LEARN WITH SASHA 🤍

Locomotion and movement
Handwritten Notes

Human Physiology

For pdf, join my telegram channel
link in description

LOCOMOTION AND MOVEMENT

Locomotion → Voluntary moment that results in change of place / location.

Simple Movement → Streaming of protoplasm in Amoeba.

Cilia (paramoecium) helps in movement of food through Cytopharynx.
↳ Locomotion as well.

Tentacles (hydra) helps in capturing prey, Locomotion.

All locomotions are movement, but all movement are not locomotion.

Methods of locomotion performed by animals vary with →
Habitats / Demand of Situation

Types of Movement in Humans →

① Amoeboid →
→ Macrophages and leucocytes in blood.
↳ Cytoskeletal elements like microfilaments.

② Ciliary →
→ Most of our internal tubular organs which are lined by ciliated epithilium.
→ Coordinated movements of cilia in trachea removes → inhaled foreign particles, dust particles.
→ passage of Ova through female reproductive tract.

③ Muscular →
→ Limbs, jaws, tongue.
→ Humans and majority of multicellular organisms use the Contractile property of muscles.

Muscle →

→ A specialised tissue of Mesodermal origin.
→ Special properties :—
Contractibility, Extensibility, Elasticity, excitability
→ 40-50% of body weight is muscle.

Flagellar Movement : →

↳ Locomotion of protozoans like euglena.
→ Swimming of Spermatozoa
→ Maintanence of water current in Canal system of Sponges (*)

Types Of Muscles : →

→ Based on ① nature of regulation of activities ② Location ③ appearance

① Skeletal / Striated / Voluntary
→ Closely associated with skeletal components.
→ primarily involved in locomotory actions and changes in body posture.

② Visceral / Smooth / non-striated / Involuntary →

→ Inner walls of hollow visceral organs (alimentary canal, Reproductive tract)

→ assist in transportation of → food through digestive tract. gametes through genital tract

③ Cardiac / Striated →

Muscles of Heart

→ assemble in a branching pattern.

→ Nervous system does not control its activities directly.

→ Involuntary

Skeletal Muscle →

made up of several bundle muscles or fascicles.

glued together with CCT-Collagenous Connective Tissue called fascia.

→ a muscle bundle → many muscle fibres.

→ 1 muscle fibre → Sarcoplasm (plasma)
→ Sarcolemma (membrane)
→ Syncitium → Many nuclei
→ Sarcoplasmic reticulum → Store house of Ca^{+} ions. ⊛

→ Inside one muscle fibre, many parallel myofilaments are present.

Microfibrils = Myofilaments

← Myofilaments →

→ Have alternate dark and light bands.

→ Striated appearance →

↓

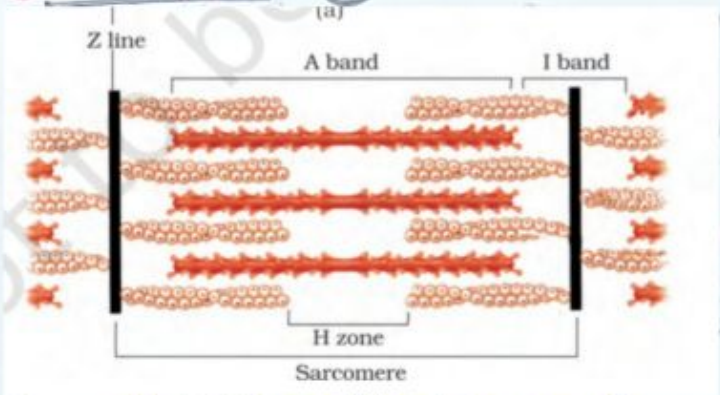
Due to distribution pattern of two proteins

Actin	Myosin
Light	Dark
(Isotropic band)	(Anisotropic Band)
I-band	A band
Thin filament	Thick filament

→ arranged as rod like structures, parallel to each other and also to the longitudinal axis of the myofibrils.

Sarcomere →

Portion of myofibril b/w two successive Z lines is called Sarcomere. ⊛



A and I bands arranged alternatively.

The edges of thin filaments partially overlap thick filaments in resting state.

This central part of thick filament overlapped, is called H Zone.

→ Z-line is an elastic fibre, firmly attaches the thin filament.

→ M line is a thin fibrous membrane, holds together the thick filaments.

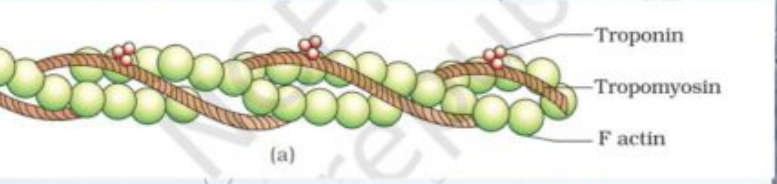
Structure Of Actin →

1 Actin contains → Two F actins, helically wound to each other.

→ Each F actin is a polymer of monomeric G actins.
G = globular.

→ 2 Tropomyosin filaments run close to the F-actins
Tropomyosin is a protein (complex) *

→ Troponin is distributed at regular intervals on the tropomyosin.



In the resting state, a subunit of troponin masks the active binding sites for myosin on the actin filaments.

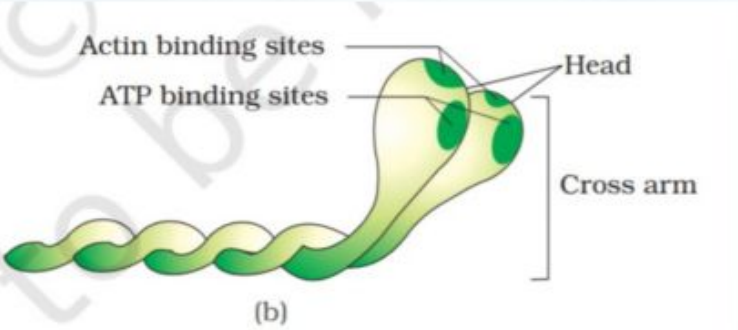
← Structure Of Myosin →

1 Myosin contains → approx 300 myosin protein molecules.
↓ made of
many meromyosins.
Meromyosin = monomeric protein

→ Each meromyosin has →

① Globular head with short arm
↳ Heavy meromyosin (HMM)
→ It projects outwards at a regular distance and angle from each other, from surface of polymerised myosin filament.
→ Globular Head has an active ATPase enzyme and has binding sites for ATP and active sites for actin.

② Tail →
Light Meromyosin (LMM).



Mechanism of Muscle Contraction: →

This mechanism is best explained by Sliding filament theory.

States that contraction of muscle fibre take place by sliding of thin filaments over thick filaments.

Contraction:

CNS
↓ Signal
Motor Neuron
↓ stimulates
Muscle fibre at neuromuscular junction.
↓ releases
Ca^{++} into sarcoplasm and binds with troponin.
↓ exposed
Active sites on actin, where myosin heads get attached.
↓ forms
Cross-bridge by utilizing energy from ATP hydrolysis
↓ Results in
Pulling of actin filaments towards 'A' band's centre.
+
Inward pulling of Z lines
↓ causes
Shortening of Sarcomere (Contraction)

Relaxation:

Cross bridge between actin and myosin.
↓
Ca^{++} ions pumped back to Sarcoplasmic cisternae.
↓
Actin filament slide out of 'A' band
↓
Length of 'I' band increases.
↓
Muscle return to its original state.

- Rx.n time of the fibres varies in different muscles.
- Repeated activation of the muscles leads to the accumulation of the lactic acid causing muscle fatigue.
- This is due to anaerobic breakdown of glycogen in muscles.

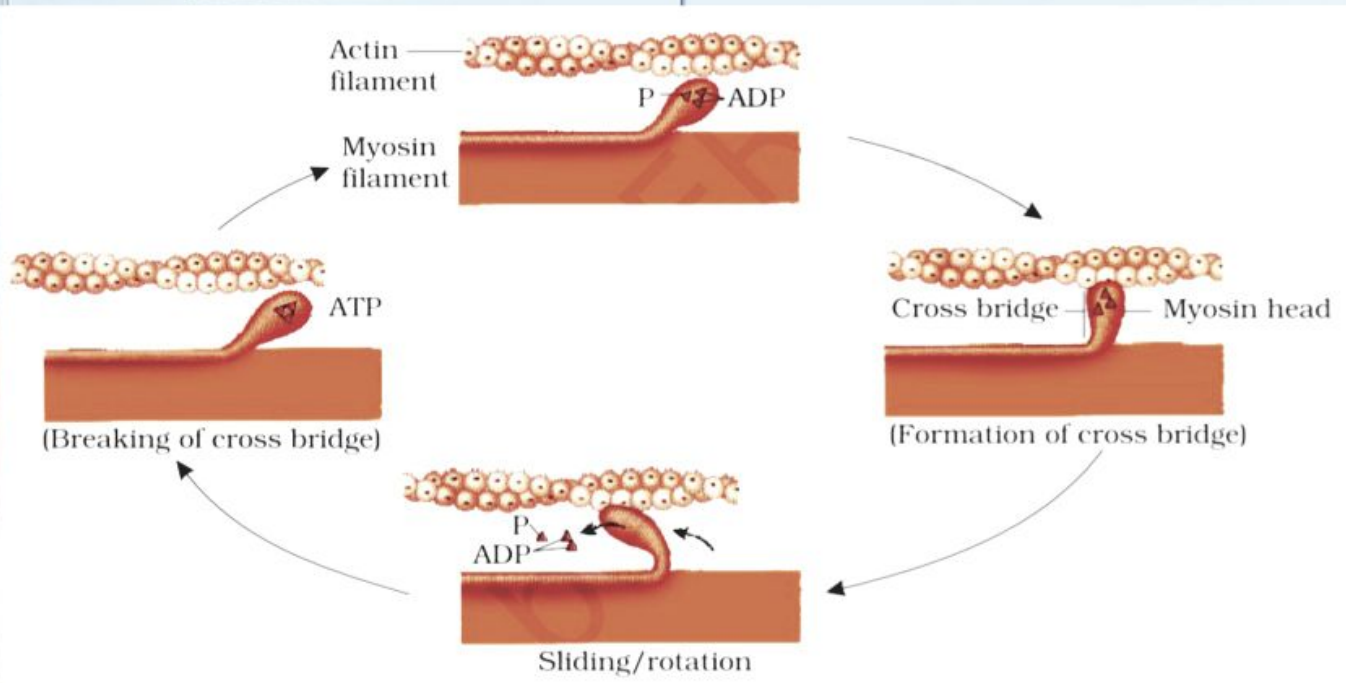


Figure 20.4 Stages in cross bridge formation, rotation of head and breaking of cross bridge

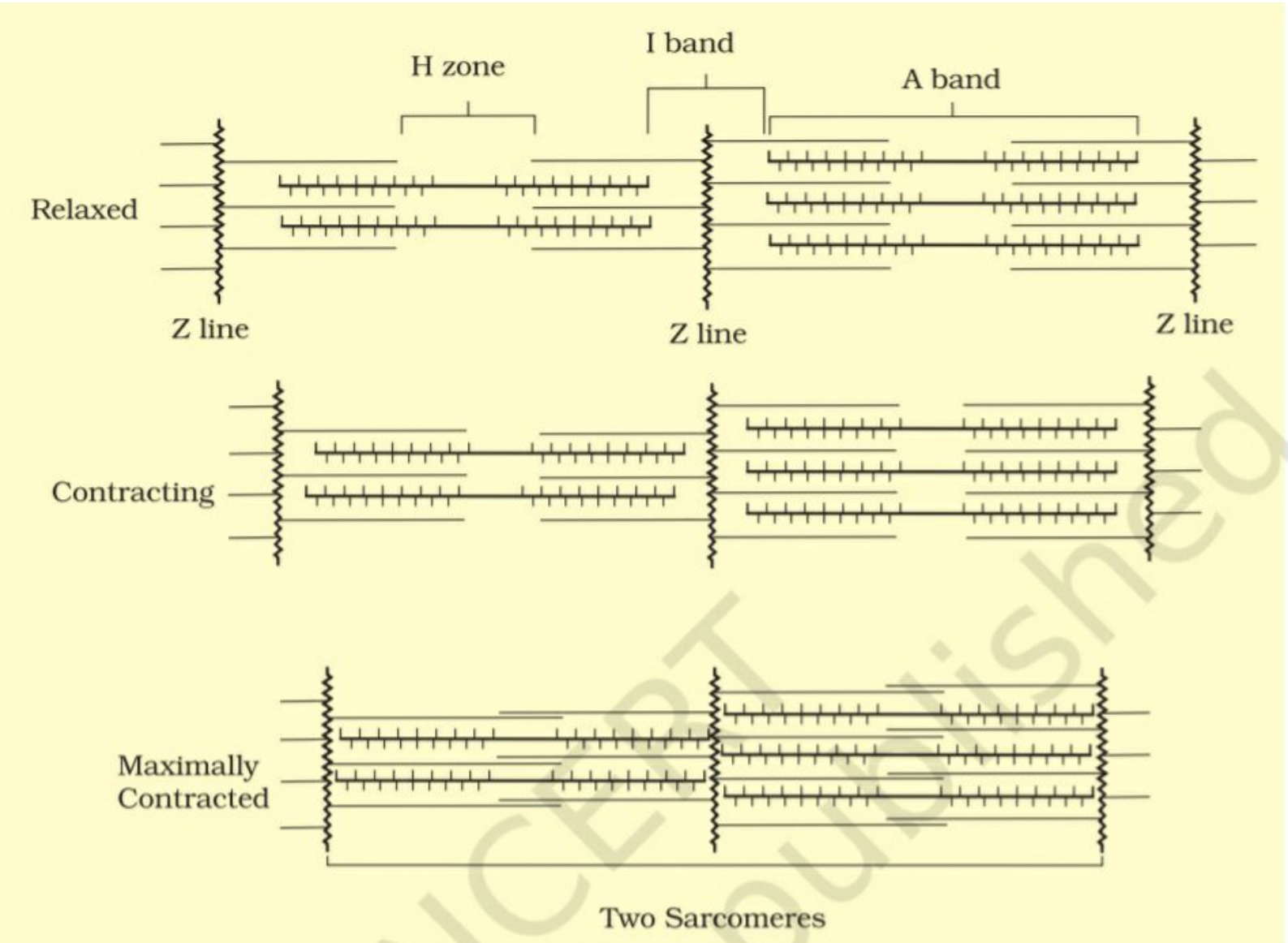


Figure 20.5 Sliding-filament theory of muscle contraction (movement of the thin filaments and the relative size of the I band and H zones)

Human Skeletal System

- Framework of 206 bones and few cartilages.

Human Skeletal

Axial skeletal system (80 bones)	Appendicular skeletal system (126 bones)
• Skull (29 bones)	• Fore-limb (60 bones)
• Vertebral Column (26 vertebrae)	• Hind-limb (60 bones)
• Sternum (1 bone)	• pectoral girdle (4 bones)
• Ribs (12 pairs)	• pelvic girdle (2 bone)

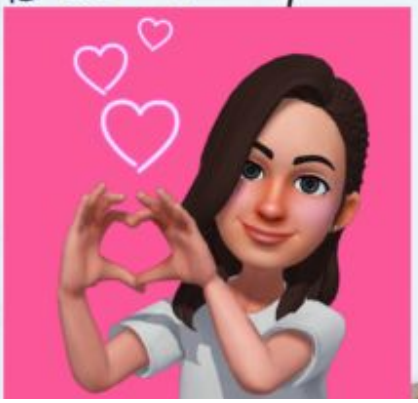
① Axial Skeletal System

* Vertebral column →

- Formed of 26 vertebrae
- Includes cervical vertebrae (7), thoracic vertebrae (12), lumbar vertebrae (5), sacral vertebrae (1 fused) and coccygeal vertebrae (1 fused).
- Skull articulates with first vertebra (atlas) with help of 2 occipital condyles (dicondylic skull).
- The vertebral column protects the spinal cord, supports the head and serves as the point of attachment for the ribs and musculature of the back.

* Ribs (12 pairs) →

- True ribs (first 7 pairs): They are attached to thoracic vertebrae and ventrally connected to sternum with the help of hyaline cartilage.
- Vertebrochondral (false) ribs (8th, 9th and 10th pairs): They do not articulate directly with the sternum but join the 7th rib with the help of hyaline cartilage.
- Floating ribs (11th and 12th pairs): They are not connected ventrally (no connection with sternum / other ribs).
- Each rib has 2 articulation surfaces on its dorsal end and hence is called bicephalic.



② Appendicular Skeletal System.

*Bones of fore-limbs.

- It includes humerus, radius, ulna, carpals (wrist bones-8), metacarpals (palm bones-5) and phalanges (digits-14).

*Bones of hind-limbs.

- It include femur (thigh bone-longest bone), patella, tibia and fibula, tarsals, metatarsals and phalanges.

*pectoral girdle

- Include clavicle and scapula
- Scapula is a large triangular flat bone situated in dorsal part of thorax between the 2nd and 7th ribs.
- Below the acromion is glenoid cavity which articulates with the head of humerus to form the shoulder joint.

*pelvic girdle.

- Formed of 2 coxal bones.

Each coxal bone is formed by the fusion of 3 bones — ilium, ischium, and pubis.

Joints

Joints are point of contact b/w bones or between bones and cartilages.

*3 types :—

① Fibrous joints.

- Do not allow any movement.

Bones are fuse end-to-end via dense connective tissues.

eg- sutures, skull.

② Cartilagenous joints.

- permits limited movements.

Bones are joined together with the help of cartilages.

eg - Joints b/w adjacent vertebrae

③ Synovial joints.

- Have a fluid filled synovial joint hence help in locomotion and other movements.

eg — Knee joint, pivot joint.

*Types of synovial joint.

- Ball and Socket joint: eg- Shoulder joint and hip joints.
- Hinge joint: eg- Knee joint, elbow joint...
- pivot joint: eg- Joints b/w atlas and axis.

- Gliding Joint: eg – Joints b/w carpels.
- Saddle Joint: eg – Joints b/w carpals and metacarpal of thumb.

Disorders of Muscular and Skeletal Systems :–

- Myasthenia gravis: Autoimmune disorder, affects neuromuscular junction → fatigue, Weakning, paralysis of skeletal muscles
- Muscular dystrophy: progressive degeneration of skeletal muscles mostly due to genetic disorder.
  most common type due to genetic deficiency of muscle protein dystrophin.
  no cure, but medics., therapy > slow course of disease.
- Tetany: Rapid spasm in muscle due to low Ca^{2+} in body fluid.
- Arthritis: Inflammation of joints.
- Osteoporosis: – age related disorder
  ↑↑se chance of fracture.
  ↓↓se bone mass.
  Common Cause > ↓↓sed estrogen levels ↳ Oldage!!
- Gout: Inflammation of joints due to accumulation of uric acid crystals.

Refer NCERT for diagrams

NEET SLAYER

Let's unlock our potential together ❤️🎆