LOCOMOTION & MOVEMENT

MOVEMENT

Amoeboid	Muscular movement	Ciliary movement
By pseudopodia e.g.-Macrophages, Leucocytes, cytoskeleton elements	By muscles e.g.-movement of Limbs, Jaws.	By cilia e.g. ova through ♀ reproductive tract

LOCOMOTION

Voluntary movement that causes changes in place/ location.

Locomotory Organs	Cilia-*Paramecium*	Tentacles-*Hydra*

MUSCLE

- Mesodermal origin
- 40-50% body weight
- Properties
  - **Excitability, Contractibility, Extensibility, Elasticity**

Types of Muscles

Skeletal Muscle	Visceral Muscle	Cardiac Muscle
• Striated • Voluntary • Rich blood supply • Locomotion, changing posture	• Non striated • Involuntary • Poor blood supply • Food transportation through GI	• Striated • Involuntary • Rich blood supply • Heart pumping blood circulation through body

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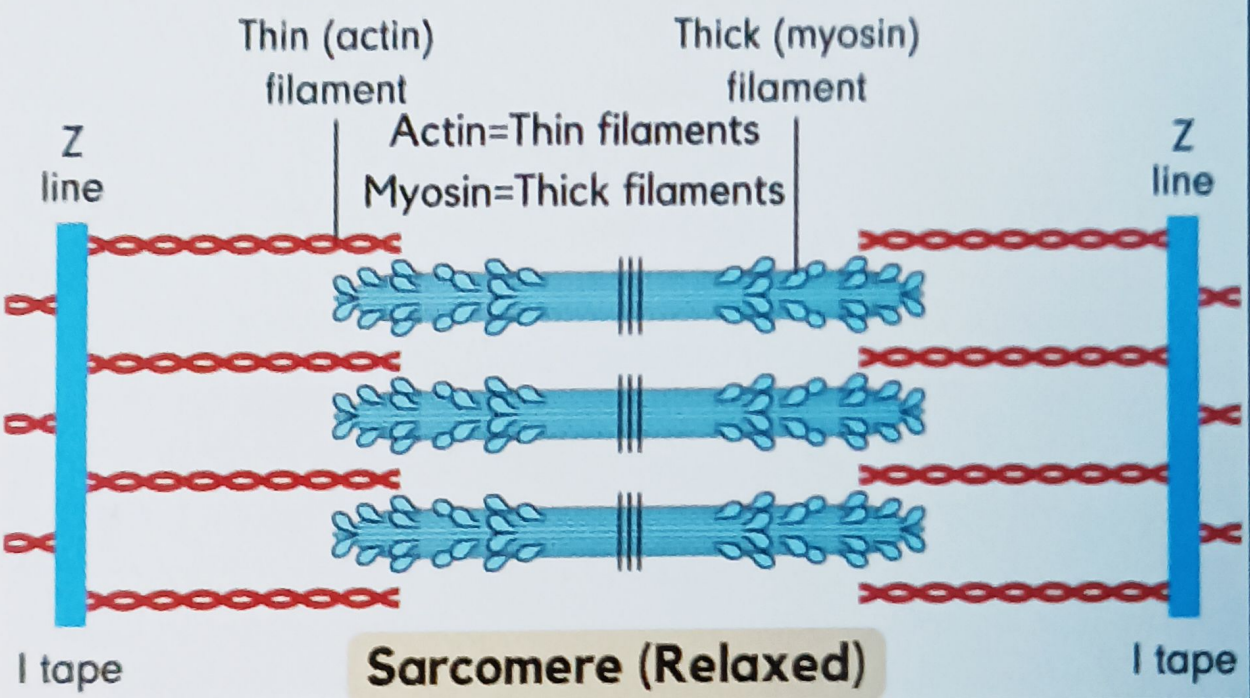
Skeletal Muscles

- Made of Muscle bundles/Fascicles

↓ held by

Fascia (cartilaginous connective tissue)

- Every muscle bundle contains **muscle fibres** (contain many nuclei) — lined by → Sarcolemma (plasma membrane) ↓ enclose → Sarcoplasm — contains filaments → **Myofibrils**



Sarcomere (Relaxed)

MYOFIBRIL

A band (Anisotropic)

- dark band
- contain actin + myosin
- middle light region-H band(only myosin)
- dark line in centre of H Band= M-Line

I band (Isotropic)

- Light bands
- contain actin
- Bisected by dark=Z-line

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CONTRACTILE PROTEINS

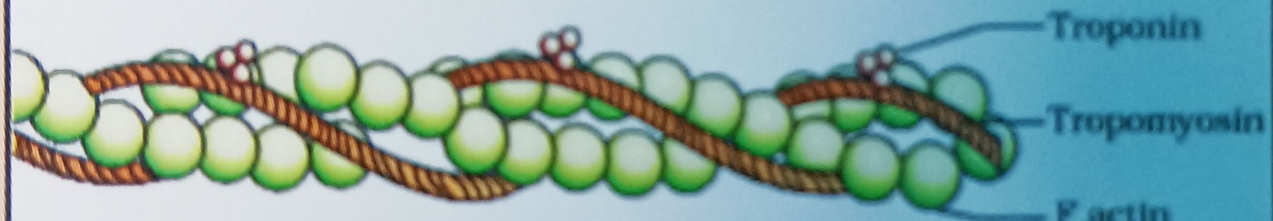
Actin

- 2 x 'F'-actins (helically coiled)
- Polymer of
- 'G' actins (globular)

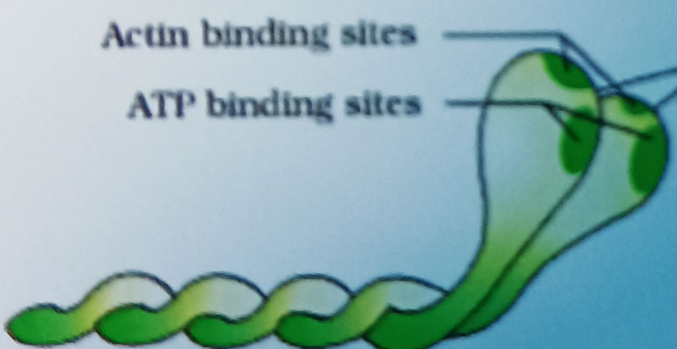
Myosin → Meromyosins

- Globular head + Short arm
  - Heavy meromyosin (HMM)
  - Project outward from polymerised myosin (cross arm)
- Tail
  - Light Meromyosin (LMM)
  - active binding sites

- 2 Filaments of tropomyosin runs close to F-Actins.
- Troponin is Distributed at Regular Intervals (active binding sites)



(a)



(b)

- Note-Globular- head active ATPase enzyme ; ATP binding site

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SLIDING FILAMENT THEORY

Note - Neuromuscular junction=motor-end plate

CNS → Motor Neuron → Motor Neuron + Muscle fibres (motor unit)

↓

Neural signal reaches neuromuscular junction

←

Release of a neurotransmitter (Acetyl choline)

↓

Action potential in sarcolemma

→

Ca^{+2} released into sarcoplasm

↓

Ca^{+2} binds to troponin

←

Active site of myosin (unmasked)

↓

ATP utilised; Myosin binds to Actin(cross bridge formation)

→

Actin pulled towards 'A' band, 'Z' line gets inward

↓

Sarcomere (contraction)

Note-'I' bands are reduced; length of 'A' bands remain same

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MUSCLE RELAXATION

Cross bridge breaks b/w actin & myosin → Ca^{+2} pumped back to sarcoplasmic cisternae → Actin filaments slide out of 'A' band → Muscle returns to its original state

- Myoglobin-Red coloured, O_2 storing pigment in muscles (Red fibres)
- Myoglobin is absent/very less in White fibres
- Aerobic muscles-Store large amount O_2 (many mitochondria)

SKELETAL SYSTEM

- Framework of cartilage & bones aiding movement of body
- Total bones=206

Axial Skeleton (80)
- Skull
- Vertebral column
- Sternum
- Ribs

Appendicular Skeleton
- Girdles
- Limb bones

Skull - Total 22 bones (dicondylic)

Cranial (8) - Forms Covering of Brain	Facial(14)

- Hyoid -(U-shaped) at the base of buccal cavity
- Ear ossicles → Malleus, Incus, Stapes

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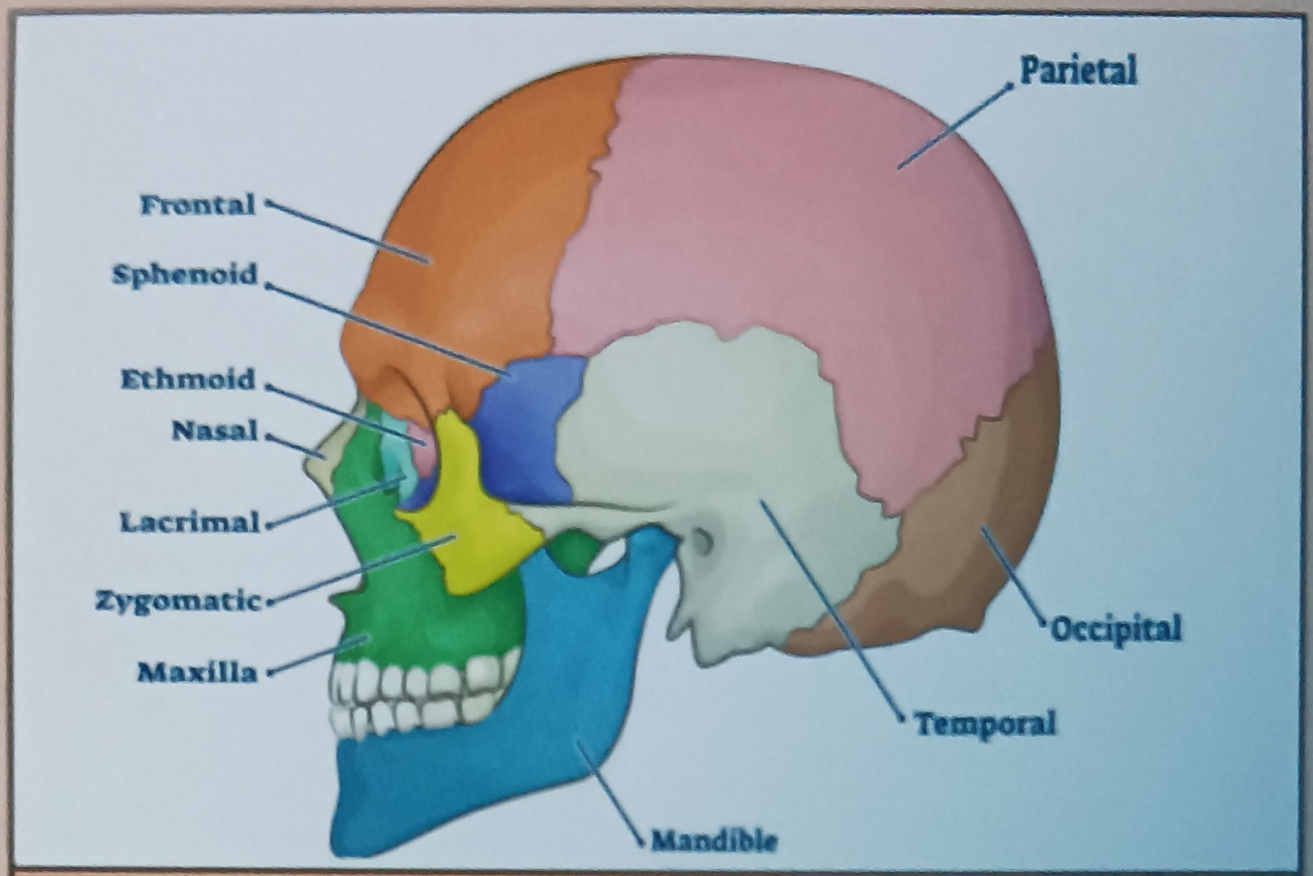
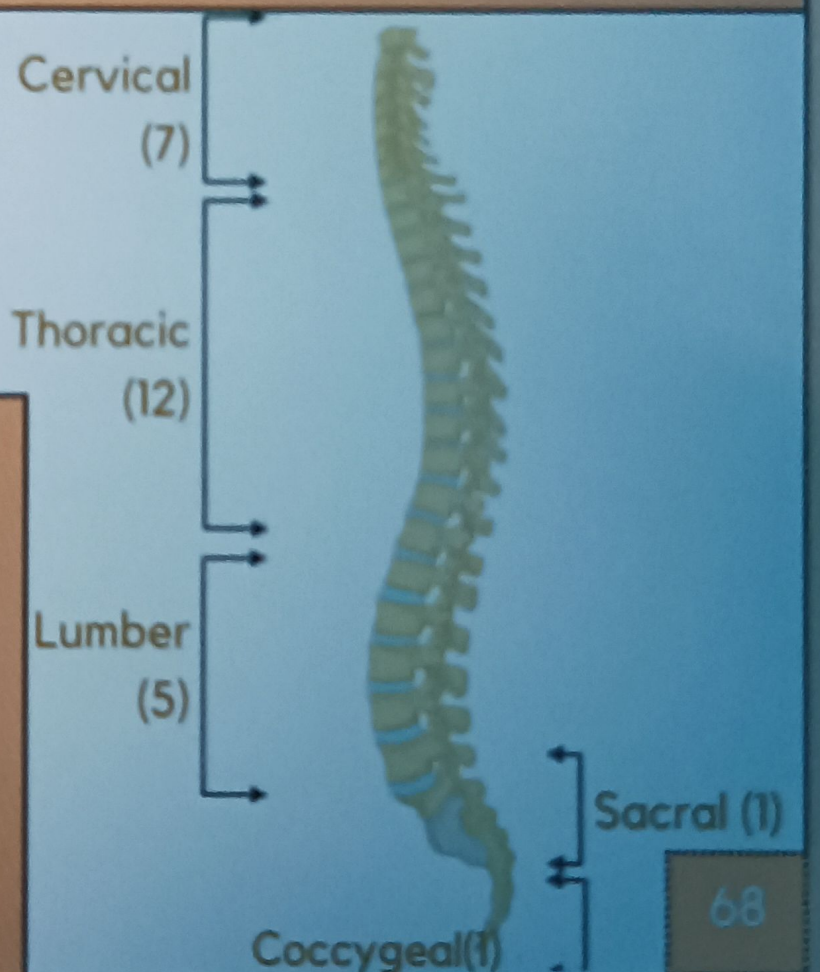


Vertebral column (26) Protects spinal cord (in neural canal)

- Cervical(7)
- Thoracic (12)
- Lumber(5)
- Sacral(1)
- Coccygeal(1)

1st Vertebra - **Atlas**



Sternum (1)
Flat bone on ventral midline (**thorax**)

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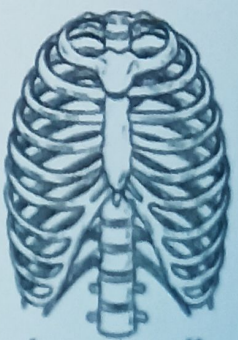
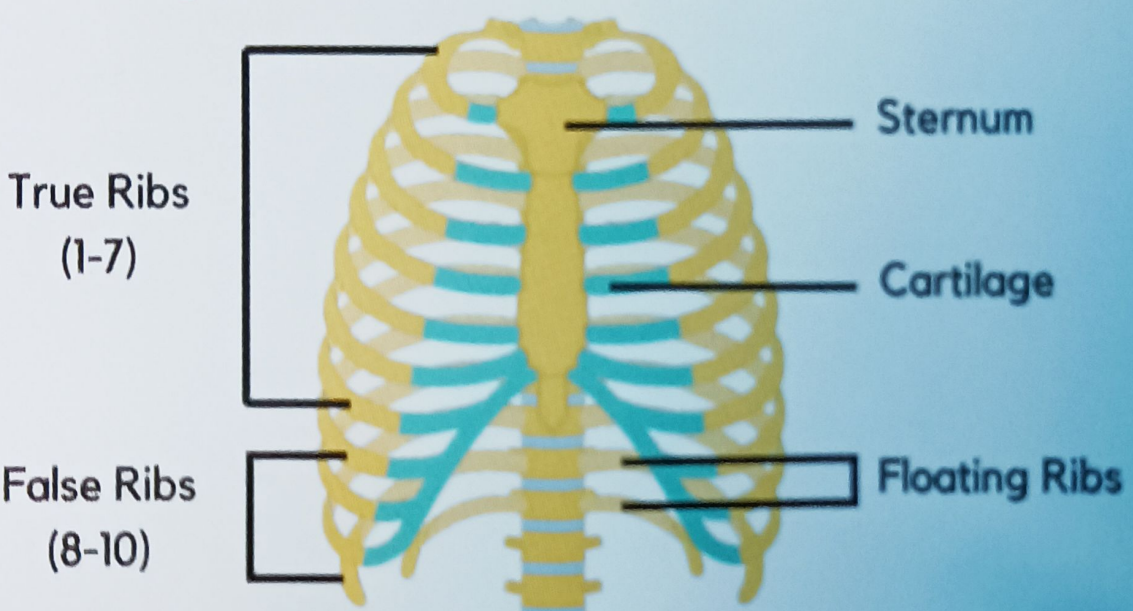
RIBS (12 pairs) - attached (with hylein cartilage)

Dorsally-vertebral column Ventrally-sternum



- **True ribs(7pairs)**
- **False ribs(8th, 9th, 10th pair)**
  - No direct attachment with sternum
  - Articulate with 7th pair
- **Floating ribs(11th & 12th)** Not connected ventrally

Rib cage = Thoracic vertebrae + ribs + sternum



LIMBS (30 Bones)

Forelimbs		Hindlimbs	
Humerus	Radius	Femur (Longest bone)	Tibia
Metacarpals(5)	Ulna	Fibula	Tarsals(ankle)(7)
Phalanges(14)	Carpals(8)	Metatarsals(5)	Phalanges

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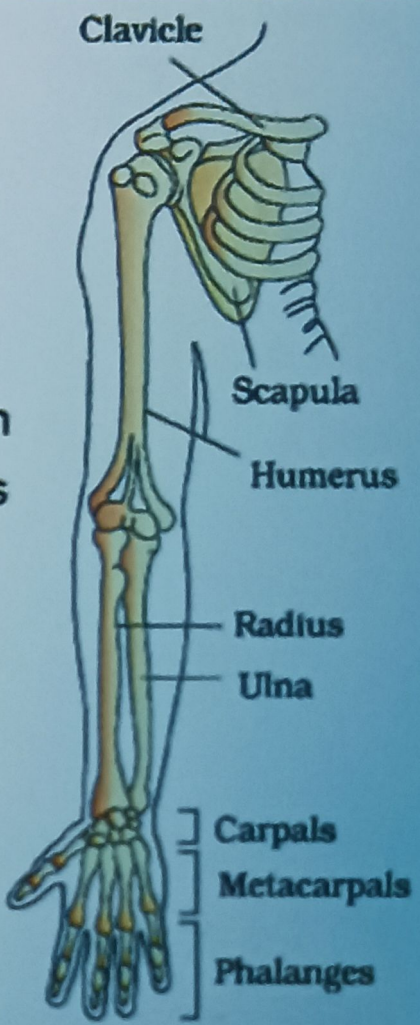
Pectoral gridle - Clavicle and Spacula

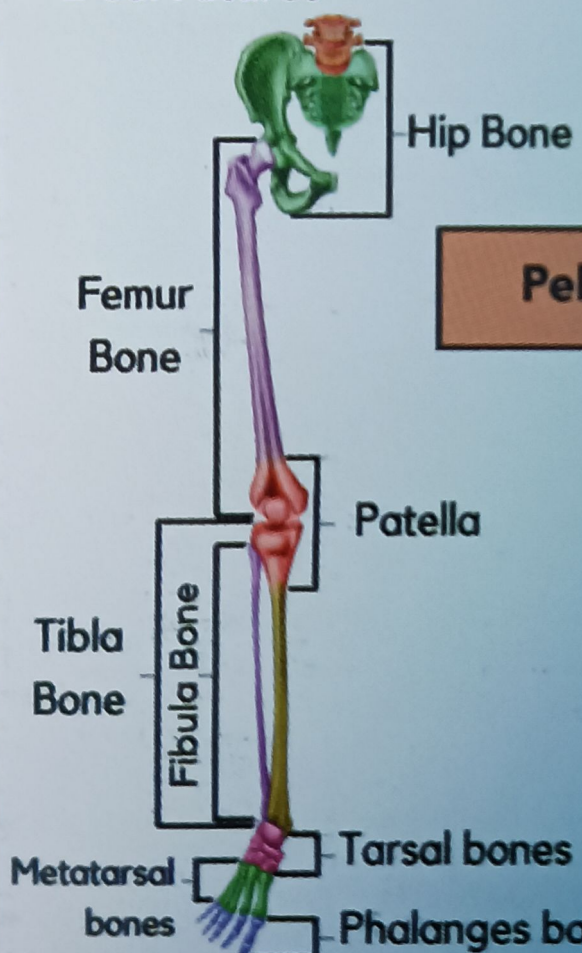
Scapula

- Triangular, flat bone
- Dorsal to thorax(b/w 2nd & 7th rib)
- Acromion-flat expanded part (for articulation)
- Spine-elevated ridge over acromion
- Glenoid cavity-depression that joins humerus(forms shoulder)



Clavicle (Collar Bone)

- Slender
- 2 curvatures



Pelvic girdle -2 coaxial bones

each
- ilium
- ischium
- pubis

- Acetabulum-fusion with thigh
- Pubic symphysis-meeting point of 2 pelvic halves **(Fibrous cartilage)**

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Joints - Contact b/w bones or bones & cartilage	
Fibrous joints	• No movement, fuse end-to-end • Dense fibrous connective tissue forms sutures e.g.-flat skull bones
Cartilaginous joints	• Joints cartilage • Limited movement e.g.-Vertebrae in Vertebral column
Synovial joints	• fluid-filled synovial cavity • movement(+)

EXAMPLES

- **Ball & Socket** - b/w humerus & pectoral girdle
- **Hinge** - knee joint
- **Pivot** - b/w atlas & axis
- **Gliding joint** - b/w carpals
- **Saddle** - b/w carpals & metacarpals(Thumb)

Disorders

- **Myasthenia gravis** - Auto-immune (affects neuro-muscular junction) - fatigue, weakness, paralysis.
- **Muscular dystrophy** - Genetic(Skeletal muscles degenerate)
- **Tetany** - Muscle spasms(Low Ca^{+2} in body)
- **Arthritis** - Joint inflammation
- **Gout** - Joint inflammation(deposition of uric acid)
- **Osteopororsis** - (Age related/Low level of estrogen) decreased bone mass

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