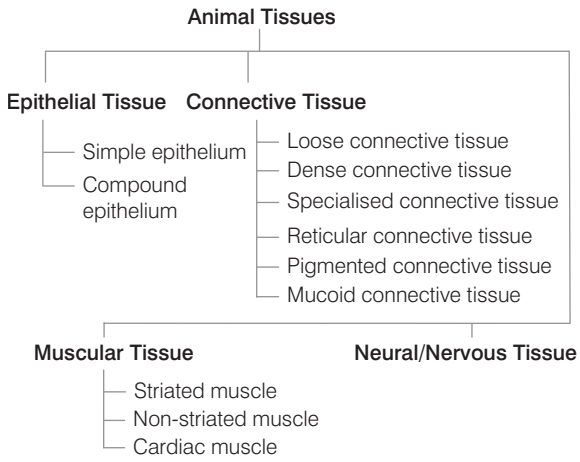
# Structural Organisation in Animals

## *Quick Revision*

- In multicellular animals, a group of similar cells having the same origin and performing a specific function forms an organisation called **tissue**.
- Cells, tissues, organs and organ system exhibit division of labour and contribute to the survival of an organism.

### Animal Tissues

The structure of cells vary according to their functions. Therefore, animal tissues can be classified broadly as




### Epithelial Tissue

- It possesses free surface and its cells are compactly packed with little intercellular matrix. It lines the body surfaces facing lumen, cavities, ducts, etc.
- Epithelial tissue is broadly classified into two categories
  - **Simple epithelium** composed of single layer of cells, which lines body cavities, ducts and tubes.
  - **Compound epithelium** composed of two or more layers of cell, which is protective in function.
- Based on structural modifications, simple epithelium is further divided into the following types
  - **Squamous epithelium** is formed of single thin layer of flat cells with irregular boundaries. It forms diffusion boundaries in the air sacs of lungs and the walls of blood vessels.
  - **Cuboidal epithelium** is composed of a single layer of cube-like cells. It performs secretion and absorption in tubular portion of nephron and glandular ducts. The cuboidal epithelium of Proximal Convoluted Tubule (PCT) of nephron in the kidney has microvilli.
  - **Columnar epithelium** is composed of a single layer of tall and slender cells with nuclei located at the base and microvilli at the free surface and is called brush bordered columnar epithelium. It helps in absorption and secretion in stomach and intestine.

- **Ciliated epithelium** is derived from columnar or cuboidal cells which bear cilia on the free surface. Its function is to move particles or mucus in a specific direction over the epithelium. It is found in the inner surface of hollow organs like bronchioles and Fallopian tubes.
- **Glandular epithelium** is formed by the modification of columnar or cuboidal cells, which become specialised for secretion. Cells are mainly of two types, **unicellular** (e.g. goblet cells) and **multicellular** (e.g. salivary gland). Based on the mode of pouring of secretions, glands are either **exocrine** (pour secretions into ducts) or **endocrine** (ductless glands pour secretions directly into the fluid bathing glands).
- **Pseudostratified epithelium** It is one cell thick, yet it appears to be multilayered. It is of two types, i.e. **pseudostratified columnar epithelium** (in the large ducts of parotid glands) and **pseudostratified columnar ciliated epithelium** (in the large bronchi and trachea).

- Based on structural modifications, compound epithelium is of following types
  - **Stratified squamous epithelium** its cells in the deepest layer are columnar or cuboidal with oval nuclei. It is of two types, i.e. **keratinised stratified squamous epithelium** (in skin epidermis) and **non-keratinised stratified squamous epithelium** (in pharynx, vagina, etc.)
  - **Stratified cuboidal epithelium** its outer cells are cuboidal and basal cells are columnar. It lines the sweat gland ducts and large salivary ducts.
  - **Stratified columnar epithelium** has columnar cells in both superficial and basal layer. It lines mammary glands, ducts and parts of urethra.
  - **Stratified ciliated columnar epithelium** whose outer layer has ciliated columnar cells and the basal layer consists of columnar cells. It lines the larynx and upper part of the soft palate.
  - **Transitional epithelium** appears stratified and consists of fewer layers of less flattened surface cells with remarkable flexibility. It is found in ureters, urinary bladder and urethra.

- Epithelium cells are structurally and functionally linked through cell junctions. The three types of cell junctions are
  - **Tight junctions** stop leakage of substances across a tissue.
  - **Adhering junctions** cement the neighbouring cells together.
  - **Gap junctions** facilitate the cells to communicate by connecting cytoplasm of adjoining cells.

### Functions of Epithelial Tissue

The main functions of epithelial tissue are listed below

- The epithelial tissue protects the underlying tissues from mechanical injury, entry of germs, harmful chemicals and drying.
- It checks the absorption of harmful or unnecessary materials.
- The epithelium of uriniferous tubules is specialised for urine excretion.
- The sensory epithelia of sense organs help to receive various stimuli from the atmosphere and convey them to the brain.
- The epithelium of alveoli of the lungs brings about the exchange of gases between the blood and air.

## Connective Tissue

It is the most abundant tissue and it helps in binding or linking, supporting and protecting other tissues in the body.

- The three types of connective tissues are

1. **Loose connective tissue** contains loosely arranged cells and fibres in a semi-fluid ground substance. It consists of two sub-types
   - **Areolar tissue** contains fibroblast, macrophages and mast cells. It supports the epithelium and is present beneath the skin.
   - **Adipose tissue** located mainly beneath the skin and is specialised to store fats.
2. **Dense connective tissue** contains compactly packed fibres and fibroblasts. It also contain two sub-types
   - **Dense regular tissue** in which collagen fibres are found in rows between parallel bundles of fibres, e.g. **tendons** (attach skeletal muscles to

bones) and **ligaments** (attach one bone to another).

- **Dense irregular tissue** in which collagen fibres and fibroblasts are oriented differently, e.g. in deeper skin layers and sclera of eyes.

3. **Specialised connective tissue** comprises of cartilage, bones and blood.
   - **Cartilage** Intercellular material is solid and pliable. The cells, chondrocytes are enclosed in small cavities. Cartilage is found in nose tip, outer ear joints and between adjacent bones of vertebral column.
   - **Bones** have a hard and non-pliable ground substance, rich in calcium salts and collagen fibres. The osteoblasts (bone forming cells), osteocytes (bone maintaining cells and osteoclasts (bone cleaning cells) are found in lacunae. The **Osteon** or **Haversian system** is the cylindrical functional unit consisting of lamellae that surrounds the Haversian canal. Bone marrow in some long bones is the site of blood cell production.
   - **Blood** is a fluid connective tissue, consisting of plasma, RBCs, WBCs and platelets. It is the main circulating fluid which enables transport of various substances.

### Functions of Connective Tissue

The connective tissue performs following main functions

- The connective tissue mainly joins one tissue to another in the organs.
- The adipose tissue stores fat.
- The cartilage and bones form a supporting framework for the body.
- Blood and lymph carry materials from one part to another in the body.

## Muscle Tissue

It is made up of fibres which are composed of myofibrils. The three types of muscles are

- **Skeletal muscles** are striated in appearance, voluntary in action and are closely attached to the skeletal bones.
- **Smooth muscles** are non-striated, involuntary muscles, found in the wall of internal organs such as blood vessels, stomach and intestine.
- **Cardiac muscles** are contractile tissues present only in the heart. The cell junctions of cardiac muscle cells fuse the plasma membrane and make them stick together. Intercalated discs act as the communication junctions allowing the cells to contract as a unit.

### Functions of Muscular Tissue

The muscle tissue performs following main functions

- These are involved in the movement of body parts and locomotion of the organism.
- Muscles are responsible for heartbeat, production of sound and peristalsis in tubular viscera.
- The muscles support the bones and other structures.
- Muscles of uterus relax and contract rhythmically during parturition.

## Nervous/Neural Tissue

It exerts the greatest control over body's response to various stimuli. Neurons, the basic unit of neural tissue, are excitable cells that show conductivity. There are also neuroglial cells that support the neurons structurally. Each neuron consists of **cyton** (cell body), **dendrites** and **axon** (processes of neuron).

### Functions of Neural Tissue

- Coordinates and control the functioning of different body parts.
- It brings about an appropriate response to each and every stimulus.

# Objective Questions

## Multiple Choice Questions

**1.** Tissue is
(a) a group of similar cells together with their intercellular substances, which perform a specific function
(b) a single specialised cell with specified functions
(c) composed of a single layer of cuboidal cells
(d) Both (a) and (c)

**2.** In a tissue, the structure of cells varies according to their
(a) origin (b) function
(c) gene content (d) None of these

**3.** The tissue which covers the external surface of the animal body and the internal surface of visceral organs is
(a) epithelial tissue (b) connective tissue
(c) adipose tissue (d) None of these

**4.** Which one of the following options is associated with epithelium?
(a) Cells are compactly packed with little intercellular matrix
(b) Cells are loosely packed with large intercellular matrix
(c) It is highly vascularised
(d) It is a supporting tissue

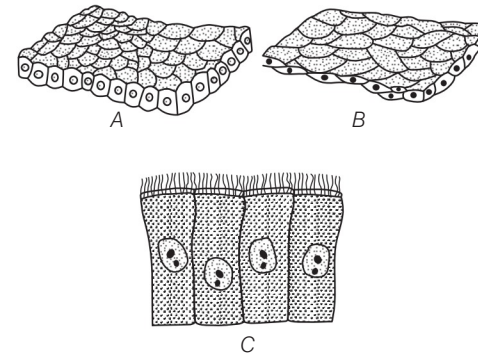
**5.** Epithelium cells are derived from
(a) ectoderm
(b) endoderm
(c) mesoderm
(d) All of the above

**6.** Analyse the following statements.
I. It forms the lining of the cavities of alveoli of the lungs.
II. It occurs in the ducts of sweat glands.
III. It forms the lining of salivary glands and endocrine glands.
IV. It is a loose connective tissue.

Which of the above statements are true about the simple epithelial tissue?
(a) I and III (b) II and III (c) III and IV (d) IV and I

**7.** Which one of the following types of cells is involved in making of the inner walls of large blood vessels?
***(NCERT Exemplar)***
(a) Cuboidal epithelium
(b) Columnar epithelium
(c) Squamous epithelium
(d) Stratified epithelium

**8.** *A*, *B* and *C* in given figures and choose the correct combination of option.




(a) A–Ciliated columnar, B–Squamous, C–Cuboidal
(b) A–Cuboidal, B–Squamous, C–Ciliated columnar
(c) A–Squamous, B–Ciliated columnar, C–Cuboidal
(d) A–Ciliated columnar, B–Cuboidal, C–Squamous

**9.** Which statement is true about simple cuboidal epithelium?
(a) It is commonly found in ducts of glands
(b) Its main function is secretion and absorption
(c) It consists of a single layer of cube-like cells
(d) All of the above

**10.** Which one of the following statements is/are not correct with reference to the columnar epithelium?

(a) It is composed of single layer of tall and slender cells
(b) Nucleus of the cell is located at its base
(c) Free surface may have microvilli
(d) It is commonly present in kidneys of mammal

**11.** The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in

(a) bile duct and bronchioles
(b) Fallopian tubes and pancreatic duct
(c) Eustachian tube and salivary duct
(d) bronchioles and Fallopian tubes

**12.** Match the following columns.

| | **Column I** (Tissues) | | **Column II** (Locations) |
|---|---|---|---|
| A. | Squamous epithelium | 1. | Present in lungs |
| B. | Cuboidal epithelium | 2. | Present in stomach |
| C. | Columnar epithelium | 3. | Present in kidneys |

Codes

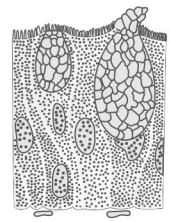
| | A | B | C | | A | B | C |
|---|---|---|---|---|---|---|---|
| (a) | 1 | 3 | 2 | (b) | 2 | 3 | 1 |
| (c) | 1 | 2 | 3 | (d) | 3 | 2 | 1 |

**13.** Some of the columnar or cuboidal cells gets specialised for secretion and are called glandular epithelium.

(a) True (b) False
(c) Cannot say (d) Partially true or false

**14.** Identify the figures and choose the correct option.


A


B

| | ***A*** | ***B*** |
|---|---|---|
| (a) | Unicellular glandular epithelium like Goblet cells of alimentary canal | Multicellular glandular epithelium like salivary gland |
| (b) | Unicellular glandular epithelium like salivary gland | Multicellular glandular epithelium like Goblet cells of alimentary canal |
| (c) | Multicellular glandular epithelium like salivary gland | Unicellular glandular epithelium like Goblet cells of alimentary canal |
| (d) | Multicellular glandular epithelium like Goblet cells of alimentary canal | Unicellular glandular epithelium like salivary gland |

**15.** Categorisation of secretory glands can be done on the basis of

(a) mode of pouring of their secretion
(b) mode of breaking down of molecules
(c) mode of segregation of products
(d) None of the above

**16.** Digestive enzymes and hormones are secreted by endocrine glands. Mucus and saliva are secreted by exocrine gland.

(a) True
(b) False
(c) Cannot say
(d) Partially true or false

**17.** Identify the incorrect pair.

(a) Pseudostratified epithelium – Forms epidermis of skin
(b) Non-keratinised stratified squamous – Provides protection
(c) Stratified cuboidal – Forms epidermis of fishes
(d) Transitional compound epithelium – Lines inner surface of urinary bladder

**18.** Glands are formed of
(a) secretory epithelial cells
(b) transitional epithelial cells
(c) stratified epithelial cells
(d) pseudostratified epithelial cells

**19.** Compound epithelium
(a) plays major role in secretion and absorption
(b) provides protection against chemical and mechanical stresses
(c) covers only dry surface of skin
(d) All of the above

**20.** Cell junctions are formed by
(a) epithelial tissue (b) connective tissue
(c) Both (a) and (b) (d) muscular tissue

**21.** Match the Column I (cell structures) with Column II (their characteristic features).

| | Column I | | Column II |
|---|---|---|---|
| A. | Tight junctions | 1. | Cement neighbouring cells together to form sheet |
| B. | Adhering junctions | 2. | Establish a barrier to prevent leakage of fluid across epithelial cells |
| C. | Gap junctions | 3. | Cytoplasmic channels to facilitate communication between adjacent cells |

Codes

| | A | B | C | | A | B | C |
|---|---|---|---|---|---|---|---|
| (a) | 2 | 3 | 1 | (b) | 3 | 2 | 1 |
| (c) | 2 | 1 | 3 | (d) | 1 | 2 | 3 |

**22.** The tissues that are most abundant, perform the function of linking and supporting other tissues of the body are
(a) epithelial tissue (b) connective tissue
(c) muscular tissue (d) nervous tissue

**23.** Which one of the following is not a connective tissue? ***(NCERT Exemplar)***
(a) Bone (b) Cartilage
(c) Blood (d) Muscles

**24.** Find out the correct pair by choosing from options given below.
(a) White collagenous fibres – Long branched and inelastic
(b) Reticulin fibres – Long, unbrarched and elastic
(c) Yellow elastin fibres – Branched and flexible
(d) Both (a) and (c)

**25.** Match the following columns.

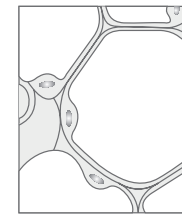
| | Column I (Tissues) | | Column II (Compositions) |
|---|---|---|---|
| A. | Areolar tissue | 1. | Fat cells |
| B. | Adipose tissue | 2. | Osteocytes |
| C. | Ligament | 3. | Loose connective tissue |
| D. | Bone | 4. | Dense regular connective tissue |

Codes

| | A | B | C | D |
|---|---|---|---|---|
| (a) | 3 | 1 | 4 | 2 |
| (b) | 1 | 2 | 3 | 4 |
| (c) | 4 | 3 | 2 | 1 |
| (d) | 2 | 1 | 4 | 3 |

**26.** Macrophages, fibroblasts and mast cells are present in
(a) dense regular connective tissue
(b) dense irregular connective tissue
(c) areolar tissue
(d) adipose tissue

**27.** Identify the figure with its correct function.



(a) Areolar connective tissue – Serves as a support framework for epithelium
(b) Adipose tissue – Stores fats, acts as heat insulators
(c) Dense regular tissue – Provides flexibility
(d) Dense irregular tissue – Provides strength and elasticity

**28.** Identify the pair with its correct function.
(a) Adipose tissue – Formation of ligaments
(b) Areolar connective tissue – Migration of cells at the site of inflammation
(c) Whte fibrous connective tissue – Insulation
(d) Yellow fibrous connective tissue – Provides strength

**29.** Tendons attach skeletal muscles to bones and ligaments attach one bone to another.
(a) True (b) False
(c) Cannot say (d) Partially true or false

**30.** Cartilage is present
I. in the tip of nose and middle ear joints.
II. between adjacent bones of vertebral columns.
III. between adjacent bones of limbs and hands in adults.
(a) I, II and III (b) I and II
(c) II and III (d) I and III

**31.** Matrix secreting cells of cartilage are known as
(a) chondrocytes (b) osteoblasts
(c) fibroblasts (d) mast cells

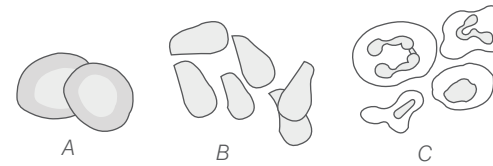
**32.** Calcified cartilage is found in
(a) head of femur (b) pectoral girdle
(c) ribs and sternum (d) Both (a) and (b)

**33.** Which of the followng statements are related to bones?
I. It is the main tissue that provides structural frame to the body.
II. It supports and protects softer tissues and organs.
III. The bone cells, osteocytes are present in the spaces called lacunae.
IV. They also interact with smooth muscles attached to them to bring about movements.
Codes
(a) I and II (b) III and IV
(c) I and IV (d) I, II and III

**34.** End of long bones are covered with
(a) muscles (b) cartilage
(c) adipose tissue (d) bone marrow

**35.** Bones of elderly people are brittle and have a risk of getting fracture more readily. This is because they contain more
(a) organic matter
(b) inorganic matter
(c) bone marrow
(d) Both (a) and (b)

**36.** Choose the correct option for given components of blood.




(a) *A*-RBC, *B*-WBC, *C*-Platelets
(b) *A*-WBC, *B*-RBC, *C*-Platelets
(c) *A*-RBC, *B*-Platelets, *C*-WBC
(d) *A*-WBC, *B*-Platelets, *C*-RBC

**37.** Match the following columns with the correct functions they perform.

| | Column I | | Column II |
|---|---|---|---|
| A. | RBC | 1. | Carry haemoglobin |
| B. | Leucocytes | 2. | Prevent clotting |
| C. | Platelets | 3. | Soldiers of the body |
| | | 4. | Maintain water balance |

Codes

| | A | B | C |
|---|---|---|---|
| (a) | 1 | 3 | 2 |
| (b) | 1 | 4 | 3 |
| (c) | 2 | 3 | 4 |
| (d) | 1 | 2 | 3 |

**38.** How marny types of leucocytes are found in a mammal?
(a) Five (b) Two (c) Four (d) Three

**39.** Each muscle is made up of long, cylindrical fibres arranged in parallel arrays. These fibres are composed of numerous fine fibrils called
(a) myofibrils
(b) microfilament
(c) fibroblast
(d) None of the above

**40.** Based on their location, muscles are classified into
(a) three types –skeletal, smooth and cardiac muscles
(b) three types –skeletal, striated and cardiac muscles
(c) three types – voluntary, involuntary and cardiac muscles
(d) All of the above

**41.** Smooth muscles are
(a) involuntary, fusiform, non-striated
(b) voluntary, multinucleate, cylindrical
(c) involuntary, cylindrical, striated
(d) voluntary, spindle-shaped, uninucleate

**42.** In the cardiac muscles,
(a) cell junctions fuse the plasma membrane of adjacent cells
(b) contraction of one cell does not affect the other cells
(c) intercalated discs prevent the communication among cardiac cells
(d) All of the above

**43.** The type of muscles present in our
(a) heart are involuntary and unstriated smooth muscles
(b) intestine are striated and involuntary
(c) thigh are striated and voluntary
(d) upper arm are smooth muscle fibres fusiform in shape

**44.** Intercalated discs are characteristic of muscles found in
(a) heart
(b) thigh
(c) urinary bladder
(d) stomach

**45.** Match the following columns.

| | Column I | | Column II |
|---|---|---|---|
| A. | Striated muscle | 1. | Wall of blood vessels |
| B. | Unstriated muscle | 2. | Nodal tissue |
| C. | Striated involuntary muscle | 3. | Biceps |

Codes

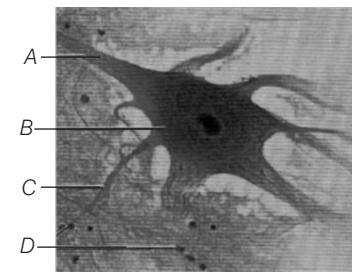
| | A | B | C | | A | B | C |
|---|---|---|---|---|---|---|---|
| (a) | 3 | 1 | 2 | (b) | 1 | 2 | 3 |
| (c) | 2 | 3 | 1 | (d) | 2 | 1 | 3 |

**46.** Which of the following tissue exerts the greatest control over the body's responsiveness to charging condition?
(a) Epithelial tissue (b) Connective tissue
(c) Muscular tissue (d) Neural tissue

**47.** Neuroglial cells make up more than
(a) one-third the volume of neural tissue in our body and form and protect the neurons
(b) one-half the volume of neural tissue in our body and form and support the neurons
(c) one-half the volume of neural tissue in our body and protect and support neurons
(d) one-third the volume of neural tissue in our body and protect and support neurons

**48.** When a ..... is suitably stimulated, an electrical disturbance is generated which swiftly travels along its plasma membrane.
(a) neuron (b) muscle fibre
(c) myofibril (d) intercalated disc

**49.** Recognise the figure and find out the correct matching.



(a) A–Axon, B–Cell body, C–Dendrite, D–Neuroglia
(b) A– Dendrite, B–Cell body, C–Axon, D–Neuroglia
(c) A–Axon, B–Neuroglia, C–Dendrite, D–Cell body
(d) A–Dendrite, B–Neuroglia, C–Axon, D–Cell body

**50** What is the function of neuroglial cells?
(a) Formation of neurons
(b) Destruction of neurons
(c) Protection of neurons
(d) Transmission of impulse along the neuron

**51.** Apolar neurons are found in
(a) higher vertebrates (b) humans
(c) *Hydra* (d) sponges

**52.** Which of the following parts of a neuron is surrounded by a fatty sheath?
(a) Axon (b) Cyton
(c) Dendrite (d) Node of Ranvier

**53.** Which statement is not true regarding nerve fibres in mammals?
(a) All nerve fibres are non-medullated
(b) Sensory nerves transmit impulses to brain and spinal cord
(c) Efferent nerves carry signals of effector organs
(d) Mixed nerves carry signals in both directions

## Assertion-Reasoning MCQs

**Direction** *(Q. Nos. 54-63) Each of these questions contains two statements Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.*

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true, but R is not the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true

**54.** **Assertion** (A) Columnar epithelium is also known as glandular epithelium.
**Reason** (R) Cells of columnar epithelium form the lining of the stomach.

**55.** **Assertion** (A) Compound epithelium plays major role in absorption, secretion and excretion.
**Reason** (R) It is not found in the stomach lining.

**56.** **Assertion** (A) Cell junctions are present in the epithelium and other tissues.
**Reason** (R) Among cell junctions, adhering junctions help to stop substances from leaking across a tissue.

**57.** **Assertion** (A) Adipose tissues are specialised to store fats.
**Reason** (R) The extra nutrients, which are not used immediately by the body get converted into fats.

**58.** **Assertion** (A) Bone is the hardest tissue of the body.
**Reason** (R) Hardness of the bone is due to the calcification of its matrix.

**59.** **Assertion** (A) The cells of connective tissue except blood secrete collagen fibres.
**Reason** (R) Fibres provide strength, elasticity and flexibility to the tissue.

**60.** **Assertion** (A) Connective tissues are the most abundant and widely distributed in the body of complex animals.
**Reason** (R) They link and support other tissues or organs of the body.

**61.** **Assertion** (A) Smooth muscles are known as involuntary muscles.
**Reason** (R) They are controlled by autonomic nervous system.

**62.** **Assertion** (A) Cardiac muscle tissue is a contractile tissue present only in heart.

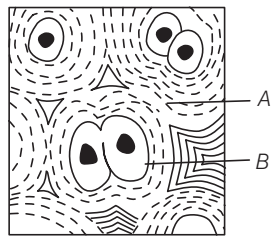
**Reason** (R) It provides rhythmic contraction to the heart.

**63.** **Assertion** (A) Neuroglial cells protect and support the neurons.

**Reason** (R) They make up 90% neural tissue in our body.

## Case Based MCQs

**64.** Identify the figure of a type of specialised connective tissue and answer the questions that follow




(i) Choose the correct option for the labels *A* and *B* in the above given specialised connective tissue.
(a) *A*-Collagen fibres, *B*-Chondrocyte
(b) *A*-Cartilage cell, *B*-Chondrocyte
(c) *A*—Chondrocyte, *B*-Collagen fibres
(d) *A*—Cartilage cell, *B*-Collagen fibres

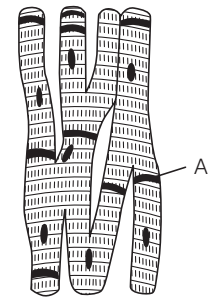
(ii) The connective tissue which lack fibres is
(a) areolar tissue
(b) adipose tissue
(c) blood
(d) ligament

(iii) Strongest connective tissue with little or no ground substance is
(a) cartilage (b) bone
(c) blood (d) adipose tissue

(iv) The most common cell found within connective tissue is
(a) histocytes (b) leucocytes
(c) lymphocytes (d) fibroblast

(v) In humans, the cartilage
(a) contains solid and pliable intercellular material
(b) in vertebrate embryo gets replaced by bones in adults
(c) is found in between the bones of vertebral column
(d) All of the above

**65.** Study the figure given below of cardiac muscle and answer the questions that follow




(i) Choose the correct option for the labelled part *A* in figure above.
(a) It represents junction between adjacent cells
(b) It represents intercalated disc
(c) It represents distinct and large myofibril
(d) Both (a) and (b)

(ii) Cardiac muscles are different from skeletal muscles in a way as
(a) they are smooth
(b) they are non-striated
(c) they are voluntary
(d) they are striated and involuntary

(iii) Cardiac muscles contract
(a) quickly and are fatigued
(b) slowly and are fatigued
(c) quickly and are not fatigued
(d) slowly and are not fatigued

(iv) Cardiac muscle cells differ from striated muscle cells in having
(a) a centrally located nucleus
(b) different myofibrils
(c) fewer mitochondria
(d) no sarcoplasmic reticulum

(v) Cardiac muscles are
(a) elongated with tapering ends
(b) striped, skeletal muscles
(c) cylindrical, branched to form network
(d) large myofibrils and distinct

**66. Direction** *Read the following and answer the questions that follow*

Most epithelial tissue are essentially large sheets of cells covering all the surfaces of the body exposed to the outside world and lining the outside of organs.

Epithelium also forms much of the glandular tissue of the body. Skin is not the only area of the body exposed to the outside. Other areas include the air way, the digestive tract, as well as the urinary and reproductive systems, all of which are lined by an epithelium. Hollow organs and body cavities that do not connect to the exterior of the body, which includes blood vessels and serous membranes, are lined by endothelium (plural=endothelia), which is a type of epithelium. Also epithelium tissue cells are joined together by various cellular junctions.

(i) The cells of squamous epithelium are
(a) multilayered and thick
(b) flat and thick
(c) thin with rigid boundaries
(d) flat with irregular boundaries

(ii) Which of the following is not a function of epithelium?
(a) Protection
(b) Connection
(c) Secretion or Excretion
(d) Absorption

(iii) Lining of body cavities, ducts and tubes are made up of
(a) compound epithelium
(b) simple epithelium
(c) cuboidal epithelium
(d) keratinised epithelium

(iv) In humans, compound squamous epithelium is found in
(a) stomach
(b) intestine
(c) trachea
(d) pharynx

(v) **Assertion** (A) Gap junctions perform cementing function to keep the neighbouring cells together.

**Reason** (R) Tight junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small and big molecules, etc.
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true, but R is not the correct explanation of A
(c) A is true, but R is false
(d) Both A and R are false

# ANSWERS

## Multiple Choice Questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. (a) | 2. (b) | 3. (a) | 4. (a) | 5. (d) | 6. (a) | 7. (c) | 8. (b) | 9. (d) | 10. (d) |
| 11. (d) | 12. (a) | 13. (a) | 14. (c) | 15. (a) | 16. (d) | 17. (a) | 18. (a) | 19. (b) | 20. (a) |
| 21. (c) | 22. (b) | 23. (d) | 24. (c) | 25. (a) | 26. (c) | 27. (b) | 28. (b) | 29. (a) | 30. (c) |
| 31. (a) | 32. (b) | 33. (d) | 34. (b) | 35. (b) | 36. (c) | 37. (a) | 38. (b) | 39. (a) | 40. (a) |
| 41. (a) | 42. (a) | 43. (c) | 44. (a) | 45. (a) | 46. (d) | 47. (c) | 48. (a) | 49. (a) | 50. (c) |
| 51. (c) | 52. (a) | 53. (a) | | | | | | | |

## Assertion-Reasoning MCQs

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 54. (b) | 55. (d) | 56. (c) | 57. (a) | 58. (a) | 59. (a) | 60. (a) | 61. (a) | 62. (a) | 63. (c) |

## Case Based MCQs

64. (i) *(a),* (ii) *(c),* (iii) *(b),* (iv) *(d)* , (v) *(d)*

65. (i) *(d),* (ii) *(d),* (iii) *(c),* (iv) *(a),* (v) *(c)*

66. (i) *(d),* (ii) *(b),* (iii) *(b),* (iv) *(d),* (v) *(d)*

# EXPLANATIONS

**2.** (b) The structure of the cells varies according to their function. Based on their functional activity, tissues are broadly classified into four types, i.e. epithelial, connective, muscular and neural.

**3.** (a) Epithelial tissue covers the external surface of the animal body, internal surface of visceral organs and lines hollow structures (except blood vessels and lymphatic vessels).

**6.** (a) Statements I and III are true about the simple epithelial tissue. Other statements are incorrect and can be corrected as

- Stratified cuboidal epithelium lines the sweat glands.
- Areolar tissue and adipose tissue are loose connective tissues, in which cells and fibres are loosely arranged in a semifluid matrix.

**7.** (c) Being thin, squamous epithelium permits easy diffusion of substances across its surface. Thus, it is involved in making of the inner walls of large blood vessels and in such case, it is called endothelium.

**9.** (d) Simple cuboidal epithelium contains a single layer of cube-like cells. This is mainly present in the tubules and ducts of glands and surface of ovary. Its important functions are secretion and absorption.

Thus, all statements are correct.

**10.** (d) Statement in option (d) is not correct with reference to the columnar epithelium and can be corrected as

Kidneys of mammals possess a single layer of cube-like cells known as cuboidal epithelium. Rest of the statements are correct.

**11.** (d) In humans, ciliated epithelial cells are present in the bronchioles and Fallopian tube. In bronchioles, these cells help in the movement of mucus and in Fallopian tubes, these are required to move the egg towards the uterus.

**12.** (a) A–1, B–3, C–2

**15.** (a) On the basis of pouring of secretions, glands are classified into two categories, i.e. endocrine and exocrine. Endocrine glands do not have ducts and their products called hormones are secreted directly into the fluid bathing the gland. Exocrine glands release their products through ducts or tubes.

**16.** (d) Exocrine glands secrete mucus, saliva and digestive enzymes. Endocrine glands secretes hormones.

Thus, option (d) is correct.

**17.** (a) Option (a) is incorrect pair and can be corrected as

Pseudostratified epithelium helps in protection, movement of secretions from glands, urine and

semen in urethra and mucus loaded with dust particles in trachea.

**21.** (c) A–2, B–1, C–3

**22.** (b) Connective tissues are most abundant and widely distributed in the body. These perform the function of linking and supporting other tissues/organs of the body.

**23.** (d) Muscle is not a connective tissue, but it is composed of long, cylindrical, numerous fine fibrils called myofibrils. Muscles form the muscular tissue.

Rest of the given tissues are all connective tissues.

**24.** (c) Option (c) is correctly pair.

Yellow elastin fibres are branched and flexible. Rest options are incorrect pairs and can be corrected as

White collagenous fibres ane long, branched and elastic having great tensile strength whereas reticulin fibres are long, unbranched and inelastic.

**27.** (b) Option (b) correctly describes the given figure with its correct function. It is adipose tissue which stores fats and acts as heat insulator.

**28.** (b) Option (b) is correct pair with its function.

Areolar connective tissue facilitates migration of cells at the site of inflammation.

Rest options are incorrectly pairs and can be corrected as

- Adipose tissue functions in storing fats and in insulation.
- White fibrous connective tissue forms tendon.
- Ligaments are formed by yellow connective tissue.

**31.** (a) Cartilage is solid pliable and resists compression. Intercellular material cells, i.e. chondrocytes are enclosed in small cavities within the matrix secreted by them. Thus, matrix secreting cells of cartilage are known as chondrocytes.

**33.** (d) All statements are related to bones except statement IV.

Incorrect statement can be corrected as Bones also interact with skeletal muscles attached to them to bring about movements.

**38.** (b) Broadly speaking, leucocytes are of two types, i.e. granulocytes, which are formed in bone marrow and agronulacytes, which are formed in liver and spleen.

**39.** (a) Muscles are composed of many long, cylindrical fibres arranged in parallel arrays. These fibres are composed of numerous fine fibrils called myofibrils. Muscles play an important role in the movement and locomotion of the body.

**41.** (a) Smooth muscle tissues are non-striated, elongated and spindle-shaped or fusiform–shaped. The action of these muscles is involuntary as these are under the control of the autonomic nervous system.

**43.** (c) The type of muscles present in our thigh are skeletal muscles that are striated and voluntary.

**44.** (a) Cardiac muscle fibres are only present in the heart. The cell has a bifurcated shape, usually with the nucleus near the centre of the cell. The cells are usually connected to each other by intercalated discs.

**45.** (a) A-3, B-1, C-2

Striated muscle (skeletal muscle)–Biceps
Unstriated (smooth muscle)–Wall of blood vessels

Striated involuntary muscle – Nodal tissue

**49.** (a) *A*– Axon, *B*–Cell body, *C*–Dendrite, *D*– Neuroglia

**50.** (c) Neuroglia or Neuroglial cells are specialised cells found in the brain and spinal cord, which support the neurons and their fibres. These cells come in different shapes and help to protect the neurons.

**53.** (a) Option (a) is not true regarding nerve fibres in mammals and can be corrected as

Both medullated and non-medullated fibres are found in mammals, Non-medullated fibres are found in autonomic nerves whereas medullated fibres are present in cranial nerves.

**54.** (b) Both A and R are true, but R is not the correct explanation of A.

Columnar epithelium is also known as glandular epithelium because some of the columnar cells get specialised to perform the

functions of secretion. They are of two types, i.e. unicellular and multicellular.

Cells of columnar epithelium form lining of the stomach and help in the secretion and absorption of nutrients.

**55.** (d) A is false, but R is true. A can be corrected as

Compound epithelium provides protection against chemical and mechanical stresses as it is a multilayered tissue. Thus, it has limited role in absorption, secretion and excretion. This epithelium is found in the moist surface of buccal cavity, pharynx, inner lining of duct of salivary glands, but not in stomach lining.

**56.** (c) A is true,, but R is false. R can be corrected as

All cells in epithelium are held together with some intercellular materials. In almost all animal tissues, specialised junctions provide both structural and functional links between its individual cells. Three types of cell junctions are found in the epithelium and other tissues. Adhering junctions perform cementing function to keep neighbouring cells together.

**57.** (a) Both A and R are true and R is the correct explanation of A.

The adipose tissue is a fat storing loose connective tissue. It is mainly located beneath the skin. The cells of this tissue are specialised to store fats. The excess of nutrients, which are not used immediately by the body gets converted into fats and are stored in this tissue.

**58.** (a) Both A and R are true and R is the correct explanation of A.

Bone is the hardest tissue in the body. Its hardness is due to the calcification of its matrix. It has hard and non-pliable ground substances rich in calcium salts and collagen fibres, which give strength to the bones.

**59.** (a) Both A and R are true and R is the correct explanation of A.

All cells of connective tissue except blood secrete fibres. There are three types of fibres secreted by connective tissue cells and each type is formed by proteins. They are collagen fibres (made up of collagen proteins), elastin fibres formed of elastin and reticular fibres (made up of reticulin). All are responsible of providing stability, elsasticity and flexibility to connective tissue.

**60.** (a) Both A and R are true and R is the correct explanation of A.

Connective tissues are the most abundant in the body with a wide distribution and connect different tissues or organs and provides support to various structures of animal body. It comprises of living cells and extracellular matrix and some specialised tissues like adipose cartilage, etc.

**61.** (a) Both A and R are true and R is the correct explanation of A.

Smooth muscles are found in stomach, oesophagus, intestine, blood vessels, iris, etc., and are involuntary in function as their functioning cannot be directly controlled. Action of these muscles can be controlled by autonomic nervous system.

**62.** (a) Both A and R are true and R is the correct explanation of A.

Cardiac muscle tissue is a contractile tissue present only in the heart. Cell junctions present in the plasma membranes of cardiac muscle cells get fused and make them stick together. Communication junctions or intercalated discs at some points allow the cells to contract as a unit, i.e. when one cell receives a signal to contract, its neighbours are also stimulated. So, cardiac muscle provides rhythmic contraction to the heart.

**63.** (c) A is true, but R is false. R can be corrected as

About 50% of all brain cells are neuroglial cells. Neuroglia or neuroglial cells are specialised cells found in the brain and spinal cord supporting the neurons and their fibres.

**64.** (i) (a) The given diagram/figure is of a cartilage. The labels are *A* is Collagen fibres and *B* is Cartilage cell or Chondrocyte.

(ii) (c) Blood is a fluid connective tissue that lacks protein fibres.

(iii) (b) Bone almost lacks the ground substance due to which it is the strongest connective tissue.

(iv) (d) Fibroblasts are commonly found cells in connective tissue. They secrete protein and polysaccharides and different type of fibres.

**65.** (i) (d) Part-*A* represents junction between adjacent cells known as intercalated disc.

(ii) (d) Cardiac muscles are striated and normally involuntary, whereas skeletal muscles are striated and voluntary.

(iii) (c) Cardiac muscles contract rapidly, rhythmically and never get fatigued. For this purpose, these muscles have abundant mitochondria, $Ca^{2+}$ ions and glycogen granules.

(iv) (a) Cardiac muscle fibres have only one nucleus and the nuclei lie near the centre. In striated or skeletal muscles, just below the sarcolemma in each fibre, many nuclei occur at irregular intervals.

Therefore, cardiac muscle cells differ from striated muscle cells in having a centrally located nucleus.

(v) (c) Cardiac muscle fibres are long and cylindrical structures which lack a definite sarcolemma. The fibres have some lateral branches, known as oblique bridges to form a contractile network.

**66.** (i) (d) The squamous epithelium is made up of single, thin layer of flattened cells with irregular boundaries.

(ii) (b) Providing connection between adjacent cells is not the function of epithelium tissue. It is the function of connective tissue.

(iii) (b) Simple epithelium is composed of a single layer of cells and it forms the lining of the body cavities, ducts and tubes.

(iv) (d) Compound squamous epithelium is made up of multilayered cells and their main function is to provide protection against chemical and mechanical stresses. This epithelium is found in pharynx, mouth, oesophagus and vagina.

(v) (d) Both A and R are false and can be corrected as
Gap junctions are cytoplasmic connections that perform the function of exchange of chemicals between the two adjacent cells.

Tight junctions are formed by the fusion or tight packing of the plasma membrane of the adjacent epithelial cells. These control or check the exchange of materials between cells.