



8. Mark the odd one in each series.

- (a) Areolar tissue; blood; neuron; tendon
- (b) RBC; WBC; platelets; cartilage
- (c) Exocrine; endocrine; salivary gland; ligament
- (d) Maxilla; mandible; labrum; antennae
- (e) Protonema; mesothorax; metathorax; coxa.

Solution:

- (a) Neuron: Areolar tissue, blood and tendon are connective tissues while neuron is a part a nervous tissue.
- (b) Cartilage: RBC, WBC and platelets are parts of vascular connective tissue while cartilage is skeletal connective tissue.
- (c) Ligament: Ligament is a connective tissue.
- (d) Antennae: Maxilla, mandible and labrum are mouth parts of cockroach while antennae are sense organs.
- (e) Protonema: Protonema is a filamentous juvenile stage in life cycle of Bryophytes, while mesothorax, metathorax and coxa are appendages of cockroach.

9. Match the terms in column I with those in column II.

Column I	Column II
(a) Compound epithelium	(i) Alimentary canal
(b) Compound eye	(ii) Cockroach
(c) Septal nephridia	(iii) Skin
(d) Open circulatory system	(iv) Mosaic vision
(e) Typhlosole	(v) Earthworm
(f) Osteocytes	(vi) Phallomere
(g) Genitalia	(vii) Bone

Solution:

- (a) - (iii), (b) - (iv), (c) - (v), (d) - (ii), (e) - (i), (f) - (vii), (g) - (vi)

10. Mention briefly about the circulatory system of earthworm.

Solution: Earthworm possesses a closed type of blood vascular system, as the blood flows through closed blood vessels. Blood is red in colour due to respiratory pigment haemoglobin. Prominent blood vessels in earthworm includes dorsal, ventral, sub- neural, lateral oesophageal and supra- oesophageal blood vessels. There are four pairs of tubular hearts, provided with valves. The anterior two pairs of hearts, known as lateral hearts lie in the 7th and 9th segments and connect the dorsal blood vessel with the ventral blood vessel. They receive blood from the dorsal blood vessel and convey it to the ventral blood vessel. The posterior two pairs of hearts are called latero-oesophageal hearts and are situated in the 12th and 13th segments. The latero-oesophageal hearts apart from connecting the dorsal and ventral blood vessels are also joined with the supra oesophageal blood vessel. Latero-oesophageal hearts carry blood from the dorsal vessel and the supra oesophageal vessel to the ventral blood vessel. Contractions keep blood circulating in one direction. Blood glands are present in the 4th, 5th and 6th segments which produce blood cells and haemoglobin which is dissolved in blood plasma. Blood cells are phagocytic in

nature.

11. Describe various types of epithelial tissues with the help of labelled diagrams.

**Solution:** Epithelial tissue is a tissue made of one or more layers of compactly arranged cells that covers external surface and internal free surface of body organs and which is underlined by a basement membrane. The various types of epithelial tissue along with the diagram are given below:

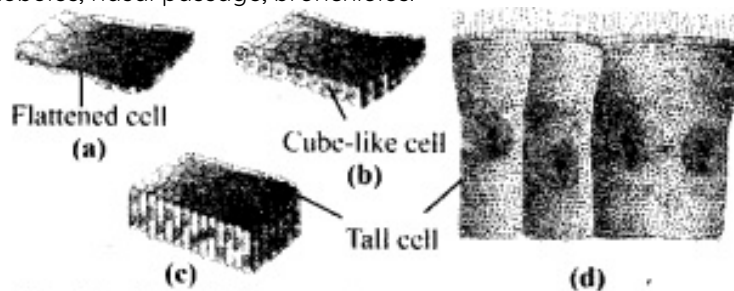
(i) Simple epithelium: It is composed of single layer of cells which rest on basement membrane. Simple epithelium generally occurs over secretory and absorptive surfaces and forms lining of body cavities, ducts and tubes. Simple epithelium is of several types.

(a) Squamous epithelium: It consists of single layer of flat cells, tightly linked together and have centrally located oval or spherical nucleus. It is also called pavement epithelium. It is found in walls of blood vessels, air sacs of lungs, and lining of eye lens.

(b) Cuboidal epithelium: Cells of cuboidal epithelium are as tall as wide, with centrally placed nucleus. Its main functions are secretion and absorption. It lines sweat gland, thyroid follicles, salivary glands. Brush bordered cuboidal epithelium, i.e., cells having microvilli on their free surface lines proximal part of uriniferous tubule, pancreatic duct, testis and ovary.

(c) Columnar epithelium: Cells are with basally located nucleus. It helps in secretion and absorption. It occurs in lining of intestine, stomach, gall bladder.

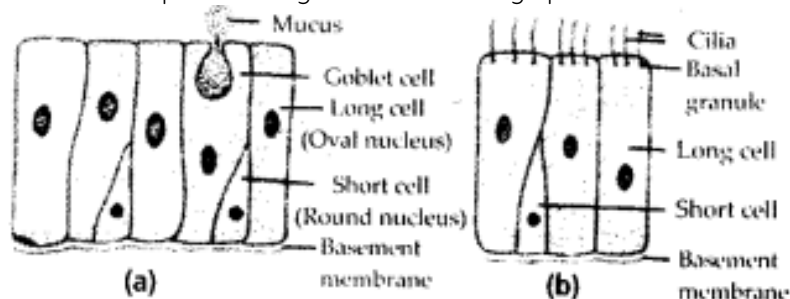
(d) Ciliated epithelium: Free surface of columnar and cuboidal cells are covered with cilia. Cilia help in moving fluids, particles, mucus, etc. in a specific direction. It occurs in the inner surface of Fallopian tubules, nasal passage, bronchioles.



**Fig.: Simple epithelium: (a) Squamous (b) Cuboidal (c) Columnar (d) Columnar cells bearing cilia.**

(e) Pseudostratified epithelium: It consists of single layer of cells but some cells are shorter than others. Due to difference in size of cells, the epithelium appears 2-3 layered. Pseudostratified columnar epithelium occurs in urethra and parotid salivary gland.

Pseudostratified columnar ciliated epithelium (only larger cells ciliated) occurs in lining layer of nasal chambers, trachea and large bronchi. It helps in moving mucus and foreign particles.

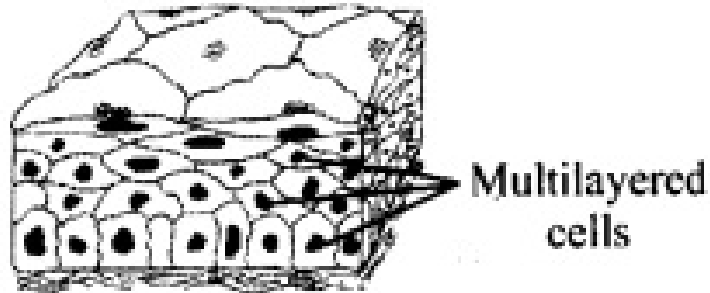


**Fig.: Pseudostratified epithelium. (a) Columnar (b) Columnar ciliated**

(ii) Compound epithelium/stratified epithelium: It is multilayered epithelium where cells of only the lowermost or basal layer are in contact with basement membrane. It provides protection against mechanical and chemical stresses and has limited role in secretion and absorption. It covers dry surface of skin, moist surface of

buccal cavity, pharynx, etc. Different types of compound epithelium are:

(a) Stratified squamous epithelium: The cells of outer layer are flattened and squamous while the inner layers are cuboidal cells. It is of two types: Non-keratinised lining oesophagus, pharynx, buccal cavity, cornea, vagina and anal canal and keratinised (cornified): forming epidermis of skin, hair, horn and nail.



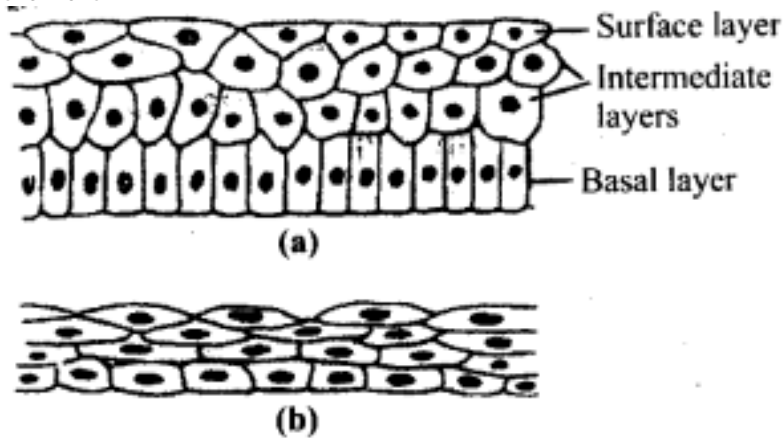
**Fig.: Compound epithelium**

(b) Stratified cuboidal epithelium: The outer layer of cuboidal cells and basal layer of columnar cells. It lines ducts of sweat glands, large salivary and pancreatic ducts.

(c) Stratified columnar epithelium: Both upper and basal layers are made of columnar cells, e.g., epiglottis covering, part of urethra.

(d) Stratified ciliated columnar epithelium: Outer layer consists of ciliated columnar cells and basal layer of columnar cells, e.g., larynx.

(iii) Transitional Epithelium: This is stratified epithelium which contains cuboidal or columnar shaped cells, which are thin and stretchable. No basement membrane is present as it would impede stretchability. It lines the inner surface of renal calyces, urinary bladder, ureter. Because of its distribution, it is also called urothelium.

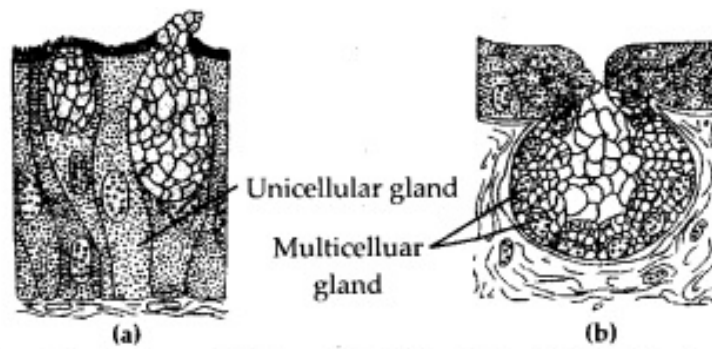


**Fig.: Transitional epithelium, (a) relaxed (= unstretched) (b) stretched.**

(iv) Glandular epithelium: It consists of specialised epithelial cells which synthesise intracellular macromolecules (protein in pancreas, lipids in adrenal glands, glycoprotein in salivary glands and all the three in mammary glands) and pour out the same in the form of a useful fluid secretion which is different from blood or any other extracellular fluid. Glands can be unicellular or multicellular on the basis of number of cells.

(a) Unicellular glands: Single-celled, e.g., goblet (mucous) cells of respiratory tract and alimentary canal.

(b) Multicellular glands: Consist of cluster of cells, e.g., Salivary glands.



**Fig.: Glandular epithelium : (a) Unicellular (b) Multicellular**

On the basis of presence or absence of duct glands can be:

- (a) Exocrine glands: These glands pour their secretion through a duct. They secrete milk, saliva, mucus, earwax. e.g., goblet cells, salivary glands, tear glands, gastric glands, intestinal glands.
- (b) Endocrine glands: They are ductless glands, which pour their secretions into blood or lymph for reaching the target region. Their secretion is called hormone e.g., pituitary gland, thyroid gland, parathyroid glands, adrenal glands.
- (c) Heterocrine glands: Both exocrine and endocrine, e.g., pancreas.

On basis of mode of secretion glands can be:

- (a) Merocrine: Secretion is discharged through diffusion, e.g., goblet cells, sweat glands.
- (b) Apocrine glands: Glandular secretion accumulates in the terminal part of the cell which is pinched off, e.g., mammary glands.
- (c) Holocrine glands: The cell filled with secretory product disintegrates during discharge of the product, e.g., sebaceous gland.
- (v) Modified epithelium: It is of following types:
  - (a) Germinal epithelium (generally cuboidal, produces gametes),
  - (b) Glandular epithelium (columnar or cuboidal secretes chemicals and mucus),
  - (c) Sensory epithelium or neuroepithelium. Epithelial cells having sensory hair on free surface and connected with nerve fibres on the other surface (generally columnar, receives and conveys stimuli), e.g., nasal epithelium, taste buds, retina, sensory spots of internal ear.
  - (d) Pigmented epithelium - The cells possess melanin granules, e.g., retinal layer in contact with choroid of eye.

12. Distinguish between

- (a) Simple epithelium and compound epithelium.
- (b) Cardiac muscle and striated muscle.
- (c) Dense regular and dense irregular connective tissues.
- (d) Adipose and blood tissue.
- (e) Simple gland and compound gland.

Solution:

- (a) Differences between simple and compound epithelium are as follows:

	<b>Simple epithelium</b>	<b>Compound epithelium</b>
(i)	It is composed of a single layer of cells.	It is composed of two or more layers of cells.
(ii)	All the cells rest on the basement membrane.	Only cells of the deepest layer rest on the basement membrane.
(iii)	It functions as lining of body cavities, ducts and tubules. Main functions are secretion and absorption.	It provides protection against mechanical and chemical stresses.

(b) Differences between cardiac and striated muscles are as follows:

	<b>Cardiac muscle</b>	<b>Striated muscle</b>
(i)	It is present in the wall of the heart, pulmonary veins and superior vena cava.	It is present in the limbs, body walls, tongue, pharynx and beginning of oesophagus.
(ii)	Fibres are branched and uninucleate.	Fibres are unbranched and multinucleate.
(iii)	Oblique bridges and intercalated discs present.	No oblique bridges and intercalated discs.
(iv)	Nerve supply from the brain and autonomic nervous system.	Nerve supply from central nervous system.

(v)	They never get fatigued.	They soon get fatigued.
(vi)	These are involuntary.	These are voluntary.

(c) Differences between dense regular and dense irregular connective tissues are as follows:

	<b>Dense regular connective tissue</b>	<b>Dense irregular connective tissue</b>
(i)	In this tissue, the collagen fibres are present in rows between many parallel bundles of fibres.	This tissue has fibroblasts and many fibres (mostly collagen) that are oriented differently.
(ii)	It occurs in dermis of skin, walls of blood vessels, lungs, bronchioles. E.g., Tendon and ligament.	This tissue is present in the skin.

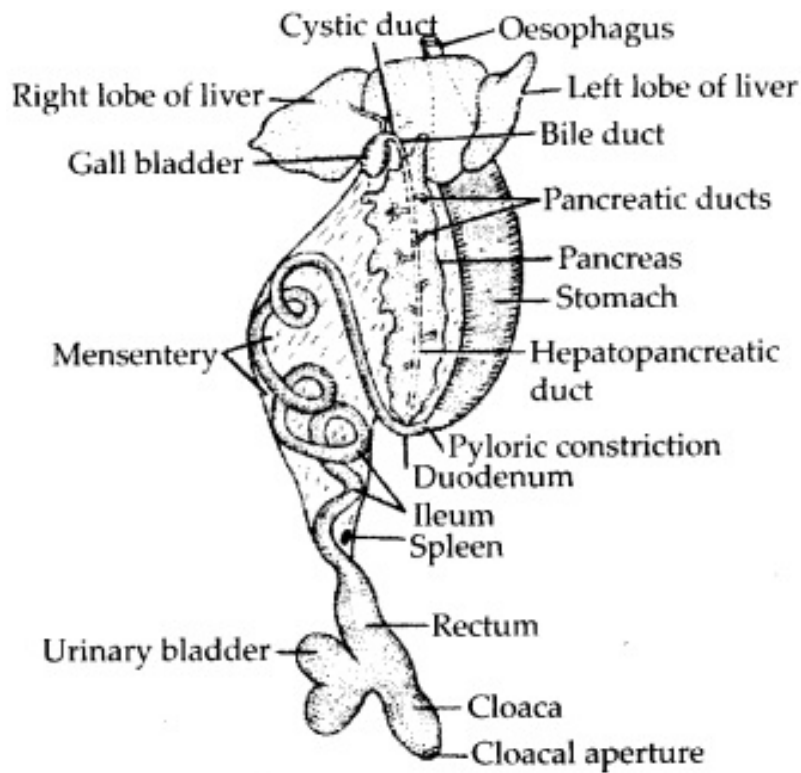
(d) Differences between adipose tissue and blood tissue are as follows:

	<b>Adipose tissue</b>	<b>Blood tissue</b>
(i)	Adipose tissue is a type of loose connective tissue located mainly beneath the skin.	Blood is a fluid connective tissue containing plasma, red blood cells (RBCs), white blood cells (WBCs) and platelets.
(ii)	The cells of this tissue are specialised to store fats. The excess of nutrients which are not used immediately are converted into fats and are stored in this tissue.	It is the main circulating fluid that helps in the transport of various substances.

(e) Differences between simple gland and compound gland are as follows:

<b>Simple gland</b>	<b>Compound gland</b>
In simple glands duct is unbranched. They are further differentiated into unbranched and branched depending upon the condition of secretory part.	In compound gland both the duct and secretory part are branched. Further differentiation is made on the basis of shape of secretory part.

13. Draw a neat diagram of digestive system of frog.  
Solution:



**Fig.: Alimentary canal of frog.**

14. Mention the function of the following:

- (a) Ureters in frog
- (b) Malpighian tubules
- (c) Body wall in earthworm.

Solution:

(a) Ureters in frog: Ureter is a transparent duct which arise from outer portion of kidney. In the "male frogs, ureter acts as urinogenital duct which runs backwards from kidneys and opens into the cloaca. It carries both urine and spermatozoa from kidney to the cloaca. In female, ureter conducts only urine from kidneys to the cloaca.

(b) Malpighian tubules: Malpighian tubules are excretory organs present in cockroach. These are present at junction of mid gut and hindgut. These are fine, long, unbranched, yellowish and blind tubules and are 100-150 in number. They help in the removal of excretory products from haemolymph.

(c) Body wall in earthworm: It consists of cuticle, epidermis, muscular layer and parietal peritoneum.

(i) It maintains the characteristic shape of the body.

(ii) It protects the internal organs.

(iii) The cuticle prevents excessive evaporation.

(iv) It serves as an ideal respiratory organ.

(v) The receptor cells play a vital sensory function.

(vi) The albumen helps in the formation of cocoon. It also serves as a food for the developing earthworm inside the cocoon.

(vii) Setae and muscles are responsible for locomotion.

(viii) Excretory matter is passed out through nephridiopores.

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