

Principles of Anatomy and Physiology
14th Edition
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WILEY

CHAPTER 6
The Skeletal System:
Bone Tissue

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Introduction

The skeletal system has 6 important functions:

- Provides support
- Protects the internal organs (brain, heart, etc.)
- Assists body movements (in conjunction with muscles)
- Stores and releases salts of calcium and phosphorus
- Participates in blood cell production (hemopoiesis)
- Stores triglycerides in adipose cells of yellow marrow

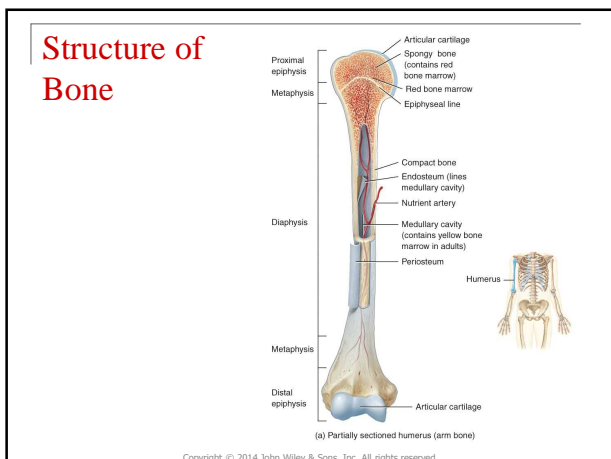
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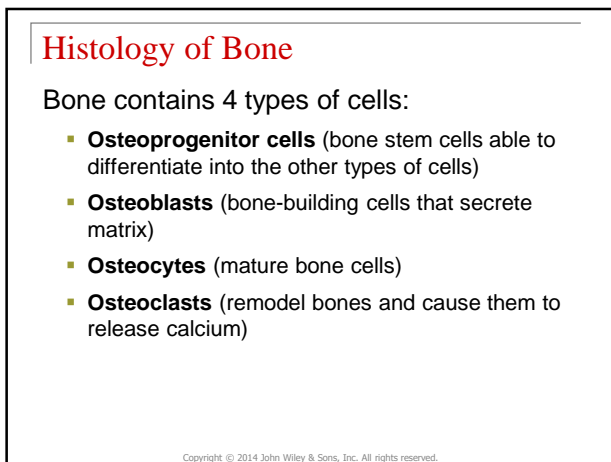
Structure of Bone

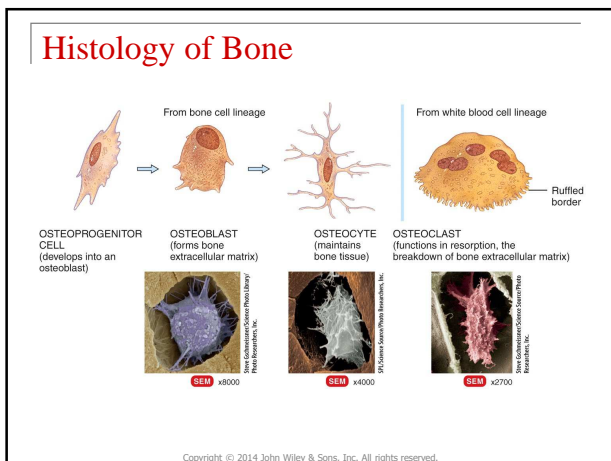
A long bone consists of several parts:

- Diaphysis (bone shaft)
- 2 epiphyses (both ends of the bone at the joints)
- 2 metaphyses (region between diaphysis and epiphysis)
- Articular cartilage covering both epiphyses
- Periosteum (connective tissue surrounding the diaphysis)
- Medullary cavity (hollow space within diaphysis)
- Endosteum (thin membrane lining the medullary cavity)

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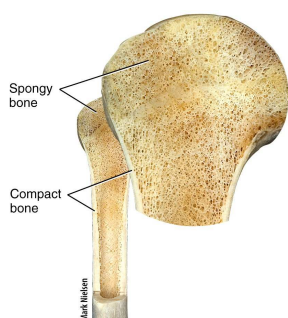




Histology of Bone

Compact bone is good at providing protection and support.

Spongy bone is lightweight and provides tissue support .



(b) Partially sectioned humerus

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Blood and Nerve Supply of Bone

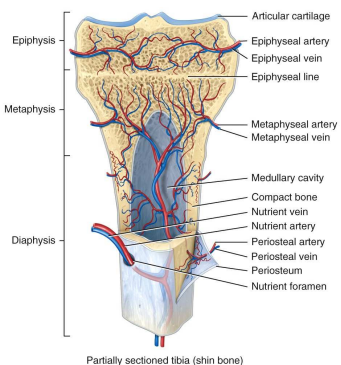
Periosteal arteries (accompanied by nerves) enter the diaphysis through Volkmann's canals. They are accompanied by **periosteal veins**.

A **nutrient artery** enters the center of the diaphysis through a **nutrient foramen**. **Nutrient veins** exit via the same canal.

The metaphyses and epiphyses also have their own arteries and veins.

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Blood and Nerve Supply of Bone



Partially sectioned tibia (shin bone)

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Bone Formation

Ossification (osteogenesis) is the process of bone formation.

Bones form in 4 situations:

- During embryological and fetal development
- When bones grow before adulthood
- When bones remodel
- When fractures heal

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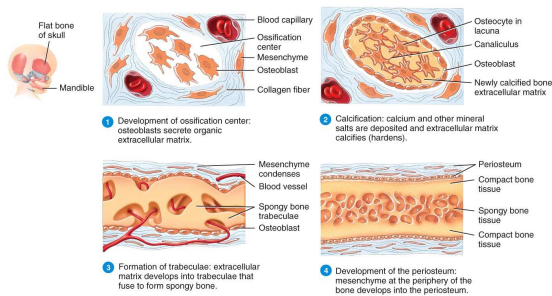
Bone Formation

Ossification takes place in 2 forms:
Intramembranous and **endochondral**.

Intramembranous ossification occurs in flat bones when a connective tissue membrane is replaced by bone.

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Bone Formation



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Bone Growth and Remodeling

Interactions Animation:

[Bone Growth and Remodeling](#)

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Bone Remodeling and Resorption

Interactions Animation:

[Bone Dynamics and Tissue](#)

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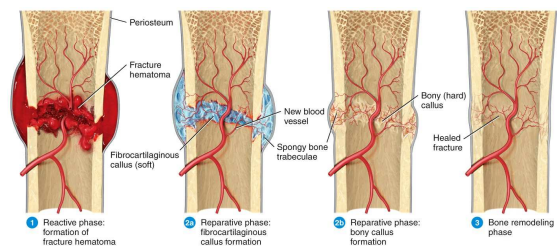
Fracture and Repair of Bone

A fracture is a break in a bone. Many different types of fractures may occur. The healing process involves 3 different phases in 4 steps.

- The **reactive phase** is an early inflammatory phase.
- The **reparative phase** includes formation of a fibrocartilaginous callus first and a bony callus second.
- The **bone remodeling phase** is the last step as the bony callus is remodeled.

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Fracture and Repair of Bone

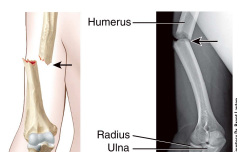


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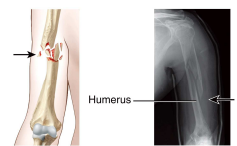
Fracture and Repair of Bone

Some common fractures include:

▪ **Open (Compound):**



▪ **Comminuted:**

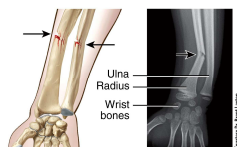


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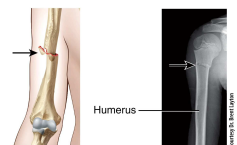
Fracture and Repair of Bone

Some common fractures include:

▪ **Greenstick:**



▪ **Impacted:**



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Fracture and Repair of Bone

Some common fractures include:

- **Pott:**



- **Colles:**



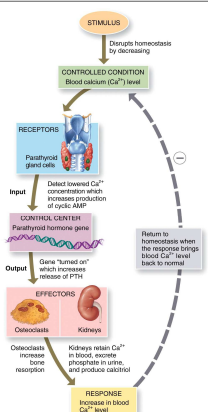
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Bone's Role in Calcium Homeostasis

Bones store 99% of the body's calcium. The parathyroid gland secretes **Parathyroid hormone (PTH)** when calcium levels drop. Osteoclasts are stimulated to increase bone resorption and calcium is released. PTH also stimulates the production of **calcitriol** by the kidneys to increase calcium absorption in the intestines.

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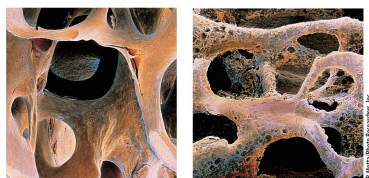
Bone's Role in Calcium Homeostasis



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Aging and Bone Tissue

From birth through adolescence, more bone is produced than is lost during remodeling. In adults, the rates are the same. Older individuals, especially post-menopausal women, experience a decrease in bone mass when resorption outpaces deposition.



(a) Normal bone SEM 30x (b) Osteoporotic bone SEM 50x

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End of Chapter 6

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