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جامعة المستقبل  
AL MUSTAQBAL UNIVERSITY

## كلية العلوم قسم الأدلة الجنائية

### المحاضرة الثامنة

## Bone & Histogenesis of Bone

المادة : علم الانسجة

المرحلة : الثانية

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## 1. Introduction to Bone

Bone is a specialized connective tissue that forms the skeleton of the human body. It provides support, protection for vital organs, and helps in movement.

Bone tissue is composed of cells embedded in a hard extracellular matrix rich in calcium salts.

### Functions of Bone

#### 1. Support

Bones provide structural support for the body.

#### 2. Protection

Bones protect vital organs such as the brain, heart, and lungs.

#### 3. Movement

Bones work with muscles to allow body movement.

#### 4. Mineral Storage

Bones store important minerals like calcium and phosphorus.

#### 5. Blood Cell Production

Blood cells are produced in the bone marrow.

## 2. Types of Bone

There are two main types of bone tissue:

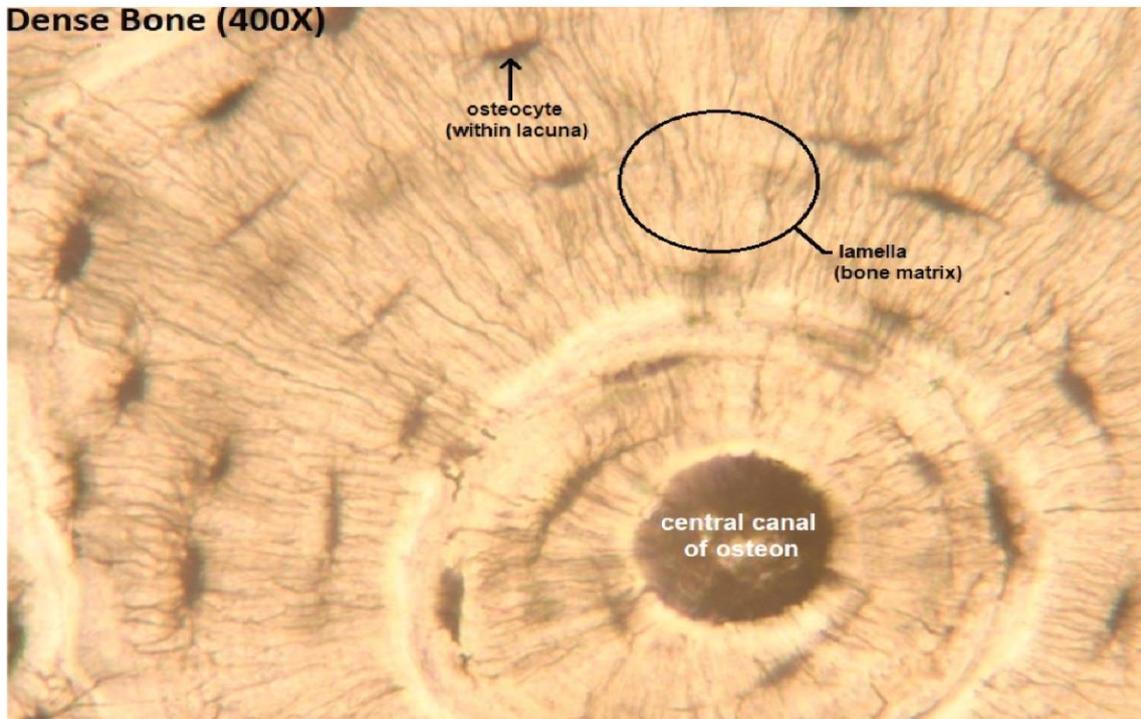
### Compact Bone

- Dense and strong
- Forms the outer layer of bones
- Provides mechanical strength

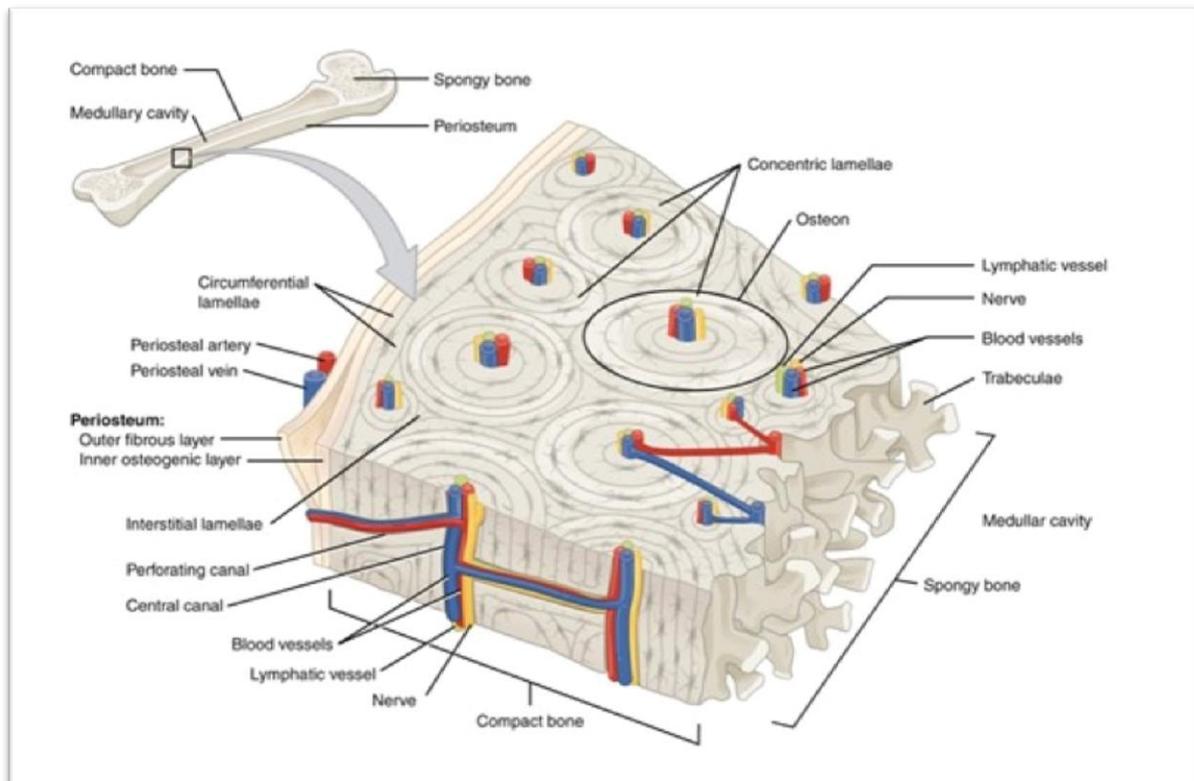
### Spongy Bone

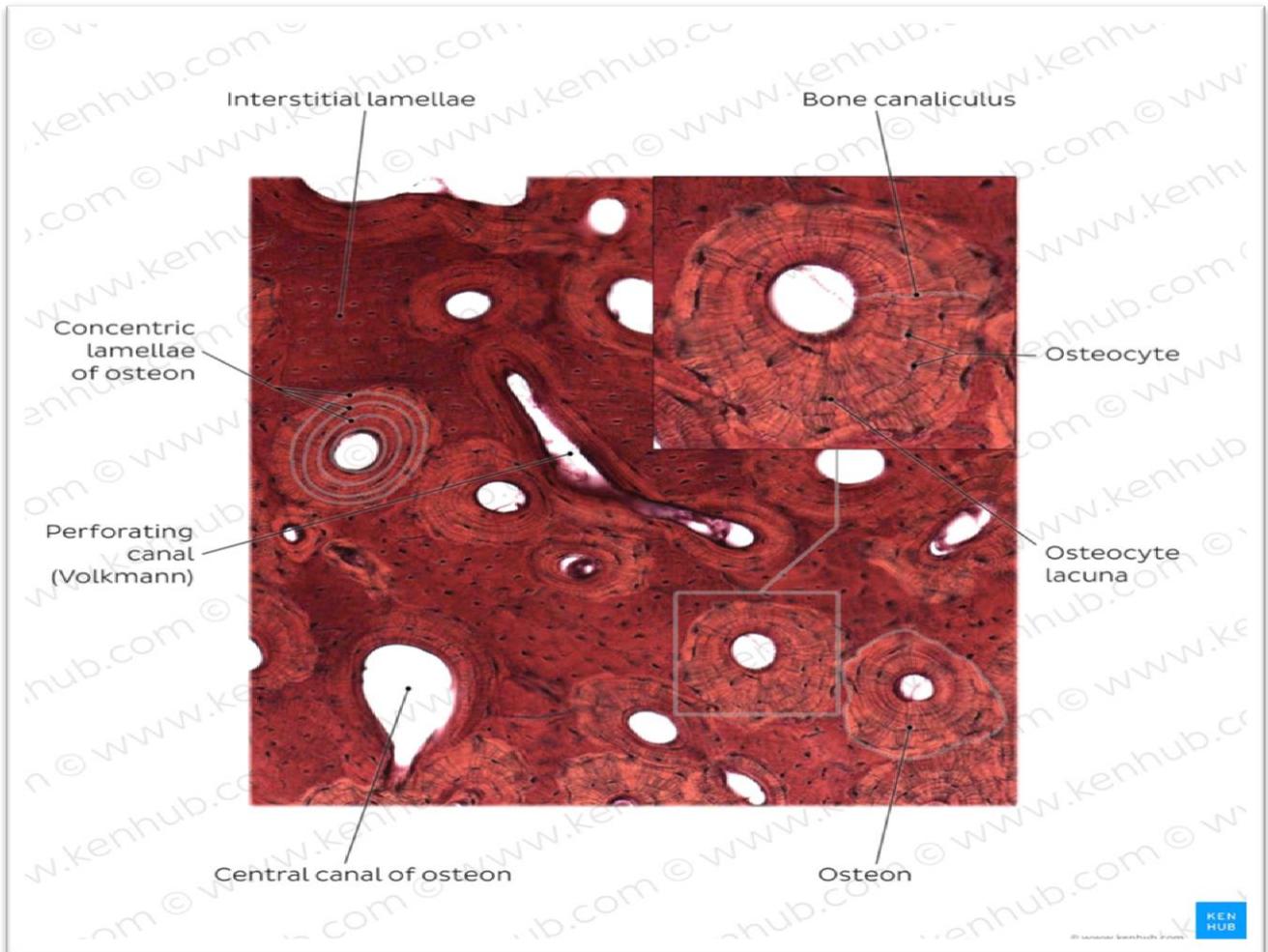
- Porous and lighter
- Found inside bones
- Contains bone marrow

**Dense Bone (400X)**



Mature bone cells called **osteocytes** are widely scattered throughout the lamella. Each osteocyte occupies a tiny space called a lacuna sandwiched between layers of lamella





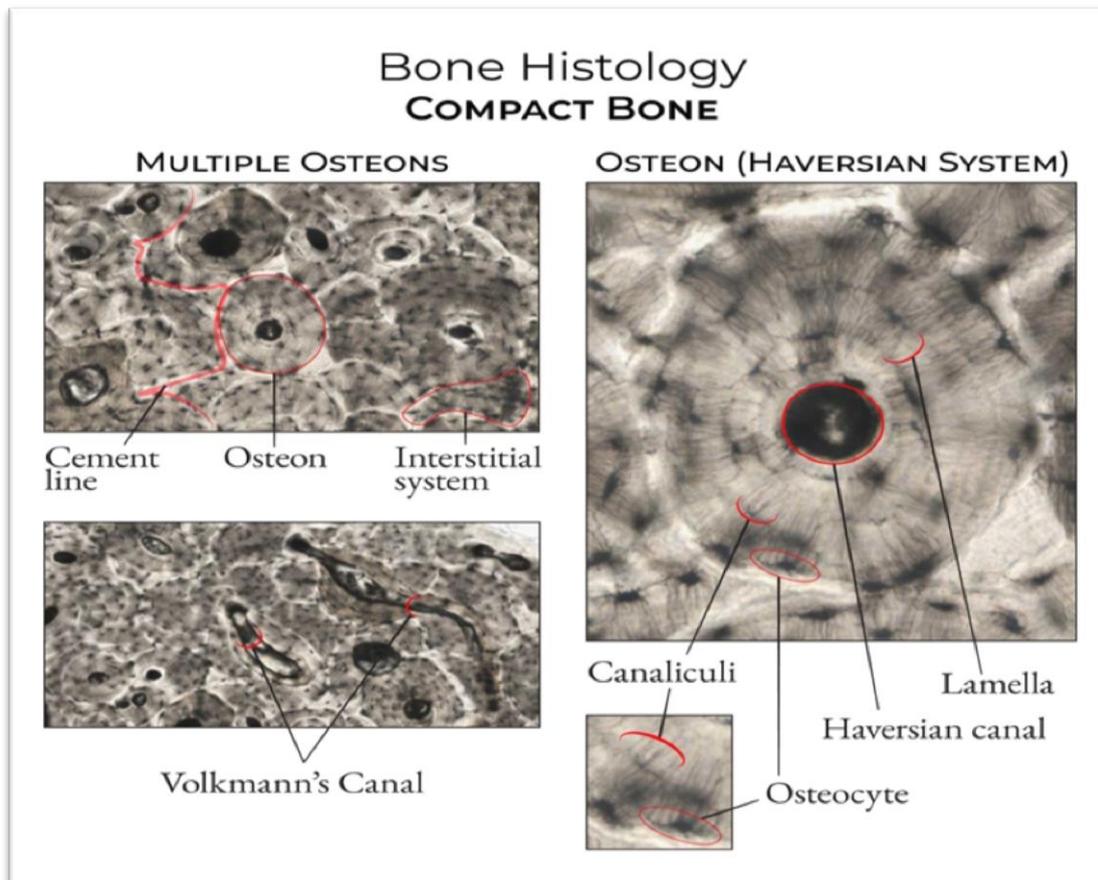
Compact bone contains structural units called **osteons**, while spongy bone consists of a network of trabeculae that surround marrow spaces.

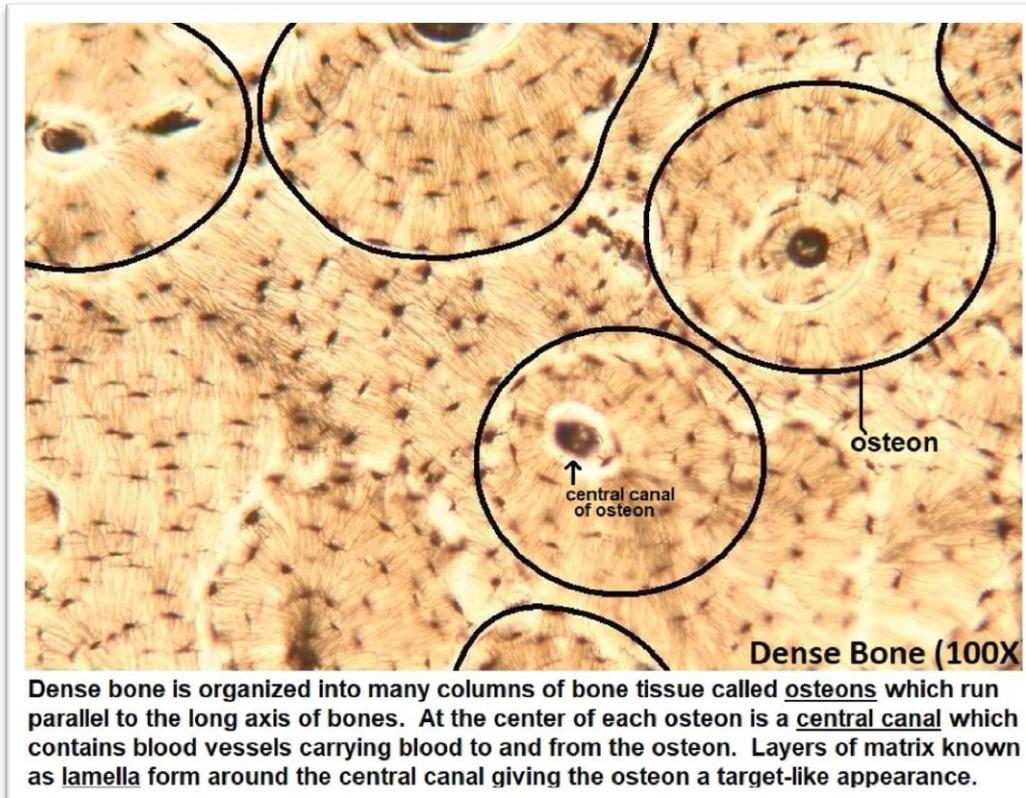
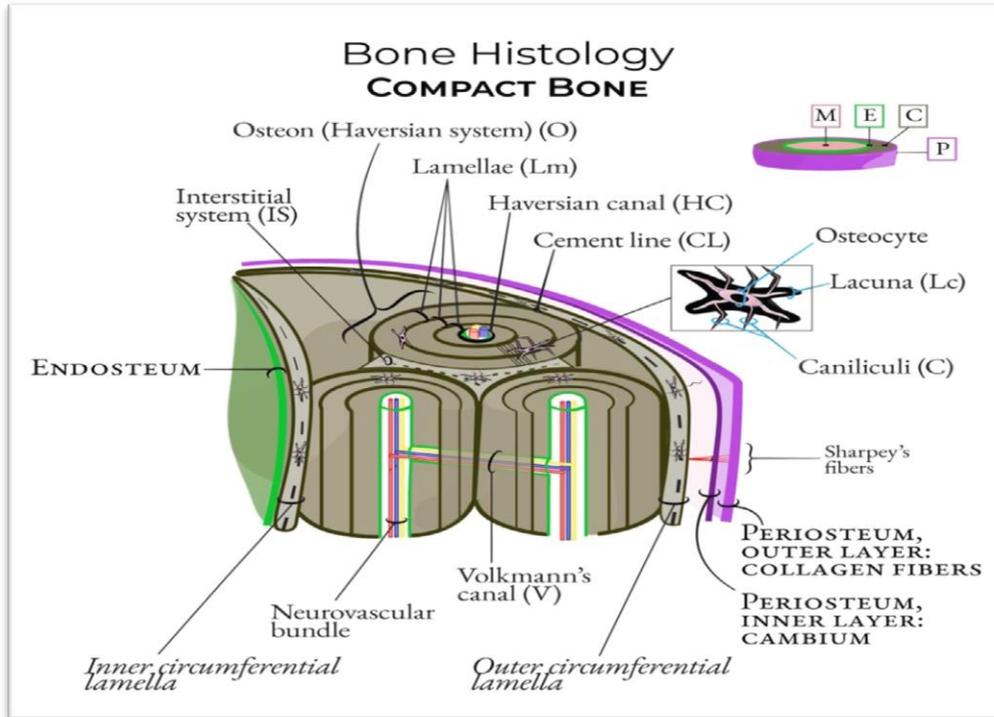
### 3. Structure of Compact Bone

The basic structural unit of compact bone is the Osteon.

Each osteon consists of:

- **Haversian canal**  
Contains blood vessels and nerves.
- **Lamellae**  
Concentric layers of bone matrix.
- **Lacuna**  
Small spaces containing bone cells.
- **Canaliculi**  
**Tiny canals that connect osteocytes.**





These microscopic channels allow nutrients and oxygen to reach bone cells.



## **4. Bone Cells**

Bone contains three major types of cells:

### **1. Osteoblasts**

Osteoblast

- Responsible for bone formation
- Produce bone matrix (collagen and proteins)

### **2. Osteocytes**

Osteocyte

- Mature bone cells
- Located in lacunae
- Maintain bone tissue

### **3. Osteoclasts**

Osteoclast

- Large multinucleated cells
- Responsible for bone resorption

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## **5. Histogenesis of Bone**

Histogenesis refers to the process of bone formation during development.

Bone forms by two main mechanisms:

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## **6. Intramembranous Ossification**

Intramembranous ossification

This process forms bone directly from mesenchymal tissue.

It occurs mainly in:

- Skull bones
- Mandible
- Clavicle



## Steps

1. Mesenchymal cells differentiate into osteoblasts.
2. Osteoblasts begin secreting bone matrix.
3. Matrix becomes mineralized.
4. Trabecular bone forms.

## 7. Endochondral Ossification

Endochondral ossification

This process forms bone by replacing a cartilage model.

It occurs in:

- Long bones
- Most bones of the skeleton

## Steps

1. A cartilage model is formed.
2. Cartilage gradually calcifies.
3. Bone tissue replaces cartilage.

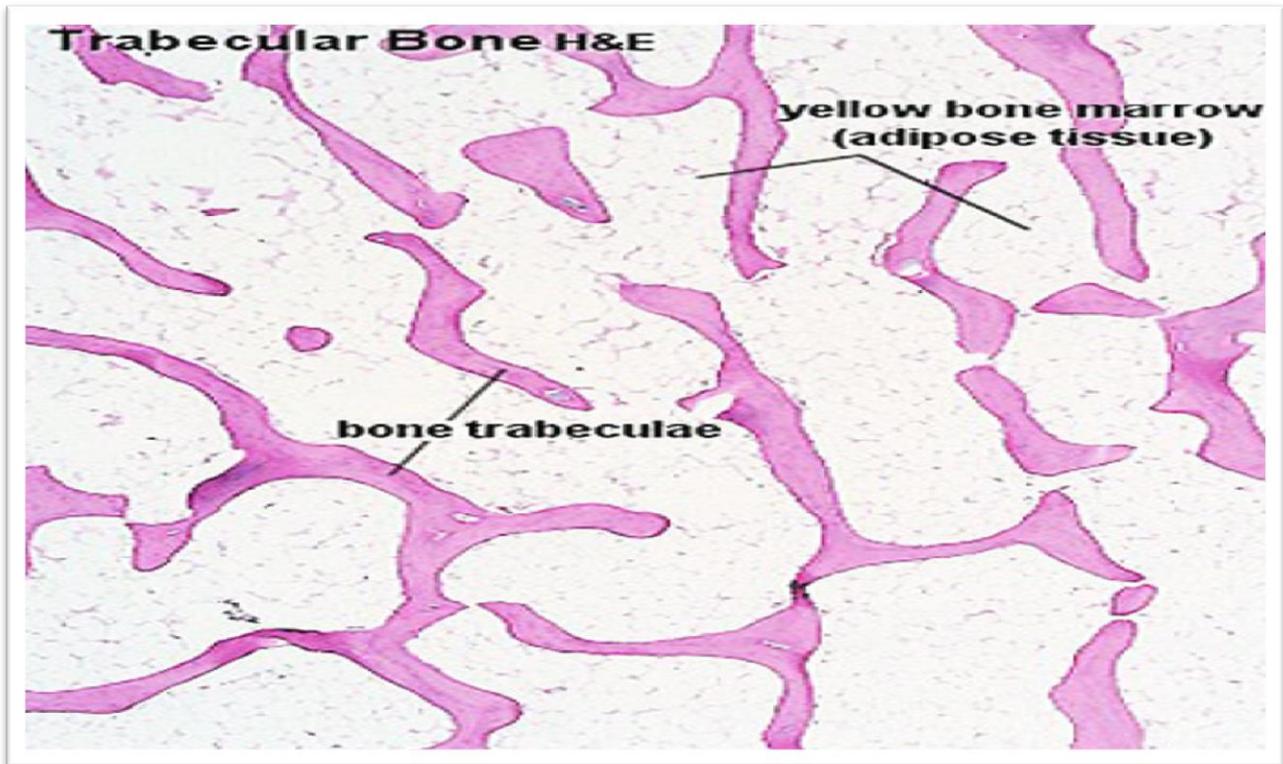
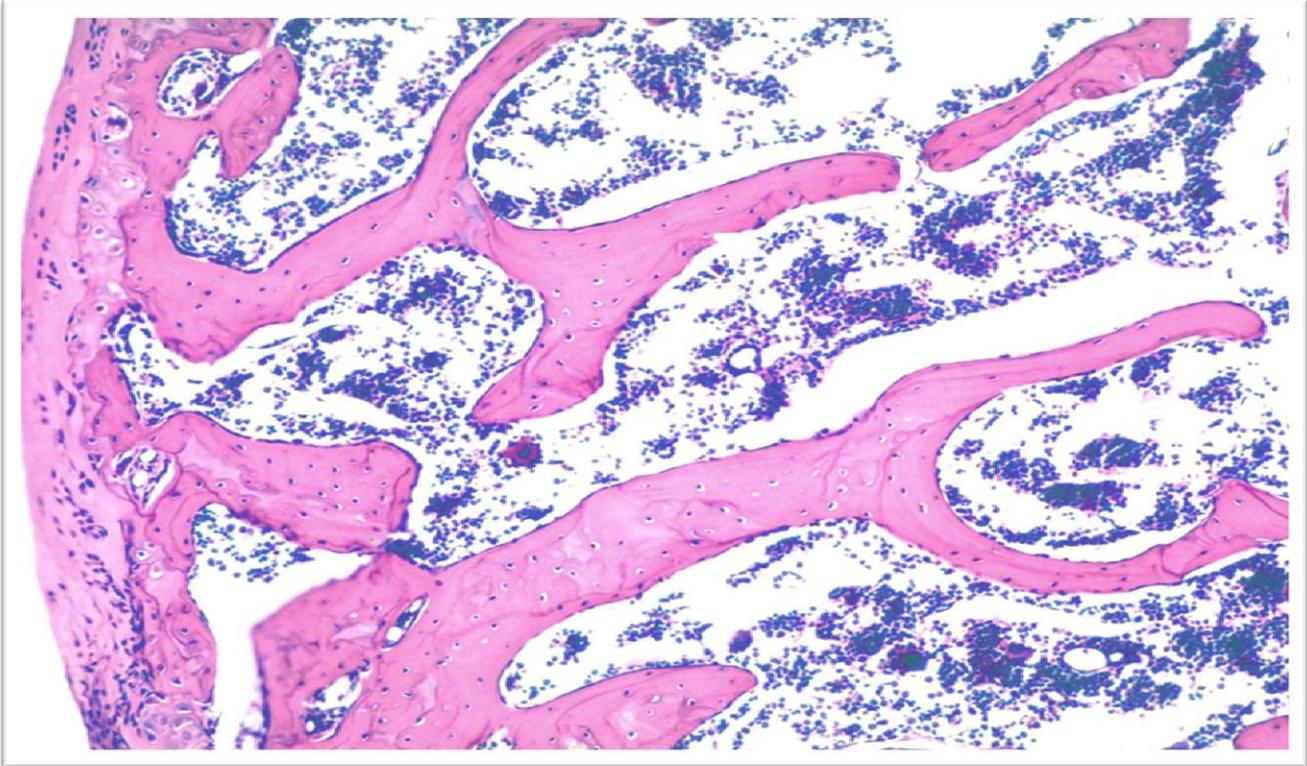
## 8. Bone Growth

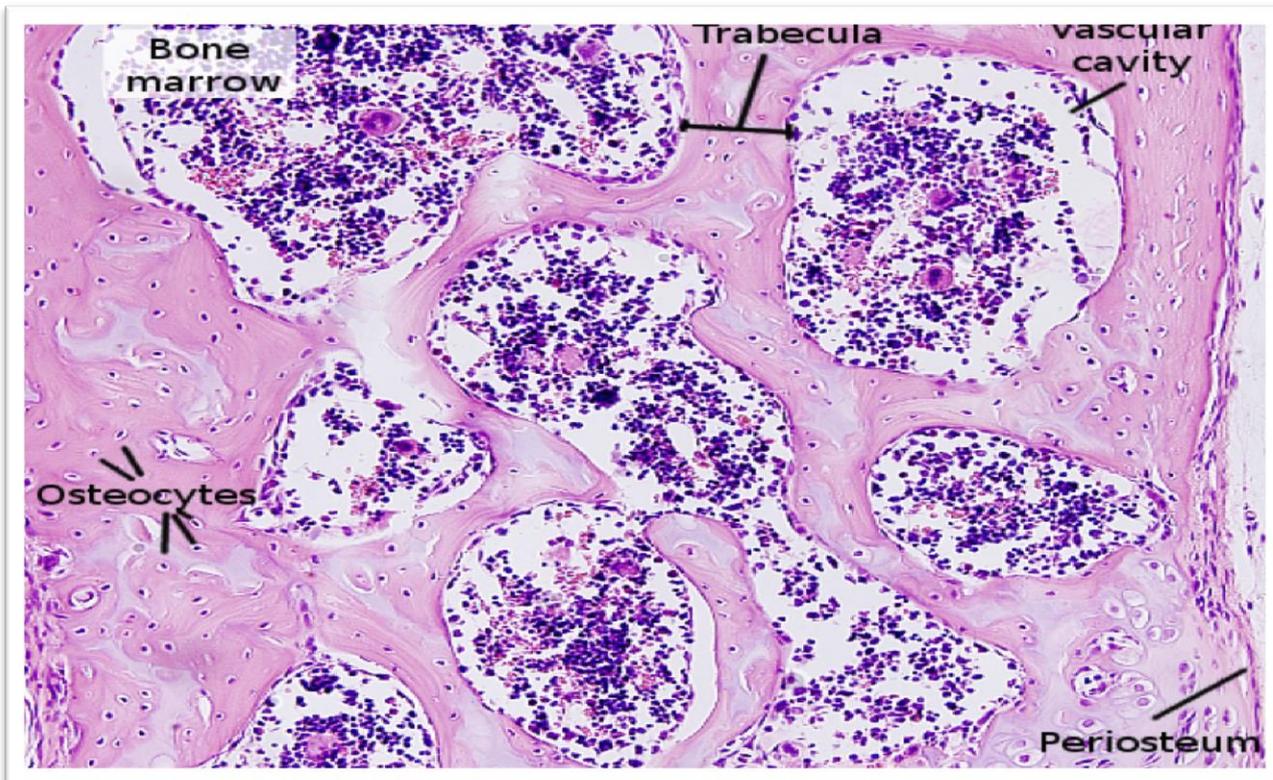
Bone grows in two ways:

### Growth in Length

Occurs at the **Epiphyseal plate**.

This cartilage plate is located between the epiphysis and diaphysis.





## Growth in Width

Also called **Appositional Growth**.

In this process:

- Osteoblasts add new bone to the surface.
- Osteoclasts remodel the internal bone.

## 9. Bone Remodeling

Bone is a dynamic tissue that constantly undergoes remodeling.

Two types of cells control this process:

- Osteoclasts → break down bone
- Osteoblasts → form new bone

This process helps:

- Maintain bone strength
- Repair microdamage
- Regulate calcium levels



## **10. Clinical Importance**

Some common bone diseases include:

- **Osteoporosis**  
Decrease in bone density.
- **Osteomyelitis**  
Infection in bone tissue.
- **Rickets**  
Caused by vitamin D deficiency.

## **Conclusion**

Bone is an essential connective tissue that provides structural support, protects organs, and participates in movement and mineral storage. Understanding the histogenesis of bone helps explain how bones develop, grow, and repair throughout life.