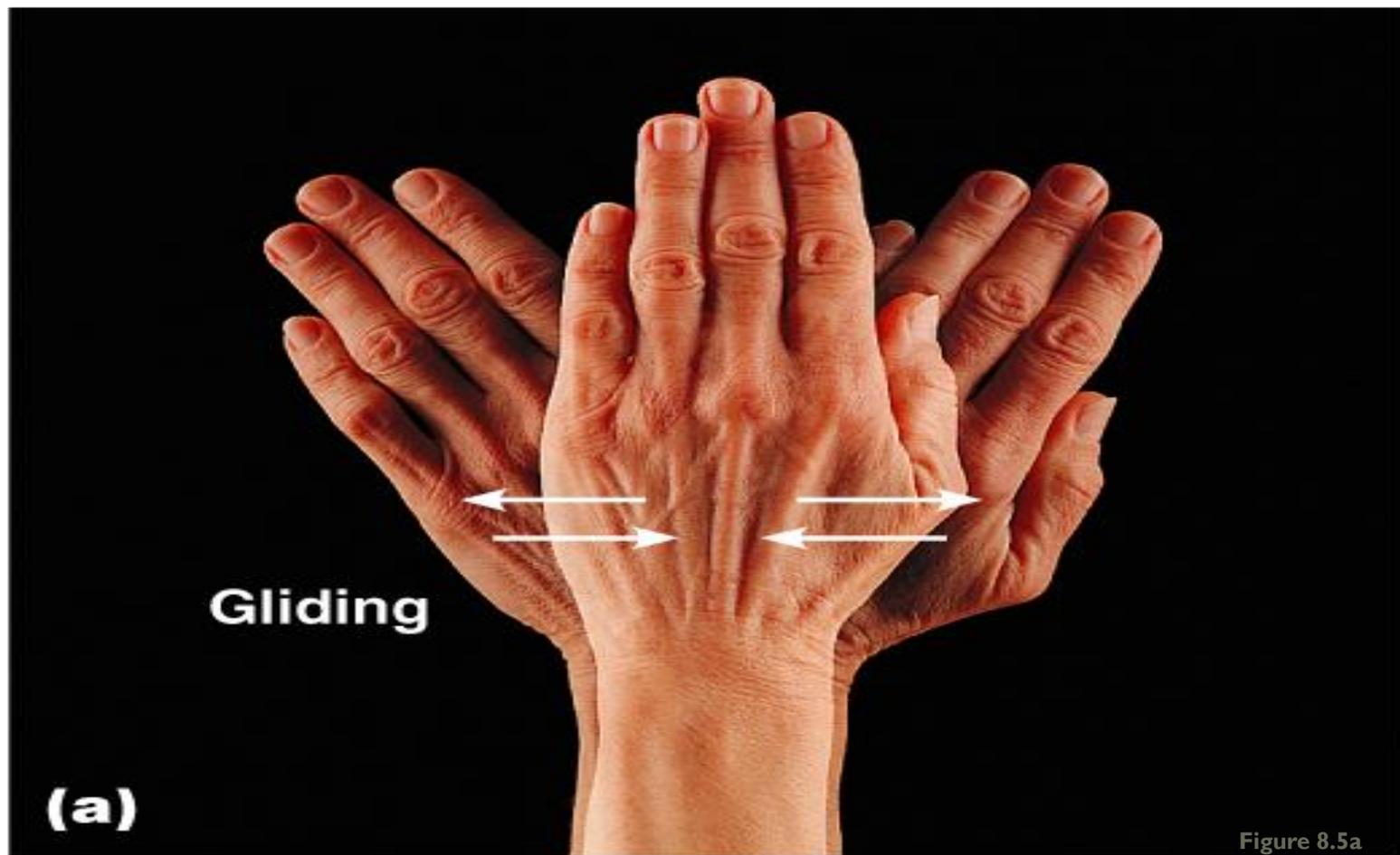
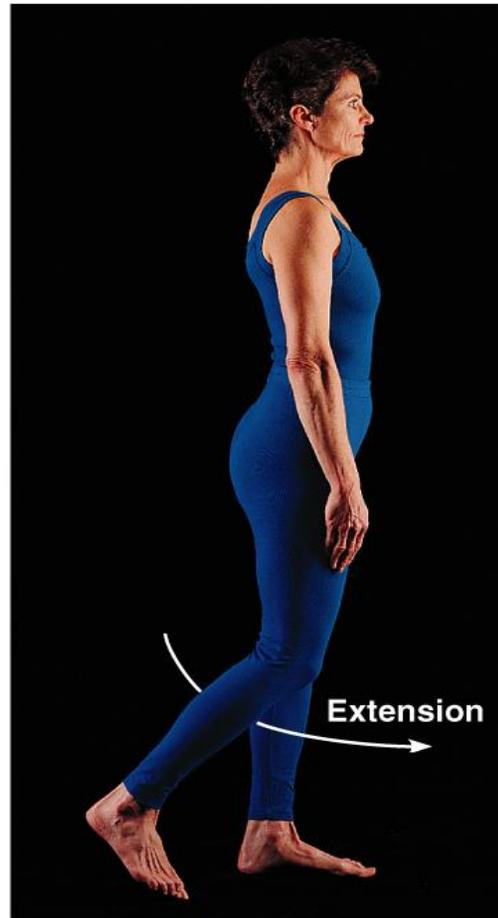
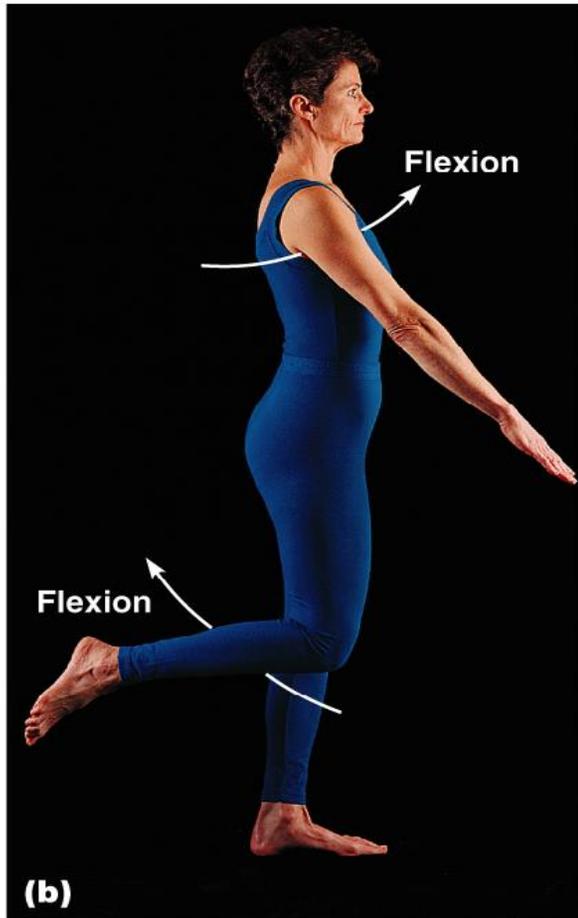


**JOINT UPDATE  
ARTHROLOGY  
D.HAMMOUDI.MD**

# GLIDING MOVEMENT



# ANGULAR MOVEMENT



# ANGULAR MOVEMENT

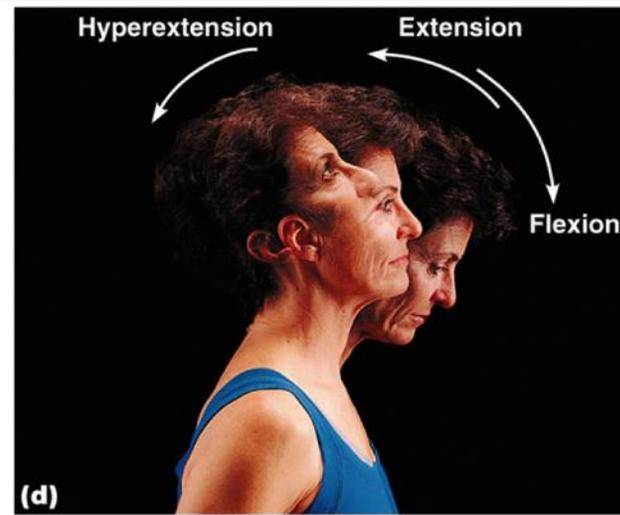
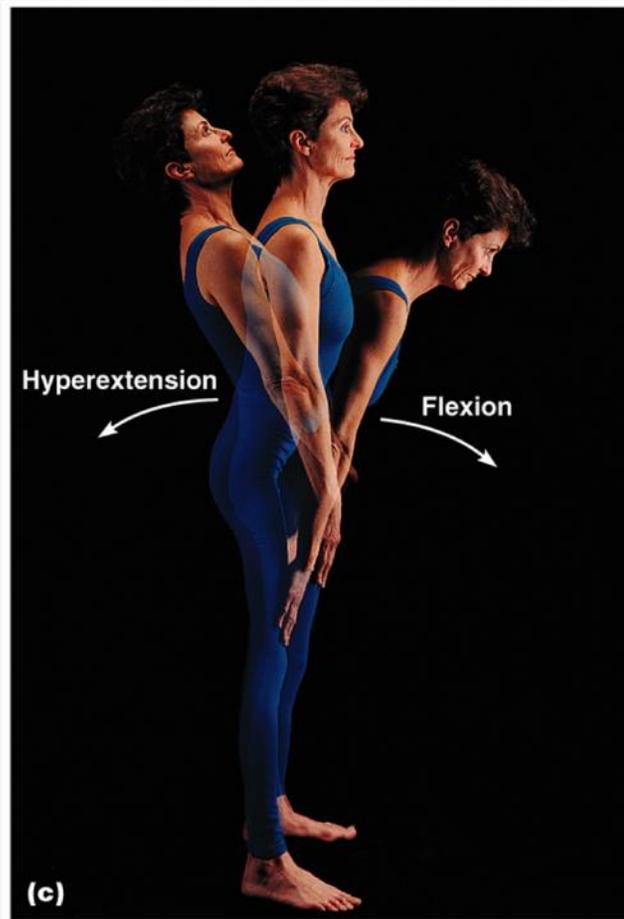
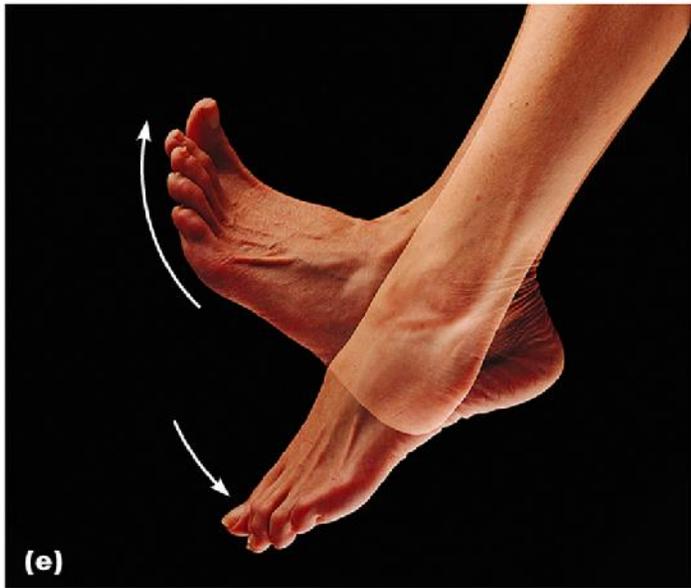


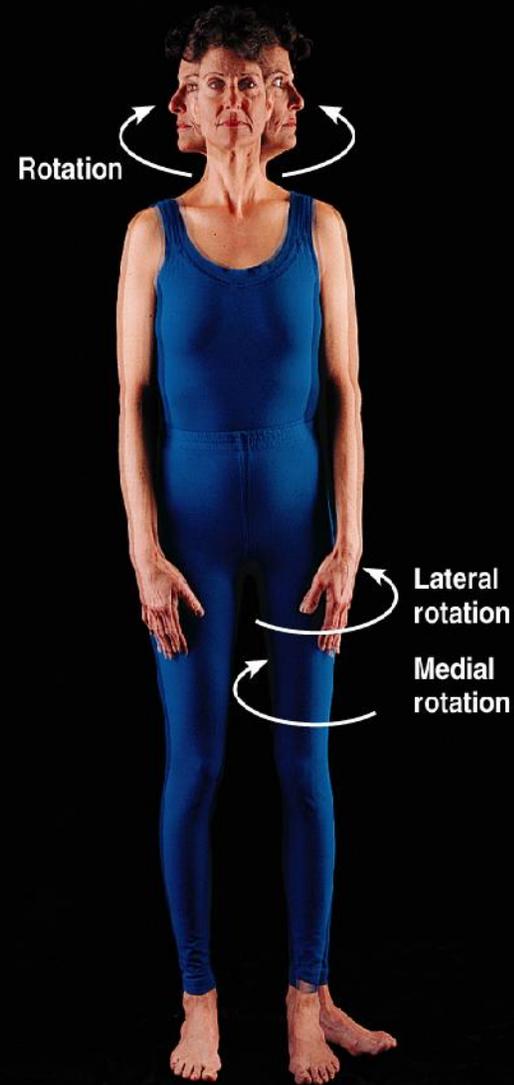
Figure 8.5c, d

# ANGULAR MOVEMENT



# ROTATION

- The turning of a bone around its own long axis
- Examples
  - Between first two vertebrae
  - Hip and shoulder joints



(g)

Figure 8.5g

# SPECIAL MOVEMENTS

- Supination and pronation
- Inversion and eversion
- Protraction and retraction
- Elevation and depression
- Opposition

# SPECIAL MOVEMENTS

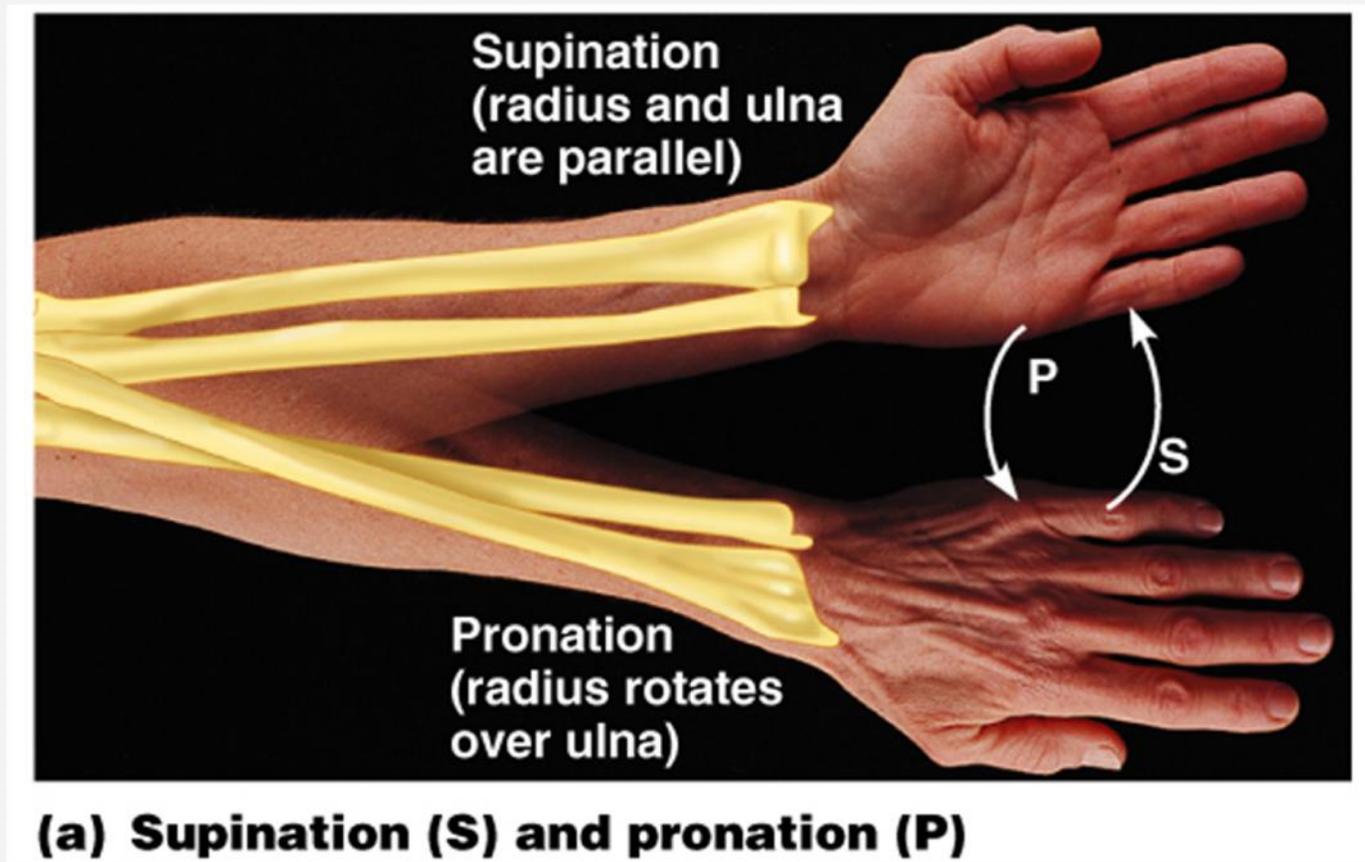
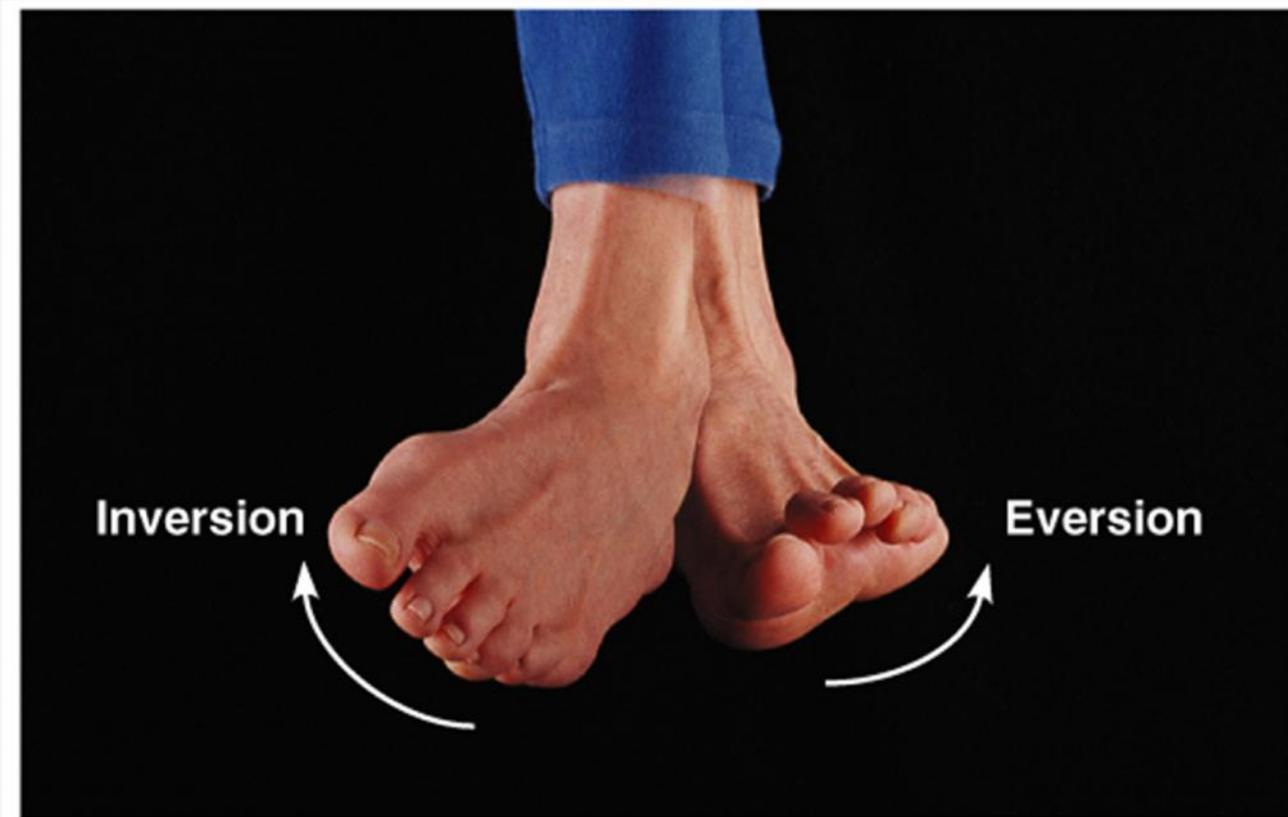


Figure 8.6a

# SPECIAL MOVEMENTS



**(b) Inversion and eversion**

Figure 8.6b

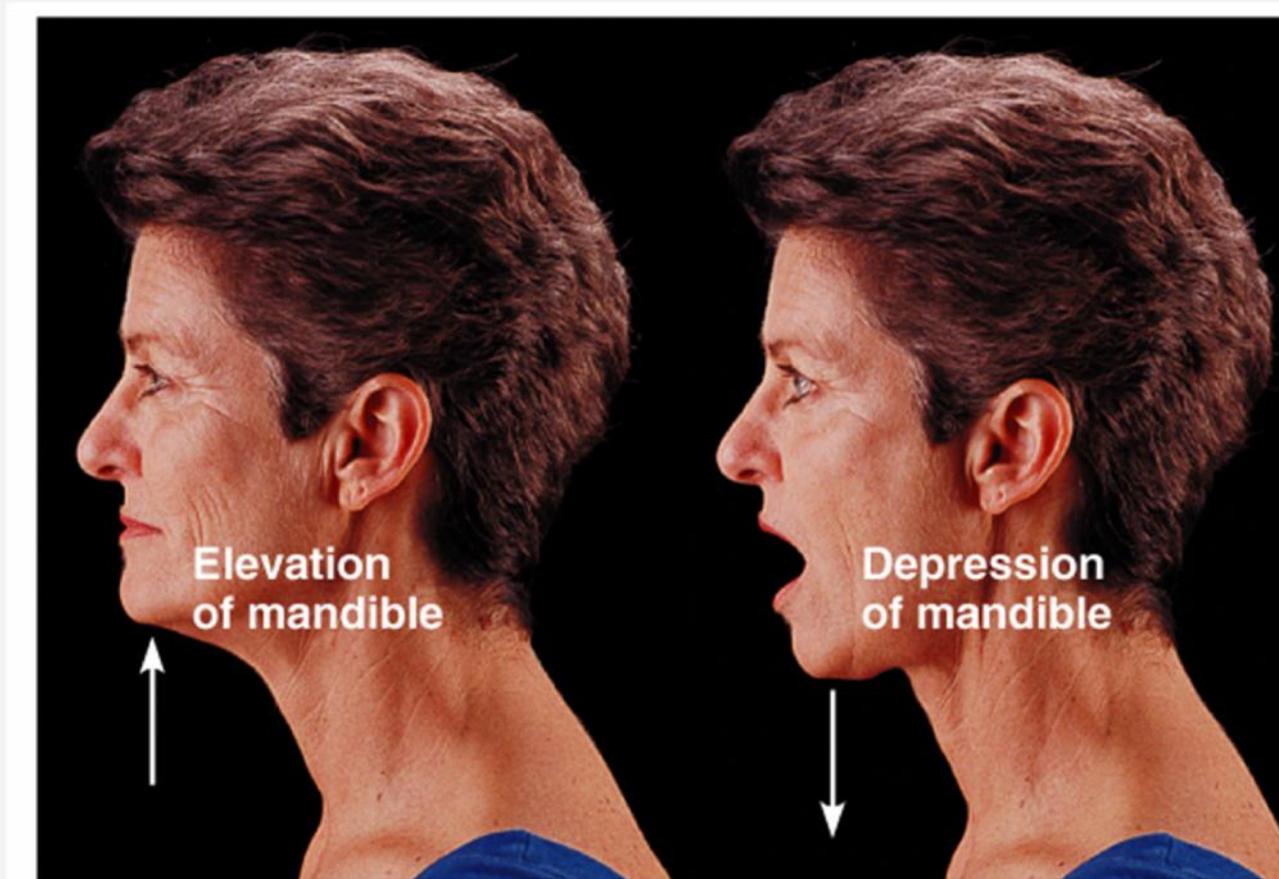
# SPECIAL MOVEMENTS



**(c) Protraction and retraction**

Figure 8.6c

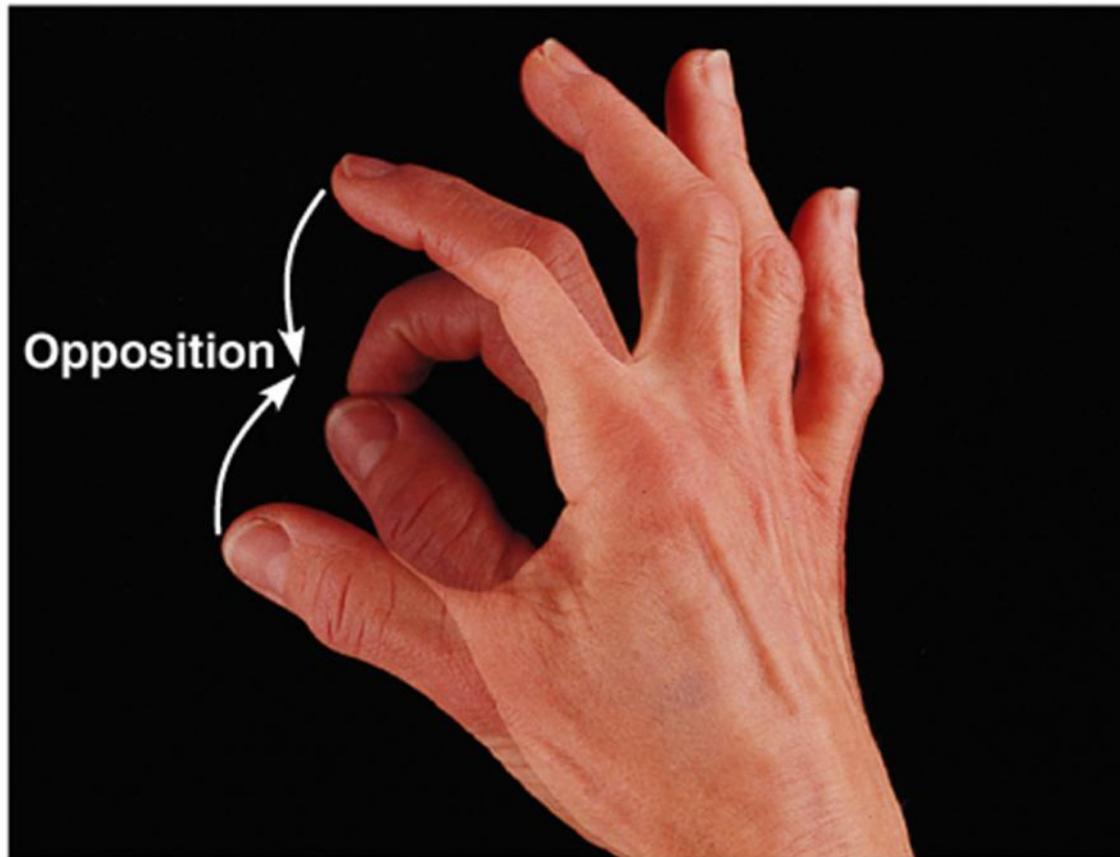
# SPECIAL MOVEMENTS



**(d) Elevation and depression**

Figure 8.6d

# SPECIAL MOVEMENTS



**(e) Opposition**

Figure 8.6e

## Arthrology: Study of joints

Joints are classified according to structure and function

### Structural:

1. **Fibrous joints:** composed of fibrous tissue with no joint cavity
2. **Cartilaginous joints:** articulating bones are united by cartilage and no joint cavity present.
3. **Synovial joints:** articular bones are separated by a fluid-filled joint cavity.

### Functional:

1. **Synarthroses:** immovable joints
2. **Amphiarthroses:** slightly movable joints (vertebral bodies and pubic bones)
3. **Diarthroses:** freely movable joints (most appendicular joints)

# JOINT BY MOTION

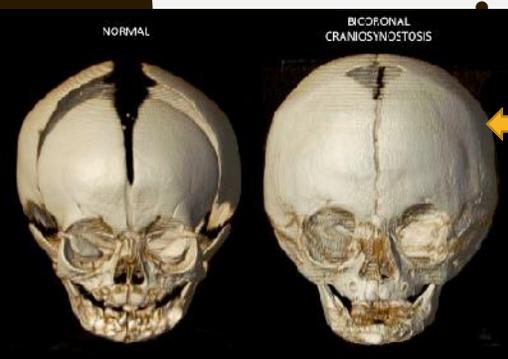
- **Immovable joints, or synarthroses:**
  - are usually adaptations to growth rather than mobility.
  - always between bones.
  - When growth ceases the bones often unite, and the joint is then obliterated by a process known as ***synostosis***:
    - In medical contexts, ***synostosis*** is the abnormal development of a joint.
    - It is a type of ***dysostosis***.

## **Movable joints, or diarthroses**

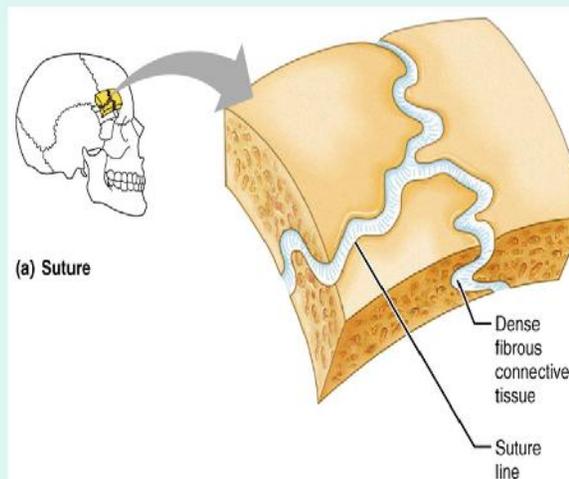
- are divided into those in which there is much and little movement.
- **little movement the term half-joint or *amphiarthrosis* is used**

Examples of synostosis include :

- ***Craniosynostosis***
- radio-ulnar synostosis
- syndactyly.

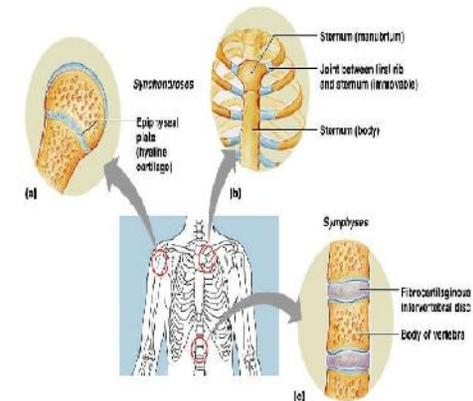


## Suture: a fibrous synarthrosis



Copyright © 2001 Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.

## Cartilagenous Joints Slightly Movable Joint (amphiarthrosis)



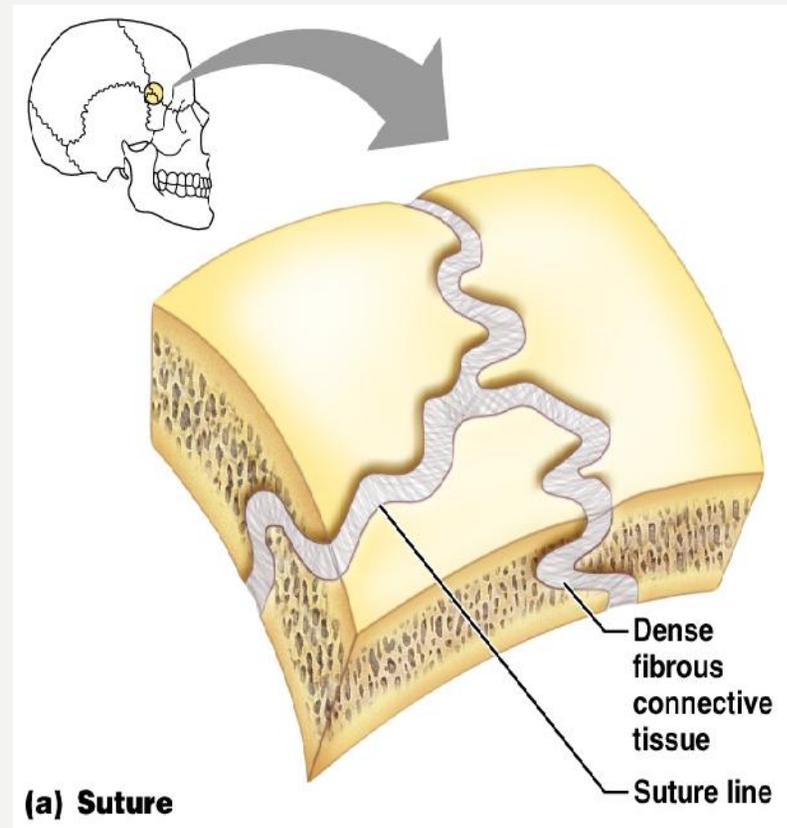
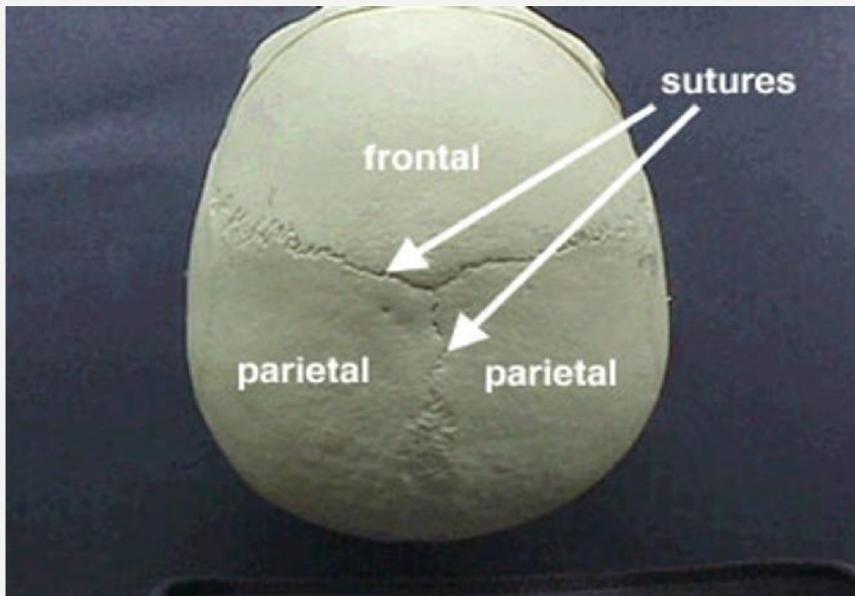
Copyright © 2001 Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.

# CLASSIFICATION OF JOINTS: FUNCTIONAL

- Functional classification is based on the amount of movement allowed by the joint
- The three functional classes of joints are:
  - **Synarthroses – immovable**
  - **Amphiarthroses – slightly movable**
  - **Diarthroses – freely movable**

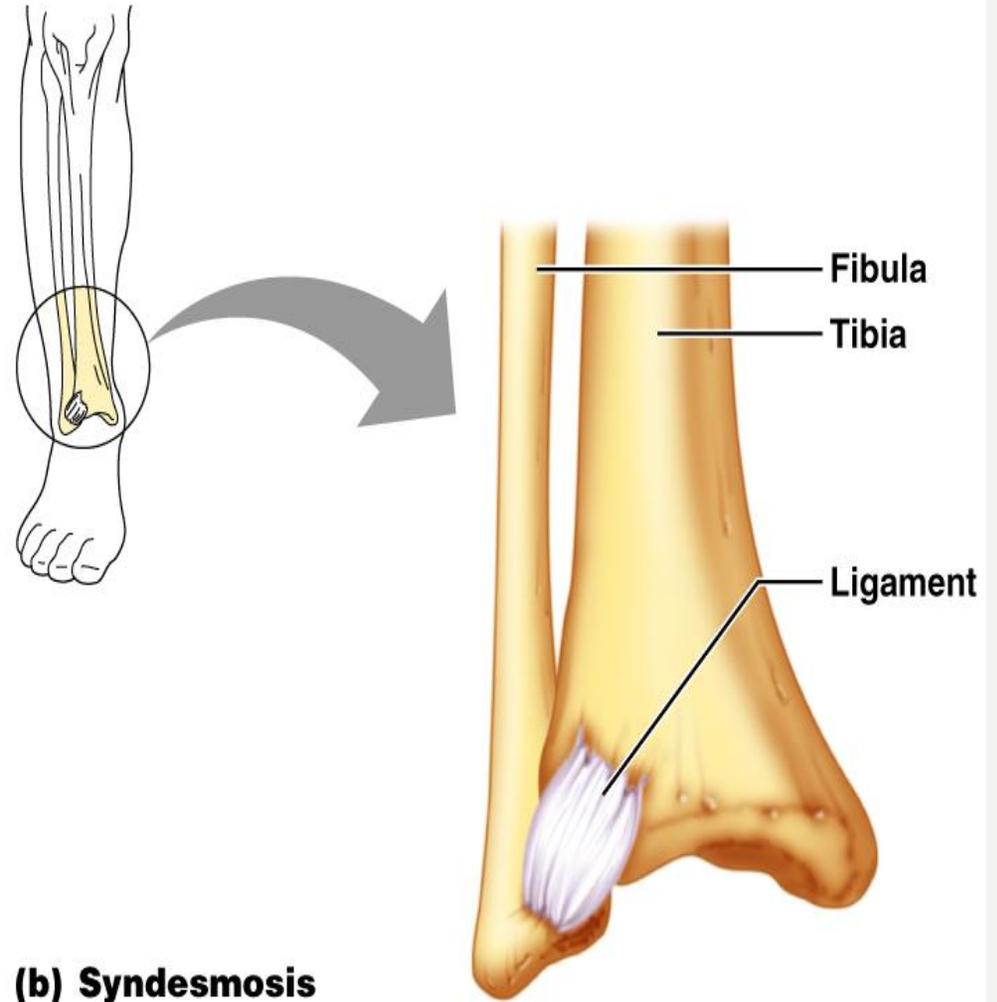
# FIBROUS STRUCTURAL JOINTS: **SUTURES**

- Occur between the bones of the skull
- Comprised of interlocking junctions completely filled with connective tissue fibers
- Bind bones tightly together, but allow for growth during youth
- **In middle age, skull bones fuse and are called synostoses**



# FIBROUS STRUCTURAL JOINTS: SYNDESMOSES

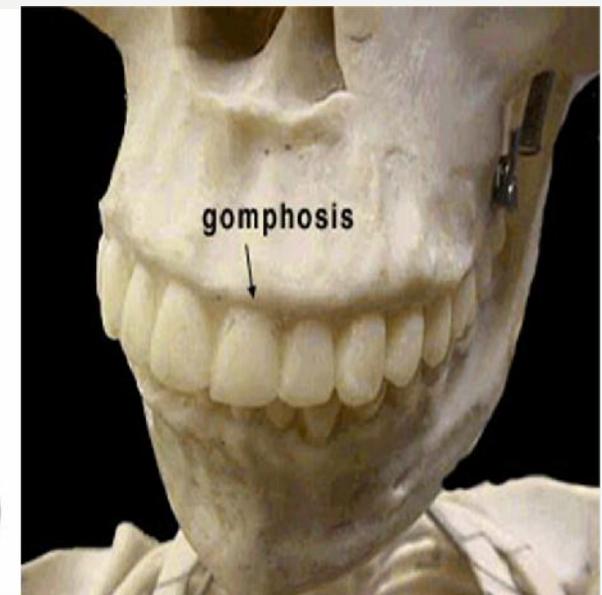
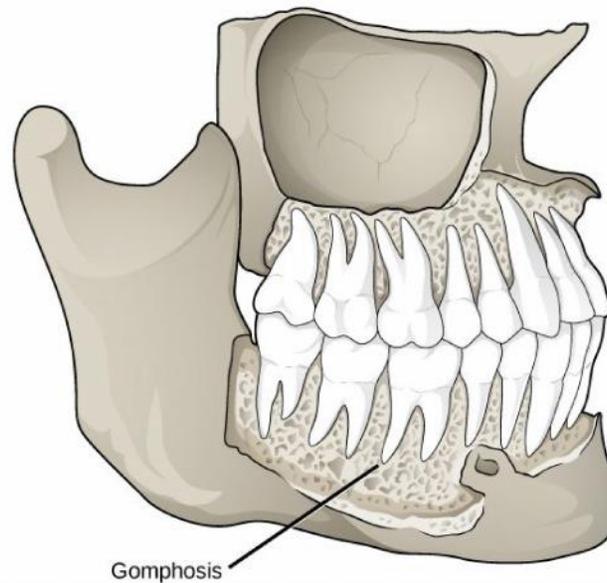
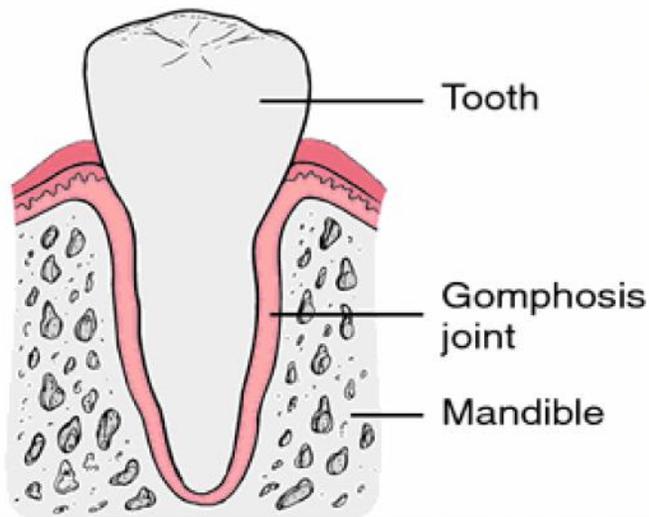
- Bones are connected by a fibrous tissue ligament
- Movement varies from immovable to slightly variable
- Examples include the connection between the tibia and fibula, and the radius and ulna



(b) Syndesmosis

# FIBROUS STRUCTURAL JOINTS: GOMPHOSES

- The peg-in-socket fibrous joint between a tooth and its alveolar socket
- The fibrous connection is the periodontal ligament



## **Cartilaginous joints:**

### **1. Synchondroses-**

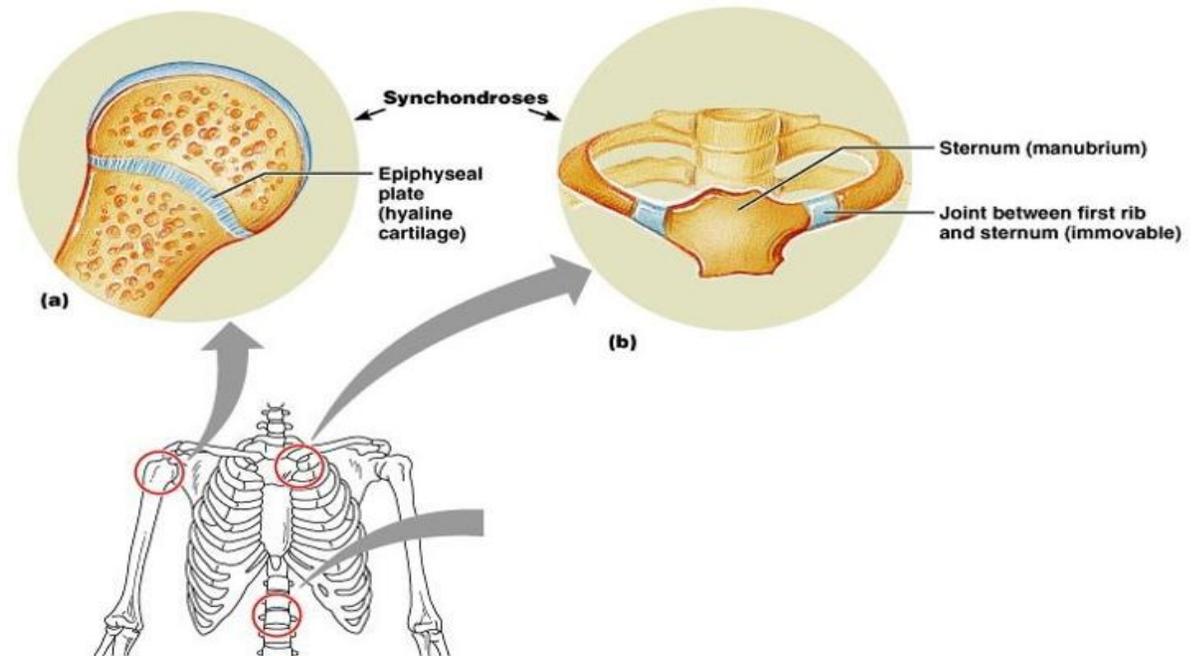
- hyaline cartilage unites bones at a synchondrosis.
- Cartilage is replaced by bone and becomes synarthrotic.
- Epiphyseal plate and the costal cartilage of the first rib and the manubrium of the sternum.

### **2. Symphyses-**

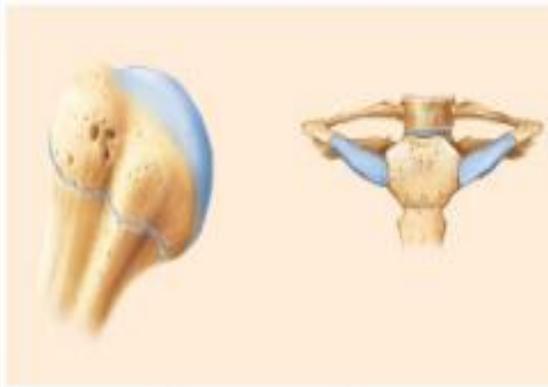
- articular surface of bone covered by hyaline cartilage fused to an intervening pad or plate.
- However, it is compressible, resilient and functionally amphiarthrotic.
- Pubic symphysis and the intervertebral discs.

# CARTILAGINOUS JOINTS: SYNCHONDROSES

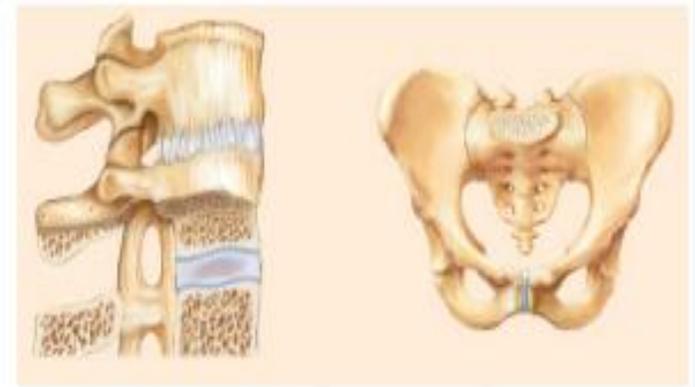
- A bar or plate of hyaline cartilage unites the bones
- All synchondroses are synarthrotic
- Examples include:
  - **Epiphyseal plates of children**
  - **Joint between the costal cartilage of the first rib and the sternum**



# CARTILAGINOUS JOINTS



Synchondroses



Symphyses

- Articulating bones are united by cartilage
- Lack a joint cavity
- Two types – **synchondroses and symphyses**

# TYPE OF JOINTS

- Synovial.

- Bone ends held in apposition by a joint capsule and ligaments.
- Surface lubricated by synovial fluid.

- Non-synovial.

- Syndesmoses-joints between bones of skull.
- Synchondroses-where sternum and ribs join.
- Symphyses-pelvic symphysis and intervertebral disks.



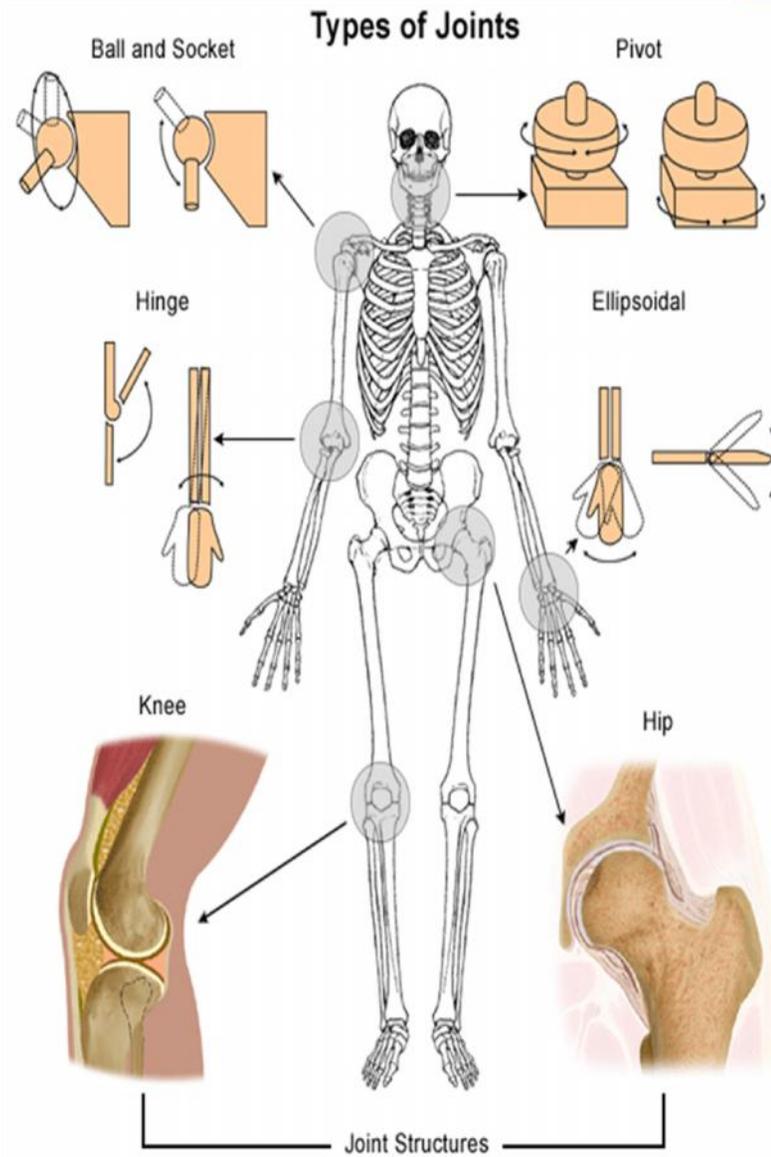
## Major joints in Human Body

**Shoulder (glenohumeral)** - articulation of glenoid fossa and humerus (**ball-and-socket**)

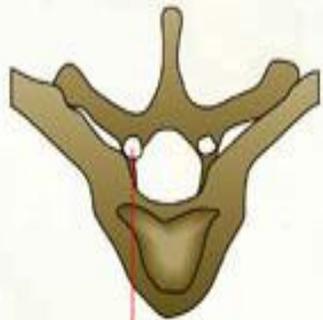
**Elbow (humeroulnar)** - articulation of humerus and ulna (**hinge**)

**Wrist (radiocarpal)** - articulation of radius and carpals (**condyloid**)

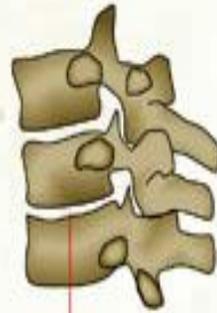
**Hip (acetabularfemoral)** - articulation of acetabulum and femoral head (**ball-and-socket**)



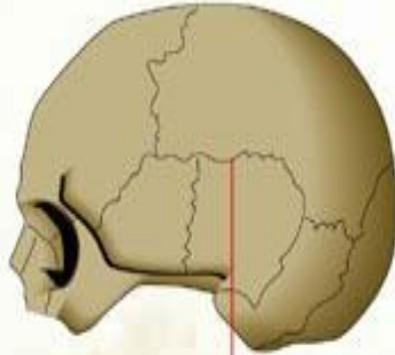
# TYPES OF JOINTS FOUND IN THE HUMAN BODY



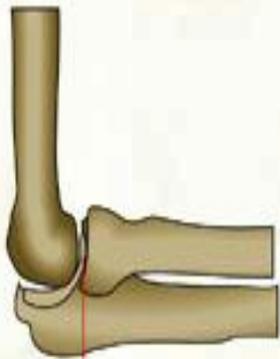
ribs and vertebrae =  
semi-mobile joints



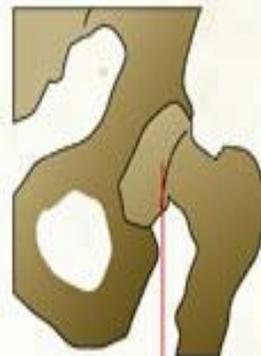
vertebrae =  
cartilagenous joints



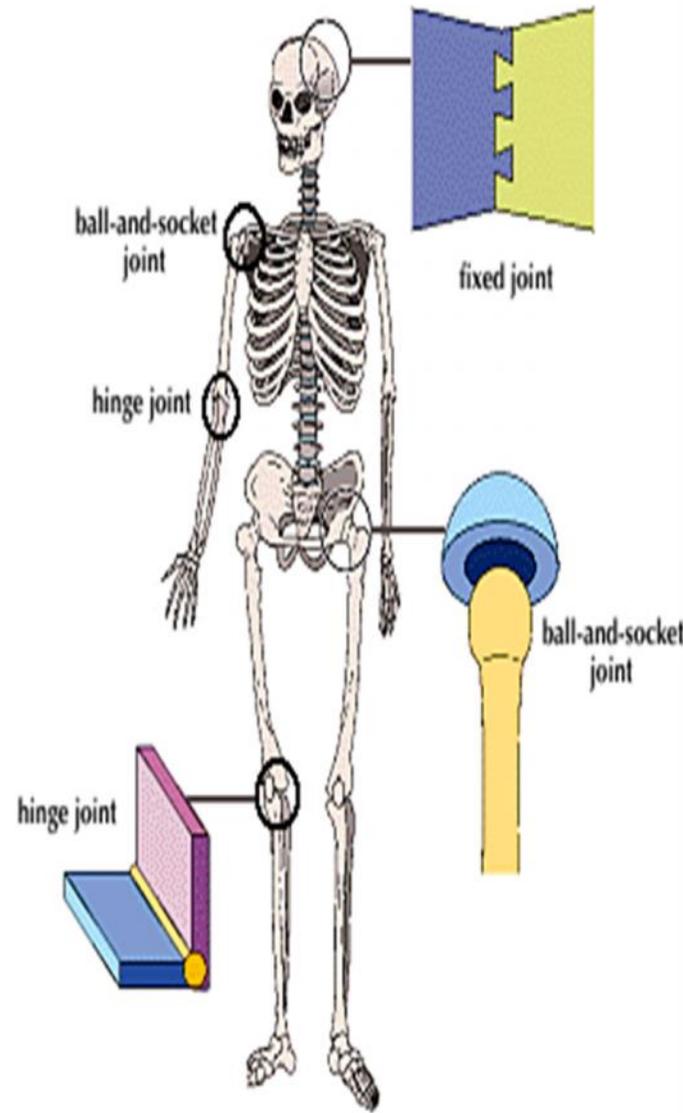
skull=  
immovable joints



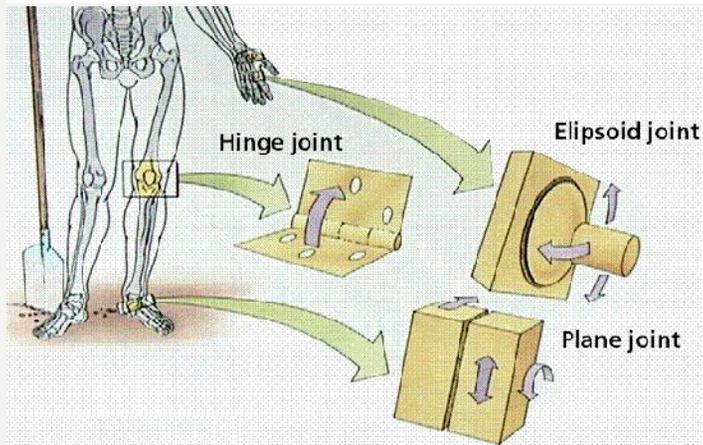
elbow=  
hinged joint



hip=  
ball and socket joint



### Anatomy of the Knee



• **Knee (tibiofemoral)** - articulation of femur and tibia (hinge)

• **Ankle (talocrural)** - articulation of tibia and fibula with talus (hinge)

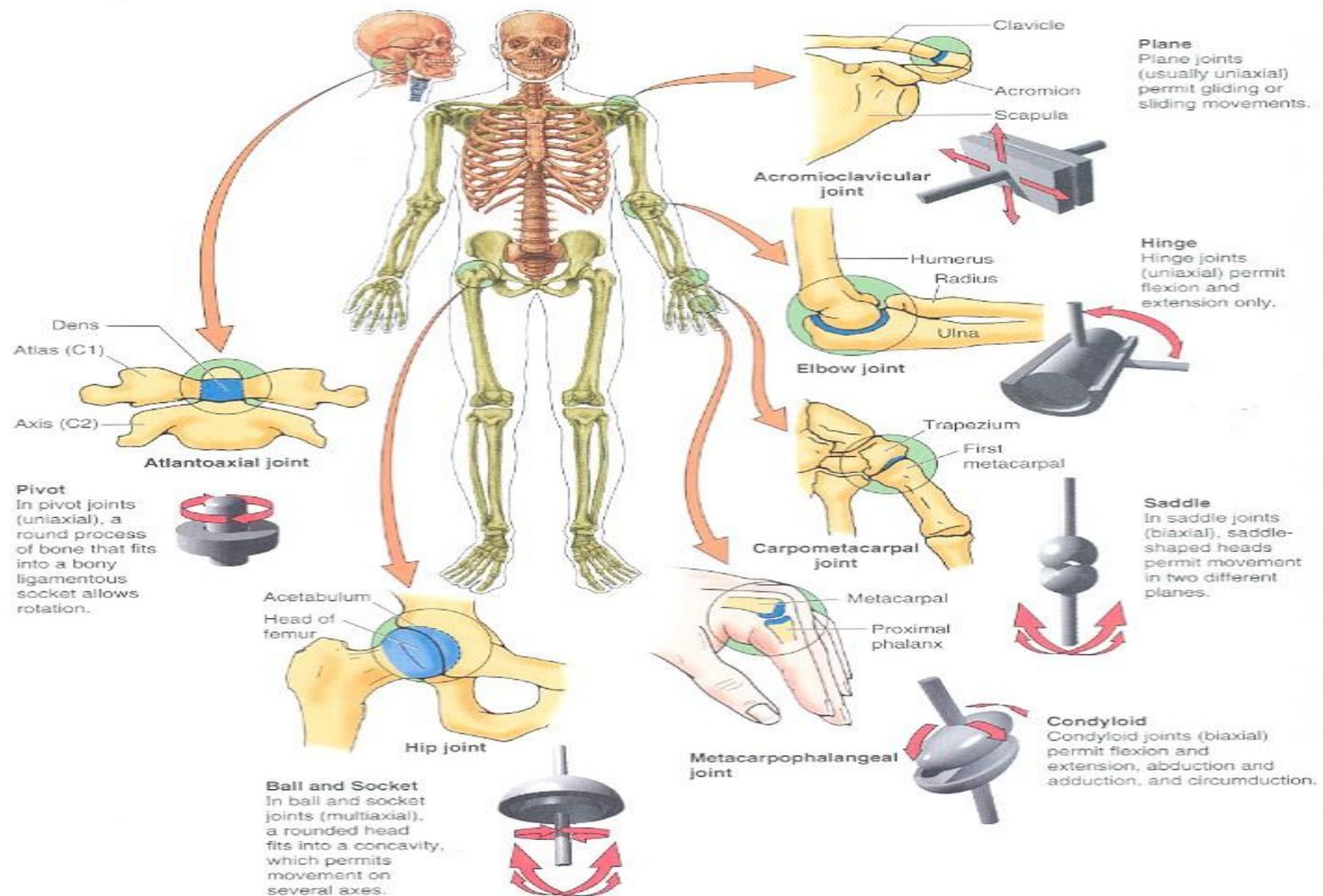
• **Spine (intervertebral)** - intervertebral disc (symphysis - amphiarthrosis)

• **Forearm (proximal and distal radioulnar)** - articulation of heads of radius and ulna (pivot)

• **neck (atlanto-occipital and atlanto-axial)**

- **atlanto-occipital** - articulation of atlas (C1) and occipital bone (skull) = condyloid joint

- **atlanto-axial** - articulation of atlas (C1) and axis (C2) = pivot joint



**Figure 1.14. Types of synovial joint.** Synovial joints are classified according to the shape of the articulating surfaces and/or the type of movement they permit. In this type of joint, the articulating bones move freely on one another.

# TYPE OF JOINTS

- Synovial.

- Bone ends held in apposition by a joint capsule and ligaments.
- Surface lubricated by synovial fluid.

- Non-synovial.

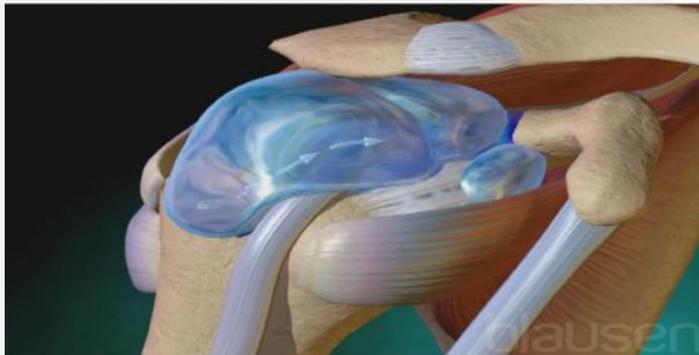
- Syndesmoses-joints between bones of skull.
- Synchondroses-where sternum and ribs join.
- Symphysis-pelvic symphysis and intervertebral disks.

## Synovial:

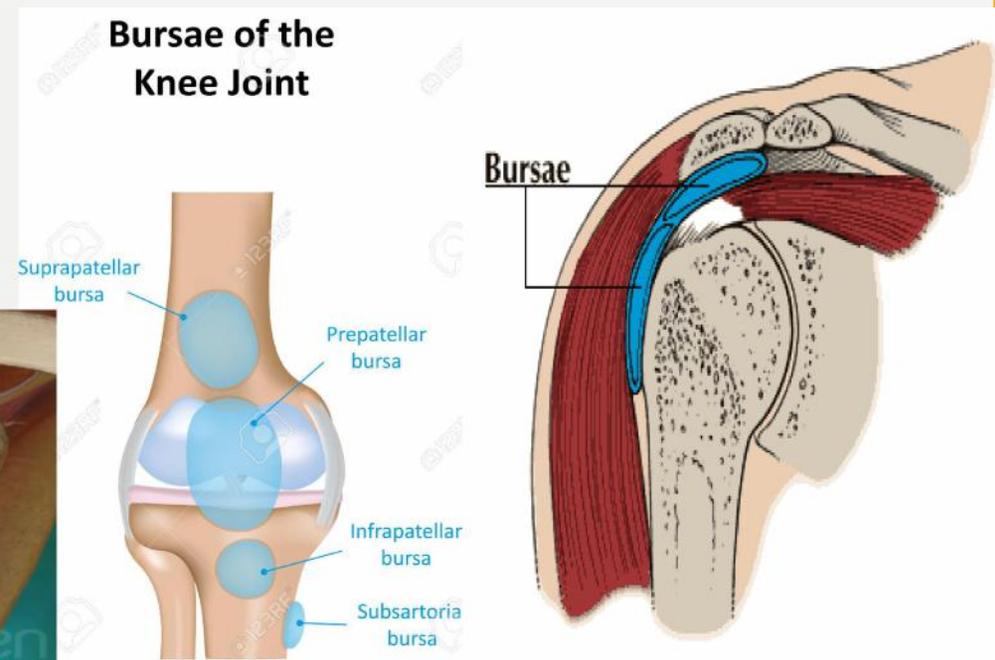
all synovial joints are diarthrotic (opposing bones move freely)

### Five distinct features of the skeleton

1. **Articular cartilage:** hyaline type forms a glassy smooth surface over the opposing ends of bones.
2. **Joint cavity:** small space
3. **Synovial fluid:** largely derived from blood; has a viscous, egg-white consistency; leaks out of cartilage; weeping lubrication.
4. **Articular capsule**
  - a. Fibrous capsule (external)
  - b. Synovial membrane (internal)
5. **Reinforcing ligaments:** support and strengthen the joint



- Synovial joints have supportive structures called **bursae**.
- These structures are flattened sacs lined with a synovial membrane and contain a thin film of synovial fluid.
- Bursae are located where ligaments, muscles, and tendons overlie and rub against bone.
- Some synovial joints have pads of fibrocartilage between the ends of bones: menisci of the knee.



# SYNOVIAL JOINTS: GENERAL STRUCTURE

• Synovial joints all have the following

- **Articular cartilage**
- **Joint (synovial) cavity**
- **Articular capsule**
- **Synovial fluid**
- **Reinforcing ligaments**

• Very common and also *provide the most movement*.

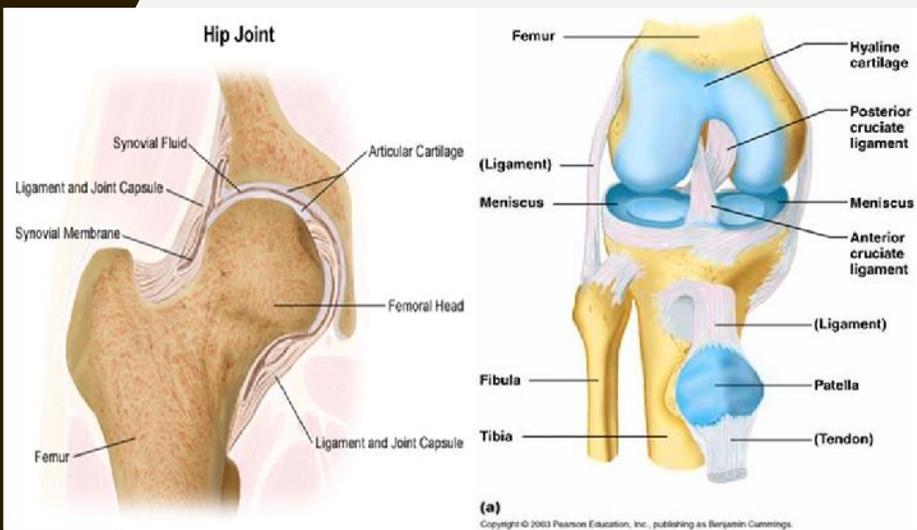
• Bones in a synovial joint have to move freely so each end of the bones that meet at the joint are covered with a layer of articular cartilage.

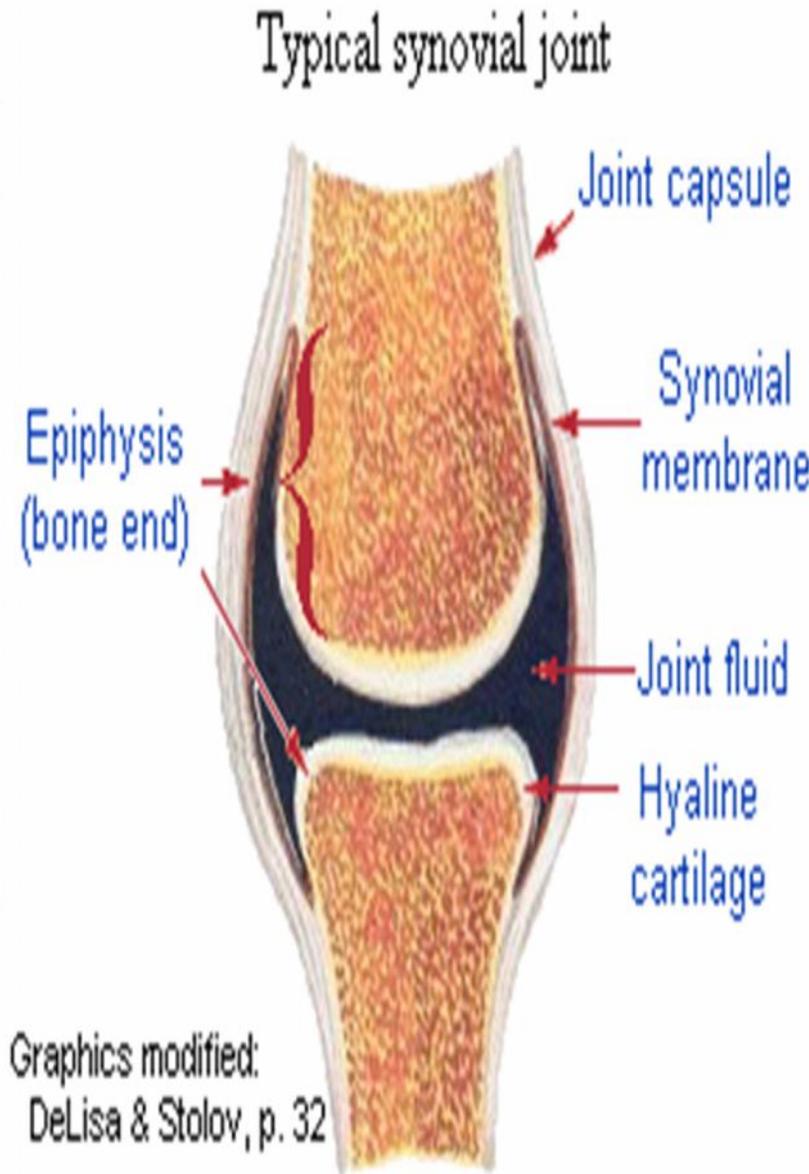
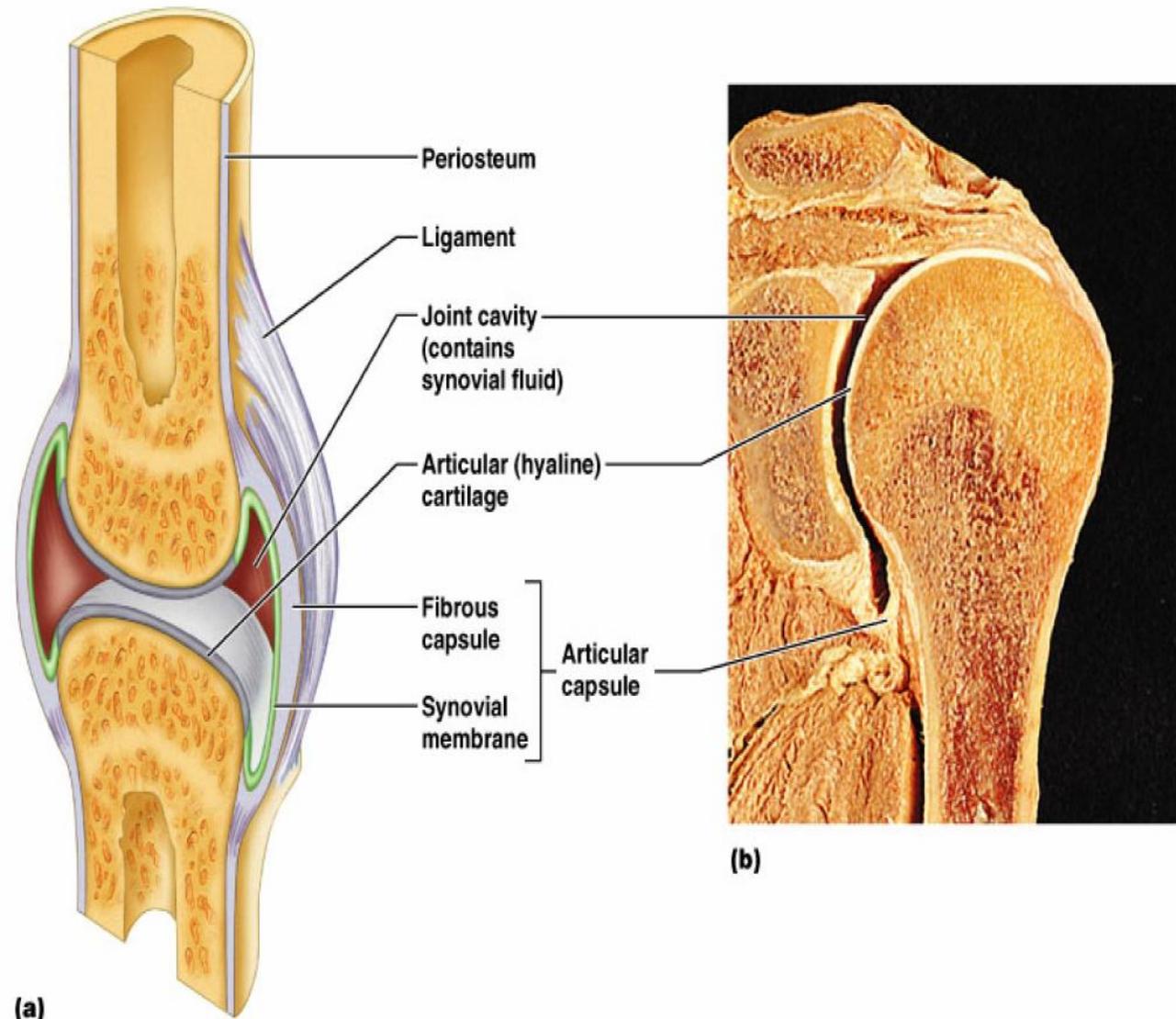
• This cartilage is kept healthy by cartilage producing cells **chondrocytes**.

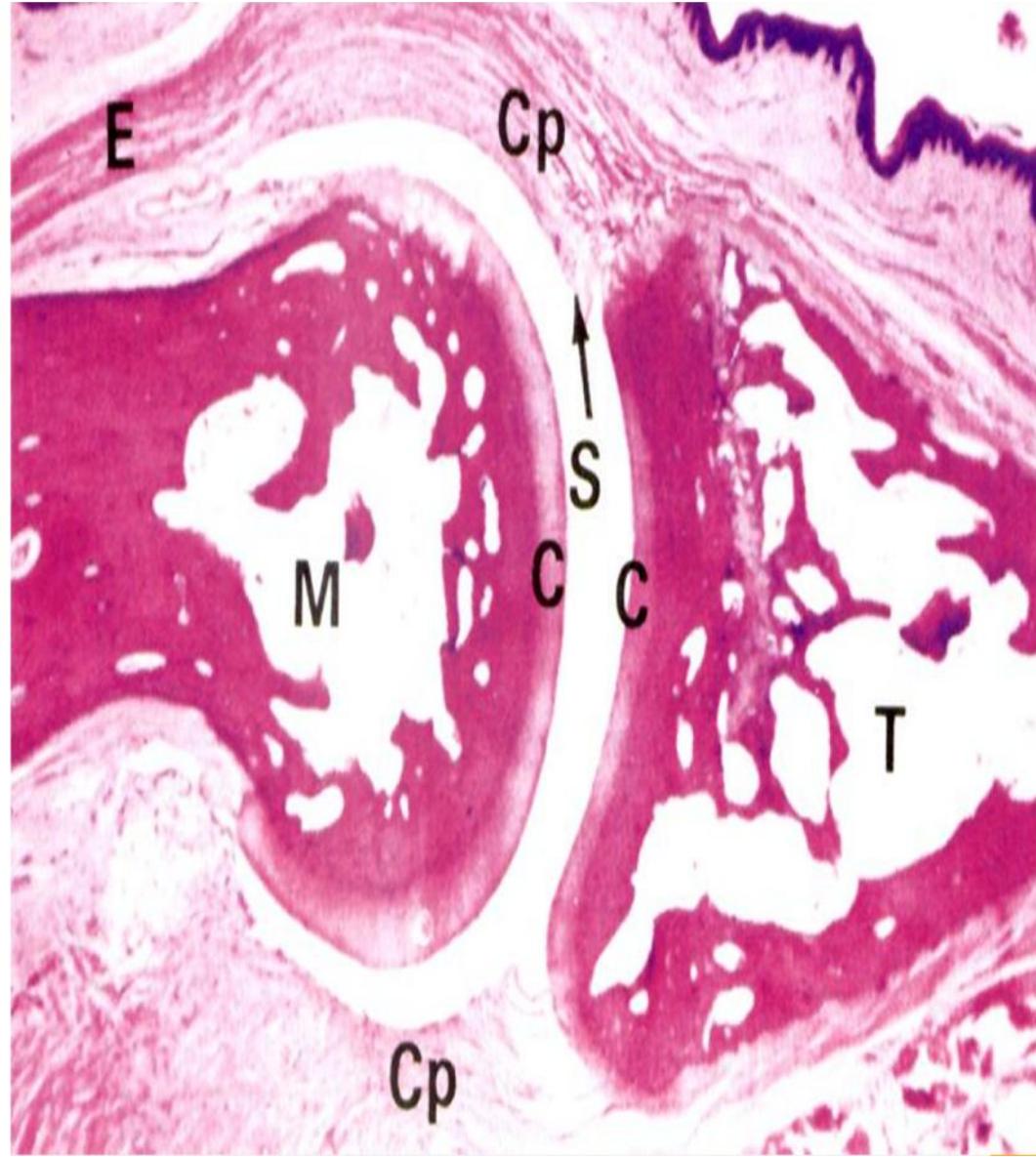
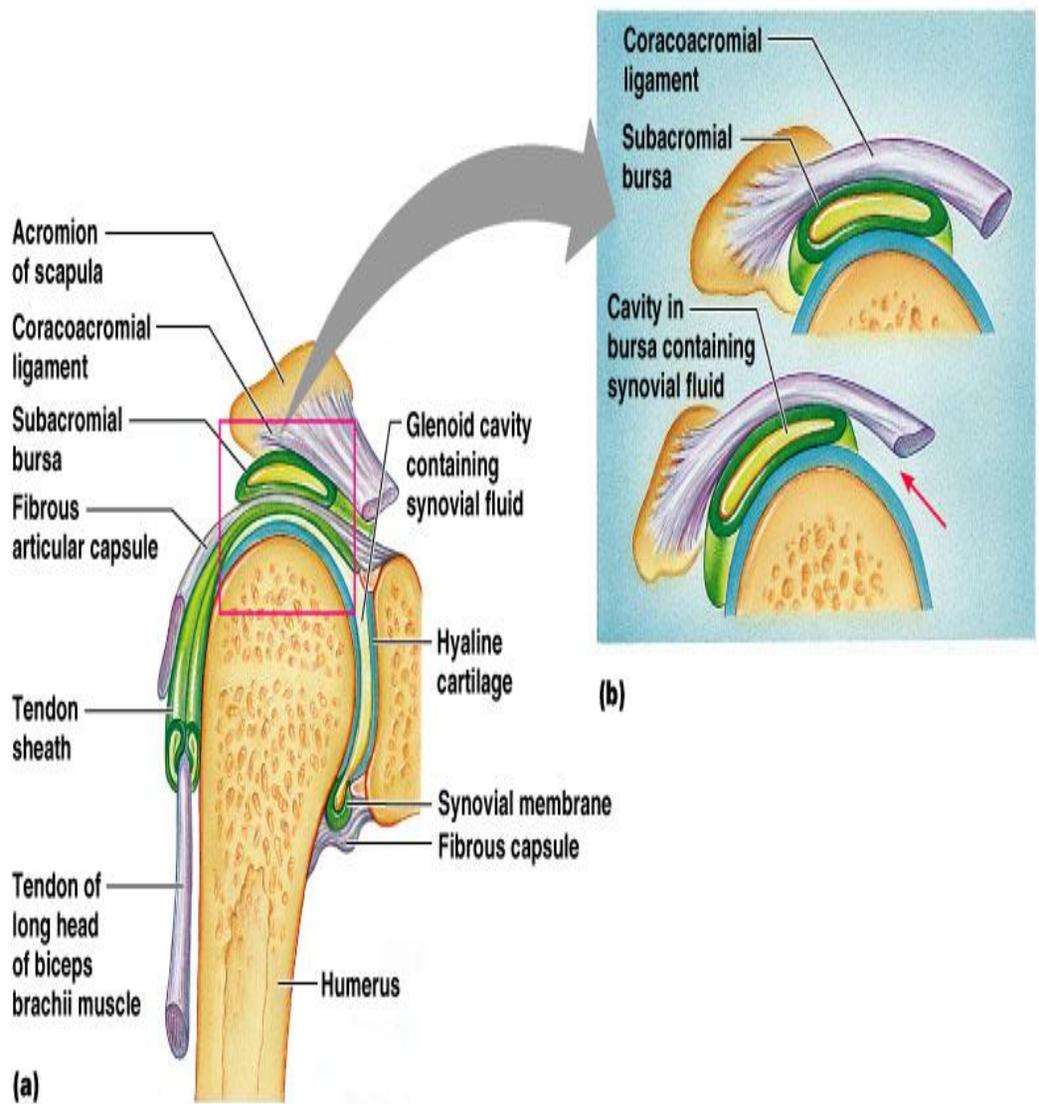
• A capsule membrane surrounds the joint and encloses a space that's filled with lubricating fluid.

• **Strong strips of connective tissue called ligaments** provide strength to the joint and help hold the bones together in the proper position.

• **The knees are good examples of large synovial joints.**







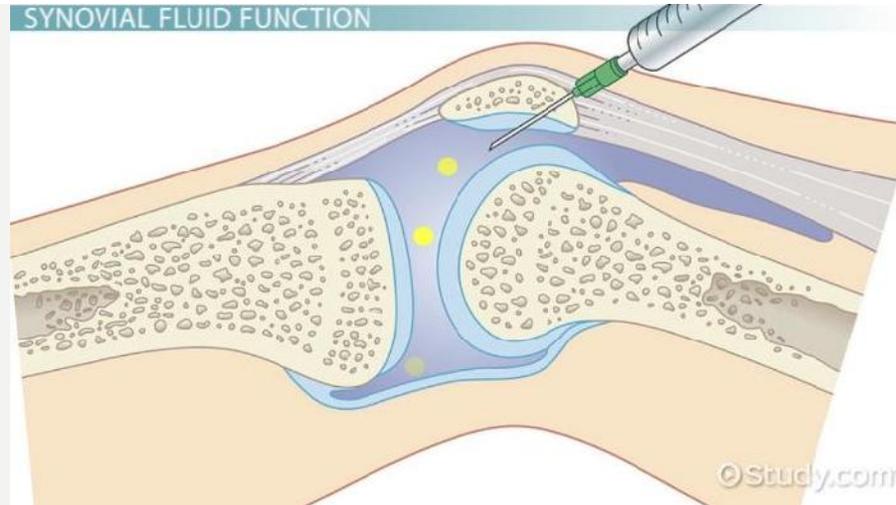
# SYNOVIAL JOINT SHAPE TYPES

- **Plane joints**--intercarpal joints
- **Hinge joints**--elbow, ankle, interj-phalangeal
- **Pivot joints**--radio-ulnar joint
- **Condylloid joints (egg into oval)**--metacarpo-phalangeal
- **Saddle joints**--carpo-metacarpal joint of thumb
- **Ball-and-socket**--hip, shoulder

The type of joint, in part, determines the range and direction of movement

# SYNOVIAL FLUID

- Fluid found in articular joints
  - Clear and viscous
- Provides low friction between articular surfaces
- Provides nutrition to cartilage
- Non-Newtonian fluid
  - Shear thinning
    - Viscosity decreases with increasing shear rate
  - Normal stress effect
    - Stress decreases with increasing shear rate

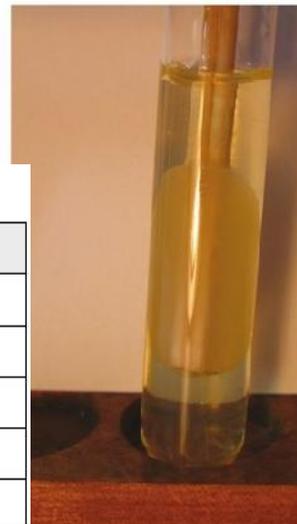


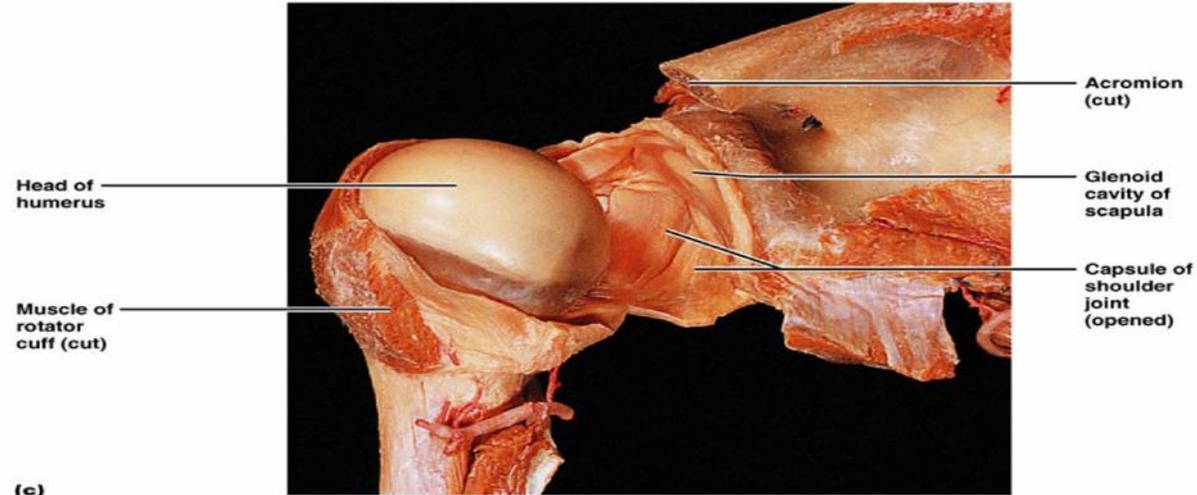
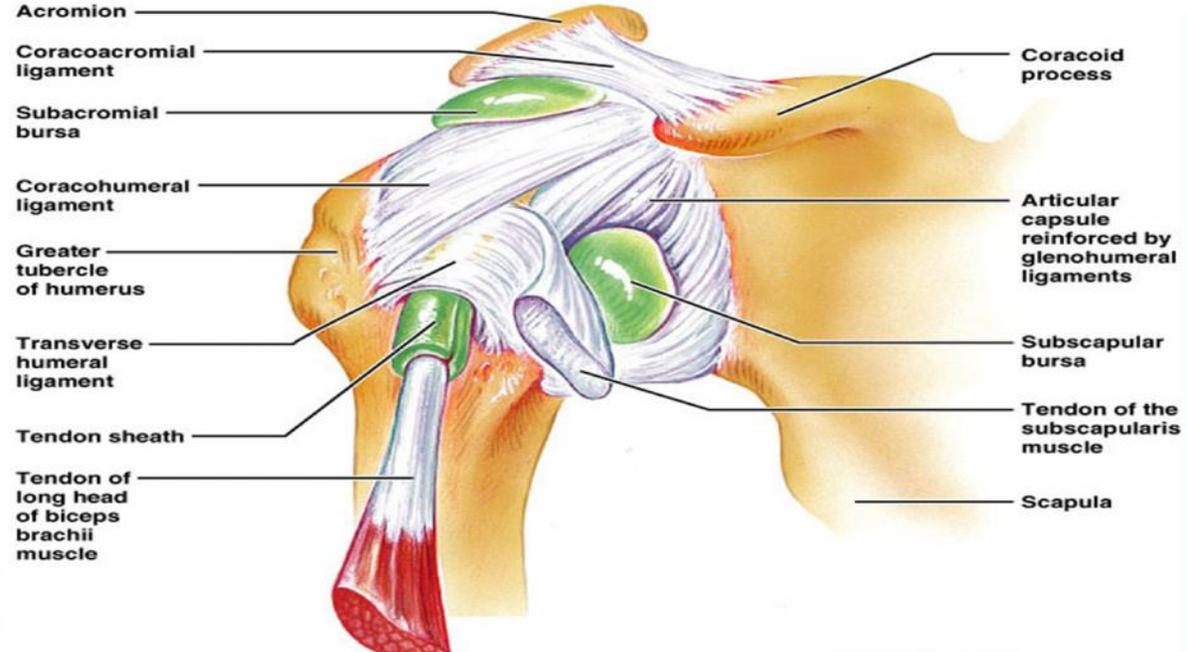
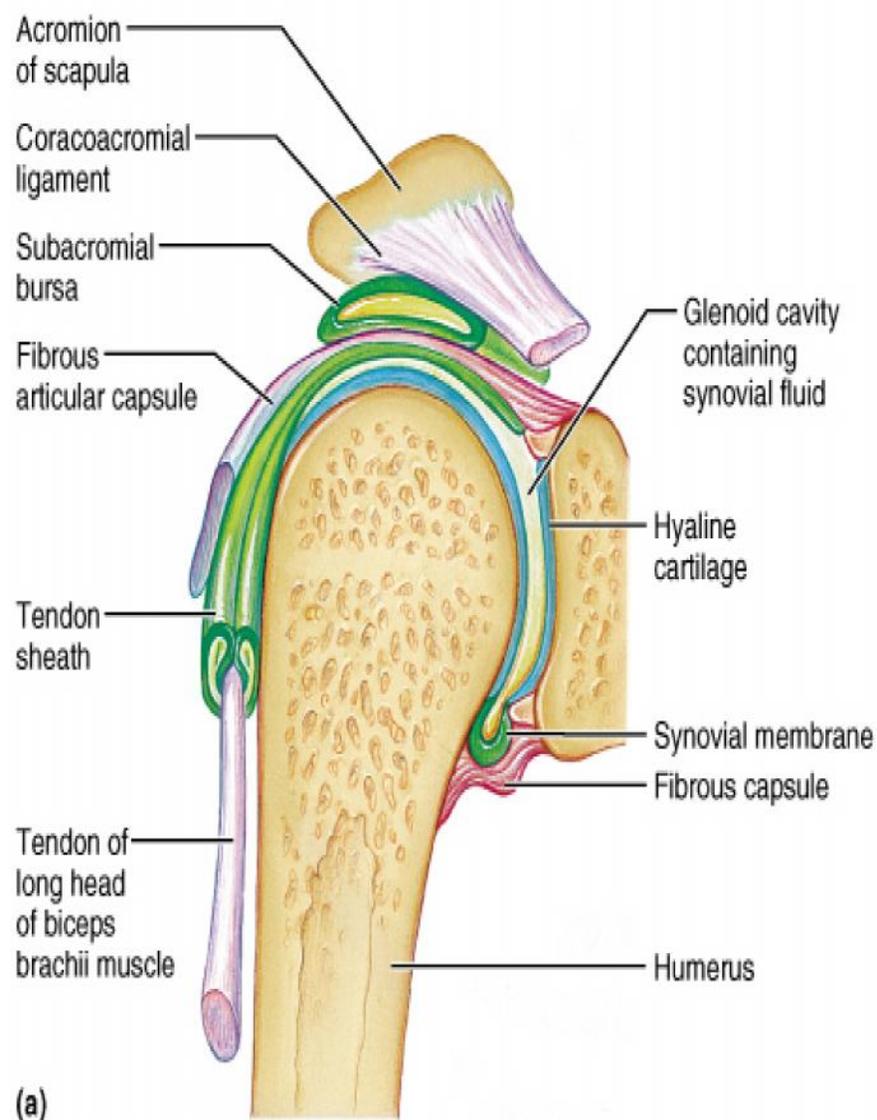
## Macroscopic Analysis: Mucin Clot (con

Mucin clot test of normal synovial fluid.

## Synovial Fluid Analysis

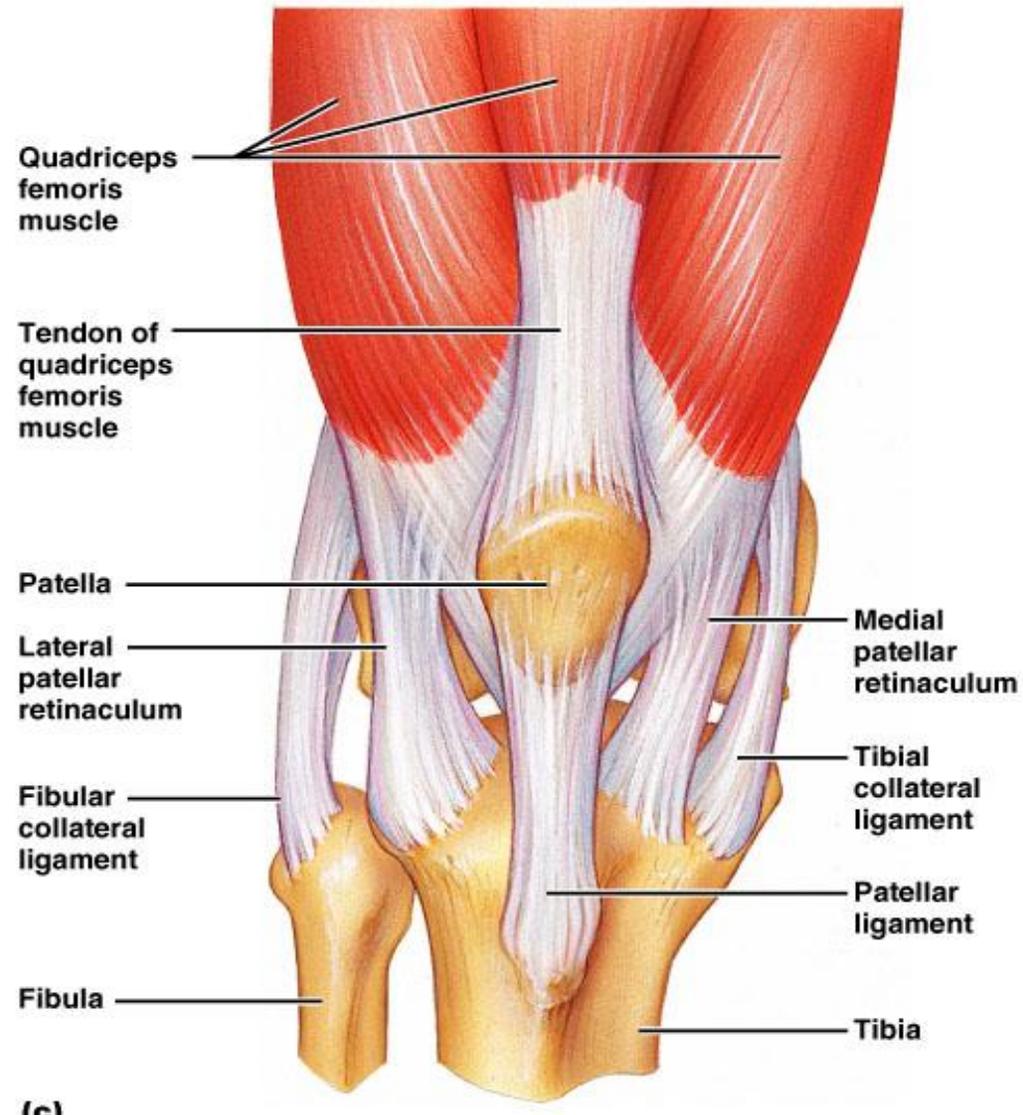
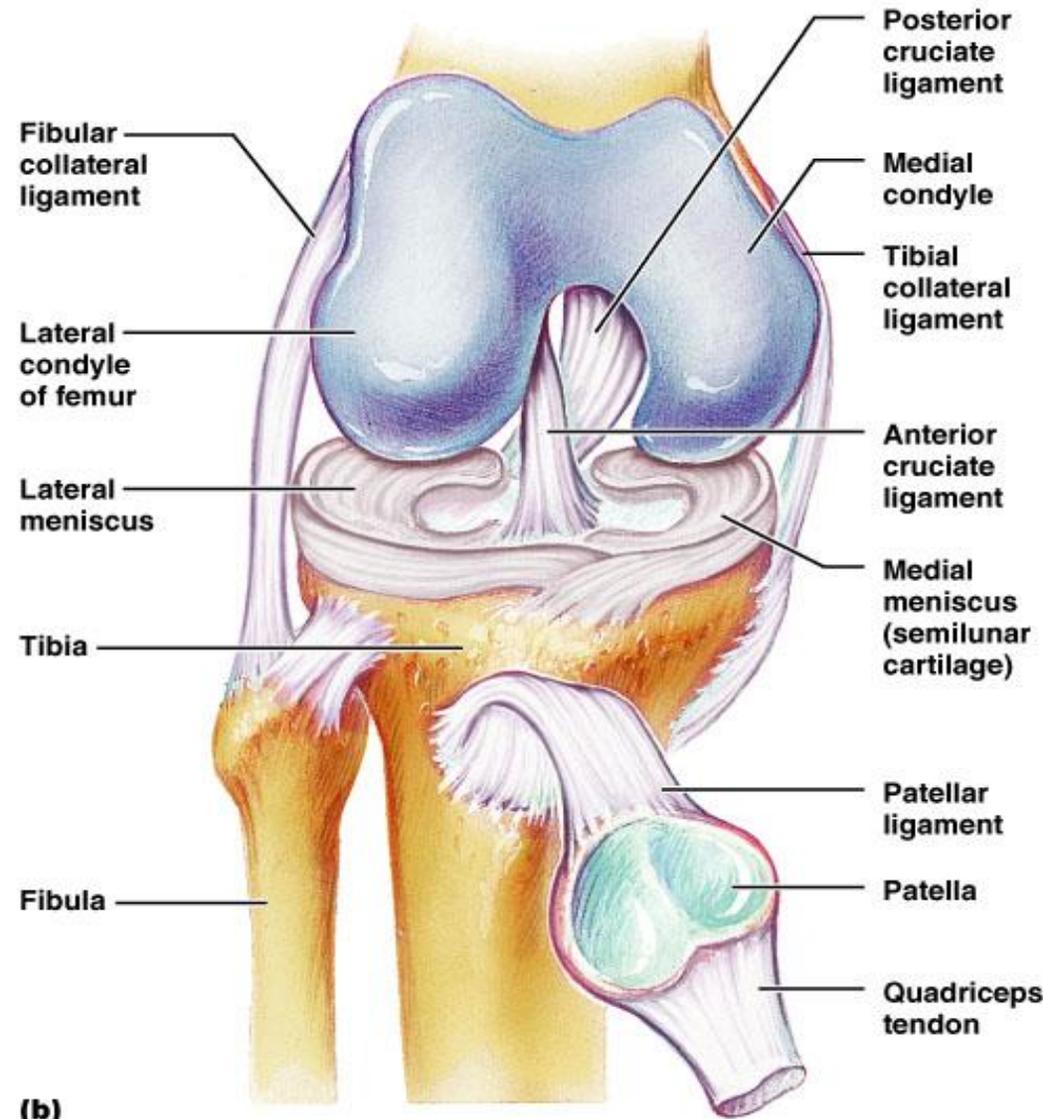
	WBC/mm <sup>3</sup>	Color	Viscosity
Normal	< 150	Colorless/Straw	High
Noninflammatory	< 3,000	Straw/Yellow	High
Inflammatory	> 3,000	Yellow	Low
Septic (purulent)	> 50,000	Pus/Mixed	Mixed
Hemorrhagic	Similar to blood	Red	Low





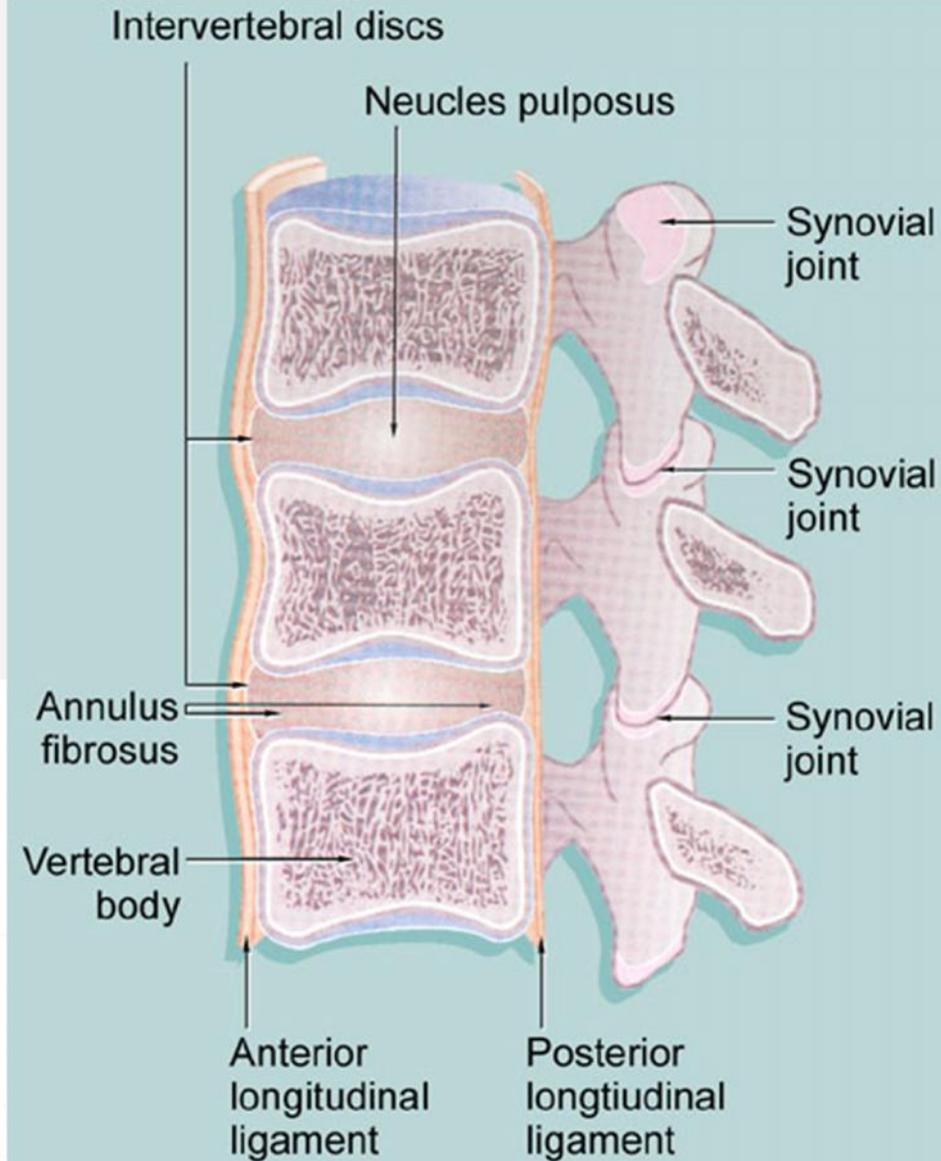
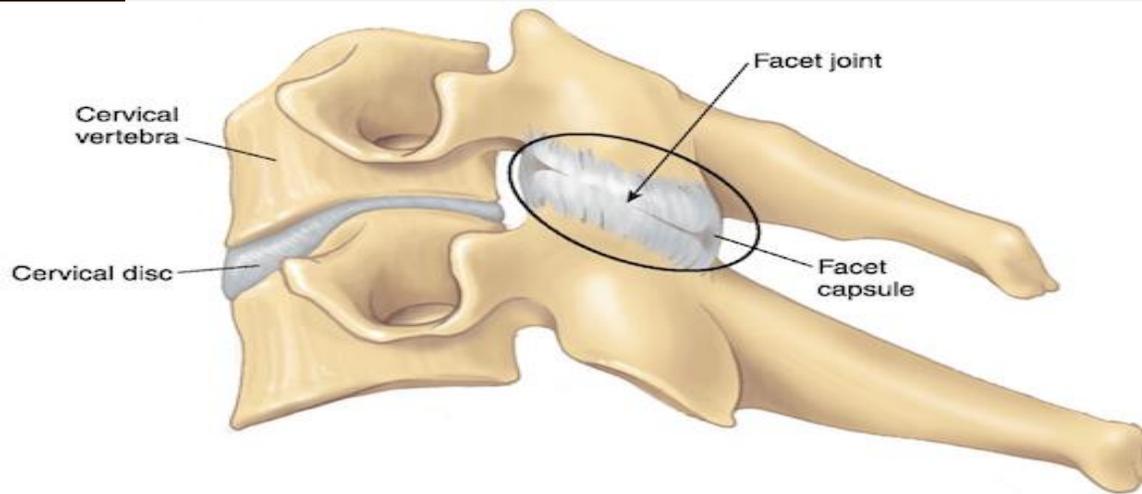
(a) Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

(c) Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.

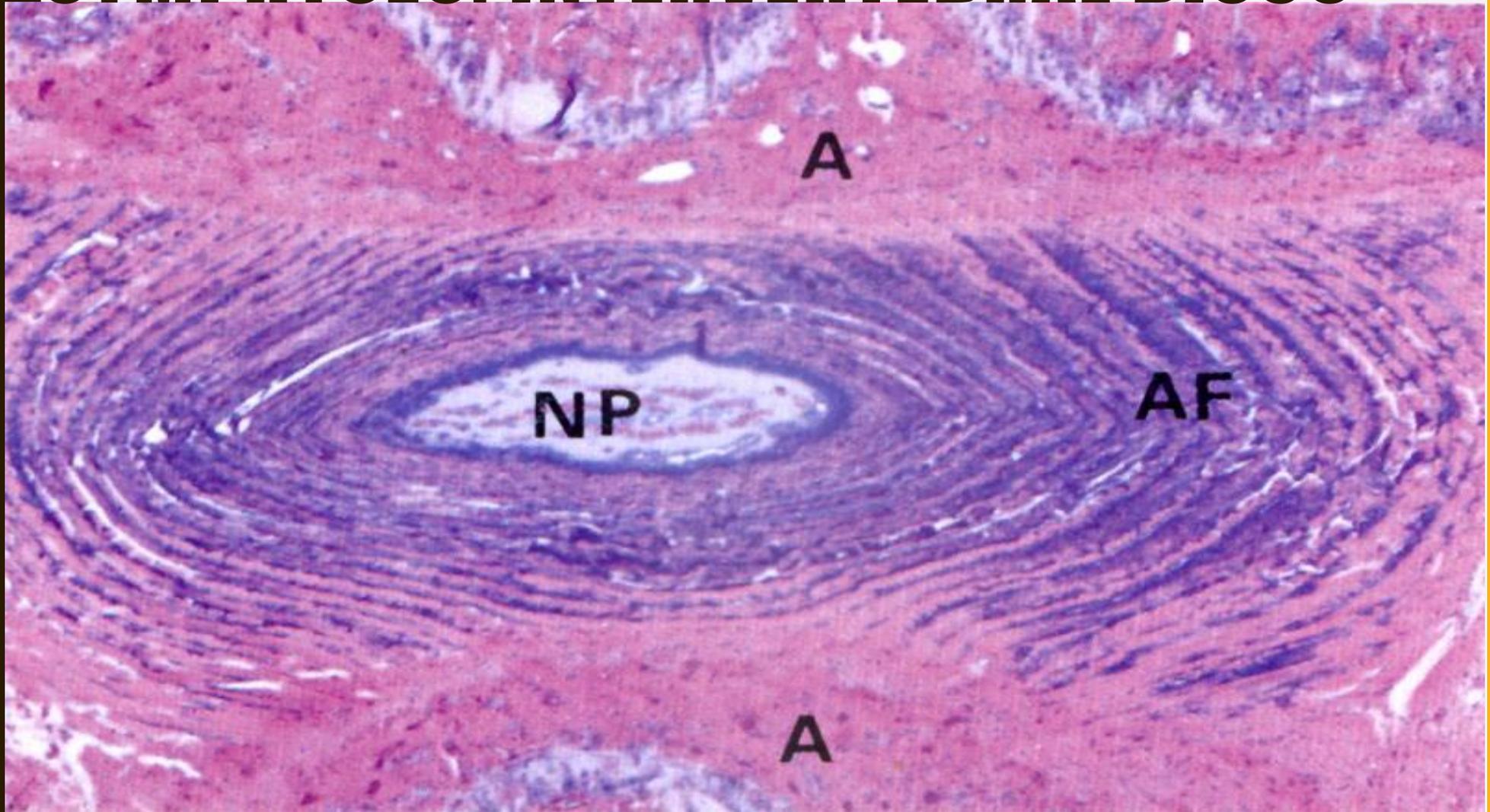


# FACETS

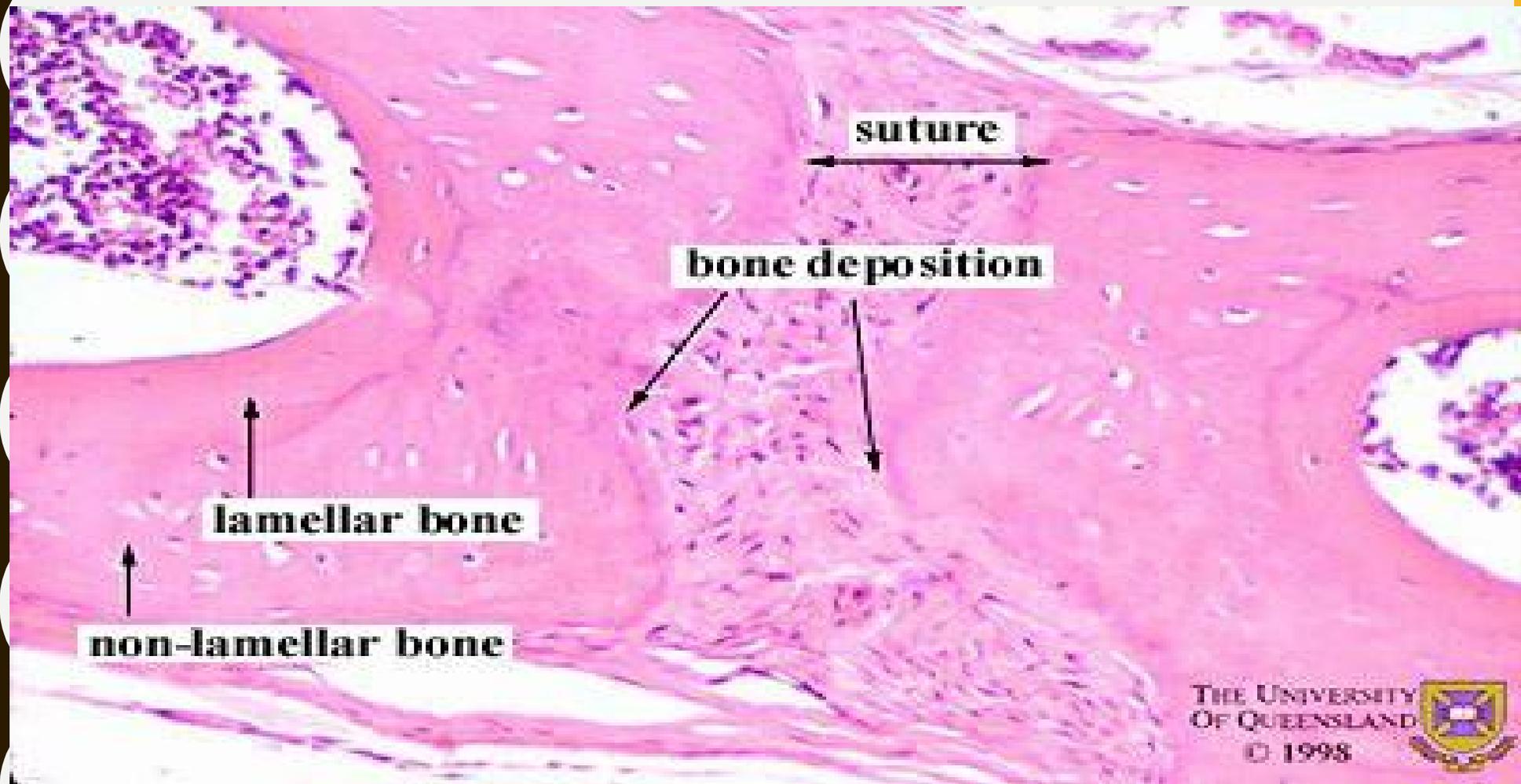
- Facets are Synovial Joints
- Allow motion **between vertebral bodies**
- Restrict motion between vertebral bodies
- Compression and Shear
  - Loading changes depending on location
  - Degeneration in the disc leads to greater loads in the facets → facet degeneration



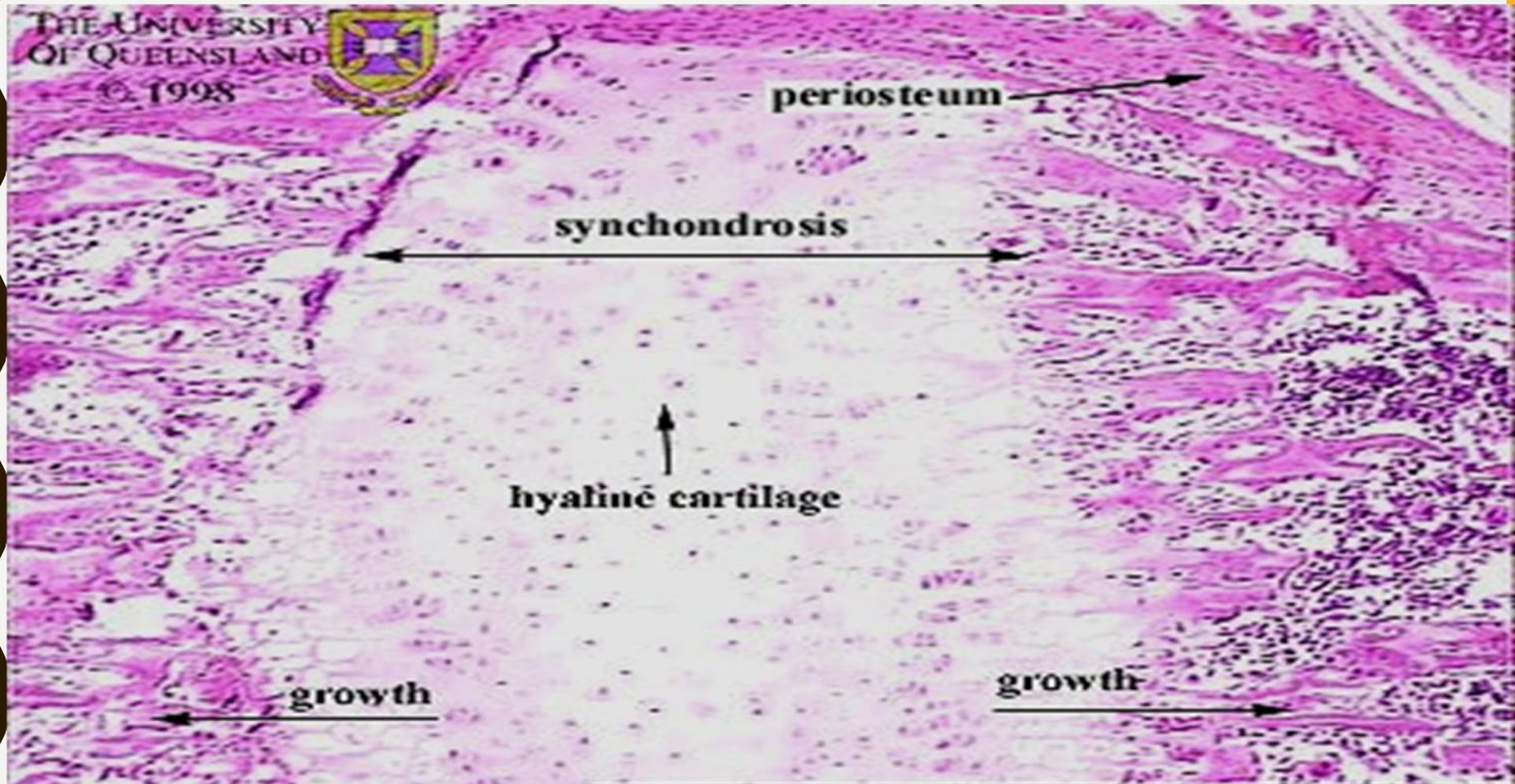
# SYMPHYSES: INTERVERTEBRAL DISCS



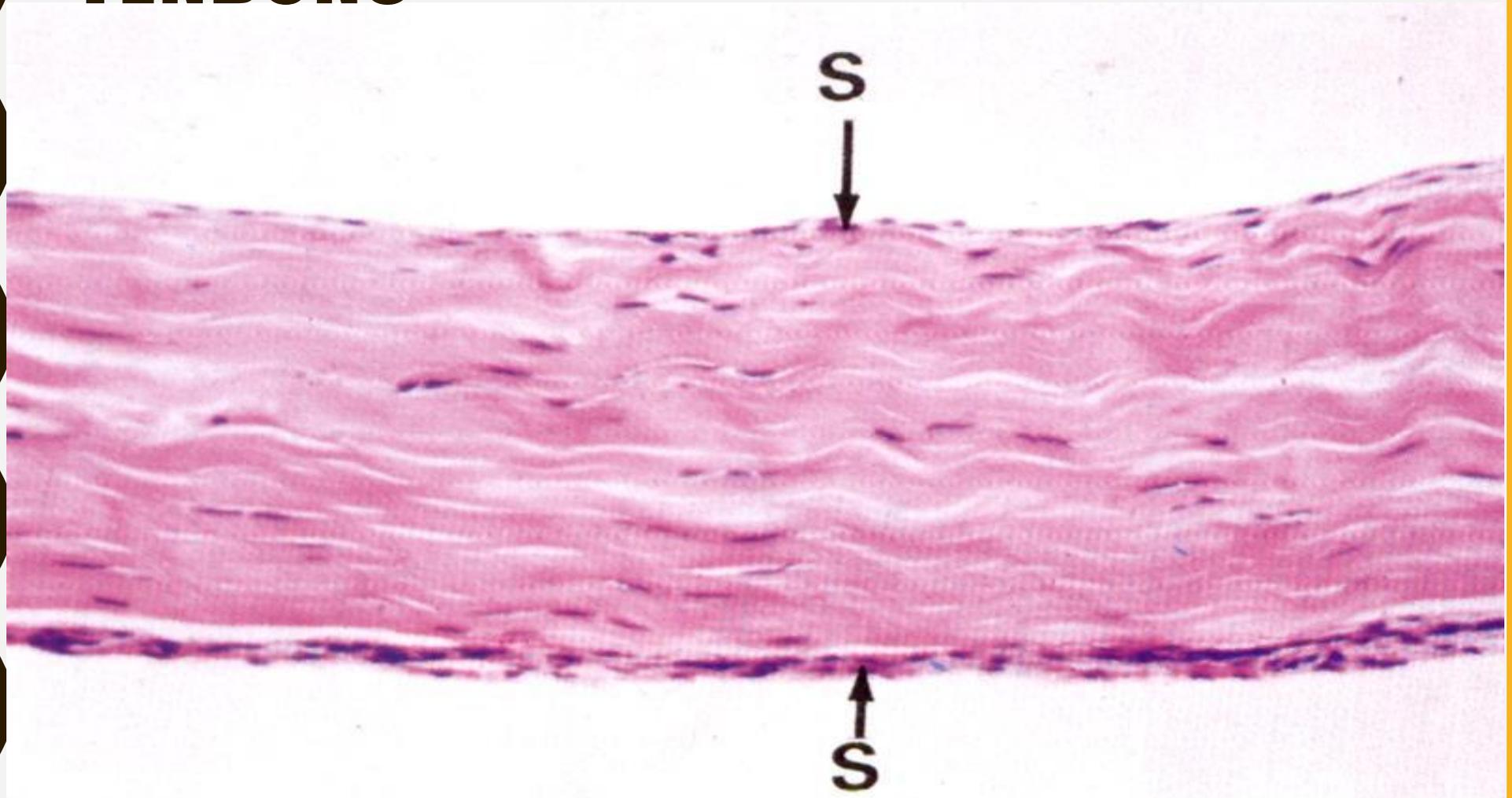
# SYNDESMOSES

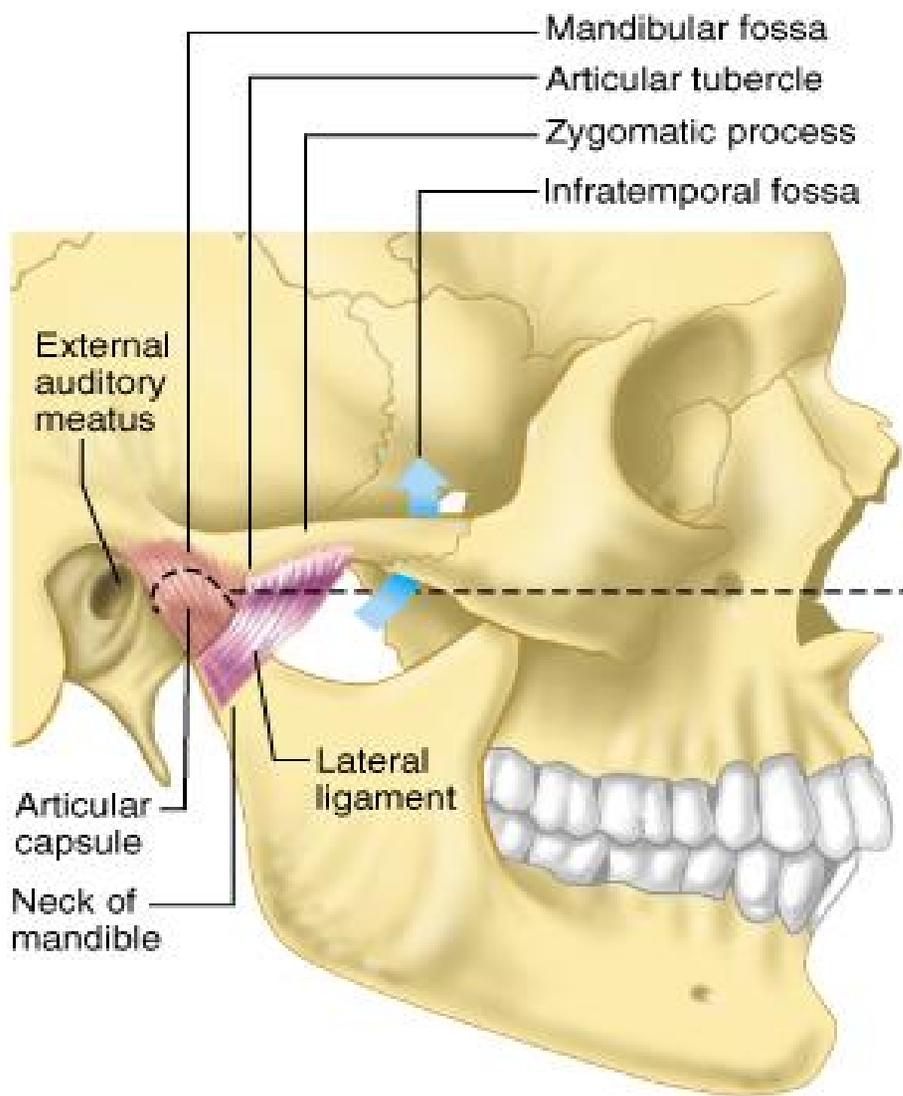


# SYNCHONDROSES

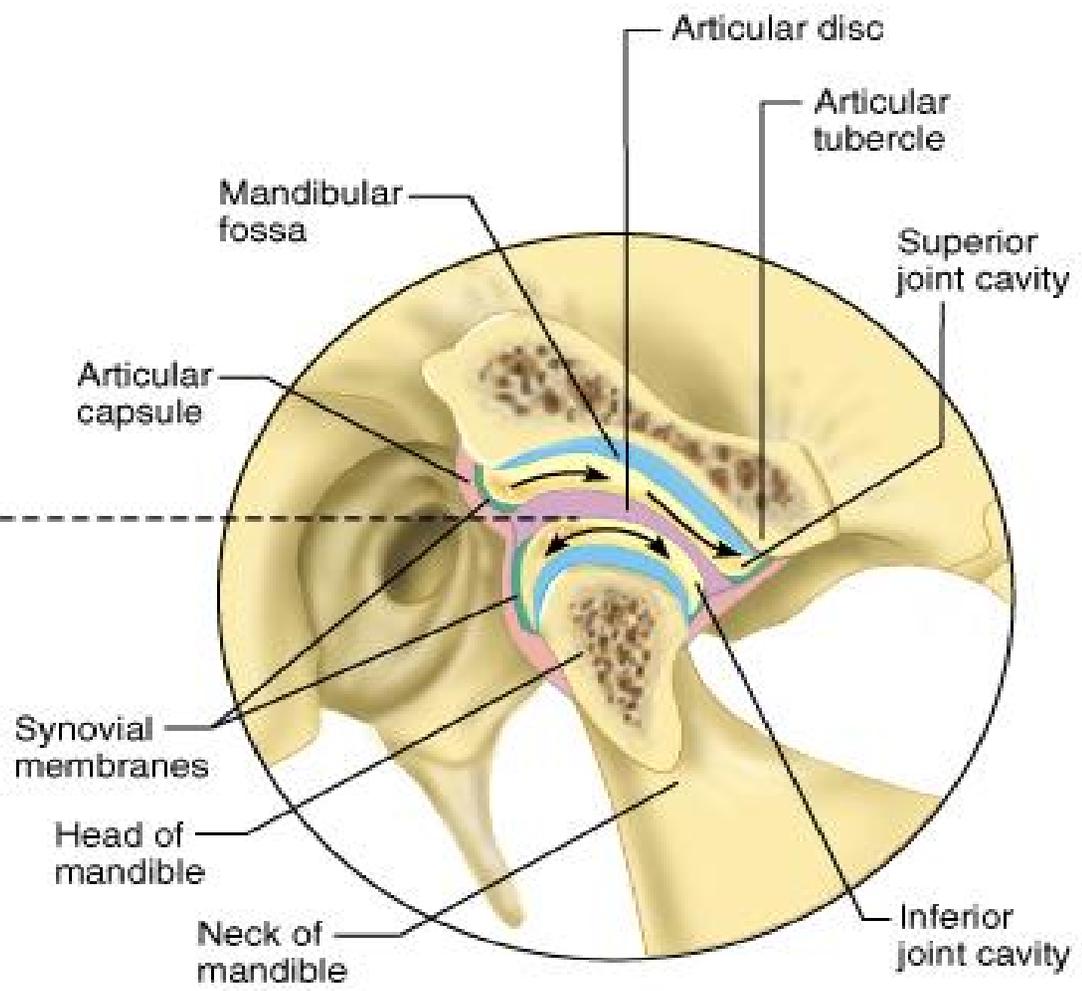


# TENDONS

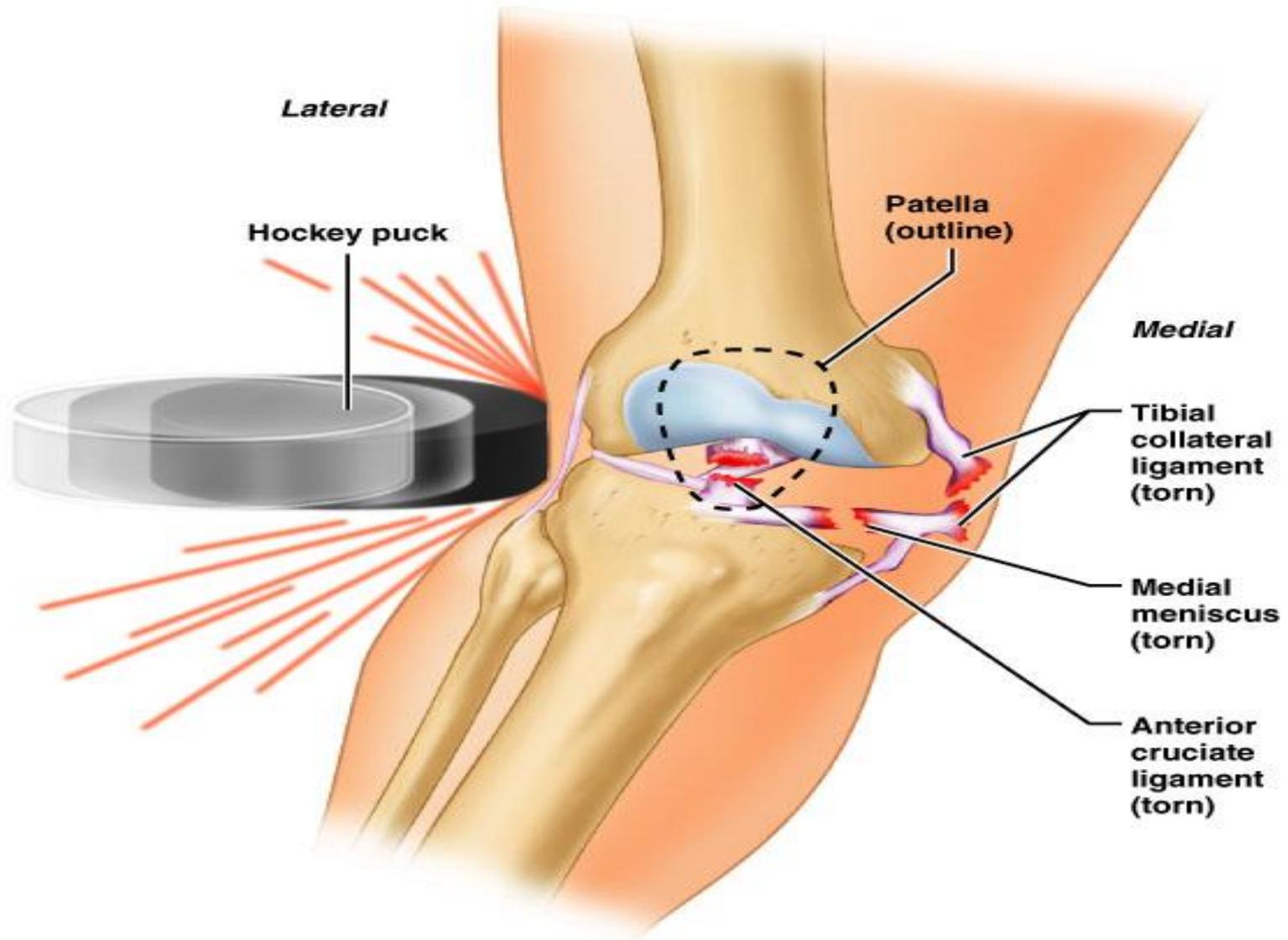




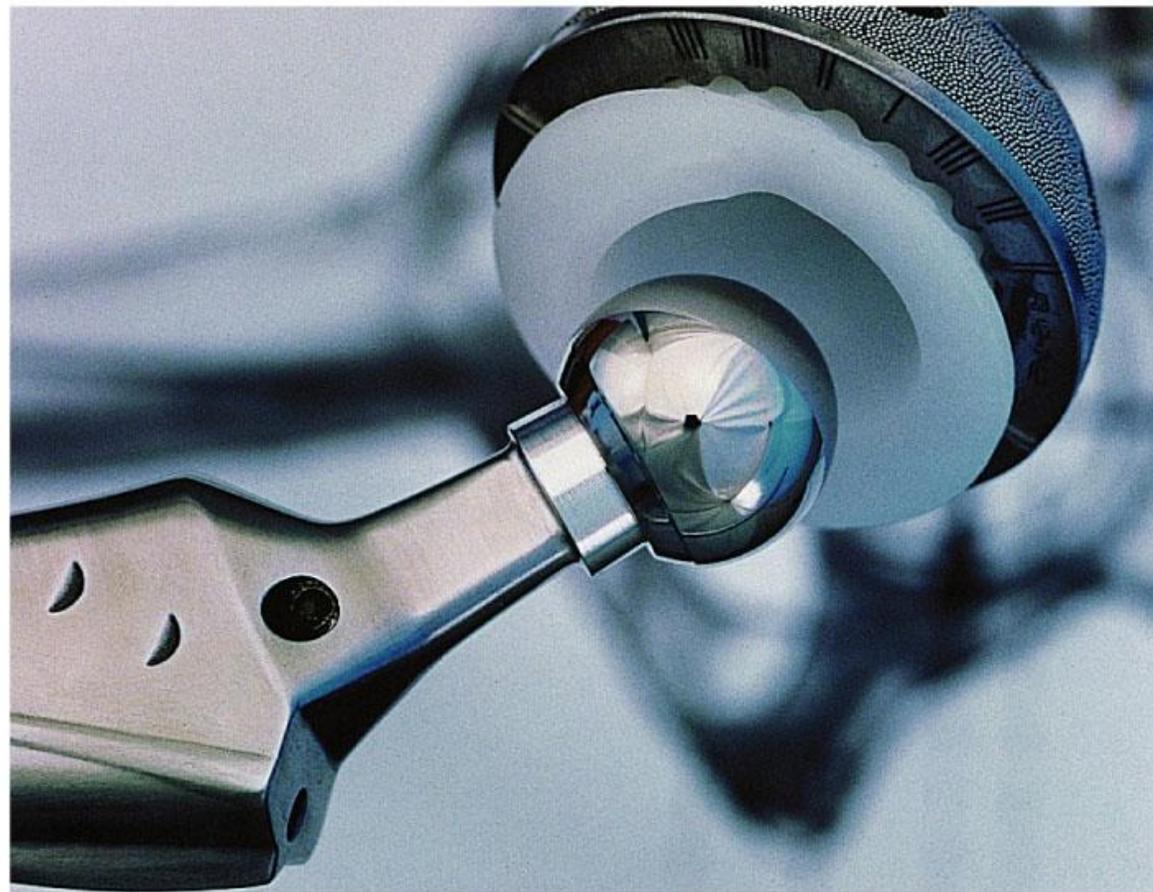
(a)



(b)



# ARTIFICIAL HIP JOINT

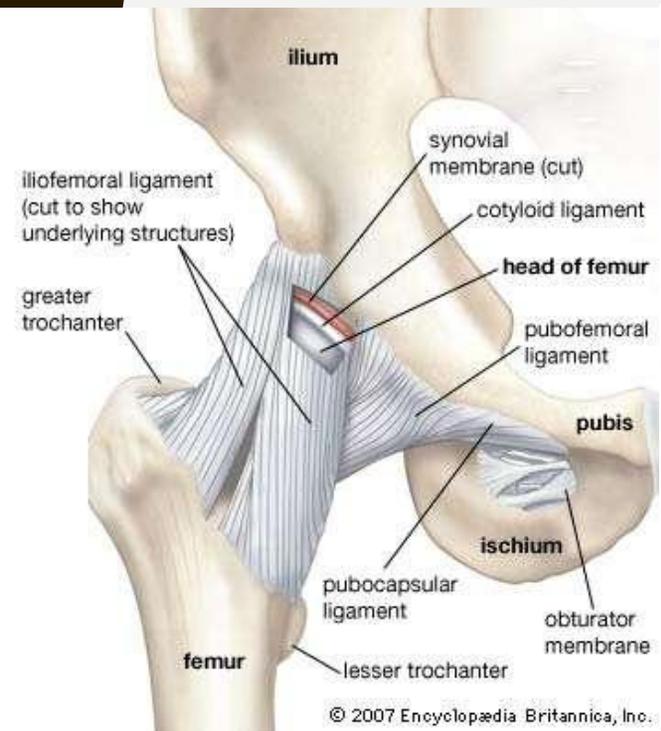
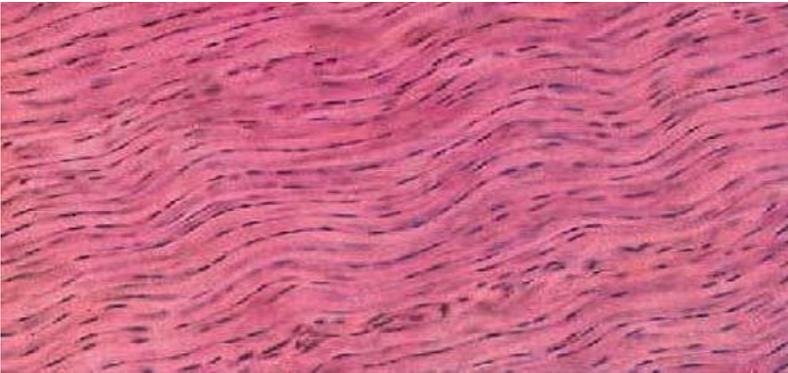


**Photograph of a hip prosthesis.**

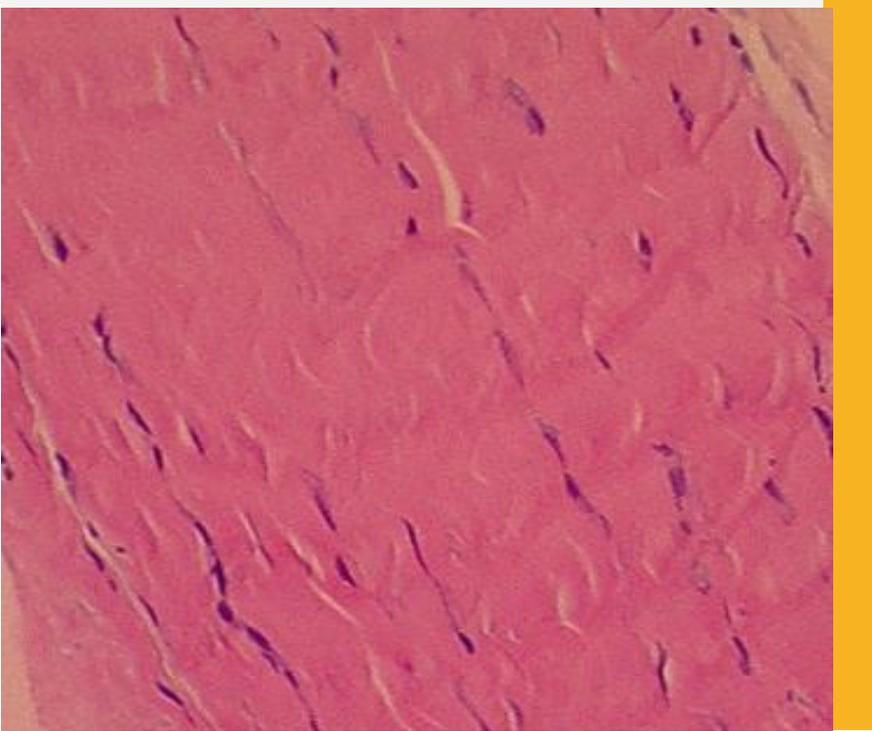
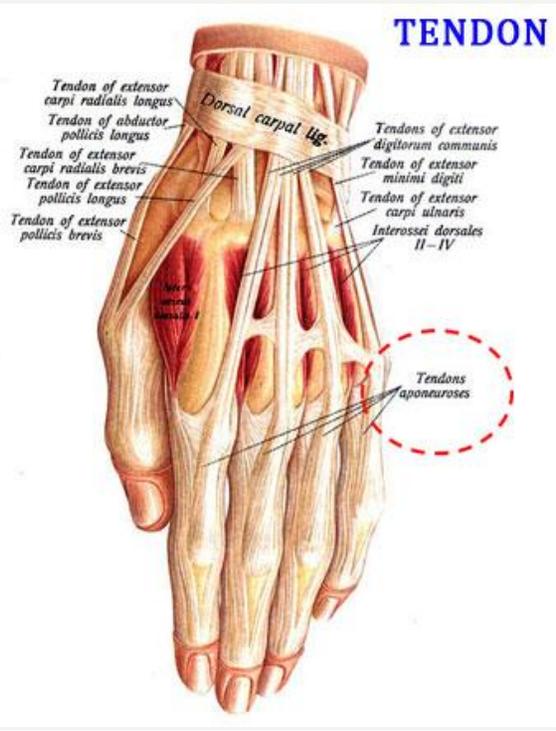
Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.

# LIGAMENTS

- Connect bone to bone and reinforce joint capsules.
- Provide stability to joints.
- Dense bands of fibrous tissue resembling tendons but not as well ordered.



© 2007 Encyclopædia Britannica, Inc.

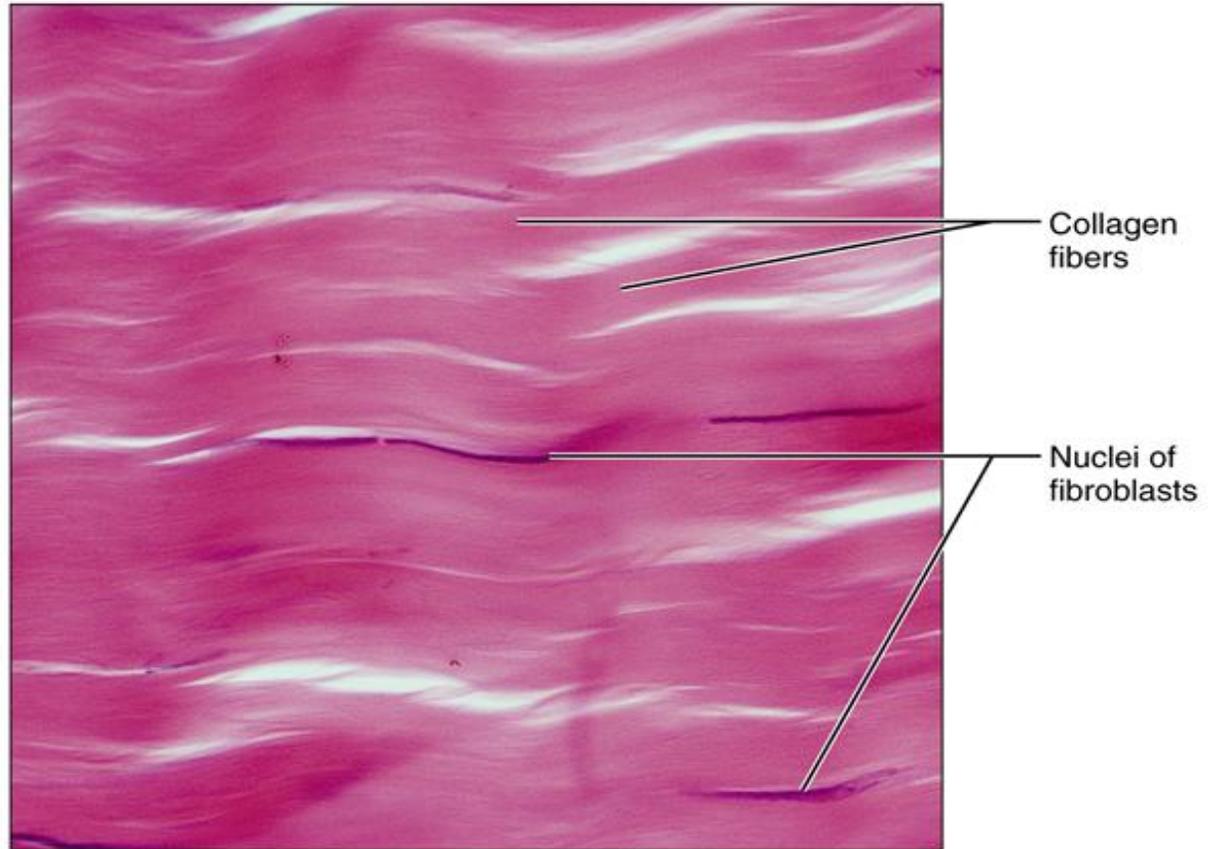
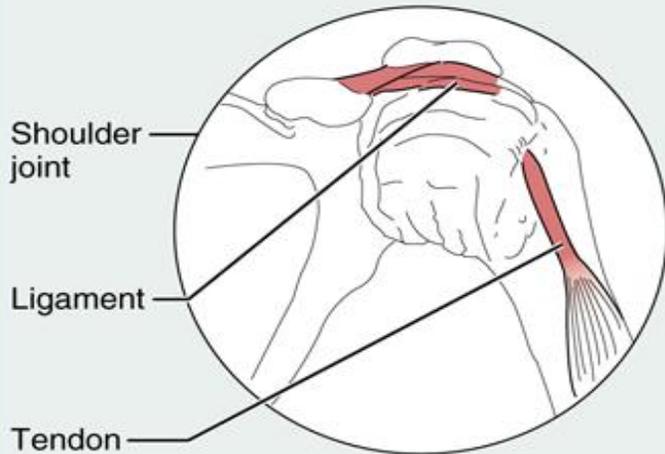


(d) Connective tissue proper: dense connective tissue, dense regular

**Description:** Primarily parallel collagen fibers; a few elastic fibers; major cell type is the fibroblast.

**Function:** Attaches muscles to bones or to muscles; attaches bones to bones; withstands great tensile stress when pulling force is applied in one direction.

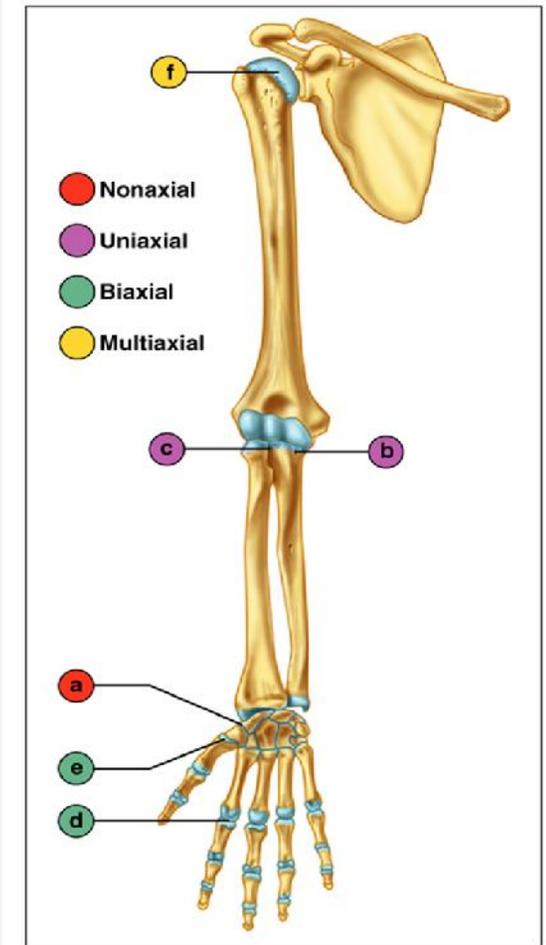
**Location:** Tendons, most ligaments, aponeuroses.



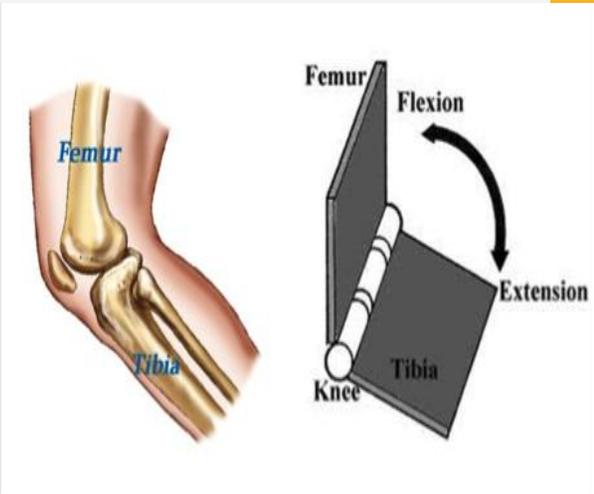
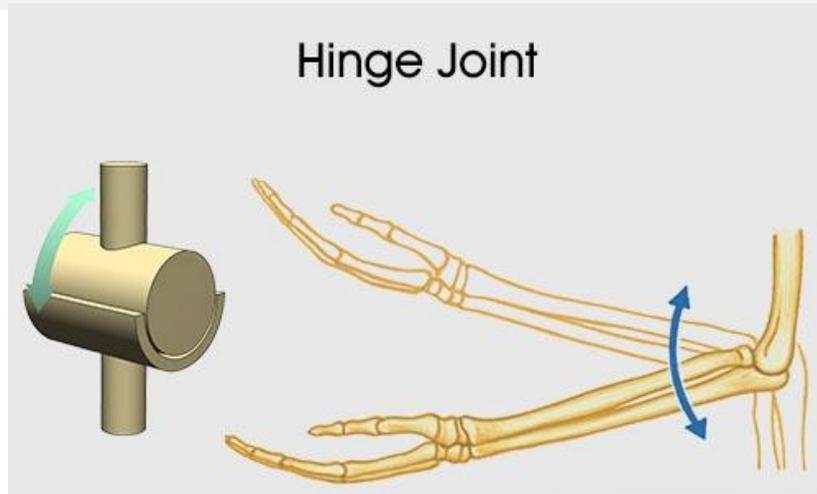
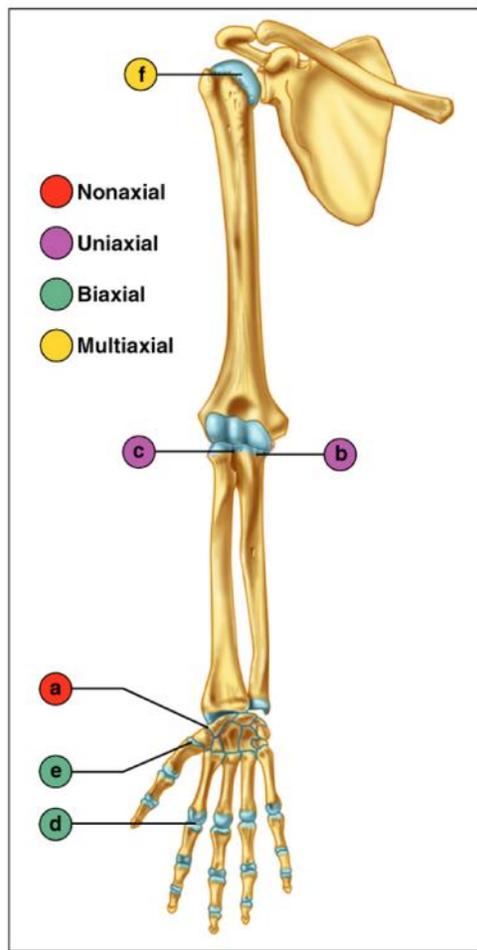
**Photomicrograph:** Dense regular connective tissue from a tendon (430 $\times$ ).

# SYNOVIAL JOINTS: RANGE OF MOTION

- **Nonaxial** – slipping movements only
- **Uniaxial** – movement in one plane
- **Biaxial** – movement in two planes
- **Multiaxial** – movement in or around all three planes

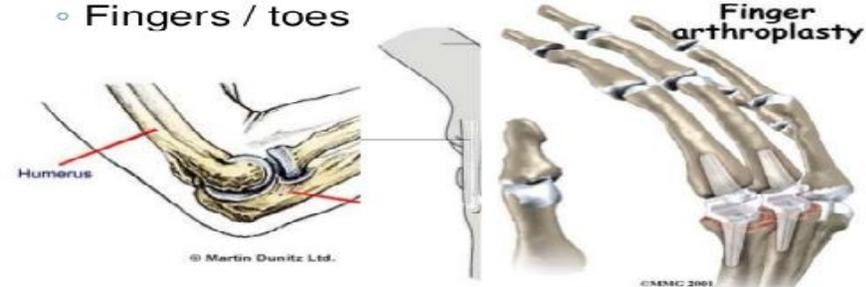


# HINGE JOINTS



## Hinge Joints

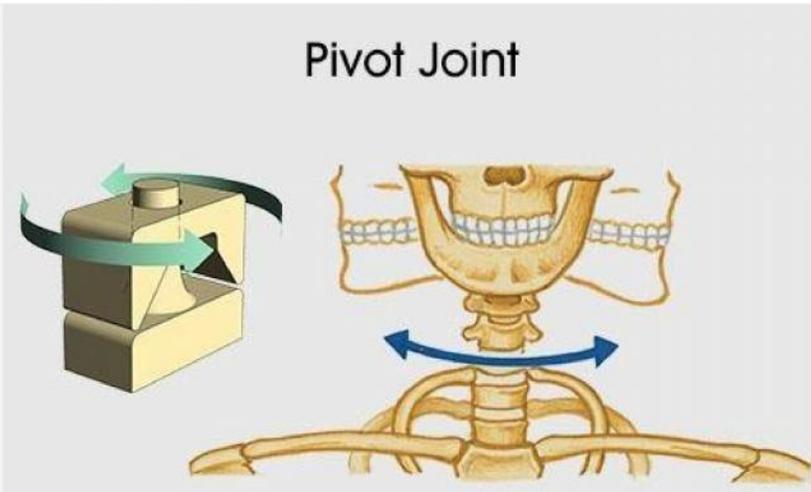
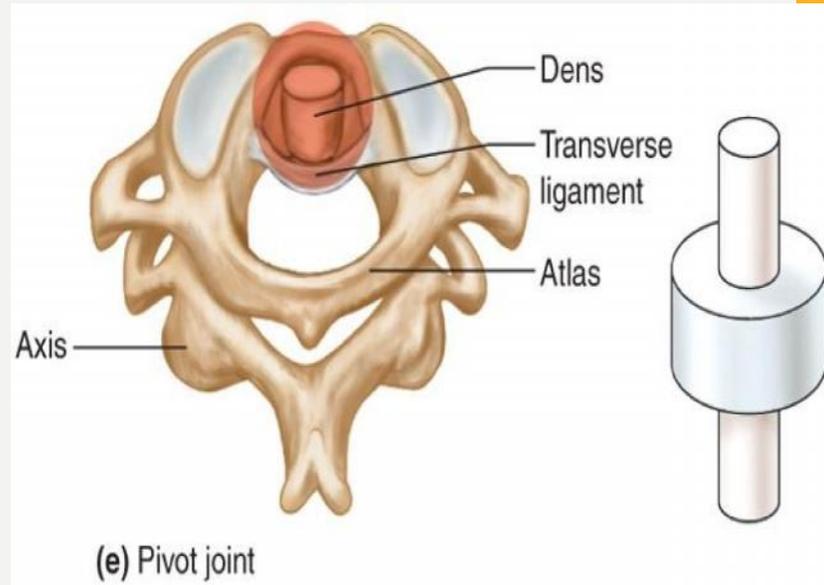
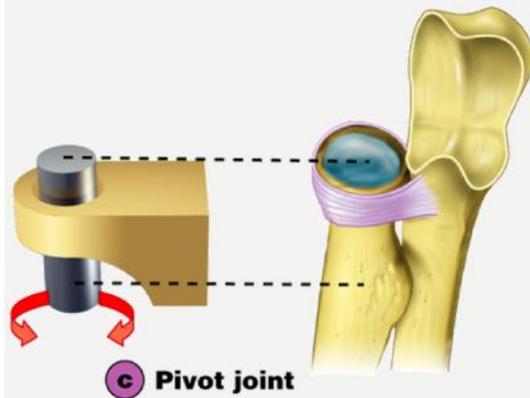
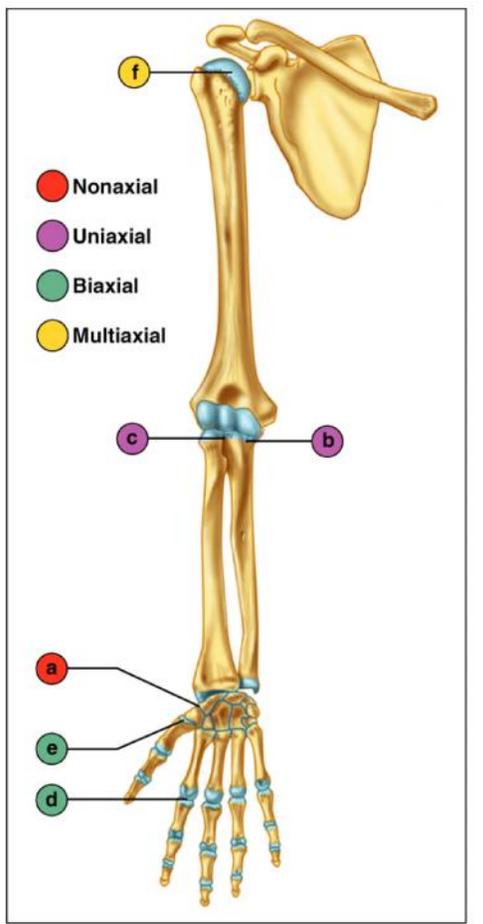
- Examples of hinge joints:
  - Elbow (between ulna and humerus)
  - Knee (between femur and tibia)
  - Fingers / toes



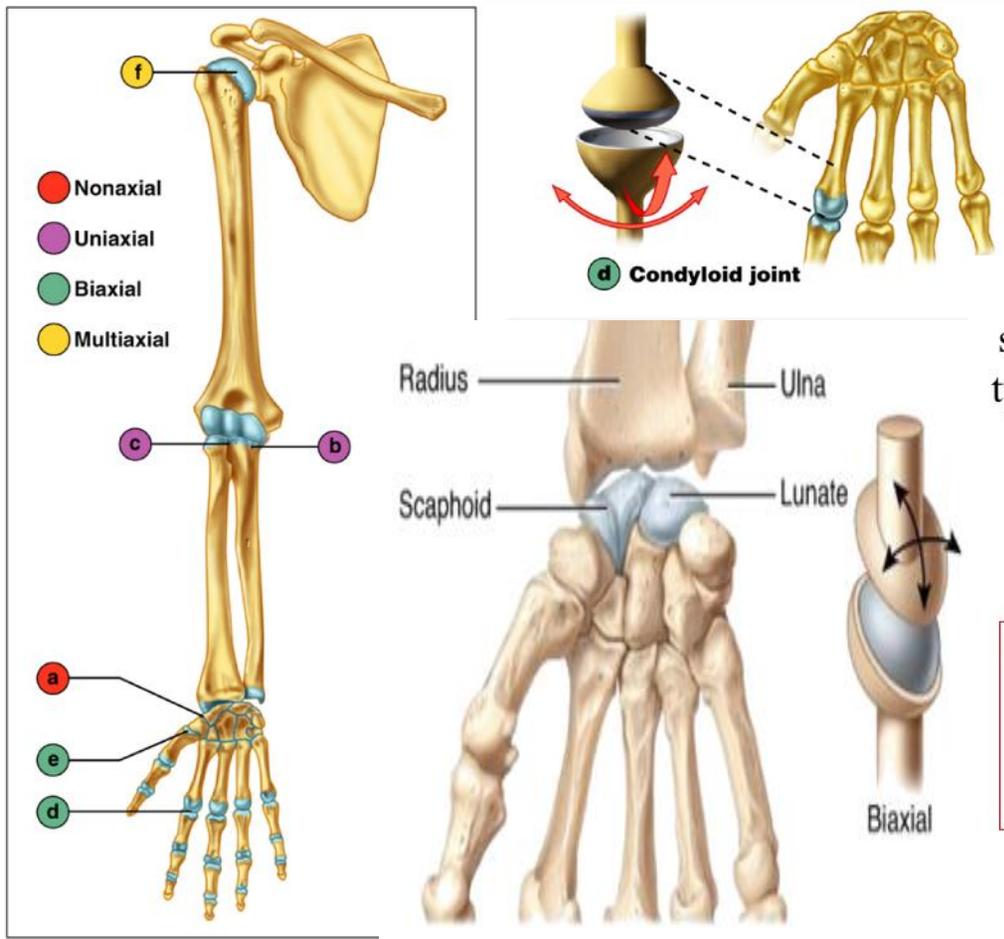
© Martin Dunitz Ltd.

© NEMEC 2001

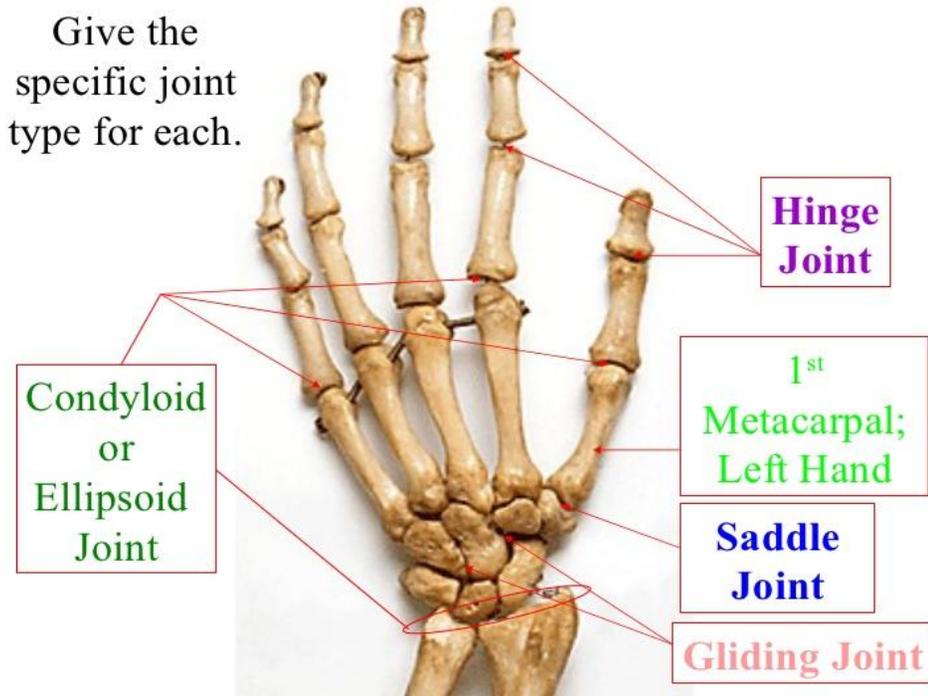
# PIVOT JOINTS



# CONDYLOID OR ELLIPSOIDAL JOINTS



Give the specific joint type for each.



# SADDLE JOINTS

