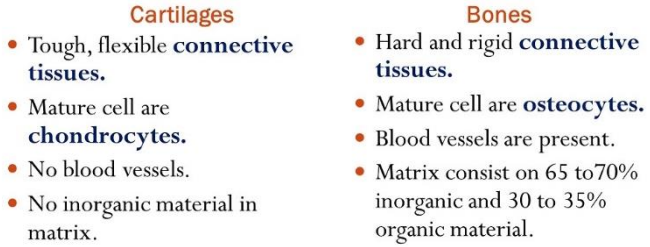
Skeletal System : Hard Protective or supporting structure of Animal Body.

Exoskeleton	Endoskeleton
Hard covering present outside the body. Ectodermal in origin & formed of non-living material.	Framework of bones and cartilage occur inside the body. Mesodermal in origin & formed of living tissue.

In human beings, a baby is born with about 300 bones which fuses to form 206 bones and some cartilages.

What are the functions of skeleton?
Ans: It provide support, protection, shape to the body, sight of muscle attachment and movement, site of blood cell formation, hearing (ear ossicles), breathing (ribs, larynx, cartilaginous rings), sound production (larynx), site of mineral storage.



Human skull have two occipital condyle and is Dicondylic (less rotation) while Monocondylic skull are found in reptiles & birds & have wider movement .

Axial Skeleton (80)

Skull (23)

Cranial- Brain Box (8)

- **Frontal (1)-** form Forehead consists of 6parts: squamous, nasal, 2 orbital plates & 2 zygomatic plates.
- **Parietal (2)-** present in side & top of skull
- **Temporal (2)-** present at base and lateral side of the skull.
- **Occipital (1)-** forms the back and base of the skull and encircles the spinal cord.
- **Sphenoid (1)-** provide anterior support, contains pituitary grands in its cavity & form eye socket
- **Ethmoid (1)-** Forms nasal cavity & eye socket

Facial Bones (14)

- **Lacrimal (2)-** forming eye socket & contains tear glands
- **Nasal (2)-** Nose support
- **Zygomatic (2)-** cheek and the outer side of the eye socket.
- **Maxillae (2)-** Upper Jaw
- **Palatine (2)-** form hard palate in the roof of mouth.
- **Nasal Conchae (2)-** Nasal cavity regulation
- **Vomer (1)-** Nasal septum
- **Mandible (1)-** Lower jaw – (only movable bone in the skull)

1 Hyoid -U-shaped (forms the base of buccal cavity/tongue)

Vertebral Column (26)

- **7 Cervical -** $C_1 – C_7$ –
  C_1 (Atlas)- allow nodding (articulate into occipital condyle.
  C2 (Axis) – allow rotation of head
- **12 Thoracic -** T_1 to T_{12}
  -ribs attach to the spine
- **5 Lumbar -** L_1 to L_5- region between thoracic and pelvic
- **Sacral** (5-fused)- forms the posterior region of pelvis.
- **Coccygeal or Coccyx-** Tail bone (4-fused)

Ear ossicles (6) (3pairs)

- **Malleus/ Hammer (1 pair)-** outer
- **1 Incus/ Anvil (1 pair)-** middle
- **1 Stapes/Stirrup – (1 pair)** – inner & **smallest bone**
- Ossicles-are harder than cartilage but softer than bones

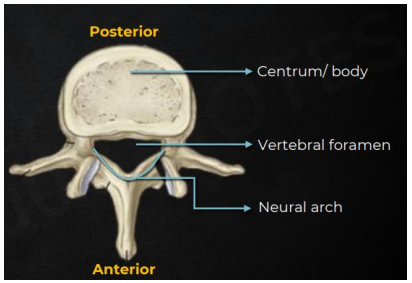
Ribs (24) (12 pairs)

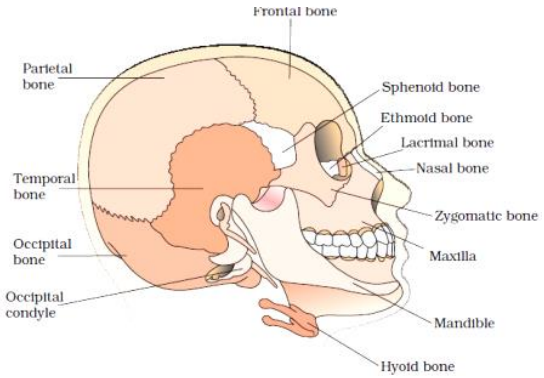
- True ribs 1st to 7th- directly attached to sternum through **hyaline** cartilage.
- False ribs- 8th, 9th and 10th- joint to 7th rib through hyaline cartilage
- Floating ribs - 11th and 12th pair- do not attached to sternum

Sternum (1)- 1 bone (Flat Chest/Breast Bone)

Foramen Magnum: A large, oval-shaped opening in the occipital bone of the skull that connects the spinal cord to the brain.
Neural canal/ Foramen vertebral canal- The canal through which spinal cord passes .

Appendicular Skeleton (126)	
Pectoral Girdle (4)	**2 Scapula-** triangular shaped bone present at back of shoulder. Humerus articulate into its glenoid cavity. **2 Clavicles-** collar bone present at top of shoulder articulate into acromion cavity of scapula
Hands (2*30)	**1 Humerus**- upper arm **1 Radius**- forearm towards thumb **1 Ulna**- forearm postaxial **8 Carpals**- wrist **5 Metacarpals**- Palms **14 Phalanges**- fingers
Pelvic Girdle (2)	**2 coxal bones-** formed by the fusion of Ilium- Upper & largest, contributes to the acetabulum (hip socket) Ischium- Lower & back portion, helps to sit & contribute to acetabulum Pubis- Inner, Forms front of hip, joins at **pubic symphysis** (made of fibrous cartilage that joins the two coxal bones ventrally) part of acetabulum.
Legs (2*30)	**1 Femur**- thigh bone (**the longest bone)** articulates into acetabulum **1 Tibia-** shank towards thumb **1 Fibula-** shank postaxial **1 Patella-** knee cap **7 Tarsals-** ankle **5 Metatarsals-** foot **14 Phalanges-** toes





Joints – are points of contact between bones, or between bones and cartilage.

1. **Fibrous joints**– do not allow any movements. Present in flat skull bones to form cranium.
2. **Cartilaginous joints**– bones are held together with the help of cartilage present in vertebrae. Permits limited movements.
3. **Synovial joints**– fluid filled synovial cavity, provide considerable movements. Ball and socket joint, hinge joints, pivot joints, gliding joints etc.

Type of Joint	Description	Example
Ball-and-Socket	Rounded end of one bone fits into a cup-like socket of another	Hip joint, shoulder joint
Hinge	Allows movement in one direction, like a door hinge	Elbow joint, knee joint
Pivot	Allows rotation around an axis	Neck joint (atlantoaxial joint)
Gliding (Plane)	Flat surfaces glide over each other	Joints between carpal or tarsal bones
Condyloid (Ellipsoid)	Oval-shaped end of one bone fits into an elliptical cavity in another	Wrist joint, metacarpophalangeal joints
Saddle	Resembles a saddle, allowing movement in two planes	Thumb carpometacarpal joint
Fixed (Immovable)	No movement allowed	Sutures of the skull
Synovial (Freely Movable)	Contains a joint cavity with synovial fluid for lubrication and movement	Knee joint, shoulder joint

Disease	Causes	Pathogenesis and Symptoms
Tetany	Calcium deficiency	Involuntary muscle contractions, spasm results due to continued contraction as the Ca ions transport back to the sarcoplasmic reticulum is affected.
Tetanus (lockjaw)	A bacterial disease, the causative organism is *Clostridium tetani*	The toxin produced by the bacteria mimics the acetylcholine and binds to receptors on muscle fibres irreversibly, causing painful contractions.
Myasthenia Gravis	Autoimmune disease	Affecting neuromuscular junction (Antibodies are produced against acetylcholine) causing weakening of muscles and paralysis.
Muscular Dystrophy	A genetic disorder, (X-linked recessive)	The gene coding for dystrophin protein is defective. The progressive degeneration of muscles takes place leading to breathing difficulty and death. Males are mostly affected.
Osteo**arthritis**	Due to Injury or infection the cartilage (within the joint) undergoes degeneration, leading to a reduction in synovial fluid's lubricating properties.	Inflammation in the joints causing pain, swelling, stiffness, and decreased joint mobility.
Rheumatoid Arthritis	Autoimmune disease	Inflammation of joints due to the attack of one's own immune system in joints.
Gout	Metabolic disorder due to increased uric acid	Uric acid crystals get deposited in the joints causing deformities, pain and inflammation.
Osteoporosis	Age-related, due to demineralisation. Decreased estrogen level in females	Reduced bone mass leading to weakening of bones and frequent fractures.