


**Key Words –
Bones Markings to Define**

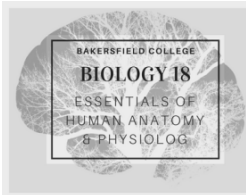
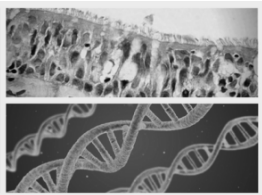
- **Sinus:** hollow cavity
- **Suture:** joint (usually in the skull)
- **Process:** projection/outgrowth
- **Foramen:** opening
- **Condyle:** rounded projection
- **Meatus:** opening or passageway
- **Tubercle:** small rounded projection
- **Tuberosity:** rounded prominence
- **Sulcus:** groove
- **Fossa:** depression or hollow

**Lecture #3:
Skeletal System
- Bones -**

Chapter 5



Marieb, 2018. Essentials of Human Anatomy & Physiology (12th Ed.)
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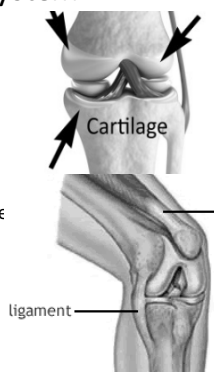
Objectives

- Describe the functional properties of the three major cartilage groups of the adult skeleton and locate examples of each.
- Describe the main functions of the bony skeleton.
- Describe the gross anatomy of a long bone.
- Describe the histology of compact and spongy bone.
- Describe intramembranous and endochondral bone growth
- Describe how long bones grow at their epiphyseal plates.
- Explain bone remodeling.
- Name and describe the various types of fractures.
- Describe symptoms of osteoporosis.

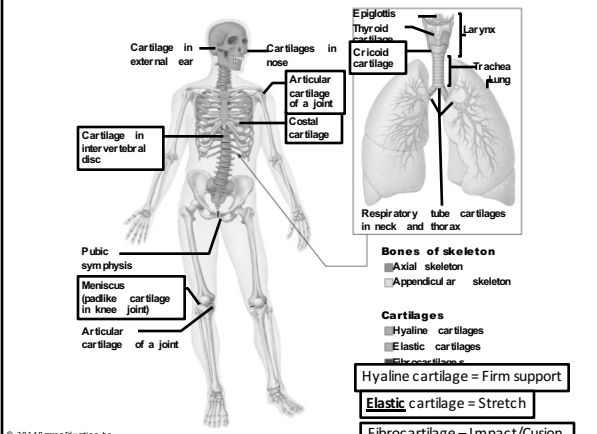
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The Skeletal System

- Composition
 - Bones (skeleton)
 - Joints: where two bones articulate
 - Cartilages: connective tissue found between joints and bone
 - Ligaments: connect bone to bones at joints



ligament



Cartilage in external ear, Cartilages in nose, Articular cartilage of a joint, Costal cartilage, Cartilage in intervertebral disc, Pubic symphysis, Meniscus (padlike cartilage in knee joint), Articular cartilage of a joint.

Epiglottis, Thyroid cartilage, Cricoid cartilage, Larynx, Trachea, Lung, Respiratory tube cartilages in neck and thorax.

Bones of skeleton
 ■ Axial skeleton
 □ Appendicular skeleton

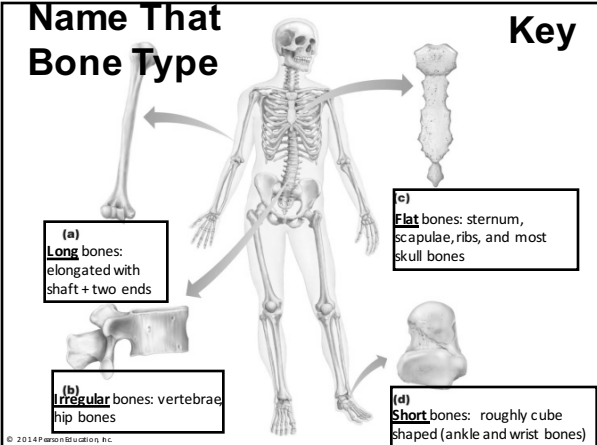
Cartilages
 ■ Hyaline cartilages
 ■ Elastic cartilages
 ■ Fibrocartilage

Hyaline cartilage = Firm support
 Elastic cartilage = Stretch
 Fibrocartilage = Impact/Cushion

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Name That Bone Type

Key



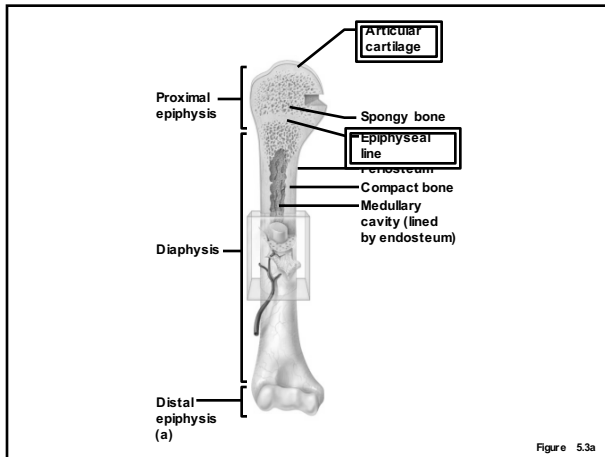
(a) **Long** bones: elongated with shaft + two ends

(b) **Irregular** bones: vertebrae, hip bones

(c) **Flat** bones: sternum, scapulae, ribs, and most skull bones

(d) **Short** bones: roughly cube shaped (ankle and wrist bones)

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II. Cartilages:

•Greek for "glassy"

<u>Hyaline</u>	<u>Elastic</u>	<u>Fibrocartilage</u>
Firm Support	Stretch/flexibility	Cushioning
	Ear Epiglottis 	Pad-like cartilages of the knee (menisci) The discs between

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III. Bones

A. **Functions:** support, protection, movement, mineral storage, blood cell formation, triglyceride (fat) storage

[Environmental Health Student Blog](#)
[Wikipedia](#)

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III. Bones


(remember: organs are composed of various tissues)

C. Bone tissue types

1. Compact: smooth and solid in appearance
2. Spongy: honeycomb

Heavy


Strong



Spongy bone (diploe)

Light

Not as strong



Trabeculae of spongy bone

Bone Marrow & Blood vessels

Figure 6.3 Flat bones consist of a layer of spongy bone sandwiched between two thin layers of compact bone.

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D. Gross Anatomy

2. Structure of a typical long bone

a. Diaphysis (shaft)

- i. Forms longitudinal axis
- ii. Medullary cavity filled with yellow marrow

b. Epiphysis (expanded end area)

- i. Epiphyseal line/epiphyseal plate
- ii. Red marrow
 - a. Blood cell production
- iii. Articular cartilage

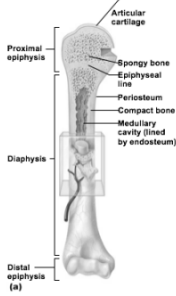


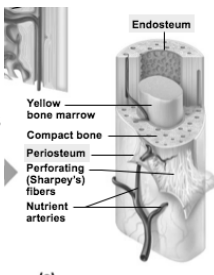
Figure 6.4a The structure of a long bone (humerus of arm).

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D. Gross Anatomy

e. Membranes

- i. **Periosteum**
 - a. Outer (external) double layered membrane
 - b. Sharpey's (perforating) fibers
 - i. Secures periosteum to underlying bone
- ii. **Endosteum**
 - a. Delicate, internal CT membrane that lines all internal passageways

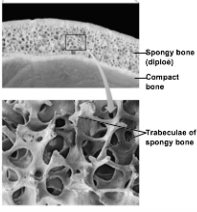


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D. Gross Anatomy

3. Structure of short, irregular bones, and flat bones

- Stuffed sandwich with thin plates of periosteum-covered compact bone on the outside and endosteum-covered spongy bone within
- Not cylindrical, so no shaft or epiphyses
- Contains bone marrow between trabeculae but no marrow cavity



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2. Structure of short, flat, irregular bones

- Sandwich: thin outside compact layers with spongy bone in between

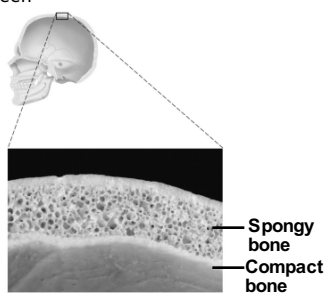
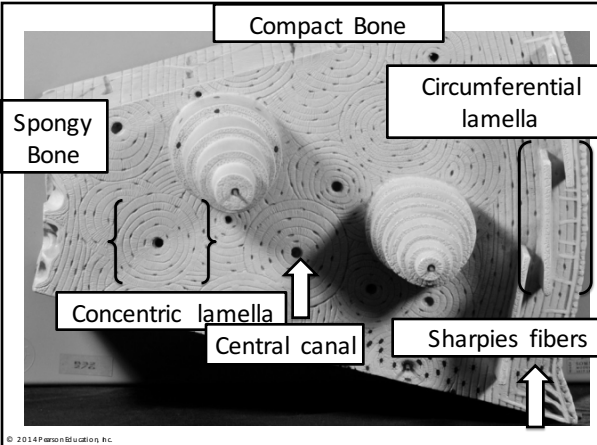
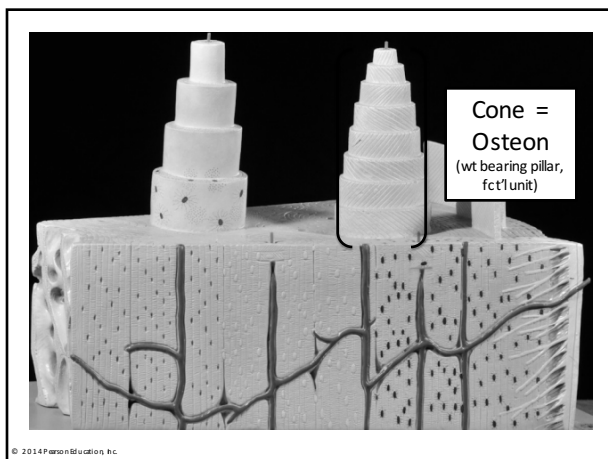
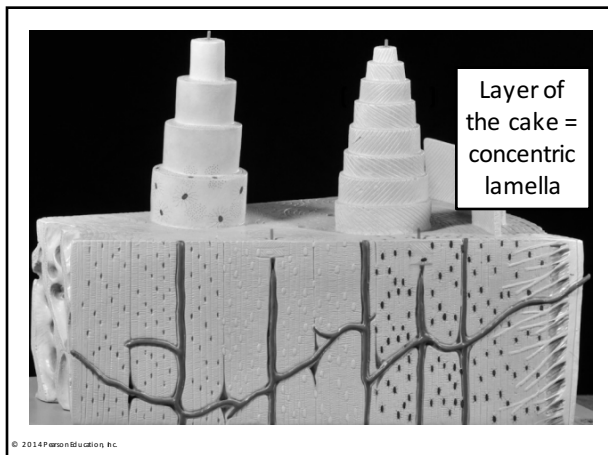


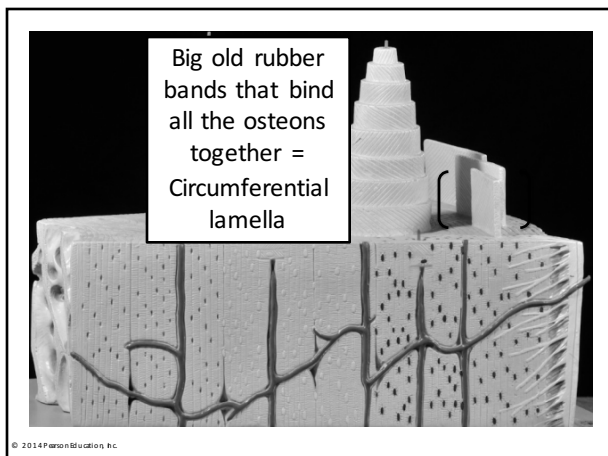
Figure 5.1

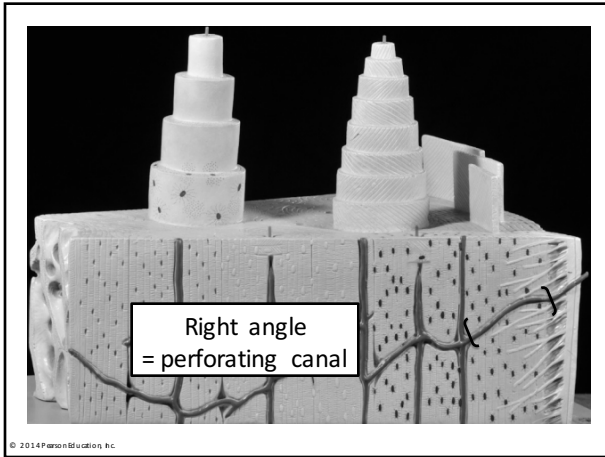


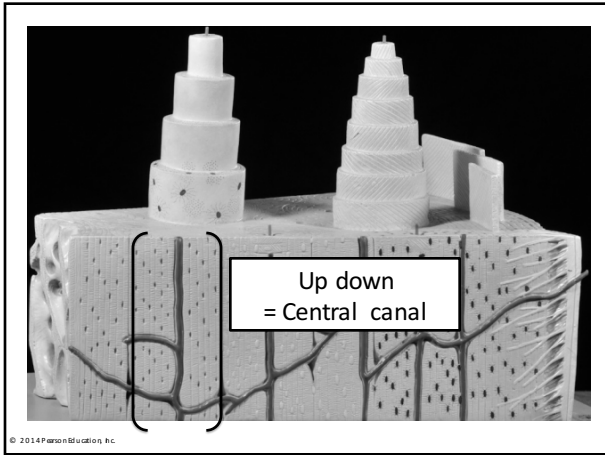
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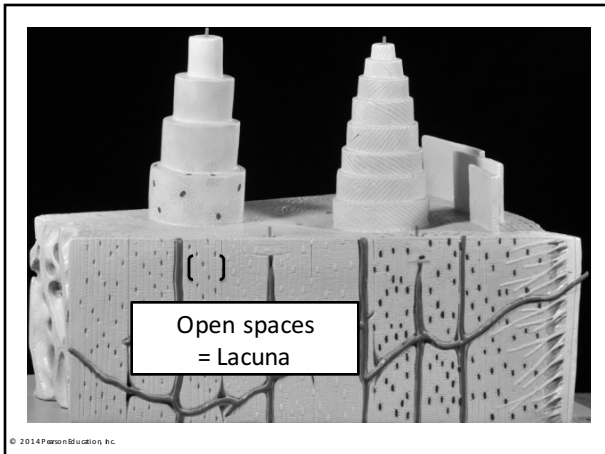


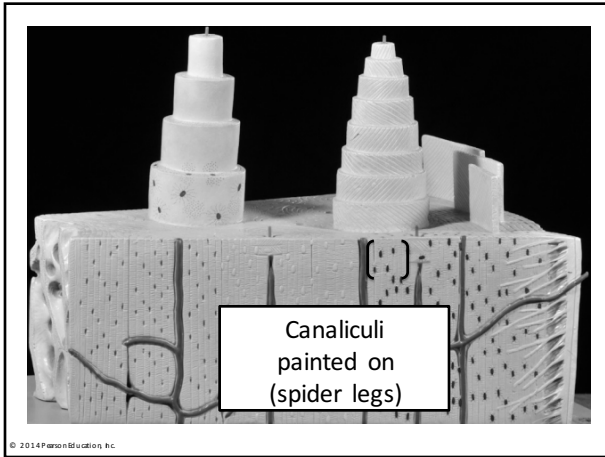












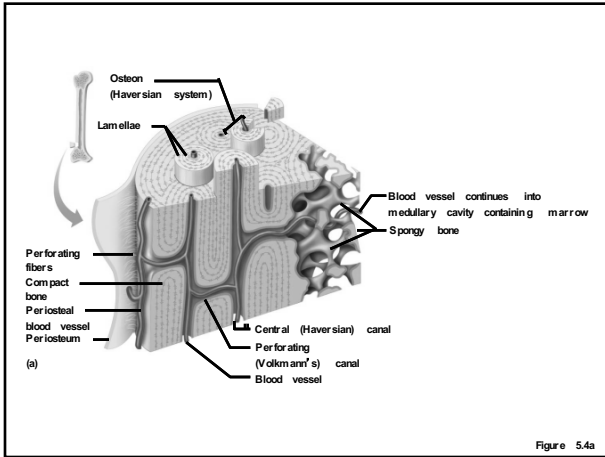
Microscopic Anatomy of Compact Bone

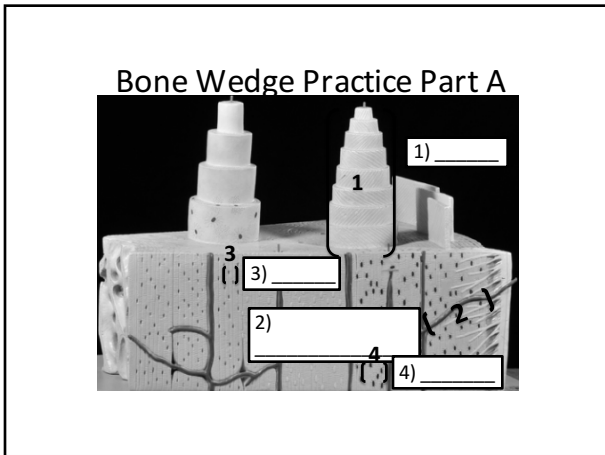
*Osteon: A unit of bone containing central canal and matrix rings

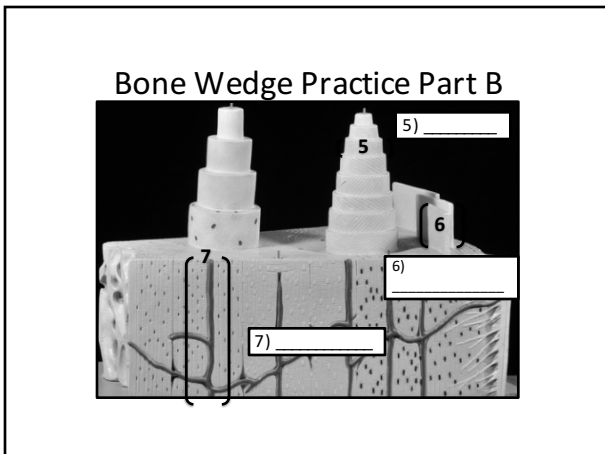
- Lamellae
 - Rings around the central canal
 - Sites of lacunae
- Central canal
 - Opening in the center of an osteon
 - Carries blood vessels and nerves
- Perforating (Volkmann's) canal
 - Canal perpendicular to the central canal
 - Carries blood vessels and nerves

Microscopic Anatomy of Bone

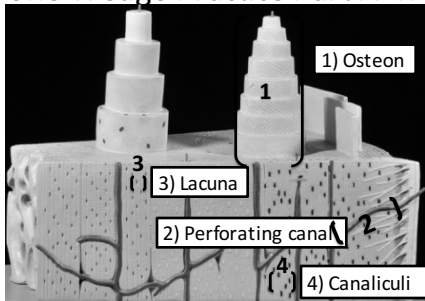
- Canaliculi
 - Tiny canals
 - Radiate from the central canal to lacunae
 - Form a transport system connecting all bone cells to a nutrient supply



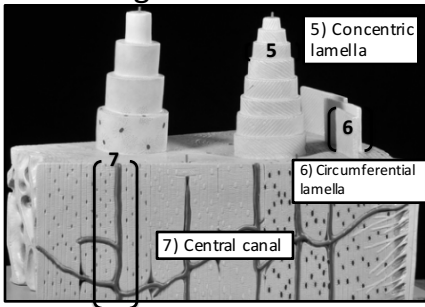




Bone Wedge Practice Part A -KEY



Bone Wedge Practice Part B -KEY



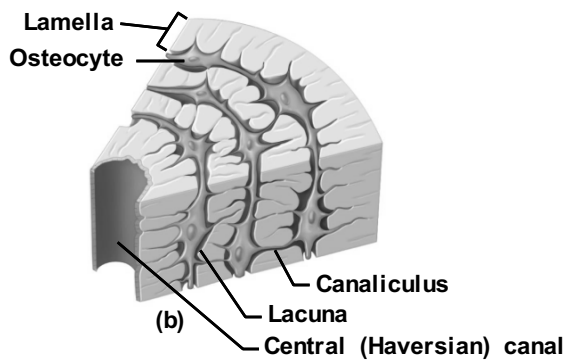
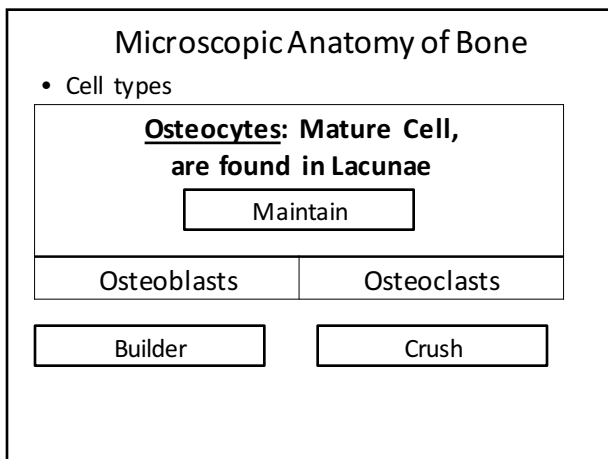
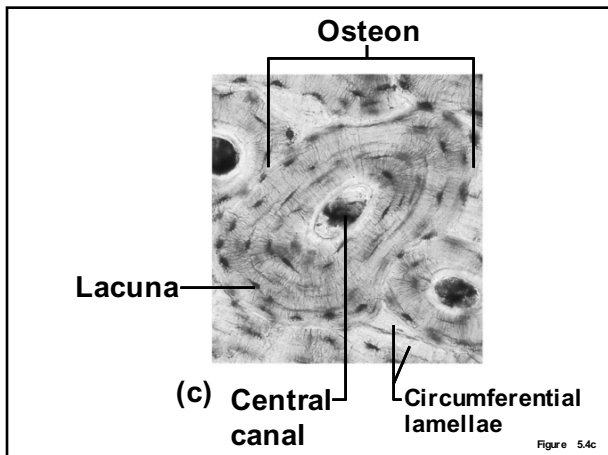
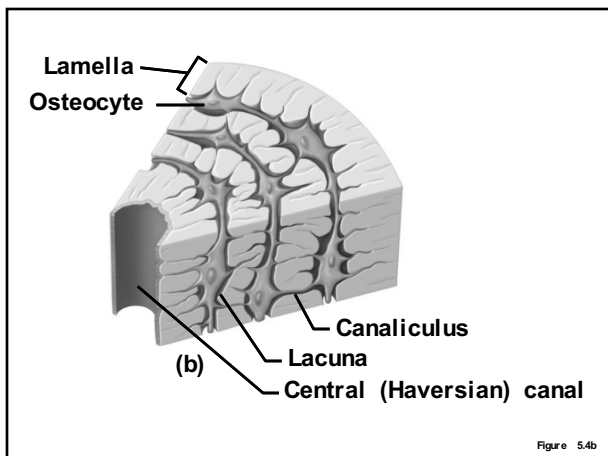


Figure 5.4b



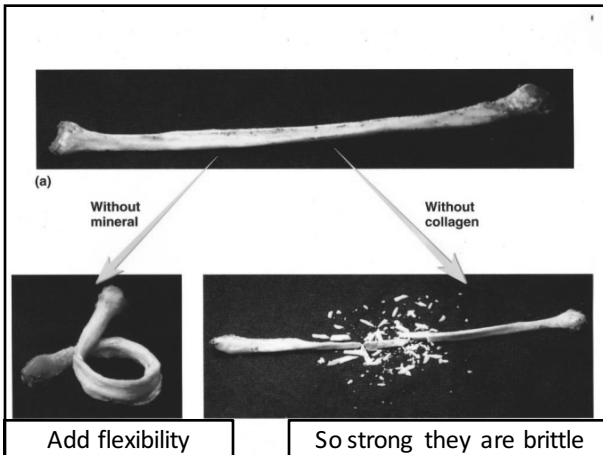




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E. Microscopic anatomy of bone

- F. Chemical composition of bone matrix
 - 1. Functional anatomy: flexibility (collagen) + strength (calcium salts)



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G. Bone Development (ossification)

Two types of bone growth:

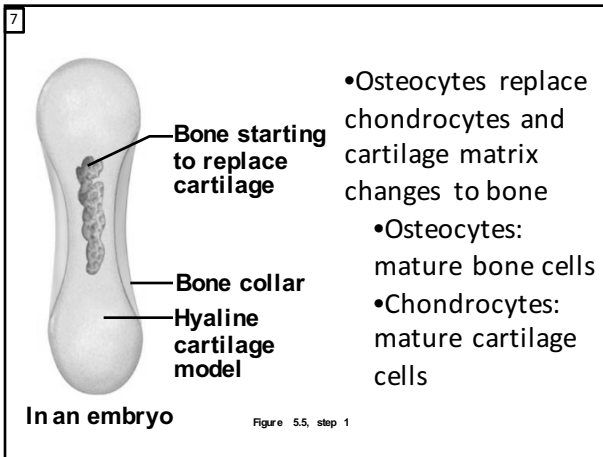
a. Intramembranous ossification	b. Endochondral ossification
Starts within Fibrous mem.	Starts in the middle of Bone in Haylie Cartilage
<i>Ziplock Bag Method</i>	<i>Inside out Method</i>
Used in: Flat Bones only	Used in: Long Bones ⁺

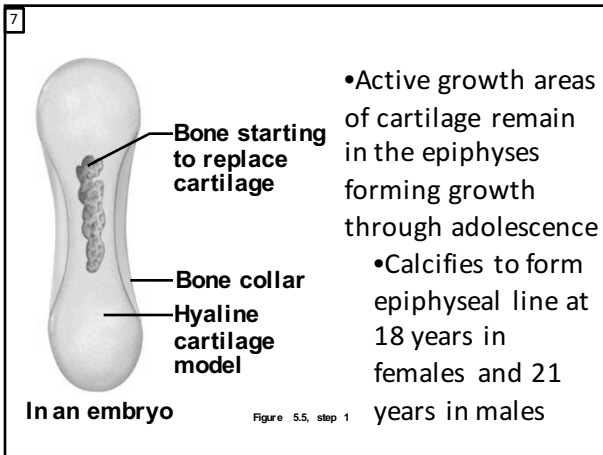
Fontanelle
Bony plates

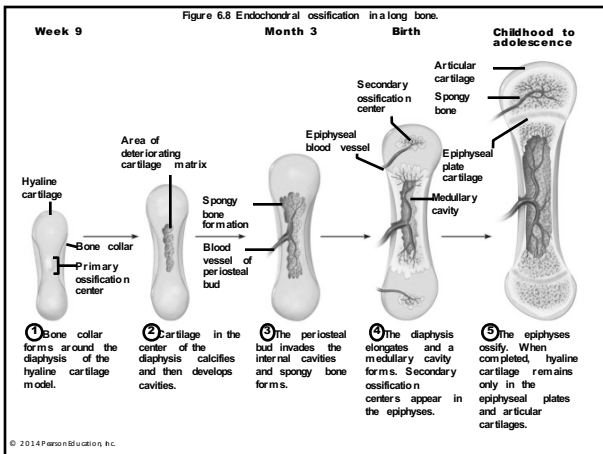
•Membranes are replaced by calcium

Bone starting to replace cartilage
Bone collar
Hyaline cartilage model

In an embryo



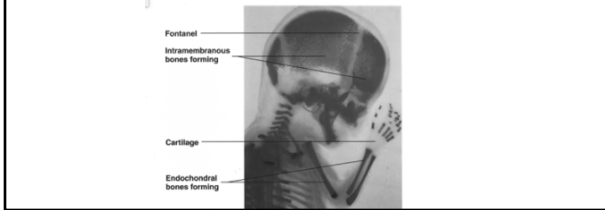




Which bone development method would close the fontanelle in an infants skull?

a. Intramembranous ossification

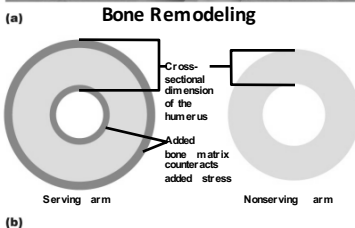
b. Endochondral ossification



- 7 Bone Remodeling
- A healthy bone is a “stressed bone”
 - Stress = lots of use, working out and increasing muscle mass
 - More osteocytes migrate to these bones
 - Bones become thicker and increase in strength [Pinterest](#)



Figure 6.14 Vigorous exercise can strengthen bone.

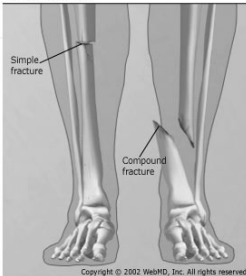


7

Bone Fractures

Fracture—break in a bone

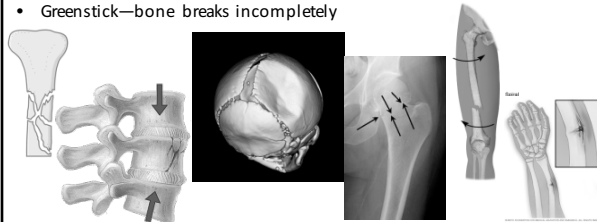
- Types of bone fractures
 - Closed (simple) fracture—break that does not penetrate the skin
 - Open (compound) fracture—broken bone penetrates through the skin
- Bone fractures are treated by reduction (realignment of the bone) and immobilization



The diagram shows two human legs from the knee down to the foot. The left leg has a 'Simple fracture' where the bone is broken but the skin is intact. The right leg has a 'Compound fracture' where the bone is broken and protrudes through the skin. The text 'Copyright © 2002 WebMD, Inc. All rights reserved.' and 'WebMD' are visible below the diagram.

Common Types of Fractures

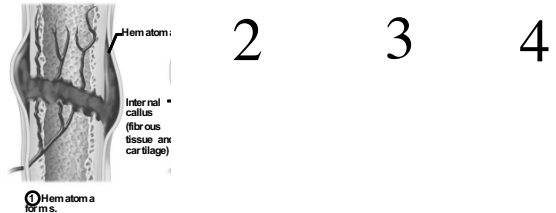
- Comminuted—bone breaks into many fragments
- Compression—bone is crushed
- Depressed—broken bone portion is pressed inward
- Impacted—broken bone ends are forced into each other
- Spiral—ragged break occurs when excessive twisting forces are applied to a bone
- Greenstick—bone breaks incompletely



The image contains several diagrams: a comminuted fracture of a long bone, a compression fracture of a vertebra, a depressed fracture of a skull, an impacted fracture of a humerus, a spiral fracture of a forearm, and a greenstick fracture of a forearm.

Repair of Bone Fractures

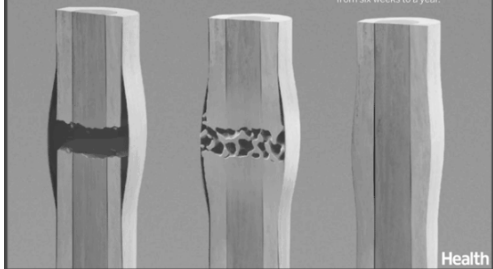
- Hematoma (blood-filled swelling) is formed
- Break is splinted by fibrocartilage to form a callus
- Fibrocartilage callus is replaced by a bony callus
- Bony callus is remodeled to form a permanent patch



The diagram shows a cross-section of a bone with a fracture. Stage 1 shows a 'Hematoma forms' at the break. Stage 2 shows 'Internal callus (fibrous tissue and cartilage)' forming around the break. Stage 3 shows a larger 'Bony callus' forming. Stage 4 shows the bone being remodeled. The text 'Figure 5.7' is at the bottom right.

A healthy bone is a stressed bone

Can't break in the same spot 2x



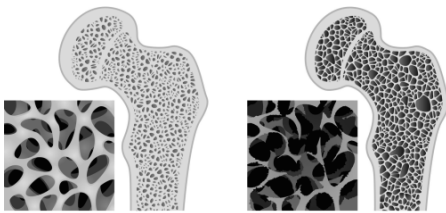
k-k club

Example of bone disease

- "Osteo" = bone "porosis" = filled with holes

This means that there is more **Osteoclast** activity than **Osteoblast** .

Osteoporosis



Healthy bone

Osteoporosis
