

# Musculoskeletal System (Bones)

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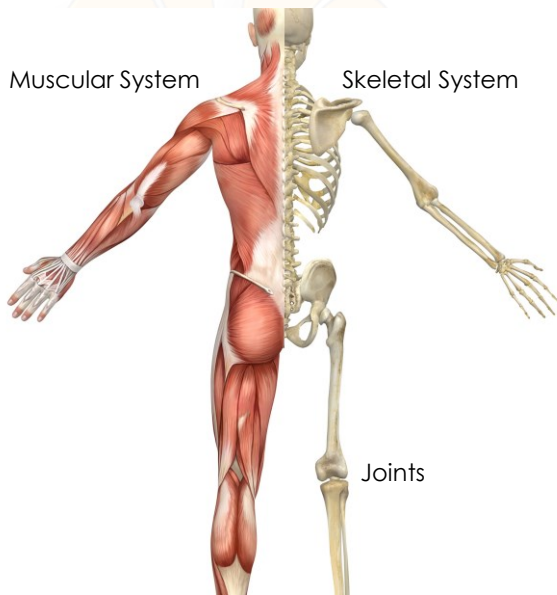
## Contents of the Lecture:

- Introduction
- Skeletal System
- Structure and Function of Bone



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## Introduction



- **Osteology:** derived from the Greek words osteon. and logos, is the scientific study of bones
- The musculoskeletal system consists of the **bones** of the skeleton, their **joints** and the **skeletal (voluntary) muscles** that move the body

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## Skeletal System (Bone)



- **Bone:** is a rigid organ that is part of skeleton
- Bone tissue (osseous tissue) is a hard tissue, a type of dense connective tissue
- Bone tissue made by different type of cell mainly **osteoblasts, osteocytes, and osteoclast**
- They are involved in the formation and mineralization of bone
- The human skeleton consists of approx. 200 individual bone
- The Skeletal system can divided into two parts- **1. Axial Skeleton** and **2. Appendicular Skeleton.**

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## Skeletal System (Bone)



### Basic Function:

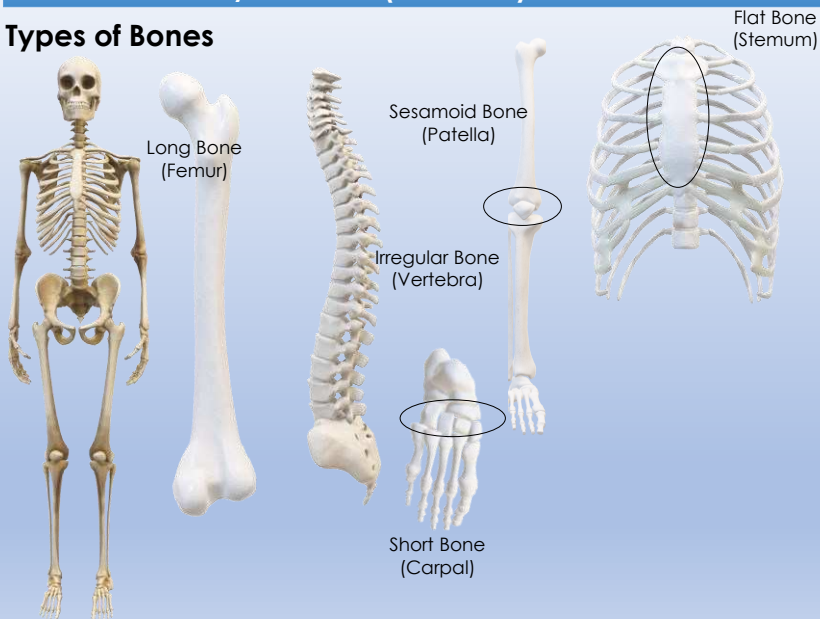
- Providing the body framework
- Helps in locomotion (movements) together with joints and muscles
- Protects internal organ
- Haemopoiesis (Blood cell formation)
- Storage of minerals, especially calcium phosphate and maintain blood calcium level

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## Skeletal System (Bone)

### Types of Bones



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## Skeletal System (Bone)

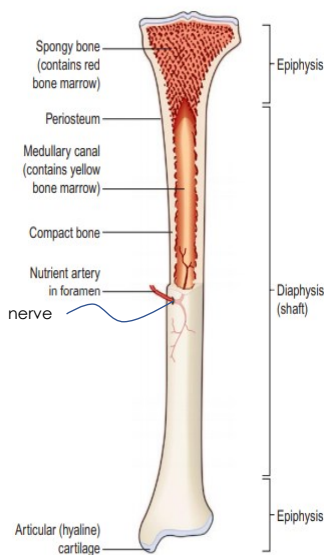


Figure 16.1 A mature long bone: partially sectioned.

### Structure of Bone

- Long bones almost cover with a vascular membrane, the periosteum (except joint area covers with hyaline cartilage). Which has two layer- outer and inner
- The outer layer is tough and fibrous, and protects the bone underneath.
- The inner layer contains osteoblasts and osteoclasts, the cells responsible for bone production and breakdown and is important in repair and remodeling of the bone

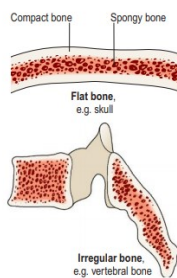


Figure 16.2 Sections of flat and irregular bones.

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## Skeletal System (Bone)

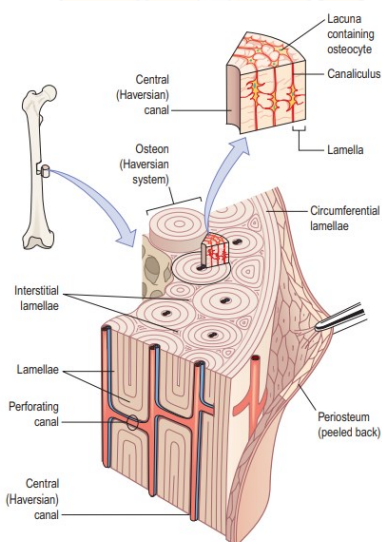


Figure 16.3 Microscopic structure of compact bone.

### Microscopic Structure of Bone

- Bone is a strong and durable type of connective tissue.
- Its major constituent (65%) is a mixture of calcium salts, (calcium phosphate) responsible for hardness.
- The remaining third is organic material, called osteoid, which is composed mainly of collagen. Collagen is very strong and gives bone slight flexibility.
- The cellular component of bone contributes less than 2% of bone mass.

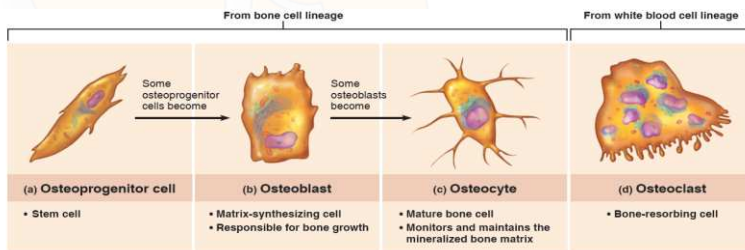
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# Skeletal System (Bone)

## Bone Cells

### 1. Osteoblast

- These bone-forming cells are responsible for the deposition of both inorganic salts and osteoid in bone tissue.
- They are therefore present at sites where bone is growing, repairing or remodelling, e.g.:
  - In the deeper layers of periosteum
  - In the centres of ossification of immature bone
  - At the ends of the diaphysis adjacent to the epiphyseal cartilages of long bones
  - At the site of a fracture



<https://images.app.goo.gl/B7Lj5JrDGLtrtPE8>

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# Skeletal System (Bone)

## Bone Cells

### 1. Osteocyte

- These are mature bone cells that monitor and maintain bone tissue, and are nourished by tissue fluid in the canaliculi that radiate from the central canal

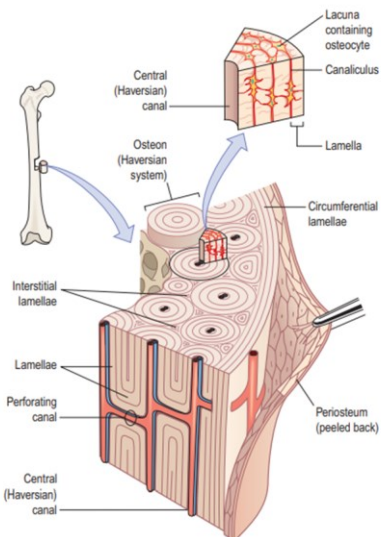


Figure 16.3 Microscopic structure of compact bone.

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## Skeletal System (Bone)

### Bone Cells

#### 3. Osteoclast

- These cells break down bone, releasing calcium and phosphate.
- They are very large cells with up to 50 nuclei, which have formed from the fusion of many monocytes
- Osteoclasts are found in areas of the bone where there is active growth, repair or remodelling, e.g.:
  - Under the periosteum, maintaining bone shape during growth and to remove excess callus formed during healing of fractures
  - Round the walls of the medullary canal

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## Skeletal System (Bone)

### Development of Bone

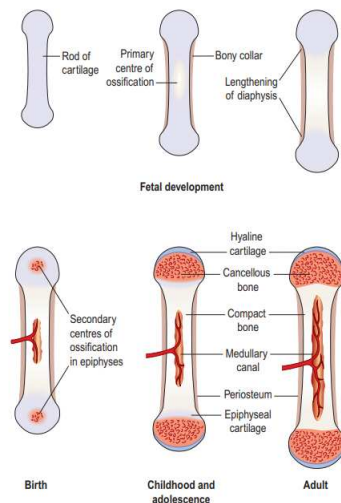


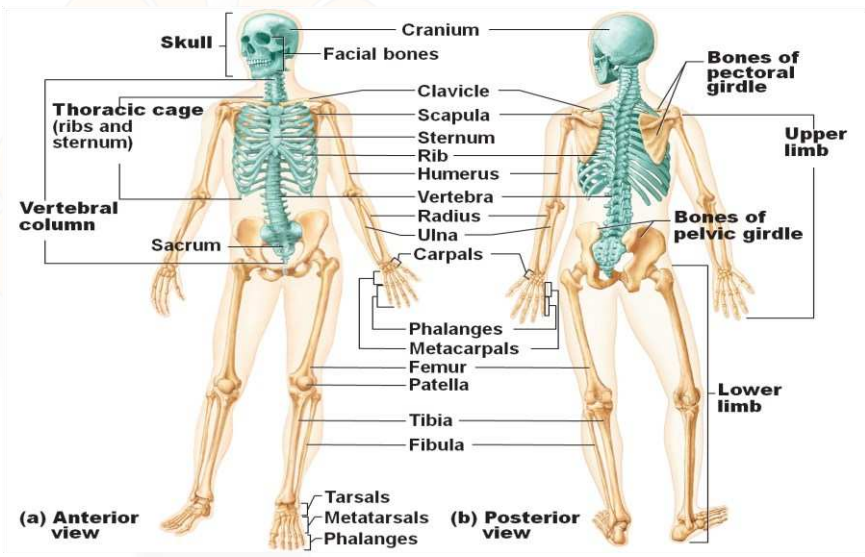
Figure 16.6 The stages of development of a long bone.

- Also called osteogenesis or ossification, (growth up to 21 years of age)
- Long, short and irregular bones develop in the fetus from rods of cartilage, **cartilage models**. Flat bones develop from **membrane models** and sesamoid bones from **tendon models**.
- During ossification, osteoblasts secrete osteoid, which gradually replaces the initial model; then this osteoid is progressively calcified, also by osteoblast action. As the bone grows, the osteoblasts become trapped in the matrix of their own making and become osteocytes.

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# Skeletal System (Bone)



Axial Bone and Appendicular Bone



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