



## NOTES: Skeletal System & Bones Part 1

### Overview of Skeletal System:

#### Skeletal System

**Bones**  
**Joints**  
**Cartilage**  
**Tendons (bone to muscle)**  
**Ligaments (bone to bone)**

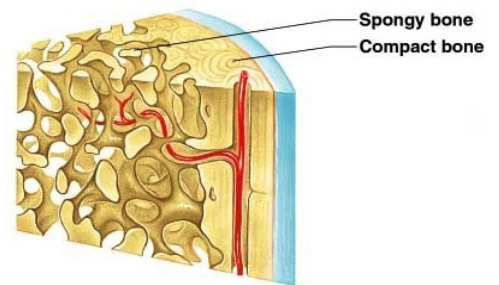


### Function of the Skeletal System

- \_\_\_\_\_ of the body
- \_\_\_\_\_ of soft organs
- \_\_\_\_\_ due to attached skeletal muscles
- \_\_\_\_\_ of minerals and fats
- \_\_\_\_\_ formation

### Types of Bone Tissue

- \_\_\_\_\_: Hard outer layer of bone
- \_\_\_\_\_: Less dense, small needle-like pieces of bone (\_\_\_\_\_)
  - Many \_\_\_\_\_
- \_\_\_\_\_: Soft tissue inside bone that produces blood cells



### Classification of Bone

- Bones are classified according to shape

#### 1. Long Bones

- Typically \_\_\_\_\_
- Have a shaft with heads at both ends
- Contain mostly \_\_\_\_\_
- Examples: Femur, humerus

#### 2. Short bones

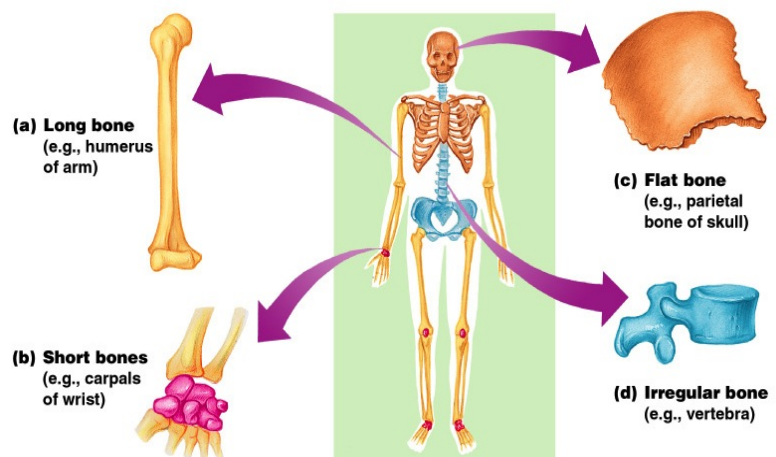
- Generally \_\_\_\_\_
- Contain mostly \_\_\_\_\_
- Examples: Carpals, tarsals

#### 3. Flat bones

- \_\_\_\_\_
- Usually curved
- Thin layers of compact bone around a layer of spongy bone
- Examples: Skull, ribs, sternum

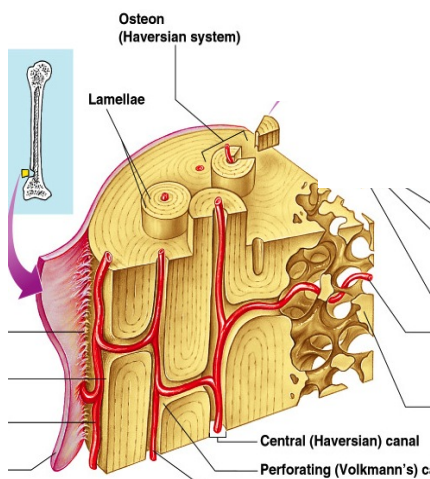
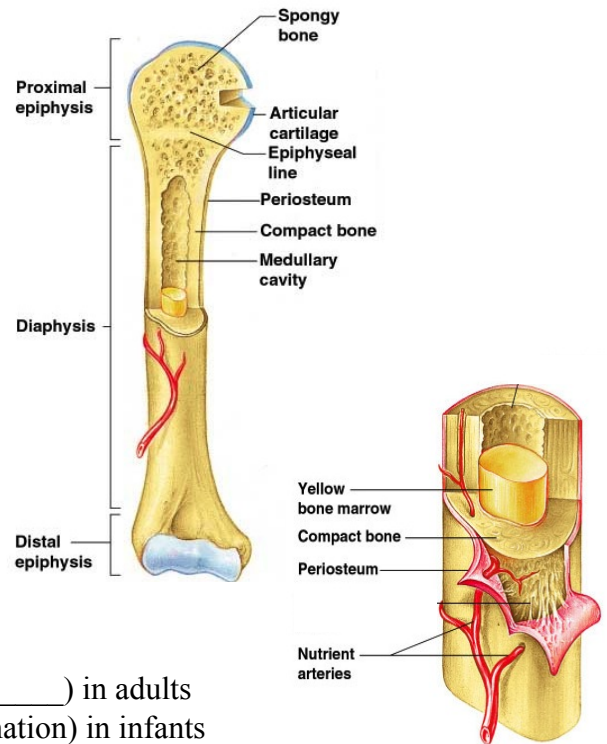
#### 4. Irregular bones

- \_\_\_\_\_
- Do not fit into other bone classification categories
- Example: Vertebrae and hip



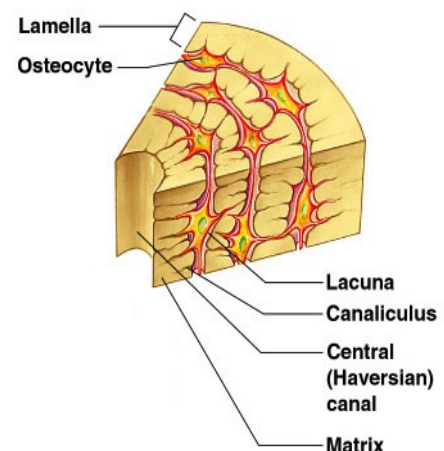
## Gross Anatomy of Long Bone

- Diaphysis - Shaft
  - Composed of \_\_\_\_\_
  - Location of \_\_\_\_\_ (fat)
- Epiphysis - Ends of the bone
  - Composed mostly of \_\_\_\_\_
  - Location of \_\_\_\_\_ (blood formation)
- Periosteum
  - \_\_\_\_\_ of the diaphysis
  - Fibrous connective tissue membrane
- Arteries
  - \_\_\_\_\_ bone cells with \_\_\_\_\_
- Articular cartilage
  - Covers the external surface of the epiphyses
  - Made of hyaline cartilage
  - \_\_\_\_\_ at joint surfaces
- Medullary cavity
  - Cavity of the shaft
  - Contains \_\_\_\_\_ (mostly \_\_\_\_\_) in adults
  - Contains \_\_\_\_\_ (for blood cell formation) in infants



## Microscopic Anatomy of the Bone

- \_\_\_\_\_ (Haversian System)
  - A unit of bone
- \_\_\_\_\_ (Haversian) \_\_\_\_\_
  - Opening in the center of an osteon
  - \_\_\_\_\_
- \_\_\_\_\_
  - Cavities containing bone cells (osteocytes)
  - Arranged in concentric rings
- Lamellae
  - Rings around the central canal
  - Sites of lacunae
- Canaliculi
  - \_\_\_\_\_
  - Radiate from the central canal to lacunae
  - Form a \_\_\_\_\_



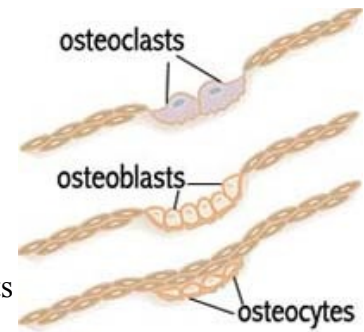
## Ossification: Bone Growth

- \_\_\_\_\_ allow for growth of long bone during childhood
  - New cartilage is continuously formed
  - Older cartilage becomes ossified (changed to bone)
    - Cartilage is broken down
    - \_\_\_\_\_
- Bones are remodeled and lengthened until growth stops
  - Bones change shape somewhat

- Bones grow in width

## Types of Bone Cells







- \_\_\_\_\_
- Mature bone cells
- \_\_\_\_\_
- Bone-\_\_\_\_\_ cells for \_\_\_\_\_
- \_\_\_\_\_
- Bone-\_\_\_\_\_ cells
- Break down bone matrix for remodeling and release of calcium
- Bone remodeling is a process done by both osteoblasts and osteoclasts



## Bone Fractures

- \_\_\_\_\_
- Types of bone fractures
  - \_\_\_\_\_ (simple) fracture – break that does not penetrate the skin
  - \_\_\_\_\_ (compound) fracture – broken bone penetrates through the skin
- Bone fractures are treated by reduction and immobilization
  - Realignment of the bone

## Common Types of Fractures

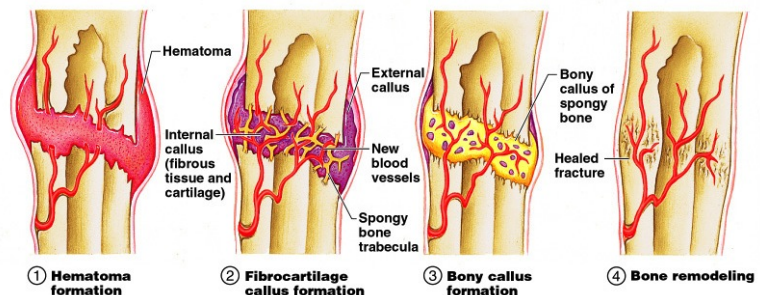
Fracture type	Illustration	Description	Comment
Comminuted		Bone breaks into many fragments.	Particularly common in the aged, whose bones are more brittle.
Compression		Bone is crushed. (i.e., osteoporotic bones).	Common in porous bones
Depressed		Broken bone portion is pressed inward.	Typical of skull fracture.
Impacted		Broken bone ends are forced into each other.	Commonly occurs when one attempts to break a fall with outstretched arms
Spiral		Ragged break occurs when excessive twisting forces are applied to a bone.	Common sports fracture.
Greenstick		Bone breaks incompletely, much in the way a green adults.	Common in children, whose bones are more flexible than those of

## Repair of Bone Fractures

- \_\_\_\_\_ (blood-filled swelling) is formed
- Break is \_\_\_\_\_ (immobilized) by \_\_\_\_\_ to form a callus
- Fibrocartilage callus is replaced by a \_\_\_\_\_
- Bony callus is \_\_\_\_\_ to form a permanent patch

### Learning Goals:

1. Describe the functions of the skeletal system.
2. Differentiate between the 4 types of bones. Give an example of each.
3. Explain how ossification works
4. Compare the 3 types of bone cells.
5. Summarize how bone fractures are repaired.



## NOTES: Human Skeletal System Part 2

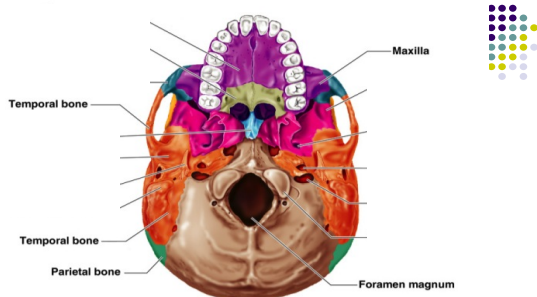
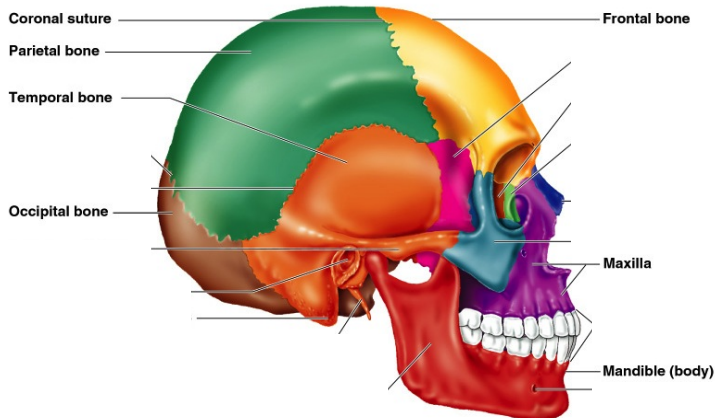
### Human Skeleton

- \_\_\_\_\_ in the adult human body
- Divided into 2 parts:
  - \_\_\_\_\_
    - Skull
    - Vertebral column
    - Rib cage
  - \_\_\_\_\_
    - Bones of arms and legs
    - Bones of shoulder
    - Pelvis



### The Axial Skeleton

- Divided into three parts
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_ (bony thorax)



● Inferior View of Skull

### The Skull

- Two sets of bones
  - \_\_\_\_\_
  - \_\_\_\_\_
- Skull bones are \_\_\_\_\_
- Only the mandible is attached by a freely movable joint

### Bones of the Cranium (Skull)

- \_\_\_\_\_
- Bones are attached by immovable joints called **sutures**
- Made up of 8 flat bones
  - 1 \_\_\_\_\_ bone
  - 2 \_\_\_\_\_ bones
  - 1 \_\_\_\_\_ bone
  - 2 \_\_\_\_\_ bones
  - 1 sphenoid bone
  - 1 ethmoid bone
- \_\_\_\_\_ – opening in the occipital bone
  - Area where spinal cord joins the brain

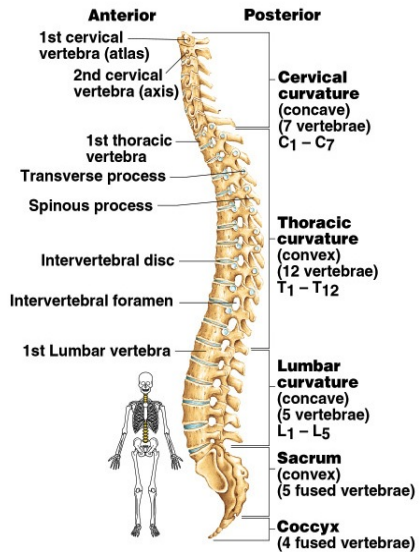
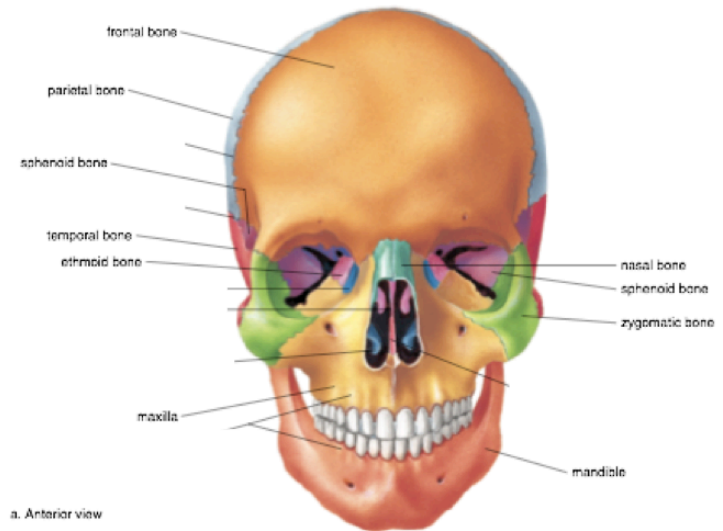
### The Fetal Skull

- \_\_\_\_\_ – fibrous membranes connecting the cranial bones
  - Allow the brain to grow
  - \_\_\_\_\_ within \_\_\_\_\_ after birth



## Facial Bones

- \_\_\_\_\_
- 2 bones that form the \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- Only movable bone of the skull
- Contains tooth sockets for 16 teeth
- \_\_\_\_\_
- Forms bridge of the nose
- Zygomatic bone
- 2 cheek bones

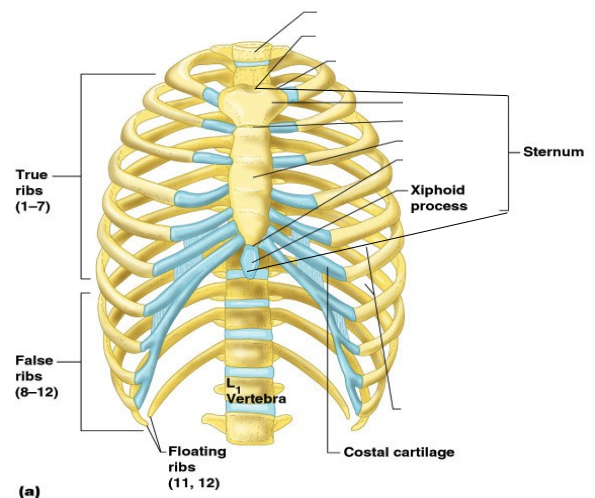


## The Vertebral Column

- Vertebrae \_\_\_\_\_ discs
- (pads of fibrocartilage)
- The spine has \_\_\_\_\_
- Each vertebrae is given a name according to its location
  - C = Cervical (C1-C7)
  - T = Thoracic (T1-T12)
  - L = Lumbar (L1-L5)
- Function: \_\_\_\_\_

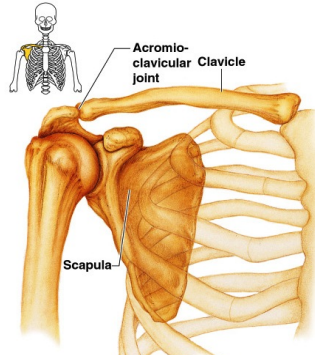
## The Rib Cage (Bony Thorax)

- \_\_\_\_\_
- Made-up of three parts:
  - 1) \_\_\_\_\_ -12 ribs connected to the vertebrae
    - \_\_\_\_\_:
    - Ribs that \_\_\_\_\_ to the \_\_\_\_\_
    - \_\_\_\_\_:
    - Ribs that \_\_\_\_\_ by a common \_\_\_\_\_
    - \_\_\_\_\_:
    - Ribs that \_\_\_\_\_ to the \_\_\_\_\_
  - 2) \_\_\_\_\_
    - Flat, blade-shaped bone
    - Composed of 3 bones: manubrium, body, \_\_\_\_\_
    - Xiphoid process
      - \_\_\_\_\_ and smallest portion of sternum
      - Attachment site for diaphragm
  - 3) \_\_\_\_\_
    - 12 thoracic vertebrae



## The Appendicular Skeleton

- \_\_\_\_\_
- \_\_\_\_\_ (appendages)
- \_\_\_\_\_

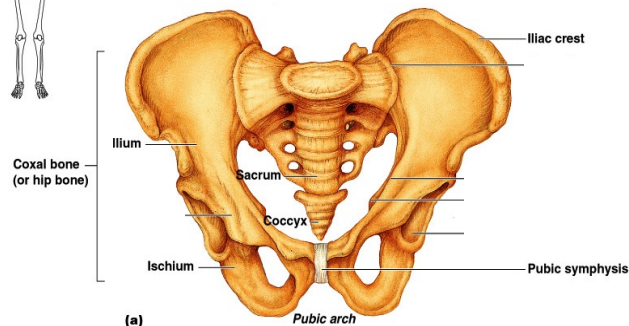
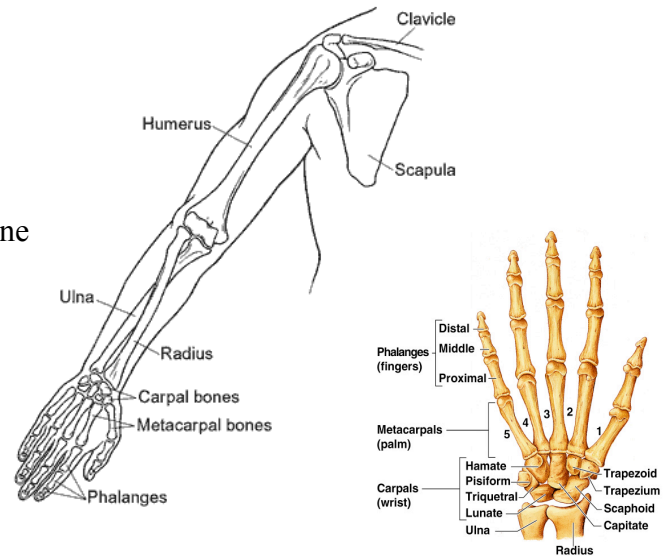


### The Pectoral (Shoulder) Girdle

- These bones allow the upper limbs to have \_\_\_\_\_
- Composed of 4 bones
  - 2 \_\_\_\_\_ – collarbone
    - Slender and s-shaped
    - Stabilizes shoulder but structurally weak (breaks easily)
  - 2 \_\_\_\_\_ – shoulder blade
    - Triangular shape

### Bones of the Upper Limb

- Humerus (upper arm)
- Radius and ulna (forearm)
- Carpals, metacarpals, phalanges (hand)
- The upper \_\_\_\_\_ is formed by a single bone
  - \_\_\_\_\_
- The \_\_\_\_\_ has two bones
  - \_\_\_\_\_
  - \_\_\_\_\_
- The hand
  - \_\_\_\_\_ – wrist
  - \_\_\_\_\_ – palm
  - \_\_\_\_\_ – fingers



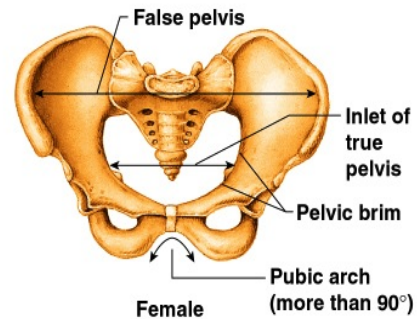
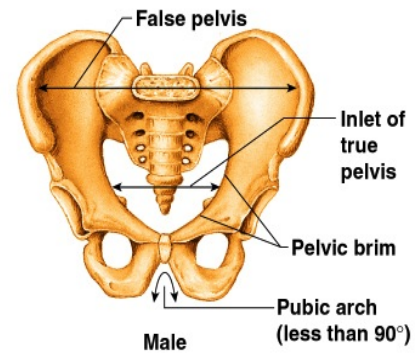
### Bones of the Pelvic Girdle

- \_\_\_\_\_
- Composed of:
  - 2 \_\_\_\_\_ bones (hipbones)
  - \_\_\_\_\_
  - \_\_\_\_\_
- The total weight of the upper body rests on the pelvis
- \_\_\_\_\_
  - Reproductive organs
  - Urinary bladder
  - Part of the large intestine

- Coxal bone:
  - \_\_\_\_\_ : largest part of coxal bone
    - \_\_\_\_\_ : top of the ilium
  - \_\_\_\_\_ : most inferior part of the coxal bone
  - \_\_\_\_\_ : anterior part of coxal bone
    - \_\_\_\_\_ : where the 2 \_\_\_\_\_

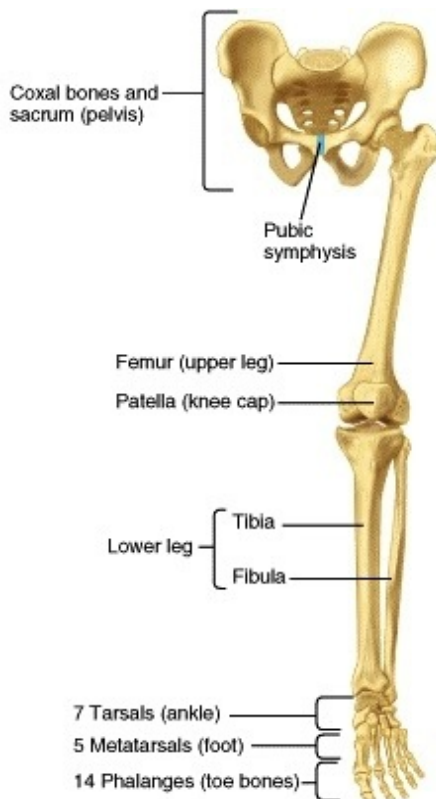
## Gender Differences of the Pelvis

- Male:
  - Not as wide or broad
  - Pelvic cavity is \_\_\_\_\_
  - Bones are \_\_\_\_\_ & larger
  - Pubic arch is more \_\_\_\_\_
- Female:
  - \_\_\_\_\_ pelvis & broader hips
  - Pelvic cavity is shallow
  - Bones are \_\_\_\_\_
  - Pubic arch is \_\_\_\_\_

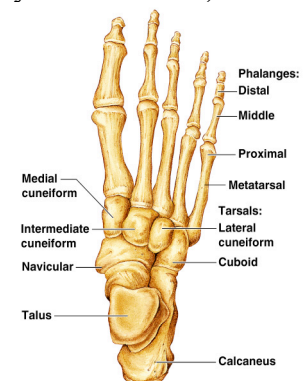


## Bones of the Lower Limb

- Femur (thigh)
- Patella (kneecap)
- Tibia & Fibula (leg)
- Tarsals, metatarsals, phalanges (foot)



- \_\_\_\_\_
- \_\_\_\_\_
- Strongest and longest bone in the body
- \_\_\_\_\_
- Triangular bone that protects the knee joint
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_ (towards the middle) to the fibula
- Thicker – bears weight of femur
- \_\_\_\_\_
- \_\_\_\_\_ (away from midline) to the tibia
- Stabilize ankle
- \_\_\_\_\_
- Ankle
- Supports weight of body
- \_\_\_\_\_
- Sole or instep
- \_\_\_\_\_
- Toes



## Learning Goals:

1. Explain how the human skeleton is divided.
2. Summarize the parts of the Axial Skeleton.
3. Summarize the parts of the Appendicular Skeleton.
4. Describe the function of the skull and vertebrae. What is different about the fetal skull?





## NOTES: Skeletal System Part 3 - Joints & Disorders

### Joints

- \_\_\_\_\_
- Functions of joints:
  - Hold bones together
  - Allow for mobility
- Joints are classified by the amount of movement allowed

### Joint Vocabulary

- \_\_\_\_\_
  - Connective tissue that connects bone to bone
- \_\_\_\_\_
  - Connective tissue that connects bone to muscles to further stabilize joint
- \_\_\_\_\_
  - Lubricating fluid found \_\_\_\_\_ bones to reduce friction
- \_\_\_\_\_
  - Fluid-filled sac that cushions joint
  - Ex: knee joint
- \_\_\_\_\_
  - Cartilaginous pads of tissue between the tibia and the femur

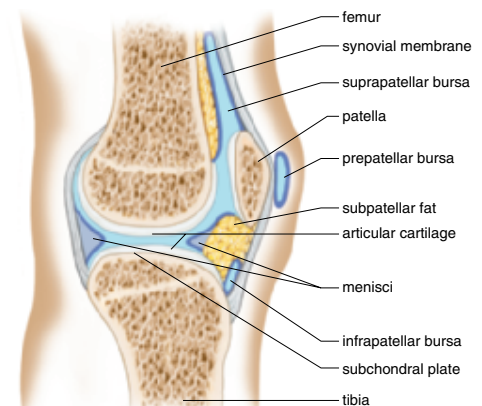
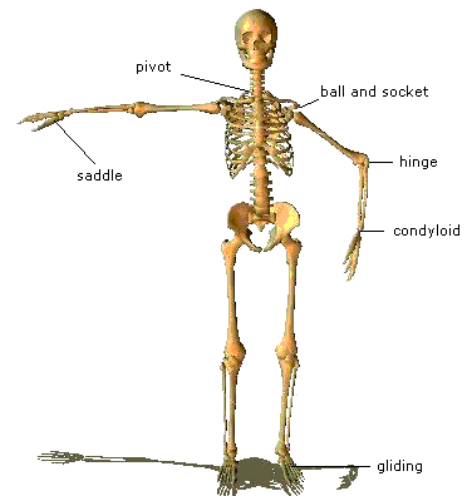
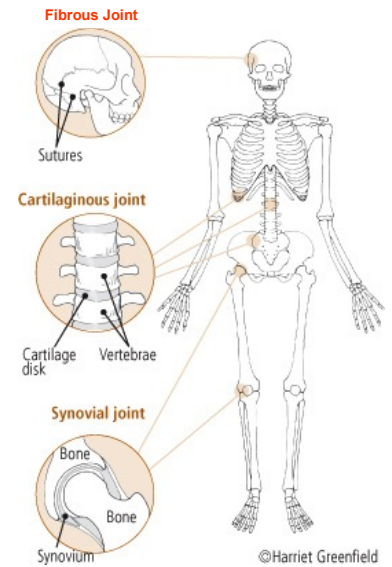
### Structural Classification of Joints

- \_\_\_\_\_:
  - Generally \_\_\_\_\_
  - Fibrous connective tissue join bone to bone
  - Example: \_\_\_\_\_
- \_\_\_\_\_:
  - Immovable or \_\_\_\_\_
  - Fibrocartilage found between bones
  - Example: ribs/sternum, \_\_\_\_\_, pelvis
- \_\_\_\_\_:
  - \_\_\_\_\_
  - Bones do not come in contact with each other
  - 6 Types of Synovial Joints (see tree map for details)
    - Pivot, Saddle, Ball & Socket, Hinge, Condylod, Gliding
  - \_\_\_\_\_

### Knee Injuries

#### 1. Torn Meniscus

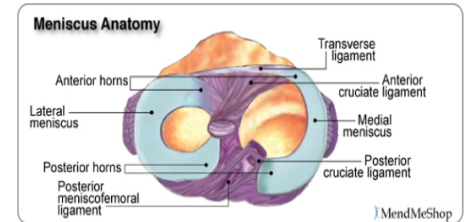
- The menisci \_\_\_\_\_ by compressing and spreading the weight evenly within the knee.
- The menisci are attached to the \_\_\_\_\_ and joint and ligaments, allowing the menisci to \_\_\_\_\_ freely.



Knee joint, lateral view

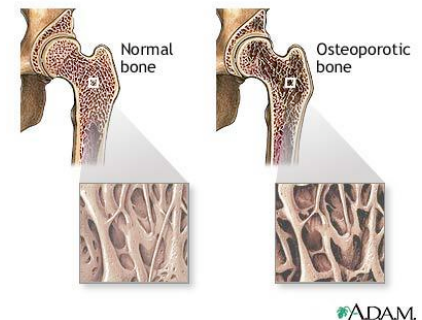
## Unit 3: Skeletal System

- Tears are one of the most common knee injuries.
  - Grow weaker with \_\_\_\_\_, and tear as a result of minor injuries or movements.
  - The most common injury occurs when the knee joint is \_\_\_\_\_ and the knee is then \_\_\_\_\_.
  - A damaged meniscus can cause it to become caught between the bones of the joint (femur and tibia).
- Symptoms: Knee then becomes swollen, \_\_\_\_\_, popping or clicking with the knee, and difficult to move.
- Treatment: \_\_\_\_\_ to repair tear by trimming a portion of the meniscus (meniscectomy).



### 2. Torn ACL (Anterior Cruciate Ligament)

- ACL provides \_\_\_\_\_ to the joint
- Common injury in athletes in contact sports
- Occurs when the knee is locked with the foot planted and the knee is \_\_\_\_\_ quickly.
- The bones are more likely to rub against each other (chronic ACL deficiency).
- Can also damage the cartilage that covers the ends of the bones and can trap and tear the menisci.
- Left untreated it can lead to osteoarthritis.



## Disorders of the Skeletal System

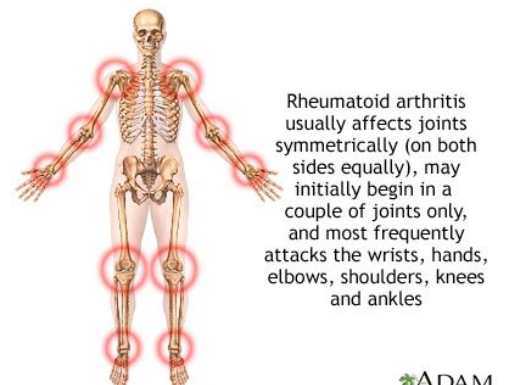
### Osteoporosis

- Most \_\_\_\_\_ bone disease
- \_\_\_\_\_ women in USA over 50 have osteoporosis
- Men over 70 are at risk
- During menopause, \_\_\_\_\_ levels drop
- Body stops making \_\_\_\_\_ due to lack of \_\_\_\_\_, resulting in \_\_\_\_\_ bones and fractures

### Arthritis

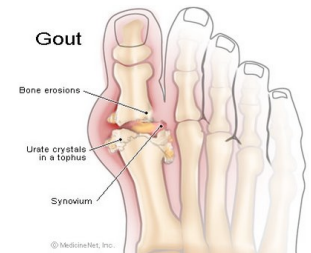
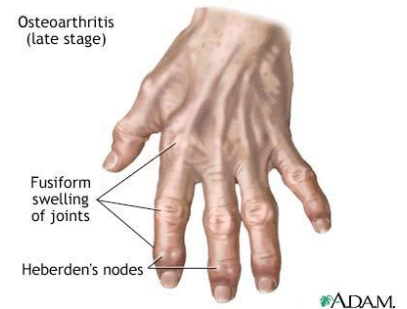
- \_\_\_\_\_ of one or more \_\_\_\_\_
- Breakdown of \_\_\_\_\_ causes bones to rub together, leading to pain, inflammation, and stiffness
- There are many different types of arthritis

- 1. \_\_\_\_\_ (OA)
  - Most common type of arthritis
  - Caused by 'wear and tear' on joint
  - Cartilage breaks down and bony spurs may develop
  - Runs in families



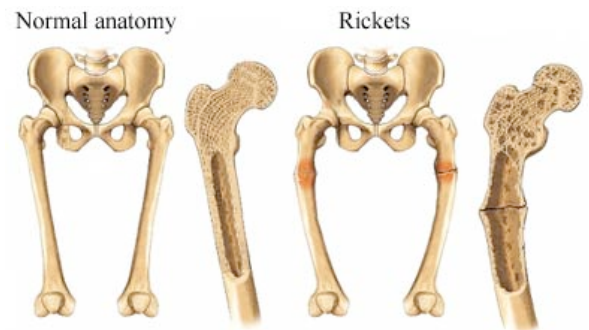
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- 2. \_\_\_\_\_ **arthritis (RA)**
  - Autoimmune disease
  - Body mistakenly attacks healthy tissues, breaking down cartilage
  - Common in middle-aged people
  - Women get RA more than men
- 3. \_\_\_\_\_
  - Type of arthritis that occurs when \_\_\_\_\_ builds up in the blood, causing crystals to form in the joint
  - Leads to major inflammation
  - More common in men, women after menopause, and those who drink alcohol



### Rickets

- Uncommon
- Caused by a lack of \_\_\_\_\_, calcium, or phosphate, leading to a weakening and deformation of bones
- Vitamin D deficiency caused by lack of \_\_\_\_\_ or rare genetic X-linked dominant trait



#### Learning Goals:

1. Describe the function of joints.
2. Explain and summarize the classification of joints.
3. Describe the common types of knee injuries.
4. Compare osteoporosis, arthritis, and rickets