

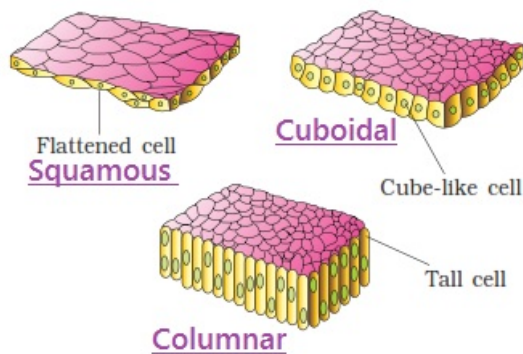
# Revision Notes on Structural Organisation in Animals

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## Epithelial Tissues

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- An epithelium is a tissue composed of one or more layers of cells that cover the body surface and lines its various cavities.
- It serves for protection, secretion and excretion.
- The word 'epithelium' was introduced by *Ruysch*.
- Epithelial tissue evolved first in animal kingdom.
- It originates from all the three primary germ layers. *e.g.* Epidermis arises from ectoderm, Coelomic epithelium from the mesoderm and epithelial lining of alimentary canal from the endoderm.
- **Types of Epithelium**



## Glands

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- Multicellular exocrine glands are classified by structure, using the shape of their ducts and the complexity (branching) of their ducts system as distinguishing characteristics.
- Shape include tubular and alveolar (Sac like).
- Simple exocrine glands *e.g.* intestinal glands, mammalian sweat glands, cutaneous glands of frog etc. have only one duct leading to surface.
- Compound exocrine glands have two or more ducts *e.g.* liver, salivary glands etc.
- **Structural classification of exocrine glands:**

Type	Example
Simple tubular	Intestinal glands, crypts of Lieberkuhn in ileum.
Simple coiled tubular	Sweat glands in man
Simple branched tubular	Gastric (stomach) gland, and Uterine gland.
Simple alveolar	Mucous gland in skin of frog, Poison gland of toad and seminal vesicle.
Simple branched alveolar	Sebaceous glands
Compound tubular	Brunner's gland, bulbourethral gland and liver.
Compound alveolar	Sublingual and submandibular parotid salivary gland
Compound tubulo alveolar	Parotid salivary glands, Mammary gland and Pancreas.

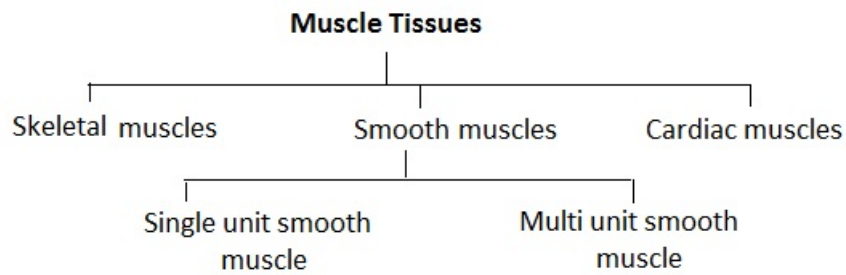
## Important Tips

- Study of tissue outside the body in a glass tube is known as in vitro, while study of living tissues in situ is known as in vivo.
- Among epithelia, simple epithelia were first to evolve.
- Transitional epithelium also called plastic epithelium or urothelium. It lacks basement membrane
- False epithelium (derived from mesenchyma a diffuse network of tissue derived from embryonic mesoderm) and lining the synovial cavities.
- Mammary glands without teats are present in prototheria.
- A malignant tumour arising from an epithelium is called a carcinoma. If it arises from a squamous epithelium it is a squamous cell carcinoma and if it arises from glandular epithelium it is called an adenoma.
- The epithelial lining of brain ventricles and central canal of spinal cord is known as ependyma.
- Stereocilia are elongated membrane outgrowths found in certain parts of male reproductive tract.

## Muscle Tissues

- Muscle cells are highly contractile (contracting to 1/3 or 1/2 the resting length).
- Muscle cells lose capacity to divide, multiply and regenerate to a great extent. Study of muscle is called myology.
- About 40% to 50% of our body mass is of muscles.
- The muscle cells are always elongated, slender and spindle-shaped, fibre-like cells, These are, therefore called muscle fibres.

- These possess large numbers of myofibrils formed of actin and myosin.



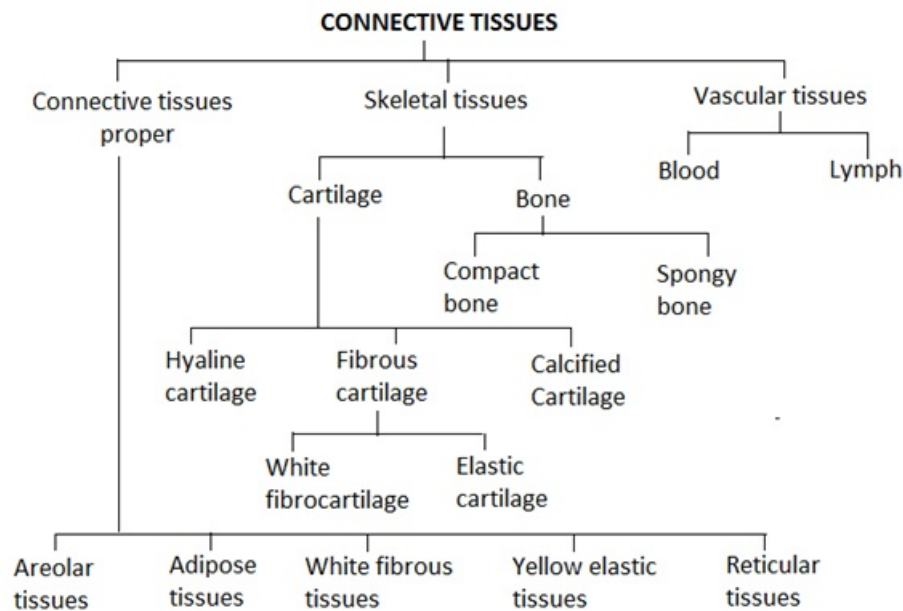
**(f) Difference between three types muscle fibres**

S.No.	Feature	Striated or Striped or Skeletal or Voluntary muscle fibres	Non-striated or Unstriated or Smooth or Visceral or Involuntary muscle fibres	Cardiac muscle fibres
1.	Shape	Long cylindrical	Fusiform (thick in middle tapering at ends) (0.02 nm to 0.2 nm long)	Network of fibres
2.	Stripes	Dark A bands and light I bands present	Absent	Present
3.	Nucleus	Many (syncytial) at periphery	Single at the centre of each cell	Many nuclei between successive end plates central position
4.	Unit	Sarcomeres, cylindrical long myofibrils placed end to end forming cylindrical myofibrils	Fusiform cells with inconspicuous borders	Oblique cross-connecting fibres make this muscle an interconnected bundle of myofibrils
5.	Attachment	To bones	To soft organs or viscera	Not attached to other organs except major blood vessels which are isolated and covered by pericardium
6.	Sarcolemma	Distinct	Absent	Absent
7.	Sarcoplasmic Reticulum	Well developed	Less extensive	Poorly formed
8.	Blood supply	Rich	Poor	Rich
9.	Contraction	Quick, fatigue fast	Slow, sustained contraction	Rhythmic, contractions originate in heart (pace maker immune to fatigue)
10.	Location	Generally peripheral, tongue, proximal part of oesophagus	Central, in hollow visceral organs, iris of the eye, dermis of the skin	Only in heart
11.	Intercalated discs	Absent	Absent	Present
12.	T-tubule system	Well developed	Lacking	Well developed
13.	Innervated nerves	Motor nerves from central nervous system (neurogenic)	Nerves from autonomic nervous system (neurogenic)	Nerves from central and autonomic nervous system (myogenic)
14.	Fibres	Unbranched	Unbranched	Fibres join by short oblique bridges
15.	Action	Voluntary	Involuntary	Involuntary

## Connective Tissues

- It connects and supports all the other tissues, the intercellular element predominating.

- The cellular element is usually scanty. In function this tissue may be mechanical, nutritive and defensive.
- It is a tissue made up of matrix (abundant intercellular substance or ground substance) and living cells that connects and support different tissues.
- Connective tissue was called mesenchyme by Hertwig (1893).
- Types of connective tissues



**(1) On the basis of their texture:**

The bones are divided into two categories spongy or cancellous or tubercular bones and compact or periosteal bones

Bone	Cartilage
1. Matrix is composed of a tough, inflexible material, the ossein.	1. Matrix is composed of a firm, but flexible material, the chondrin.
2. Matrix is always impregnated with calcium salts.	2. Matrix may be free or impregnated with calcium salts.
3. Bone cells lie in lacunae singly.	3. Cartilage cells lie in lacunae singly or in groups of two or four.
4. Osteocytes are irregular and give off branching processes in the developing bone.	4. Chondroblasts are oval and devoid of processes.
5. Lacunae give off canaliculi.	5. Lacunae lack canaliculi.
6. There are outer and inner layers of special bone forming cells, the osteoblasts, that produce new osteocytes, which secrete new lamellae of matrix.	6. There are no special cartilage-forming cells. Cartilage grows by division of all chondroblasts.
7. Matrix occurs largely in concentric lamellae.	7. Matrix occurs in a homogenous mass.
8. Bone is highly vascular.	8. Cartilage is nonvascular.
9. Bone may have bone marrow at the centre.	9. No such tissue is present.

**(2) On the basis of origin of bone:**

Ossification or osteogenesis is the process of bone formation. A bone is classified into four categories.

Characters	Spongy bone	Compact bone
Arrangement of lamellae	There is no regular Haversian system so have spongy texture.	Have regular Haversian system
Occurrence	In skull bones, ribs, centrum of vertebrae and epiphyses of long bones	In the shaft (diaphysis) of long bones
Marrow cavity	Broad	Narrow
Type of bone marrow	Red marrow in the spaces between lamellae	Yellow marrow in marrow cavity
Function	Marrow forms RBCs and Granular WBCs	Marrow stores fats

### (3) On the basis of treatment:

These are of two types :-

Characters	Dried bone	Decalcified bone
Type of treatment	Subjected to high temperature.	Subjected to dilute solution of <i>HCl</i> .
Nature of matter left	With only mineral matter.	With only organic matter.
Marrow cavity	Empty.	With bone-marrow.
Fate of cells	Periosteum, endosteum, osteoblasts and osteocytes are absent being killed by high temperature.	Periosteum, endosteum, osteoblasts and osteocytes all are present.
Lacunae	Lacunae present.	Lacunae absent.

(6) **Number of RBC:** The number of RBCs is counted by instrument haemocytometer. The total number of RBC per cubic mm of blood is called RBC count. RBC count is slightly lower in women than a man and number of RBC is more in people who live on mountains because there is less oxygen. RBC are absent in cockroach.

S.No.	Organism	Number of RBCs
1.	Male	5 – 5.4 million / cubic mm of blood
2.	Female	4.5 – 5 million / cubic mm of blood
3.	Infants	65 – 70 lacs/ cubic mm of blood
4.	Embryo	85 lacs/ cubic mm of blood
5.	Rabbit	70 lacs / cubic mm of blood
6.	Frog	4 lacs / cubic mm of blood

(7) **Life span of RBC:** The life span of red blood corpuscles circulating in the blood stream varies in different animals. RBCs have longest life span in blood. The mammals RBC have short life span due to absence of nucleus, which is disappeared during development.

S.No.	Organism	Life span of RBCs
1.	Mammals and Human	120 days or 4 months
2.	Rabbit	80 days
3.	Frog	100 days
4.	New born	100 days

(8) **Function of RBCs:** The major function of erythrocytes is to receive  $O_2$  of respiratory surfaces and then transport and readily deliver it to all cells of body. This important function is performed by haemoglobin which has a great ability to combine loosely and reversibly with  $O_2$  and is, hence, called “respiratory pigment”. Haemoglobin, in annelids, is dissolved in the plasma because of absence of red blood corpuscles. In mollusc and some arthropods, etc., a different respiratory pigment, haemocyanin is found dissolved in the plasma. This pigment is bluish due to presence of copper in place of iron.

### (9) Comparison Between Blood and Lymph

Blood	Lymph
1. Red corpuscles present.	1. These are absent.
2. White corpuscles fewer, neutrophils most numerous.	2. White corpuscles more; lymphocytes most numerous.
3. Soluble proteins more than insoluble proteins.	3. Insoluble proteins more than soluble proteins.
4. Amount of nutrients and $O_2$ comparatively more.	4. Amount of nutrients and $O_2$ comparatively less.
5. Amount of $CO_2$ and metabolic wastes normal.	5. Amount of these much more.

## Important Points

- Argentaffin cells which produce a precursor of serotonin, a potent vasoconstrictor hormone, occurs in intestinal cells.
- The brown adipose tissue in human is restricted till third month of post natal life.
- White fibres yield gelatin on boiling and are digestible with enzyme pepsin but yellow (elastic) fibres are not digestible by enzyme trypsin.
- The fat in the globules is stored in the form of triglycerides.
- The Cytoplasmic granules basophils contain histamine.
- Sprain – Excessive pulling of ligaments.
- Plasma cells are also called as “Cart wheel cells”.
- Collagen constitutes about 33% of total body protein.

## Nervous Tissues

- A most complex tissue in the body, composed of densely packed interconnected nerve cells called neurons (as many as  $10^{10}$  in the human brain).
- It specialized in communication between the various parts of the body and in integration of their activities.
- Nervous tissue is ectodermal (from neural plate) in origin.
- Difference between axon and dendron

Characters	Axon	Dendron
1. Number	Always single	May be one or more in number
2. Structure	Formed of neuroplasm with only neurofibrils but no Nissl's bodies.	Formed of neuroplasm with both neurofibrils and Nissl's bodies
3. Size	Long sized processes	Small sized processes
4. Direction of new impulses	Always away from the cell body	Always towards the cell body
5. Nature	<u>Efferent</u>	<u>Afferent</u>
6. Branching	Generally absent	Generally present

- **Classification of nervous tissues**

