

SKELETAL SYSTEM

This system is a combination of various bones. There are 213 bones in children and 206 bones in adults. These bones differ in shape and size. These bones are joined together by ligaments. They provide support and protection to the delicate organs of our body. Some of the bones act as levers in our body. Bones also provide surfaces for the attachment of the skeletal muscles. In this system is a structure of bones. Skeleton or skeletal system can be divided into two parts for better understanding:

1. Axial Skeleton
2. Appendicular Skeleton

1. **Axial Skeleton.** This skeleton consists of the following bones:

- | | | |
|----------------------|---|--------------------------------------|
| (a) Skull | — | 28 |
| (b) Sternum | — | 1 |
| (c) Ribs | — | 24 |
| (d) Hyoid bone | — | 1 |
| (e) Vertebral column | — | 26 for adults and
33 for children |

2. **Appendicular Skeleton.** This skeleton consists of the following bones:

- | | | |
|-----------------|---|----|
| (a) Upper limbs | — | 64 |
| (b) Lower limbs | — | 62 |

Types of Bones

According to shape and formation of bones, there are various types of bones, which are as follows:

1. **Long Bones.** Long bones are found mainly in the upper and lower limbs. These bones act as levers in our body and help in making movement possible. Long bones, such as humerus and femur, consist of a shaft and two extremities each. Only due to the length of these bones these are called long bones.
2. **Short Bones.** These bones are short in length, hence these are called short bones. For example, carpus and tarsus are called short bones. These bones are light in weight but they are strong enough. These bones are made of cancellous bone tissues. These bones are covered with compact tissues. These bones help in exerting force.
3. **Flat Bones.** Usually these bones are found where protection is required, such as the bones of skull, scapulae and ribs. There is always large surface on flat bones for the attachment of muscles.
4. **Irregular Bones.** These bones have a peculiar shape. So, these bones cannot be grouped under any preceding heads. A vertebra is a good example of these bones. Some bones of the face are also included under this head.

5. **Sesamoid Bones.** The word *sesamoid* is derived from Greek word *sesamon*, a 'seed of the sesamun', and ends 'form' or 'resemblance'. These bones are found in knee (Patella), hand and foot.

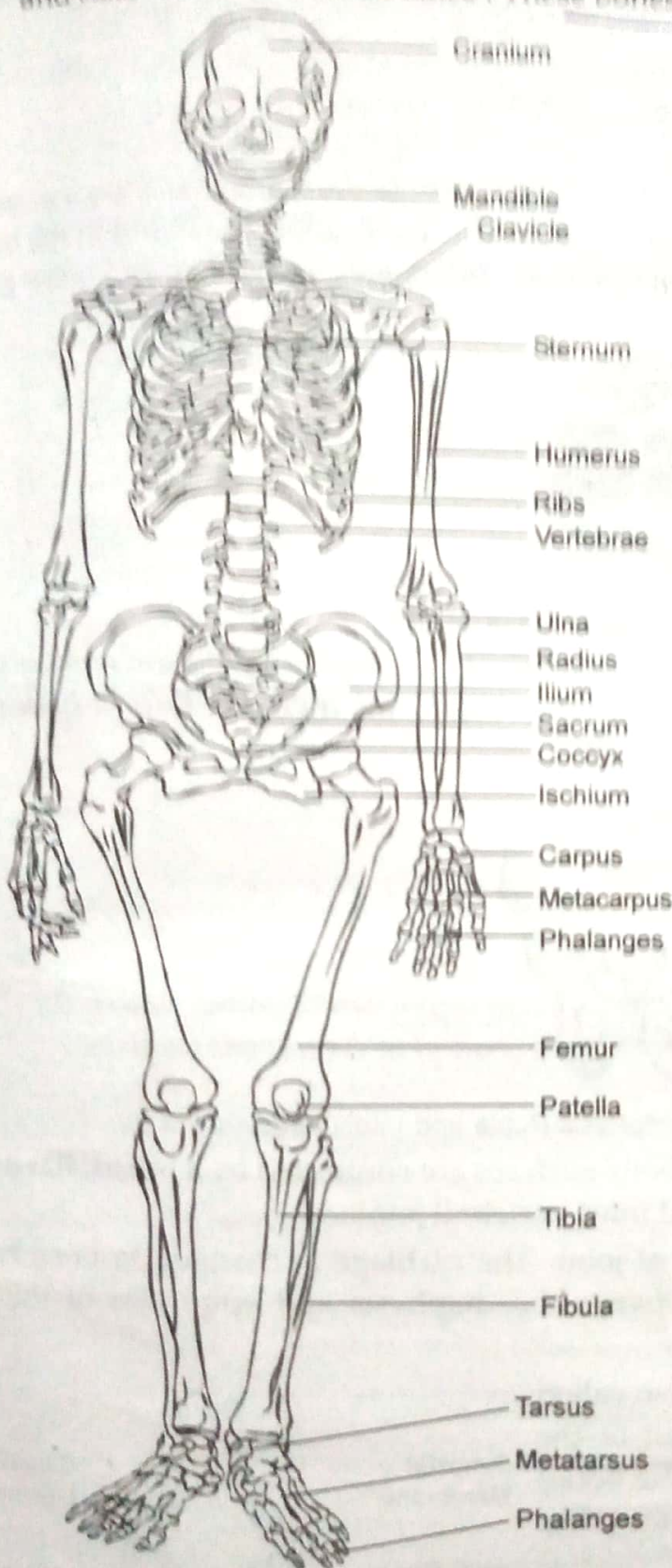


Fig. 3.1. Front View of the Human Skeleton

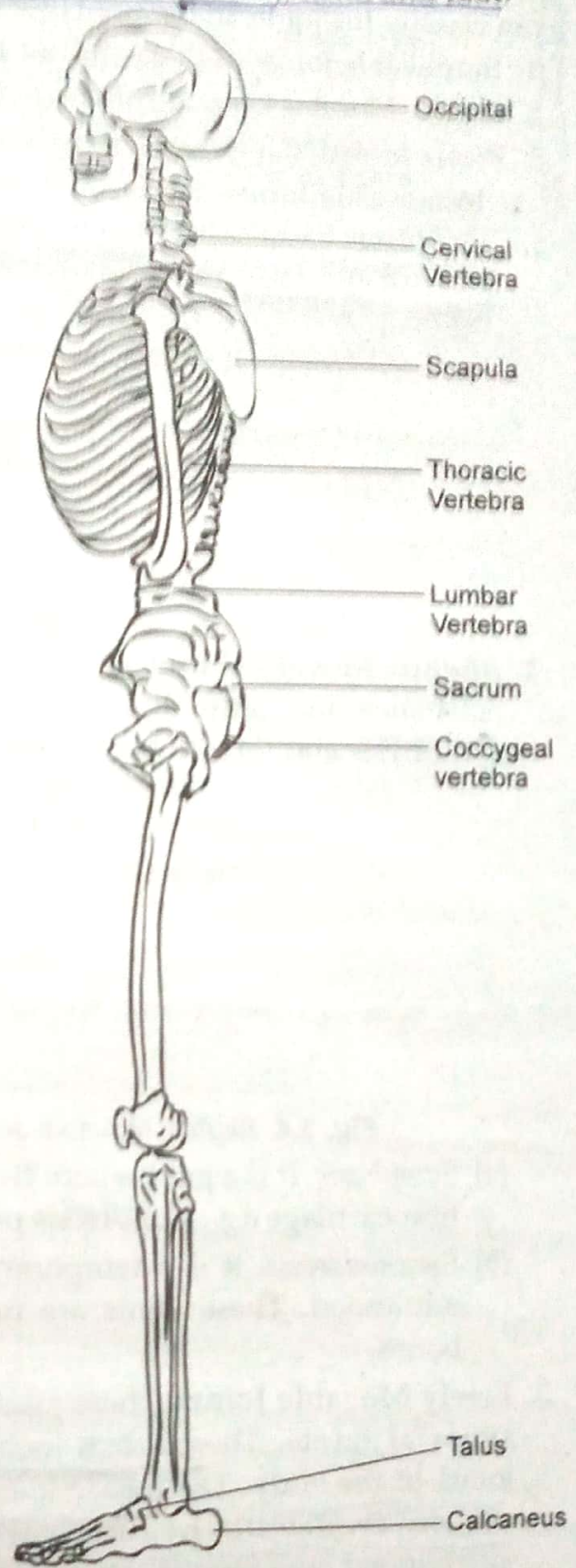


Fig. 3.2. Side View of the Human Skeleton

Joints of Bones

A joint or an articulation is the union of only two or more bones of the skeleton. The study of joints is called Arthrology. In fact, articulating surfaces of the bones are sometimes separated by a thin membrane, sometimes by connective tissue, or fibrocartilage and, in the freely moving joints, are completely separated.

Classification of Joints. Joints are classified according to the amount of movement of which are capable and their structural composition. So, according to the capability of movement we can classify the joints in three categories:

1. Immovable Joints or Synarthroses Joints
2. Slightly Movable Joints or Amphiarthroses Joints
3. Freely Movable Joints or Diarthroses Joints

1. Immovable Joints. These joints are also called fibrous joints, because the bones are connected by fibrous tissue. These joints are fixed and do not move. These joints are found in the bones of skull and face (with the exception of mandible). These joints are shown in Figure 3.3 below.



Fig. 3.3. Immovable Joints of Skull

2. Slightly Movable Joints. In these joints surfaces of bones are separated by some intervening substance and only slight movement is possible. This joint includes two varieties—(a) symphysis and (b) synchondrosis.



Fig. 3.4. Slightly Movable Joints—Symphysis Pubis and Inter-Vertebral Joints

(a) **Symphysis.** It is a joint where two long bony surfaces are connected by a broad, flat disc of fibrocartilage e.g., symphysis pubis and inter-vertebral joints.

(b) **Synchondrosis.** It is a temporary form of joint. The cartilage is changed to bone by adulthood. These joints are found between the diaphysis and epiphyses of the bones.

3. Freely Movable Joints. These joints are also called synovial joints. These joints include most of the joints of the body. The adjacent ends of the bones are covered with hyaline cartilage and are surrounded by a fibrous articular capsule, which is strengthened by ligaments. Tendons of muscles pass over these joints and play a vital role in stabilizing the joint. The hyaline cartilage provides a smooth surface for the opposing bones, lubricated by synovial fluid. These freely movable joints are further classified in six categories.

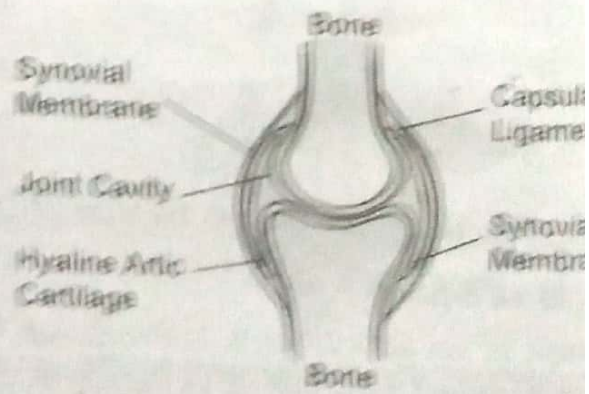


Fig. 3.5. Synovial Joint (Freely Movable Joints)

- (a) Gliding Joints. These joints permit gliding movements only, as in the joints between carpal bones of the wrist, between tarsal bones of the ankle.
- (b) Hinge Joints. These joints permit angular movement in one direction, like a door on its hinges. The movements of these joints are called flexion and extension e.g., humerus and ulna (elbow), knee and ankle joints, and in the joints of phalanges.
- (c) Condylloid Joints. These joints allow an angular movement in two directions e.g., wrist joint. Movements of this joint include flexion, extension, adduction, abduction and circumduction, but no rotation.

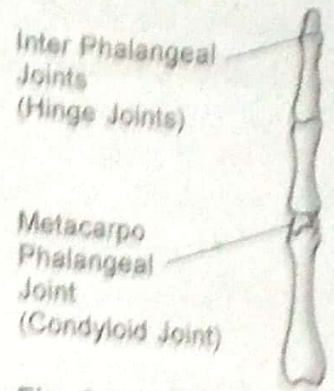


Fig. 3.6. Hinge Joint and Condylloid Joint

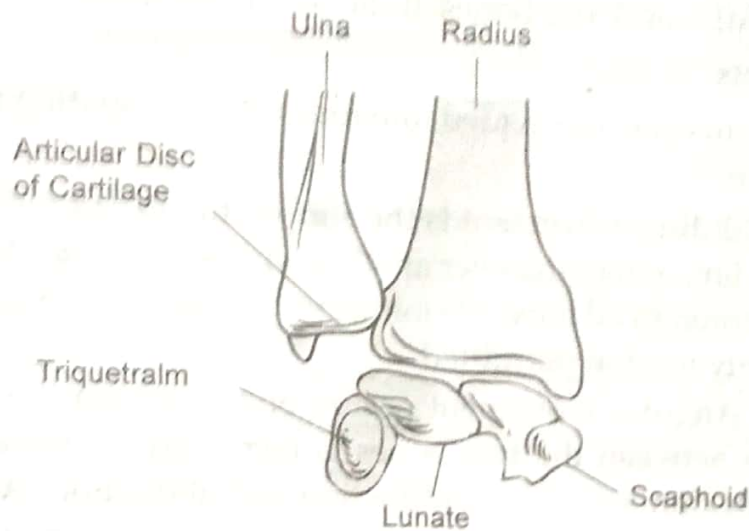


Fig. 3.7. Wrist Joint

- (d) Saddle Joints. These joints permit a great freedom of movements e.g., joint of thumb. It enables the thumb to oppose the fingers.

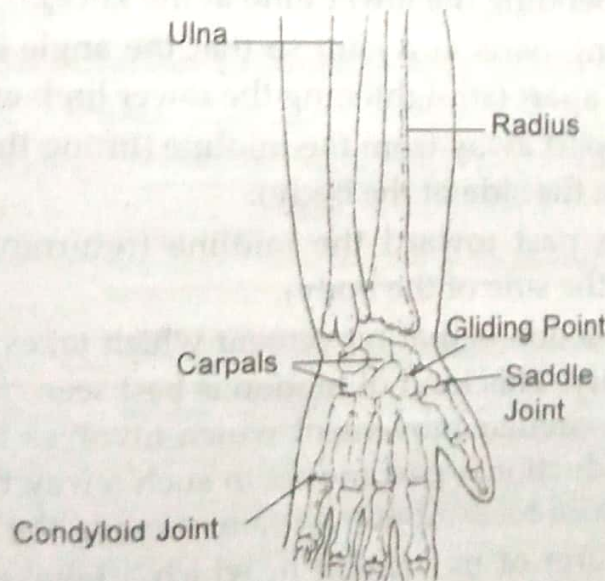


Fig. 3.8. Saddle Joint and Condylloid Joint

- (e) Ball and Socket Joints. These joints have an angular movement in all directions and a pivot movement. In this form of joint, a more or less rounded head lies in cup-like cavity. Shoulder joint and hip joints are the examples of ball and socket joints.

Functions of Bones

The important functions of bones are given below:

1. **Provides Support.** The bones are principal organs of support. They support the whole body.
2. **Provides Protection.** Bones provide protection for some of the soft and delicate organs of the body such as skull and ribs.
3. **Bony System Serves for the Attachment of Muscles.** Bony system provides surface for the attachment of the skeletal muscles. This bony framework affords attachment for the soft parts, maintains them in position, shelters them, helps to control and direct varying internal pressures and gives stability to the whole body.
4. **Bony System Gives Shape to the Body.** Bones play a vital role in shaping the body. It may provide long or short stature.
5. **Act as Levers.** Bones act as levers in our body. These help in doing work easily.
6. **Passive Instruments of Locomotion.** Bones are passive instruments of locomotion or movements. In fact, these enable us to move.

Effects and Benefits of Exercises and Training on Skeletal System

It requires a longitudinal study to observe the effects of exercises on skeletal system. If exercises are performed regularly for a longer period, effects can be observed. These changes are permanent and not temporary one. Following changes in skeletal system can be judged, when exercises and training are performed for prolonged period:

1. **Flexibility of Joints.** Exercise enhances the flexibility of the joints. It means that range of movement of a joint increases when exercises are done at least for two months. The signs of