



NEET Biology

Short Notes

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LOCOMOTION AND MOVEMENT

Introduction

The movement of the body parts or the change in position of the whole organism is supported and executed with the help of the skeleton. In the majority of the non-chordates, either the haemocoel or the exoskeleton provides the necessary supports. In human, the bony endoskeleton is responsible for the movement and locomotion. Apart from this, the skeleton serves the following functions:

- Supports the body
- Protects the internal organs
- Produces the blood cells
- Stores the mineral ions

Bone also called the osseous tissue, is the hard and specialised connective tissue in the body. It is mesodermal in origin. The movements of the bones are facilitated as they are connected with the skeletal muscles and are supported by the cartilage. Cartilage is the flexible connective tissue that serves to provide smooth surfaces for the movements.

Skeletal System in Humans

The human skeletal system is made up of bones, cartilage and ligaments that join the bones. In an adult, there are 206 bones. A younger individual would have more bones as compared to an older individual. The basic functionality of the skeletal system is to provide the ability to move and locomote. The lower part of the system is specialised for the locomotion. The upper part of the skeleton can bring about a range of movements, for example, lifting, carrying etc.

The skeletal system can be divided into two sub-types:

1. The Axial System:
It shapes the vertical and the central axis of the body and consists of the bones of the head, neck, chest and back. Altogether there are 80 bones in this system.
2. The Appendicular System:
It consists of the bones of the upper limbs, lower limbs and the bones connecting limbs to the axial skeleton. There are 126 bones in this system.


Axial Skeletal System

1. Skull

It consists of 22 bones joined via synarthrodial (immovable) joints. Only the 22nd bone called the mandibles are movable. The skull is studied under the following heads:

A) Neurocranium

It is present around the brain. The following bones can be located in this part:



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Occipital Bone	It is the base of the skull. It has an opening called foramen magnum through which spinal cord passes
Two Temporal Bones	These form the part of the base and the sides of the skull. These are lateral to the temporal brain.
Two Parietal Bones	These form the upper part and the upper sides of the skull.
Sphenoid Bone	It is located in the mid of the skull
Ethmoid Bone	It acts as a barrier between the nasal cavity and brain.
Frontal Bone	It forms the front part of the skull. The squamous part forms the forehead, Orbital part forms the orbit of eyes, the nasal part forms the roof of the nose.

B) Viscerocranium:

It has the following Facial bones:

1. The vomer
2. Two Nasal Conchae
3. Two Nasal Bones
4. Two Maxilla: Upper Jaw
5. The Mandible: Lower Jaw
6. Two Palatine Bones
7. Two Zygomatic Bones: Cheek Bones
8. Two Lacrimal Bones

C) Hyoid Bone: It is located at the base of the buccal cavity. It is not connected with any bone.

2. Vertebral Column:

The backbone is located dorsally. It is made up of 26 vertebrae. The atlas is the first vertebrae. It serves to protect the spinal cord and providing bending ability. It can be divided into the following regions:

- Seven Cervical vertebrae
- Twelve Lumbar vertebrae
- Five Sacral vertebrae
- One Coccygeal vertebra

3. Ribs:

These are 24 in number forming 12 pairs and protect the organs in the thoracic cavity. The first seven pairs are called true ribs as they are attached with the sternum ventrally. The 8th, 9th and 10th pairs do not attach to the sternum, they attach to the 7th pair. So, these are called the false ribs. The 11th and 12th pairs remain free and are called floating ribs. These provide a protective bony cover to the heart.

Appendicular Skeletal System

It consists of the forelimb and the hindlimb, each containing 30 bones. The pectoral and the pelvic girdle form the connection between the limbs and the axial skeleton. These are discussed below:

1. Pectoral Girdle:

It attaches forelimbs to the upper skeleton. It has the following bones:

Scapula or the Shoulder Blade	It forms the posterior of the shoulders. It is a flat bone with a triangular shape
Clavicle or Collar Bone	These are horizontal long bones.

2. Pelvic Girdle:

It is made up of hip bone or the coxal bone that attaches with the hindlimbs and the sacral vertebrae of the backbone. The coxal bones are immobile and serve to bear the weight. Each coxal bone is formed by the fusion of upper ilium bone, lower ischium bone and the inner pubis bone.

Limb Bones


1. Forelimbs:

There are the following regions with their corresponding bones:

REGION	BONES
Arm (between shoulder and elbow joint)	Humerus
Forearm (between elbow joint and wrist joint)	Ulna (located medially) and Radius (Located laterally)
Hand	Carpal Bones (base of hand) Metacarpal Bones (palm) Phalanx Bones (fingers and thumbs)

2. Hindlimbs:

There are the following regions with their corresponding bones:



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REGION	BONES
Thigh (between hip joint and the knee joint)	Femur Patella or knee-cap
Leg (between knee joint and the ankle joint)	Tibia (located medially) Fibula (located laterally)
Foot	Tarsals (distal ankle) Metatarsals (midfoot) Phalanx (Toes)

Joints

Joints are the points or the regions where the connection between the two bones or bone and cartilage occurs. The joints can be classified as follows:

Fibrous or Immovable Joints	The bones are bound with dense fibrous connective tissues, so the movement is not possible. For example, sutures between the bones of skull.
Cartilaginous or Slightly Movable Joints	The ends of the bones have hyaline cartilage, so a slight degree of movement is possible. For example, joints between the vertebrae in vertebral column.
Synovial or Freely Movable Joints	These joints have a synovial cavity (fluid-filled) surrounded by the articular capsule.


Types of Synovial Joints:

1. Ball and Socket joint: One bone forms a ball-like structure into which the socket-like structure of the other bone is fixed. For example, shoulder joint and hip joint.
2. Hinge joint: One bone forms convex end that articulates with the concave end of the other bone. Movement is possible in one plane only. For example, elbow joint, knee joint etc.
3. Pivot Joint: It allows the rotatory movements. For example, radioulnar joint.
4. Gliding Joint: Bones are firmly attached via ligaments so limited movement occurs in all directions. For example, joints of carpals and tarsals.
5. Saddle Joint: It is a biaxial joint. It resembles ball and socket joint. For example, joint between thumb and carpals.

Functions of Joints:

1. Provide the ability to perform the movements.
2. Provide flexibility.
3. Provide lever system to the body along with the muscles and the bones.

Lever System:



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The bones, muscles and ligaments form the lever system because they allow the varying degrees of the movements in the human body.

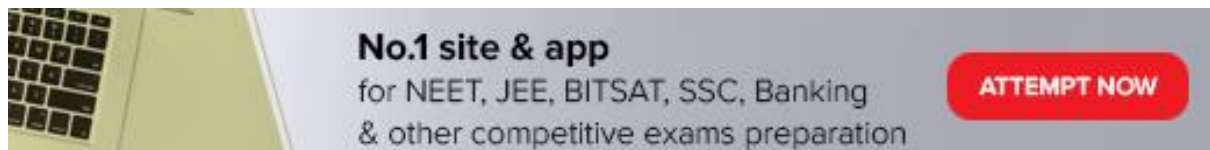
1. The first-class lever is formed between the skull (weight) and the atlas. The fulcrum is located between the weight and the force.
2. The second-class lever is formed between lower leg (tibia and fibula) and tarsals. The weight is located between the axis and the force.
3. The third-class lever is formed by the elbow joint. The force is located between the axis and the weight.

Disorders of the Muscular and the Skeletal System:

1. Muscular Dystrophy: It is a congenital disorder that results in the muscular wasting and deterioration. The patients do not have a long life-span.
2. Tetany: Low level of the calcium ions resulting in the frequent and painful muscle contractions, also called tremors. It is associated with the hyposecretion of the parathyroid hormone.
3. Arthritis: It is an autoimmune disorder, sometimes can be due to pathogenic infection that causes the inflammation of the joints.
 - 3.1. Rheumatoid Arthritis: It is the inflammation of the synovial joint membrane.
 - 3.2. Osteoarthritis: It is the degenerative disease of the articular capsule of the synovial joints.
 - 3.3. Gout Arthritis: Accumulation of the uric acid crystals in the joints.
 - 3.4. Infectious Arthritis: This is caused due to pathogenic infections.
4. Osteoporosis: The excessive resorption of the calcium by the bones makes them brittle and degenerate the bony tissue. It enhances fracture incidences.
5. Osteomalacia or Rickets: It is a degenerative disease of bones in children, specifically caused due to lack of vitamin D.

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