

Chapter-20

LOCOMOTION AND MOVEMENT

POINTS TO REMEMBER

Arthritis : an inflammatory joint disease characterised by inflammation of joints.

Coccyx : tail bone formed by fusion of four coccygeal vertebrae in man.

Dicondylic Skull : A Skull with two occipital condyles.

Endo Skeleton : A skeleton present outside the body.

Fascicule : Bundles of muscles fibres held together by connective tissue.

Fascia : Collagenous connective tissue layer that surrounds muscle bundles.

Floating ribs : The ribs that remain free anteriorly.

False ribs : The ribs whose sternal part are join to sternal part of a true rib.

Myoglobin : A red coloured pigment present in sarcoplasm of muscle.

Sarcomere: A portion of myofibril between two successive 'Z' lines.

Sarcolemma : The plasma membrane of a muscle.

Gout : Inflammation of joints due to accumulation of uric acid crystal.

Suture : immovable joints between skull bones.

Synovial joints : Freely movable joints between limb bones.

Patella : A sesamoid bone acting as kneecap

Intervertebral disc : Fibro carti lagenous pad present between the vertebrae and act as shock absorbers.

L.M.M. : Light meromyosin

HMM : Heavy meromyosin

Types of Movement :

1. Amoeboid movement : These movement takes place in phagocytes where leucocytes and macrophages migrate through tissue. It is affected by pseudopodia formed by the streaming of protoplasm (as in amoeba)

2. Ciliary movement : These movement occurs in internal organs which are lined by ciliary epithelium.

3. Muscular Movement : This movement involve the muscle fibers, which have the ability to contract and relax.

Properties of Muscle : (i) Excitability (ii) Contractility
(iii) Extensibility (iv) Elasticity

Types of Muscles :

- Skeletal muscles or striated muscles** - These involved in locomotion and change of body postures. These are also known as voluntary muscles.
- Visceral muscles or smooth muscles** - These are located in inner wall of hollow visceral organ, smooth in appearance and their activity are not under control of nervous system.
- Cardiac muscles** - The muscles of heart, involuntary in nature, striated and branched, These are uninucleated.

Structure of myofibril :

- Each myofibril consist of alternate dark and light band.
- Dark band - contain myosin protein and is called A-band or Anisotropic band.
- Light band - Contain actin protein and is called I Band or Isotropic band.

- I Band is bisected by an elastic fiber called 'Z' line. Actin filament (thin filament) are firmly attached to the 'Z' lines.
- Myosin filament (thick filament) in the 'A' Band are also held together in the middle of 'I' Band by thin fibrous membrane called 'M' line.
- The portion between two successive 'Z' lines is considered as functional unit of contraction and is called a sarcomere.

STRUCTURE OF ACTIN AND MYOSIN FLAMENT

1. **Actin filament** : An actin filament is made of two 'F' actins which are helically wound to each other. Two filaments of tropo myosin protien also run close to 'F' actins throughout its lenth. A complex protien Troponin is distributed at regular intervals on tropomyosin which mask the actin binding site for myosin

2. **Myosin filament** : Each myosin filament is a polymer of meromyosin. Each meromyosin has two components – a globular head with a short arm and a tail. Head is made of heavy moromyosin while tain is made of light meromyosin. The head with its short arm project outward at regular distance and angle from each other and is known as cross arm. The head has an active site for actin and binding site for ATP.

Red muscle fibres :

- There are red in colour due to presence of high content of myoglobin.
- These contain plenty of mitochondria
- Sarcoplasmic reticulum is less in these fibres.

White muscle fibres :

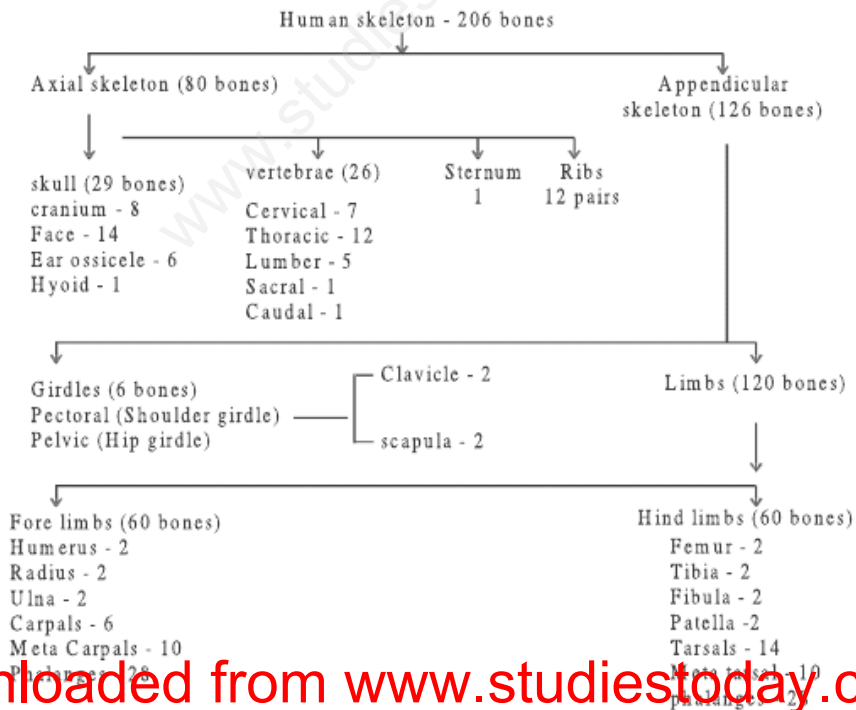
- These are pale or whitish due to presence of less content of myoglobin.
- These contain fewer metochondria
- Sarcoplasmic reticulum is more/high

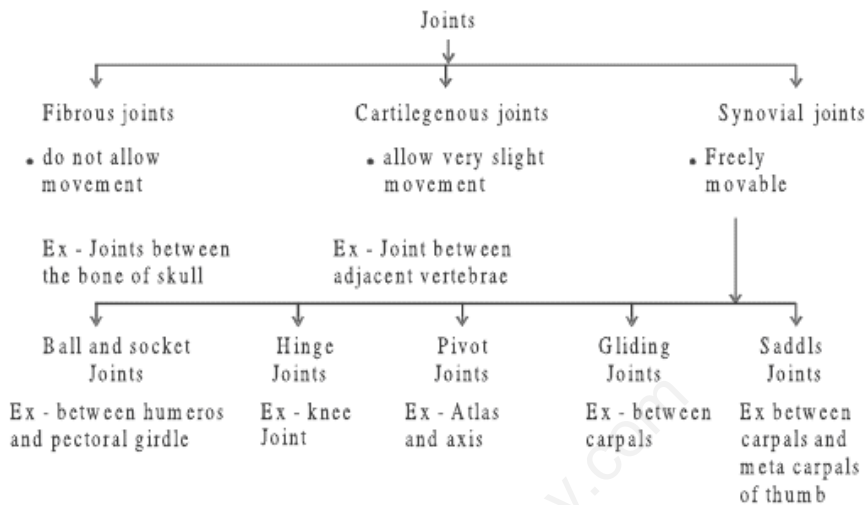
Mechenism of Muscle contraction : Sliding filament theory.

The contraction of musle fiber takes place by the sliding of actin (thin filament) on myosin (thick filament).

- Muscle contraction is initiated by a signal sent by the CNS via a motor neuron.
- Impulse from motor nerve stimulates a muscle fiber at neuro muscular junctions.

- Neurotransmitter releases here which generates an action potential in sarcolemma.
- These causes release of Ca^{++} into sarcoplasm. These Ca^{++} binds with troponin, thereby remove masking of active site.
- Myosin head binds to exposed active site on actin to form a cross bridge, utilising energy from ATP hydrolysis.
- This pulls the acin filament towards the centre of 'A' band.
- 'Z' lines also pulled inward thereby causing a shortning of sarcomere i.e. contraction.
- 'T' band get reduced, whereas the 'A' band retain the length.
- During relaxation, the cross bridge between the actin and myosin break. Ca^{++} pumped back to sarcoplasmic cestermae. Actin filament slide out of 'A' band and length of 'T' band increases. This returns the muscle to its original state.





QUESTIONS

Very Short Answer Questions (1 mark each)

1. How many bones are present in each limb?
2. Why do skeletal muscle show striation?
3. Name last two pairs of ribs.
4. Write the name of chemical that causes fatigue in the muscles.
6. What lubricate the freely movable joints at the shoulder?
7. Name of longest bone of human body.
8. Give the first vertebra.
9. Define a sarcomere.
10. Name the cup shaped bone that constitutes the knee cap.

Short Answer Questions-II (2 marks each)

11. Write any two difference between cardiac muscle and skeletal muscle.
12. Distinguish between red fibre and white fiber.
13. Name the two types of girdles found in human body and write their role.
14. State the role of calcium ions and ATP in muscle contraction.
15. Name the bones of fore limb (hand) of human body. Give their number in each limb.

Short Answer Questions-I (3 marks each)

16. What makes the synovial joints freely movable? List any four types of synovial joints.
17. Name the category of bones forming the ribcage. How are these articulated to each other to form the cage ?
18. How are actin and myosin filament arranged in a muscle fibre?
19. Mention the factor which is responsible for the following :
(i) Tetany (ii) Gout (iii) osteoporosis

Long Answer Questions (5 marks each)

20. Explain the important steps of sliding filament theory of muscle contraction.

ANSWERS

Very Short Answers (1 mark)

1. 30 bones.
2. Due to distribution pattern of actin and myosin protien.
3. Floating ribs.
4. Actin and myosin
5. Lactic acid
6. Synovial flivd
7. Femur
8. Atlas
9. A portion of myofibril between two successive 'Z' lines.
10. Knee cap

Short Answers -II (2 marks)

11. Refer NCERT Text book Class XI Page 303.
12. Refer Points to remember
13. Refer NCERT Text book Class XI Page 311.
14. Refer NCERT Text book Class XI Page 307 and 308.
15. Refer Points to remember

Short Answers -I (3 marks)

16. Refer NCERT Text book Page 312. Class XI
17. Refer NCERT Text book Page 310. Class XI
18. Refer NCERT Text book Page 305. Class XI
19. Refer NCERT Text book Page 312. Class XI

Long Answer (5 marks)

20. Refer Points to remember

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