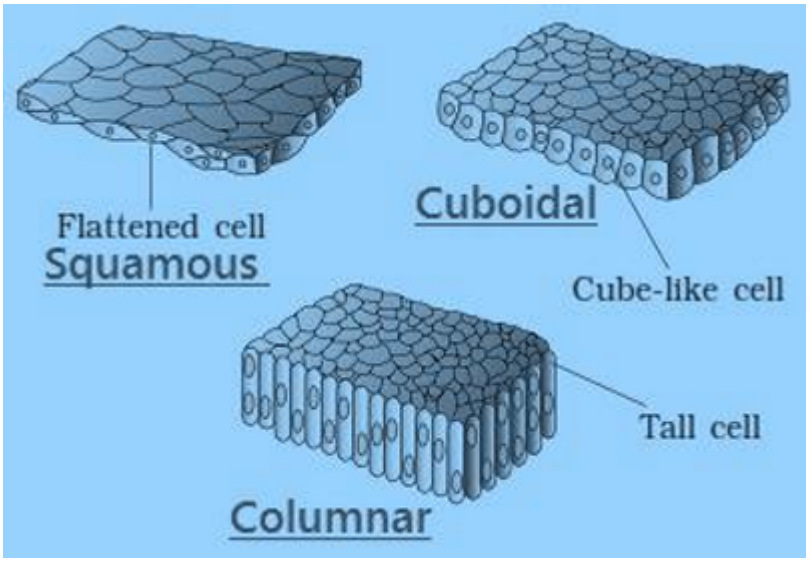
Structural Organization in Animals

Epithelial Tissues

- 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..
- 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

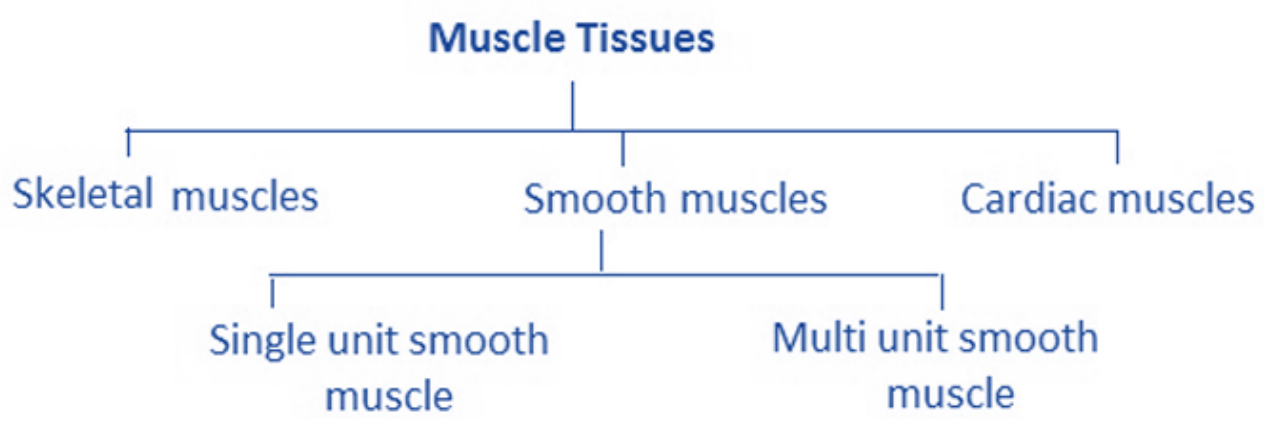
- Multicellular exocrine glands are classified by structure, using the shape of their ducts and the complexity (branching) of their ducts system as distinguishing characteristics.
- Shape include tubular and alveolar (Sac like).
- Simple exocrine glands e.g. intestinal glands, mammalian sweat glands, 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.

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.



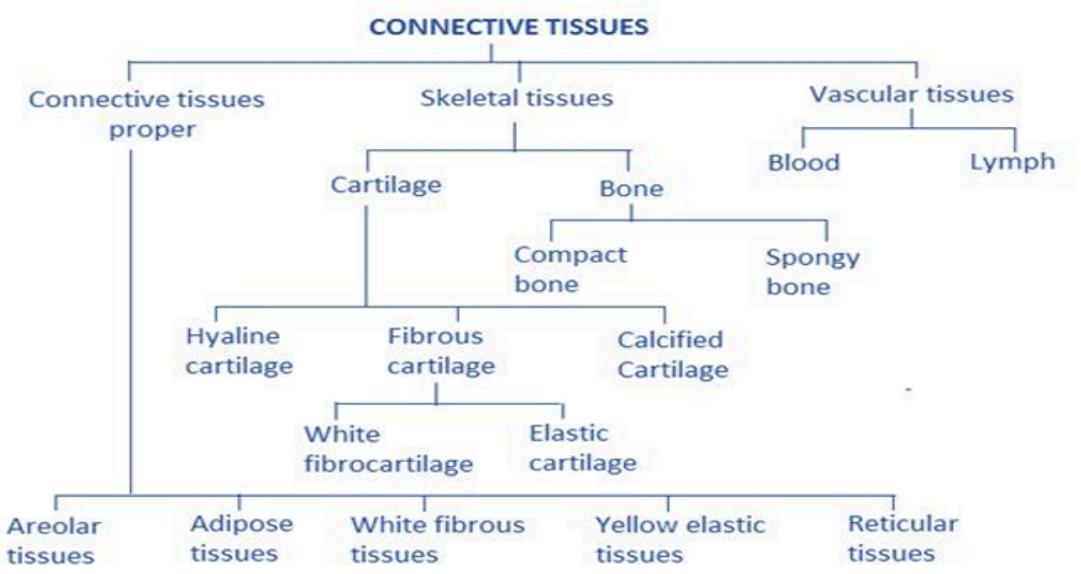
(f) Difference between three types muscle fibres

S.No.	Feature	Striated or Striped or Skeletal or Voluntary muscle fibres	Non-striated or Unstriped 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 tubecular 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 impregenated with calcium salts.
3. Bone cells lie in lucunae 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 in nonvascular.
9. Bone may have bone marrow at the centre.	9. No such tissue is present.

(6) Number of RBC: The number of RBCs is counted by instrument haemocytometer.

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:

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