

Locomotion & Movement



Human Body (Muscles & Skeleton)

Muscles

The muscular tissue is mesodermal in origin. It is made up of the cells called muscle fibres. These constitute around 40% to 50% of the human body weight. These show the following types of features:

1. **Excitability:** The muscles are capable of responding to the nerve impulse; that is, they are capable of depolarising and polarising their membranes and transfer the potential difference across the membrane to the sarcoplasmic reticulum.
2. **Contractility:** While showing excitability, the muscles respond by contraction along the long axis. This property is called contractility.
3. **Elasticity:** The property of the muscles to regain the original shape after an event of the excitation and the contraction is called elasticity.
4. **Extensibility:** The property to extension and stretching is called the extensibility.

Types of Muscles

There are the following three types of muscles:

1. Skeletal Muscles or the Striated Muscles:

- These can be located below the skin, specifically, the skin covering the limbs. The skeletal muscles contract and bring about stimulation or inhibition of the movement.

2. Cardiac Muscles:

- These are exclusively **located in the heart**.
- These are also **striated but are not under voluntary control**.
- These are uninucleate. These are branched, and their branches are connected via the intercalated discs.
- These intercalated discs have gap-junctions due to which a coordinated contraction can be achieved.

3. Smooth Muscles or Visceral Muscles:

- These are unstriated in appearance. These are associated with the visceral organs like stomach, urinary bladder, etc., so they are also not under voluntary control.
- These are spindle-shaped, uninucleate, and are innervated by the autonomic nervous system.

Relaxation of Muscles

It occurs when the action potential terminates at the motor neurons, and so, the Ca^{++} ions are taken back in the sarcoplasmic reticulum. The myosin-binding sites are masked with tropomyosin and cross-bridges are broken.

Skeleton

Bone also called the osseous tissue, is the hard and specialized 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 specialized for the locomotion. The upper part of the skeleton can bring about a range of movements, for example, lifting, carrying etc.

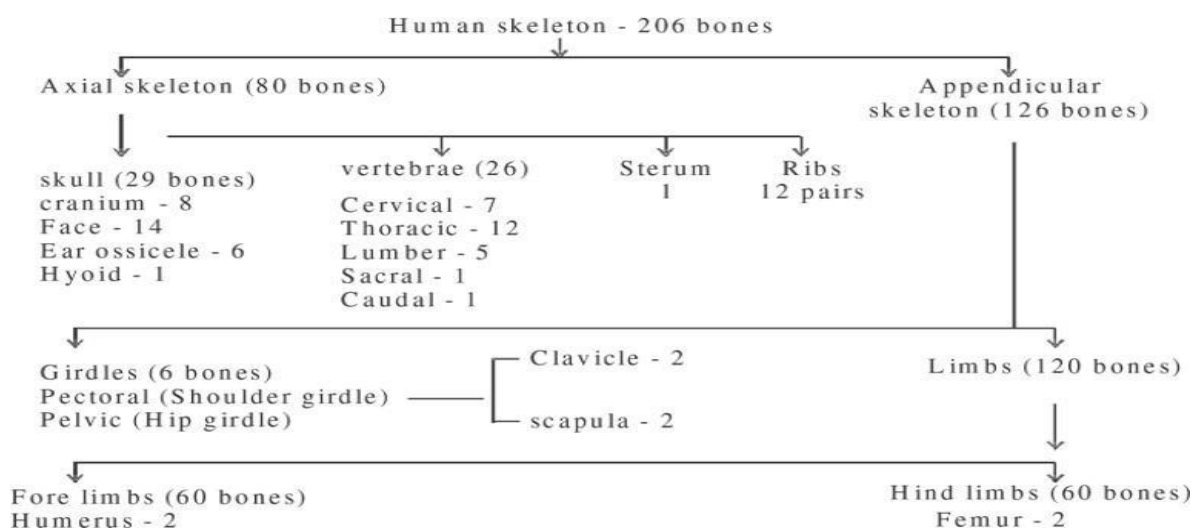
The skeletal system can be divided into two sub-types:

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.

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.



Joint

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 the 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 the vertebral column.
Synovial or Freely Movable Joints	These joints have a synovial cavity (fluid-filled) surrounded by the articular capsule.

Types of Freely Movable 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 form 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
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 a ball and socket joint—for example, the joint between thumb and carpals.

Functions of Joints:

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

Disorders of the Skeletal System:

1. **Arthritis:** It is an autoimmune disorder, sometimes can be due to the pathogenic infection that causes the inflammation of the joints.
 - Rheumatoid Arthritis: It is the inflammation of the synovial joint membrane.
 - Osteoarthritis: It is the degenerative disease of the articular capsule of the synovial joints.
 - Gout Arthritis: Accumulation of the uric acid crystals in the joints.
 - Infectious Arthritis: This is caused due to pathogenic infections.

2. **Osteoporosis:** The excessive resorption of the calcium by the bones makes them brittle and degenerate the bony tissue. It enhances fracture incidences.
3. **Osteomalacia or Rickets:** It is a degenerative disease of bones in children, specifically caused due to lack of vitamin D.
