

## Division of Skeleton

The skeletal system includes all of the bones, cartilages, and ligaments of the body that support and give shape to the body and body structures. The **skeleton** consists of the bones of the body. For adults, there are 206 bones in the skeleton. Younger individuals have higher numbers of bones because some bones fuse together during childhood and adolescence to form an adult bone. The primary functions of the skeleton are to provide a rigid, internal structure that can support the weight of the body against the force of gravity, and to provide a structure upon which muscles can act to produce movements of the body. The lower portion of the skeleton is specialized for stability during walking or running. In contrast, the upper skeleton has greater mobility and ranges of motion, features that allow you to lift and carry objects or turn your head and trunk.

In addition to providing for support and movements of the body, the skeleton has protective and storage functions. It protects the internal organs, including the brain, spinal cord, heart, lungs, and pelvic organs. The bones of the skeleton serve as the primary storage site for important minerals such as calcium and phosphate. The bone marrow found within bones stores fat and houses the blood-cell producing tissue of the body. These bones can be grouped in two divisions: axial skeleton and appendicular skeleton. The 80 bones of the axial skeleton form the vertical axis of the body. They include the bones of the head, vertebral column, ribs and breastbone or sternum. The appendicular skeleton consists of 126 bones and includes the free appendages and their attachments to the axial skeleton. The free appendages are the upper and lower extremities, or limbs, and their attachments which are called girdles. The named bones of the body are listed below by category.

### **Axial Skeleton (80 bones)**

The skeleton is subdivided into two major divisions—the axial and appendicular. The **axial skeleton** forms the vertical, central axis of the body and includes all bones of the head, neck, chest, and back ([link]). It serves to protect the brain, spinal cord, heart, and lungs. It also serves as the attachment site for muscles that move the head, neck, and back, and for muscles that act across the shoulder and hip joints to move their corresponding limbs.

The axial skeleton of the adult consists of 80 bones, including the **skull**, the **vertebral column**, and the **thoracic cage**. The skull is formed by 22 bones. Also associated with the head are an additional seven bones, including the **hyoid bone** and the **ear ossicles** (three small bones found in each middle ear). The vertebral column consists of 24 bones, each

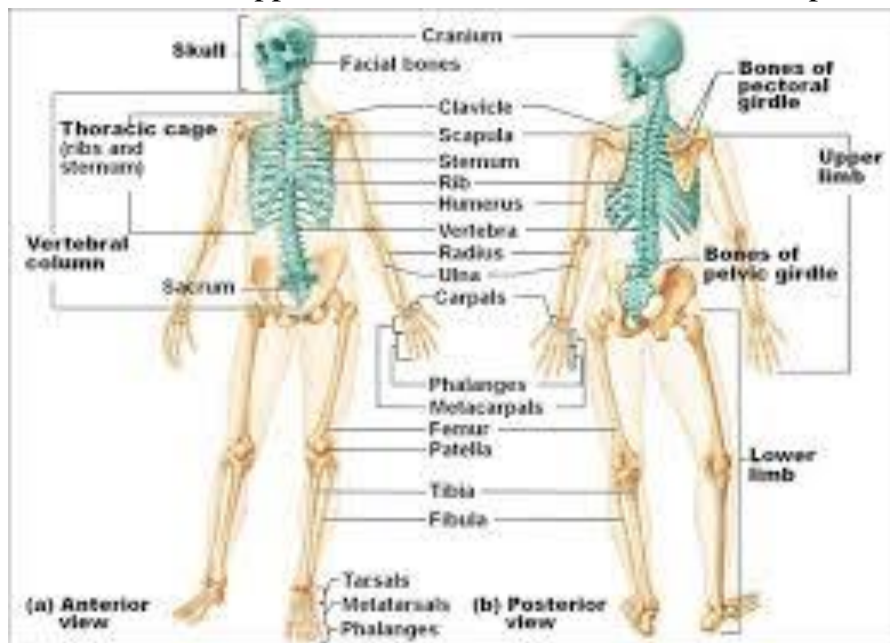
called a **vertebra**, plus the **sacrum** and **coccyx**. The thoracic cage includes the 12 pairs of **ribs**, and the **sternum**, the flattened bone of the anterior chest.

### Axial and Appendicular Skeleton

The axial skeleton supports the head, neck, back, and chest and thus forms the vertical axis of the body. It consists of the skull, vertebral column (including the sacrum and coccyx), and the thoracic cage, formed by the ribs and sternum. The appendicular skeleton is made up of all bones of the upper and lower limbs.

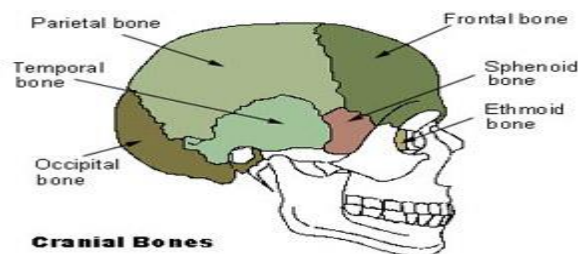
### The Appendicular Skeleton

The **appendicular skeleton** includes all bones of the upper and lower limbs, plus the bones that attach each limb to the axial skeleton. There are 126 bones in the appendicular skeleton of an adult. The bones of the appendicular skeleton are covered in a separate chapter.



### Skull (28)

bony structure that forms the head, face, and jaws, and protects the brain; consists of 22 bone.

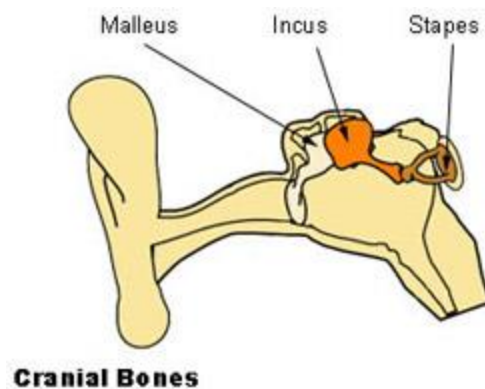


## **Cranial Bones**

- Parietal (2)
- Temporal (2)
- Frontal (1)
- Occipital (1)
- Ethmoid (1)
- Sphenoid (1)

## **Facial Bones**

- Maxilla (2)
- Zygomatic (2)
- Mandible (1)
- Nasal (2)
- Platine (2)
- Inferior nasal concha (2)
- Lacrimal (2)
- Vomer (1)



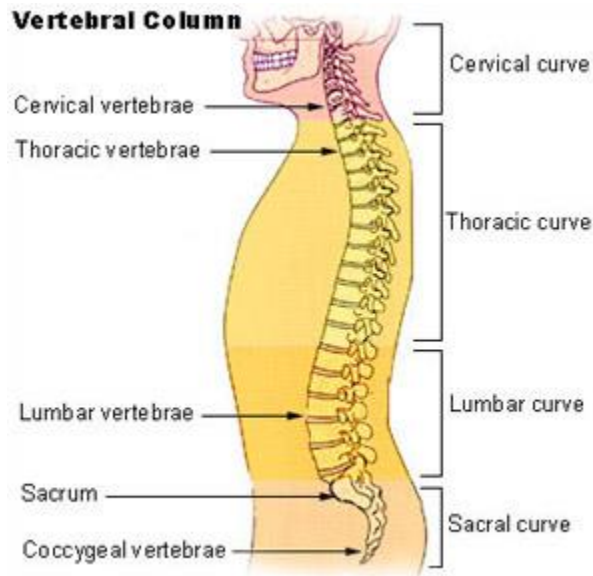
## **Auditory Ossicles**

three small bones located in the middle ear cavity that serve to transmit sound vibrations to the inner ear

- Malleus (2)
- Incus (2)
- Stapes (2)

## **Hyoid (1)**

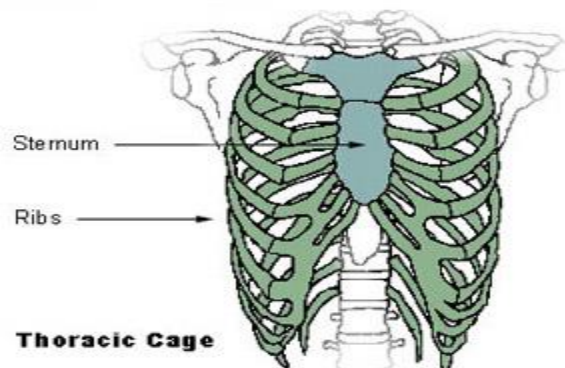
small, U-shaped bone located in upper neck that does not contact any other bone



## Vertebral Column

- Cervical vertebrae (7)
- Thoracic vertebrae (12)
- Lumbar vertebrae (5)
- Sacrum (1)
- single bone located near the inferior end of the adult vertebral column that is formed by the fusion of five sacral vertebrae; forms the posterior portion of the pelvis
- Coccyx (1)
- small bone located at inferior end of the adult vertebral column that is formed by the fusion of four coccygeal vertebrae; also referred to as the “tailbone”

entire sequence of bones that extend from the skull to the tailbone



## **Thoracic Cage**

consists of 12 pairs of ribs and sternum

- Sternum (1)

flattened bone located at the center of the anterior chest

- Ribs (24)

thin, curved bones of the chest wall

## **Appendicular skeleton**

The appendicular skeleton is composed of 126 bones and it comprises of the-

1. Pelvic girdle
2. Upper Limbs
3. Lower Limbs
4. Shoulder Girdle or the Pectoral

## **Skeletal System Physiology**

The primary functions of the skeletal system include movement, support, protection production of blood cells, storage of minerals and endocrine regulation.

### **Support**

The primary function of the skeletal system is to provide a solid framework to support and safeguard the human body and its organs. This helps in maintaining the overall shape of the human body.

Also check: Function of Short Bones

### **Protection**

The skeletal system also helps to protect our internal organs and other delicate body organs, including the brain, heart, lungs and spinal cord by acting as a buffer. Our cranium (skull) protects our brain and eyes, the ribs protect our heart and lungs and our vertebrae (spine, backbones) protect our spinal cord.

### **Movement**

Bones provide the basic structure for muscles to attach themselves onto so that our bodies are able to move. Tendons are tough inelastic bands that attach our muscle to that particular bone.

Also read: Femur Structure and Function

### **Storage**

The bone matrix of the skeletal system is mainly involved in storing or preserving different types of essential minerals which are required to facilitate growth and repair of the body

cells and tissues. The cell-matrix acts as our calcium bank by storing and releasing calcium ions into the blood cell when required.

### **Regulation of Endocrine glands**

The bone cells present within the skeletal system plays an important role in releasing the synthesized hormones from the respective endocrine glands for the further requirement by the body for different metabolisms. Apart from these functions, the skeletal system also contributes to the regulation of blood sugar.

#### Types of joints and function

One of the key characteristics that distinguish living organisms from non-living is the ability to locomote and move. This is feature is crucial for survival as living organisms need to adapt to their environment and cater to their own biological needs such as food, self-preservation, and mating.

Most living organisms have their own special systems for locomotion and movement. These might include rudimentary structures such as cilia, flagella or much more complex structures like wings or feet. Furthermore, scientists have theorized that locomotion and movement have significantly contributed to man's evolutionary process – from being quadrupedal to bipedal and increase in the brain's volume.

Locomotion is the ability to move from one place to another. The major key factors that help in locomotion are bones and muscles. In humans and other vertebrates, the bones form a framework called the skeletal system that provides structure and shape. Furthermore, these bones allow movement through different types of joints.

### **Joints**

A joint, also known as an articulation or articular surface, is a connection that occurs between bones in the skeletal system. Joints provide the means for movement. The type and characteristics of a given joint determine its degree and type of movement. Joints can be classified based on structure and function.

The joints help us to rotate our shoulder, bend our knees and elbows, swivel our neck and more. By definition, a joint is a point where two bones meet to provide a framework that permits movement. Bones are attached to one another by tissues called ligaments. Muscles are attached to bones through tendons.

#### **Explore more: Joints**

### **Classification of Joints**

There are two different types of joints- Structural and Functional classification of joints.

- **Structural classification of joints.**

According to the structural classification of joints, they are divided into 3 types, namely:

## **Fibrous Joints**

Fixed joints, also called immovable joints, are found where bones are not flexible. In such joints, bones have been fused together in such a way that they are fixed to that part, most commonly to create a structure. A prominent example of a fixed joint is the skull, which is made up of a number of fused bones.

Other examples include the upper jaw, rib cage, backbone, and pelvic bone, etc.

## **Cartilaginous Joints**

Cartilaginous joints are partly movable joints comprising of symphysis or synchondrosis joints. These joints occur only in those regions where the connection between the articulating bones is made up of cartilage. Synchondrosis are temporary cartilaginous joints which are present in young children and last until the end of their puberty.

For example, the epiphyseal plates present at each end of the long bones is responsible for bone growth in children. The symphysis or the secondary cartilaginous joints (the place where bones join) is permanent. Examples include the pubic symphysis. Other examples of cartilaginous types of joints include the spinal column and the ribcage.

## **Synovial Joints**

The synovial joints are the most common type of joint because this joint helps us to perform a wide range of motion such as walking, running, typing and more. Synovial joints are flexible, movable, can slide over one another, rotatable and so on. These joints are found in our shoulder joint, neck joint, knee joint, wrist joint, etc.

- **Functional classification of joints.**

Functional classification of joints is based on the type and degree of movement permitted. Based on the type and degree of movement permitted. There are six types of freely movable joint and are mentioned below with the examples:

## **Ball and Socket Joints**

Here, one bone is hooked into the hollow space of another bone. This type of joint helps in rotatory movement. An example ball and socket joint are the shoulders.

## **Pivotal Joints**

In this type of joint, one bone has tapped into the other in such a way that full rotation is not possible. This joint aid in sideways and back-forth movement. An example of a pivotal joint in the neck.

### **Hinge Joints**

Hinge joints are like door hinges, where only back and forth movement is possible. Example of hinge joints is the ankle, elbows, and knee joints.

### **Saddle Joints**

Saddle joint is the biaxial joint that allows the movement on two planes—flexion/extension and abduction/adduction. For example, the thumb is the only bone in the human body having a saddle joint.

### **Condyloid Joints**

Condyloid joints are the joints with two axes which permit up-down and side-to-side motions. The condyloid joints can be found at the base of the index finger, carpals of the wrist, elbow and the wrist joints. This joint is also known as a condylar, or ellipsoid joint.

### **Gliding Joints**

Gliding joints are a common type of synovial joint. It is also known as a plane or planar joint. This joint permit two or more round or flat bones to move freely together without any rubbing or crushing of bones. This joint is mainly found in those regions where the two bones meet and glide on one another in any of the directions. The lower leg to the ankle joint and the forearm to wrist joint are the two main examples of gliding joints.