ANP1106B

Anatomy and Physiology of the Joints

Chapter 8

W 2017

Required Readings

Chapter 8: pp. 251 272

Specific Objectives

4.1 Describe the structural and functional classification of joints
4.2 Describe the structure of synovial joints, bursae and tendon sheaths
4.3 Describe the types of movements that can occur at synovial joints
4.4 Describe the structures and movements of: shoulder, elbow, hip, knee

Classification of Joints:

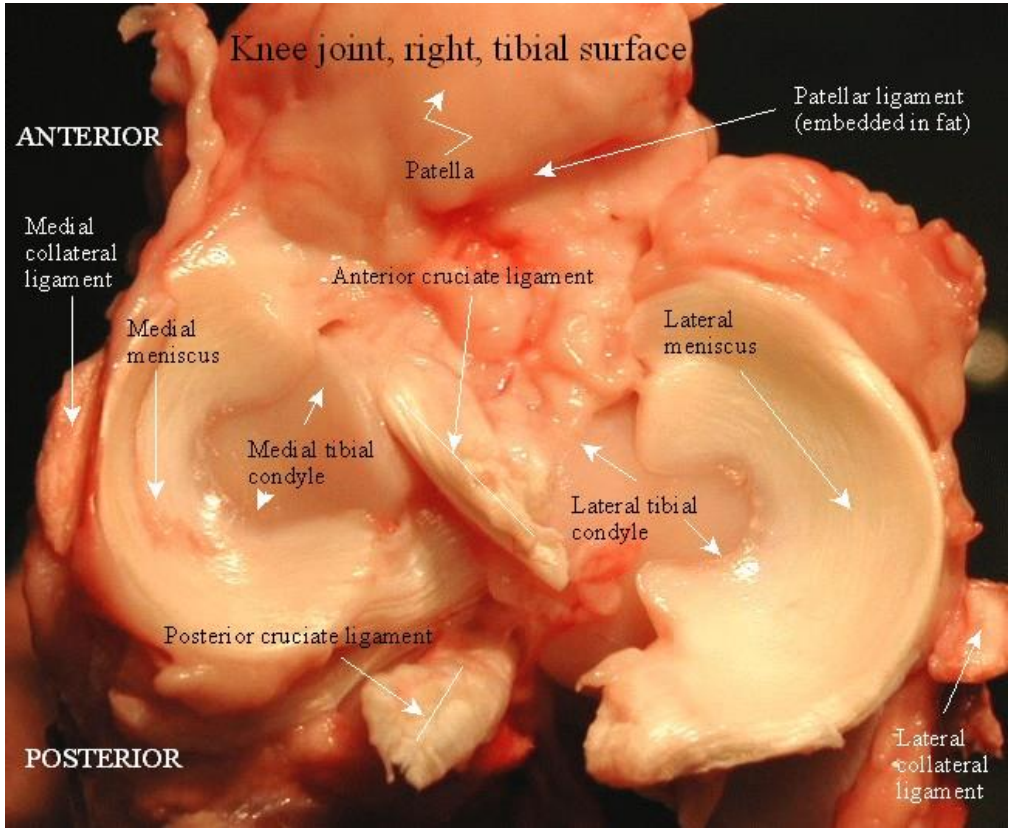
- a joint is a site where 2 or more bones meet
- classified by **structure** (*what holds the joint together? Is there a cavity?*) & by **function** (*how much freedom of movement is allowed at that joint?*)

Structurally – 3 types:

- **fibrous**
- **cartilaginous**
- **synovial**

Functionally – 3 types:

- **synarthroses**
- **amphiarthroses**
- **diarthroses**



http://biology.clc.uc.edu/fankhauser/Labs/Anatomy_&_Physiology/A&P201/Articulations/dissected_joints.html

Fibrous Joints

Bones joined by fibrous CT; no joint cavity so very little to no movement at joint

Sutures (= Synostose; *NO* movement):

- seams only found between bones of skull
- overlapping or interlocking of 2 bones; junction filled with very short CT fibers

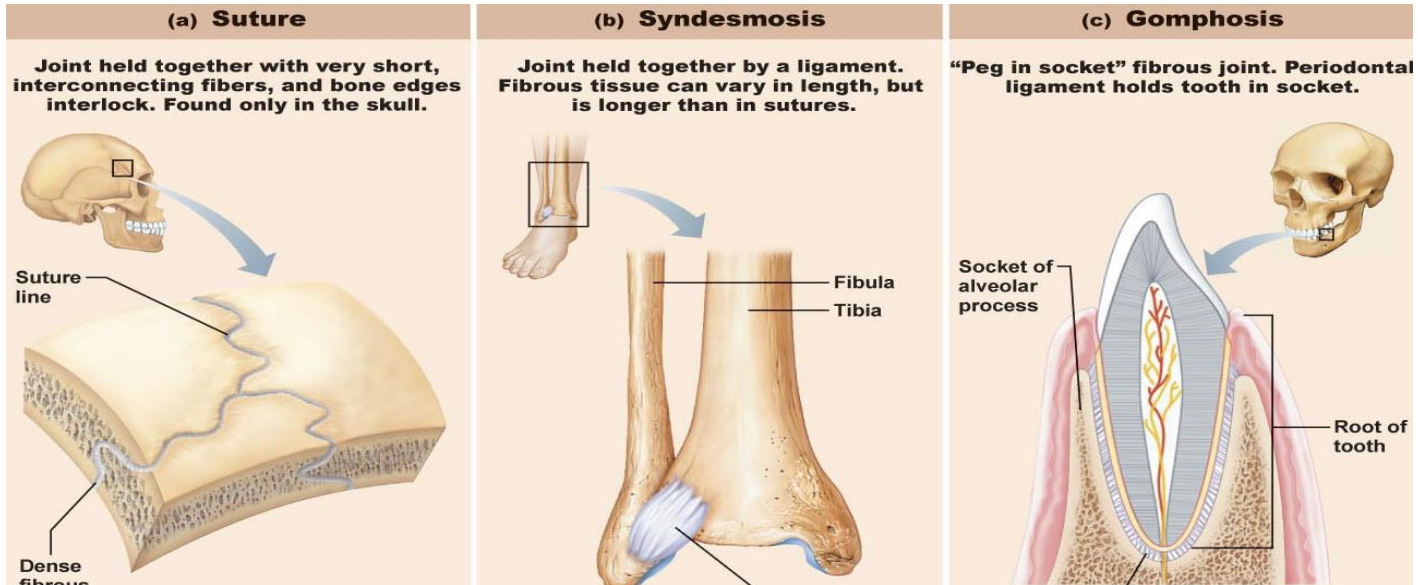
Syndesmoses (*very LIMITED* movment):

- cord (**ligament**) or sheet (**interosseous membrane**) of fibrous CT

Gomphoses: (gompho = nail [Greek])

- peg-in-socket; **only example = tooth in bony socket**

Fig. 8.1



Cartilaginous Joints

- **Bones are united by cartilage (no joint cavity)**
- Immovable joints

Synchondroses:

- areas of growth: eg: **epiphyseal plates**, between each of 1st 7 ribs & sternum

Symphysis:

- articular surfaces covered with hyaline cartilage - linking plate of fibrocartilage
- strength with flexibility: eg: **pubic symphysis, intervertebral joints**

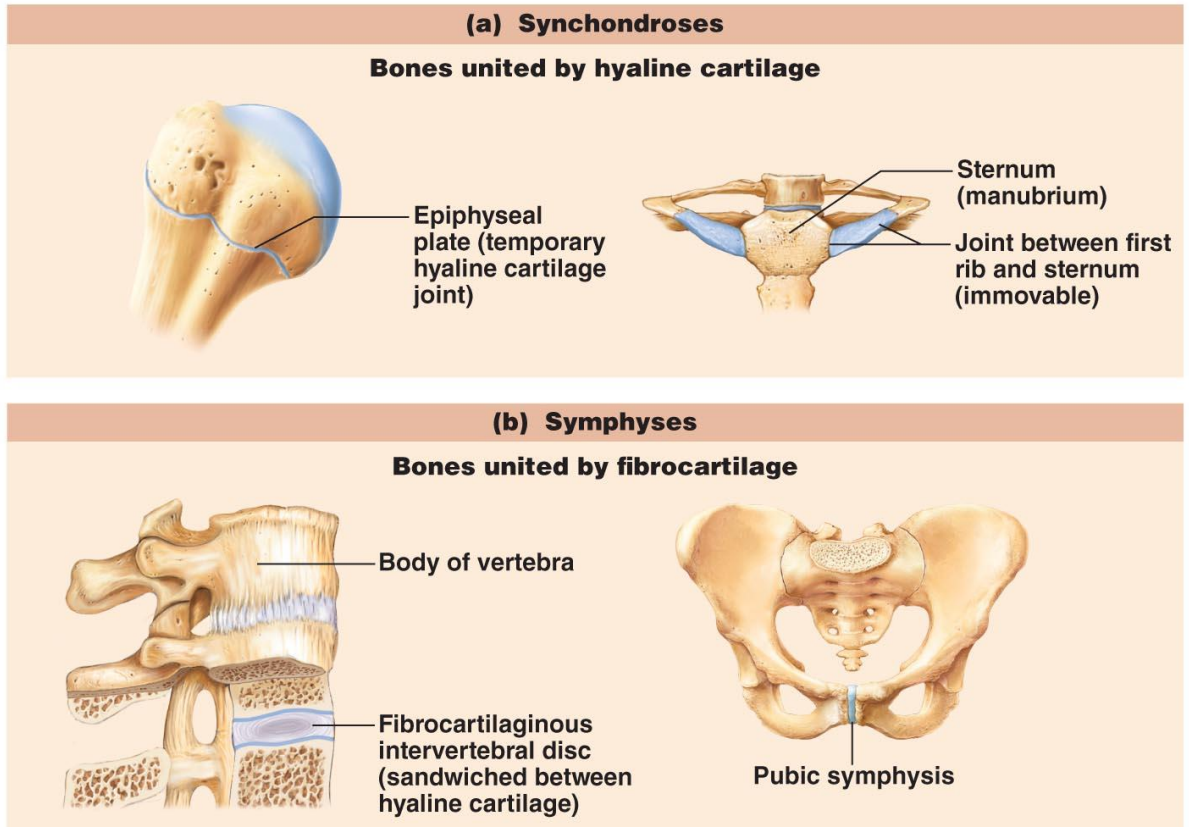


Fig. 8.2

General structure of a synovial joint

Most joints - lots of movement

<u>5 characteristics:</u>

- **Articular cartilage:**
  - covers opposing bone surfaces
  - cushioning so bone not crushed
- **Joint cavity:**
  - synovial cavity; fluid-filled
- **Articular capsule:**
  - double-layered
- **Synovial fluid:**
  - fills joint cavity
  - reduces friction

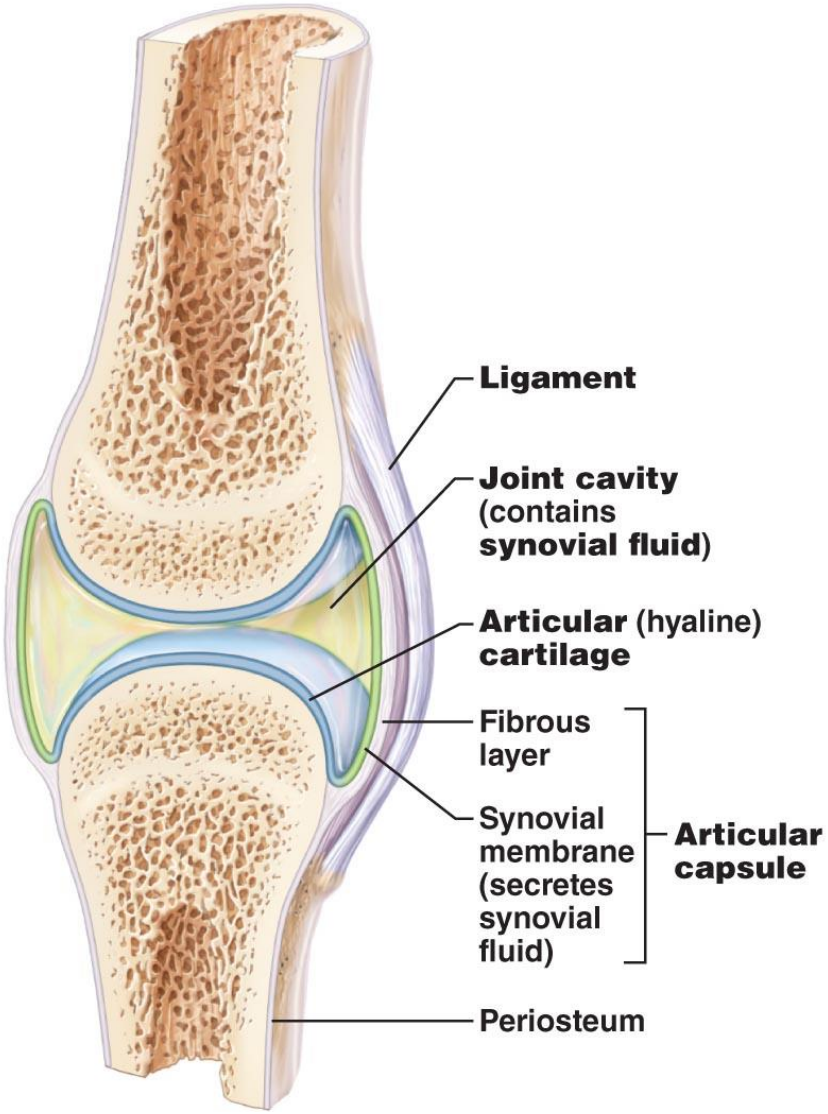
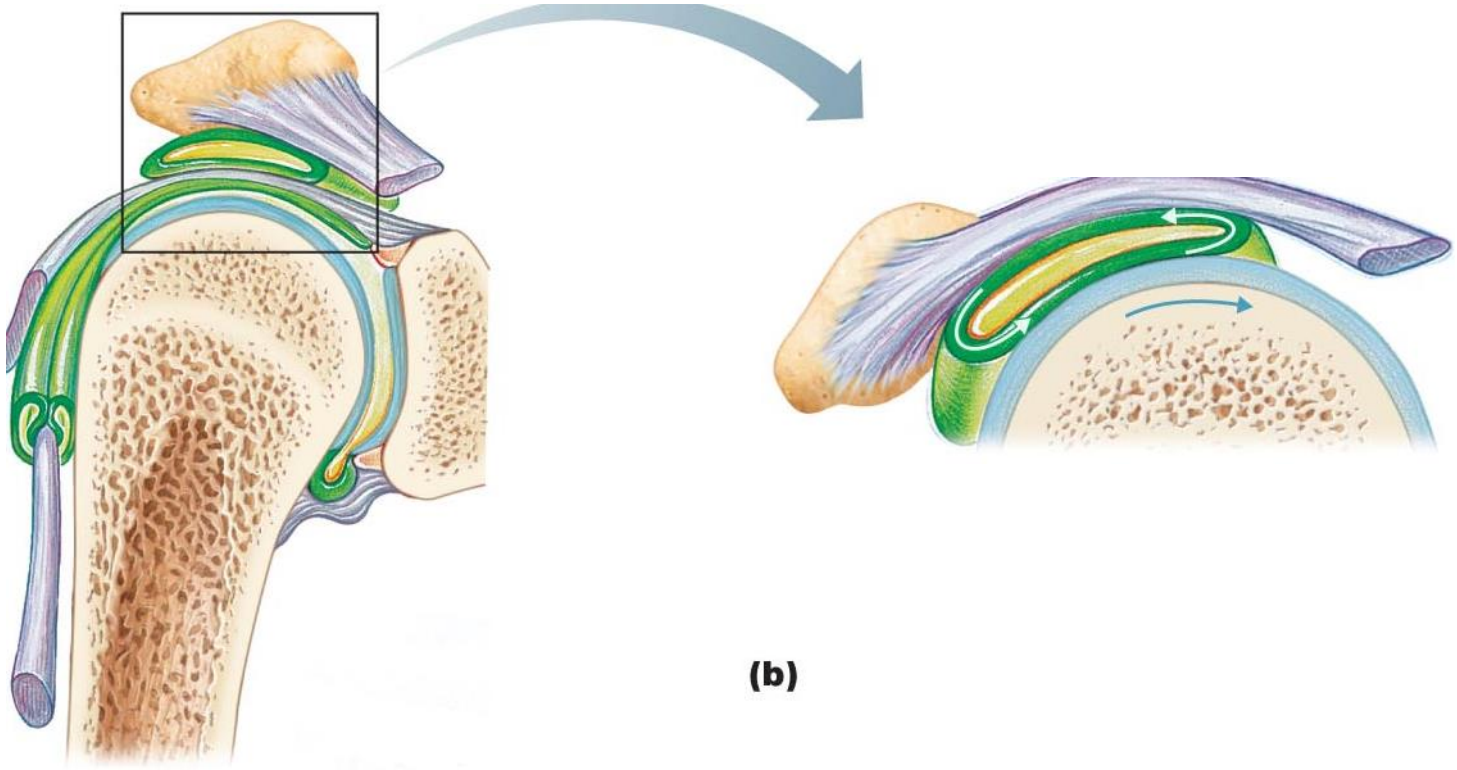


Fig. 8.3

Bursae & tendon sheaths

Fig. 8.4



Bursae & tendon sheaths:

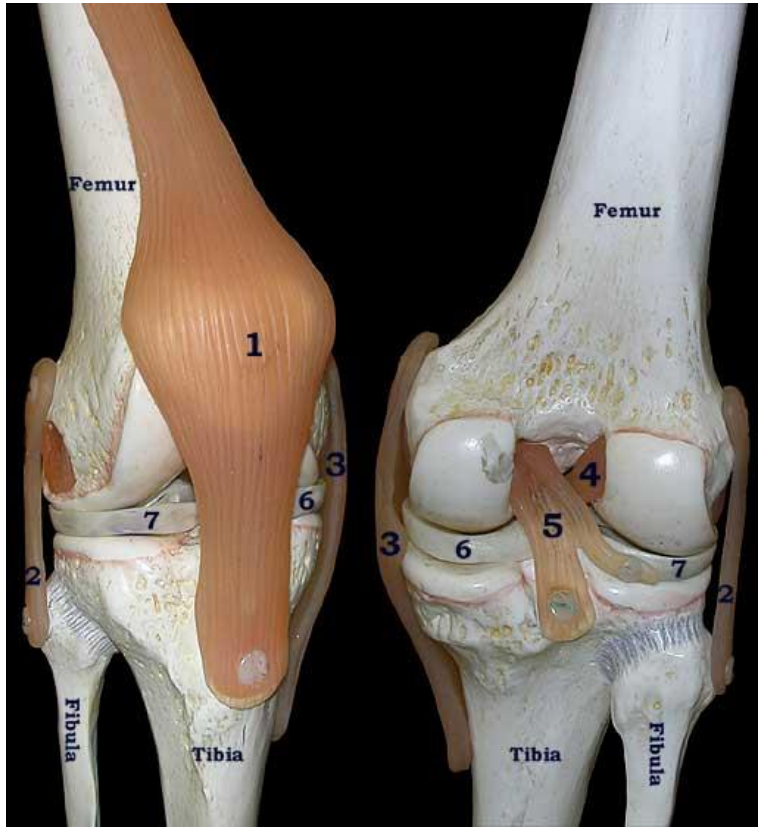
- bags of lubricant = reduce friction
- **bursa** is a sac lined with synovial membrane
  - containing a thin film of synovial fluid
  - found where ligaments, muscles, skin or muscle tendons overlie & rub together
  - **tendon sheath** = elongated bursa that wraps around a tendon

Factors that influence stability of *synovial* joints

Synovial joints: allow lots of movement, so not as stable as fibrous/cartilaginous joints

3 factors influence joint stability:

1. **Articular surfaces:**
   - shape of articular surfaces of many joints does not contribute much to stability
   - deep ball & socket joints have good shape for stability
2. **Ligaments:**
   - more ligaments = more strength
   - ligaments can only stretch ~6% of length before they break - **stretched** ligaments stay **stretched**
3. **Muscle tone:**
   - tendons of muscles crossing joints usually most important stabilizing factor - kept taut by **muscle tone**
   - esp: shoulder, knee, arches of foot



www.uky.edu/.../110Lab7/ Lab7Images/KneeJoint.jpg

Common Joint Injuries (Sprains)

Partially torn:

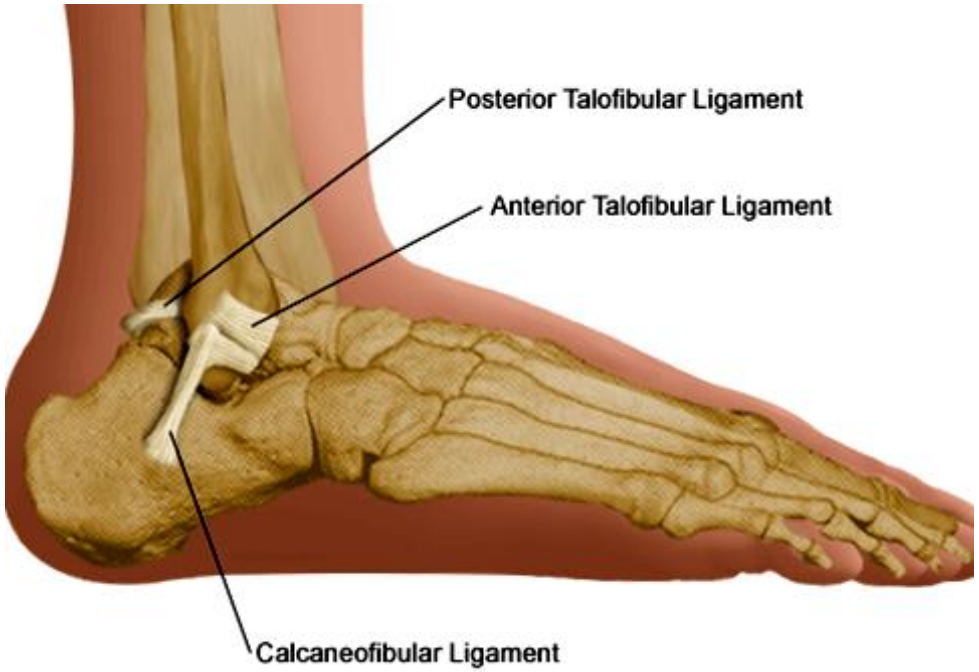
- ligaments repair themselves (slowly due to poor vascularization)
- completely torn ligaments may require surgery

Cartilage injuries:

- usually the knee - because cartilage has no blood supply, cannot repair itself
- pieces break off / interfere with joint function → arthroscopic surgery

Dislocations:

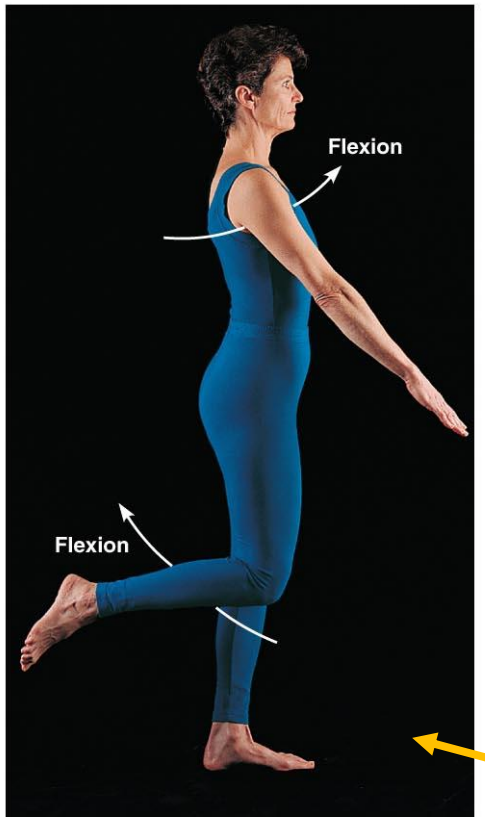
- bones forced out of their normal positions at a joint; need to be reduced
- repeat dislocations common because ligaments get stretched



Ligaments Involved in Ankle Sprains

www.stlouischildrens.org/. ../images/ei_0190.gif

Movements allowed by Synovial Joints



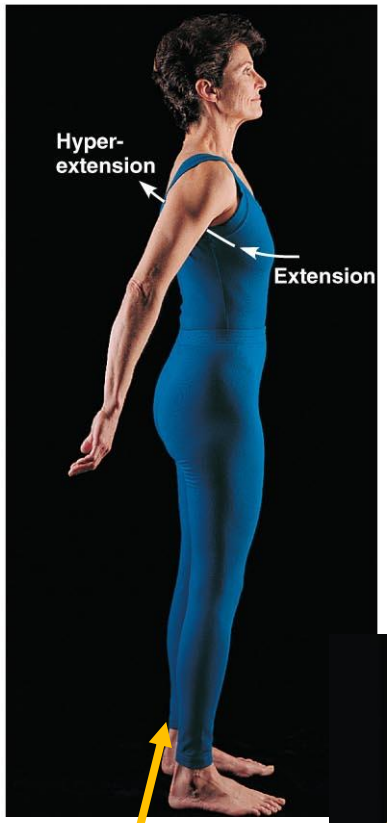
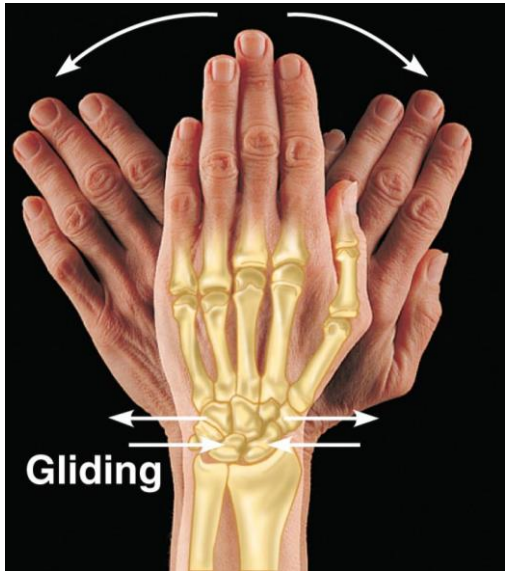
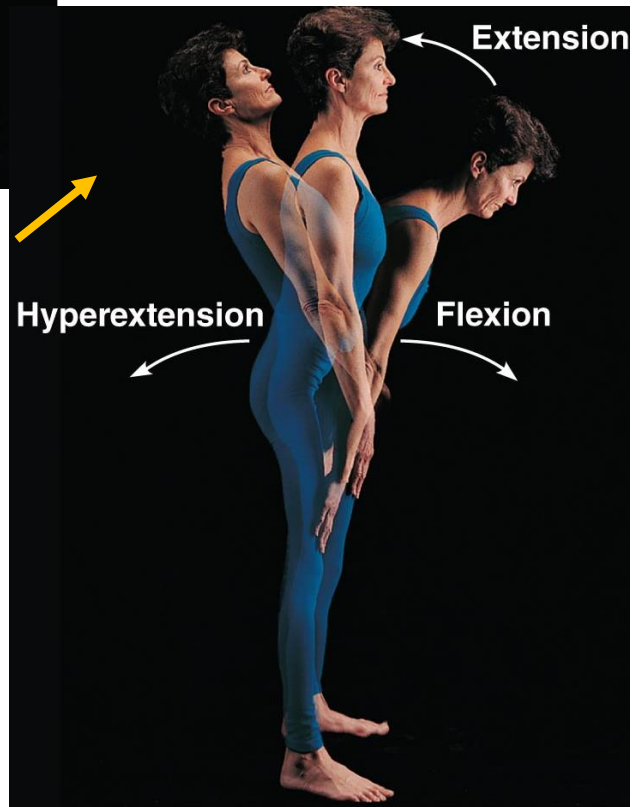


Fig. 8.5



Angular Movements



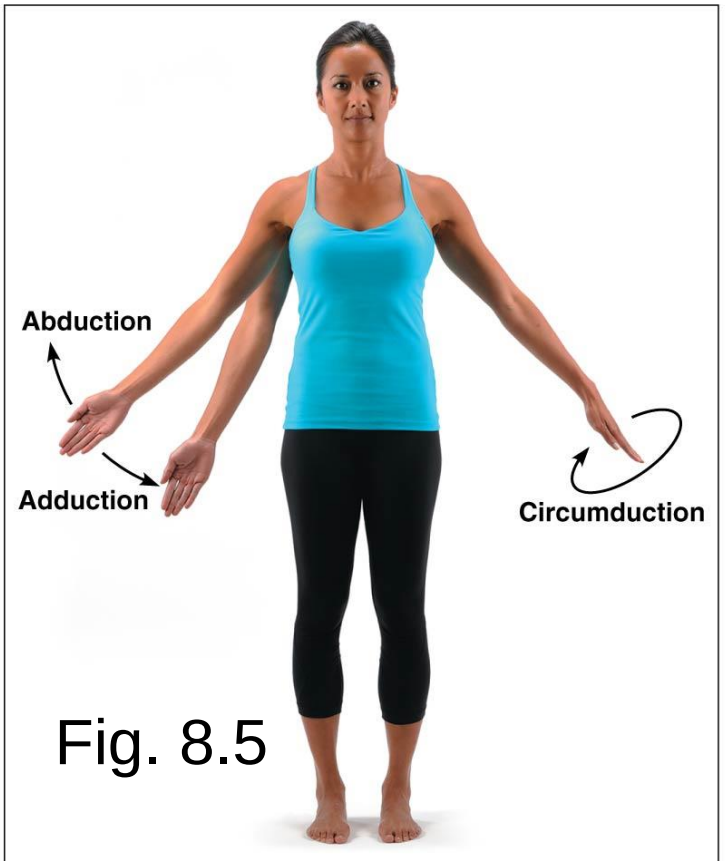
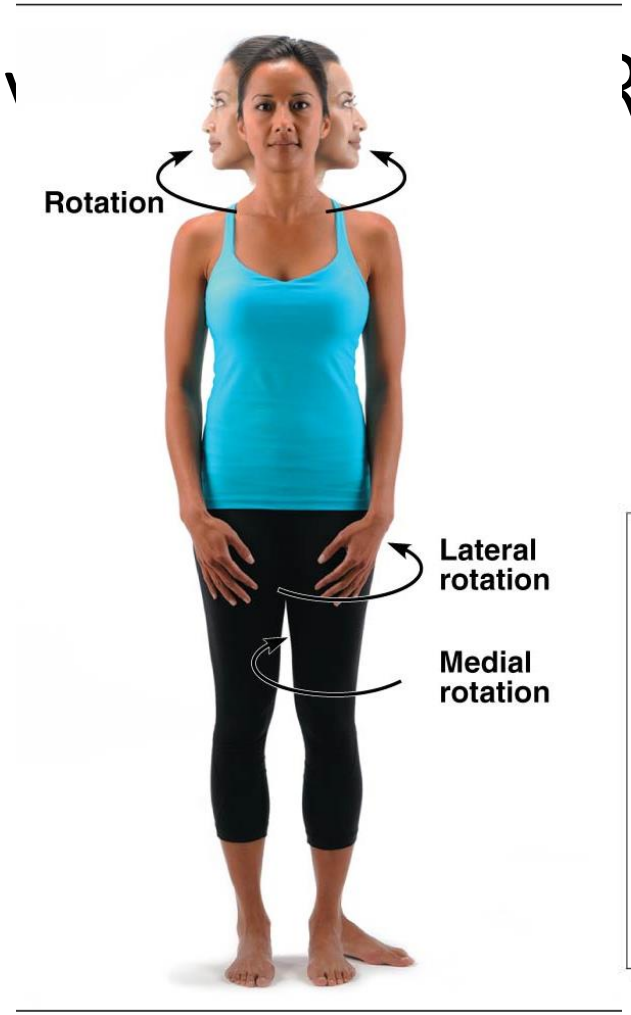
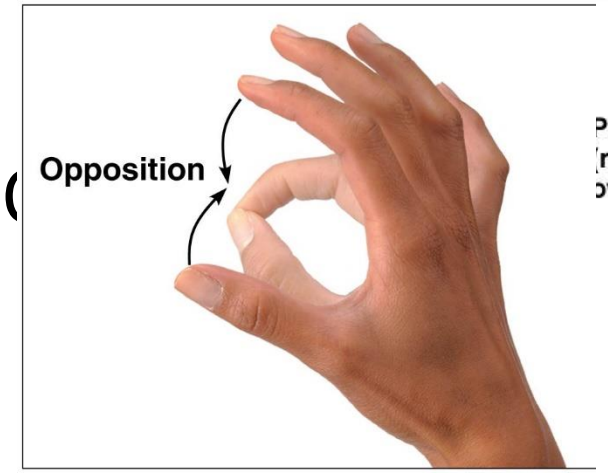
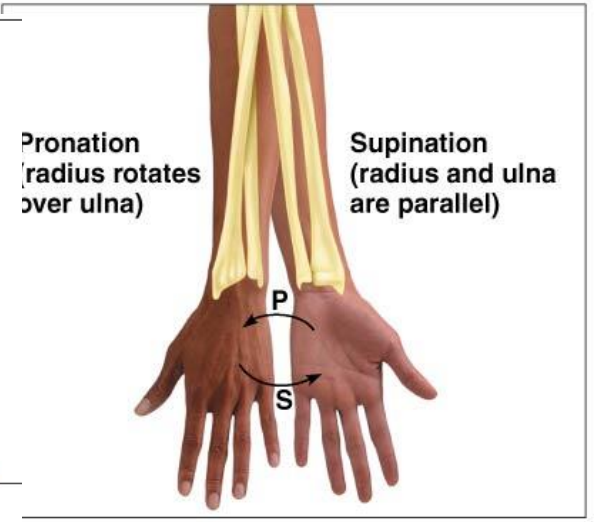


Fig. 8.5

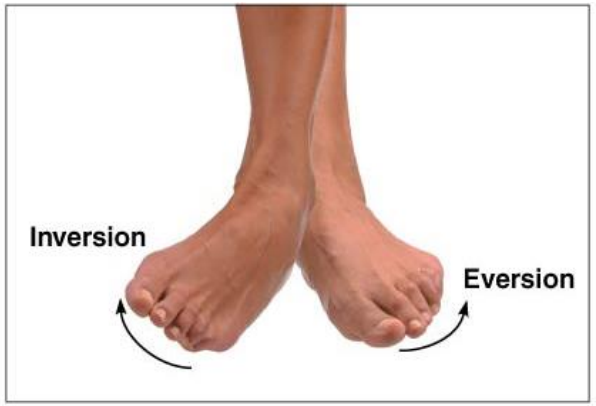




(f) Opposition



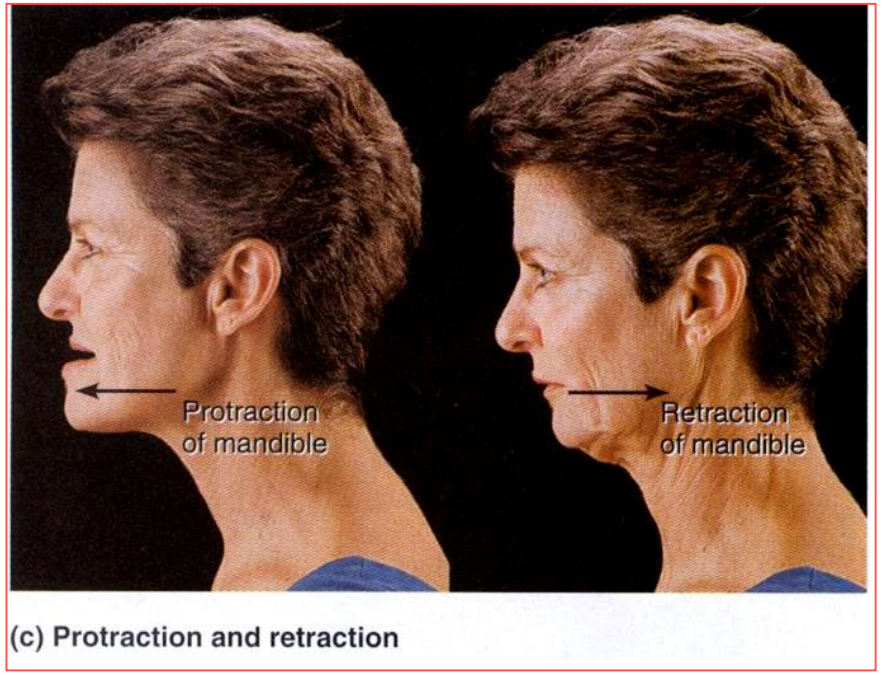
(a) Pronation (P) and supination (S)



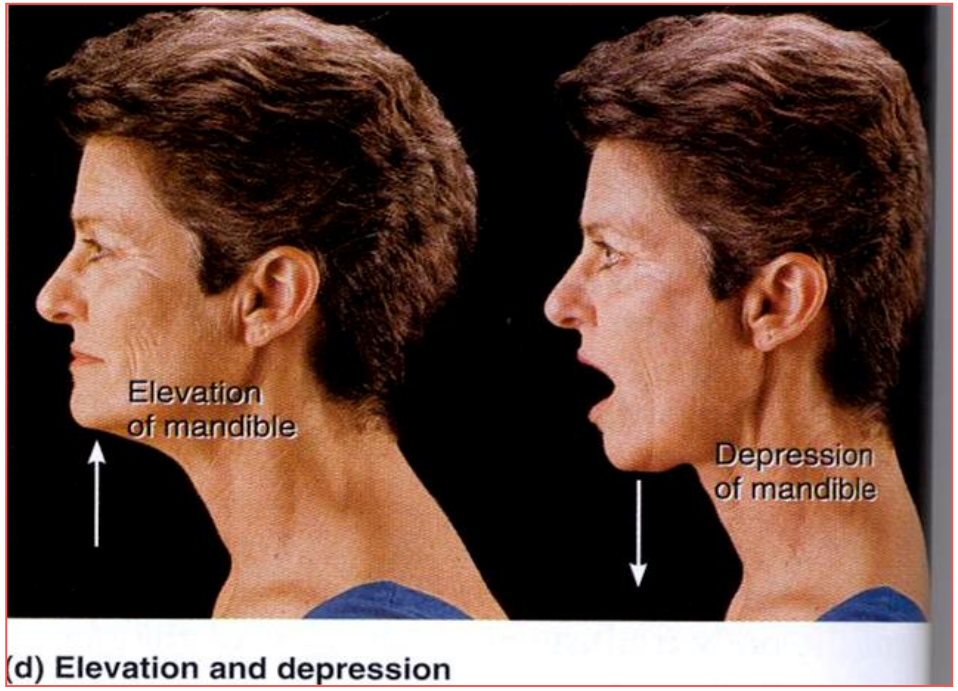
(c) Inversion and eversion

Fig. 8.6

Special Movements

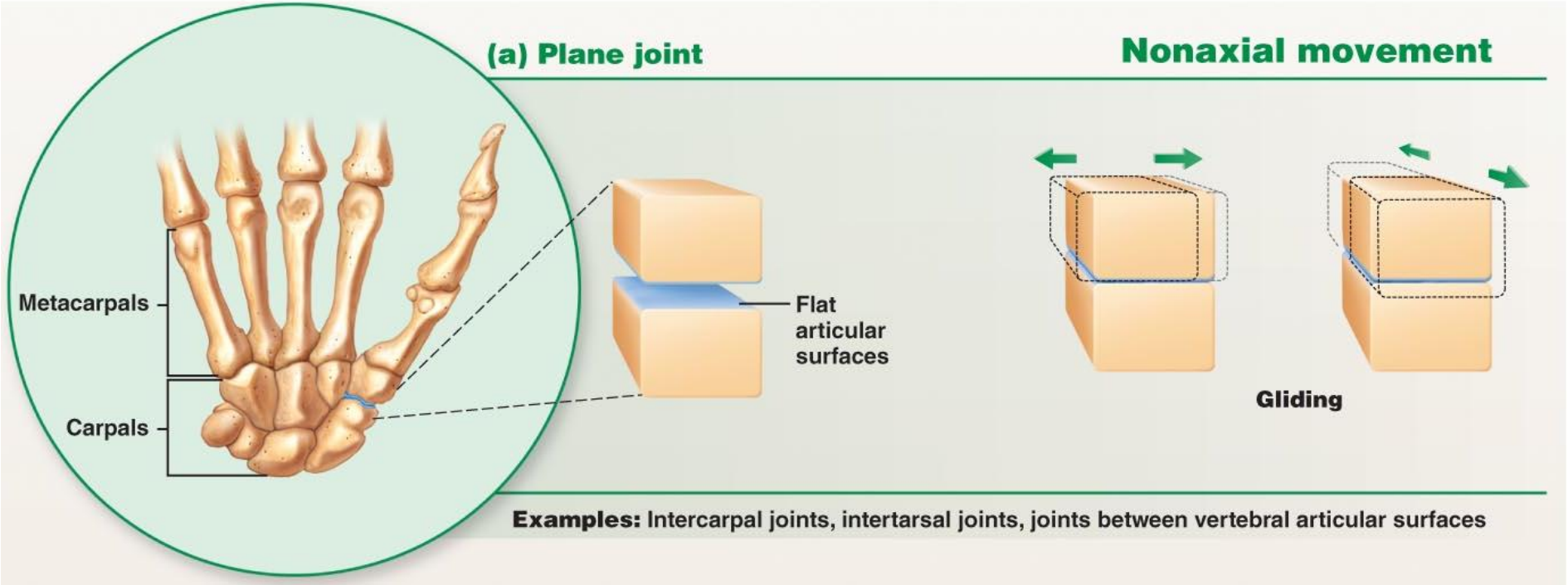


(c) Protraction and retraction



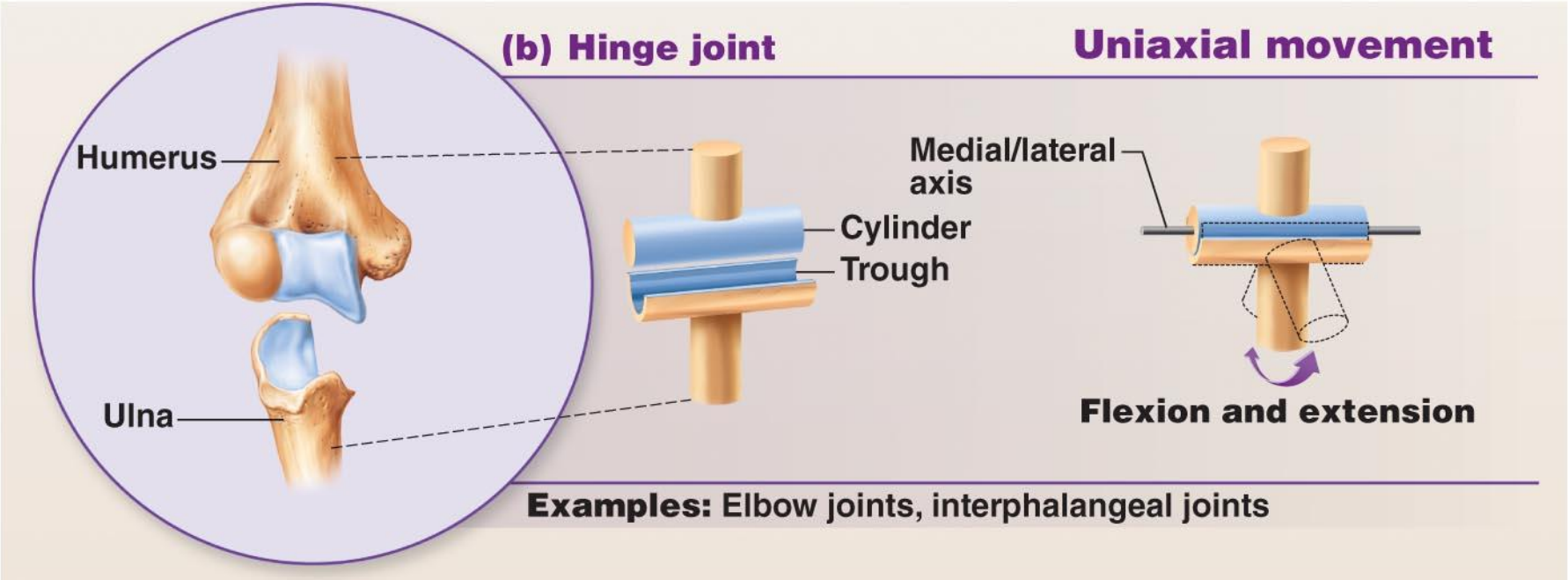
(d) Elevation and depression

Shape of articulating surfaces determines types of movements permitted by these synovial joints



(1) plane joint:
2 flat opposing surfaces
gliding
e.g. intercarpal joints

Fig. 8.7



(2) hinge joint: cylinder into trough – flexion/ extension e.g. elbow

Fig. 8.7 (cont)

(3) pivot joint :
insertion into a ring or sleeve eg: between atlas & dens of axis

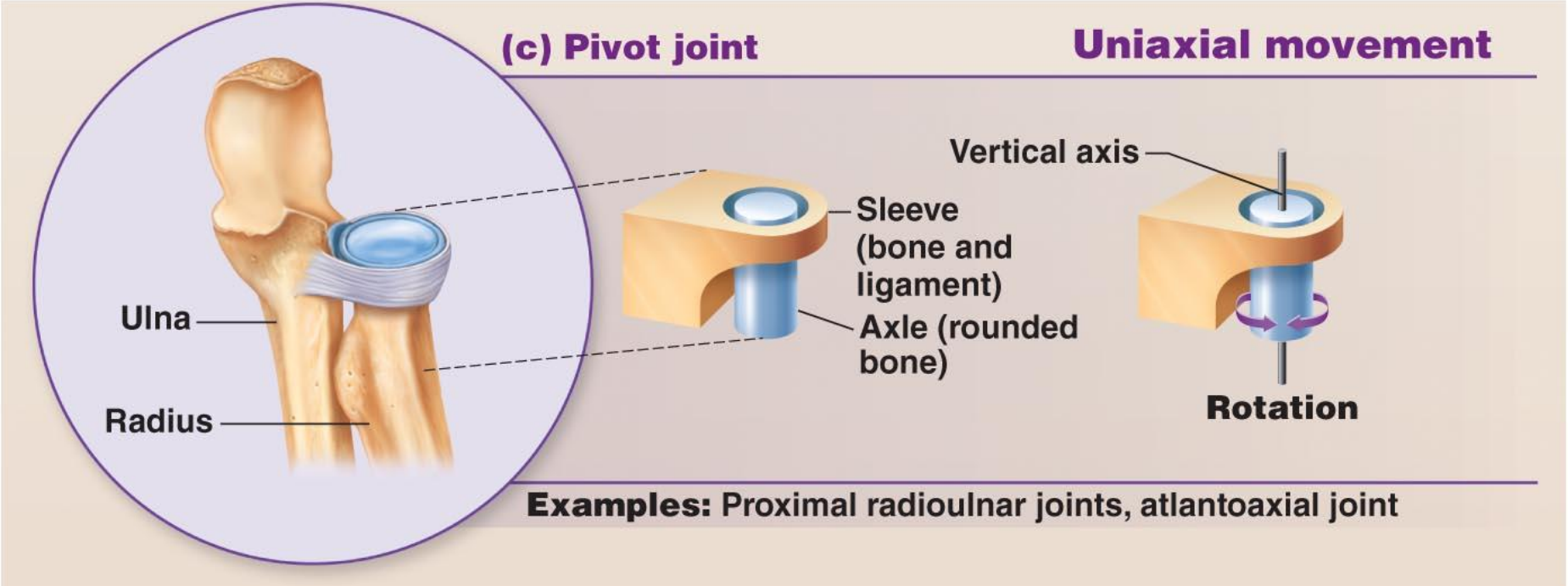


Fig. 8.7 (cont)

(4) condylar joint = “knuckle-like”- both articulating surfaces oval all planes of motion

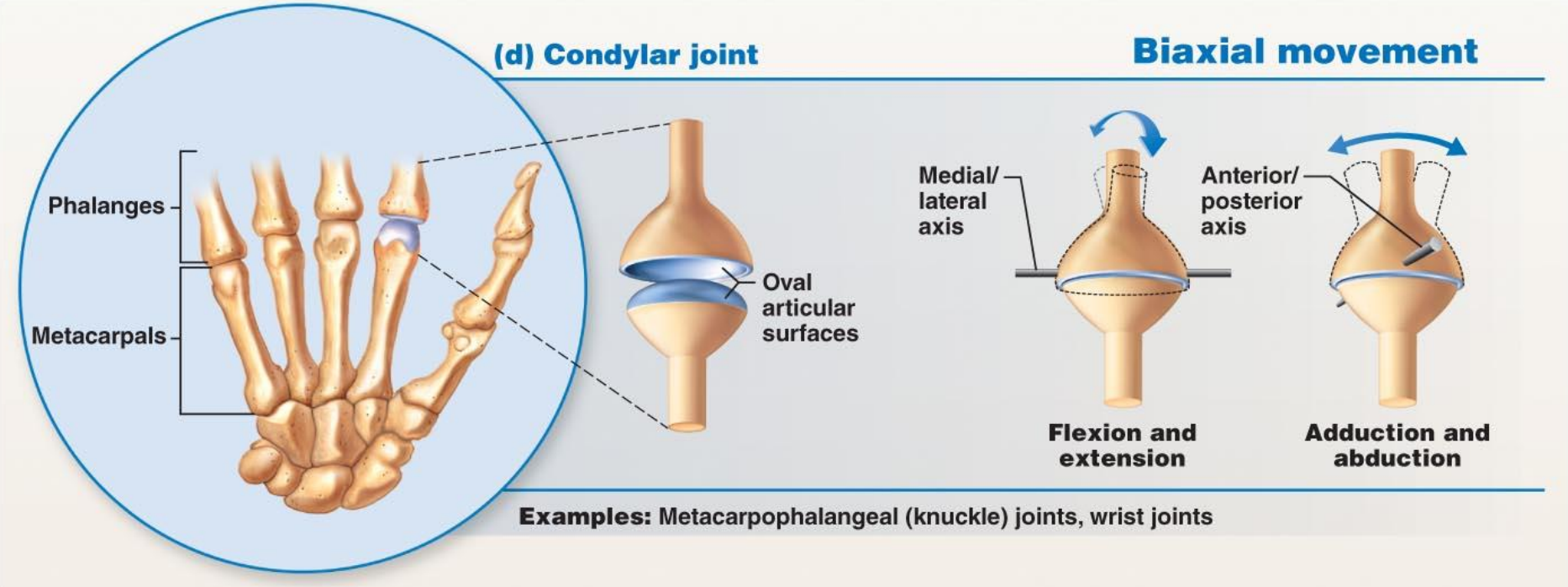
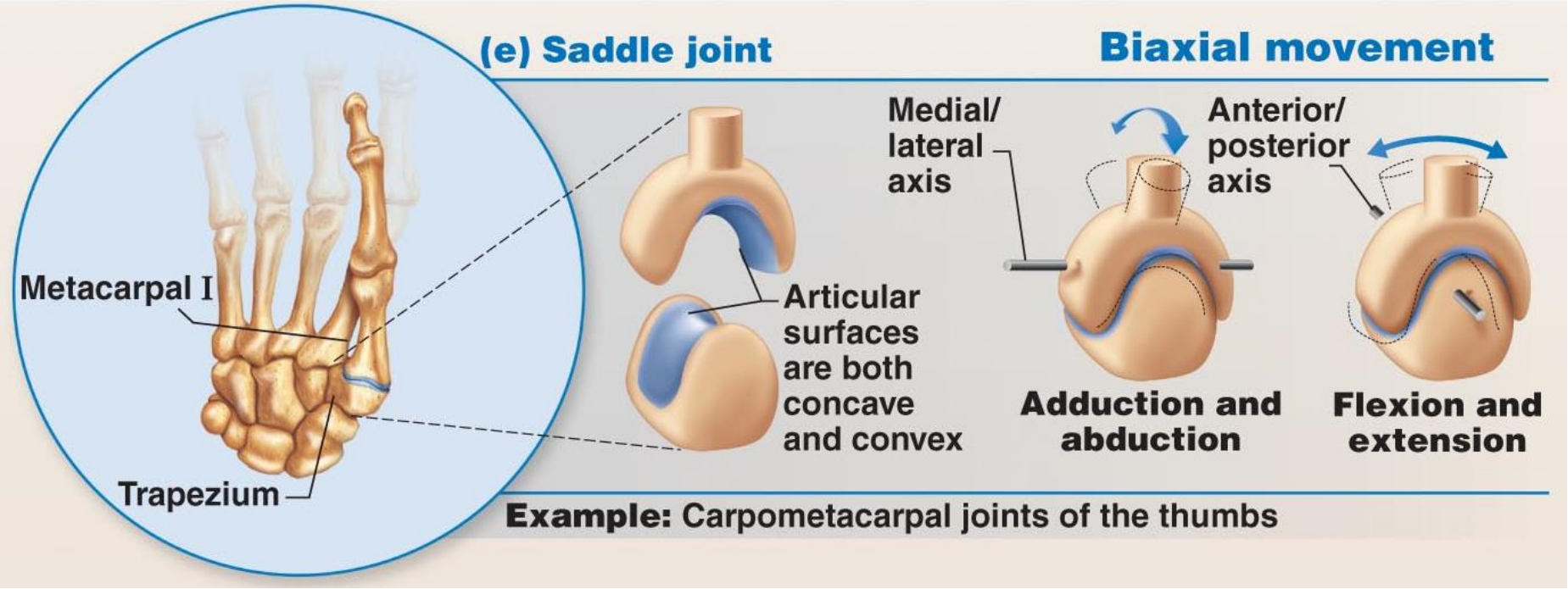
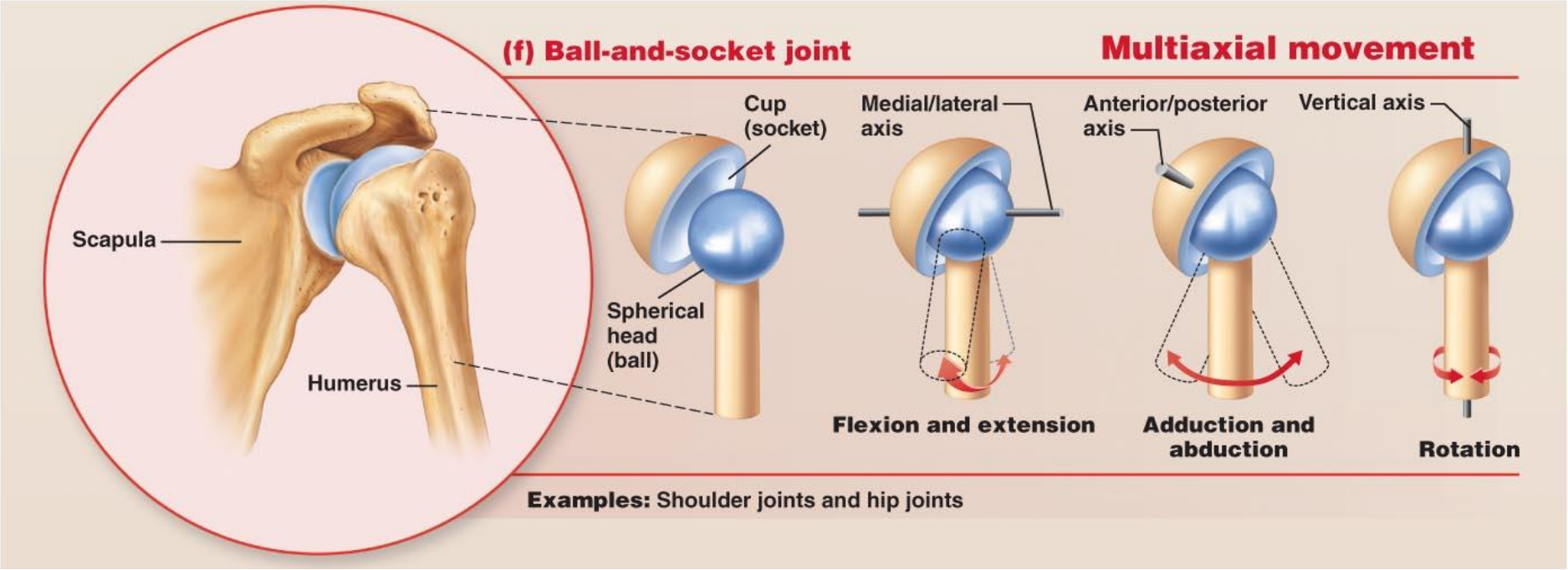


Fig. 8.7 (cont)



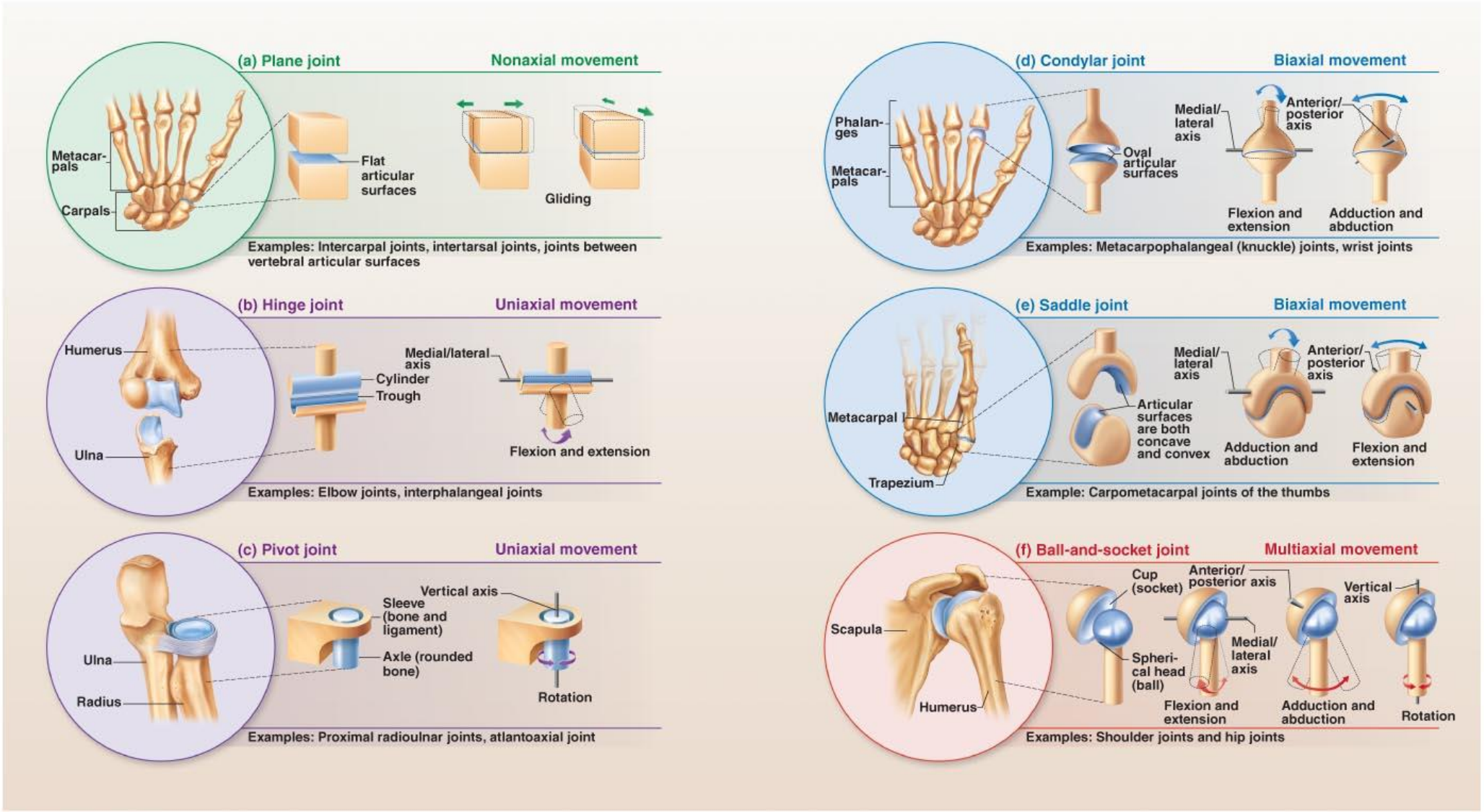
(5) Saddle joint – similar to condylar, but saddle shape permits even more freedom of movement

Fig. 8.7 (cont)



(6) Ball-and-socket joint

Figure 8.7 Shapes of joint surfaces determine movement at synovial joint



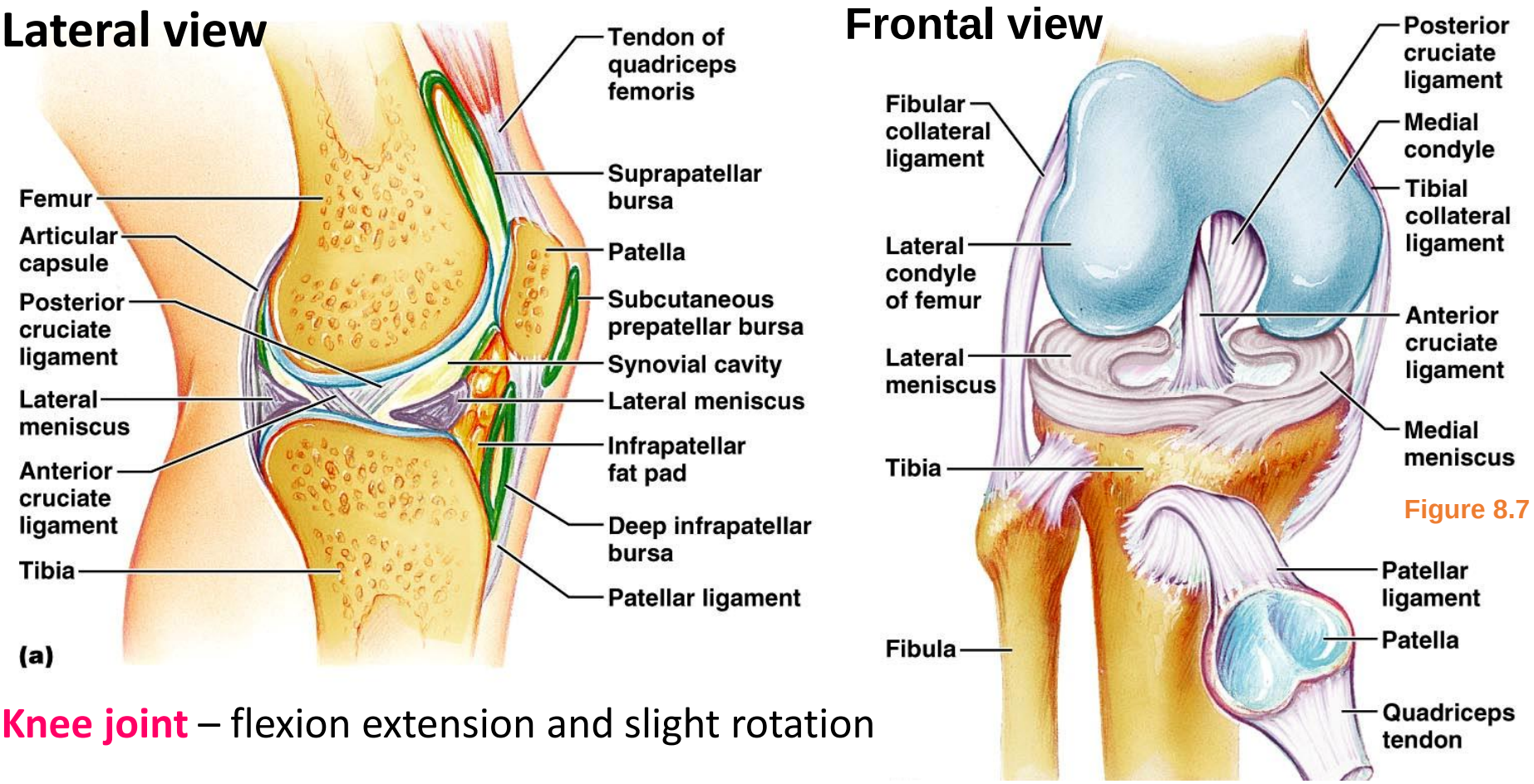


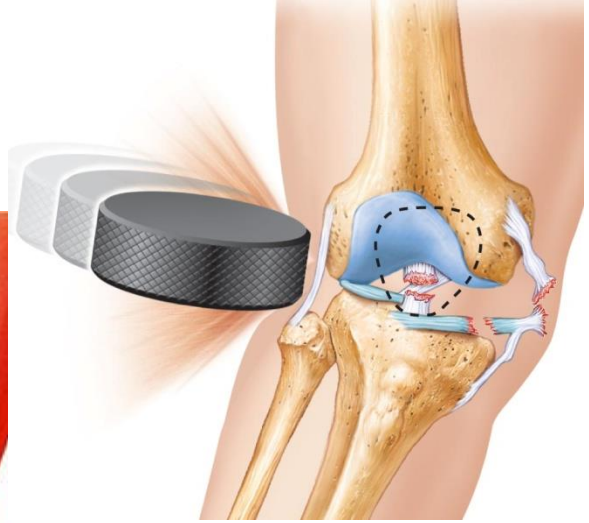
Figure 8.7

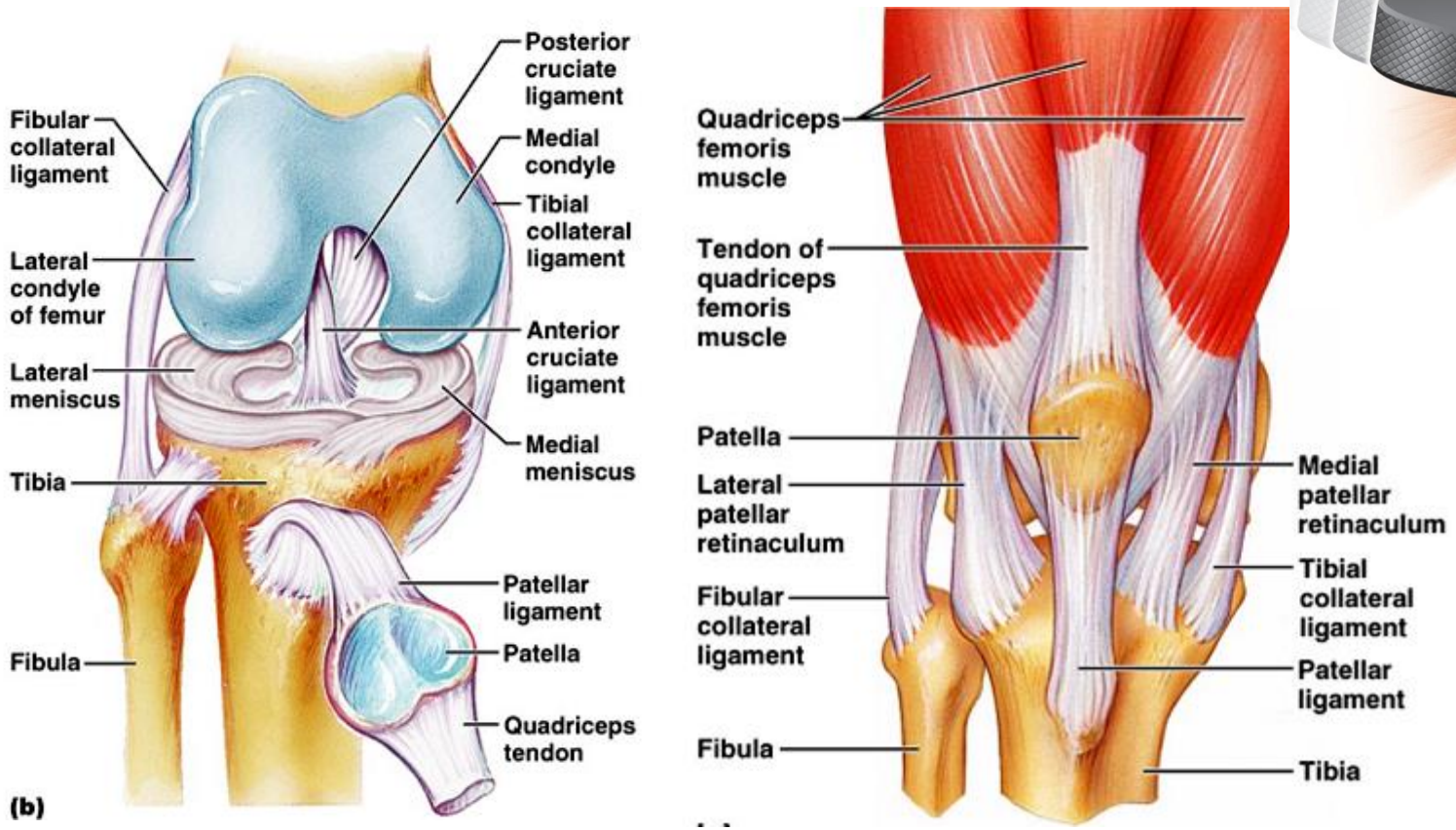
Knee joint – flexion extension and slight rotation

Three joints – femoropatellar, lateral tibiofemoral and medial tibiofemoral

Anteriorly the joint capsule is replaced by three broad ligaments that are continuous with the quadiceps tendon. There are two intracapsular ligaments (**anterior and posterior cruciate**), two **menisci** (medial and lateral, attached at the fibrous capsule) and two extracapsular ligaments (**fibular collateral** and **tibial collateral**). Note the subcutaneous **prepatellar bursa** (water on the knee).

Tearing of: tibial collateral & anterior cruciate ligaments and medial meniscus



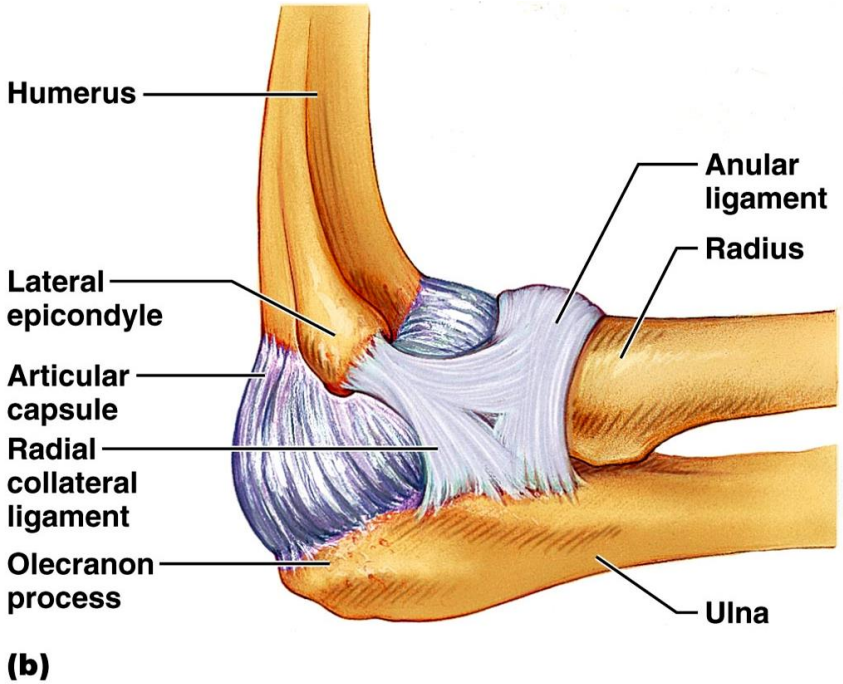


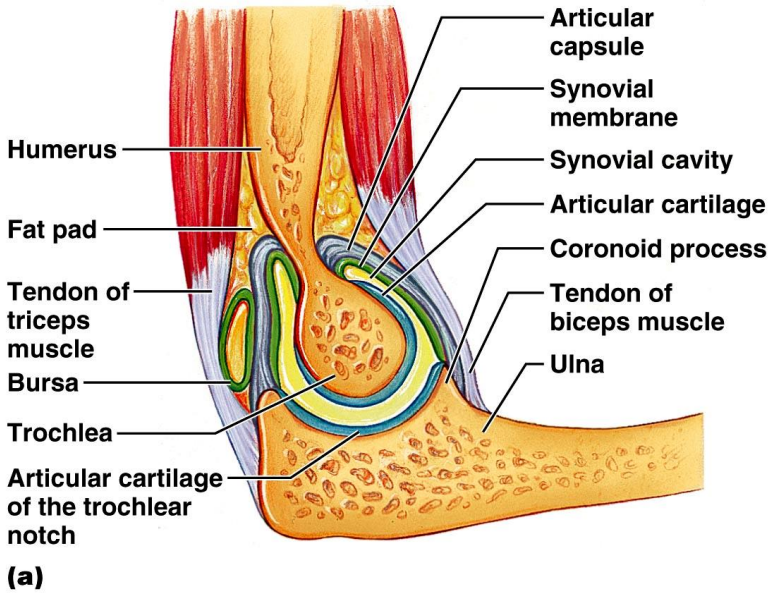
This slide is not to introduce new material, but to show the joint in context of muscle attachments

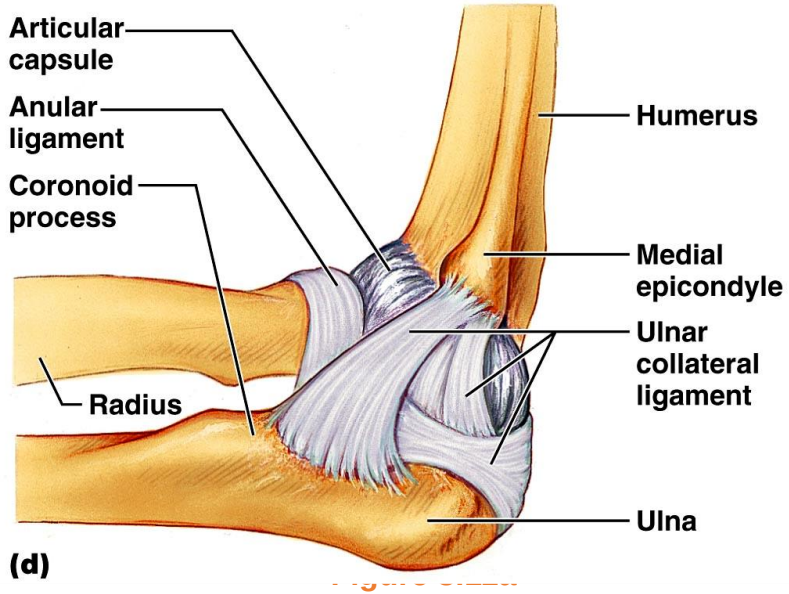
- Note that the cruciate ligaments are covered by synovial membrane and therefore are outside the synovial cavity and that the knee locks by rotating medially.

Elbow Joint (Hinge Joint)

- Largely through the articulation of the **trochlea** of the humerus with the **trochlear notch** on the ulna
- The joint is stabilized by radial and ulnar collateral ligaments and of note is the **annular ligament** allowing rotation of the radius during pronation and supination



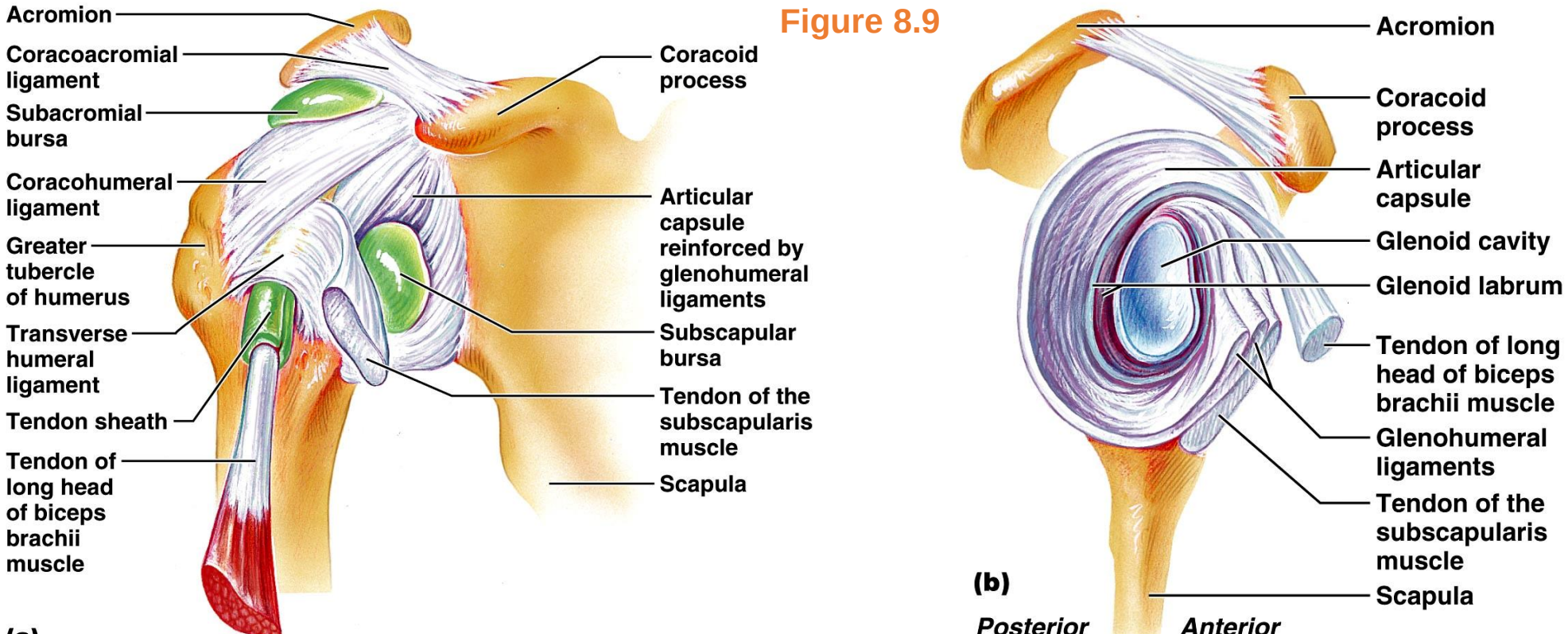




Glenohumoral joint

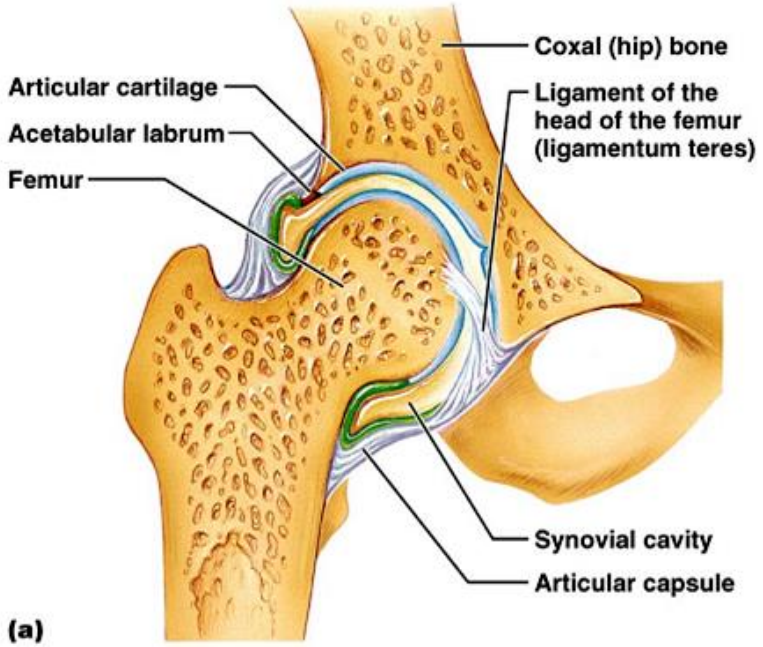
- the glenoid cavity is broadened slightly by the **glenoid labrum** (fibrocartilagenous rim) but is still only 1/3rd the size of the head of the humerus
- the only ligament of note is the **coracohumeral**
- it is largely the tendons of the rotator cuff muscles that stabilize this joint.

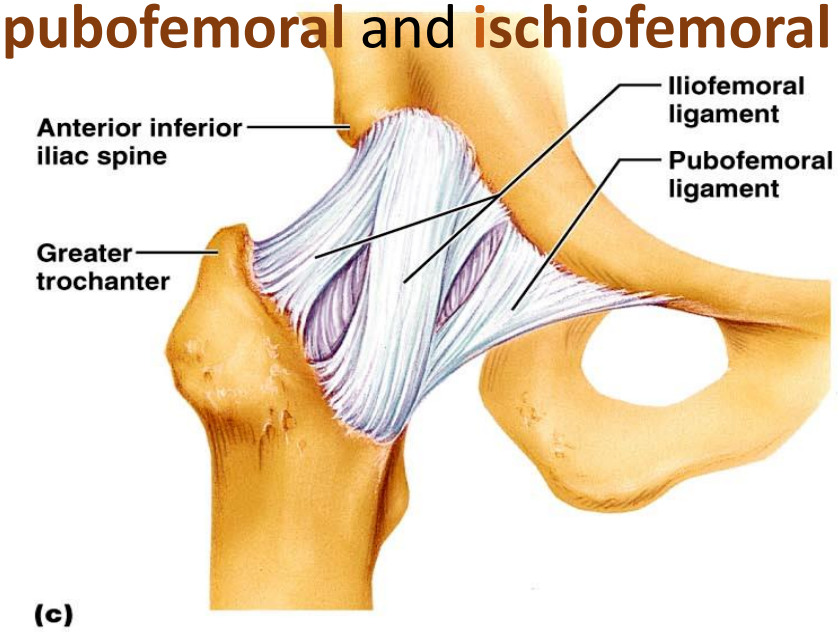
Figure 8.9



Hip Joint

- A deep ball and socket joint
- There is an *intracapsular ligament* (ligament of the head of the femur – **ligamentum teres**) but its function in humans is unclear – damage to its artery however may lead to arthritis of the hip joint.
- Extracapsular ligaments to note are the **iliofemoral**, **pubofemoral** and **ischiofemoral** ligaments





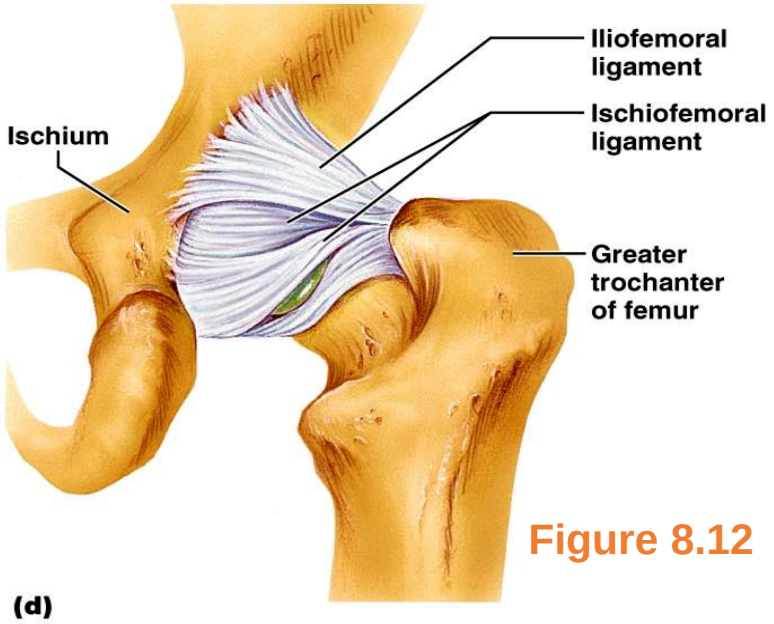
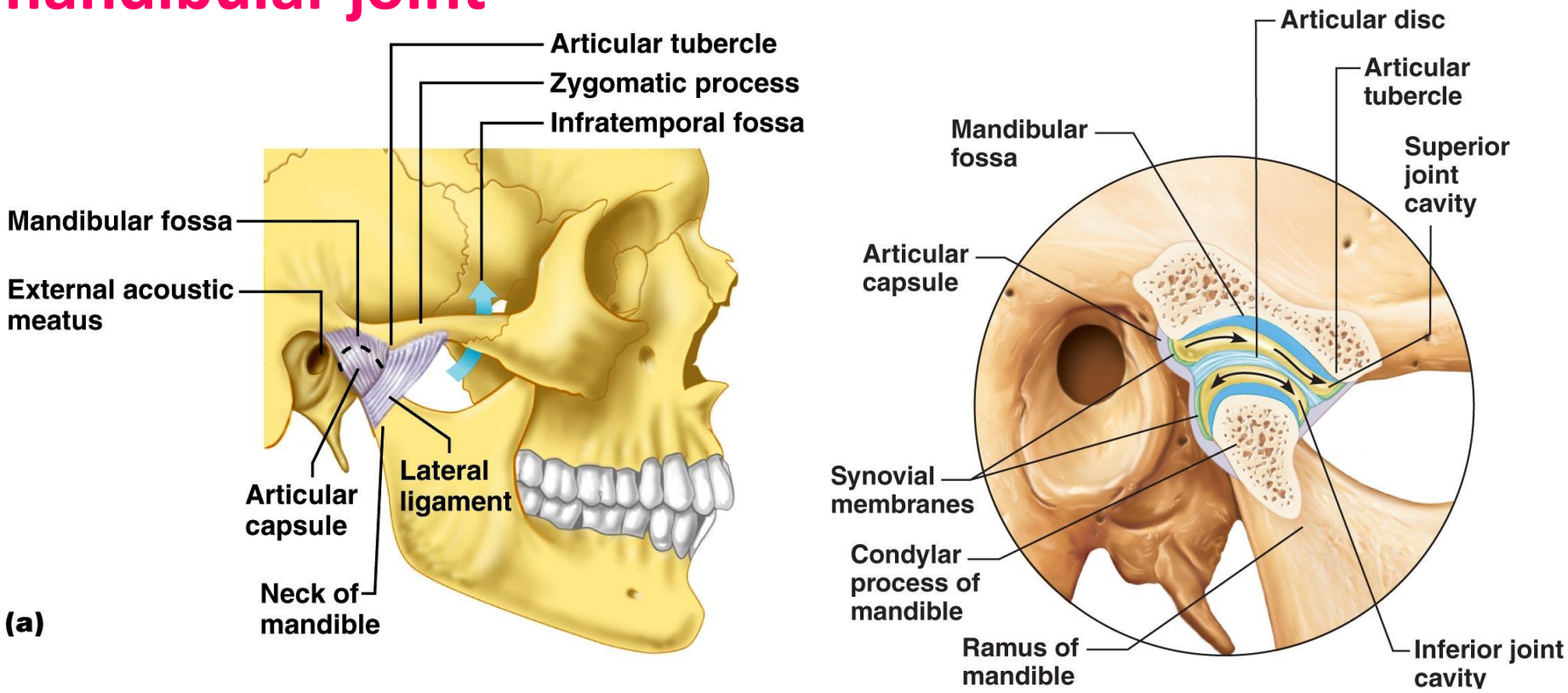


Figure 8.12

Temporomandibular joint

Figure 8.13



- Articulation of the **mandibular condyle** with the **mandibular fossa** and the articular tubercle of the temporal bone.
- Stabilized by a lateral ligament. There is an articular disk * that divides the synovial cavity into superior and inferior compartments.
- Initial jaw opening is hinged (mandibular condyle within the temporal fossa).
- There is gliding when the condyle articulates with the articular tubercle.