Locomotion and Movement

CHAPTER 20

NCERT FOCUS

ANSWERS

Topic 1

1. The different type of movements exhibited by cells of human body are :

Amoeboid movements : These are found in leucocytes of blood and phagocytes of certain body organs.

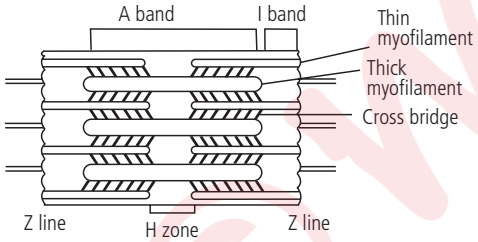
Ciliary movements : Large number of our internal tubular organs are lined by ciliated epithelium. For instance, the cilia of the cells lining the trachea, oviducts and vasa efferentia propel dust particles, eggs and sperms respectively by their coordinated movements in specific directions in these organs.

Muscular movements : These are brought about by the action of skeleton, joints and muscles. These are of two types: movements of body parts and locomotion.

Flagellar movements : Human sperms (typical example of flagellated cells) exhibit the flagellar movement.

Topic 2

1. Structure of a sarcomere showing different regions is given below:



2. According to sliding filament theory of muscle contraction, the actin and myosin filaments slide past each other with the help of cross-bridges to reduce the length of the sarcomeres.

3. Mechanism of muscle contraction is explained by sliding filament theory which states that contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. As a nerve impulse reaches the terminal end of the axon, synaptic vesicles fuse with the axon membrane and release a chemical transmitter, acetylcholine which binds to receptor sites of the motor end plate. When depolarisation of the motor end plate reaches a certain level, it creates an action potential. An action potential (impulse) passes from the motor end plate over the sarcolemma and then into the T-tubules and sarcoplasmic reticulum and stimulates the sarcoplasmic reticulum to release calcium ions into the sarcoplasm. The calcium ions bind to troponin causing a change in its shape and position. This in turn alters shape and the position of tropomyosin, to which troponin binds. This shift exposes the active sites on the F-actin molecules. Myosin cross-bridges are then able to bind to these active sites. The heads of myosin molecules project laterally from thick myofilaments towards the surrounding thin myofilaments. These heads are called cross bridges. The head of each myosin molecule contains an enzyme myosin ATPase. In the presence of myosin ATPase, Ca^{++} and Mg^{++} ions, ATP breaks down into ADP and inorganic phosphate, releasing energy in the head. Energy from ATP causes energised myosin cross bridges to bind to actin.

$$ATP \xrightarrow[Ca^{++}, Mg^{++}]{\text{Myosin ATPase}} ADP + Pi + Energy$$

The energised cross-bridges move, causing thin myofilaments to slide along the thick myofilaments.

Topic 3

1. (a) True

(b) False - H-Zone of striated muscle fibres represents only thick filaments.

(c) True

(d) False - There are 12 pairs of ribs in man.

(e) True

2. (a) Actin filaments and myosin filaments can be differentiated as follows :

S.No.	Actin filaments (Thin myofilaments)	Myosin filaments (Thick myofilaments)
(i)	Found in both A-and I-bands.	Found only in A band of sarcomere.
(ii)	Thinner (0.005 mm) and shorter (2–2.6 mm) than myosin filaments.	Thicker (0.01 mm) and longer (4.5 mm) than actin filaments.
(iii)	Cross bridges absent, hence have smooth surface.	Cross bridges present, hence have rough surface.
(iv)	More numerous than myosin filaments, six of them surround each myosin filament.	Fewer than actin filaments.
(v)	Free at one end and are joined to Z-line by other end.	Free at both the ends.

(vi)	Consist of 3 proteins : actin, tropomyosin and troponin.	Consist of 2 proteins : myosin and meromyosin.
(vii)	Slide into H-zone during muscle contraction.	Do not slide during muscle contraction.

(b) Differences between red muscle fibres and white muscle fibres are given in the following table:

S.No.	Red muscle fibres	White muscle fibres
(i)	They are thin.	They are much thicker.
(ii)	They contain abundant mitochondria, low glycogen content and poorly formed sarcoplasmic reticulum.	They are poor in mitochondria and have abundant glycogen granules and well formed sarcoplasmic reticulum.
(iii)	They are dark red as they contain abundant pigment myoglobin.	They are light in colour as they have very little myoglobin.
(iv)	Their myoglobin stores O_2 as oxymyoglobin that releases O_2 for oxidation during muscle contraction.	They have little or no store of oxygen.
(v)	They get energy for contraction by aerobic respiration.	They get energy for contraction mainly by anaerobic respiration.
(vi)	They accumulate little lactic acid.	They accumulate lactic acid during strenuous work.
(vii)	They undergo slow sustained contractions for long periods.	They undergo fast contractions for short periods.
(viii)	They are not fatigued with work.	They soon get fatigued with work.
(ix)	They are innervated by thin, slow-conducting nerve fibres. Example : Extensor muscles of the back in man.	They are innervated by thick, fast-conducting nerve fibres. Example : Eyeball muscles.

(c) Differences between pectoral and pelvic girdles are given in the following table:

S.No.	Pectoral girdle	Pelvic girdle
(i)	It lies on the postero-lateral aspect of the upper region of the thorax.	It is located in the lower part of the trunk.
(ii)	It consists of two dissimilar bones: scapula and clavicle.	It consists of two similar bones, innominate.
(iii)	Scapula and clavicle are not further divided into any type of bone.	Each innominate bone consists of three bones : ilium, ischium and pubis.
(iv)	It provides articulation to the arm bones.	It provides articulation to the bones of the leg.
(v)	It has at its lateral angle a shallow concavity, the glenoid cavity, for articulation of the head of the humerus.	It has at the middle of its lateral surface a deep, cup-shaped hollow, acetabulum.

3. Smooth muscle – Involuntary
Tropomyosin - Thin filament
Red muscle – Myoglobin
Skull – Sutures

4. (a) Pivot joint
(b) Saddle joint
(c) Hinge joint
(d) Ball and socket joint
(e) Fibrous joint
(f) Cartilaginous joint

5. (a) 7
(b) 14
(c) tropomyosin, troponin
(d) sarcoplasmic reticulum
(e) 11^{th} and 12^{th}
(f) 8

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