

Long Answer Type Question

Q. 1. Explain the important steps of sliding filament theory of muscle contraction. (DDE 2017)

Ans. (i) Central Nervous system initiate muscle contraction via motor neuron.

(ii) Motor neuron—stimulate muscle fibre→secrete neurotransmitter→generate action potential in the sarcolemma→ Release of Ca^{2+} in sarcoplasm Ca^{2+} binds with troponin→ Unmask active site Myosin head binds to actin at active site and form cross bridge using ATP. → Pulls the actin filament towards the centre of 'A' band→Z lines also pulled thereby shortening of sarcomere i.e., contraction. I band get reduced, where the A band retain the length.

During relaxation:

Cross bridge between actin and myosin break→ Ca^{2+} pumped back into sarcoplasmic cisternae→ Actin filament slide out of 'A' band and length of I band increases.

Q. 2. Write the Characteristic of red and white muscle fibres.

Ans. 2

(b) They contain respiratory pigment myoglobin, which store more amount of oxygen which provides energy

(c) They carry slow and sustained contractions for long periods without undergoing fatigue.

(d) They are highly vascular and contain numerous mitochondria.

(e) The extensor muscles of the back in man remain in stained contraction to maintain erect posture against gravity.

White muscle fibre:

(a) These are thicker, longer in size and innervated by long nerve fibres.

(b) They do not contain myoglobin, and get energy by anaerobic respiration.

(c) They are not highly vascular and contains very less mitochondria.

(d) They are meant for fast work for short duration.

(e) These have extensive sarcoplasmic reticulum for fast release of calcium ions to initiate contraction.

(f) They accumulate lactic acid and get fatigued.

Q.3. What is the role of Ca and ATP in muscle contraction? [V. Imp.]

OR

What is the role of calcium ions in muscle contraction?

OR

Trace the events in a muscle fibre from the time it receives the impulse through the neuromuscular junction up to the contractile response.

OR

Give the summary of the electrical and the biochemical event in muscle contraction.

Ans. Events in Muscle fibre: (i) A nerve impulse arriving at neuromuscular junction stimulates contractile response.

(ii) Due to the Depolarisation of the surface of sarcomeres, it spreads quickly.

(iii) Neurotransmitter is released at the neuromuscular junction.

(iv) It enters into the sarcomere through membrane channel. Na^+ moves inside the sarcomere.

(v) It is called inflow of Na^+ .

(vi) Action potential is generated in the sarcomere Action potential travels to the full length of muscle fibre.

(vii) The sarcoplasmic reticulum, then, releases the Ca^{++} which is stored here.

(viii) It binds to the specific sites found in the troponin of the thin actin filament.

(ix) Change takes place in troponin and active sites of F-actin are exposed to myosin head.

(x) Myosin head shows Mg^{++} dependent ATPase activity.

(xi) During relaxation of muscle, Ca^{++} is pumped back into the sarcoplasmic reticulum.

(xii) Consequently, the troponin component is freed to inhibit the active sites for myosin head. Cross bridges are broken.

(xiii) The thin filaments assume their normal position.

(xiv) The muscle fibre then comes in relaxed state.

Q. 4. Briefly explain the appendicular skeleton of humans.

Ans. Appendicular skeleton: It consists of 2 parts-the girdles and the limbs.

(i) Pectoral girdle: It is called shoulder girdle. It is formed of the two bones: (a) Clavicle and (b) Scapula

(a) **Clavicle:** It is a small 'S' shaped collar bone. It lies on the antero-lateral side of the thoracic basket. On outside, it articulates with the sternum. It articulates with the scapula on other end. It is called collar bone.

(b) **Scapula:** A large dorsoventrally flattened triangular bone having club-shaped spine is called shoulder blade. A glenoid cavity fits the head of humerus. There is an acromion process articulating with the clavicle.

Fore limb: It consists of thirty bones.

(a) The upper arm has humerus. It is a straight bone with a long shaft. (b) The lower end of humerus articulates with the radius-ulna. Deltoid ridge is the characteristic feature of this bone. (c) Radius is slightly shorter than ulna. (d) The lower end of it articulates with the carpal of wrist. Carpals (wrist bones) are eight. (e) Metacarpals are five. (f) Phalanges are three bones in each finger.

Digital formula of phalanges: 2,3,3,3,4

(i) **Pelvic girdle:** It consists of two halves. Each is called innominate which has three bones:

(a) ilium, (b) ischium, and (c) pubis. They unite in the centre to form acetabulum. Two hip bones make arch behind by uniting with the sacrum and the coccyx.

Hind limb: It consists of 30 bones.

(a) Femur is thigh bone. It is longest bone of the body.

(b) The patella forms knee cap (patella).

(c) Two bones lie in the shank region of the leg:

(i) tibia and (ii) fibula.

(d) Seven tarsal bones make ankle.

(e) The foot possesses 7 tarsals.

(f) Metatarsals are five in number.

(g) And Phalanges are 14 in number.

Q. 5. Explain any two disorders of bones.

Ans. Disorders of bones: Arthritis and osteoporosis are two diseases of bones in humans.

(i) Arthritis Inflammation of the joints is the main cause of it. It is of many types like rheumatoid arthritis, osteoarthritis and gouty arthritis. (a) The rheumatoid arthritis is diagnosed by the presence of rheumatoid factor. The joints becomes immovable. It is cured by heat treatment and physiotherapy.

(b) The osteoarthritis is a degenerative joint disorder. It is characterized by the degeneration of the articular cartilage and proliferation of new bones.

(c) The gouty arthritis is called gout. This is caused due to excessive formation of uric acid which gets deposited at the joints.

(ii) **Osteoporosis:** (a) It is age-dependent systemic disorder. (b) It is characterized by low bone mass, microarchitectural deterioration of the bone. (c) It is also characterized to fracture.

(d) It can occur in the pregnant women. (e) Thyrocalcitonin, parathyroid and sex-hormones imbalance is the main cause of this disease. (f) Major causative factors are the deficiency of vitamin D and calcium deficiency in the body.

Q. 6. How Many types of synovial joints are there? Explain. [NCT – 2007]

Ans. According to the shape and the movement, the synovial joints are of six types:

(i) Gliding Joint: The articular surface of this joint are usually flat, permitting only back and forth and side to side movements. No rotation or twisting is possible because bones are tightly packed. e.g., joints between carpal and tarsal bones.

(ii) **Hinge joint:** In this, the surface of one bone fits into the concave surface of another bone. e.g., joints in elbow, knee, ankle etc.

(iii) **Pivot joint:** A pivot joint is a joint that allows movement in only one plane. In this rounded bone fits into a shallow depression of another bone. Ex. Joint between atlas and axis, radius and ulna.

(v) **Saddle joint:** It allows the movement in two planes freely. The projection of one bone fits in saddle shaped depression of another bone. e.g., the joint between the carpal and metacarpal of thumb of hand.

(vi) **Ball and socket joint:** This is the most freely movable joint. In this, a ball like structure on the one bone fits into socket like structure in another bone. e.g., shoulder and hip joints.