arises from the axon hillock of the cyton. It shows fine branching at the terminal end. Each branch ends in a swollen structure, called synaptic knob or **bouton**. The axons carry impulses aways from the cell body to other neurons. The synaptic knobs of terminal branches of neuron are connected with dendrite branches of an adjacent neuron. Each such junction, in fact, has minute gap called synapse. It is meant for the transmission of nerve impulse from on neuron to the other.

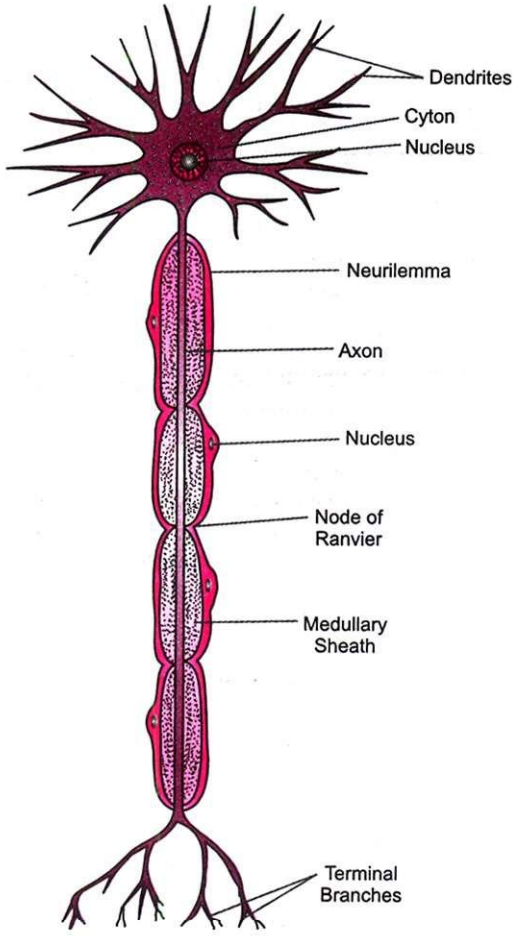


Figure : A NEURON (NERVE CELL AND NERVE FIBRES)

◈ Muscular Tissue :

- Locomotion and movements are due to muscular tissues contain highly contractile muscle cells.
- It is made up of muscle fibres.
- On the basis of their structures and functions, they can be divided as striated, unstriated and cardiac muscles.

◈ Connective Tissue :

- Connectvie tissues of animals serve the functions of binding and joining one tissue to another (i.e. connecting bones to each other, muscles to bones etc.) forming protective sheath and packing material around the various organs separating them so that they do not interfere with each other acitivities, Carrying materials from on part to another in the body, forming a supporting from work of cartilage and bones for the body etc.
- **Types of connective tissue :**
  The connective tissues are of ***five*** major types : -
  (i) Areolar tissue (Loose connective tissue)
  (ii) Dense Regular connective tissue
  (iii) Adipose tissue
  (iv) Skeletal tissue
  (v) Vascular tissue (Fluid).

(i) Areolar tissue :

- The areolar tissue is also known as **loose connective tissue.** It is most widely distributed connective tissue in the animal body. It consists of a transparent, jelly-like sticky matrix containing numerous fibres and cells and abundant mucin.
- Muscle is a contractile tissue which brings about movements, regarded as motors of the body.
- Muscle cells are elongated slender like cells and called muscle fibres.
- The muscles are of three types : as compared below :

Characteristics	Striped	Unstriped	Cardiac
Location	Occur in the body wall, limbs, tongue, pharynx and beginning of oesophagus	Occur in the wall of hollow viscera, iris of the eye and dermis of the skin.	Occur in the walls of heart, pulmonary veins and superior venacava.
Other names	Also called striated, skeletal and voluntary muscle fibres	Also called non-striated, smooth, visceral and involuntary muscle fibres.	Also called heart muscle fibres.
Shape	Cylindrical	Spindle	Cylindrial
Action	Voluntary	Involuntary	Involuntary
Light & Dark bands	Present	Absent	Absent
Branching	Absent	Absent	Present

The fibres are mostly of two types : **(a) White collagen fibres.** They are made up of a protein called collage, which on boiling with water changes to gelatin, and **(b) yellow elastic fibres.** They are formed of a protein called elastic. Collagen fibres provide flexibility and strength whereas elastic fibres provide elasticity.

- The areolar tissue is connective in function. It fixes the skin with the muscles, fills the spaces inside the organs, Attaches the blood vessels and nerves with the surrounding tissues, fastens the periotneum to the body wall and viscera. It is commonly called **"Packaging tissue"** of the body. Examples, bone periosteum, muscle perimysium, nerve perineurium, etc.

(ii) Dense regular connective tissue :

- Dense regular connective tissue consists of orderd and densely packed fibres and cells. The fibres are loose and very elastic in nature. They are secreted by the surrounding connective tissue cells. This

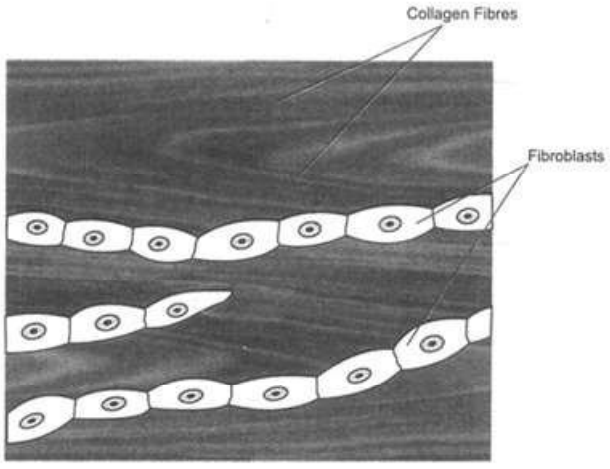


Figure : DENSE REGULAR CONNECTIVE TISSUE

(a) Tendon : Tendons are cord-like, very tough, inelastic bundles of white collagen fibres bound together by areolar tissue. The cells present in the tendons are elongated fibroblasts which lie in almost continuous rows here and there. The tendons connect the skeletal muscles with the bones.

(b) Ligaments : Ligaments are cords formed by yellow elastic tissue in which many collagen fibres are bound together by areolar tissue. The fibroblasts are irregularly scattered. This tissue combines strength with great flexibility. The ligaments serve to bind the bones together.

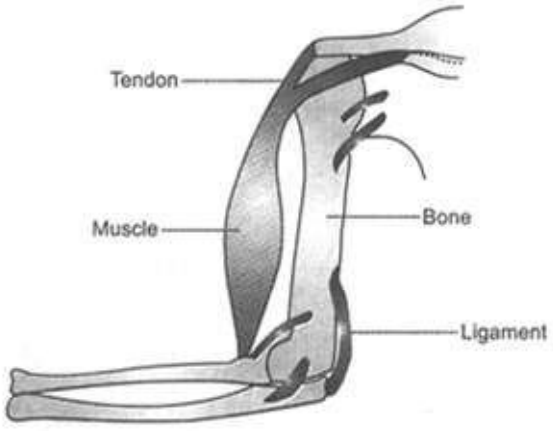


Figure : ATTACHMENT OF TENDOMS AND LIGAMENTS

Difference between tendon and ligament :

Tendons	Ligaments
1. Tendons are very tough and inelastic.	1. Ligaments are elastic.
2. They connect the skeletal muscles with the bones.	2. Ligaments connect bones to other bones at joints.
3. Tendons are made up of white fibrous tissue. Yellow elastic fibres are, however, absent.	3. Ligaments are made up of yellow elastic fibres. The white fibres also occur but they are very fine.
4. Fibroblasts occur in rows.	4. Fibroblasts lies scat - ered.

(iii) Adipose tissue :

- Adipose is primarily a fat storing tissue in which the matrix is packed with large, spherical or oval fat cells (or **adipocytes**). Each fat cell contains a large fat globule. The matrix also contains fibroblasts, macrophages, collagen fibres and elastic fibres. The adipose tissue is arranged in lobules encased in areolar tissue.

- The adipose tissue is found beneath the skin, in the covering of the heart, around the blood vessels and kidney and in yellow bone marrow. This tissue stores fat and insulates the body against heat loss. It forms a shock aborbing cushion around the kidneys and the eyeballs. Bulbber in whales is, in fact, an insulating fat body. Similarly, **hump** in camel is also rich in adipose tissue.

(iv) Skeletal tissue :

- Skeletal tissue forms the rigid skeleton which supports the vertebrate body, helps in locomotion and provides protection to many vital organs. There are *two* types of skeletal tissues.
  (a) Cartilage, and
  (b) Bone

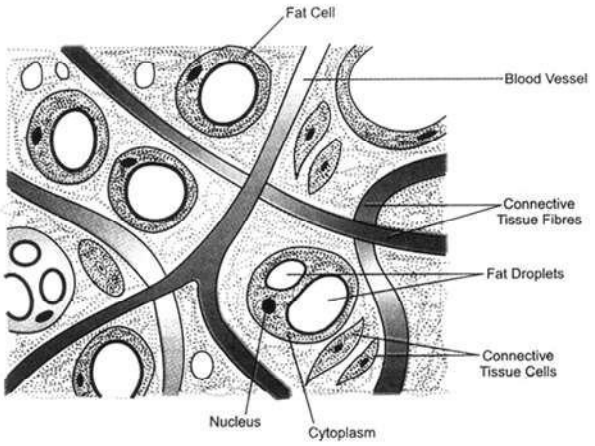


Figure : ADIPOSE TISSUE

(a) Cartilage

- **Characteristics.** Cartilage is a hard but flexible skeletal tissue consisting of living cells embedded in a matrix. The cells (chondroblasts) become chondrocytes when get surrounded within special fluid-filled chambers, called lacunae (sing. lacuna). The lacunae (containing chondrocytes)are separated by the amorphous matrix (chondrin) that contains glycoproteins, collagen and elastic fibres. The surface of cartilage is surrounded by irregular connective tissue forming the perichondrium. Growth of cartilage occurs continuously due to multiplication of chondrocytes by mitosis, deposition of matrix within existing cartilage and from activity of the deeper cells of the perichondrium. Blood vessels and nerves are absent in the matrix.

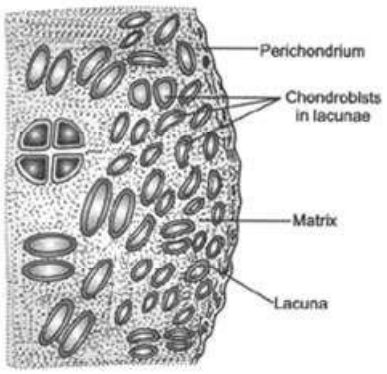


Figure : CARTILAGE

- **Occurrence.** This tissue occurs in very few parts of the body. In humans, the cartilage occurs at the ends of long bones, the pinnae of ears, the ends of nose, in the walls of respiratory ducts, within intervertebral discs, etc. In sharks and rays, the entire skeleton is cartilage.

- **Functions.** Cartilage is more compressible than bone. It absorbs stresses and provides flexibility to the body parts.

(b) Bone

- **Characterisitics.** Bone is a very strong and non-flexible vertebrate connective tissue. A compact bone consists of living bone cells. Called osteoblasts, embedded in a firm, calcified matrix. The osteoblasts are contained in lacunae (spaces) which are arranged in concentric circles present throughout the matrix. The lacunae are also traversed by nerves and blood vessels. The blood vessels passing through them provide nutrients to osteoblasts and help exchange of materials. The matrix in cmposed of about 30% organic materials (chiefly collagen fibres and glycoproteins) and 70% inorganic bone salts (mainly phosphates and charbonates of calcium and magnesium, hydroxyapatite, etc.). These inorganic salts are responsible for hardness of the bone.

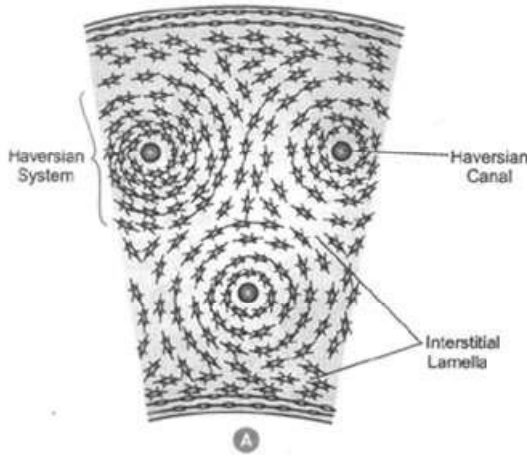


Figure : T.S. Of LONG BONE

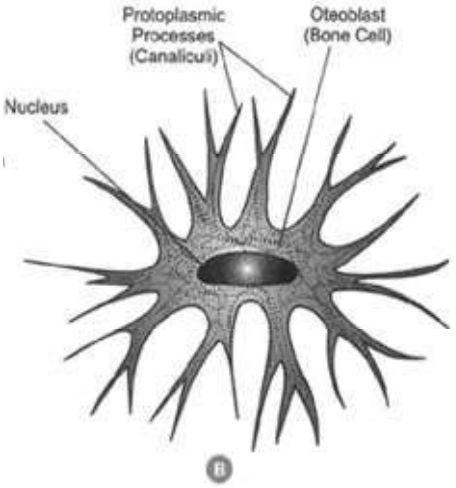


Figure : OSTEOBLAST

Cartilage	Bone
1. Cartilage is soft, elastic and flexible.	1. Bone is hard, tough and inelastic.
2. Matrix of cartilage consists of entirely organic matter.	2. Matrix of bone is both organic and inorganic.
3. Cartilage do not have blood supply (except in perichondrium).	3. Bones have rich blood supply.
4. Growth of cartilage is unidirectional.	4. Growth of bone is bidirectional.

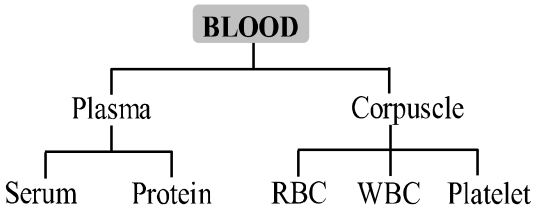
- **Functions.** Bones form endoskeleton of vertebrates. They provide levers for movement and support for soft parts of the body. Bones also protect many delicate tissues and organs.

(iv) Fluid Connective Tissue : (Vascular Tissue)

Fluid connective tissue links the different parts of body and maintains a continuity in the body. It includes blood and lymph.

(a) Blood :

- It is a fluid connective tissue.



◈ **Functions of blood :**

- Blood transports nutrients, hormones and vitamins to the tissues and transports excretory products from the tissues to the liver and kidney.
- The red blood corpuscles (RBC's) carry oxygen to the tissues for the oxidation of food stuff.
- The white blood cells (WBC's) fight disease either by engulfing and destroying foreign bodies or by producing antitoxins and antibodies that neutrophils and harmful effects of germs.
- Granulocytes include neutorphils, eosinophils and basophils.
- Agranulocytes include lymphocytes and monocytes.
- Blood platelets disintegrate at the site of injury and help in the clotting of blood.

(b) Lymph:

Nature :

- Lymph is a colourless fluid that has filtered out of the blood capillaries. Red blood corpuscles and some blood proteins are absent in it. In the lymph, white blood cells are found in abundance.

Functions :

- Lymph transports the nutrients (oxygen, glucose) that may have filtered out of the blood capillaries back into the heart to be recirculated in the body.
- It brings CO_2 and nitrogenous wastes from tissue fluid to blood.