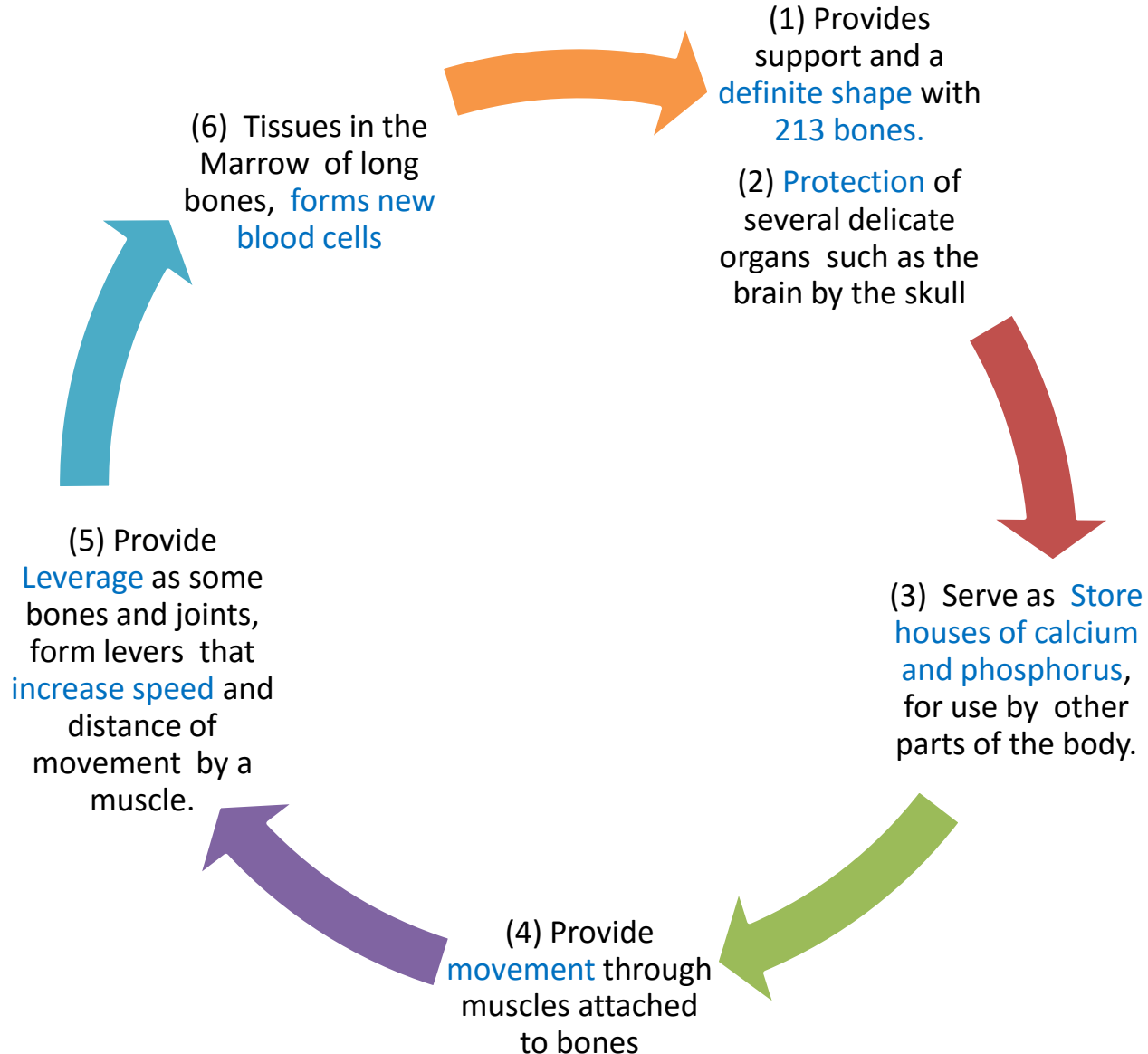


# 15. Movement and Locomotion

Fundamentals of Biology for  
competitive exams

# Ch. 15. Movement and Locomotion: Functions of Human Skeleton



## The constituents of Skeleton include -

(a) **Bones**: consist of **organic and inorganic** substances. 2/3<sup>rd</sup> of bone structure is inorganic. If its inorganic substances are removed by dissolving them in weak hydrochloric acid, the organic part of the bone remains. This is as soft as cloth, and can be tied into a knot.

If the bone is heated strongly, its organic matter gets destroyed or oxidized, and the mineral part turns into ash.

(b) **Cartilages**: support and connect and give shape to external projections such as nose and ears.

(c) **Ligaments** : that bind the bones together.

On basis of shape, bones are classified as (a) long (b) short (c) flat (d) Irregular

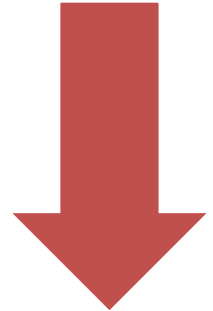
# Bones and Joints

Long bones are **highly mineralised** or calcified. They are hard and rigid with connective tissues. They can withstand severe stress.

**Bone cells are called Osteocytes.** These are arranged in the form of concentric rings, embedded in a ground matrix, where **collagen fibres** and **mineral salts** (calcium and phosphorus) are deposited.

The external surface of the long bone is covered by a **membrane** called **periosteum**. Periosteum consists of outer fibrous and inner cellular layers, that are richly supplied with blood vessels.

Bone marrow at the centre, is of two types (a) **Yellow marrow** is the central portion and (b) **Red marrow** is at both its ends. The red marrow produces red blood cells.



**A Joint** is the point where two bones meet .

**Kinds of Joints:** These are of three kinds

(a) Immovable Joints ( 8 in the cranium )

(b) Partially Movable Joints ( Between vertebrae )

(c) Freely movable Joints that are further sub divided as Gliding joints, Pivot joints, Hinge joints, and Ball and Socket joints.



# Divisions of the Skeleton



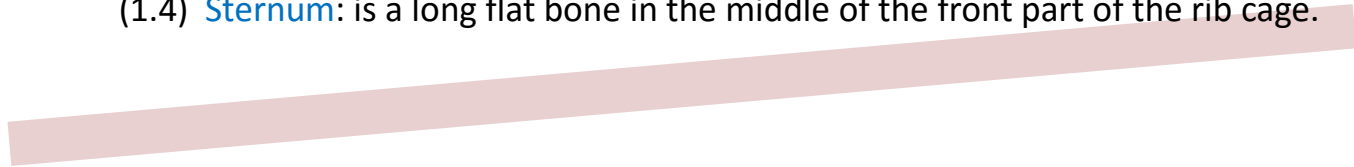
**Skeleton has two main divisions:** (1) axial skeleton with central framework and (2) Appendicular skeleton with four limbs.

(1) Axial Skeleton: (1.1) **Skull** with (a) Cranium of 8 bones and (b) a **foramen magnum** at its base for spinal cord.

(1.2) **Vertebral Column:** 33 bones called vertebrae. Vertebrae have a ring like structure, with a solid cylinder shaped centrum, a neural canal, two neural arches. Two Neck cervical vertebrae called atlas and axis. Thoracic vertebrae have long neural spines directed backwards, that fit into the tubercle of the ribs. Lumbar vertebrae have well developed spines to which the powerful back muscles are attached. Sacrum is a large bone formed by the fusion of five vertebrae. Coccyx is a single bone formed by the fusion of four vertebrae.

(1.3) **Ribs:** 12 pairs of ribs + thoracic vertebrae + sternum = the bony cage. First 7 pairs are the true ribs that are attached to the sternum in front by hyaline cartilage. 8<sup>th</sup>, 9<sup>th</sup>, and 10<sup>th</sup> pair are joined by hyaline cartilage, to the 7<sup>th</sup> rib pair. 11<sup>th</sup> and 12<sup>th</sup> pairs are 'floating ribs' as they remain suspended freely without being attached to any bone.

(1.4) **Sternum:** is a long flat bone in the middle of the front part of the rib cage.



(2) **Appendicular skeleton:** Bones of limbs and girdles. (2.1) Bones of the four limbs correspond to each other. Upper limbs have a single long bone below the elbow called '**humerus**' with two long bones in the upper arm called the '**radius**' and '**ulna**'. The **Wrist** has 8 **carpals**, 5 **metacarpals** in the palm, and 14 **phalanges** in fingers and thumb. The lower limbs have the **longest bone femur** above the knee, **tibia and fibula** below the knee. **The Ankle** has 7 **tarsals**, 5 long **metatarsals** in middle foot, and 14 **phalanges** in toes. The **knee cap** is a special bone developed from a tendon, and is called **patella**. (2.2) **Girdles:** Shoulder girdles and hip girdles. The shoulder or pectoral has two flat triangular scapula or shoulder blades and glenoid cavity. The hip or pelvic girdle is trough shaped formed by the two hip bones. On each side is a large articular cavity or acetabulum.

# Muscles

The movement of Voluntary muscles can be controlled, but the movement of involuntary muscles cannot be consciously controlled. Muscles of the heart , stomach and the lungs are involuntary muscles

Provide the means of all movements. Muscles that cause opposing movements to bring the movable muscle back to its position, are called antagonistic muscles. ( biceps, triceps.)

Muscles are bundles of contractile tissues, having two ends. One is fixed and the other is movable. The movable end has tendons attached to the bone.

Cover the skeletal framework and give shape to the body.

Help maintaining posture while, sitting, standing, walking. Muscles of the limbs are based on principles of lever.