

Republic of Iraq
Ministry of higher education and
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Mustansiriyah University
College of science
Department of Biology



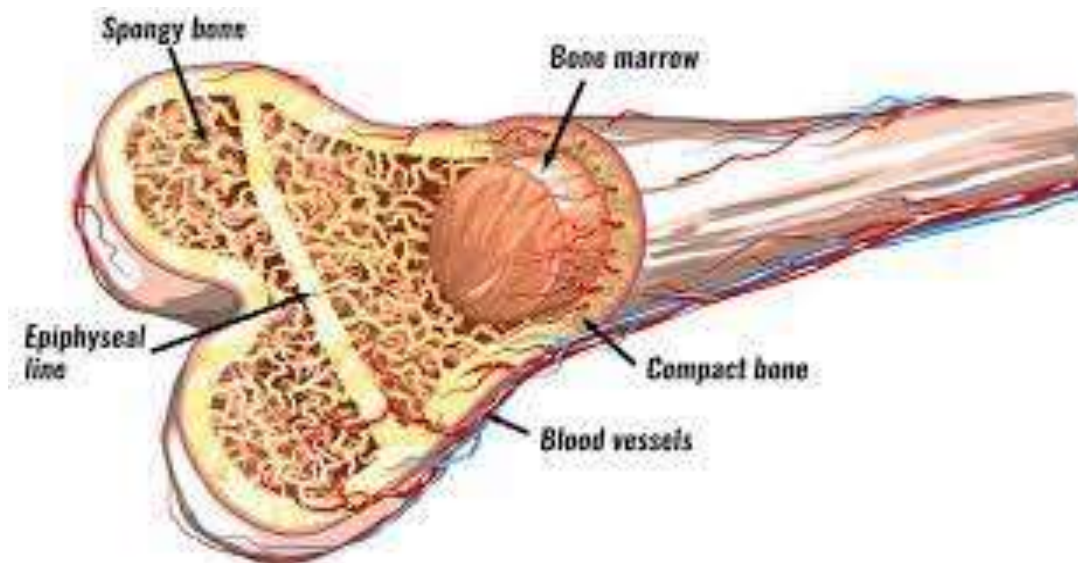
وزارة التعليم العالي والبحث العلمي
الجامعة المستنصرية
كلية العلوم
قسم علوم الحياة

Histology

The Bone

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Bone is a specialized form of dense connective tissue in which the extracellular matrix has been hardened to accommodate a supporting function. The fundamental components of bone, like all connective tissues, are **cells** and **matrix (Fibres and Ground substance)**. There are four key cells of bone tissue.

1. Cells

1. Osteoprogenitor cells (**osteogenic cells**) sites in **an inner layer of periosteum, endosteum, bone marrow cavities**. It is flat cell, flat nucleus and basophilic cytoplasm. They are **capable to divide and give osteoblasts**.



Osteoblasts are oval branched cells with an oval eccentric nucleus, **synthesize the bone matrix and are responsible for its mineralization**. They are derived from osteoprogenitor cells. It site the **same as osteogenic cells**.

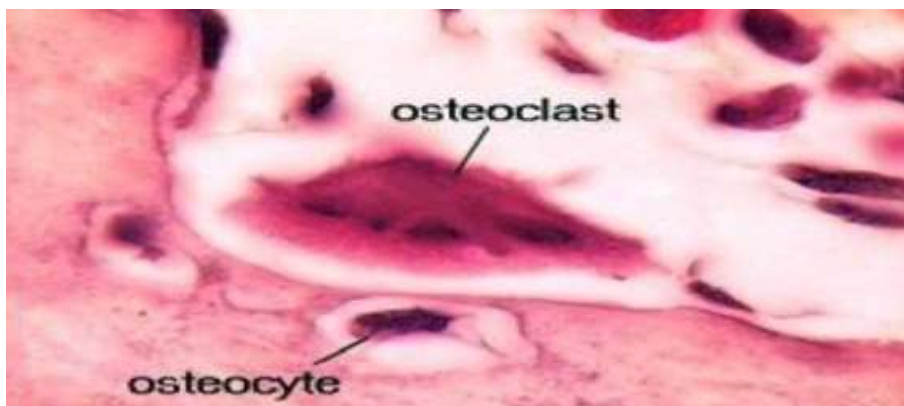


Osteocytes are oval branched cells with an oval centric nucleus, inactive osteoblasts that have become trapped within the bone they have formed. **Present inside lacunae between bone lamellae**. Connected with one another by processes passing through bone **canaliculi**. **Maintain mineral concentration of matrix**.



Osteoclasts break down bone matrix through phagocytosis. They are derived from the **monocyte** (macrophage) cell line. Each cell lies in a shallow cavity called **Howship's lacuna**. Present in Endosteum, at sites of old, injured, or unneeded bone.

They are responsible for Bone resorption.



2. Fibres (95%)- -collagen fibre Type1

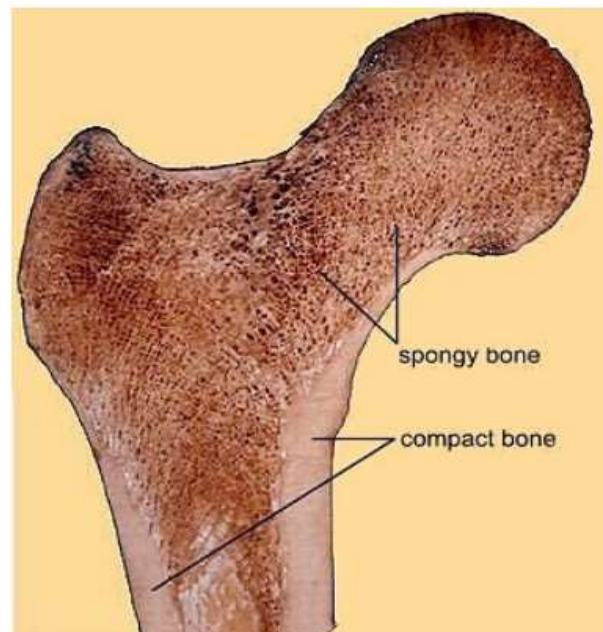
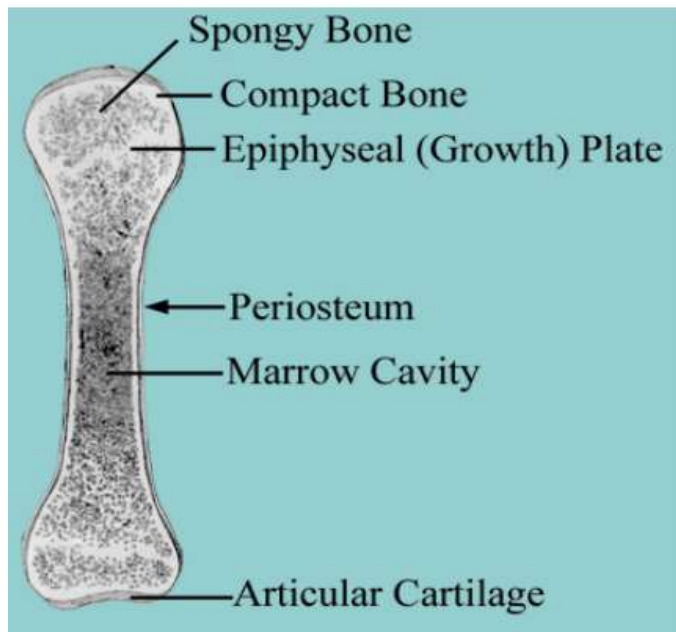
3. Ground substance (5%) Inorganic Part (Calcium phosphate 85%, calcium carbonate 10%) Organic Part (Collagen)

Function of bone

- Makes supportive frame work
- Provide the levers for locomotion by forming articulations
- Give attachment to muscles & ligaments
- Provide mechanical protection to the vital organ
- Store calcium, phosphate and other ions
- Form blood in their marrow
- Bears body weight

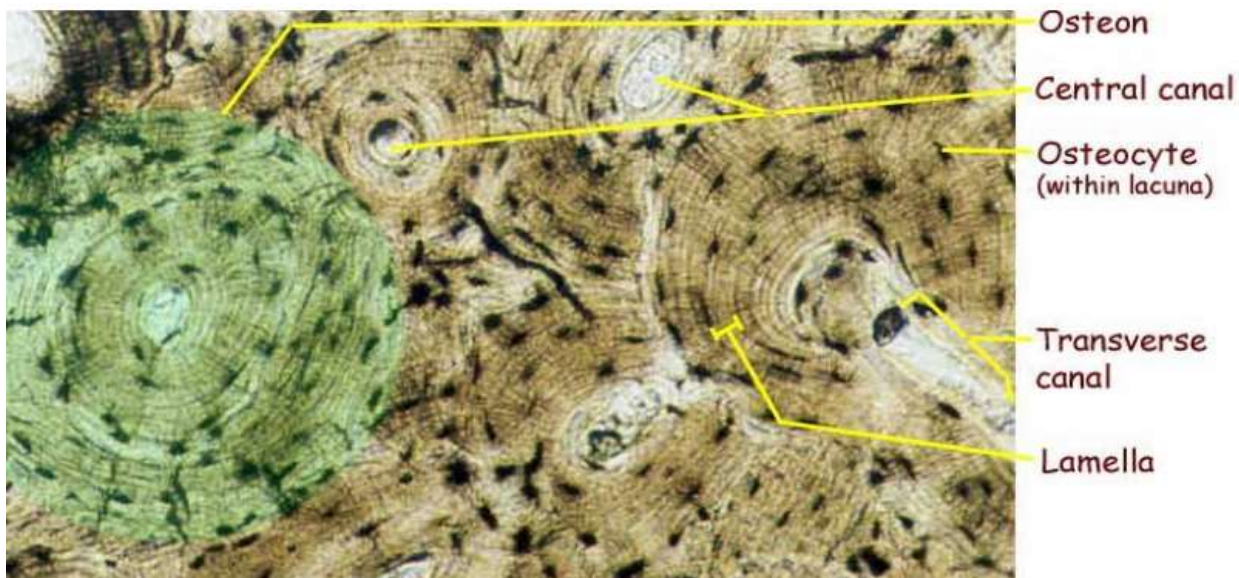
Types of bones

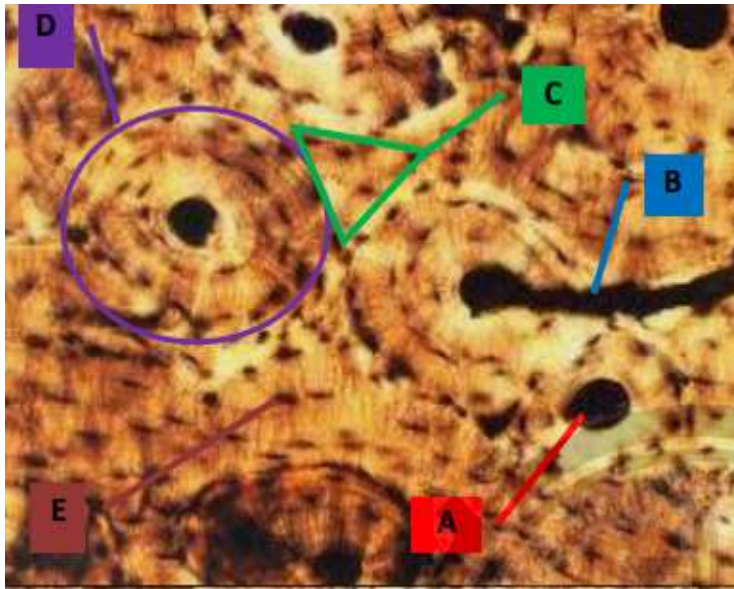
- Compact (Lamellar) bone
- Spongy (cancellous) bone



A-Structure of Compact Bone

- **Circumferential System**
 - ✓ **Periosteal** (The tissue covering the outer surface of bone. It consists of two layers. The outer fibrous layer is rich in blood, lymphatic vessels, and nerves that pass into the bone and inner layer is composed of osteoblasts surrounded by osteoprogenitor cells).
 - ✓ **Endosteal** (A layer of osteoprogenitor cells and osteoblasts that lines medullary cavity and also contains scattered osteoclasts)
- **Haversian System:** Most Characteristic feature. Also Known as **osteon** : IS the Structural and Functional unit of compact bone, Each osteon has four parts:
 - ✓ **The lamellae** concentric rings of extracellular matrix that consist of calcium and phosphates
 - ✓ **Osteocyte** within lacunae,
 - ✓ **Haversian canal** contains blood vessels and nerves.
 - ✓ **Canaliculi** networks of minute canals that project from lacunae containing the processes of osteocytes, their function provide routes for nutrients to reach osteocytes and for wastes to leave them.
- **Interstitial System**





Transverse Section of compact bone

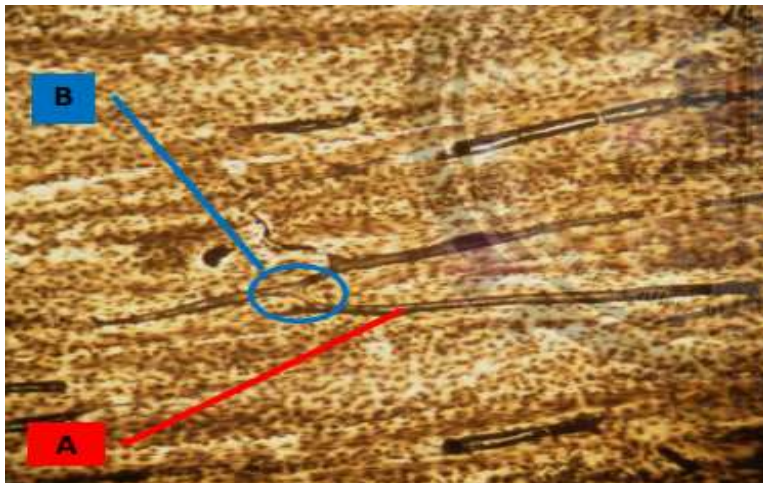
A-Haversian canal

B- Volkmann's canal (connect Haversian canal together)

C- Interstitial lamellae

D- Haversian system

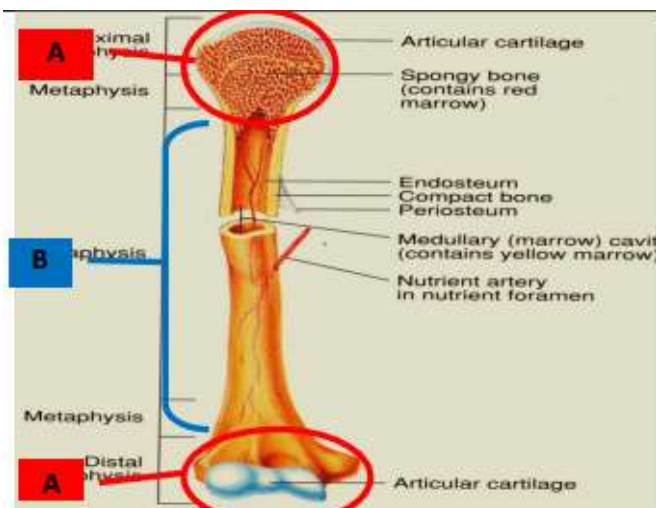
E- Osteocyte



Longitudinal section of compact bone

A-Haversian canal

B- Volkmann's canal



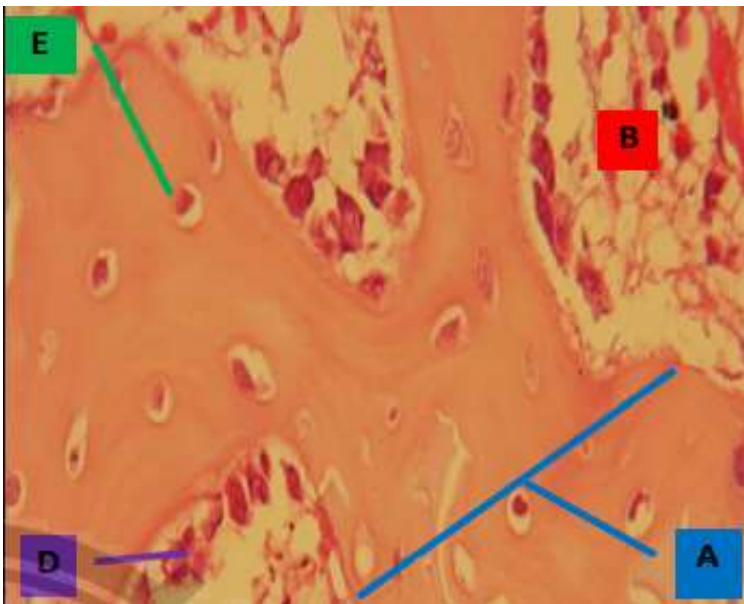
The Long bones

A- Epiphysis (Head of bones)

B- Diaphysis (Shaft of bone)

B- Structure of Spongy (cancellous) bone

- ✓ Spongy bone, also known as **cancellous bone** or **trabecular bone**, is a very porous type of bone.
- ✓ It is highly vascularized and **contains red bone marrow**.
- ✓ Spongy bone is usually **located at the ends of the long bones (the epiphyses)**, with the harder compact bone surrounding it.
- ✓ Spongy bone is softer and weaker than compact bone, but is also **more flexible**.
- ✓ Spongy bone **consists of plates (trabeculae)** of bone adjacent to small, **irregular cavities that contain red bone marrow**
- ✓ Trabeculae contain lamellae, osteocytes, lacunae, and canaliculi

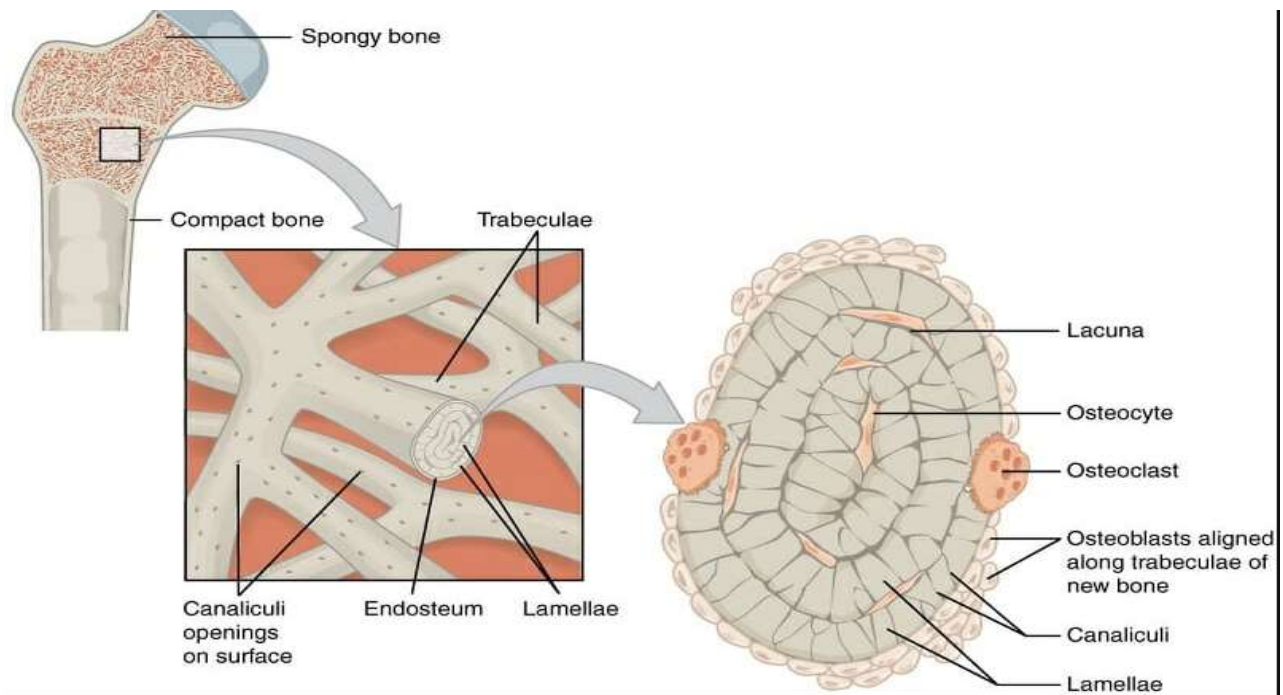


A- Trabecula

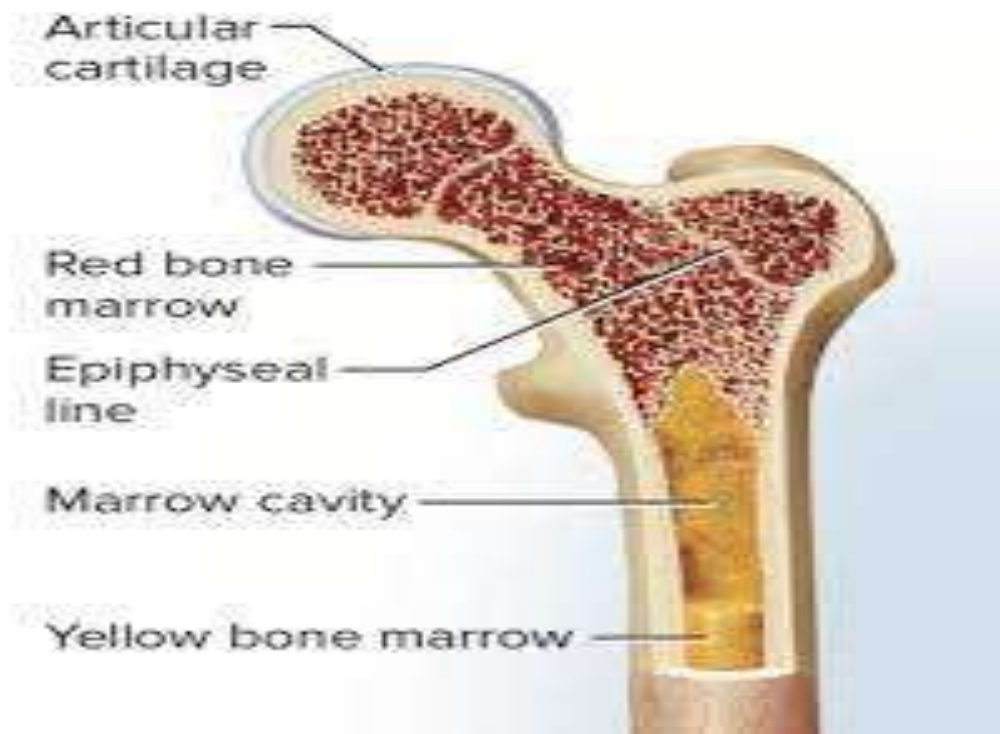
B- Bone marrow

D-osteoblast

E- Osteocyte within lacuna



There are 2 types of bone marrow:



Red bone marrow	Yellow bone marrow
Mainly located in the shoulder blades, skull, and long bones and flat bones (fills the spaces between the spongy bone)	Mainly located in the hollow cavity of long bones
Present from fetal maturity to adulthood	Slowly acts as a replacement of the red bone marrow from the fifth post-natal year onward
Level slowly decreases with age	Level slowly increases with age
Rich in hematopoietic cells	Rich in adipocytes
Color: red	Color: Yellowish
Responsible in the production of platelets, red blood cells, and white blood cells	Responsible for the storage of fats and the release of blood cells during emergency situations
Comprised of active cells that continuously divide and multiply to develop and release blood cells	Comprised of inactive cells that release blood cells in emergency situations