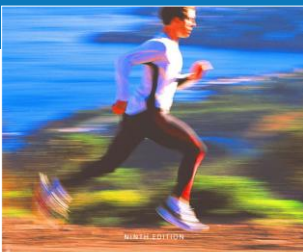


PowerPoint® Lecture Slide Presentation  
by Patty Bostwick-Taylor  
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## The Skeletal System

ESSENTIALS OF  
HUMAN ANATOMY  
& PHYSIOLOGY

ELAINE N. MARIEB

5 PART A

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## The Skeletal System

- Parts of the skeletal system
  - Bones (skeleton)
  - Joints
  - Cartilages
  - Ligaments
- Two subdivisions of the skeleton
  - Axial skeleton
  - Appendicular skeleton

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## Functions of Bones

- Support the body
- Protect soft organs
- Allow movement due to attached skeletal muscles
- Store minerals and fats
- Blood cell formation

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## Bones of the Human Body

- The adult skeleton has 206 bones
- Two basic types of bone tissue
  - Compact bone
    - Homogeneous
  - Spongy bone
    - Small needle-like pieces of bone
    - Many open spaces

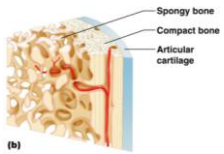
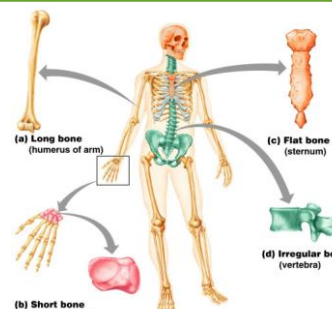


Figure 5.2b

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## Classification of Bones on the Basis of Shape



(a) Long bone (humerus of arm)

(b) Short bone (carpal of wrist)

(c) Flat bone (sternum)

(d) Irregular bone (vertebra)

Figure 5.1

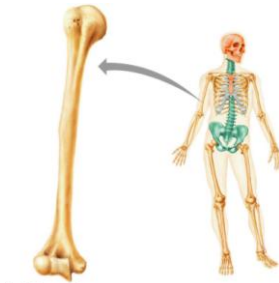
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## Classification of Bones

- Long bones
  - Typically longer than they are wide
  - Have a shaft with heads at both ends
  - Contain mostly compact bone
- Example:**
  - Femur
  - Humerus

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## Classification of Bones



(a) Long bone  
(humerus of arm)

Figure 5.1a

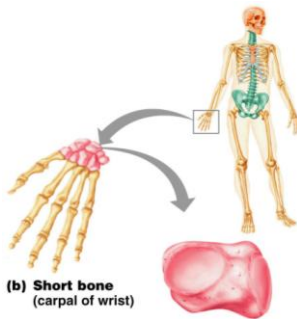
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## Classification of Bones

- Short bones
  - Generally cube-shape
  - Contain mostly spongy bone
  - **Example:**
    - Carpals
    - Tarsals

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## Classification of Bones



(b) Short bone  
(carpal of wrist)

Figure 5.1b

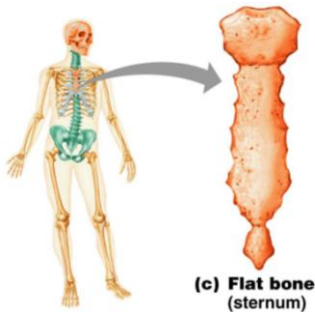
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## Classification of Bones

- Flat bones
  - Thin, flattened, and usually curved
  - Two thin layers of compact bone surround a layer of spongy bone
  - **Example:**
    - Skull
    - Ribs
    - Sternum

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## Classification of Bones



(c) Flat bone  
(sternum)

Figure 5.1c

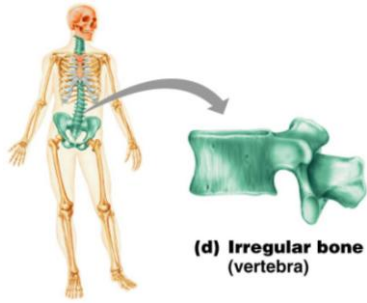
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## Classification of Bones

- Irregular bones
  - Irregular shape
  - Do not fit into other bone classification categories
  - **Example:**
    - Vertebrae
    - Hip bones

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## Classification of Bones



(d) Irregular bone  
(vertebra)

Figure 5.1d

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## Anatomy of a Long Bone

- Diaphysis
  - Shaft
  - Composed of compact bone
- Epiphysis
  - Ends of the bone
  - Composed mostly of spongy bone

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## Anatomy of a Long Bone

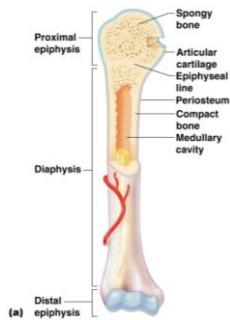


Figure 5.2a

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## Anatomy of a Long Bone

- Periosteum
  - Outside covering of the diaphysis
  - Fibrous connective tissue membrane
- Sharpey's fibers
  - Secure periosteum to underlying bone
- Arteries
  - Supply bone cells with nutrients

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## Anatomy of a Long Bone

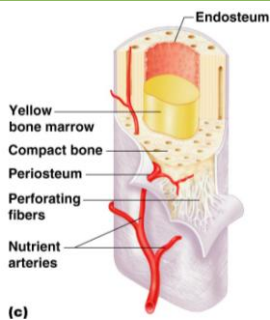


Figure 5.2c

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## Anatomy of a Long Bone

- Articular cartilage
  - Covers the external surface of the epiphyses
  - Made of hyaline cartilage
  - Decreases friction at joint surfaces

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## Anatomy of a Long Bone

- Epiphyseal plate
  - Flat plate of hyaline cartilage seen in young, growing bone
- Epiphyseal line
  - Remnant of the epiphyseal plate
  - Seen in adult bones

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## Anatomy of a Long Bone

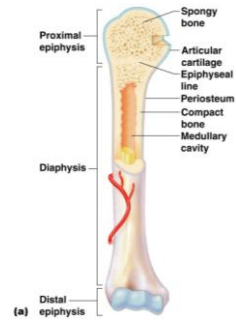


Figure 5.2a

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## Anatomy of a Long Bone

- Medullary cavity
  - Cavity inside of the shaft
  - Contains yellow marrow (mostly fat) in adults
  - Contains red marrow (for blood cell formation) in infants

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## Anatomy of a Long Bone

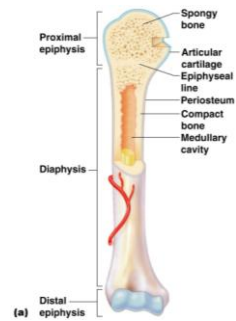


Figure 5.2a

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## Bone Markings

- Surface features of bones
  - Sites of attachments for muscles, tendons, and ligaments
  - Passages for nerves and blood vessels
- Categories of bone markings
  - Projections or processes—grow out from the bone surface
  - Depressions or cavities—indentations

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## Bone Markings

TABLE 5.1 Bone Markings

Name of bone marking	Description	Illustration
<b>Projections That Are Sites of Muscle and Ligament Attachment</b>		
Tuberosity	Large, rounded projection; may be roughened	Trochanters, Iliac crest, Intertrochanteric line
Crest	Narrow ridge of bone; usually prominent	Iliac crest
Trochanter (tro-kan'ter)	Very large, blunt, irregularly shaped process (the only examples are on the femur)	Ischial spine, Ischial tuberosity
Line	Narrow ridge of bone; less prominent than a crest	Coxal bone, Femur of thigh, Medial epicondyle
Tubercle (too-ber-kl)	Small, rounded projection or process	Vertebra, Adductor tubercle
Epicondyle	Raised area on or above a condyle	Medial epicondyle
Spine	Sharp, slender, often pointed projection	Spinous process
Process	Any bony prominence	

Table 5.1 (1 of 2)

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## Bone Markings

TABLE 5.1 Bone Markings (continued)

Name of bone marking	Description	Illustration
<b>Projections That Help to Form Joints</b>		
Head	Bony expansion carried on a narrow neck	
Facet	Smooth, nearly flat articular surface	
Condyle (or 'dill')	Rounded articular projection	
Ramus (or 'mus')	Armlike bar of bone	
<b>Depressions and Openings Allowing Blood Vessels and Nerves to Pass</b>		
Meatus (mea-'tull')	Canal-like passageway	
Sinus	Cavity within a bone, filled with air and lined with mucous membrane	
Fossa (fos-'ah)	Shallow, basinlike depression in a bone, often serving as an articular surface	
Groove	Furrow	
Fissure	Narrow, slitlike opening	
Foramen (fora-'ment)	Round or oval opening through a bone	

Table 5.1 (2 of 2)

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## Microscopic Anatomy of Bone

- **Osteon (Haversian system)**
  - A unit of bone containing central canal and matrix rings
- **Central (Haversian) canal**
  - Opening in the center of an osteon
  - Carries blood vessels and nerves
- **Perforating (Volkman's) canal**
  - Canal perpendicular to the central canal
  - Carries blood vessels and nerves

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## Microscopic Anatomy of Bone

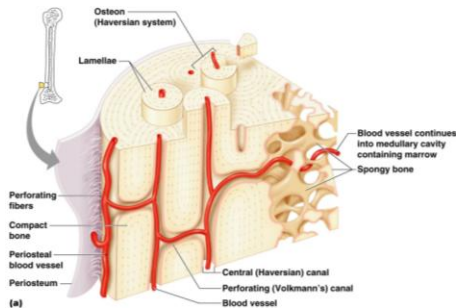


Figure 5.3a

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## Microscopic Anatomy of Bone

- **Lacunae**
  - Cavities containing bone cells (osteocytes)
  - Arranged in concentric rings
- **Lamellae**
  - Rings around the central canal
  - Sites of lacunae

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## Microscopic Anatomy of Bone

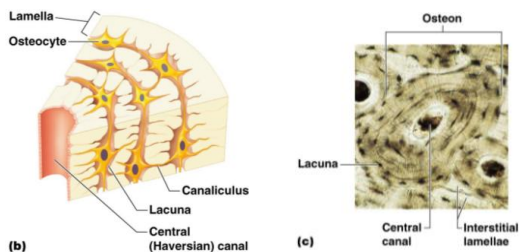


Figure 5.3b-c

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## 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

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## Microscopic Anatomy of Bone

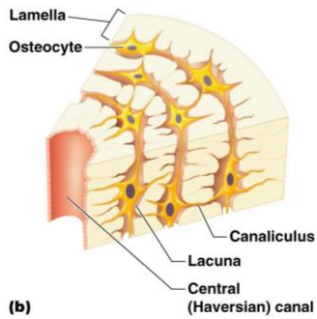


Figure 5.3b

## Formation of the Human Skeleton

- In embryos, the skeleton is primarily hyaline cartilage
- During development, much of this cartilage is replaced by bone
- Cartilage remains in isolated areas
  - Bridge of the nose
  - Parts of ribs
  - Joints

## Bone Growth (Ossification)

- Epiphyseal plates allow for lengthwise growth of long bones during childhood
  - New cartilage is continuously formed
  - Older cartilage becomes ossified
    - Cartilage is broken down
    - Enclosed cartilage is digested away, opening up a medullary cavity
    - Bone replaces cartilage through the action of osteoblasts

## Bone Growth (Ossification)

- Bones are remodeled and lengthened until growth stops
  - Bones are remodeled in response to two factors
    - Blood calcium levels
    - Pull of gravity and muscles on the skeleton
  - Bones grow in width (called appositional growth)

## Long Bone Formation and Growth

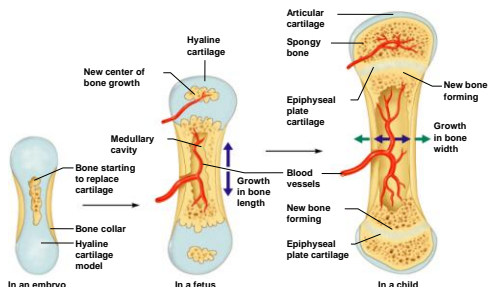


Figure 5.4a

## Long Bone Formation and Growth

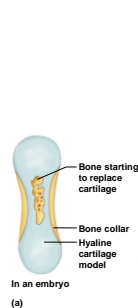


Figure 5.4a, step 1

## Long Bone Formation and Growth

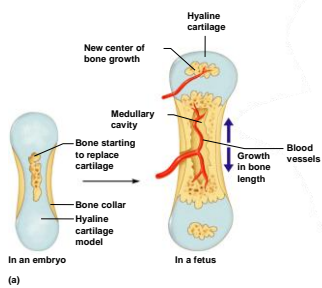


Figure 5.4a, step 2

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## Long Bone Formation and Growth

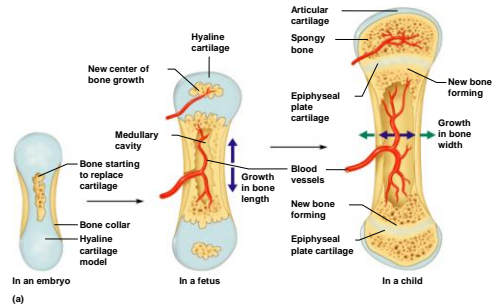
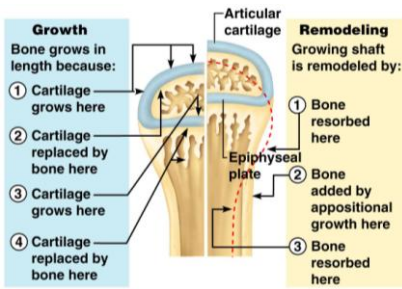


Figure 5.4a, step 3

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## Long Bone Formation and Growth



(b)

Figure 5.4b

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## Types of Bone Cells

- **Osteocytes**—mature bone cells
- **Osteoblasts**—bone-forming cells
- **Osteoclasts**—bone-destroying cells
  - Break down bone matrix for remodeling and release of calcium in response to parathyroid hormone
- Bone remodeling is performed by both osteoblasts and osteoclasts

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