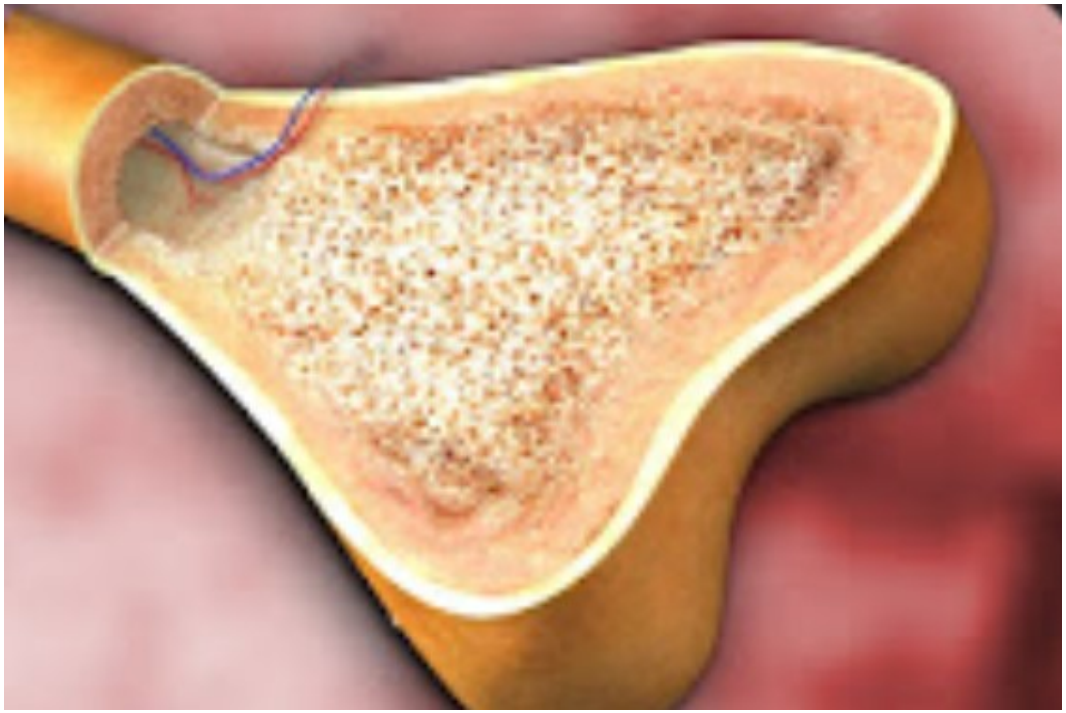
PROPERTIES AND STRUCTURE OF BONES

COMPOSITION OF BONES

- The bone is composed of **organic** and **inorganic** matters.
- Roughly it contains **30% organic** and **70% inorganic** matter and this proportion varies with the bones in different parts of the body.
- The proportion varies with the age and there is **high percentage of organic matter in growing animals**, which is slowly replaced by inorganic matter.

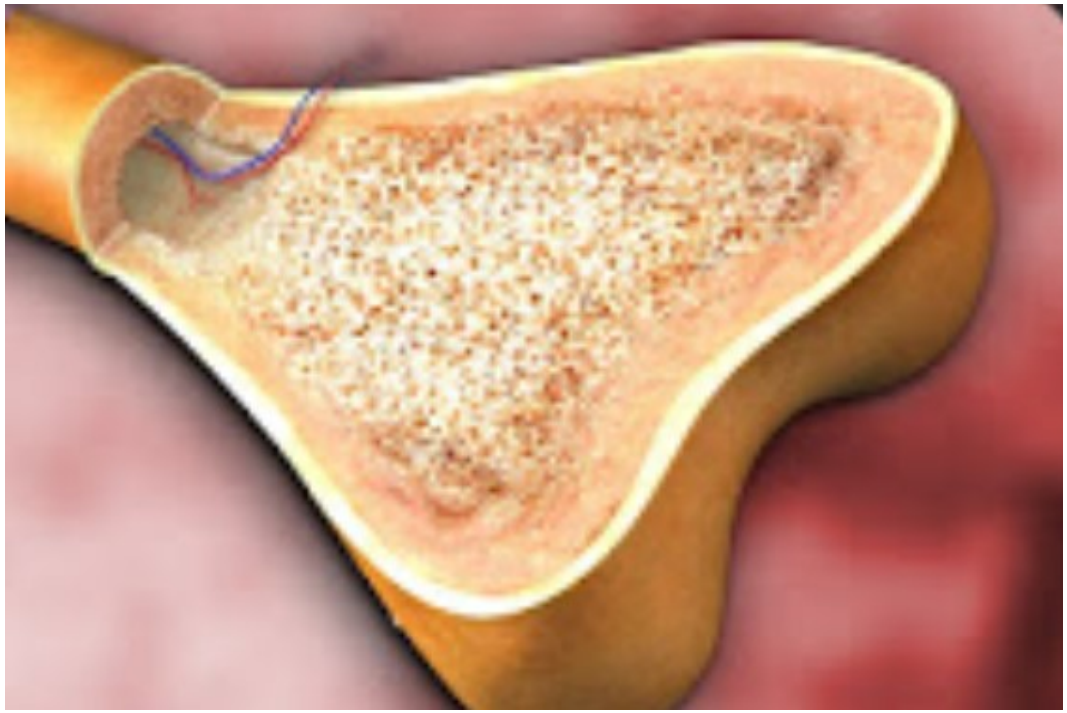
Organic matter

- It is present in the bone are **bone cells, collagen fibres and matrix or the intercellular substance**.
- The organic matter chiefly consists of the fibrous protein - collagen and ossein and chondroitin sulphate.
- The organic part contributes to the **flexibility**.



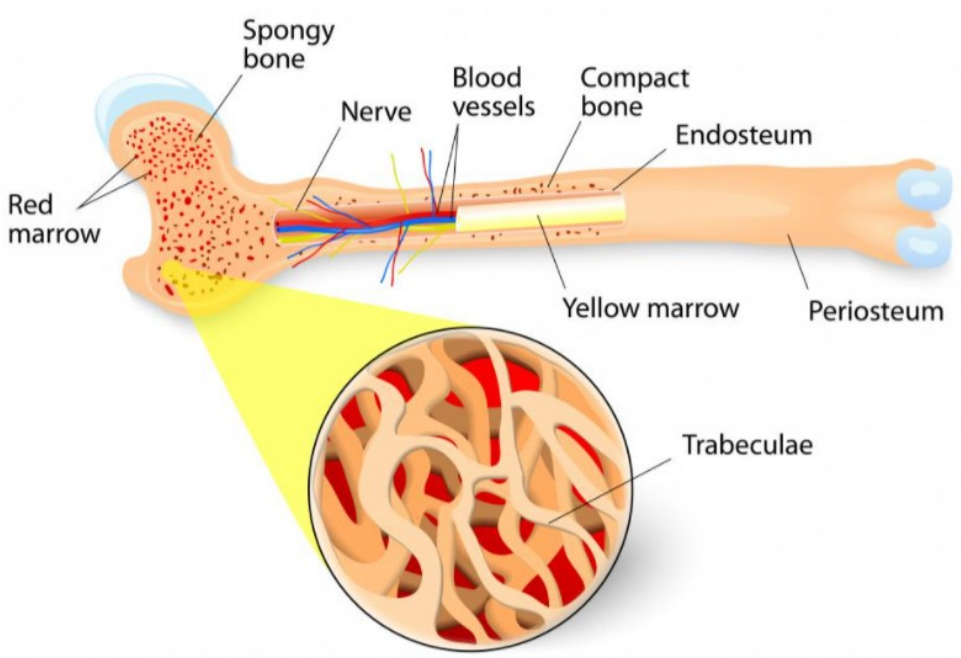
Inorganic matter

- It consists mostly of **calcium phosphate** (about 86%), and small amounts of **calcium carbonate** (5.8%), **magnesium phosphate** (3%), **sodium carbonate and sodium chloride** (5.2%).
- The inorganic salts are responsible for the **rigidity and hardness** of bone.



STRUCTURE OF BONE

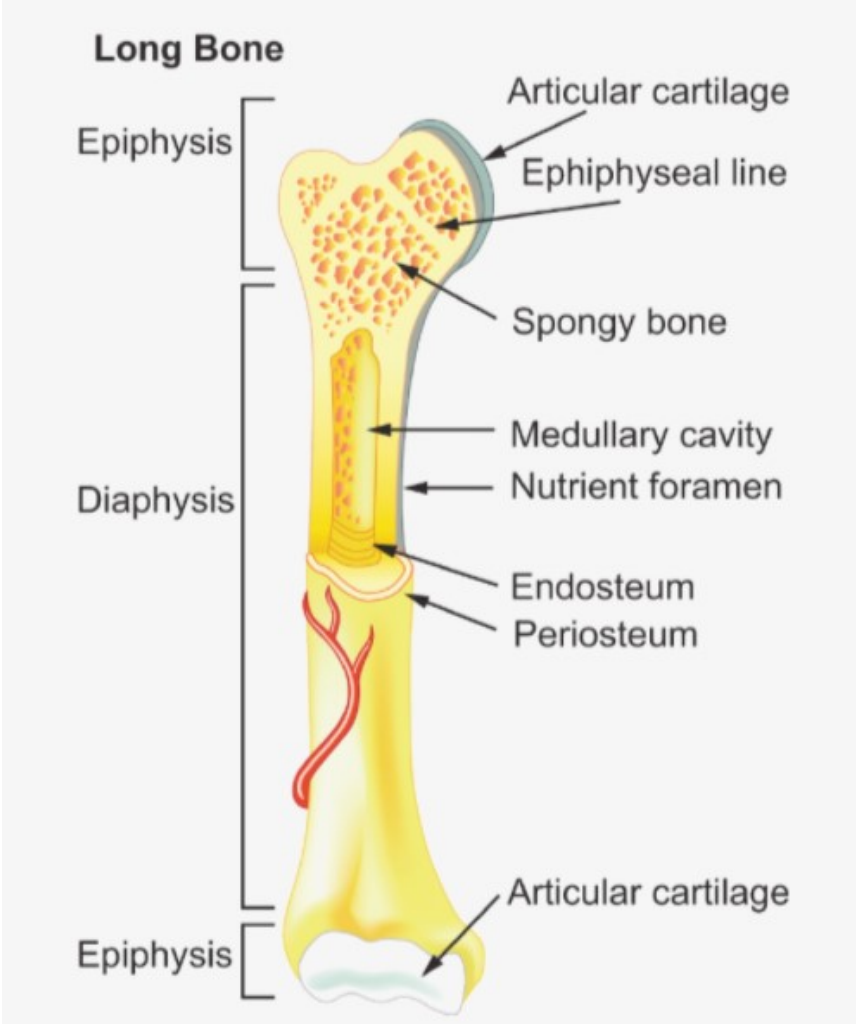
- Bones are composed of two types of substances- **compact and spongy.**
- In a long bone there remains a large elongated cavity within the body known as **marrow cavity**. The cavity remains filled up by bone marrow.
- In spongy bones there are plenty of small spaces which also remain occupied by the bone marrow.



STRUCTURE OF BONE

- The outer surface of a bone is covered by a membrane except where it is covered by a cartilage. This membrane is known as **periosteum**.

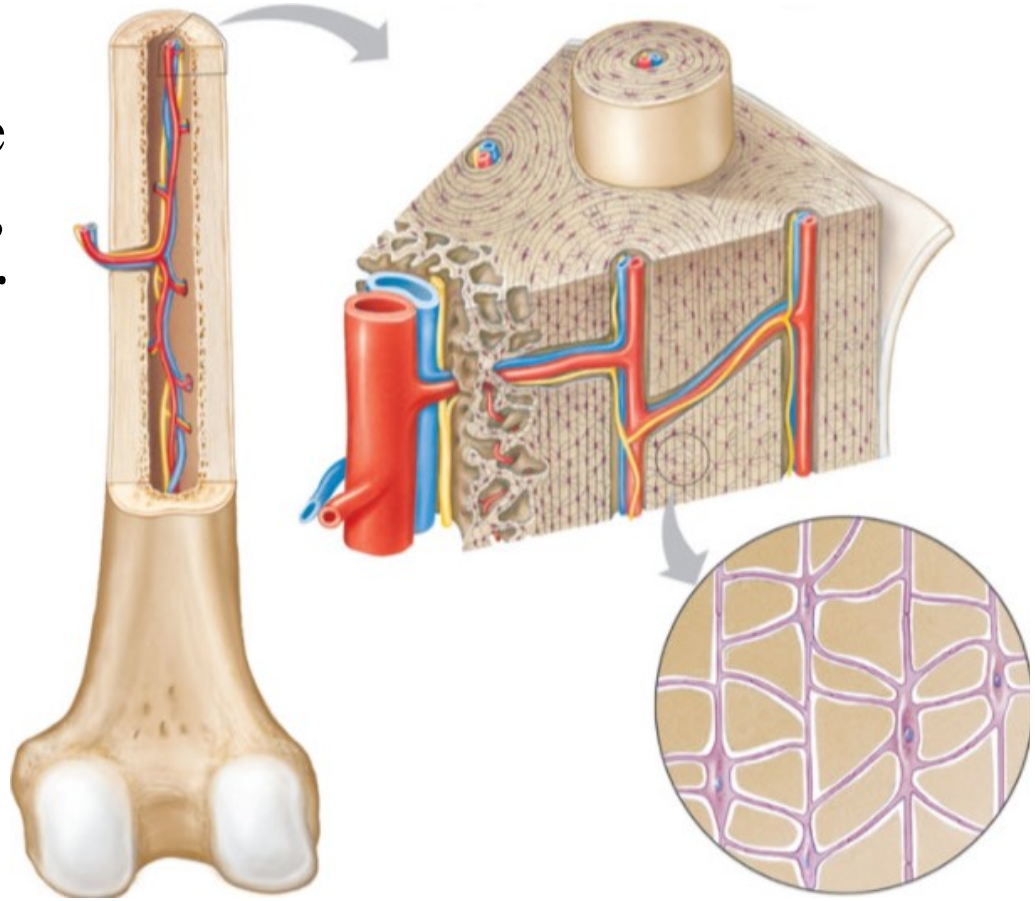
- A thin membrane also invests the medullary cavity is known as **endosteum**.
- The cartilage which covers the articular surface of a bone is known as **articular cartilage**.



Compact bone

- A **dense and hard** substance situated at the external aspect of the bone and surrounds spongy substance.
- In the long bones the compact substance is **thin at the ends and very thick at the body.**

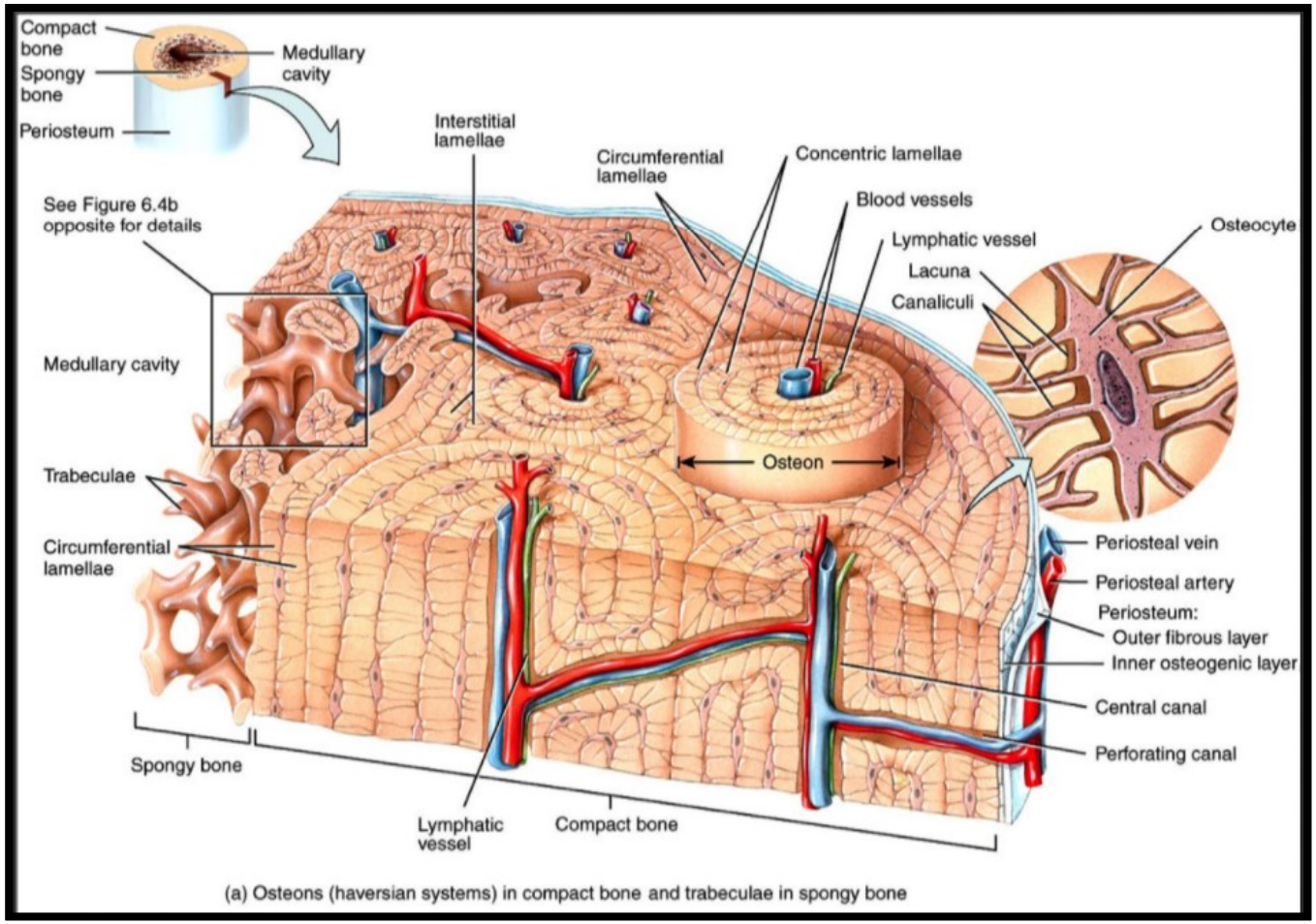
➢It comprises of a bony tissue arranged in a definite pattern, known as **Haversian system or osteons.**



Haversian system or osteons

- Numerous very narrow canals pass through the compact substance along the length of the bone are known as **Haversian canals**, which carry blood vessels and nerves.

- Around these canals bone matrix is present in the form of several **concentric lamellae.**

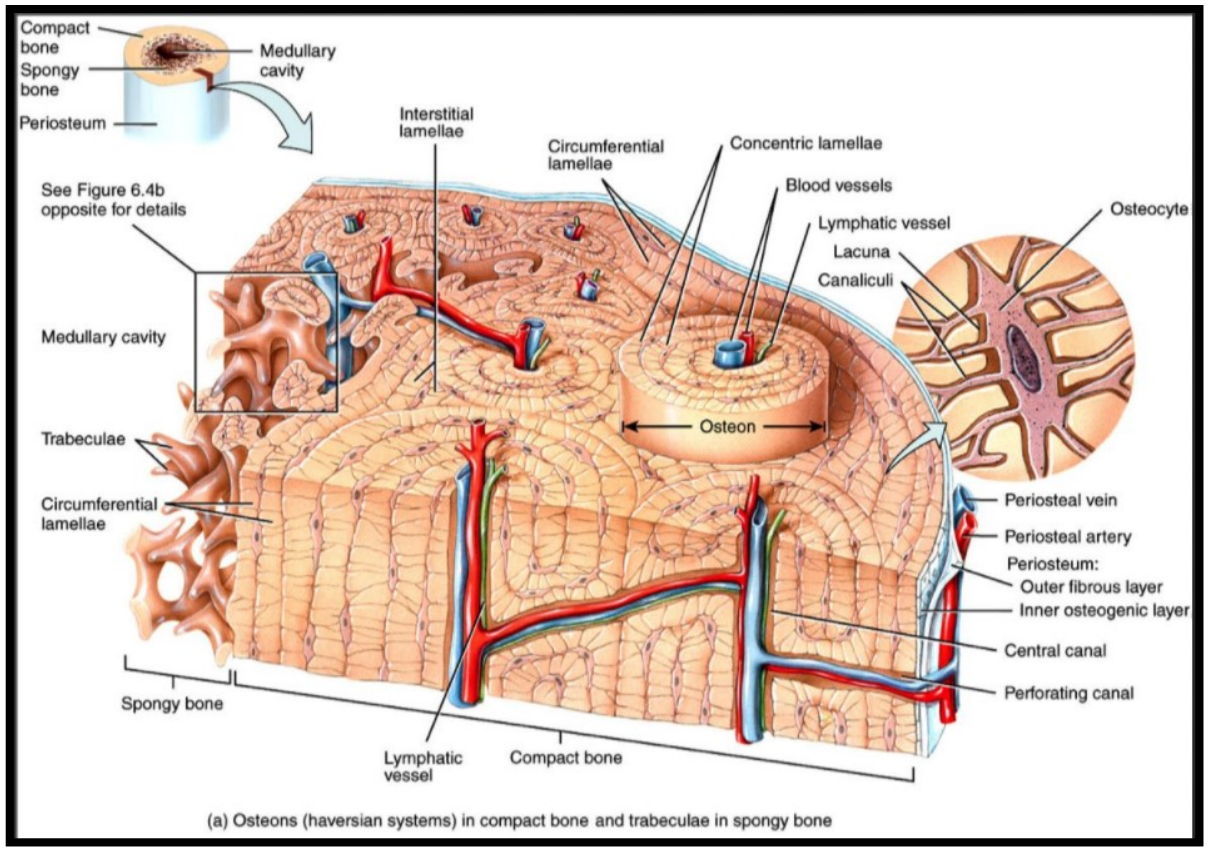


(a) Osteons (haversian systems) in compact bone and trabeculae in spongy bone

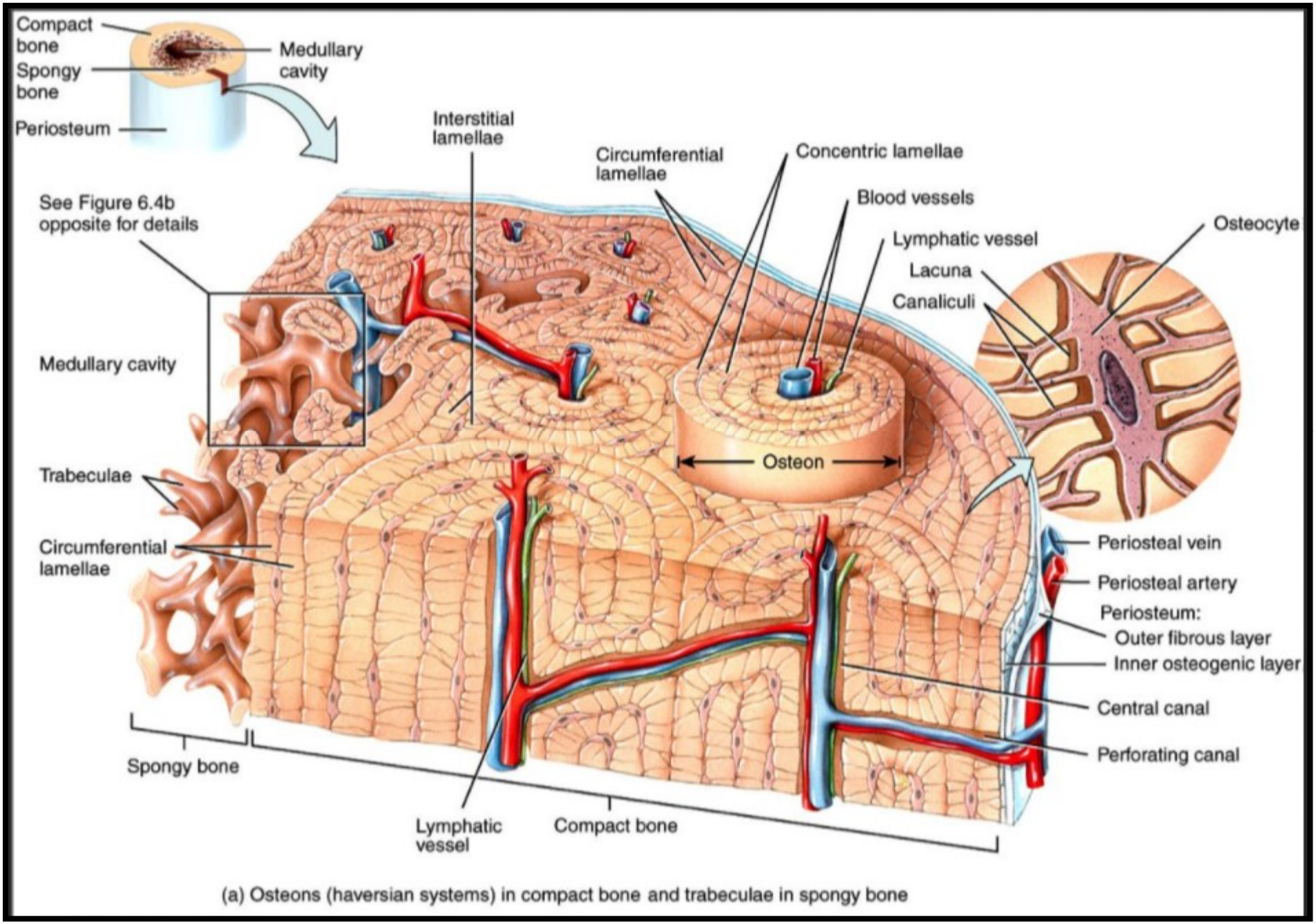
Haversian system or osteons

- In between the lamellae there are minute spaces known as **lacunae** which give accommodation to the **bone cells- the osteocytes**.
- Very minute canals radiate from these lacunae to accommodate the **processes of bone cells**. These are called **canaliculi.**

- All these structures, i.e.. the **Haversian canal, the lamellae, lacunae and canaliculi** constitute the Haversian system.



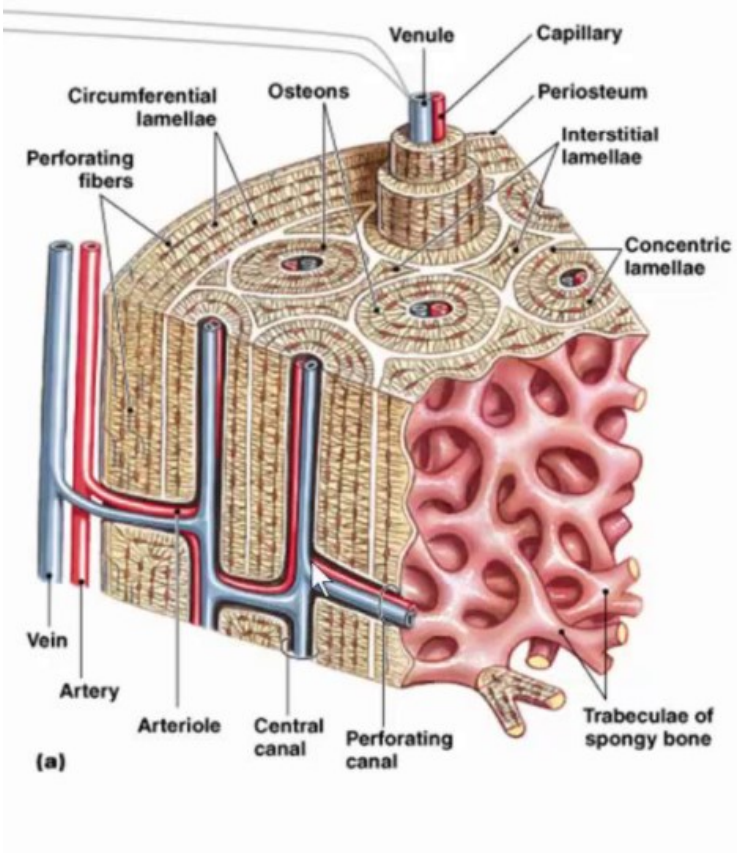
(a) Osteons (haversian systems) in compact bone and trabeculae in spongy bone



(a) Osteons (haversian systems) in compact bone and trabeculae in spongy bone

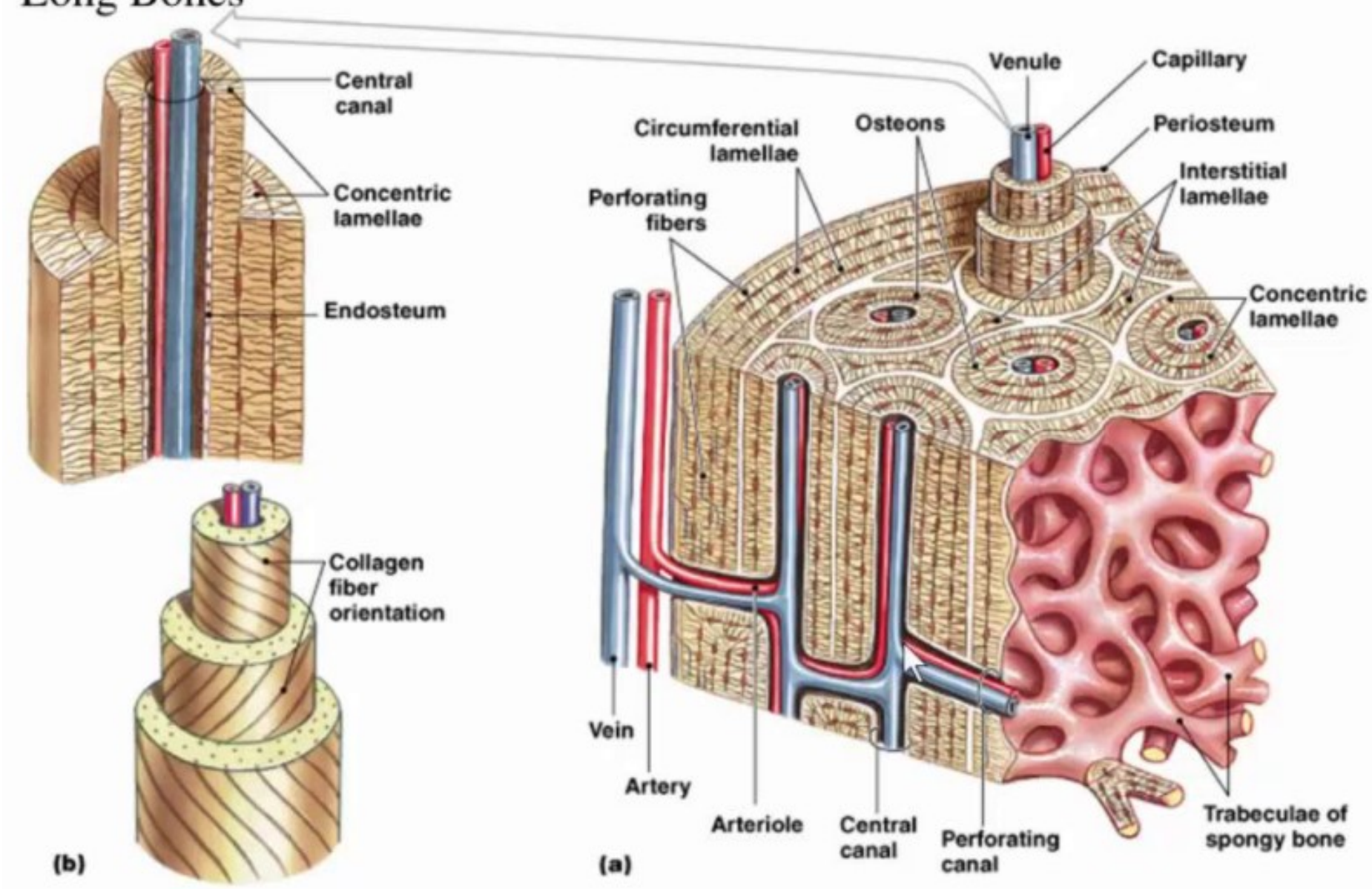
Haversian system or osteons

- In between Haversian systems the triangular areas are filled up by irregular boney deposits called **interstitial lamellae**.
- The Haversian canals communicate with the marrow cavity and with surface of the bones by some **transverse canals** which are not surrounded by boney lamella.



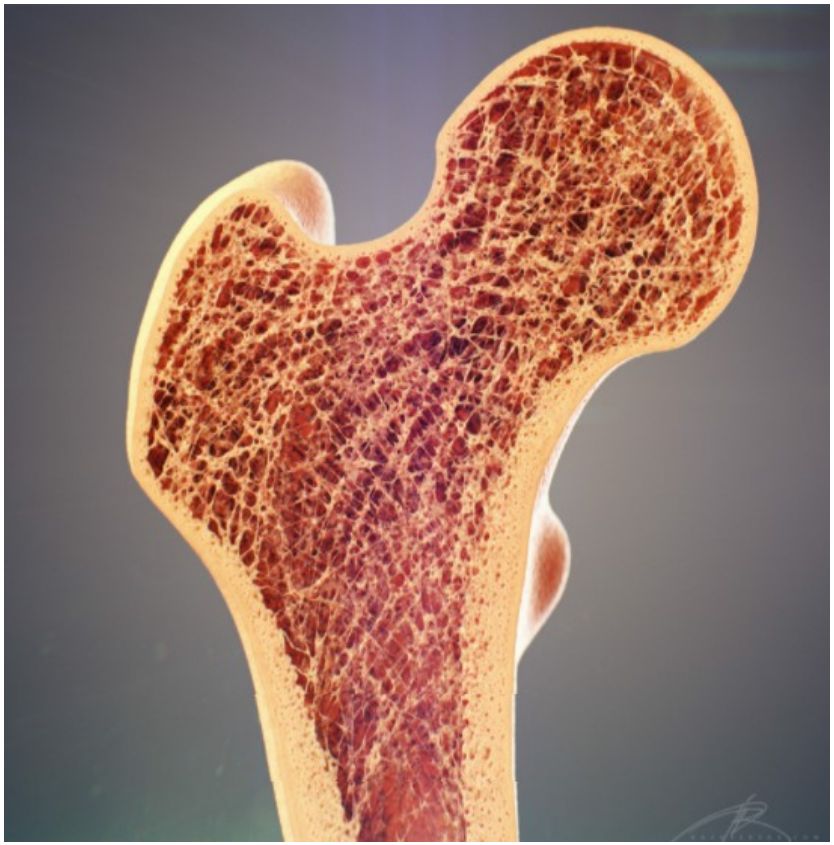
- These transverse canals are known as **Volkmann's canals**. These canals also communicate with the spaces of spongy bone.

Long Bones


Central canal
Concentric lamellae
Endosteum
Collagen fiber orientation
(b)
Venule
Capillary
Circumferential lamellae
Osteons
Periosteum
Interstitial lamellae
Perforating fibers
Concentric lamellae
Vein
Artery
Arteriole
Central canal
Perforating canal
Trabeculae of spongy bone
(a)

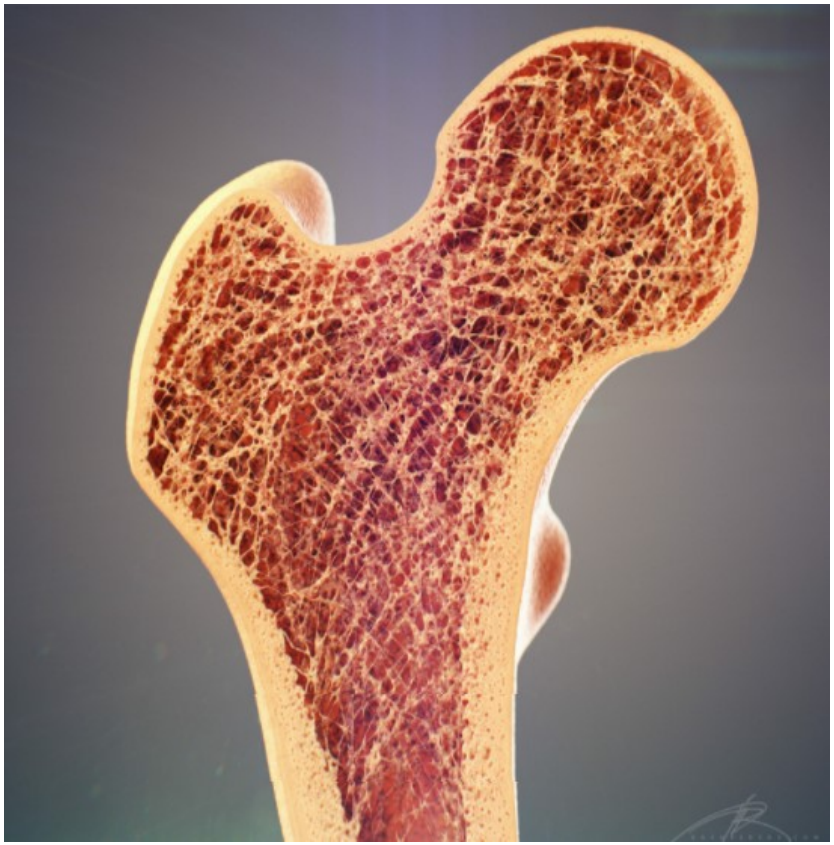
Cancellated or Spongy bone

- It is made up of delicate plates, which intercross each other forming a meshwork with spaces containing marrow.
- Cancellated bone is found in the epiphyses of long bones and is always covered by a layer of compact bone.
- **Haversian systems are absent**.



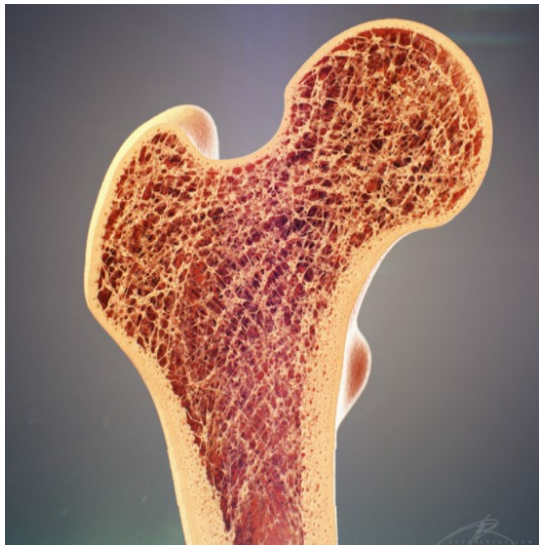
BONE MARROW

- The medullary or marrow cavity of long bones and marrow spaces of all the bones are occupied by a **soft and pulpy tissue**, known as bone marrow.
- There are two kinds of marrow **- red and yellow**.



Red marrow

- It occupies the interstices of spongy bone everywhere and medullary cavity of long bones at birth.
- After birth, the red marrow is gradually replaced by yellow marrow.
- Red marrow is an important **blood forming substance and contains precursors of erythrocytes, granular leukocytes of the blood, giant cells, which give rise to platelets and a few fat cells.**
- In the adult, red marrow is present only in the vertebrae, sternum, ribs, skull bones and epiphyses of long bones.



Yellow marrow

- It consists of **ordinary adipose tissue** especially in the medullary cavity of long bones and short bones.
- Yellow marrow fills the spaces of the spongy bone in **short bones (carpals and tarsals) and medullary cavity of long bones.**

➢Yellow bone marrow stores fat. There are two types of stem cells in yellow bone marrow (adipocytes and mesenchymal stem cells). These cells preserve **fat for energy production and develop bone, cartilage, muscles and fat cells for your body.**

Thank You