Skeletal System

INTORDUCTION

- The hard part of an animal body present inside or outside the body collectively form the skeletal system.
- Skeleton serves as the reservoir of many minerals, like calcium and phosphate.
- The marrow of the long bones is the site for the haemopoiesis, i.e., formation of blood cells (RBC, WBC).
- The skeleton plays a vital role in movement and locomotion.
- Human skeleton consists of 206 pieces of bones.
- In infants 306 bones are present.
- (i) Bone is a hard connective tissue in which the ground substance is very hard and contains calcium salts. The ground substance has enormous irregular spaces, called as lacunae, in which the osteocytes are present.
- (ii) Cartilage is a firm and elastic connective tissue with large number of chondrocytes embedded in the matrix. Bone and cartilage help the individuals to sit, walk and run; They also provide protection to many vital organs like brian, eyes and heart etc. Human skeleton consist of two parts.



(a) Axial Skeleton:

It consists of skull, vertebral column, ribs and sternum.

- (i) The skull: Consists of 29 bones, having the following parts:
- (A) Cranial bones: These are 8 flattened bones, tighty interlocked, forming a box which is called as cranium, in which brain remains protected.

- (B) Facial bones: These are 14 in number, form the front part of the skull along with skeleton of nose, hard palate and lower jaw.
- (C) Hyoid bone: It is a U shaped bone placed at the floor of the buccal cavity.
- (D) Bones of middel ear: These are three in each ear namely malleus, incus and stapes.
- (ii) Vertebral column: It is formed of a series of bones called as vertebrae. In humans 26 vertebrae are present serially along the length of the trunk, Each vertebra is centrally hollow. The vertebrae are named on the basis of the region the region of the body where they are located. In the neck region, they are called as cervical vertebrae, while in the thoracic and abdominal regions they are named thoracic and lumbar vertebrae, respectively.



- Cervical vertebrae are 7 in number
- Thoracic vertebrae are 12 in number
- Lumbar are 5 in number
- Sacrum -1 (5)
- Coccygeal -1 (4).
- (iii) Sternum: The thorax is supported by sternum on the ventral side.
- (iv) Ribs: The ribs have two facets, which articulate ventrally to the sternum and dorsally to the thoracic vertebrae. There are twelve pairs of ribs at the sides of the thoracic cavity.

RIBS						
(12 pairs, lie in thorax)						
True ribs	False ribs	Floating ribs				
7 pairs	3pairs	2pairs				
Sternal parts	Sternal parts	Sternal pairs				
Attached	attached to sternal	are free				
To the sternum	parts of 7 th true rib					

(b) Appendicular Skeleton:

It consists of fore and hind limbs and pectoral and pelvic girdles. There are 126 bones present in the human appendicular skeleton.

 (i) Fore limb bones: These are divided into arm bones and leg bones. Each are has 30 bones, which constitute humerus (upper arm), ulna and radius (lower arm), carpals (wrist), metacarpals (palm), and phalanges (digits).

Limb Bones





(ii) Hind limb bones: Each leg has 30 bones. Thigh (upper part of the leg) has the support of the longest and heaviest bone of the body, i.e. femur. Tibia and fibula bones tighter support the shank of the leg; tibia is larger than fibula and bears the major body weight. Proximally, tibia articulates with femur at the distal end, both tibia and fibula together articulate with the talus bone of the tarsals. Tarsals of each leg consist of seven bones forming the ankle. Five metatarsals distally articulate with the phalanges.

HIND LIMB BONES 30 in number **FEMUR** Tibia-Foot-Patella Femur Fibula **Bones** (1 bone) (Longest & (Two (26 bones) (One sesamoid thickets bone bones lie bone, forms of body, lies in shank knee cap) in thigh) of leg) (i)A rounded (i) Tibia is inner head to fit in &thicker. acetabulum (ii) Fibula is outer & thinner. of pelvic girodle. (ii)A rod-like shaft Tarsals Metatarsals Phallanges (7 in number, (5 in number, (14 in number. in ankle) lie in sole of foot) lie in toes, phallangel formula llium Pubis. Socket for femur accetabulum) Ischium Head of femur Pubic----/ Symphysis Femur Patella Fibula Tibla Tarsals

Hind Limb

Phalanges

Metatarsals

(ii) Girle bones: These provide a connection between the axial skeleton and limbs. The two girdles are named as pectoral and pelvic girdles, respectively.



JOINTS

Joints are the place of articulation between two or more bones or between a bone and a cartilage. Due to the presence of a number of joints, the movement of the different body parts and the whole body is possible.

- (a) Types of Joints:
- (i) Fixed or immovable or fibrous joint: There is no space between the bones. The attached bones are tightly held with the help of white fibrous connective tissue e.g. Joints of skull bones.
- (ii) Slightly movable or cartilaginous joint: It is an articulation between the bones that allows very little movement. E.g. Between bones of vertebrae and pelvic girdle.
- (iii) Movable joint or synovial joint: It is a Joint which allows the movement of articulation bones such that they can move extensively upon each other. The space between bones is called synovial cavity. This cavity remains filled with a viscous and slippery synovial fluid. These are of following types:
- (A) Ball and socket joint e.g., Shoulder joint, hip joint
- (B) Hinge joint e.g., Elbow joint & knee joints
- (C) Pivot joint e.g. Atlas and axis vertebrae
- (D) Angular joints e.g., Wrist joint
- (E) Gliding joints e.g., Carpals in wrist ant tarsals in ankle.

MUSCLE BONE RELATION

Movement of organs and different parts of the body are brought about by the contraction of skeletal muscles inserted into the articulating bones.

- Flexible Connective tissue bands called ligaments stabilize the joints by holding the articulatin boens together.
- Tendons (Insertion of skeletal muscles): The skeletal muscles are attached to the bones by tendons. Tendons are formed of white fibrous connective tissue consisting entirely of collagen fibres. These are tough and nonelastic and are capable of bearing sudden stresses. Tendons are present at the ends of skeletal muscle bundle.

MECHANISM OF CONTRACTION OF MUSCLE

The muscles contract in response to a nerve impulse, which is transmitted to an end plate. Situated at the terminal branch of the axon. The contractile element consists of two type's protein. Actin and myosin, occurring as thick and thin filaments respectively. The process of muscle contraction is intimately associated with protein filaments of the myofibrils. The sarcomere is the uint of contractility and is represented by the region between successive Zdiscs. During muscle contraction the thin actin filaments slide among thick myosin filaments & result in shortening of sarcomere. The contraction sarcomeres causes the muscle to shortenin length. During contraction I-bands shorten and Z_ discs disappear, but the length of A-bands remains constant throughout the process.



MECHANISM OF MUSCLE CONTRACTION

EXERCISE

1. Pelvic girdle is present in

(a)	Shoulder bone	(b) humerus
-----	---------------	-------------

- (c) thigh (d) none of these
- 2. The total number of canines in the permanent dental set of humans is

(a) 12	(b) 8
--------	-------

- (c) 6 (d) 4
- 3. The number of floating ribs, in the human body, is
 - (a) 6 pairs (b) 6 pairs
 - (c) 3 pairs (d) 2 pairs
- 4. Cranium of human contains a total of
 - (a) 8 bones (b) 12 bones
 - (c) 14 bones (d) 20 bones
- 5. Which of the following components is a part of the pectoral girdle?

	(a) Ilium	(b) Sternum			
	(c) Acetabulum	(d) Glenoid cavity			
6.	Appendicular skeleton includes all except				
	(a) Hind limbs				
	(b) Forelimbs				
	(c) Vertebral column				
	(d) Pectoral and pelvi	c girdles			
7.	Acetabulum is present in joint:				
	(a) Hip	(b) Knee			
	(c) Elbow	(d) Shoulder			
8.	The ends of two bones	are connected by:			
	(a) Muscles	(b) Ligaments			
	(c) Tendons	(d) Calcified			
9.	In man, the coccygeal bones is found in:]				
	(a) Skull	(b) Pelvic girdle			
	(c) Pectoral girdle	(d) Vertebral column			
10.	Total number of bones	s in human skull is:			
	(a) 26	(b) 29			
	(c) 30	(d) 107			

ANSWER KEY

SKELETAL SYSTEM

Q.	1	2	3	4	5	6	7	8	9	10
А.	С	D	D	А	D	С	Α	В	D	В