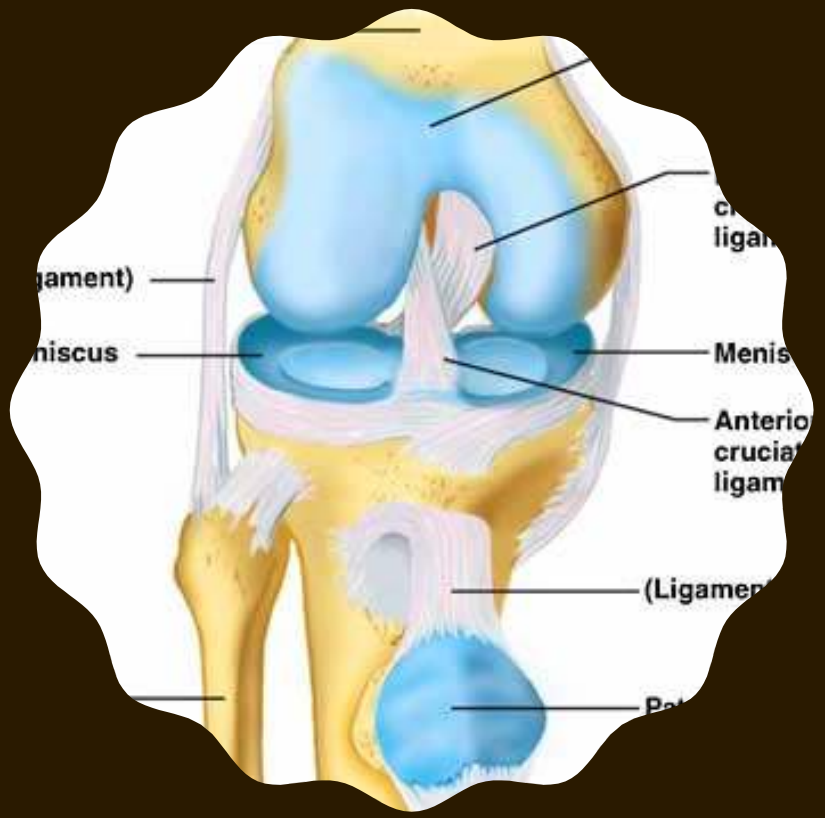


JOINT UPDATE ARTHROLOGY D.HAMMOUDI.MD

GLIDING MOVEMENT

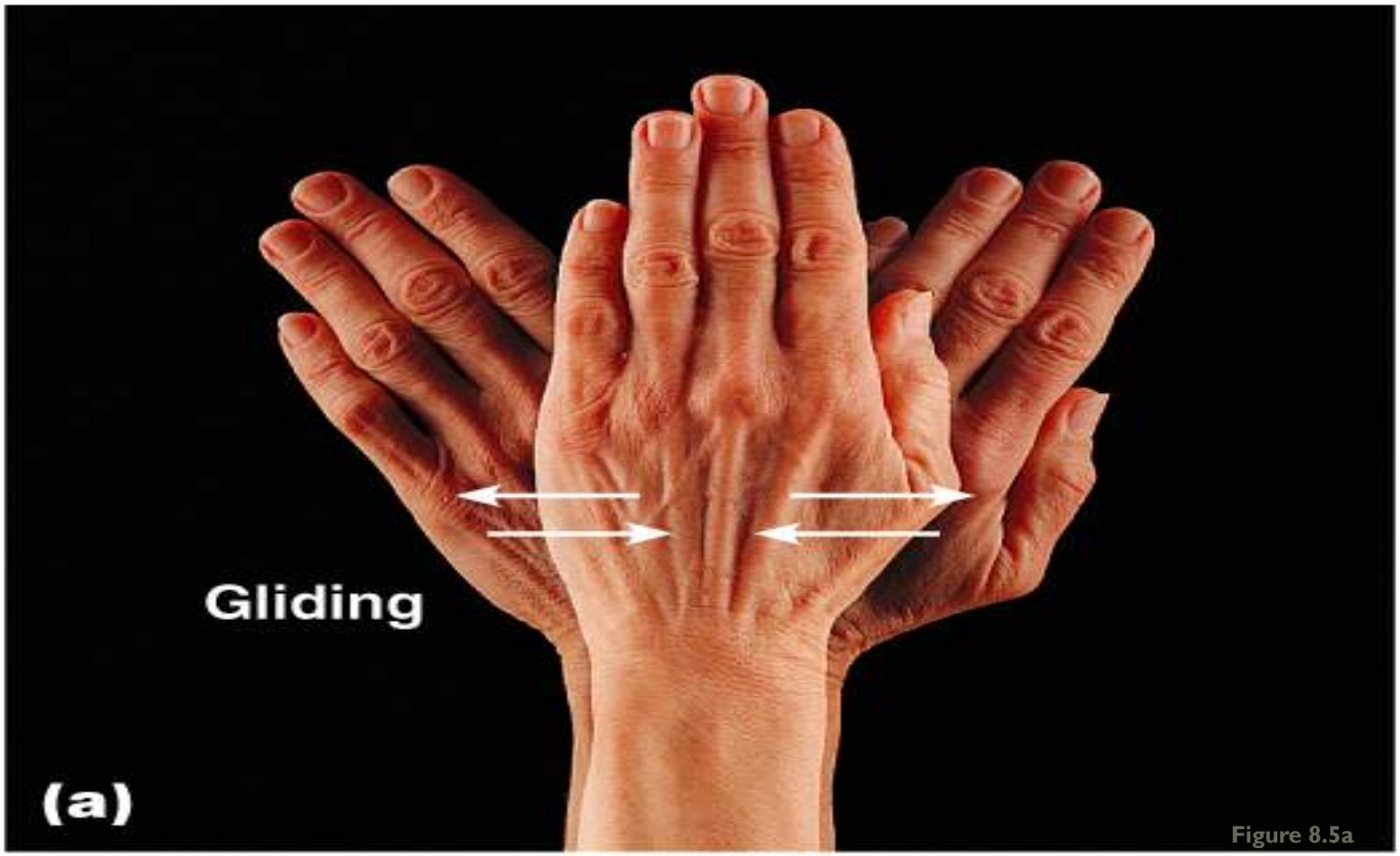
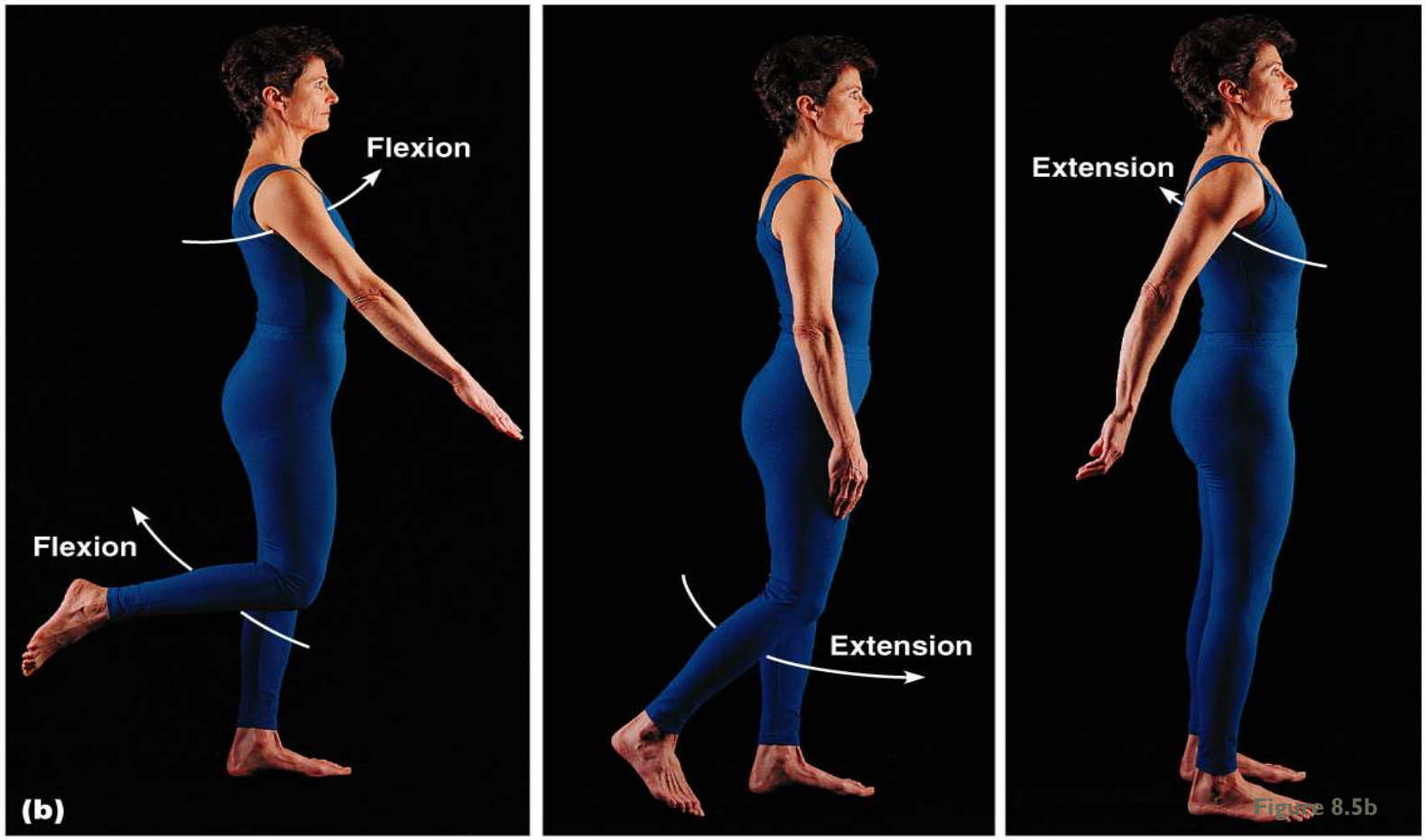
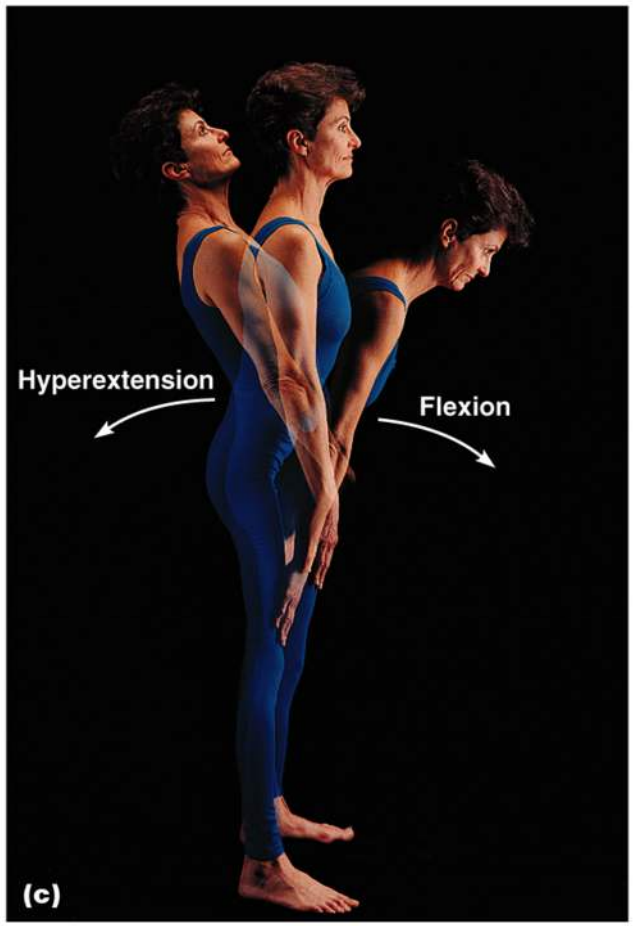


Figure 8.5a

ANGULAR MOVEMENT



ANGULAR MOVEMENT



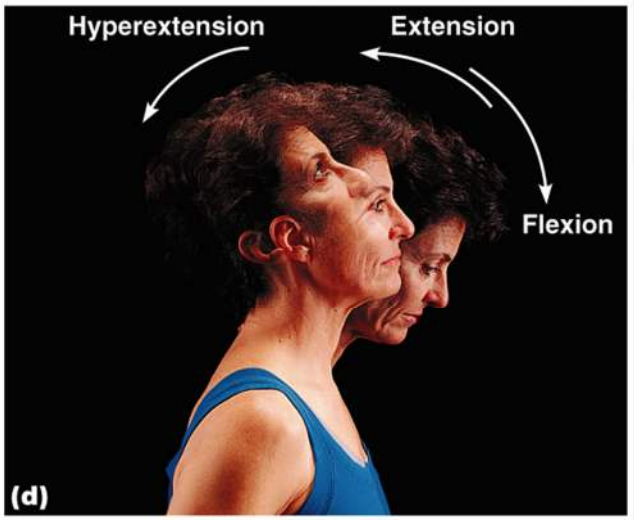
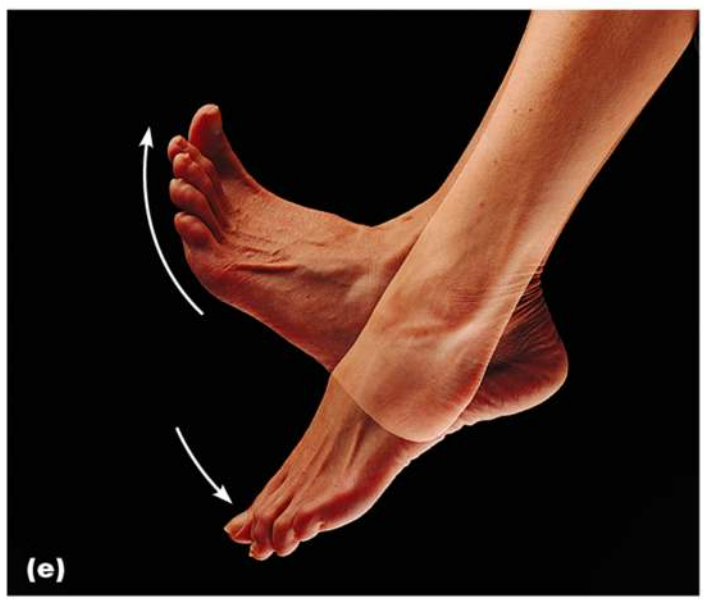


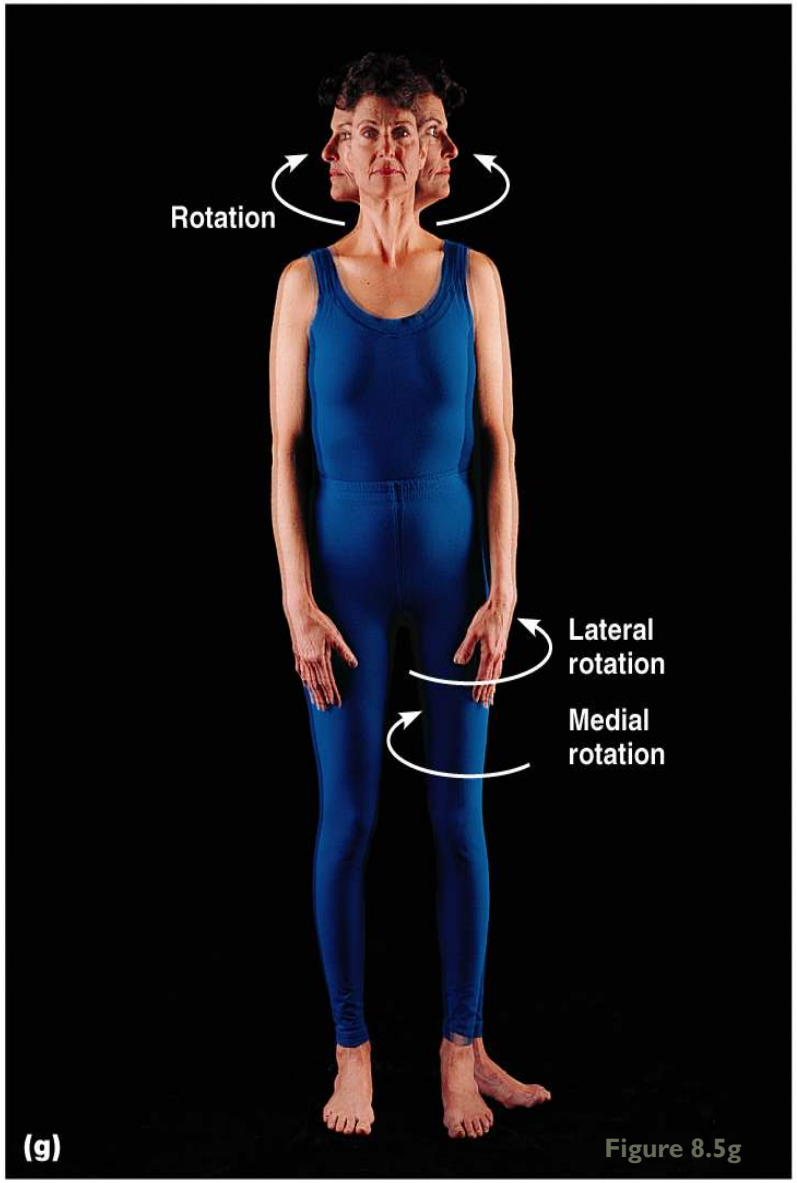
Figure 8.5c, d

ANGULAR MOVEMENT



ROTATION

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



SPECIAL MOVEMENTS

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

Types of Movements at Synovial Joints

Rotation-a bone revolving around its own longitudinal axis

e.g. turning the head from side-to-side at the atlanto-axial joint (between the atlas and axis) when shaking your head-"no".

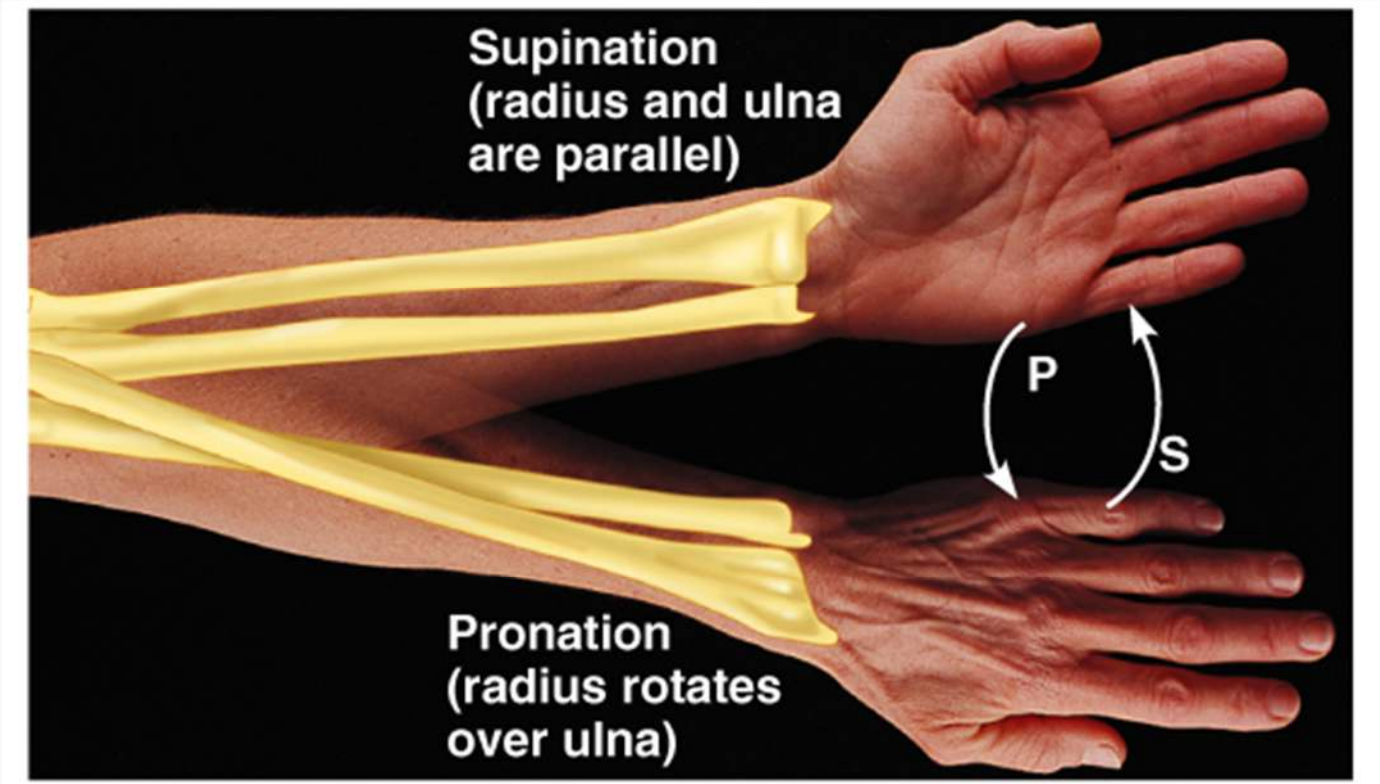
In limbs the rotation is defined *relative to the midline*

e.g. medial or internal rotation of the humerus

Special Movements-only occur at certain joints.

1. **Elevation**-upward movement opposes **depression**
2. **Protraction**-anterior movement opposes **retraction**
3. **Inversion**-inward movement of feet opposes **eversion**
4. **Dorsiflexion**-bending the foot at the ankle (standing on heels) opposes **plantar flexion**
5. **Supination**-radioulnar movement where palm is face-up opposes pronation (palm is face down)
6. **Opposition-** movement of thumb to touch fingers

SPECIAL MOVEMENTS



(a) Supination (S) and pronation (P)

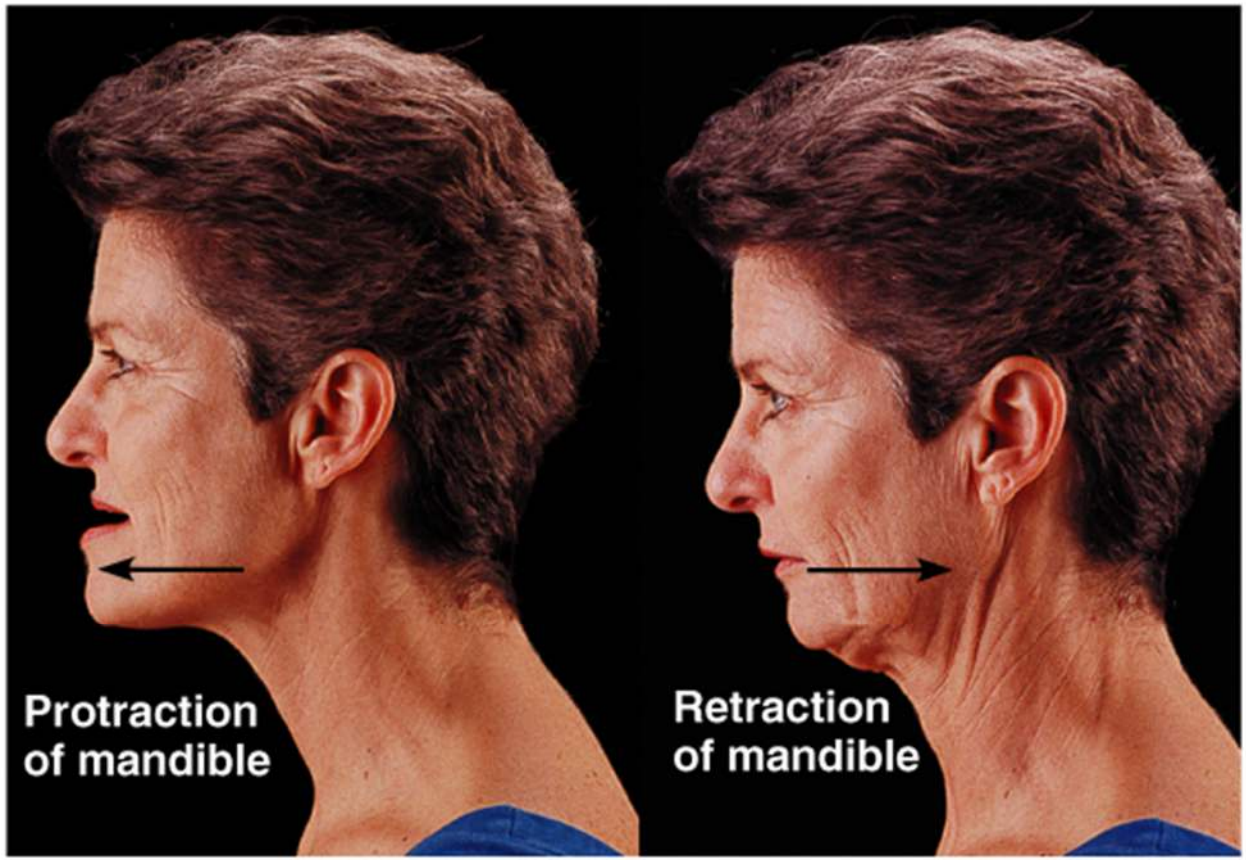
Figure 8.6a

SPECIAL MOVEMENTS

(b) Inversion and eversion

Figure 8.6b

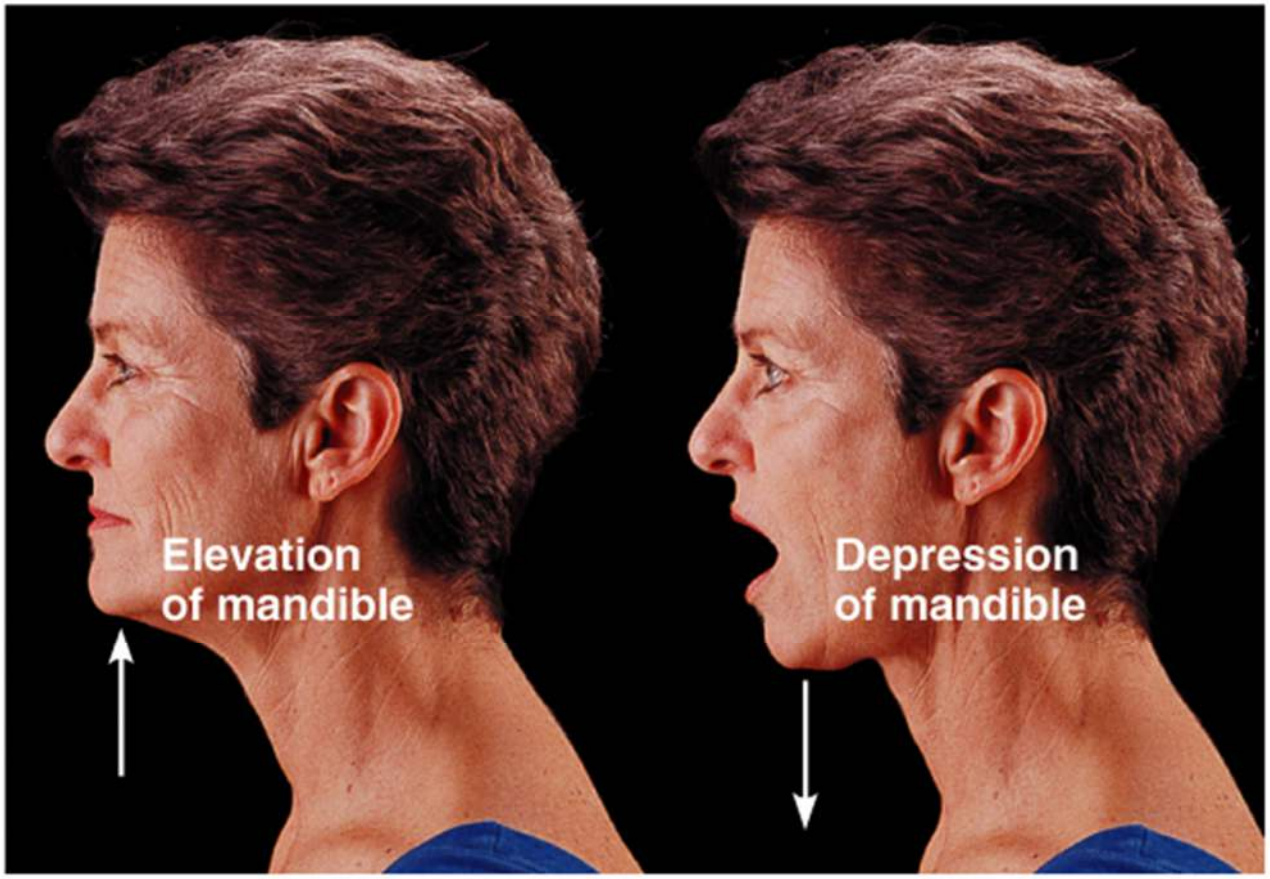
SPECIAL MOVEMENTS



(c) Protraction and retraction

Figure 8.6c

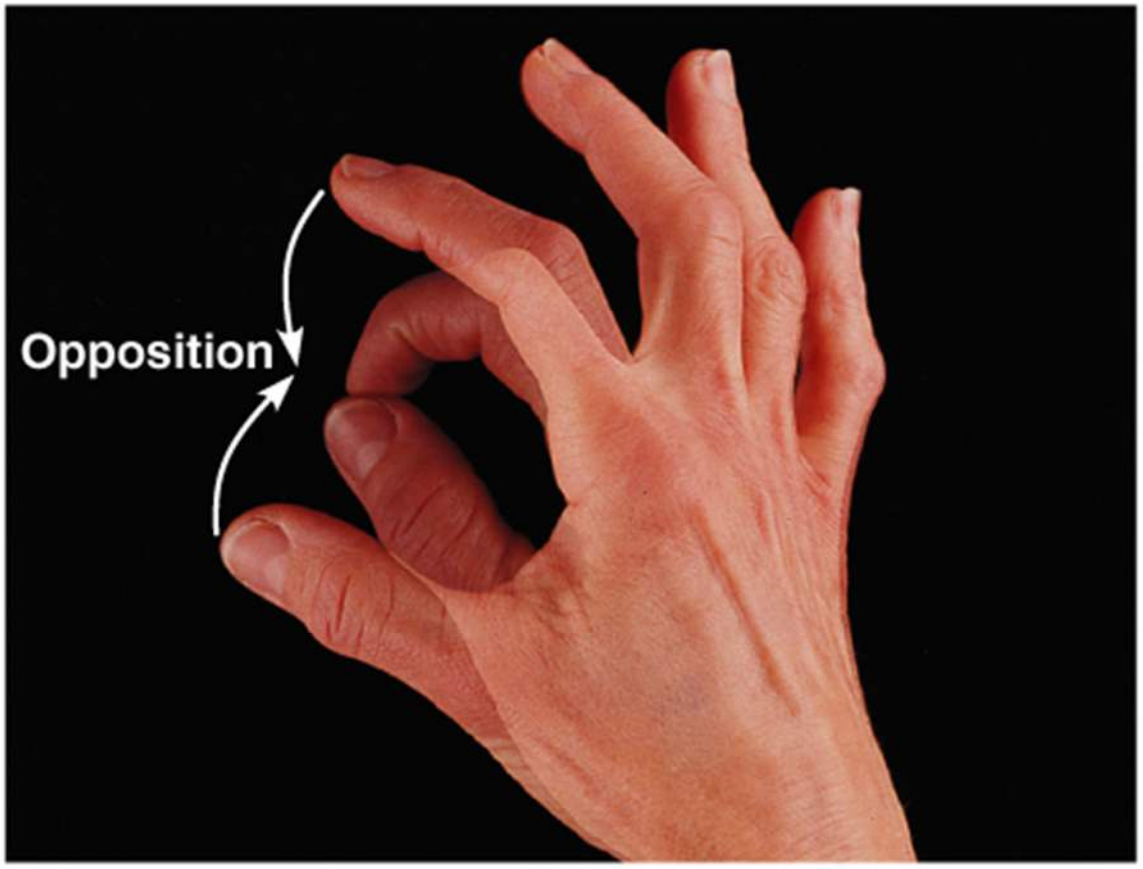
SPECIAL MOVEMENTS



(d) Elevation and depression

Figure 8.6d

SPECIAL MOVEMENTS

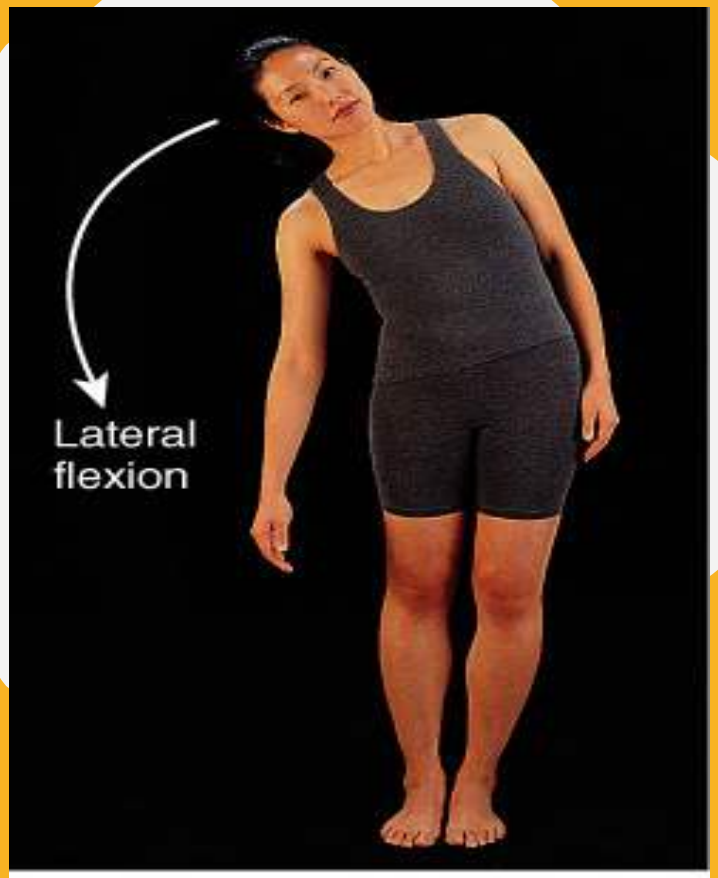


(e) Opposition

Figure 8.6e

Types of joint movement at synovial joints-angular

Lateral Flexion-decrease in the angle between articulating bones

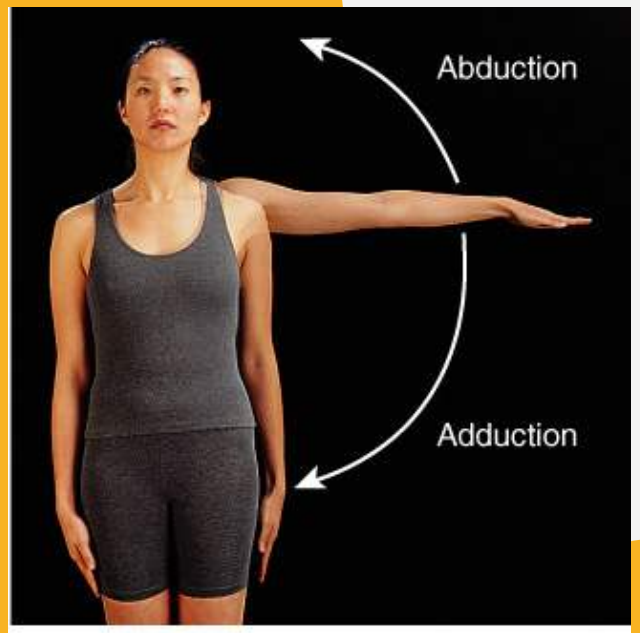


(g) Intervertebral joints

John Wilson White

Types of joint movement at synovial joints-angular

Abduction-movement away from the midline
Adduction-movement toward the midline
Circumduction-movement of the distal end of a body part in a circle



(a) Shoulder joint

John Wilson White

(b) Wrist joint

John Wilson White

Types of joint movement at synovial joints-angular

Abduction-movement away from the midline
Adduction-movement toward the midline

(c) Hip joint

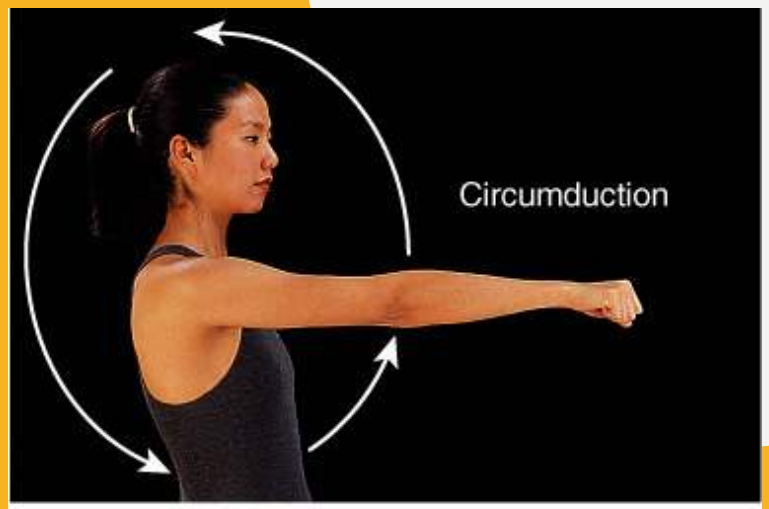
John Wilson White

(d) Metacarpophalangeal joints of the fingers (not the thumb)

John Wilson White

Types of joint movement at synovial joints-angular

Circumduction-movement of the distal end of a body part in a circle



(a) Shoulder joint

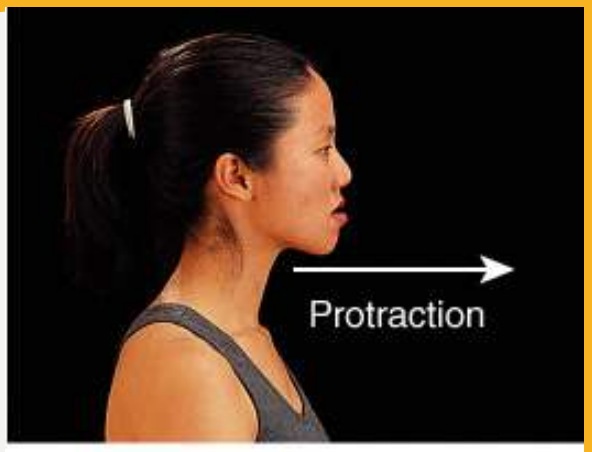
John Wilson White

(b) Hip joint

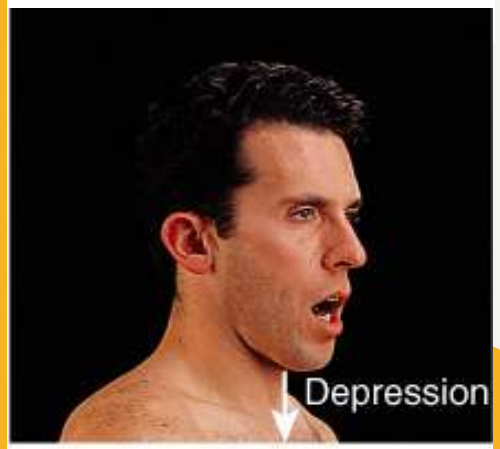
John Wilson White

Special Movements at Synovial Joints

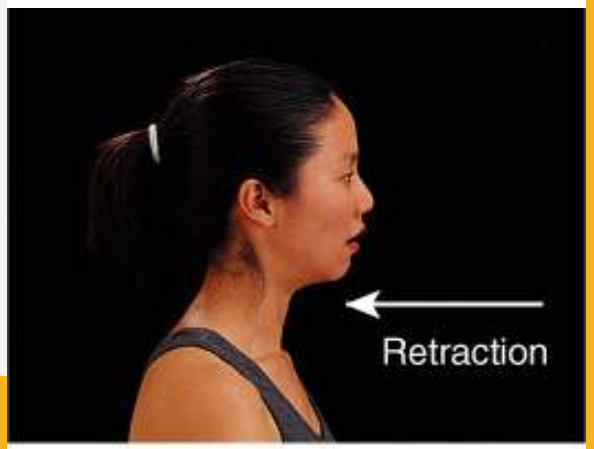
(a) Temporomandibular joint



(c) Temporomandibular joint

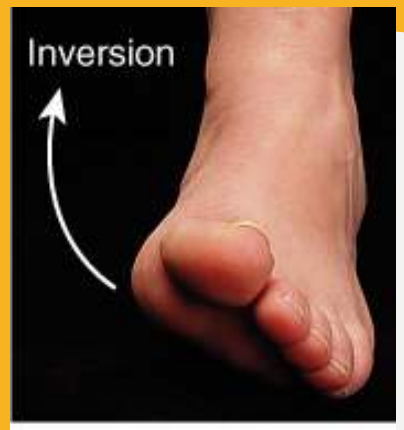


(b) Temporomandibular joint



(d) Temporomandibular joint

Special Movements at Synovial Joints



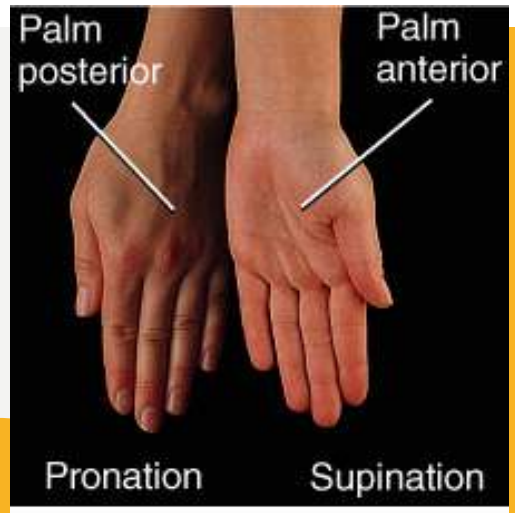
(e) Intertarsal joints

John Wilson White

(f) Intertarsal joints

(g) Ankle joint

John Wilson White



(h) Radioulnar joint

Arthrology: Study of joints

Joints are classified according to structure and function

Structural:

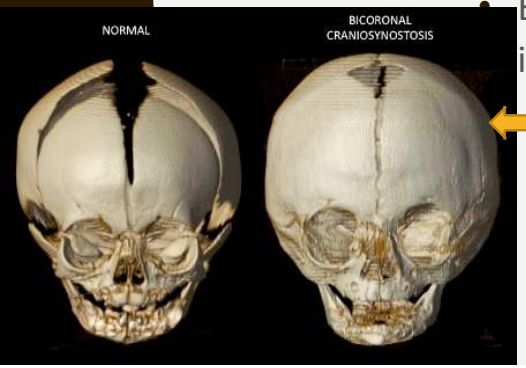
1. **Fibrous joints:** composed of fibrous tissue with no joint cavity
2. **Cartilaginous joints:** articulating bones are united by cartilage and no joint cavity present.
3. **Synovial joints**: articular bones are separated by a fluid-filled joint cavity.

Functional:

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

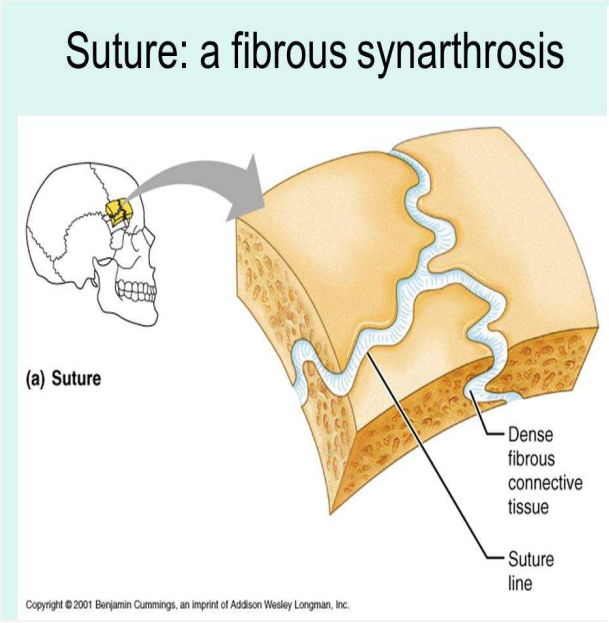
JOINT BY MOTION

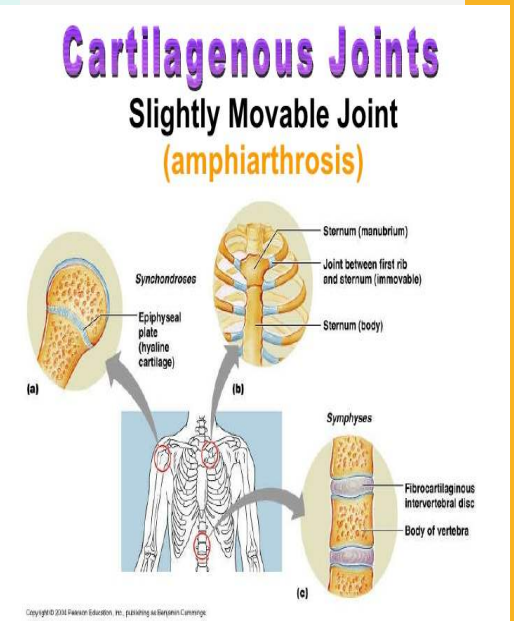
- **Immovable joints, or *synarthroses:***
  - are usually adaptations to growth rather than mobility.
  - always between bones.
  - When growth ceases the bones often unite, and the joint is then obliterated by a process known as ***synostosis***:
    - In medical contexts, **synostosis** is the abnormal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



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**





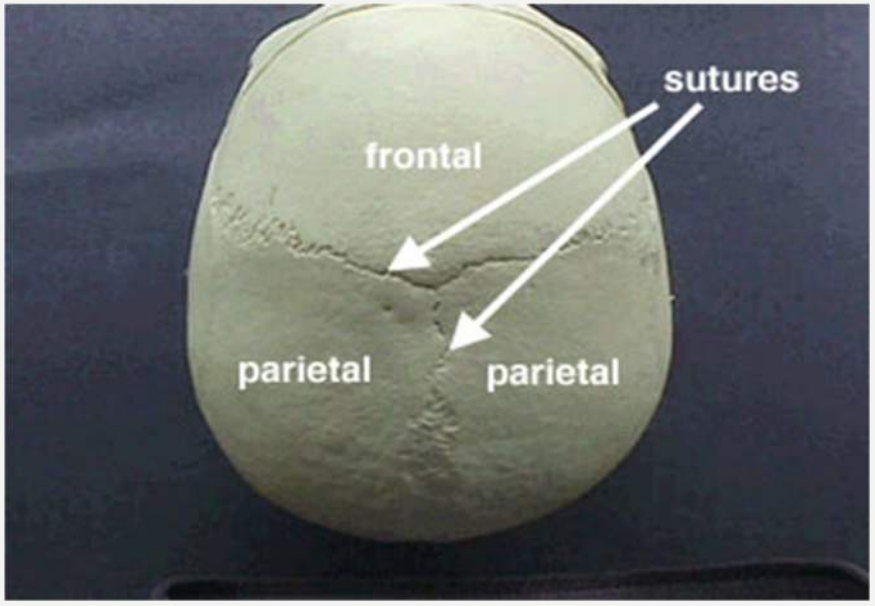
CLASSIFICATION OF JOINTS: FUNCTIONAL

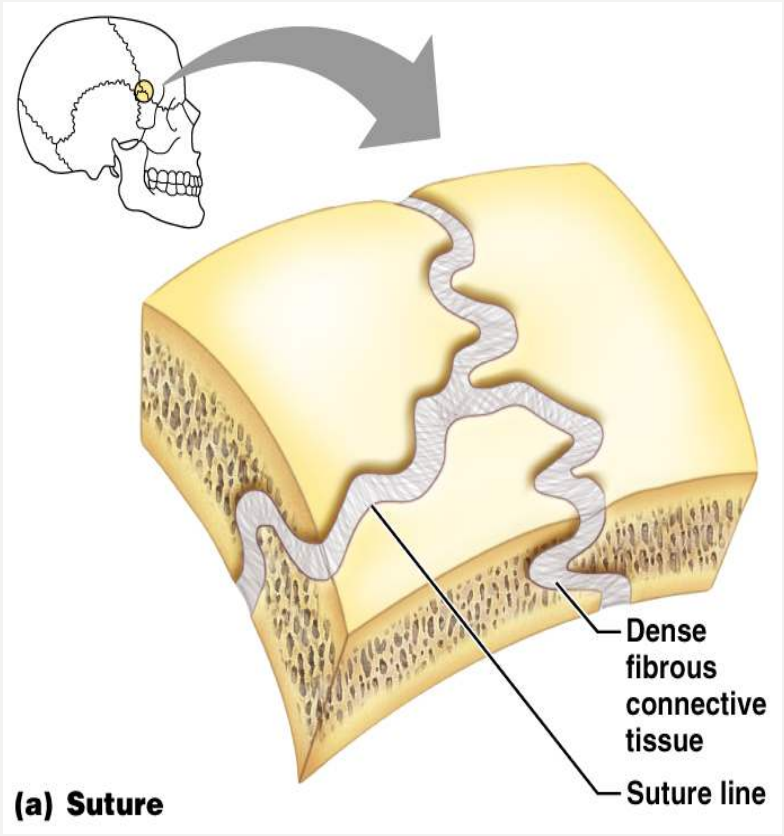
- Functional classification is based on the amount of movement allowed by the joint
- The three functional classes of joints are:
  - **Synarthroses – immovable**
  - **Amphiarthroses – slightly movable**
  - **Diarthroses – freely movable**

FIBROUS STRUCTURAL JOINTS: SUTURES

- Occur between the bones of the skull
- Comprised of interlocking junctions completely filled with connective tissue fibers

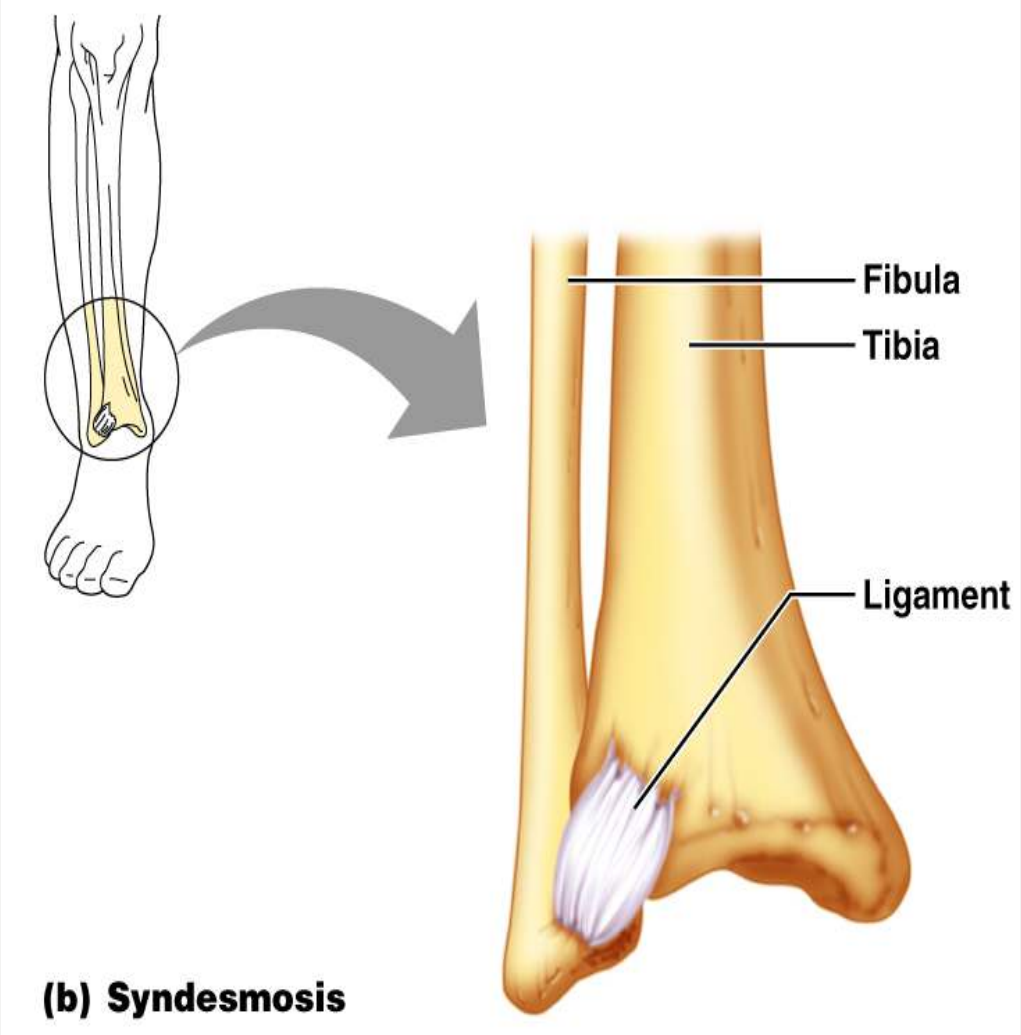
  Bind bones tightly together, but allow for growth during youth
- **In middle age, skull bones fuse and are called synostoses**





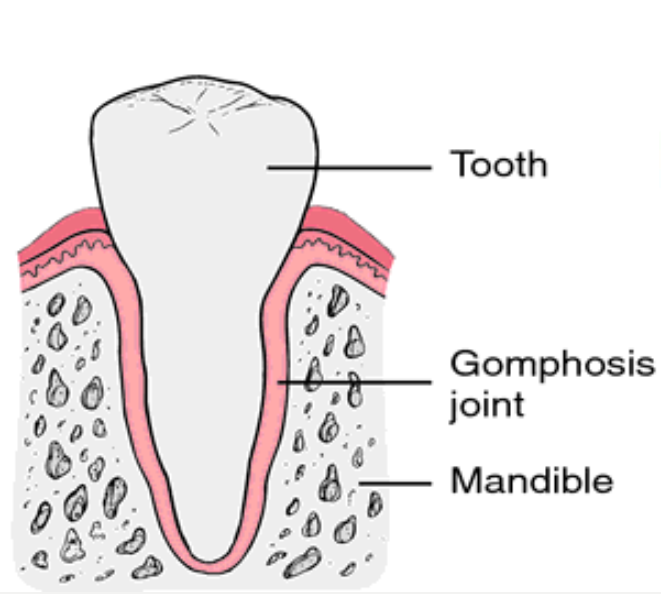
FIBROUS STRUCTURAL JOINTS: SYNDESMOSES

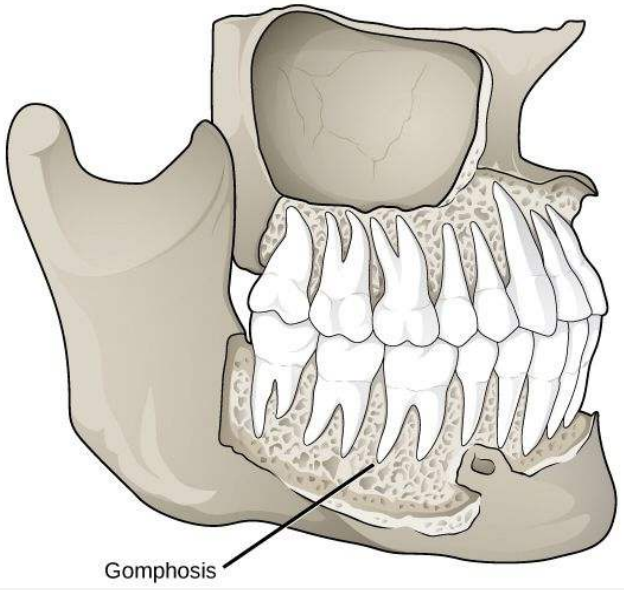
- Bones are connected by a fibrous tissue ligament
- Movement varies from immovable to slightly variable
- Examples include the **connection between the tibia and fibula, and the radius and ulna**

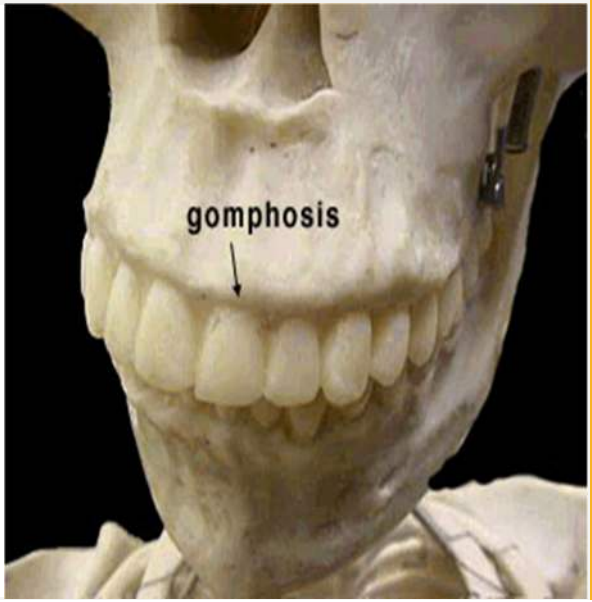


FIBROUS STRUCTURAL JOINTS: GOMPHOSES

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







Cartilaginous joints:

1. Synchondroses-

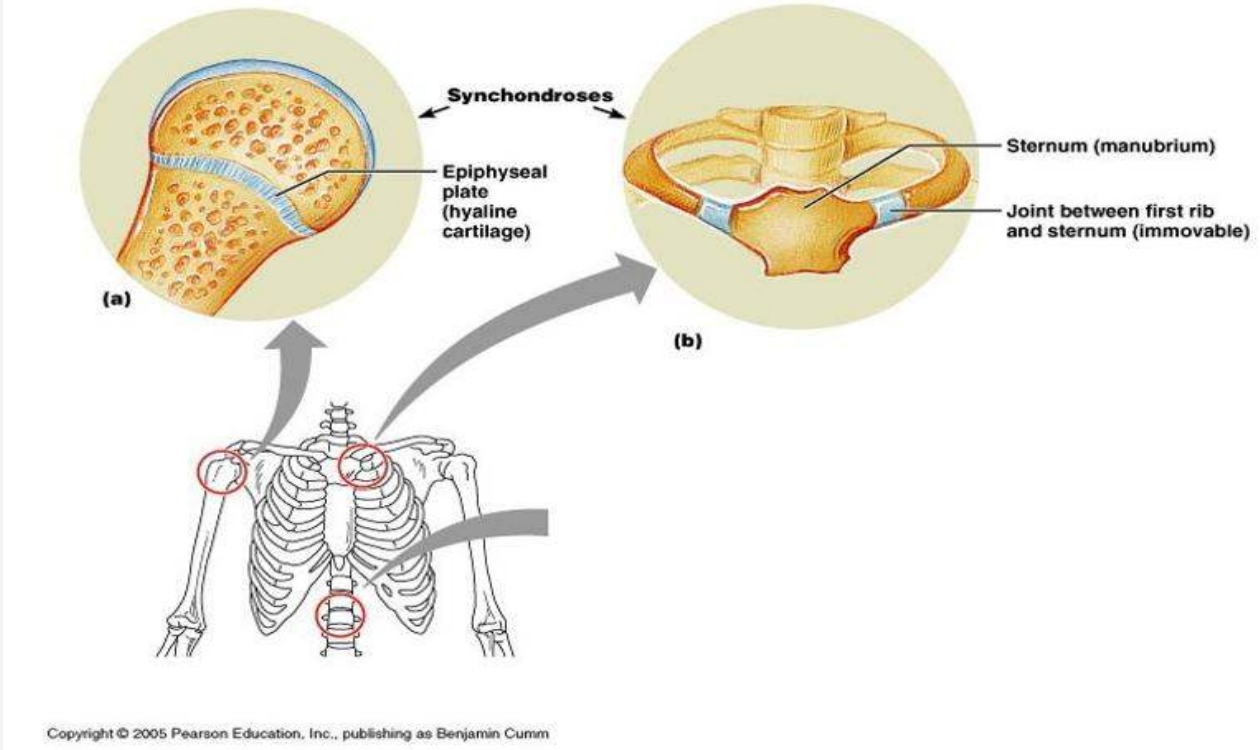
- hyaline cartilage unites bones at a synchondrosis.
- Cartilage is replaced by bone and becomes synarthrotic.
- Epiphyseal plate and the costal cartilage of the first rib and the manubrium of the sternum.

2. **Symphyses-**

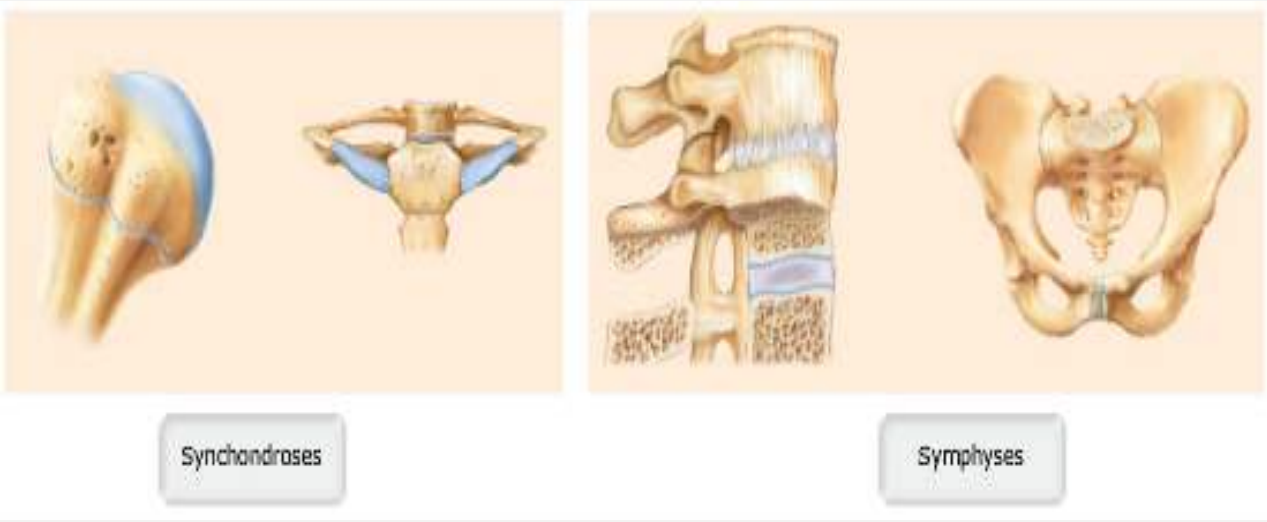
- articular surface of bone covered by hyaline cartilage fused to an intervening pad or plate.
- However, it is compressible, resilient and functionally amphiarthrotic.
- Pubic symphysis and the intervertebral discs.

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



- 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.**
  - **Sympheses-pelvic symphysis and intervertebral disks.**

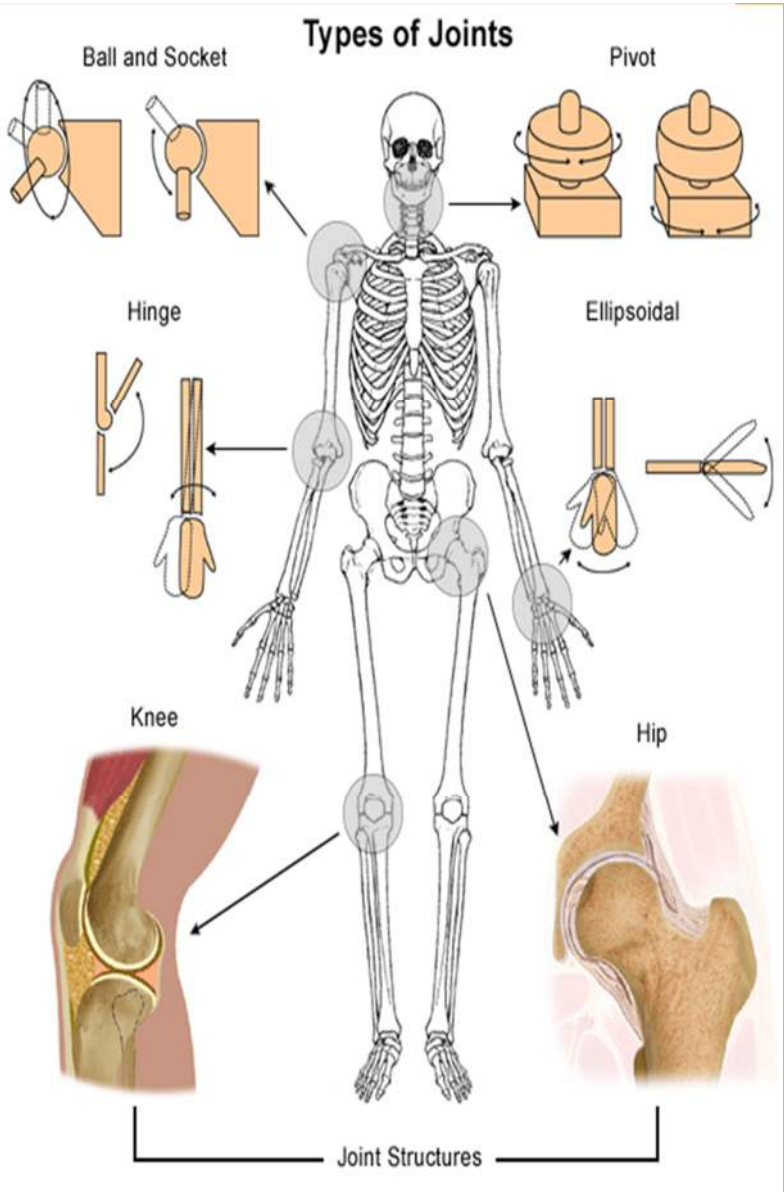
Major joints in Human Body

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

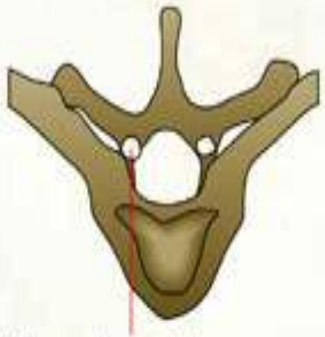
***Elbow* (humeroulnar)** -articulation of humerus and ulna (hinge)

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

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

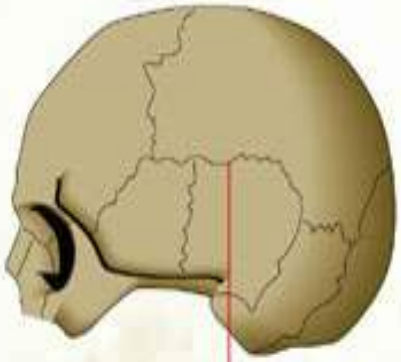


TYPES OF JOINTS FOUND IN THE HUMAN BODY

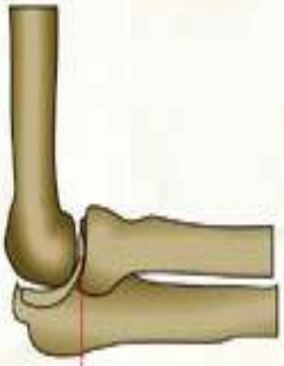


ribs and vertebrae =
semi-mobile joints

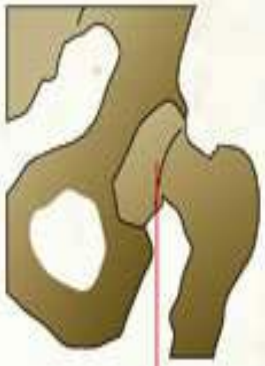
vertebrea =
cartilagenous joints



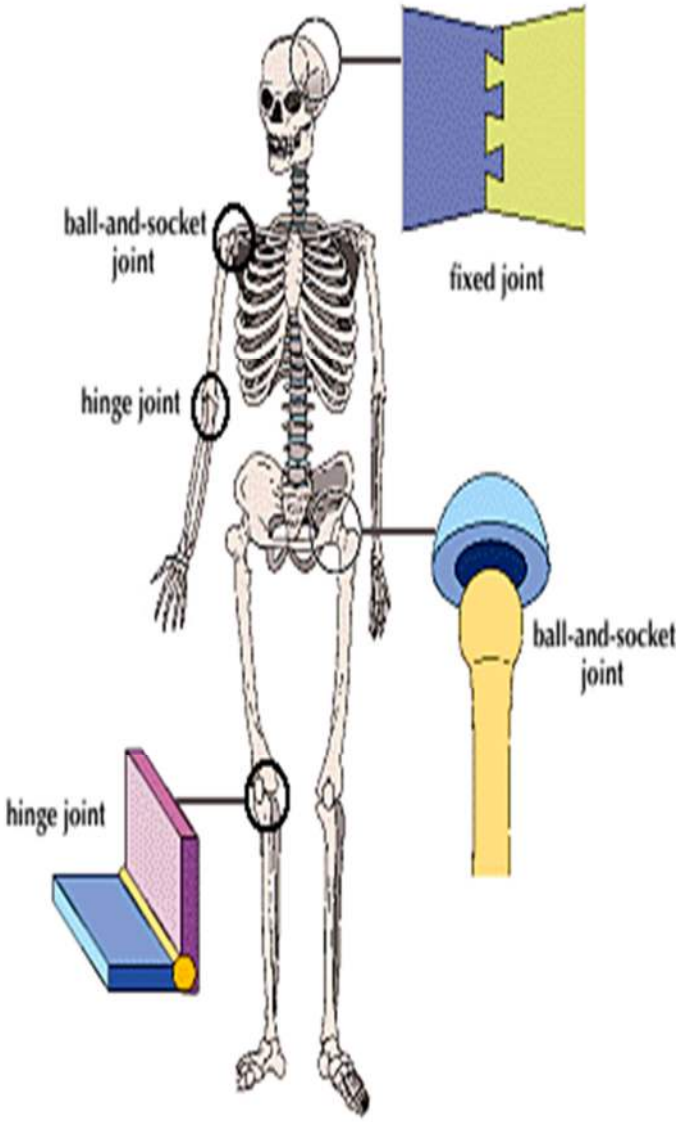
skull=
immovable joints

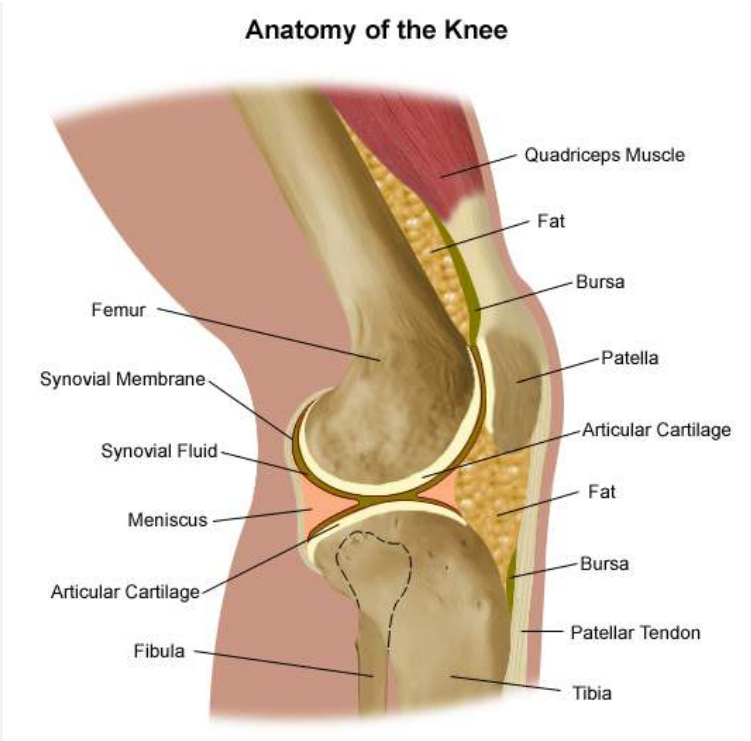


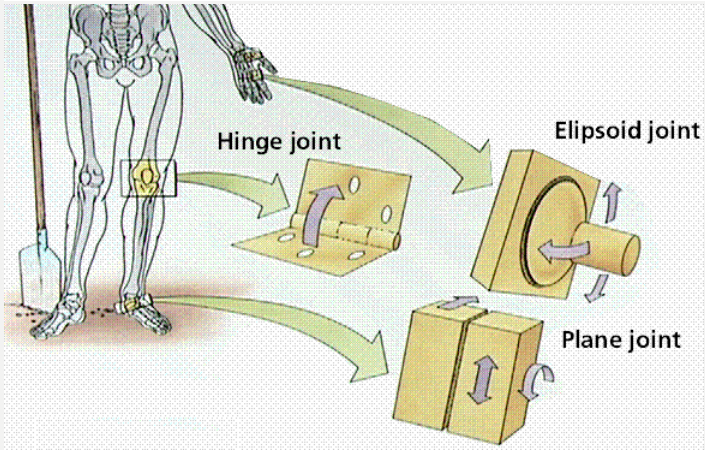
elbow=
hinged joint



hip=
ball and socket joint







- ***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

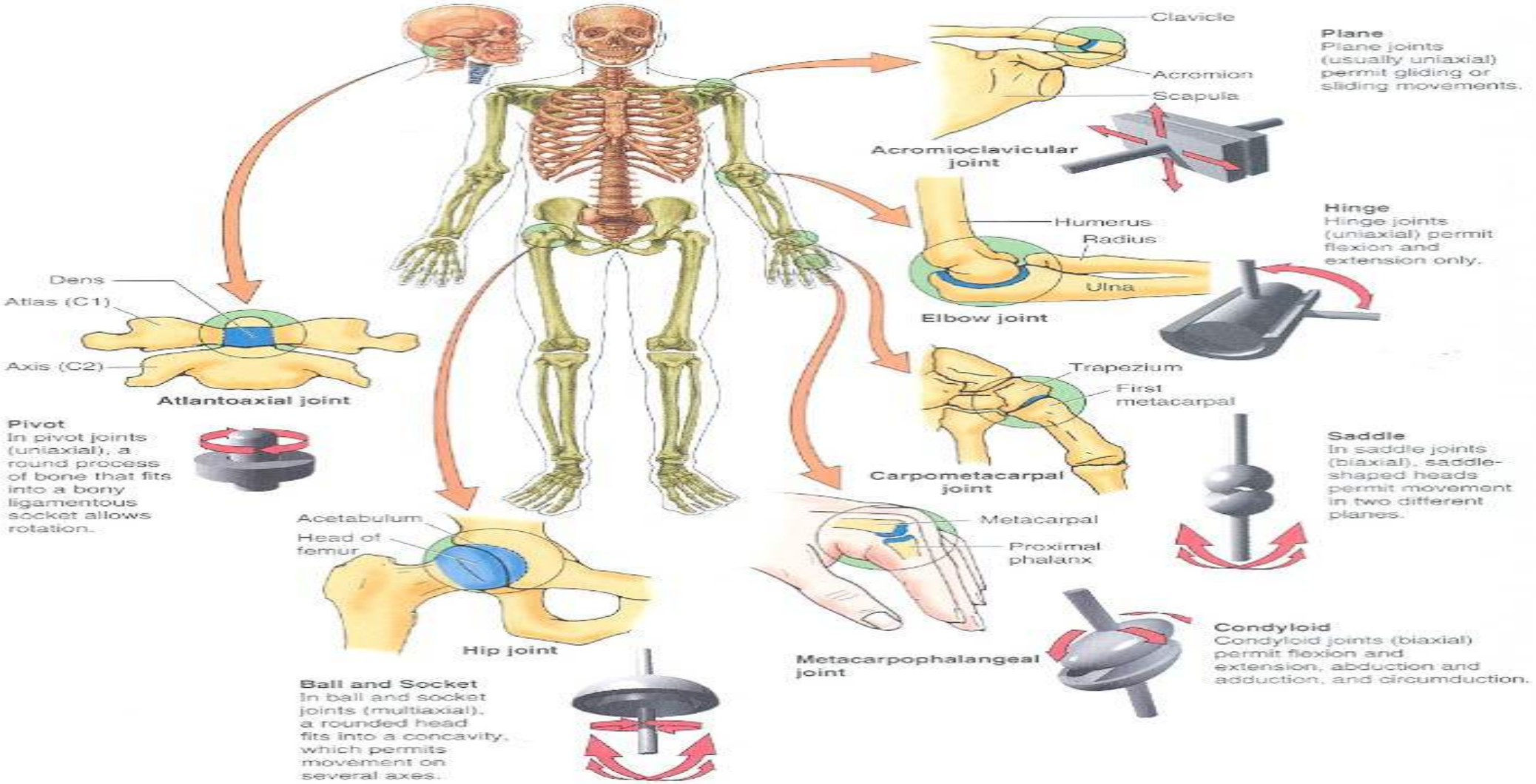


Figure I.14. Types of synovial joint. Synovial joints are classified according to the shape of the articulating surfaces and/or the type of movement they permit. In this type of joint, the articulating bones move freely on one another.

TYPE OF JOINTS

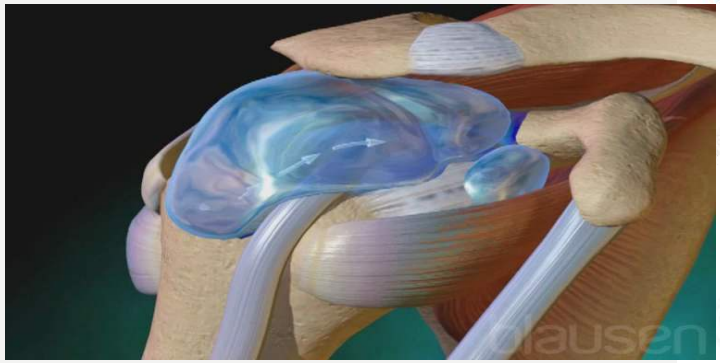
- **Synovial.**
  - Bone ends held in apposition by a joint capsule and ligaments.
  - Surface lubricated by synovial fluid.
- **Non-synovial.**
  - **Syndesmoses**-joints between bones of skull.
  - **Synchondroses**-where sternum and ribs join.
  - **Symphysis-pelvic** symphysis and intervertebral disks.

Synovial:

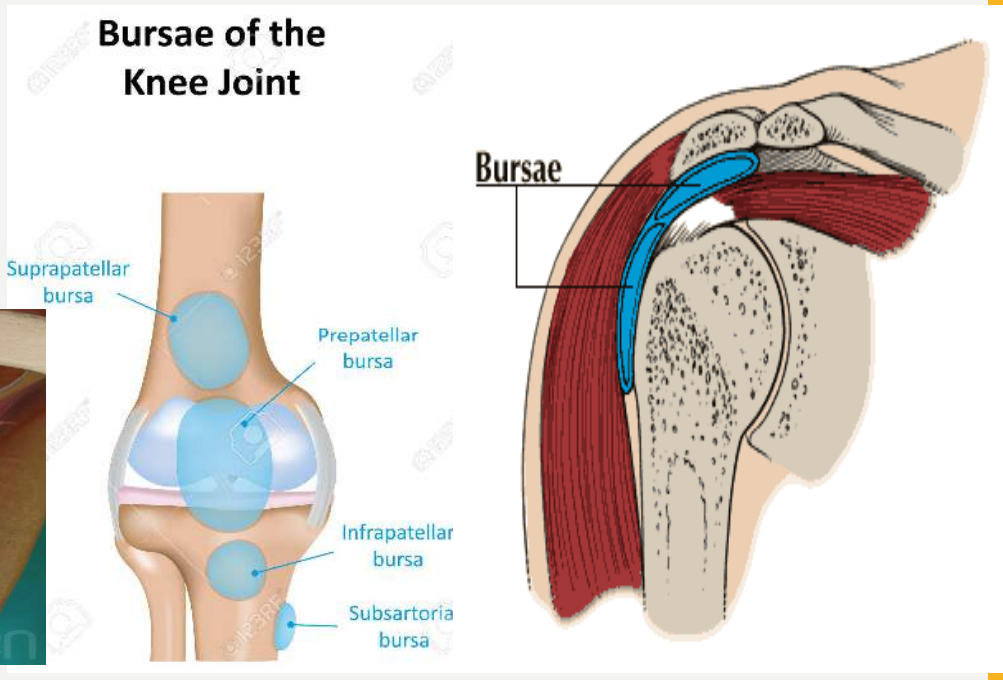
all **synovial joints are diarthrotic (opposing bones move freely)**

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**

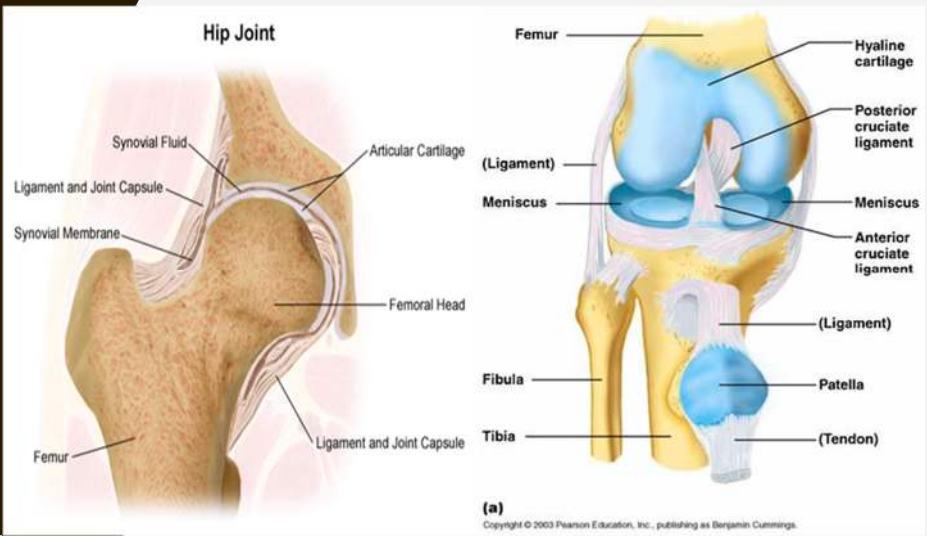
•Very common and also ***provide the most movement***.

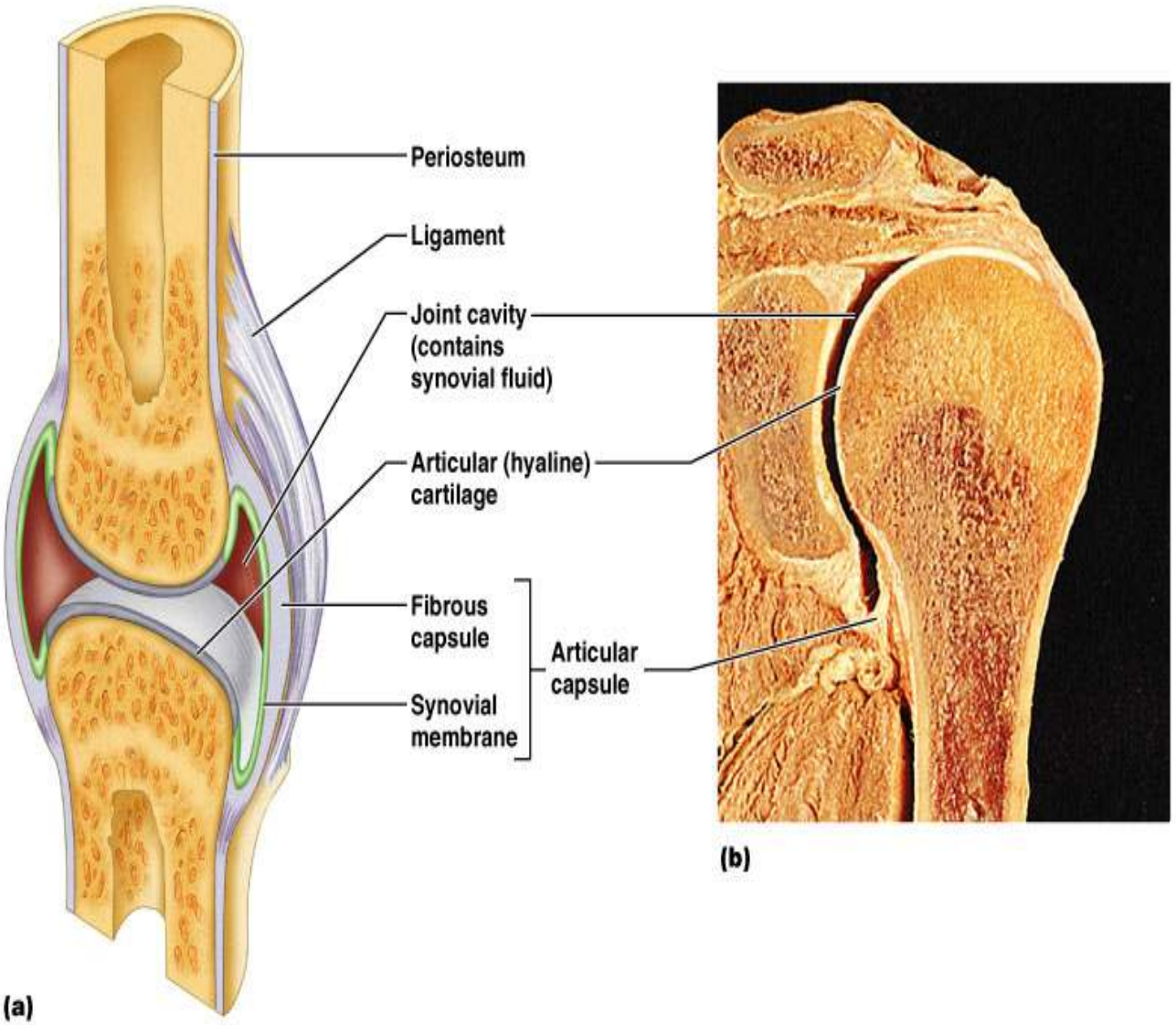
•Bones in a synovial joint have to move freely so each end of the bones that meet at the joint are covered with a layer of articular cartilage.
•This cartilage is kept healthy by cartilage producing cells **chondrocytes**.

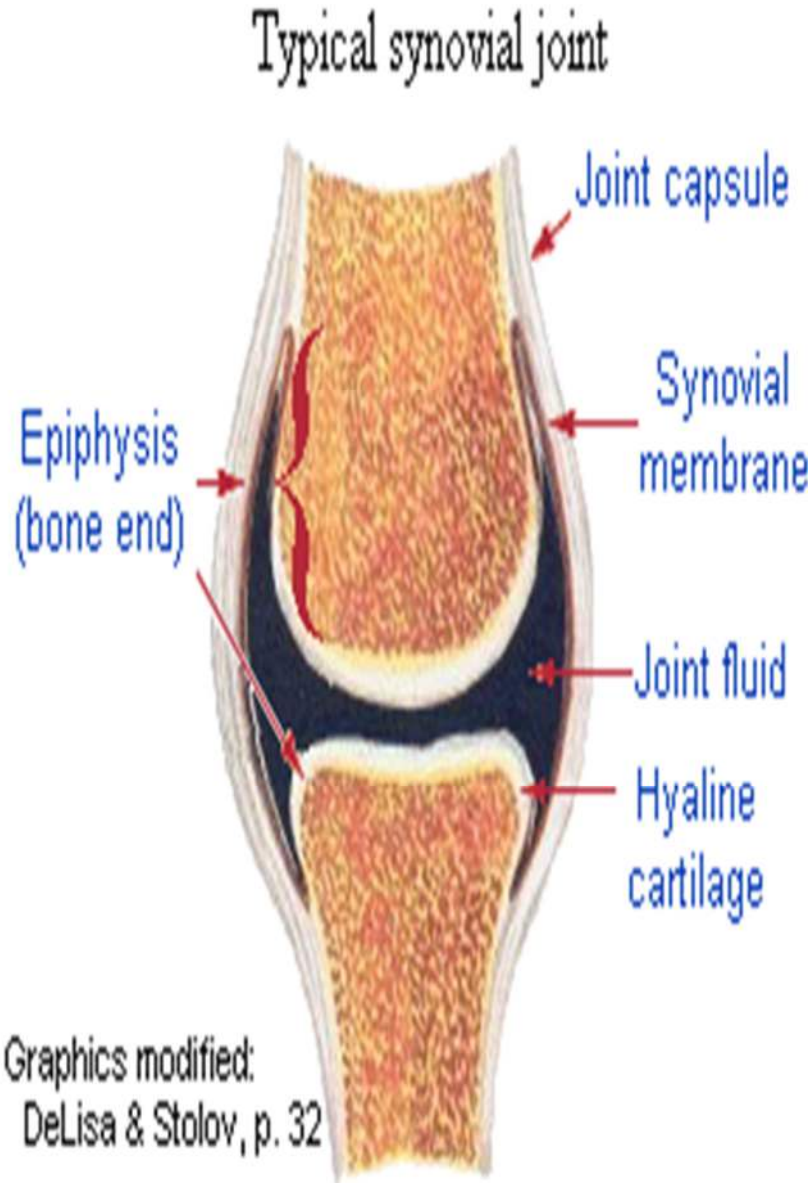
•A capsule membrane surrounds the joint and encloses a space that's filled with lubricating fluid.

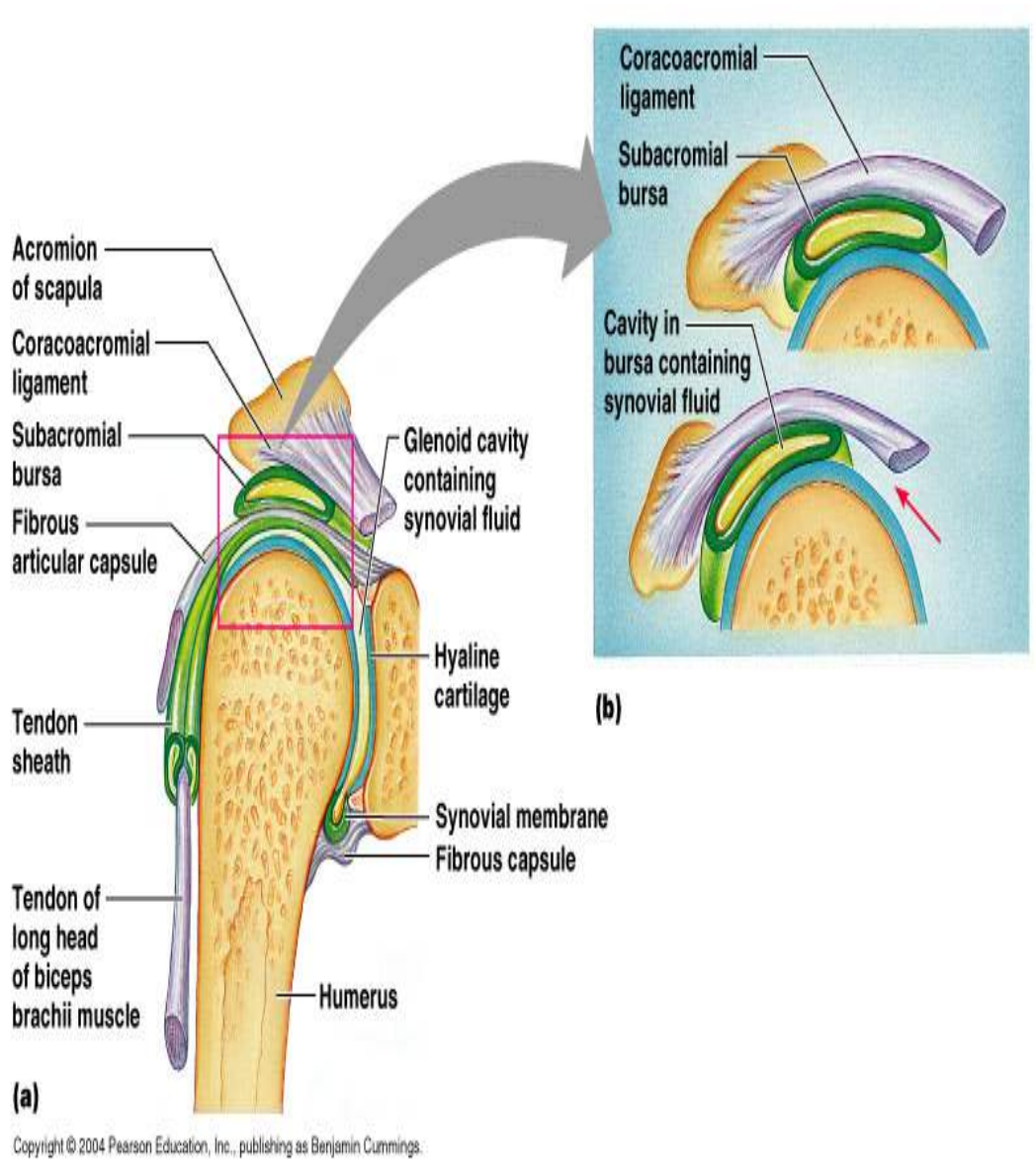
•Strong strips of connective tissue called **ligaments** provide strength to the joint and help hold the bones together in the proper position.

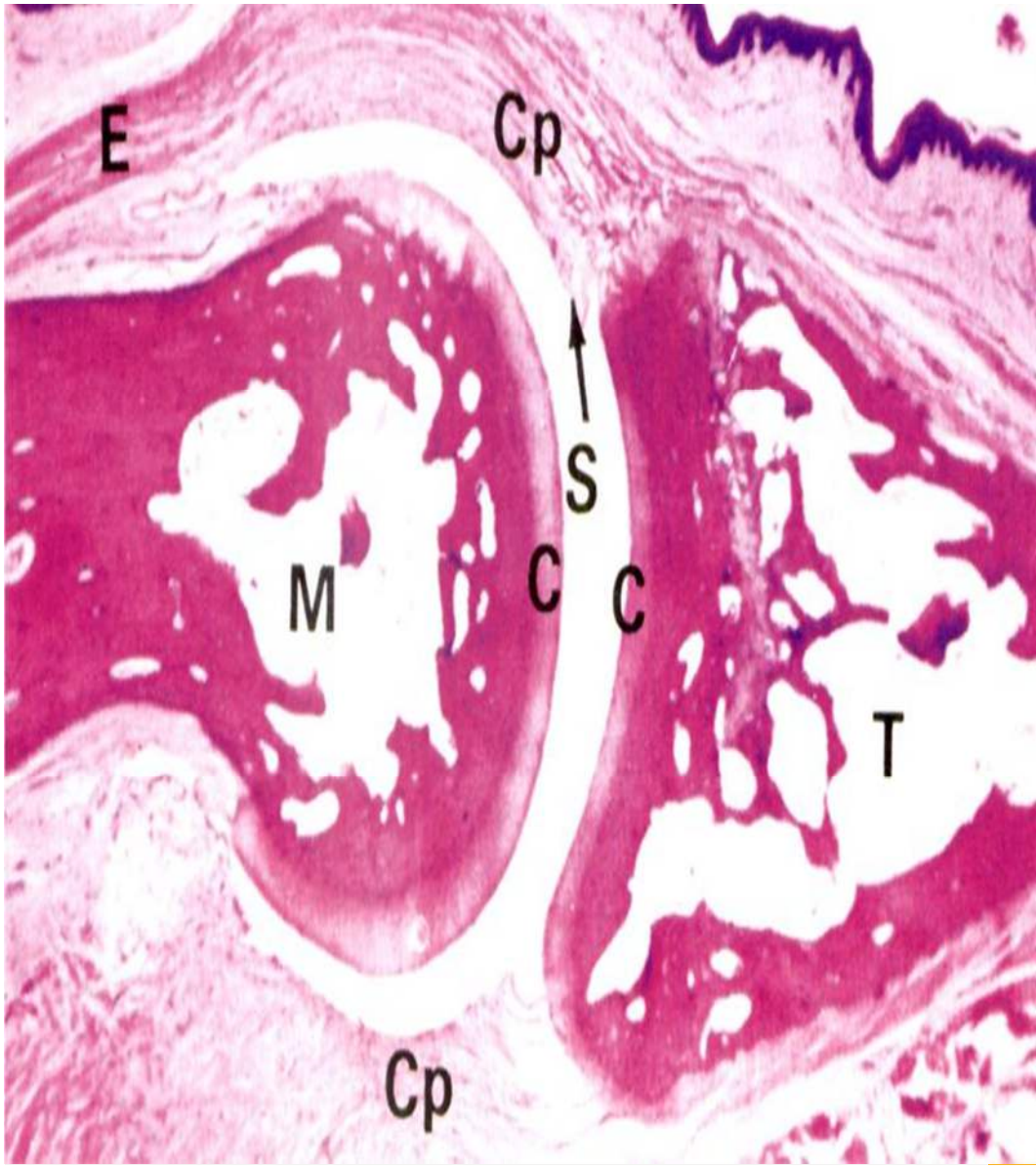
•**<u>The knees are good examples of large synovial joints.</u>**











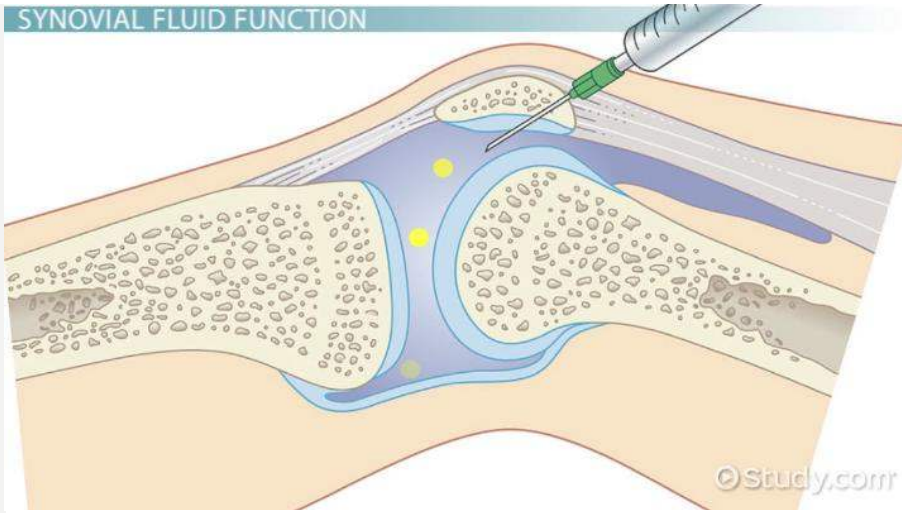
SYNOVIAL JOINT SHAPE TYPES

- **Plane joints**--intercarpal joints
- **Hinge joints**--elbow,ankle, interj-phalangeal
- **Pivot joints**--radio-ulnar joint
- **Condyloid 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

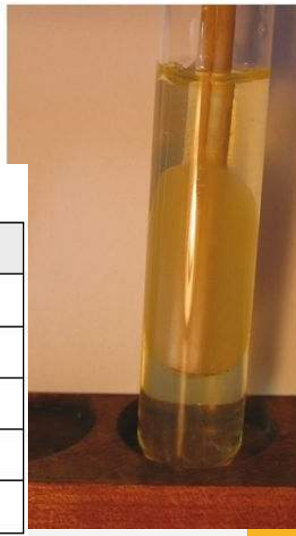
SYNOVIAL FLUID

- 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 (cor

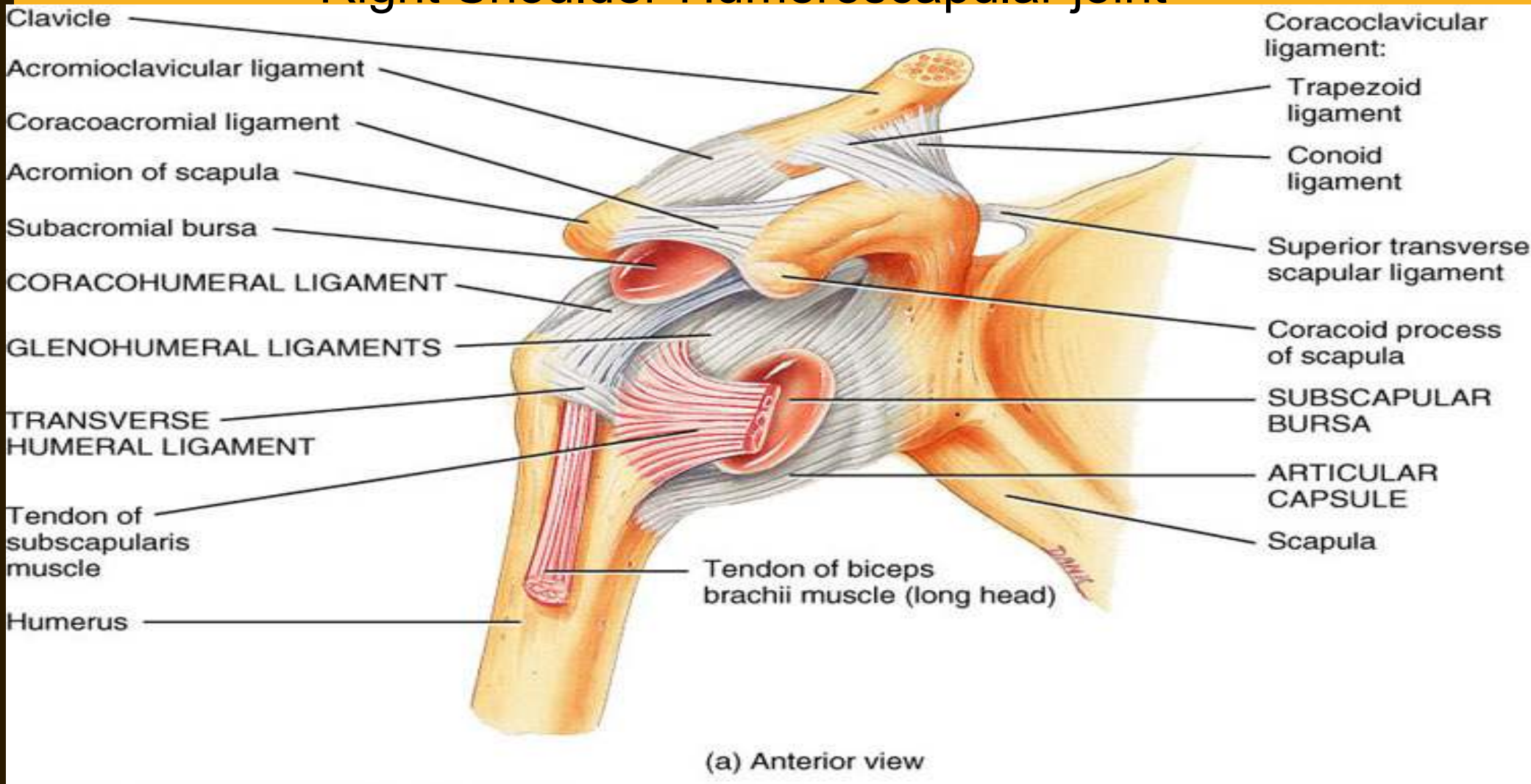
Mucin clot test of normal synovial fluid.



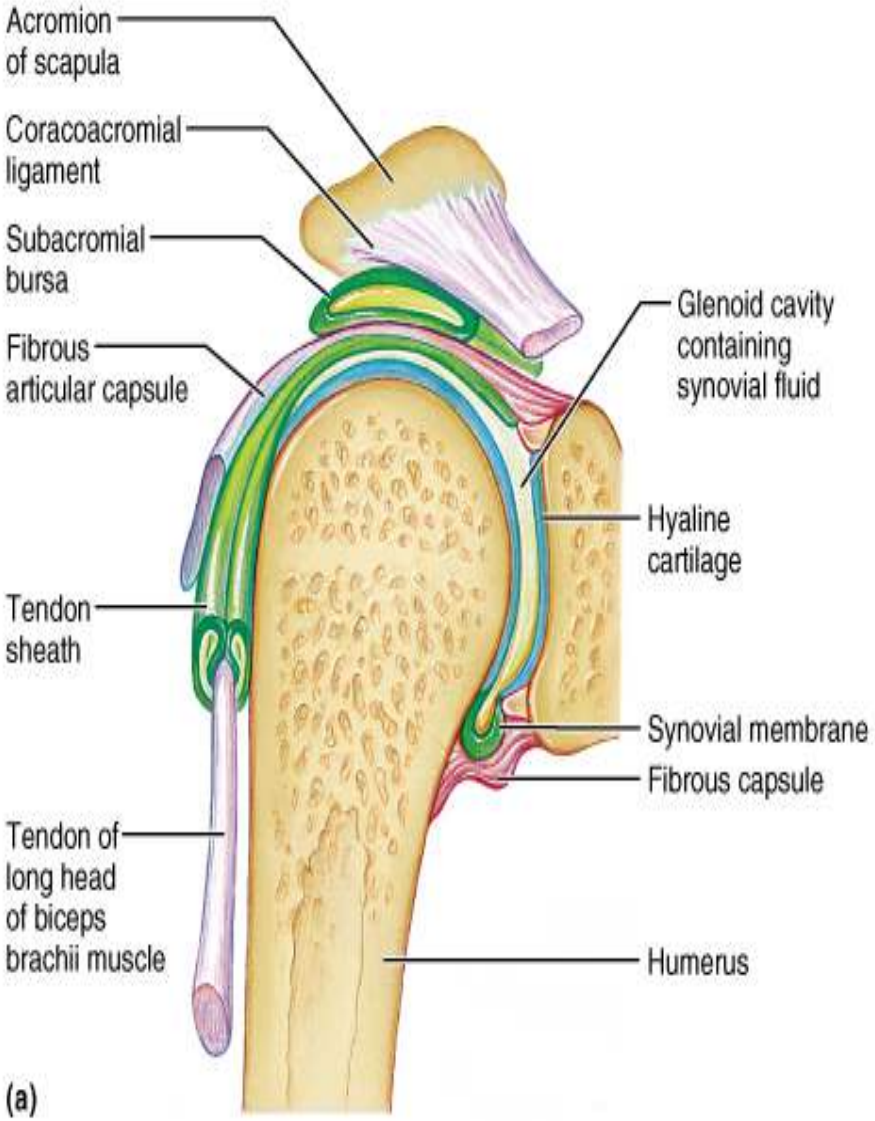
Synovial Fluid Analysis

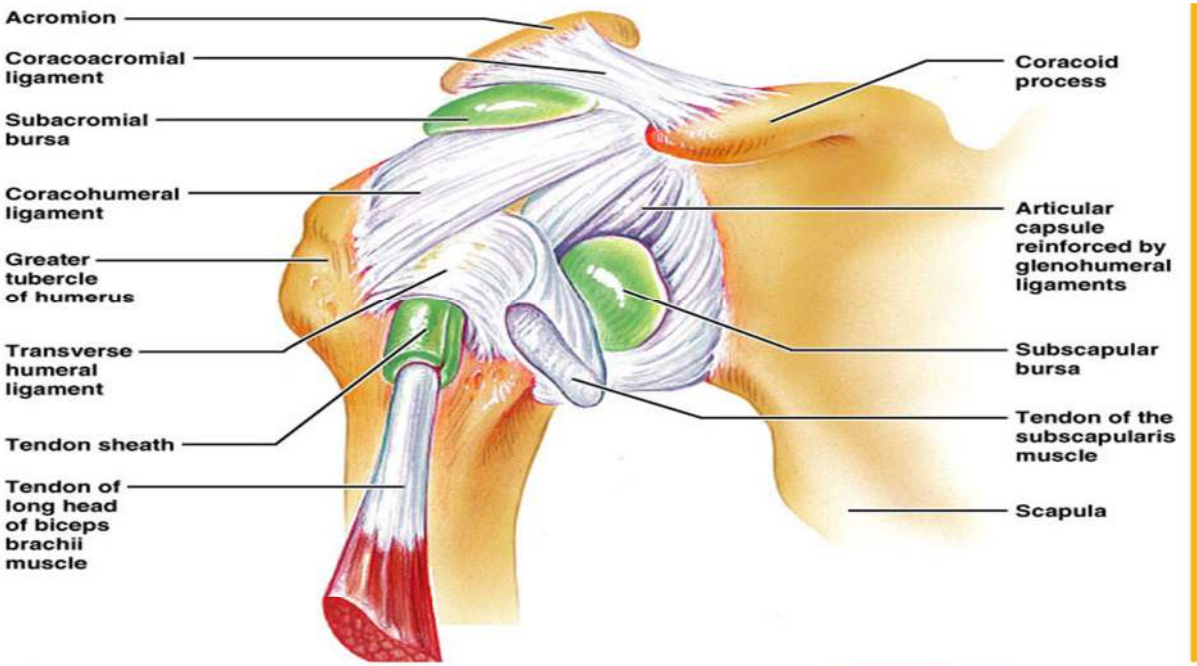
	WBC/mm³	Color	Viscosity
Normal	< 150	Colorless/Straw	High
Noninflammatory	< 3,000	Straw/Yellow	High
Inflammatory	> 3,000	Yellow	Low
Septic (purulent)	> 50,000	Pus/Mixed	Mixed
Hemorrhagic	Similar to blood	Red	Low

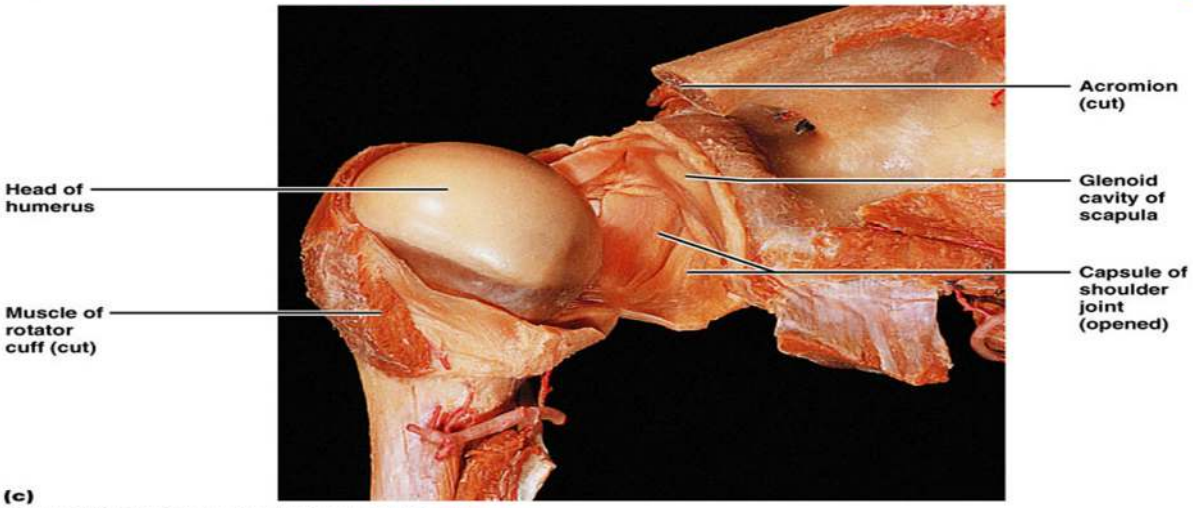
Right Shoulder-Humeroscapular joint

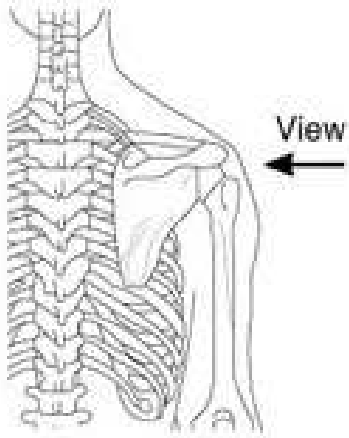


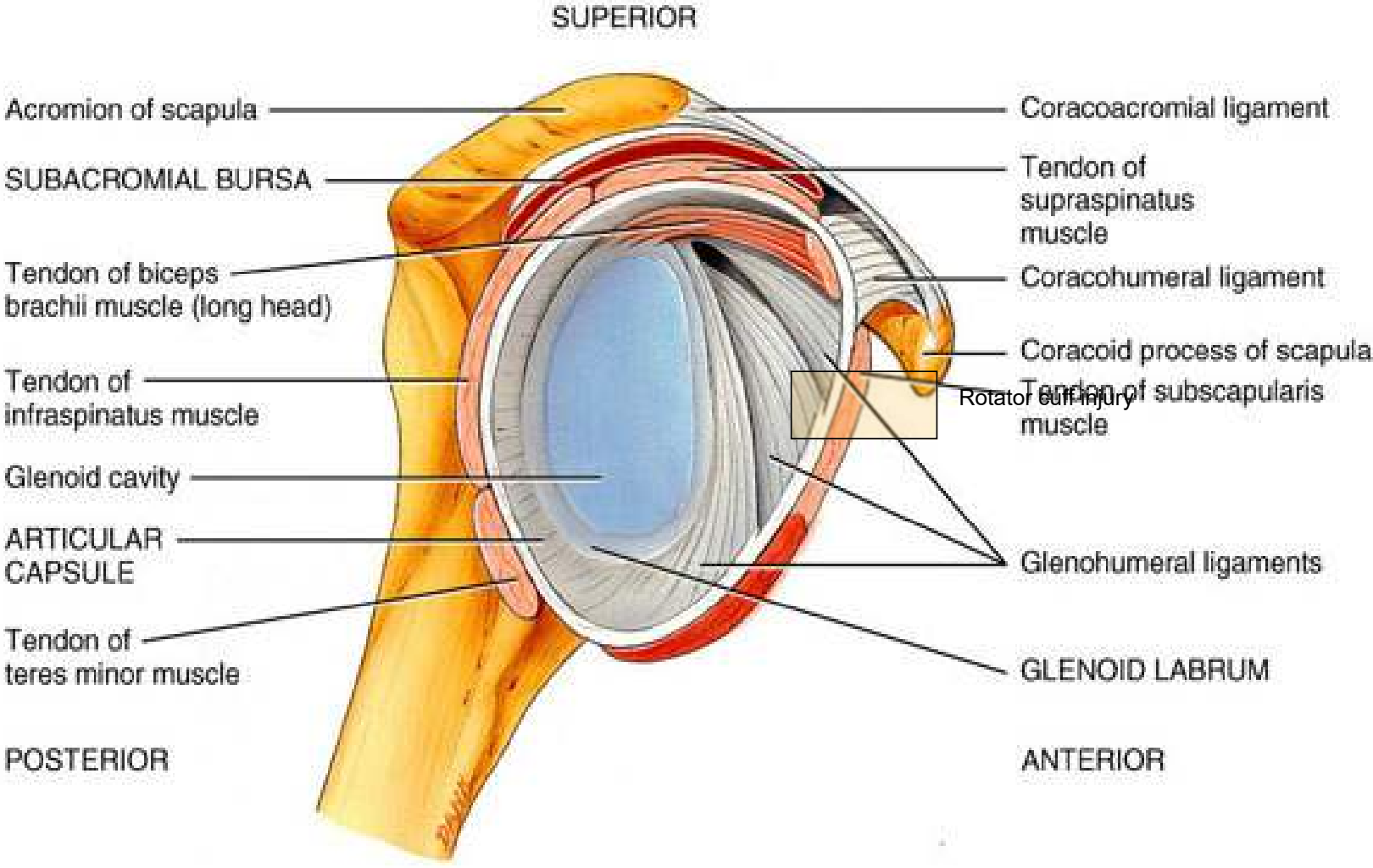
(a) Anterior view







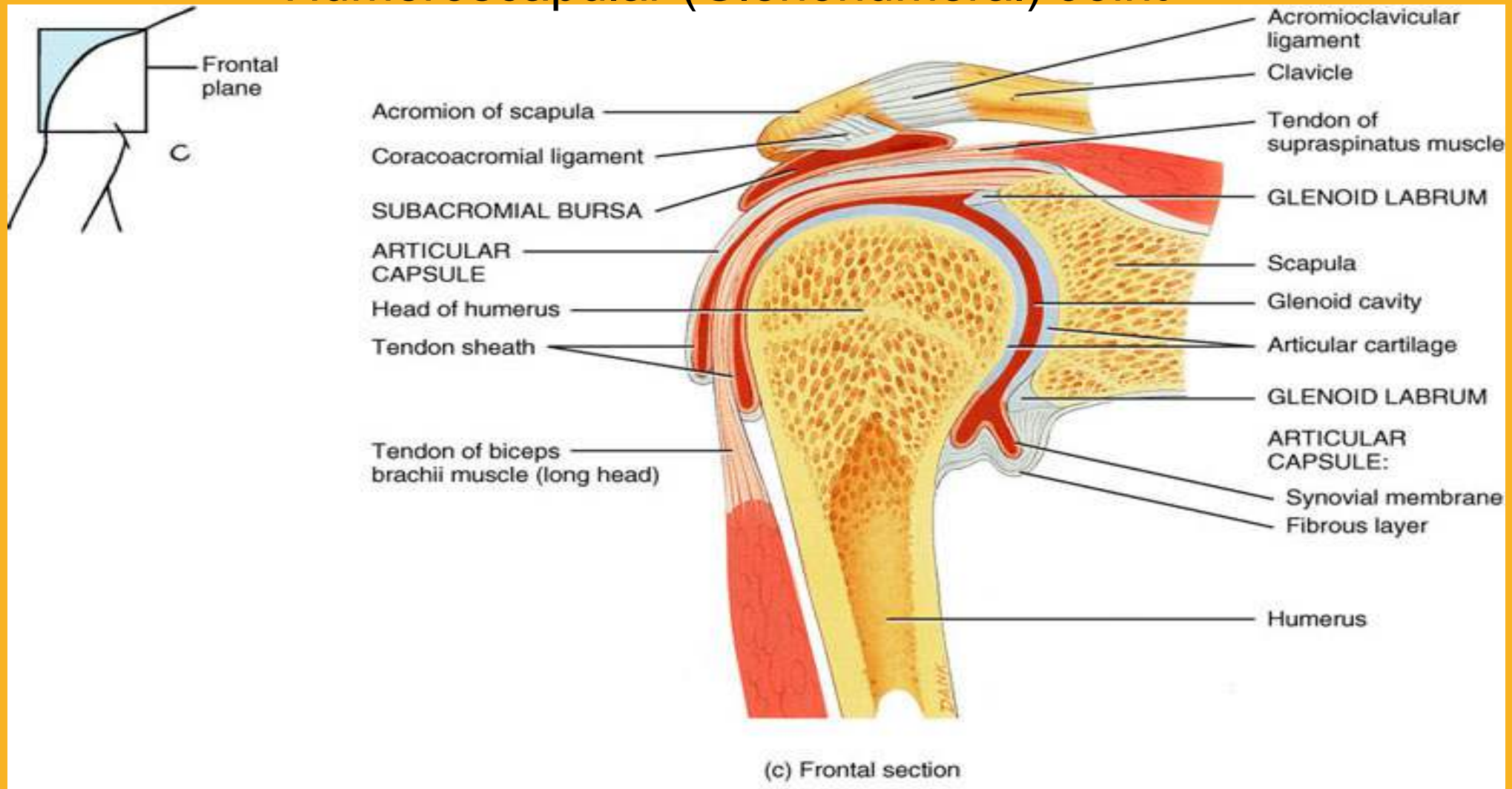




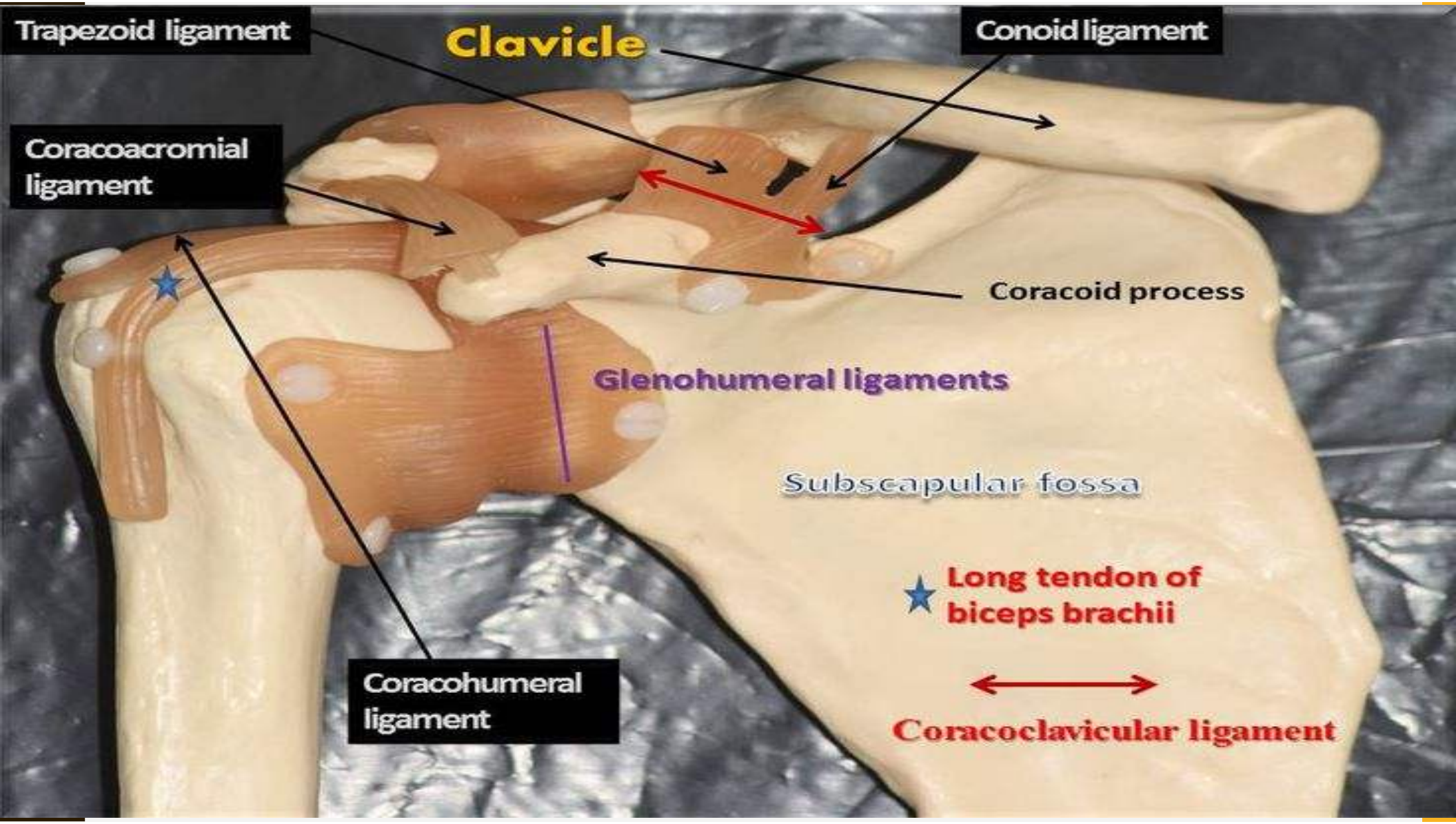
(b) Lateral view (opened)

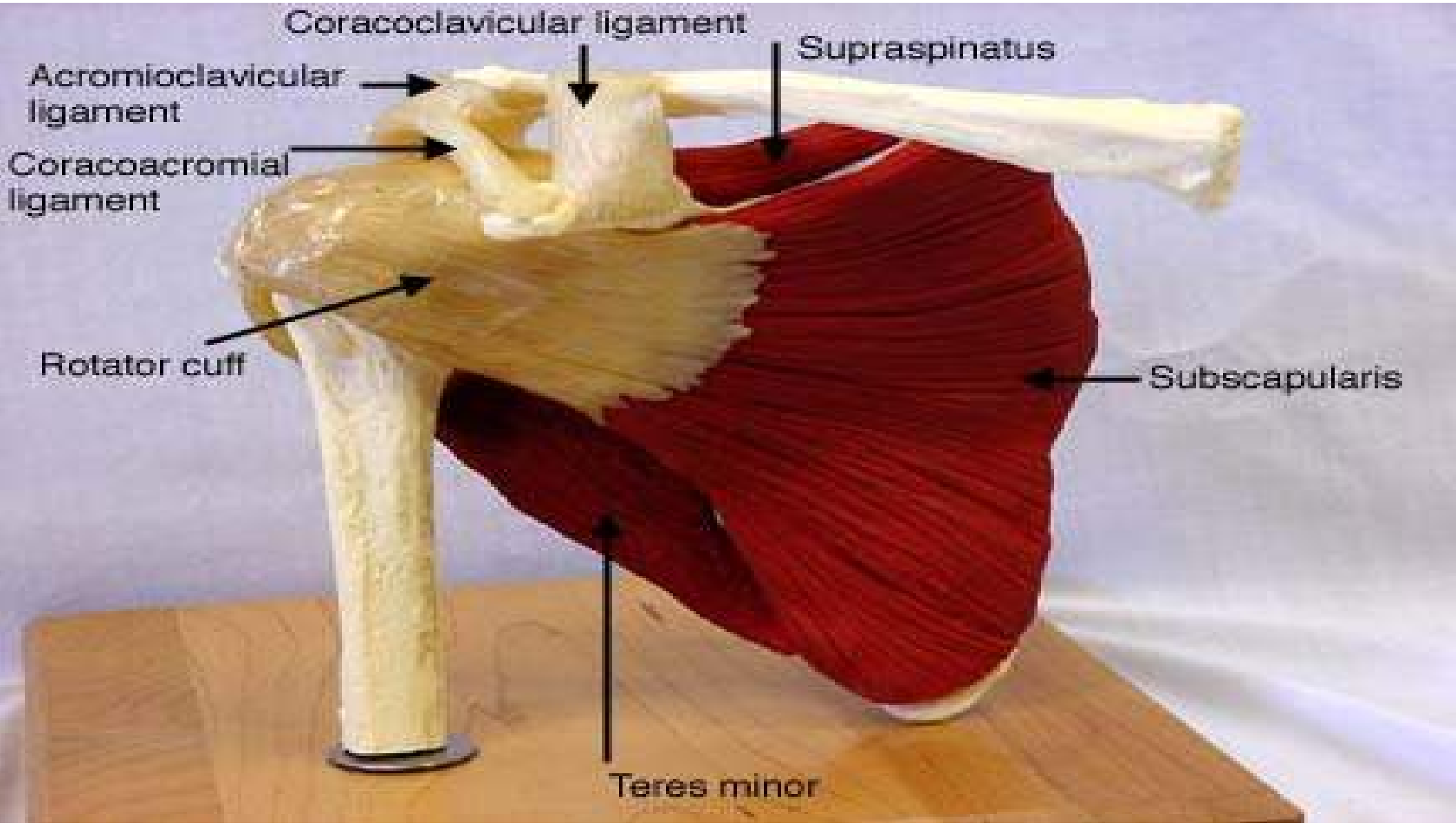
Humeroscapular (Glenohumeral) Joint

Humeroscapular (Glenohumeral) Joint

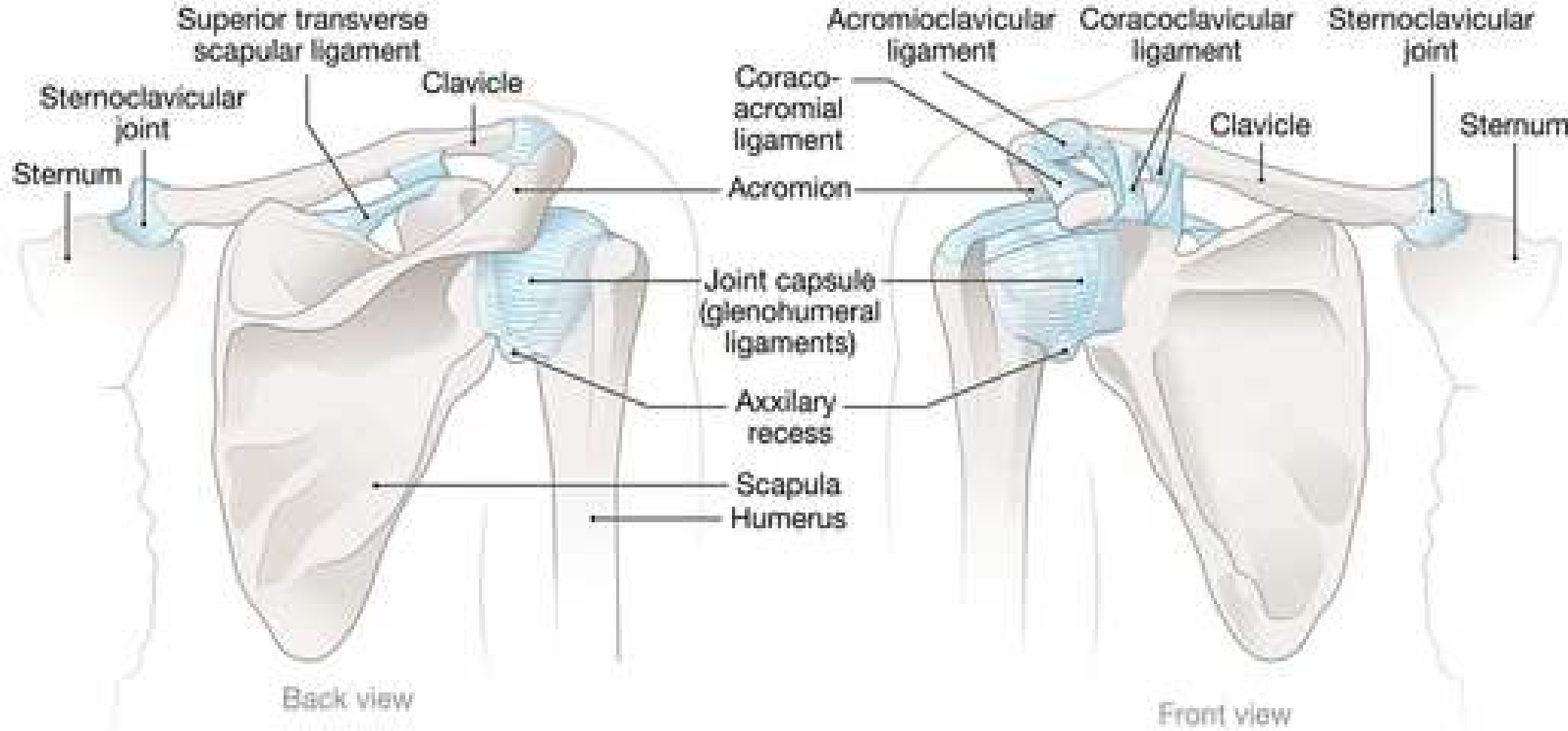


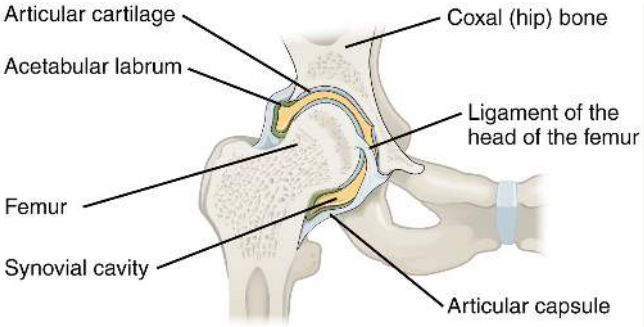
(c) Frontal section


Trapezoid ligament
Clavicle
Conoid ligament
Coracoacromial ligament
Coracoid process
Glenohumeral ligaments
Subscapular fossa
Long tendon of biceps brachii
Coracohumeral ligament
Coracoclavicular ligament

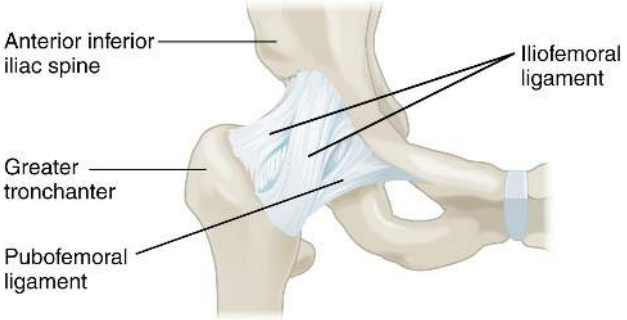

Coracoclavicular ligament
Supraspinatus
Acromioclavicular ligament
Coracoacromial ligament
Rotator cuff
Subscapularis
Teres minor

Shoulder anatomy. Joints and ligaments

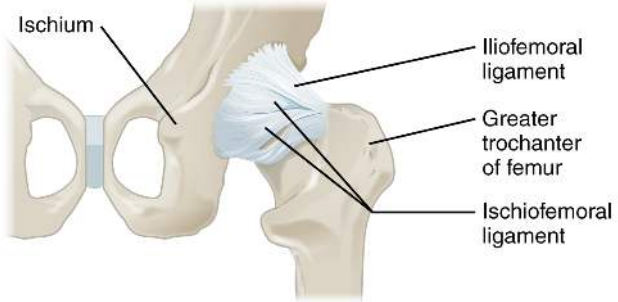




(a) Frontal section through the right hip joint

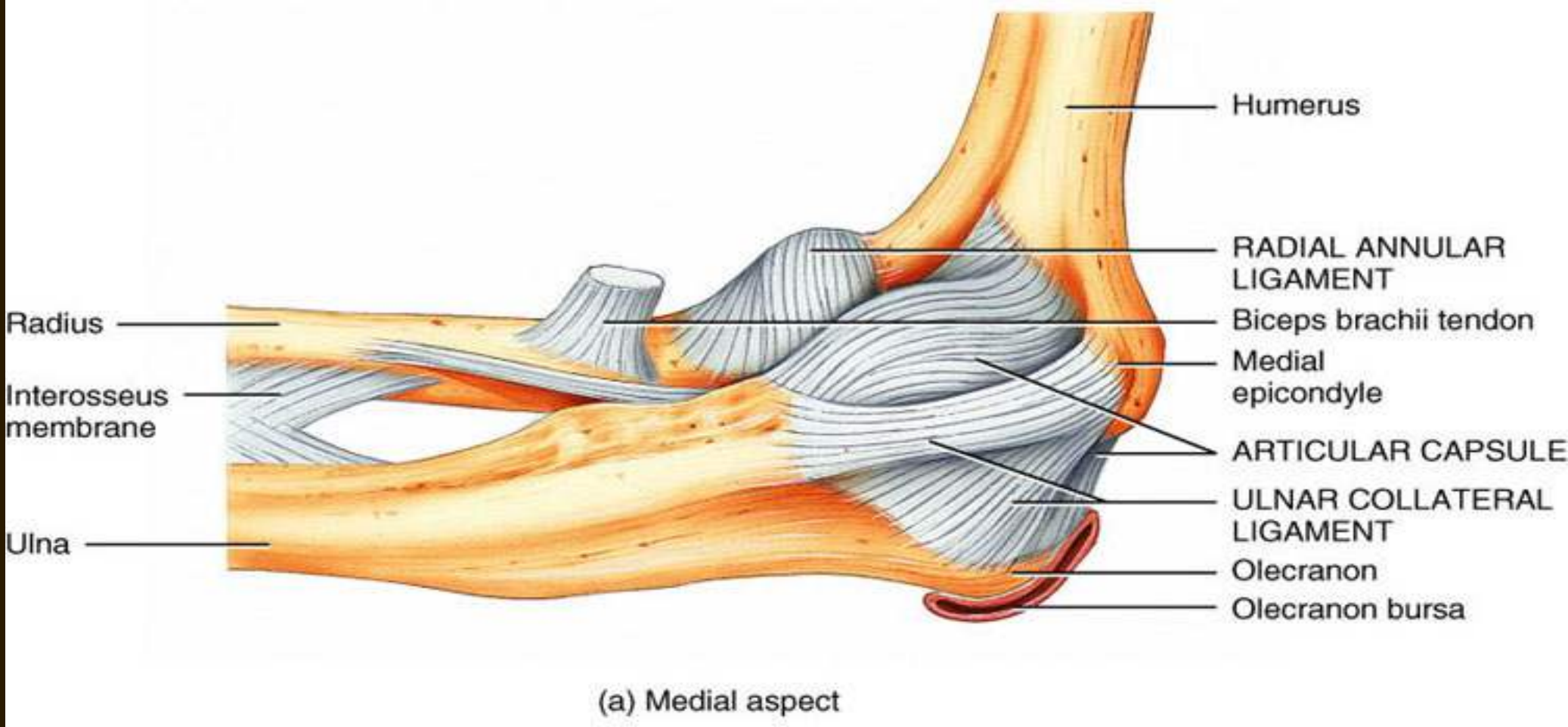


(b) Anterior view of right hip joint, capsule in place



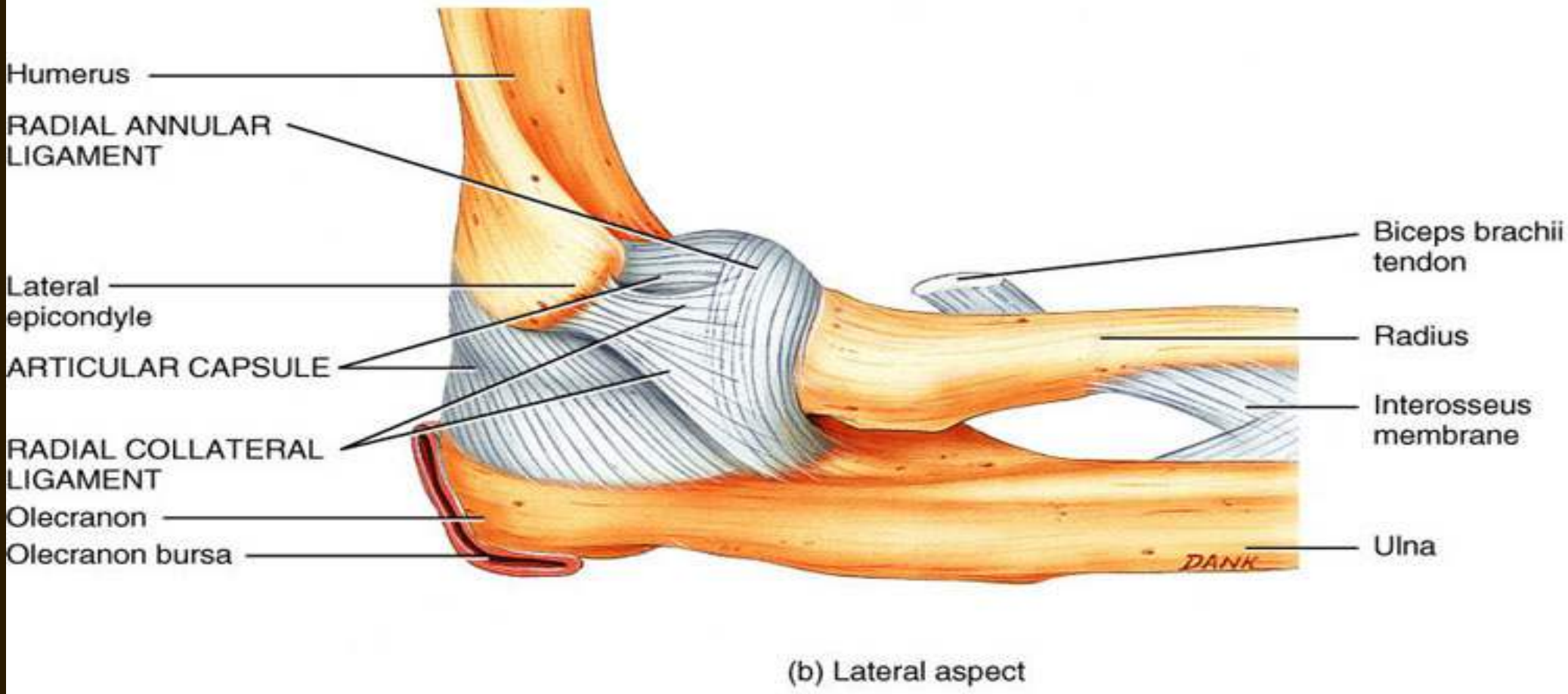
(c) Posterior view of right hip joint, capsule in place

Right Elbow Joint-medial view



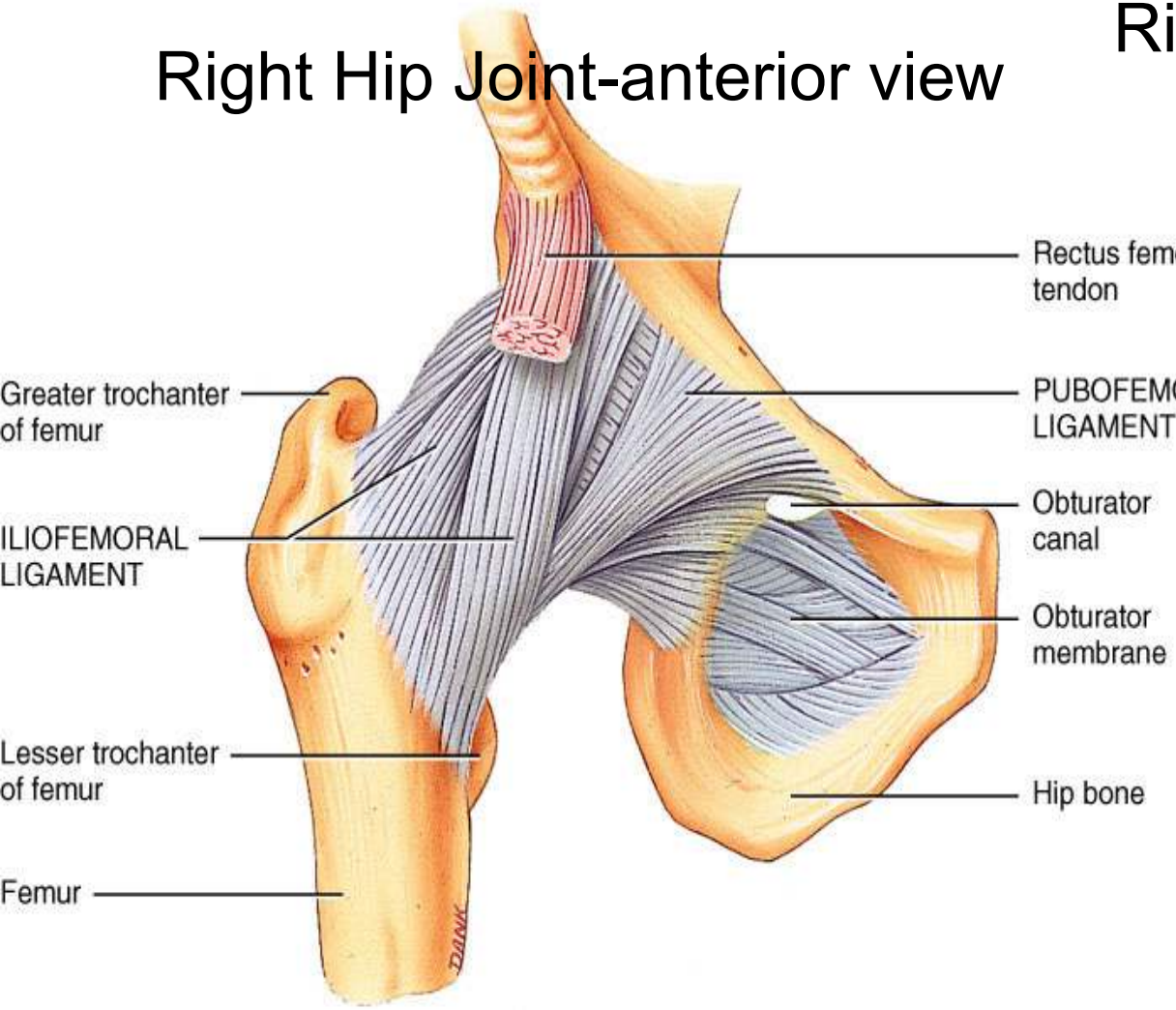
(a) Medial aspect

Right Elbow Joint-lateral view



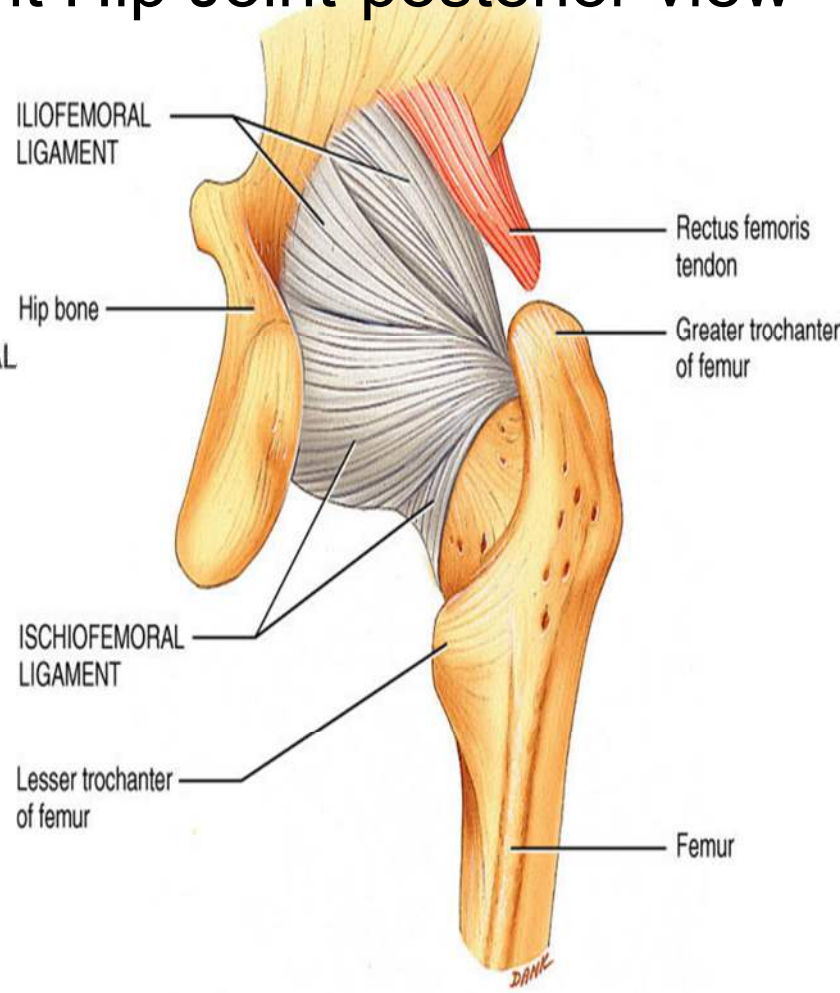
(b) Lateral aspect

Right Hip Joint-anterior view

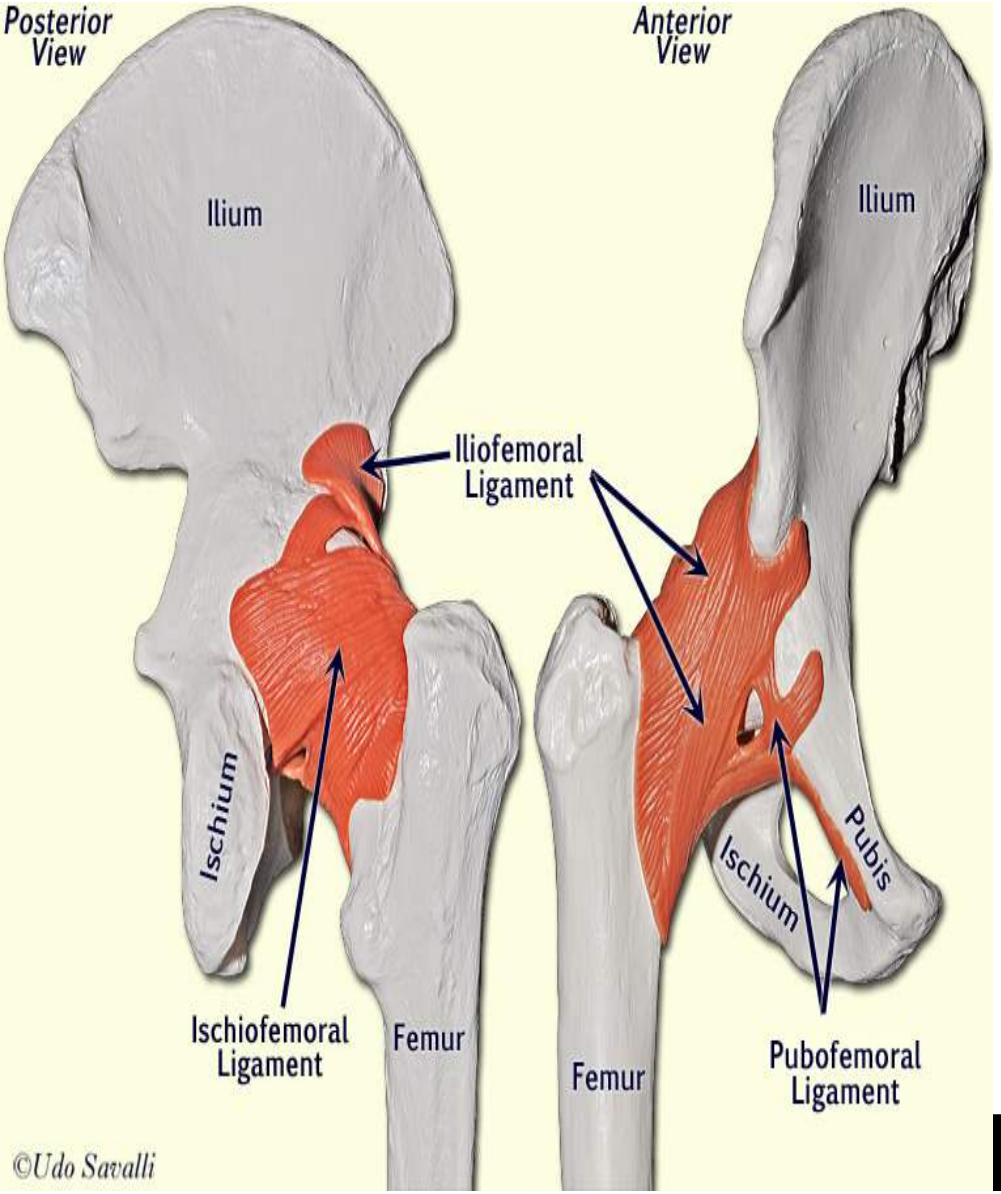


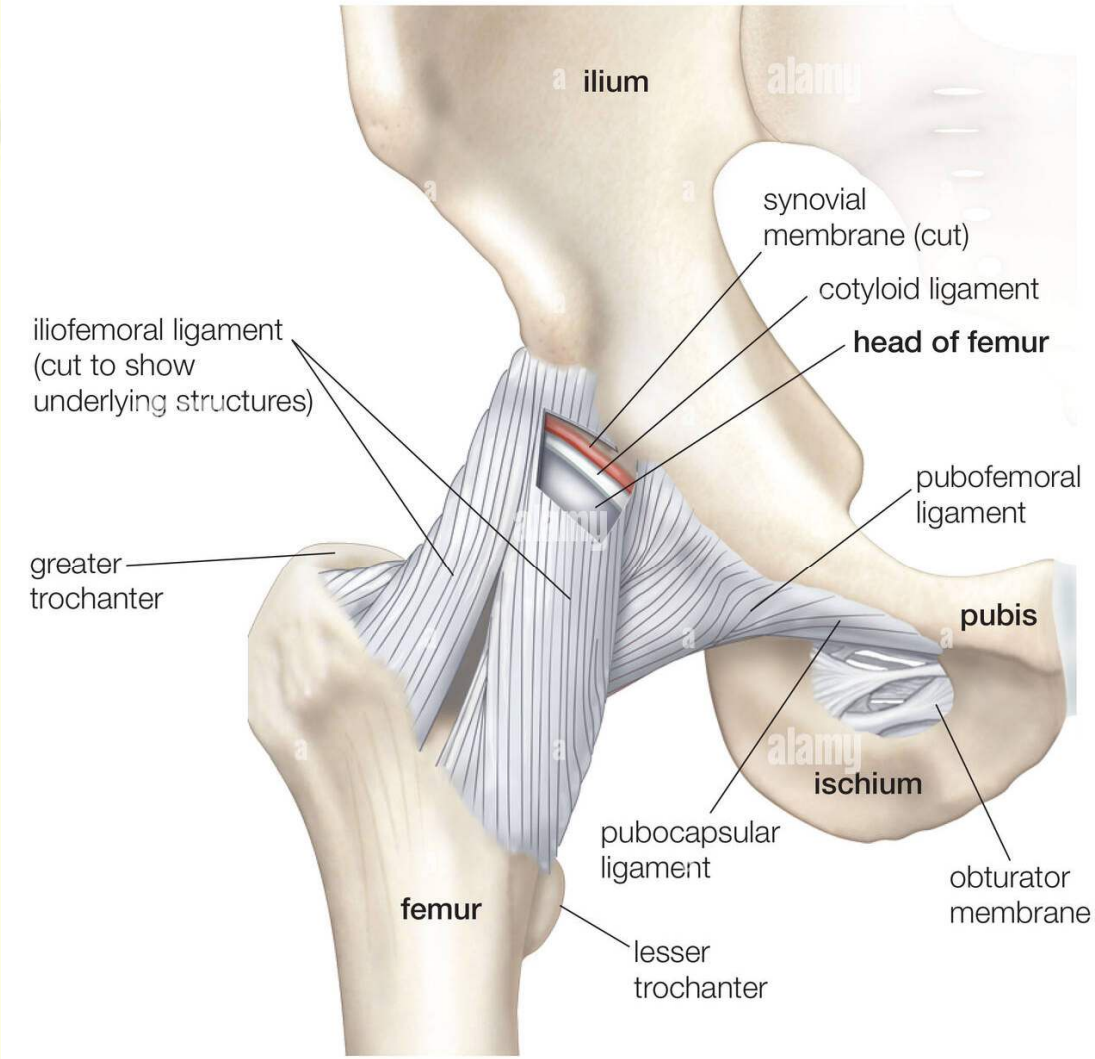
(a) Anterior view

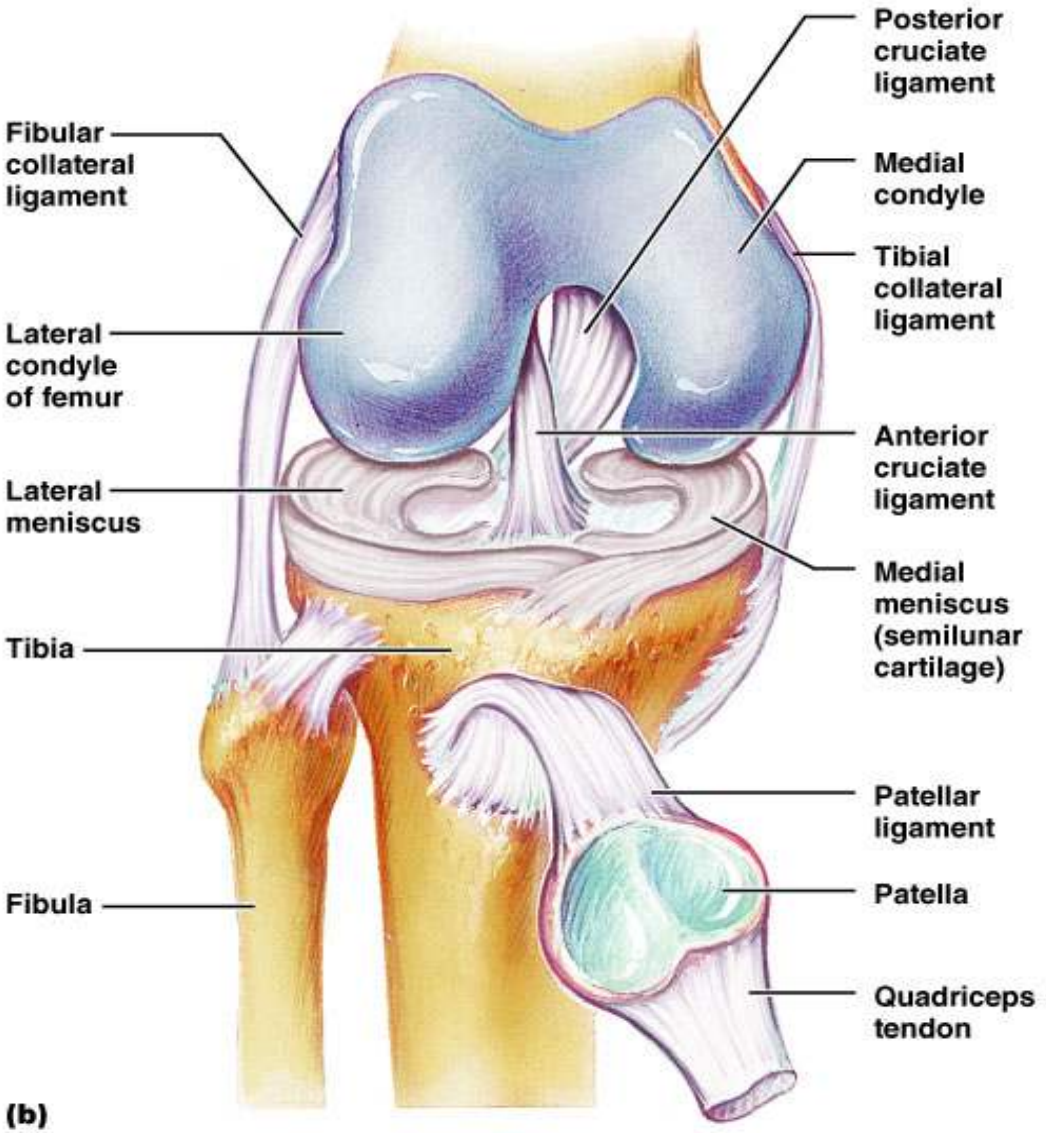
Right Hip Joint-posterior view

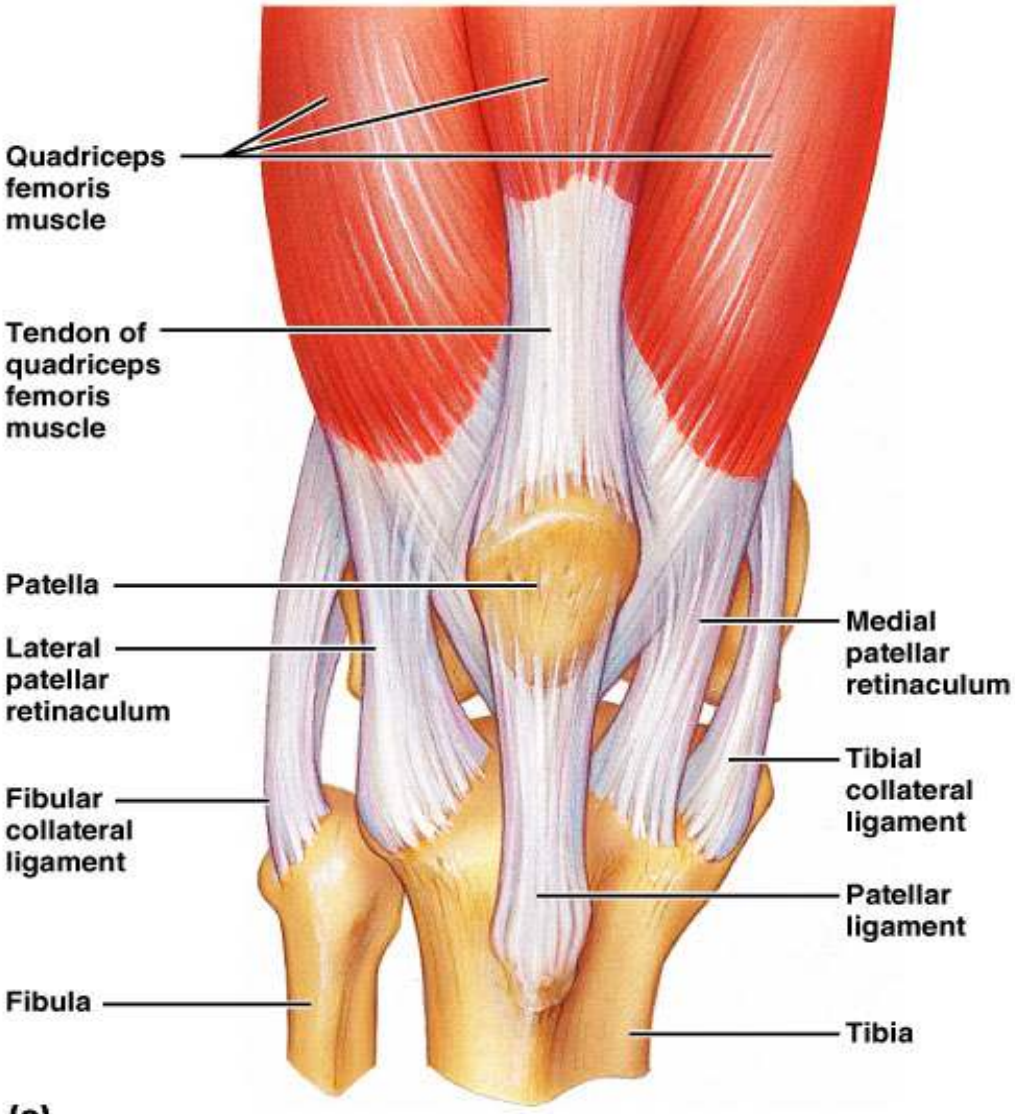


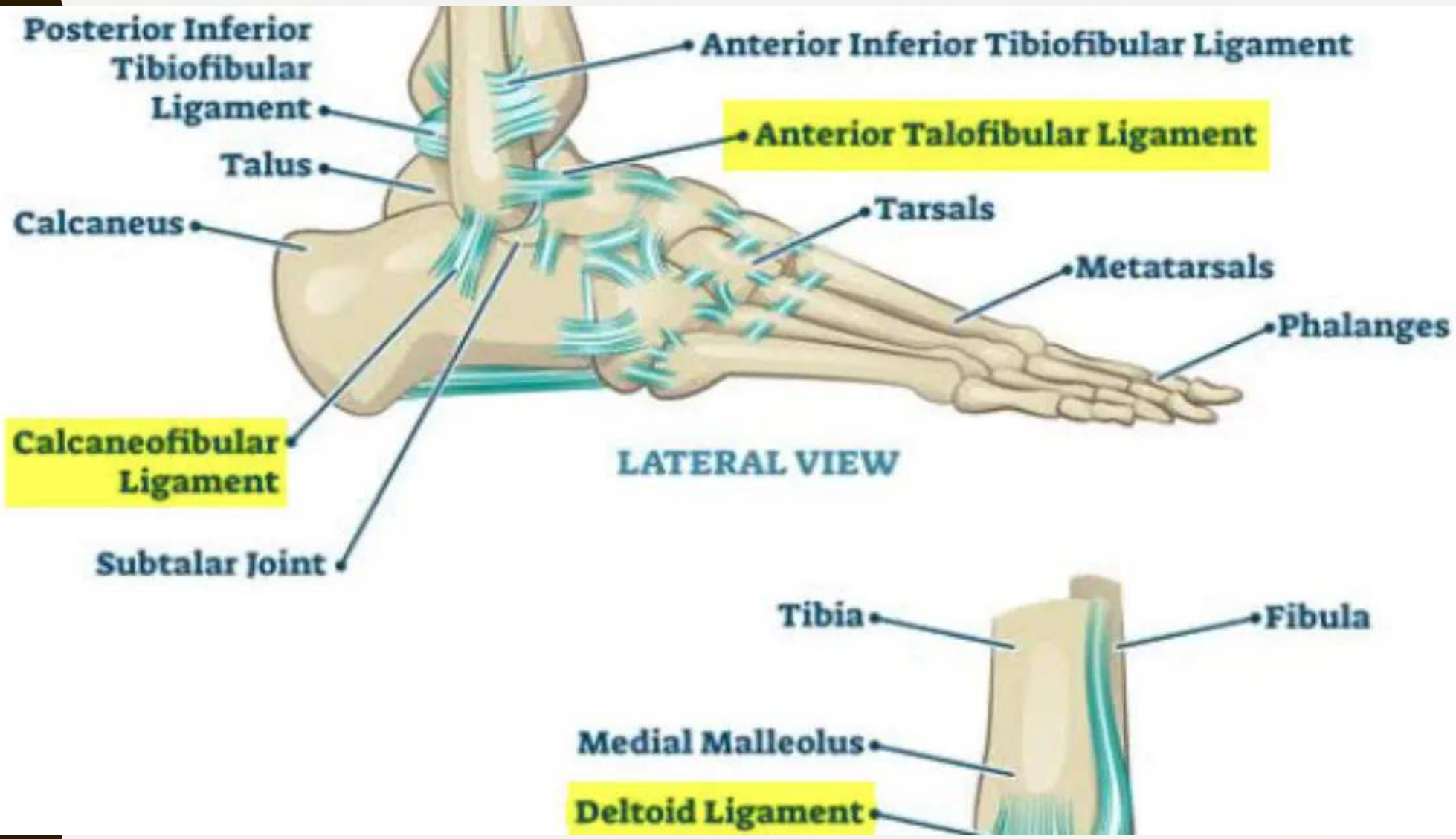
(c) Posterior view

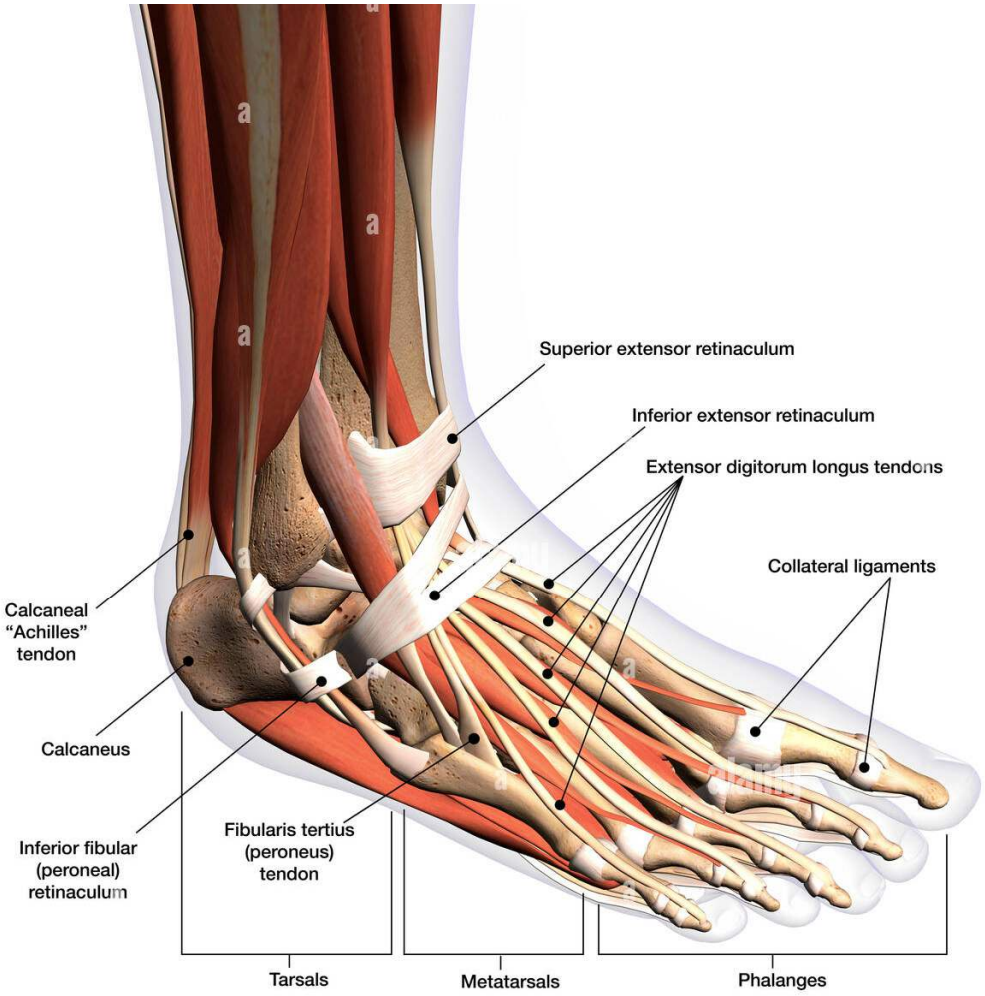


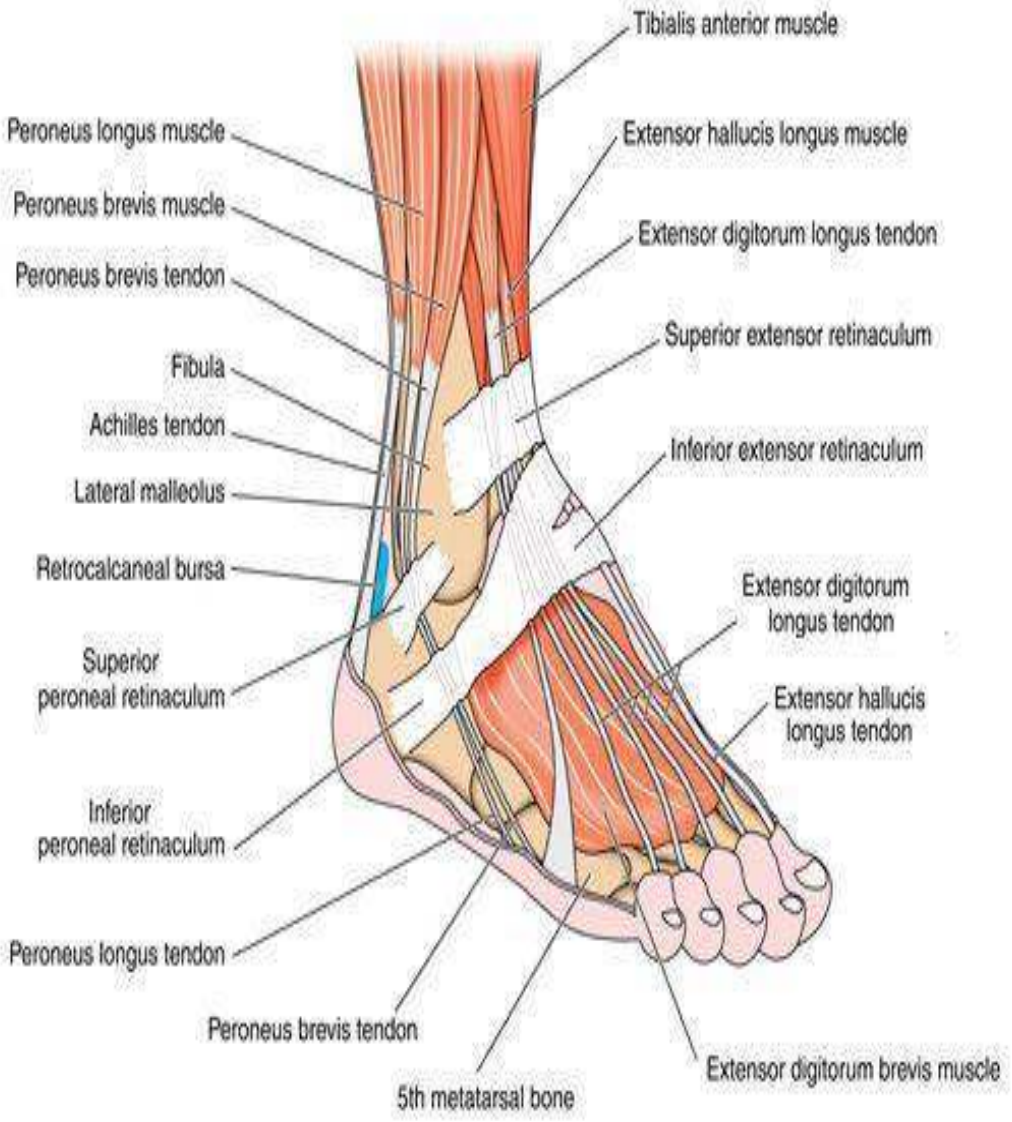






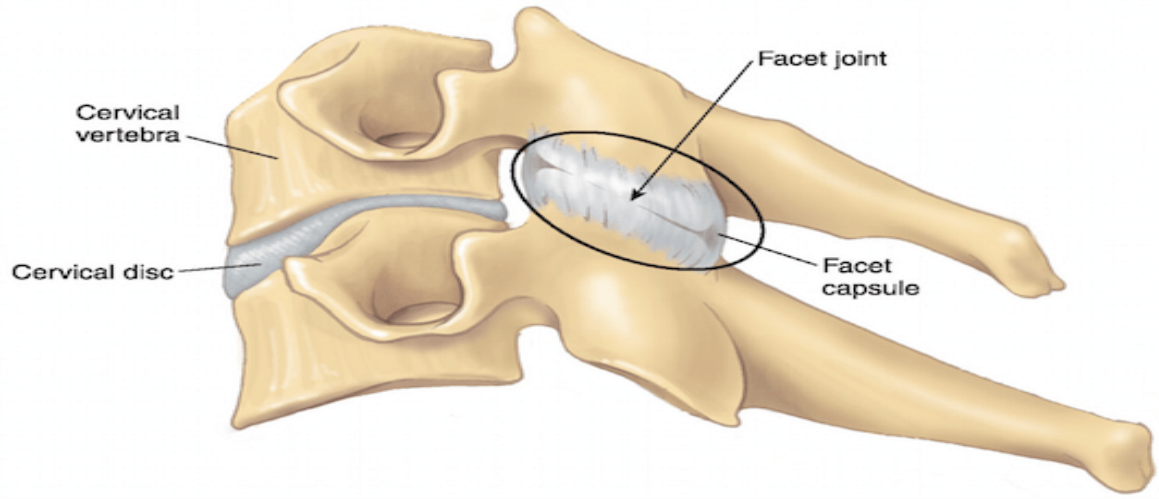

Posterior Inferior Tibiofibular Ligament
Anterior Inferior Tibiofibular Ligament
Anterior Talofibular Ligament
Talus
Calcaneus
Tarsals
Metatarsals
Phalanges
Calcaneofibular Ligament
Subtalar Joint
LATERAL VIEW
Tibia
Fibula
Medial Malleolus
Deltoid Ligament

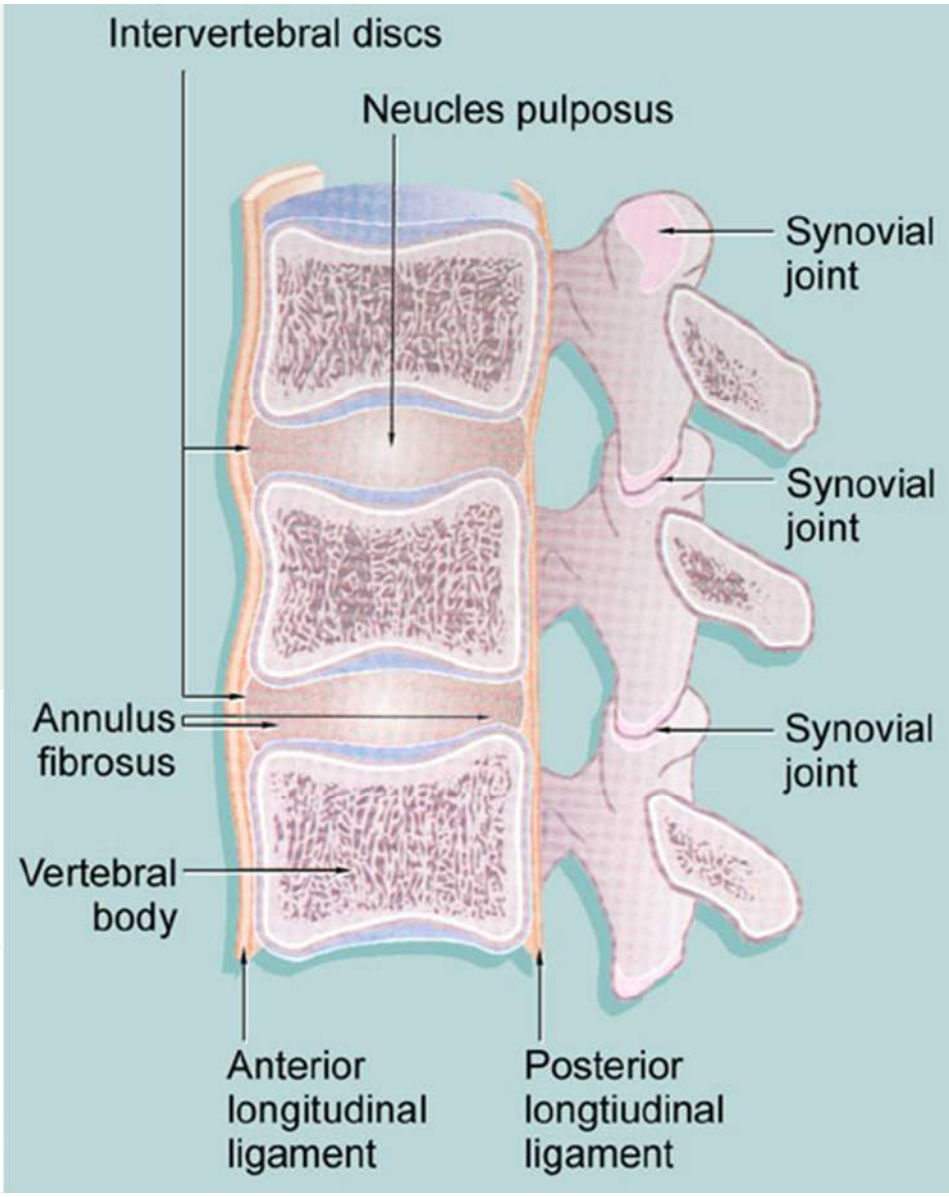




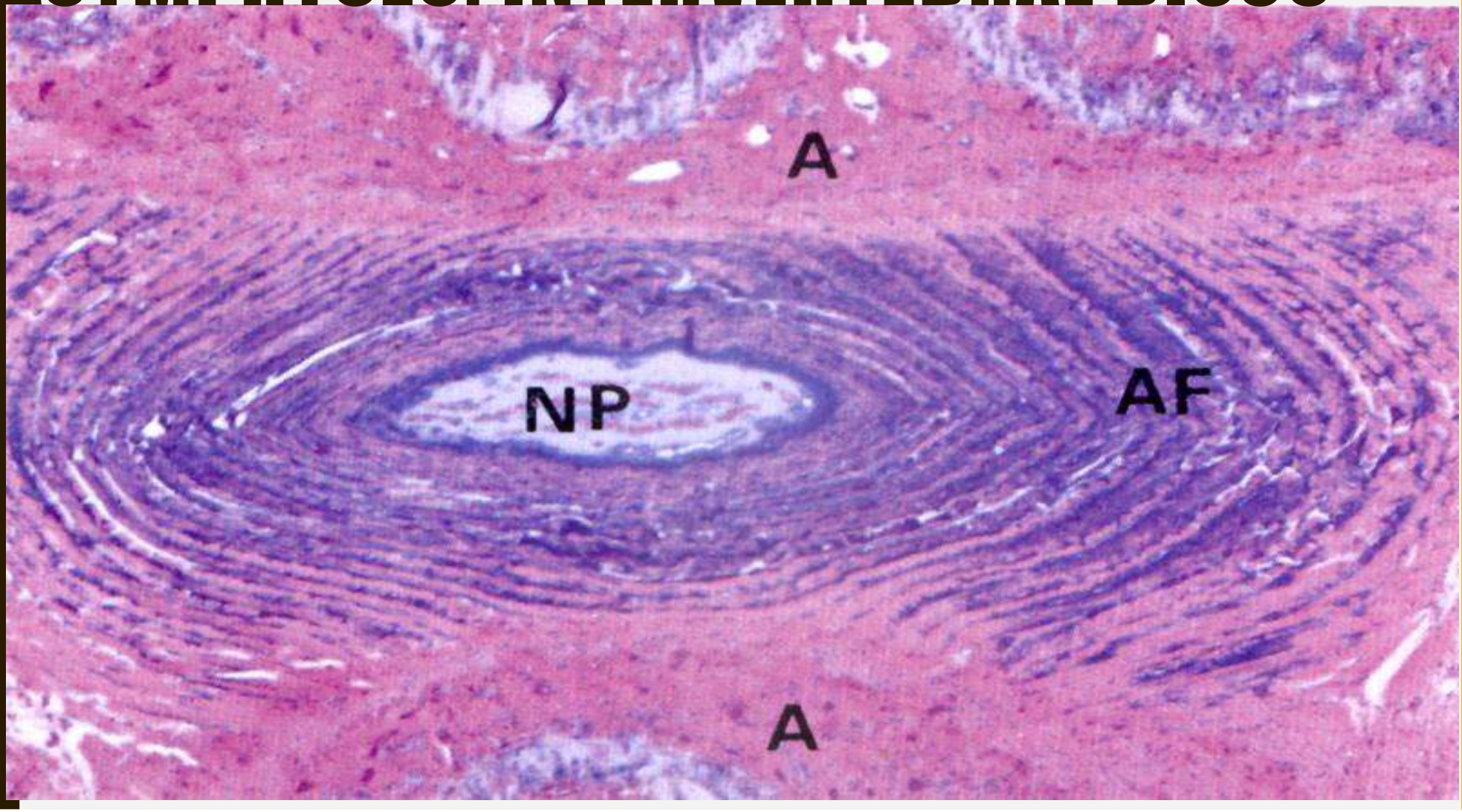
FACETS

- **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

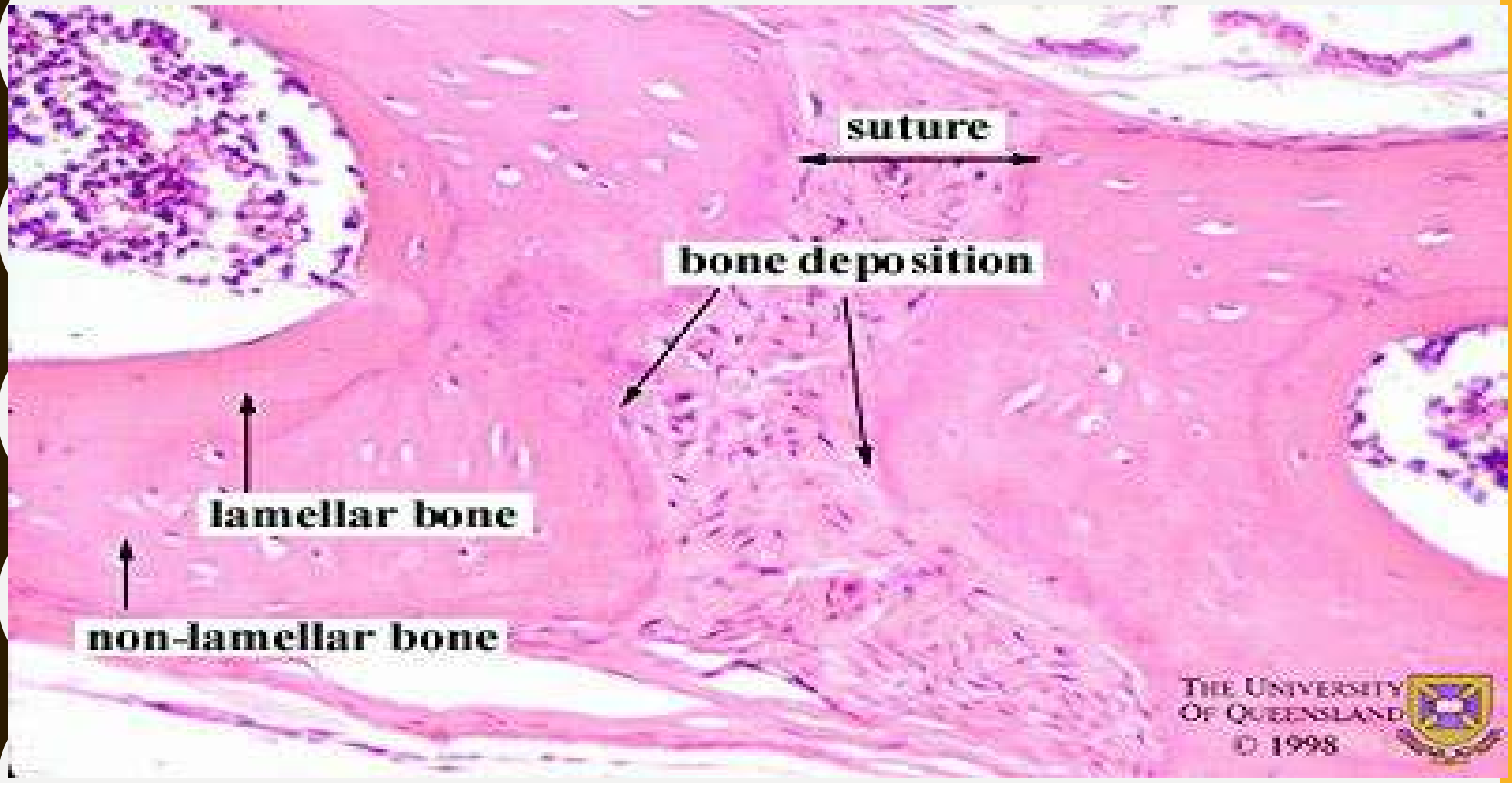




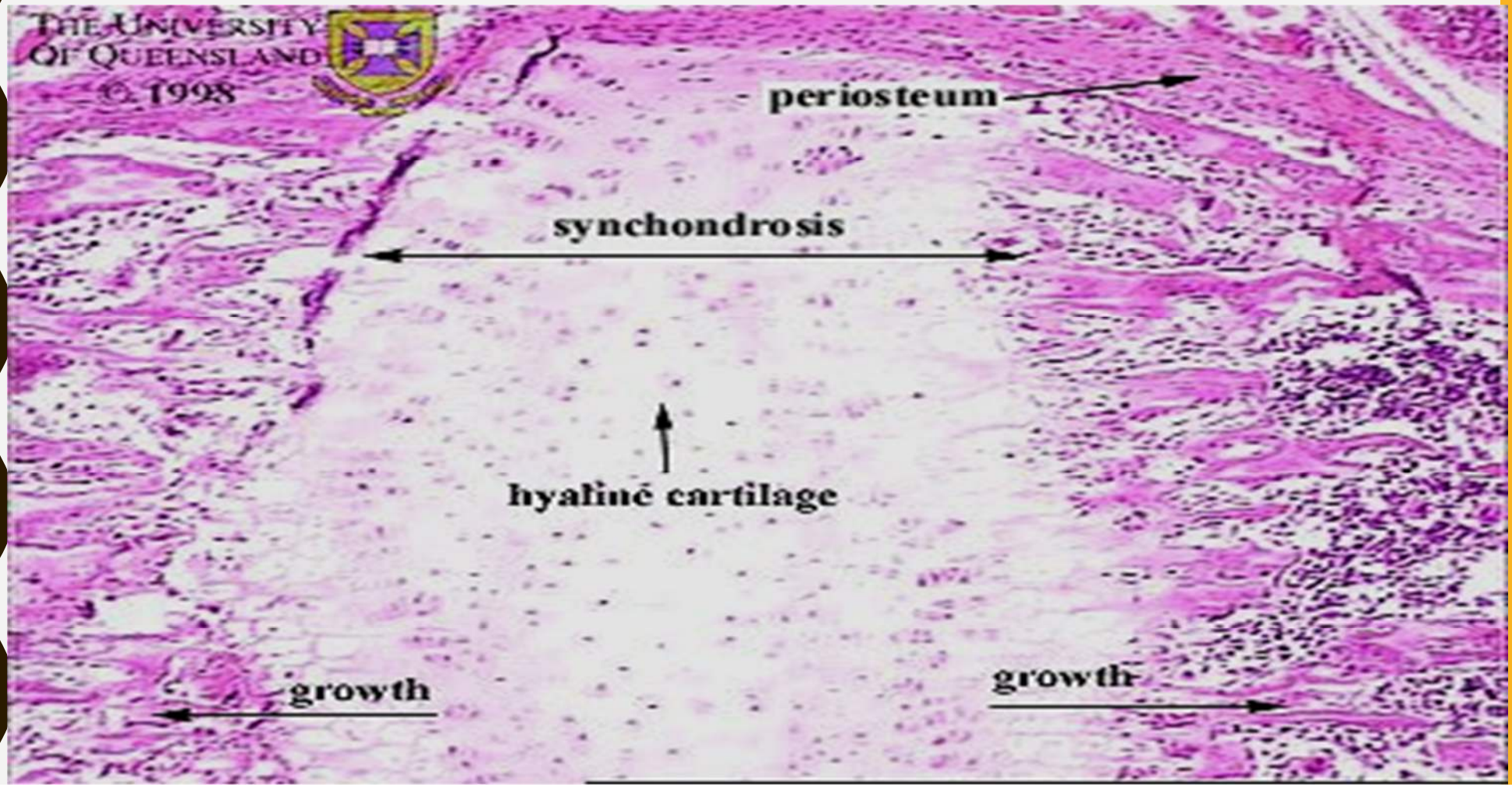
SYMPHYSES: INTERVERTEBRAL DISCS



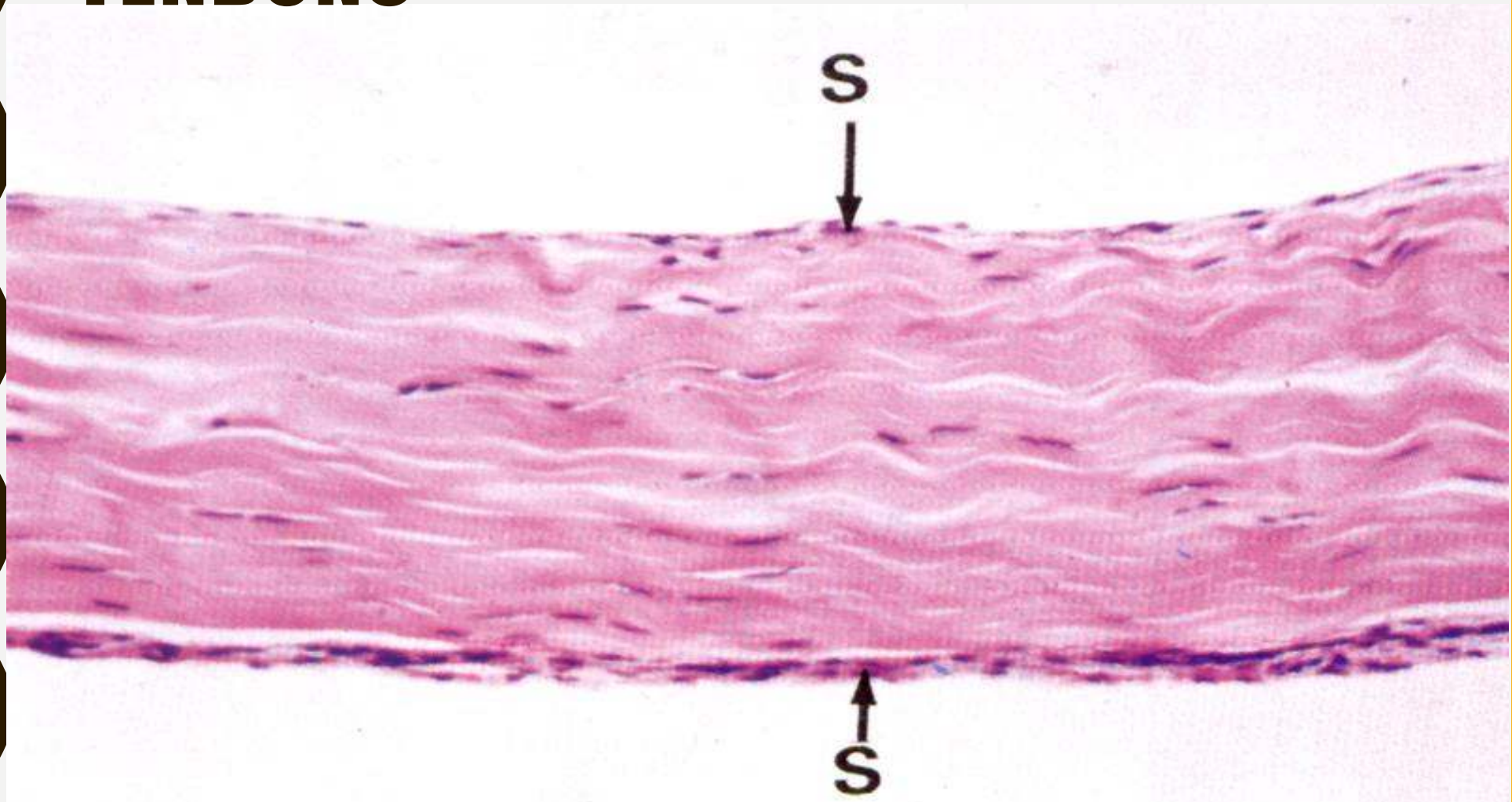
SYNDESMOSES

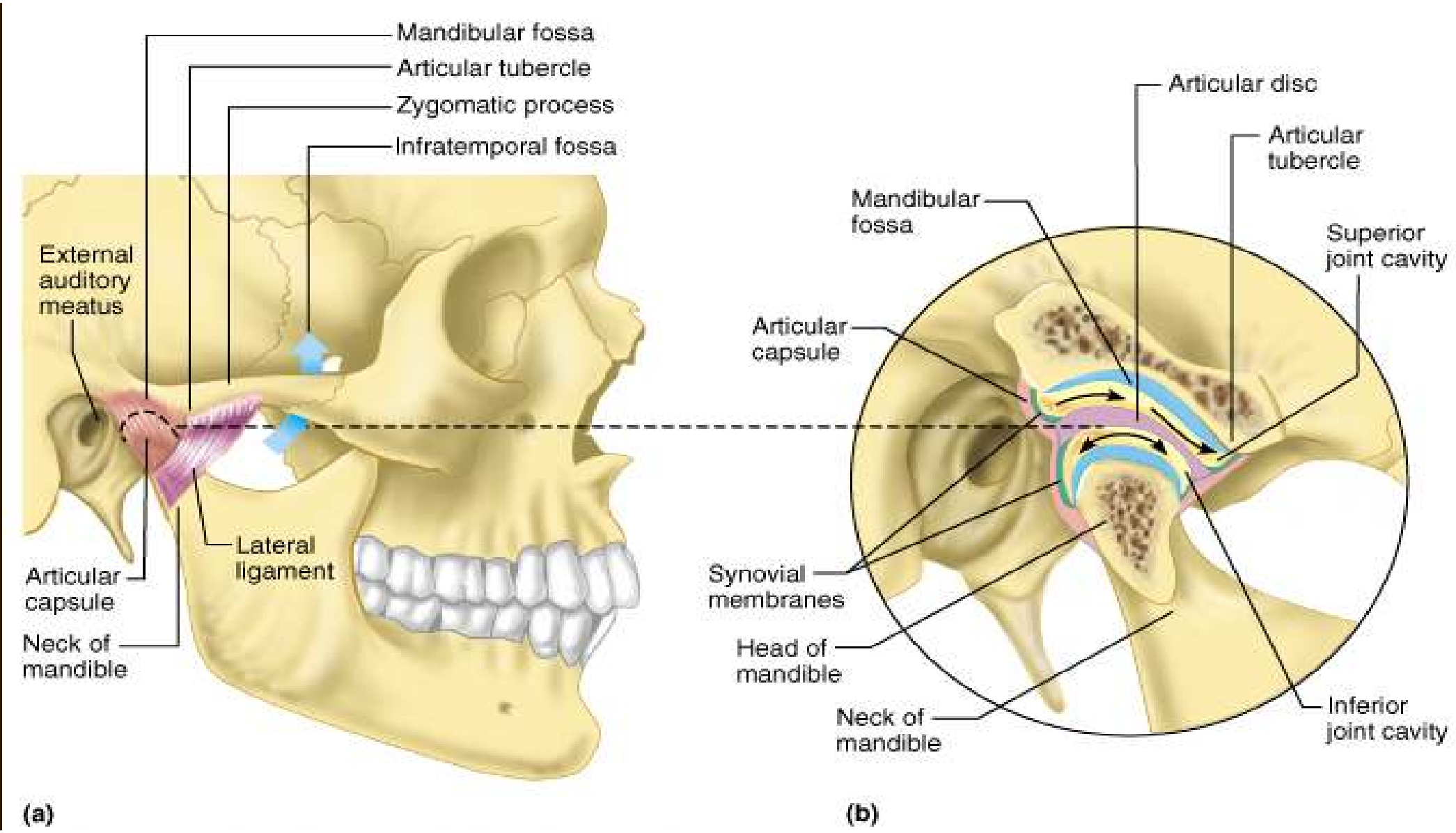


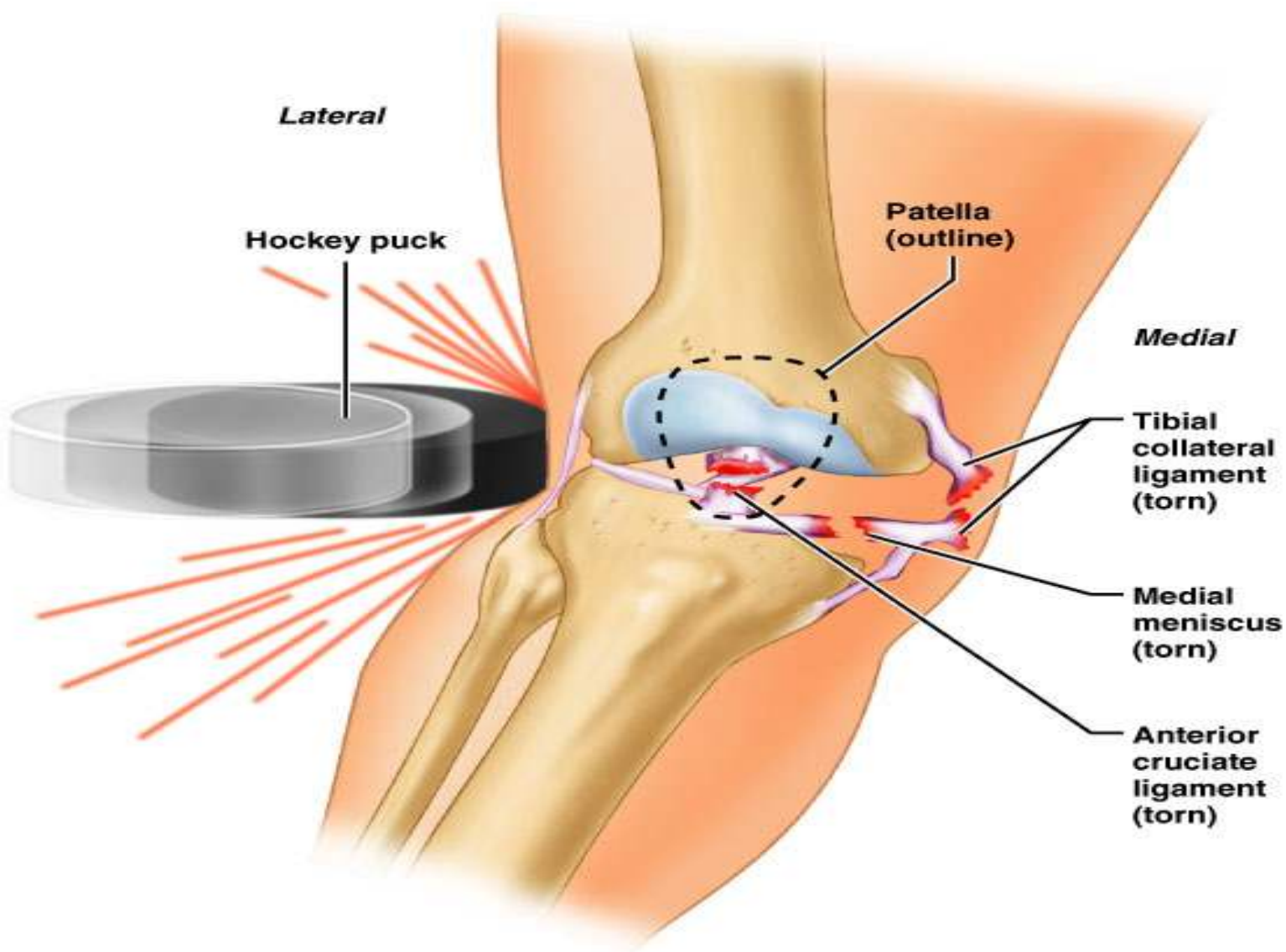
SYNCHONDROSES



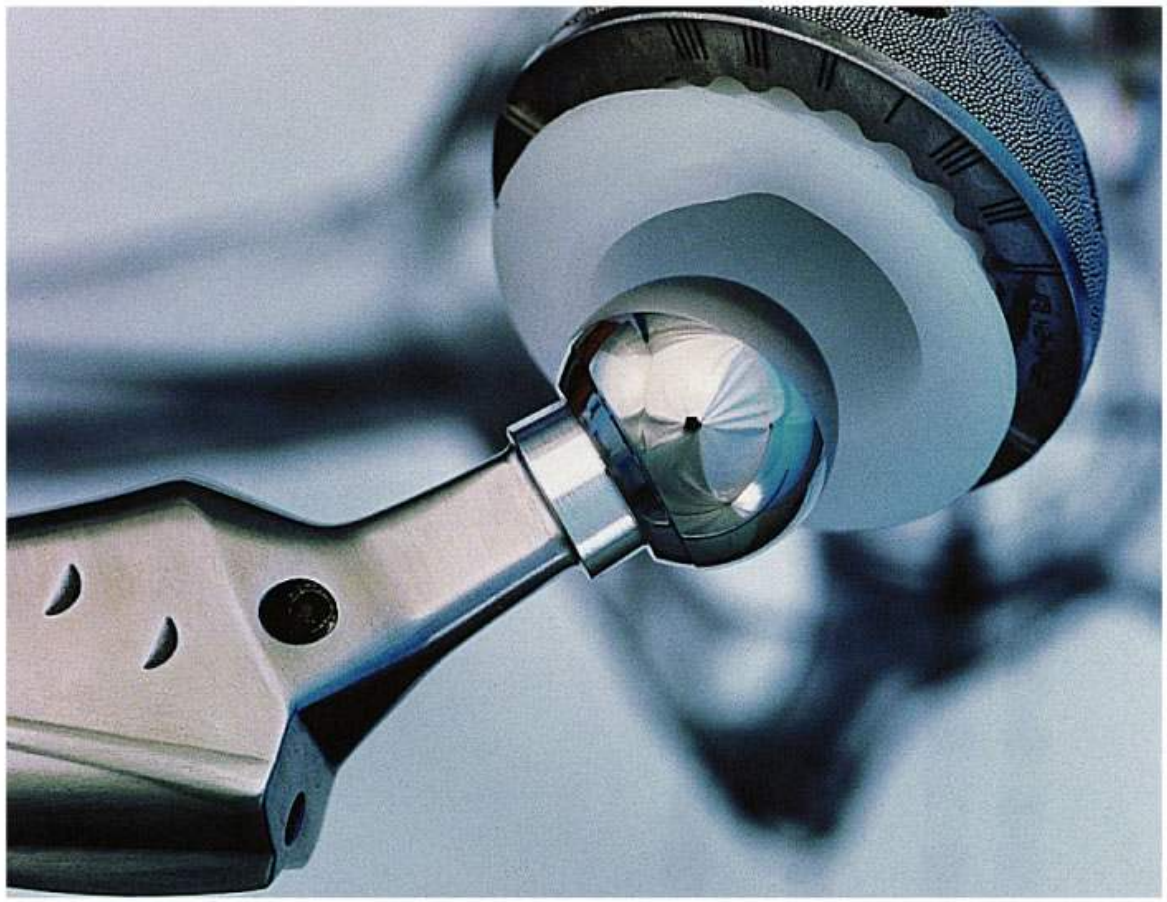
TENDONS




Mandibular fossa
Articular tubercle
Zygomatic process
Infratemporal fossa
External auditory meatus
Lateral ligament
Articular capsule
Neck of mandible
(a)
Articular disc
Articular tubercle
Mandibular fossa
Superior joint cavity
Articular capsule
Synovial membranes
Head of mandible
Neck of mandible
Inferior joint cavity
(b)

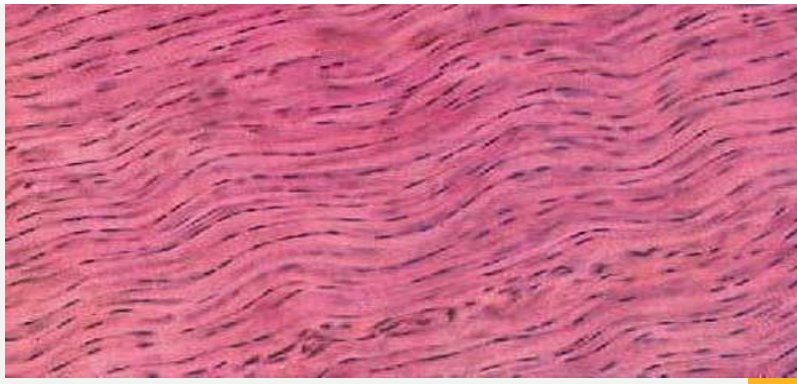


ARTIFICIAL HIP JOINT

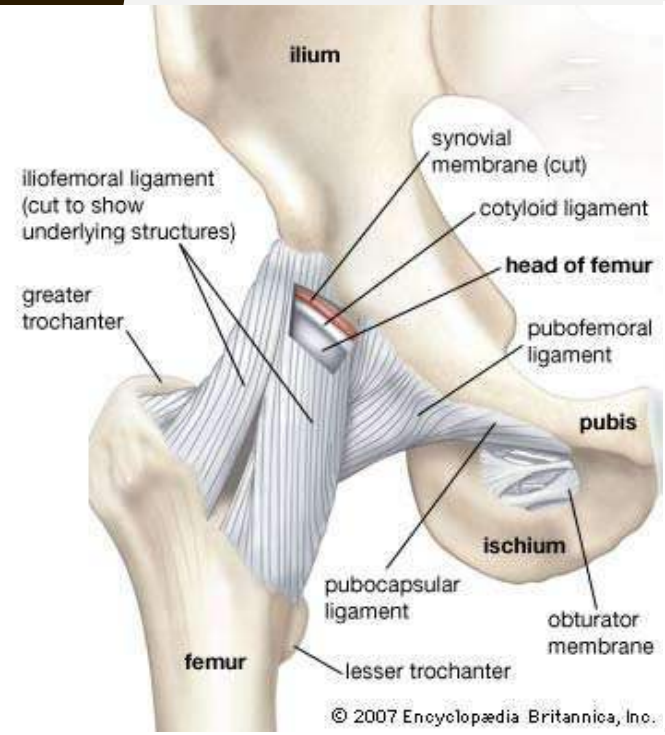


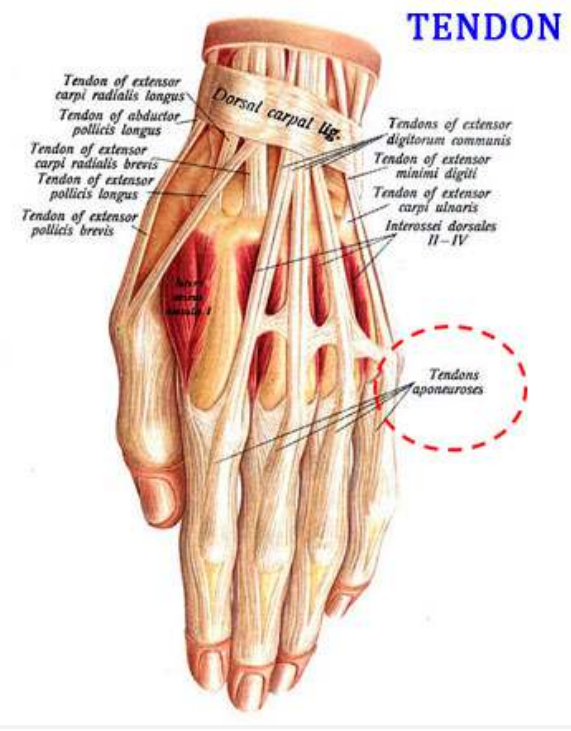
Photograph of a hip prosthesis.

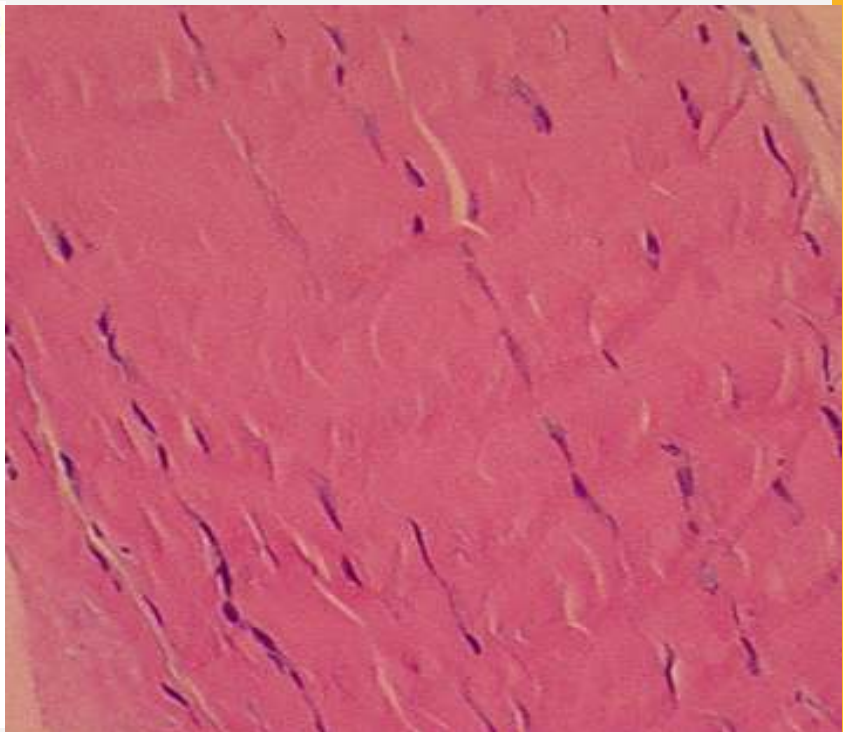
LIGAMENTS



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





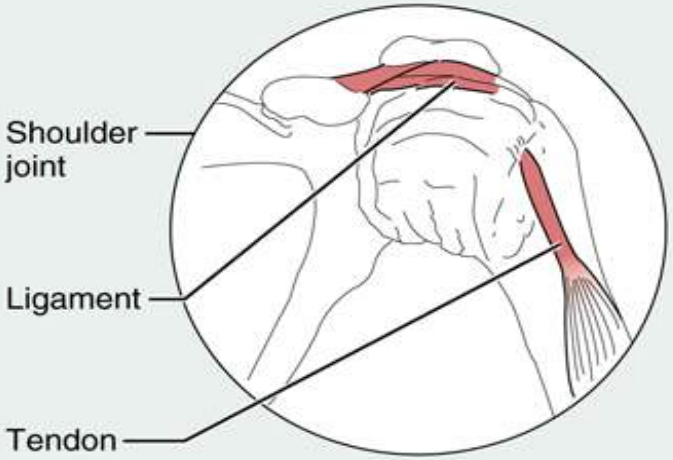


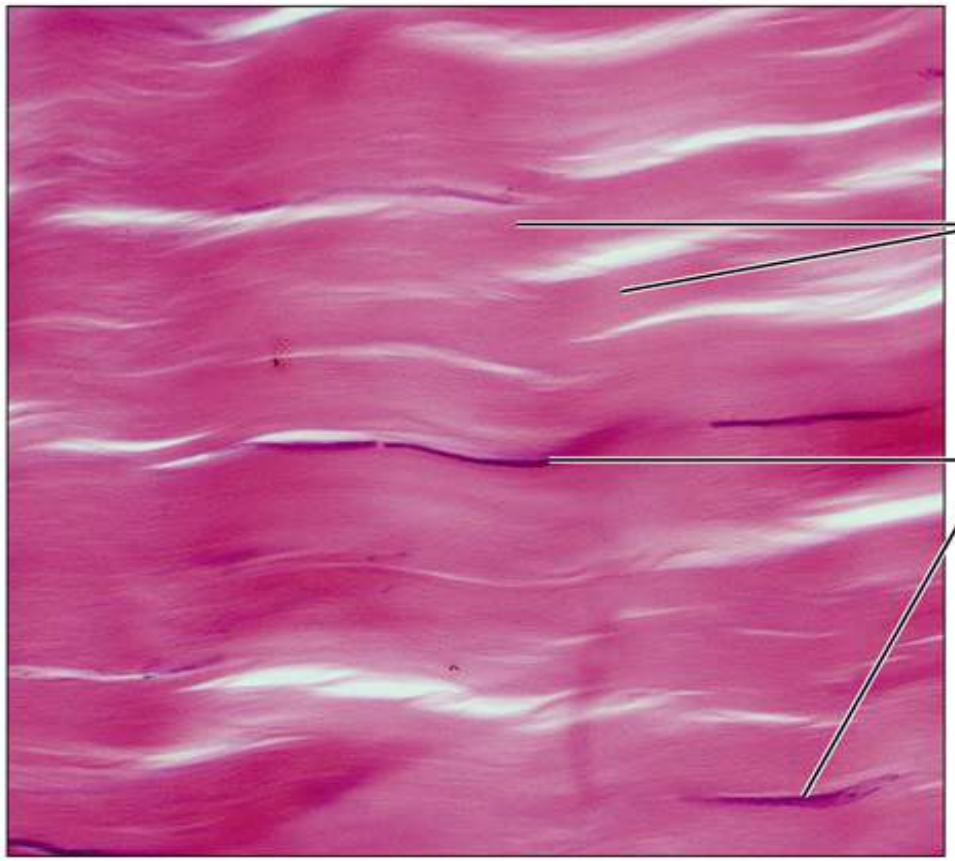
(d) Connective tissue proper: dense connective tissue, dense regular

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.

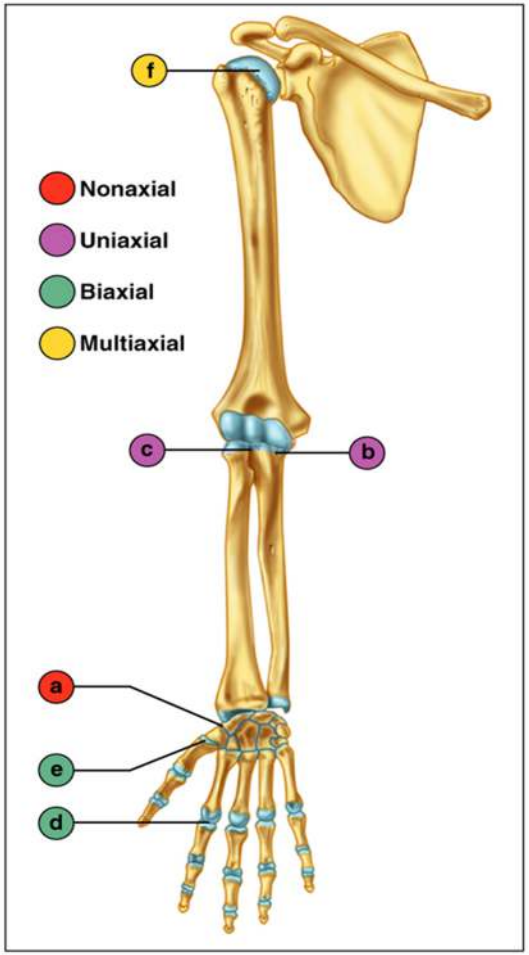




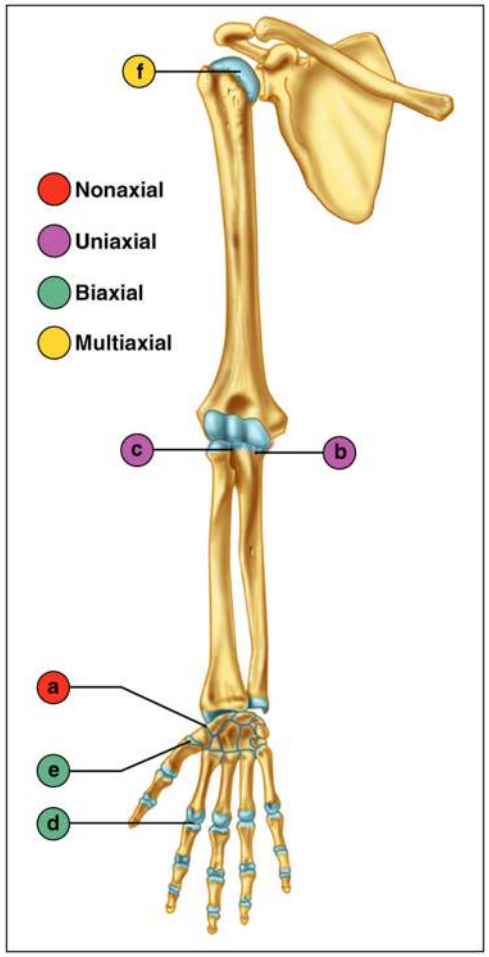
Photomicrograph: Dense regular connective tissue from a tendon (430×).

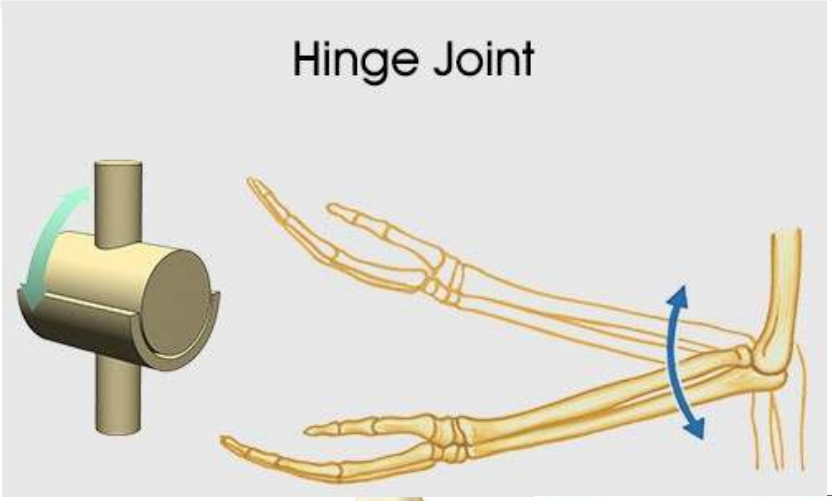
SYNOVIAL JOINTS: RANGE OF MOTION

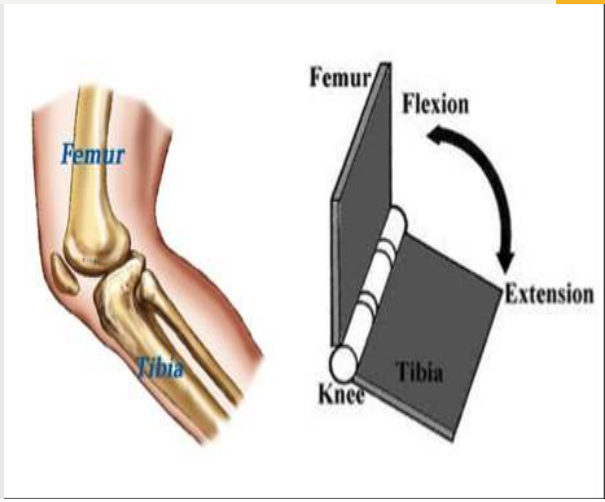
- **Nonaxial** – slipping movements only
- **Uniaxial** – movement in one plane
- **Biaxial** – movement in two planes
- **Multiaxial** – movement in or around all three planes

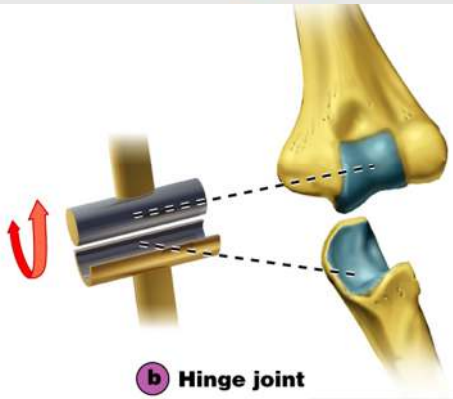


HINGE JOINTS



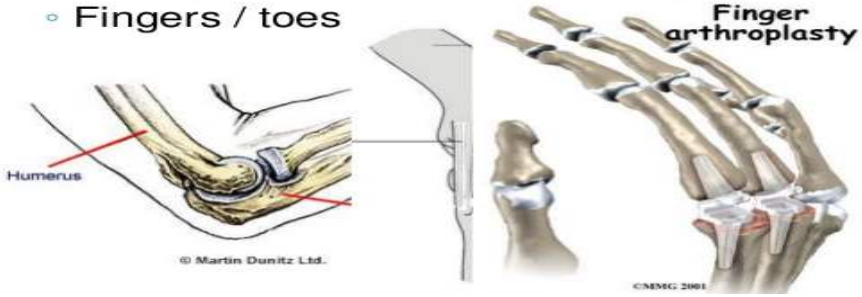




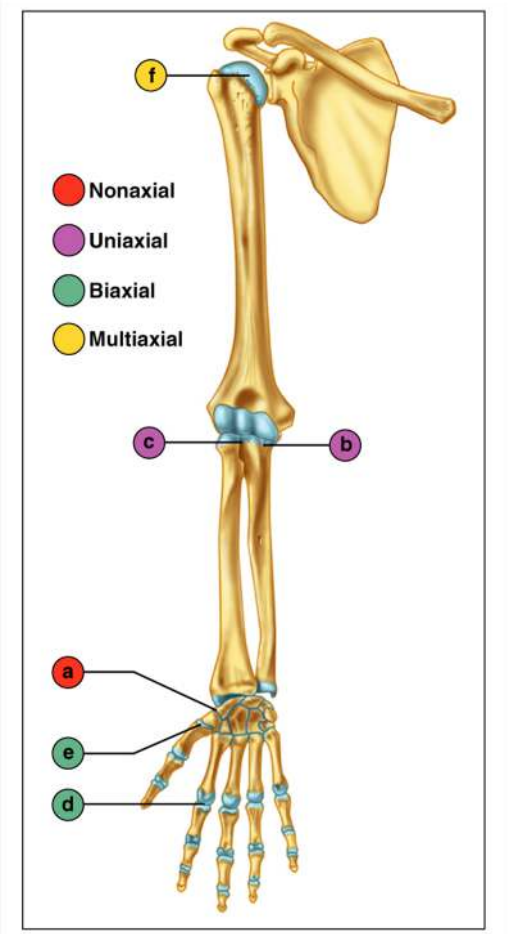


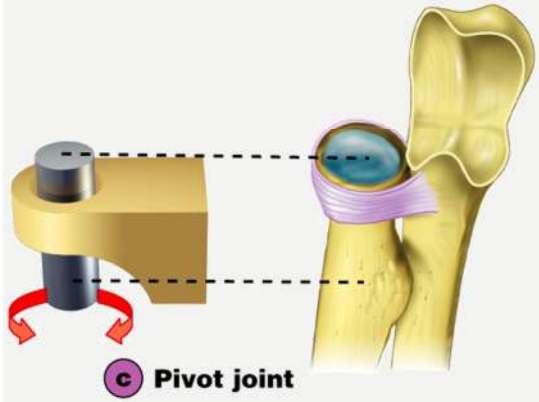
Hinge Joints

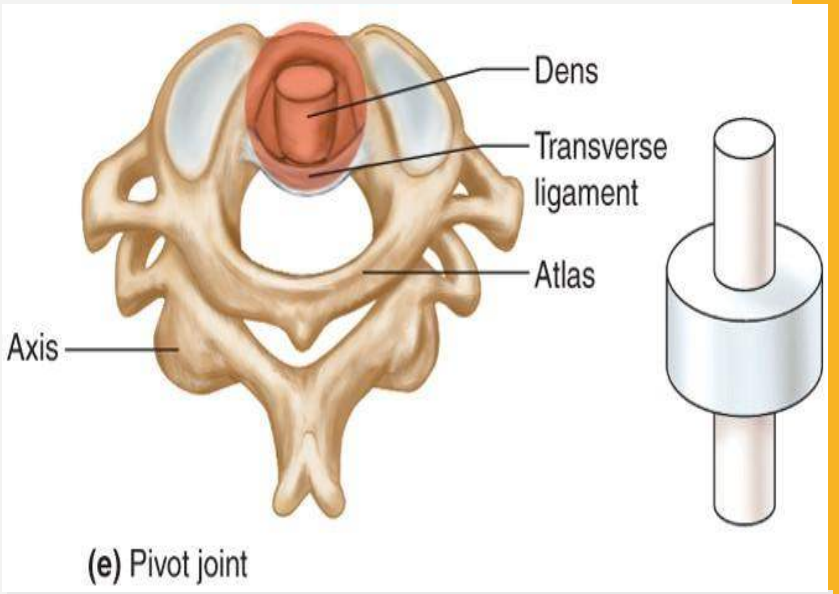
- Examples of hinge joints:
  - Elbow (between ulna and humerus)
  - Knee (between femur and tibia)
  - Fingers / toes

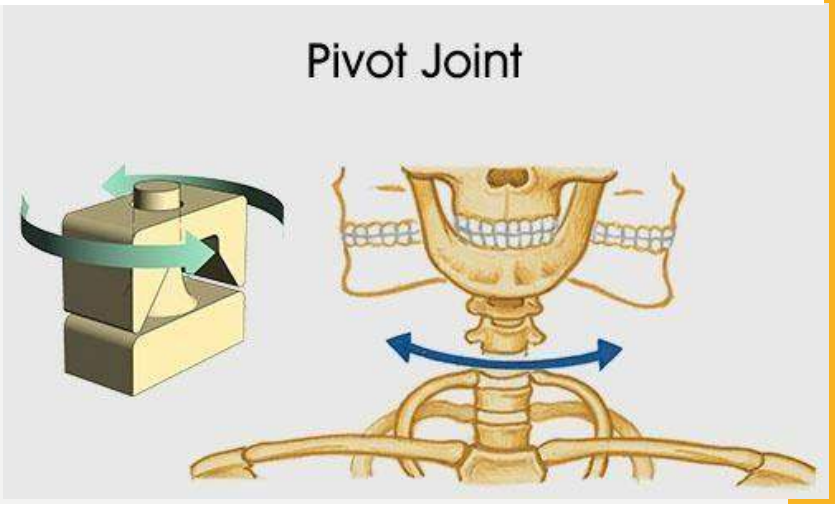


PIVOT JOINTS

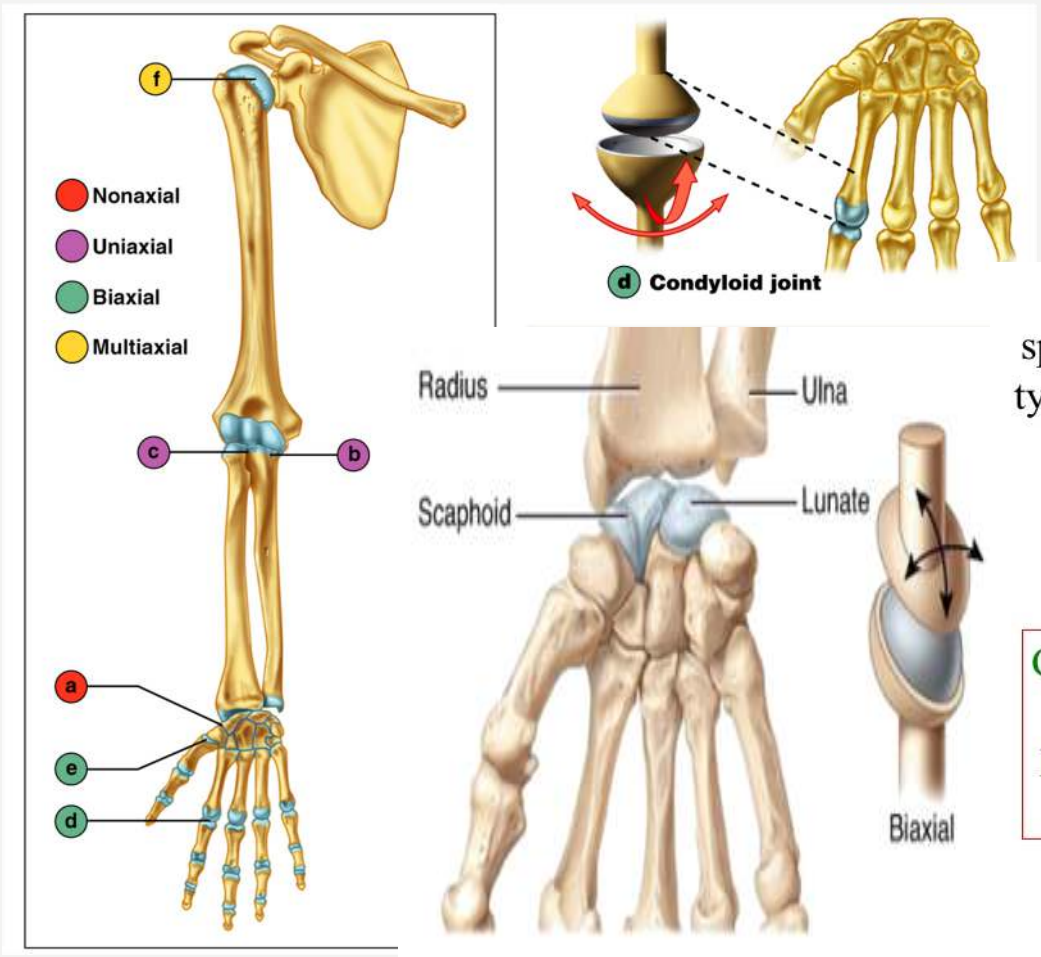




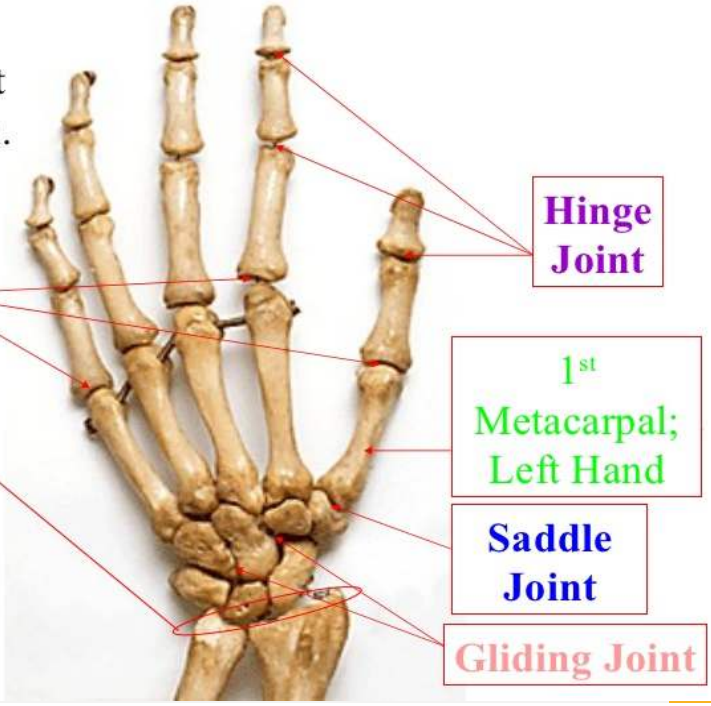




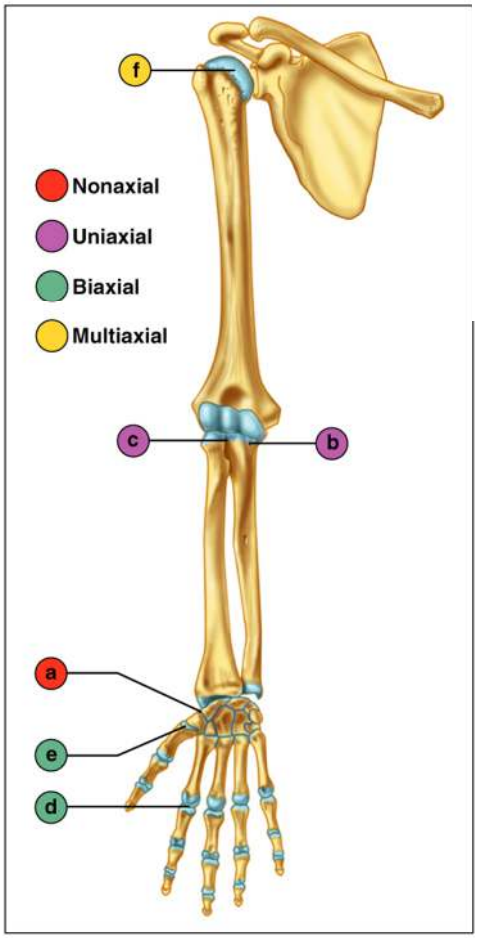
CONDYLOID OR ELLIPSOIDAL JOINTS

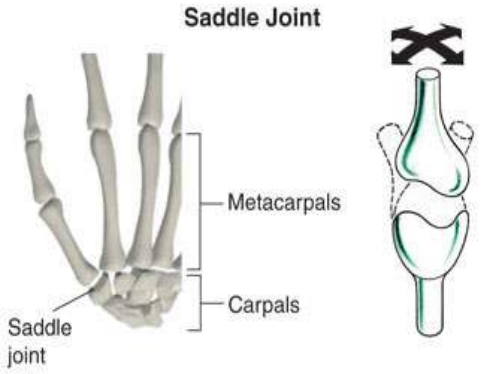


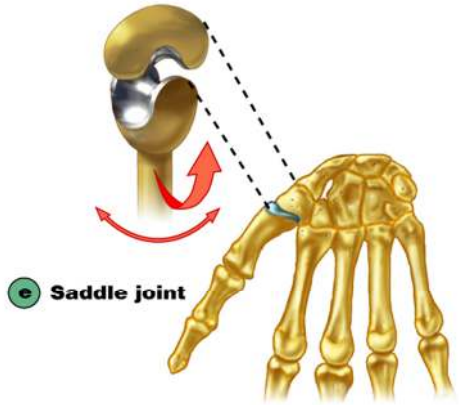
Give the specific joint type for each.

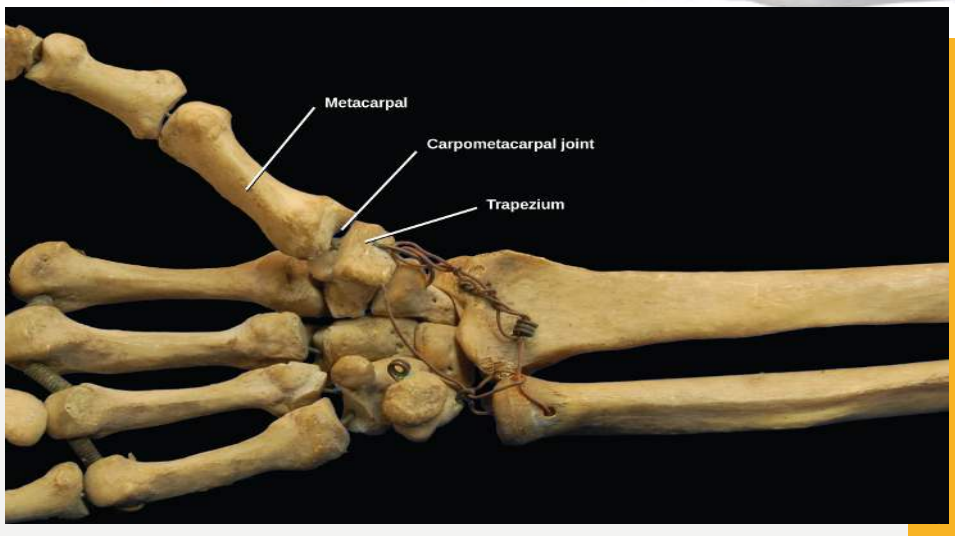


SADDLE JOINTS









IN PICTURE

FIGURE 8.1 FIBROUS JOINTS.

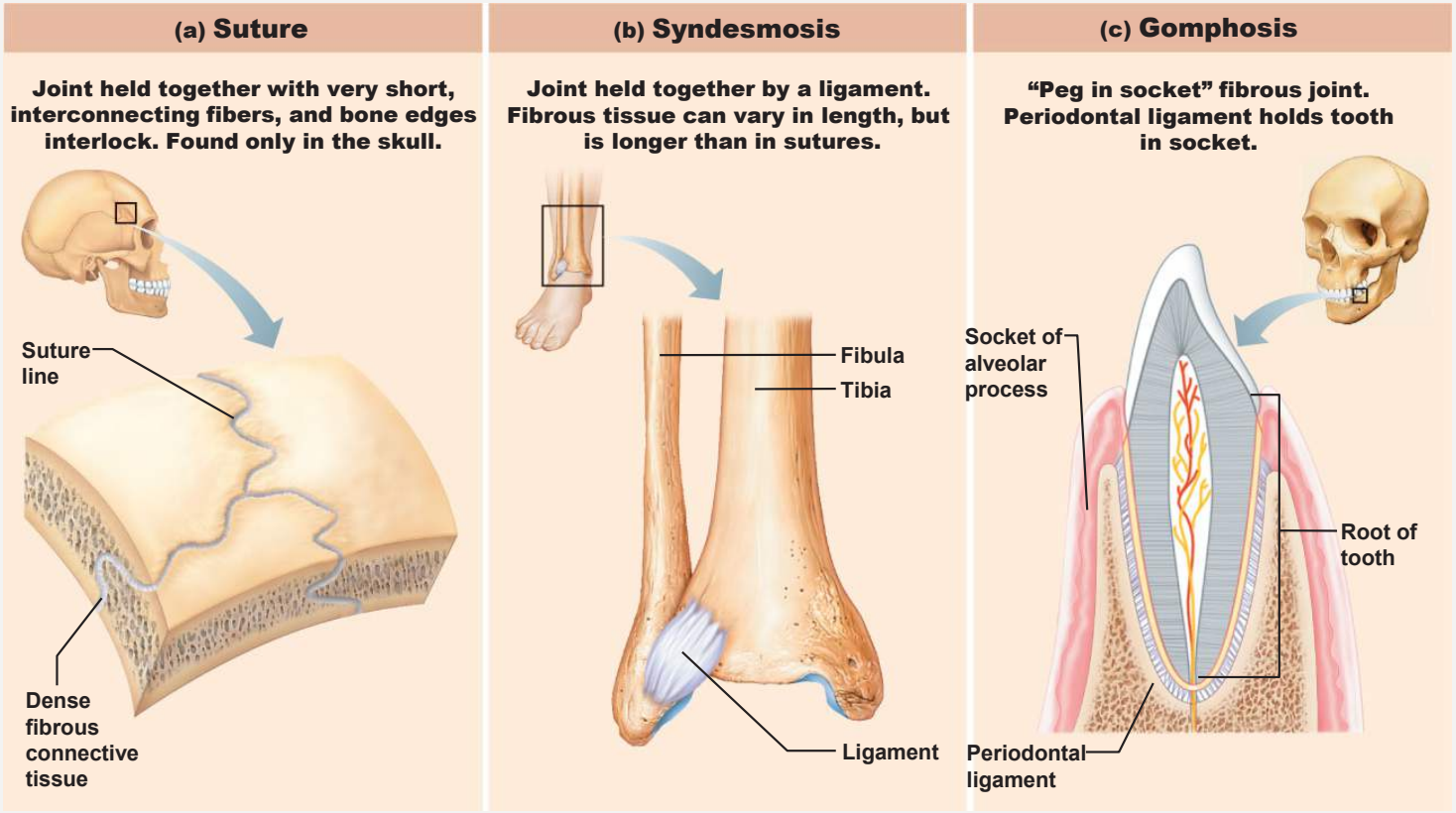


FIGURE 8.2 CARTILAGINOUS JOINTS.

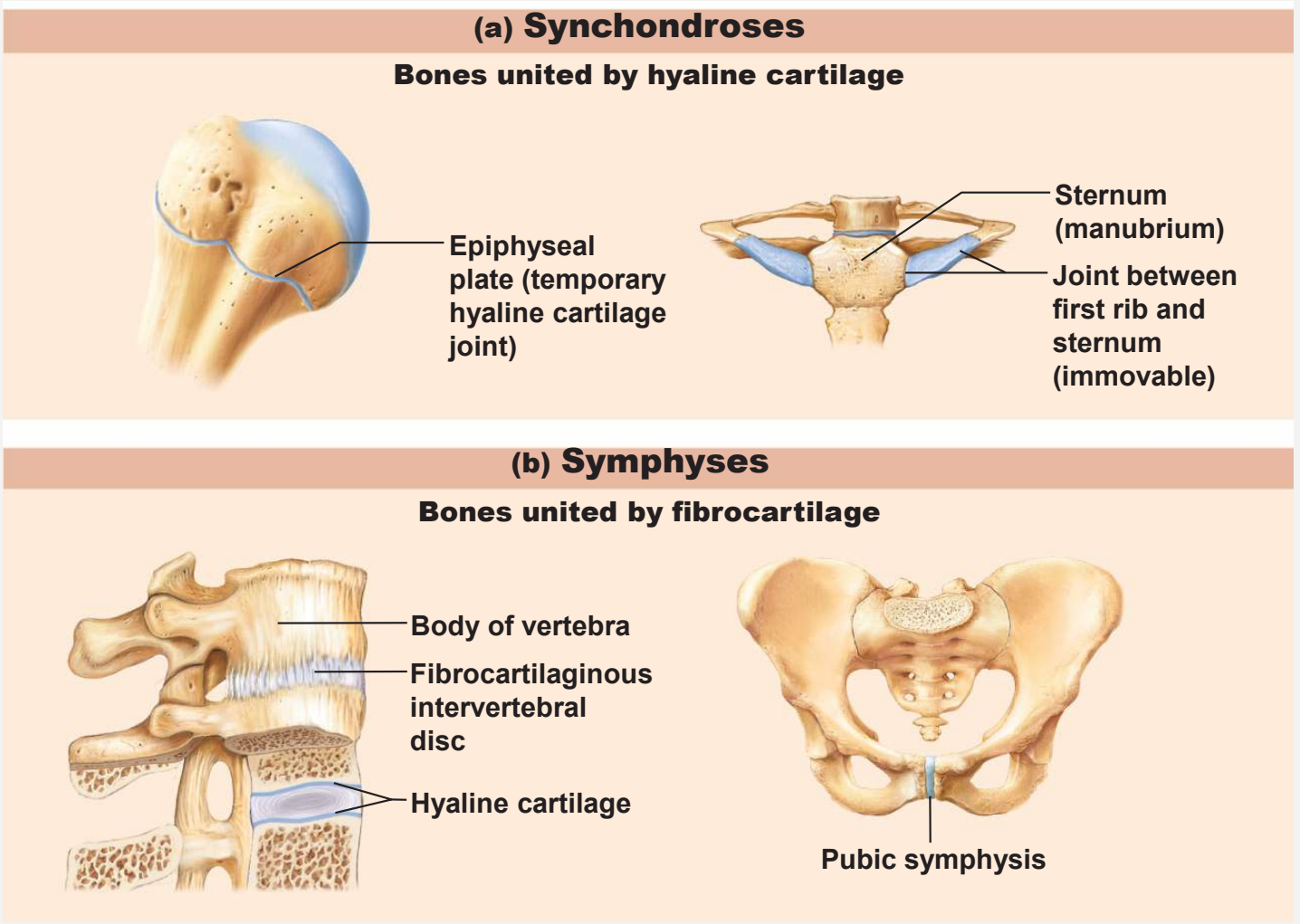


FIGURE 8.3 GENERAL STRUCTURE OF A SYNOVIAL JOINT.

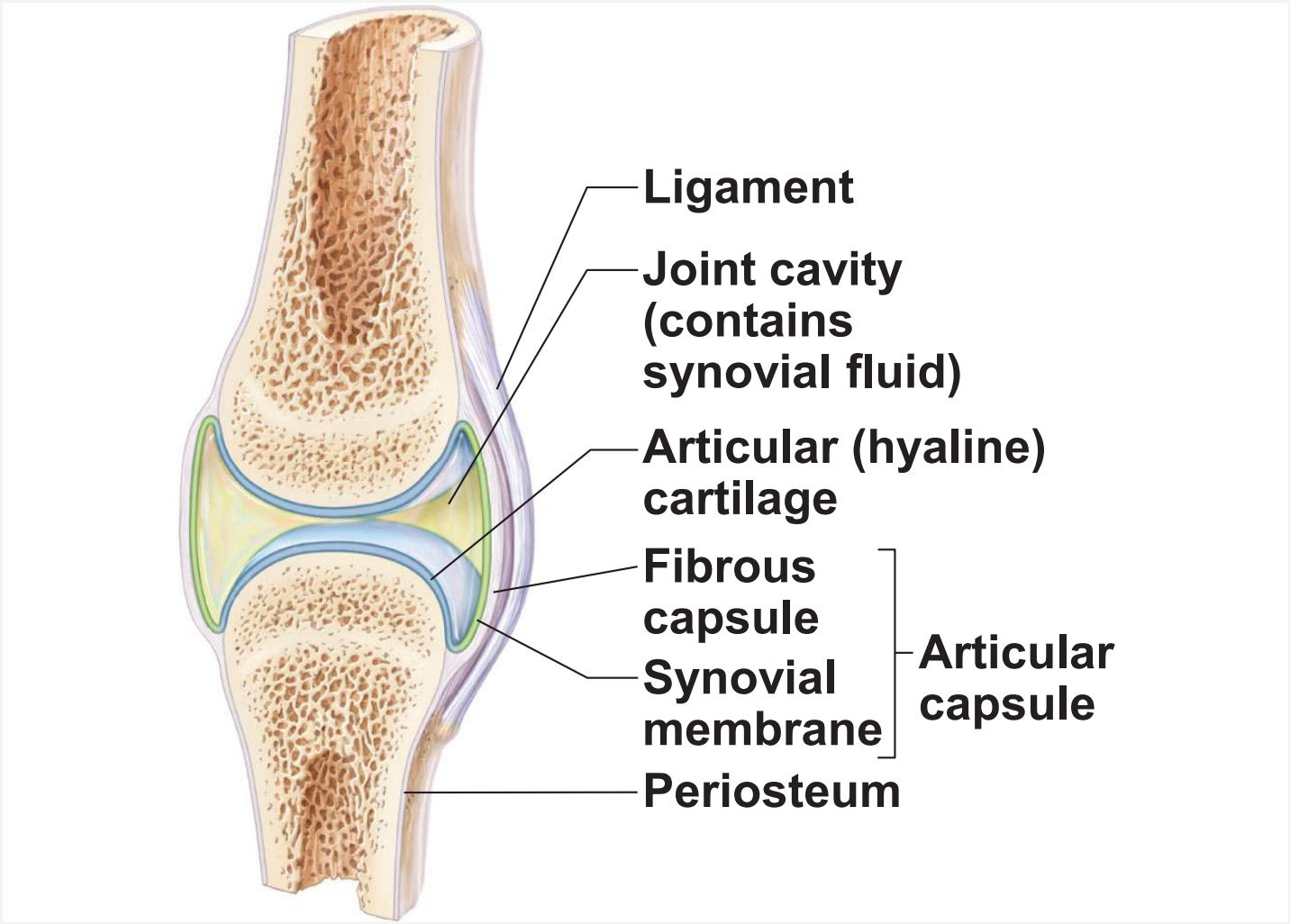
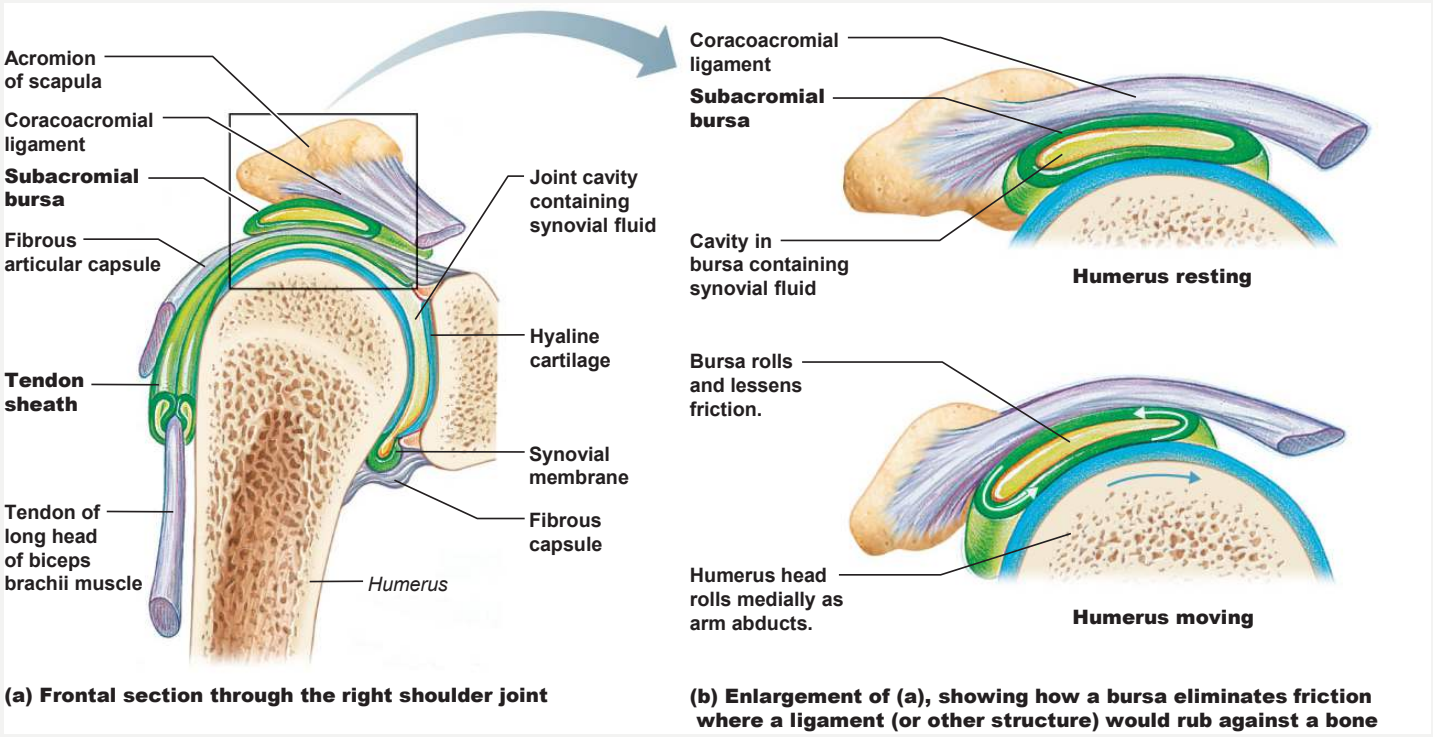


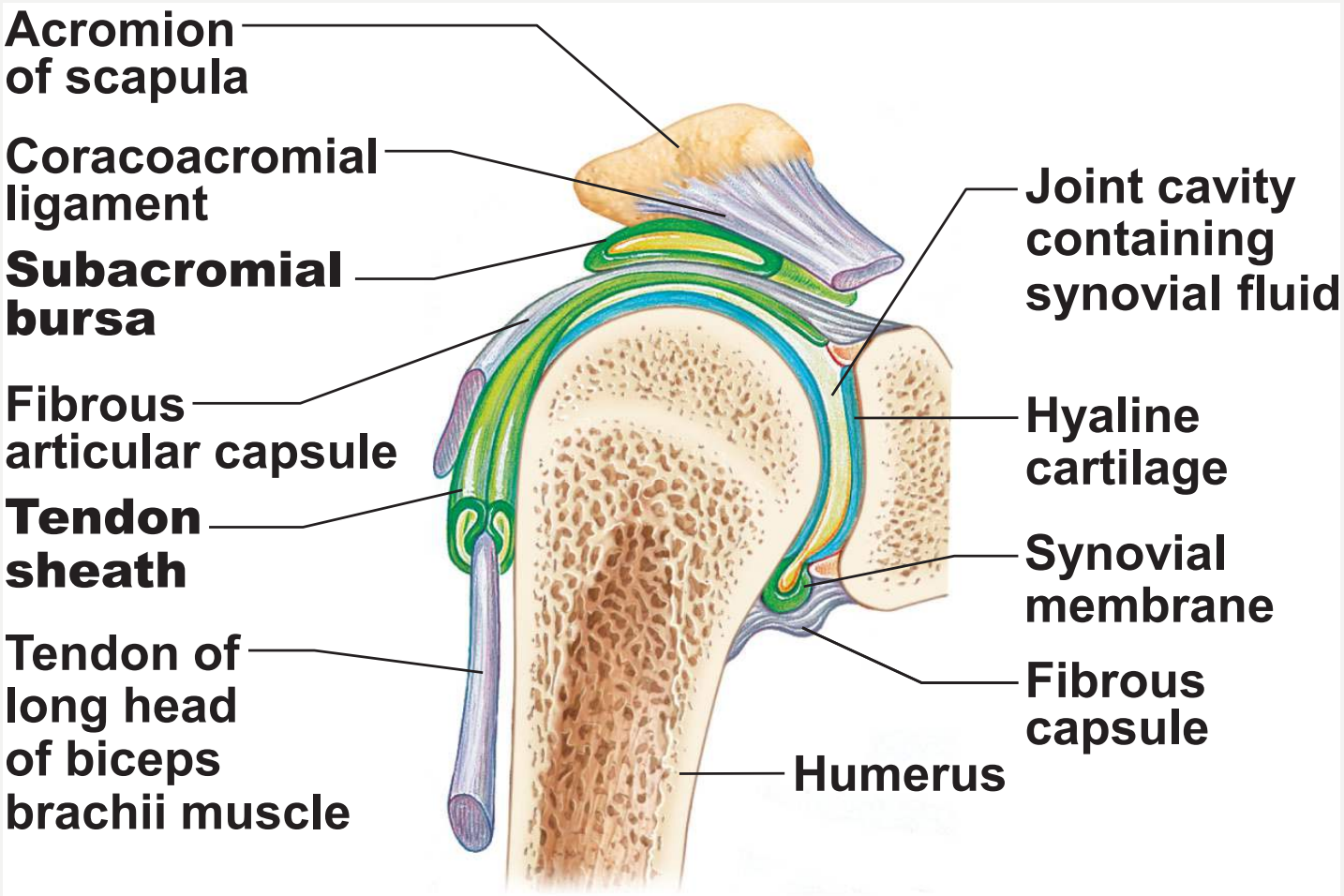
FIGURE 8.4 BURSAE AND TENDON SHEATHS.



(a) Frontal section through the right shoulder joint

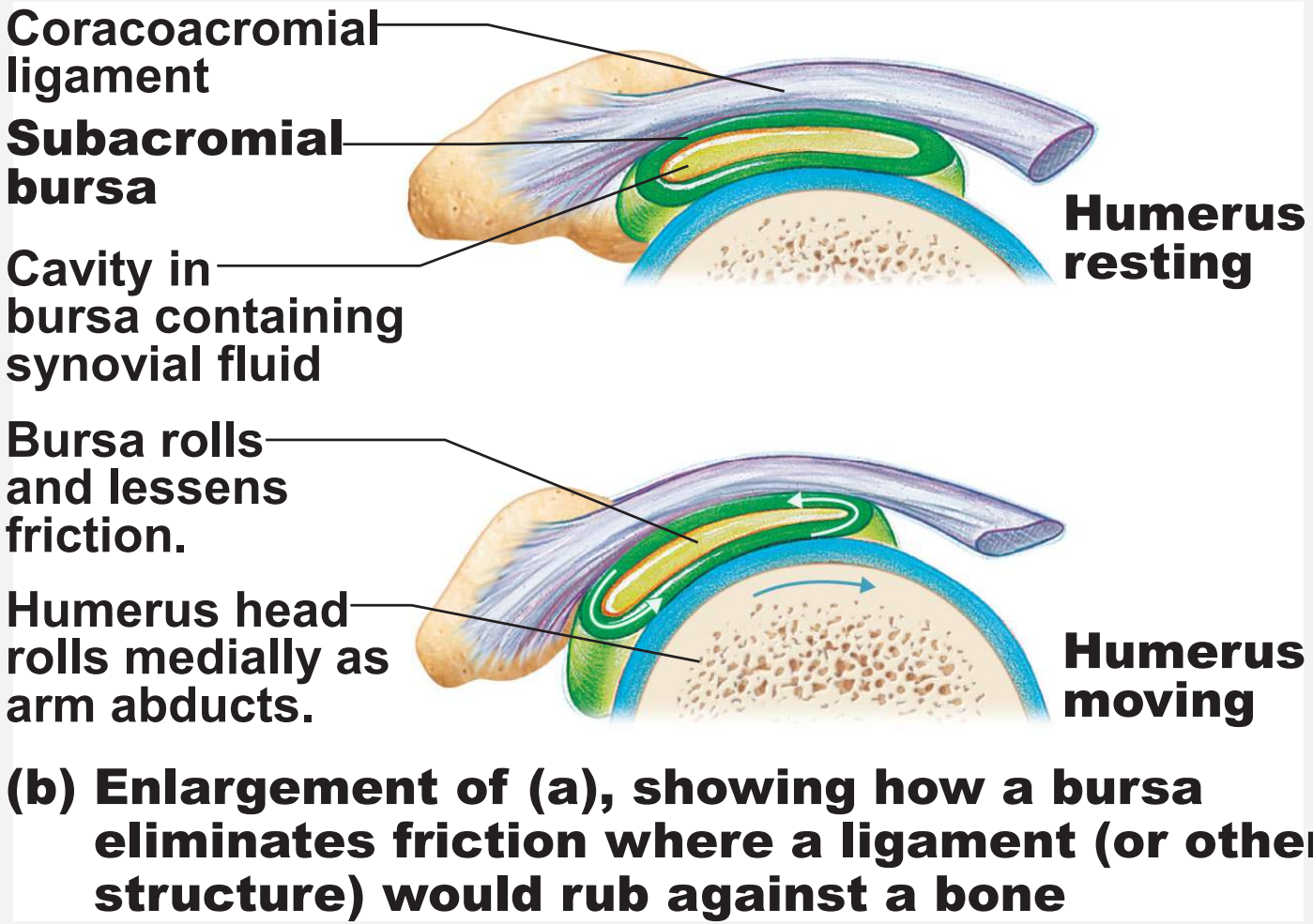
(b) Enlargement of (a), showing how a bursa eliminates friction where a ligament (or other structure) would rub against a bone

FIGURE 8.4A BURSAE AND TENDON SHEATHS.



(a) Frontal section through the right shoulder joint

FIGURE 8.4B BURSAE AND TENDON SHEATHS.



(b) Enlargement of (a), showing how a bursa eliminates friction where a ligament (or other structure) would rub against a bone

FIGURE 8.7A TYPES OF SYNOVIAL JOINTS.

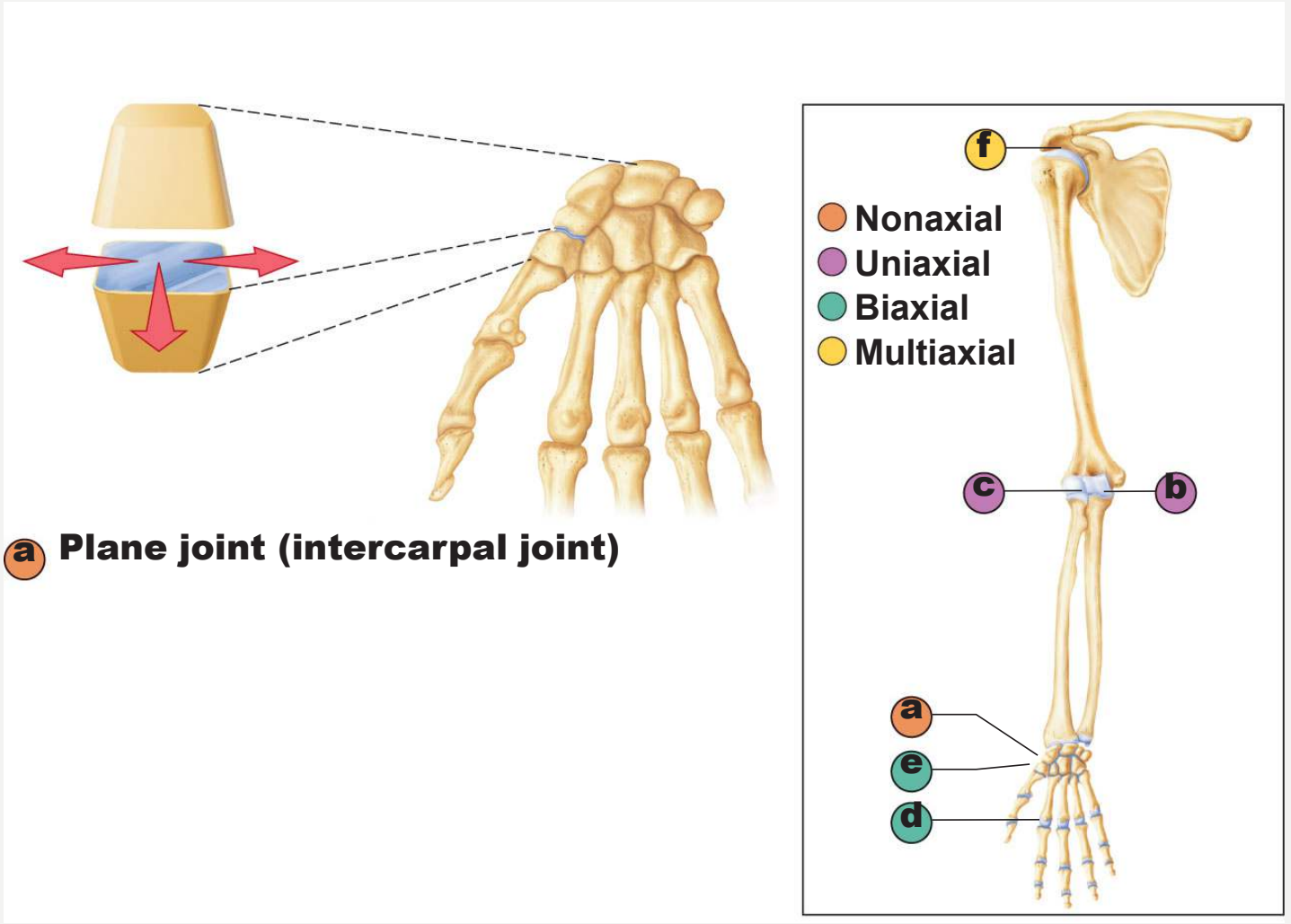


FIGURE 8.7B TYPES OF SYNOVIAL JOINTS.

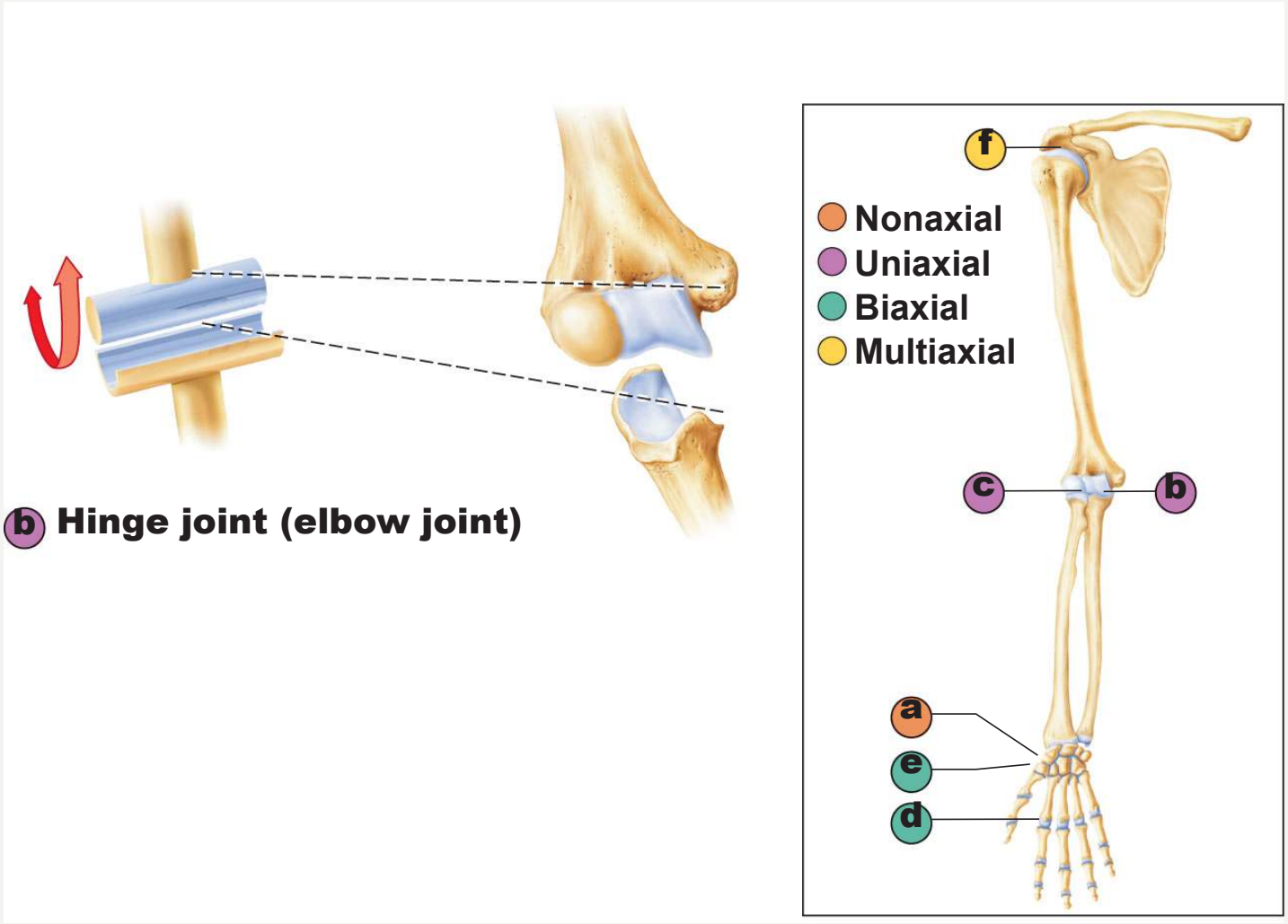


FIGURE 8.7C TYPES OF SYNOVIAL JOINTS.

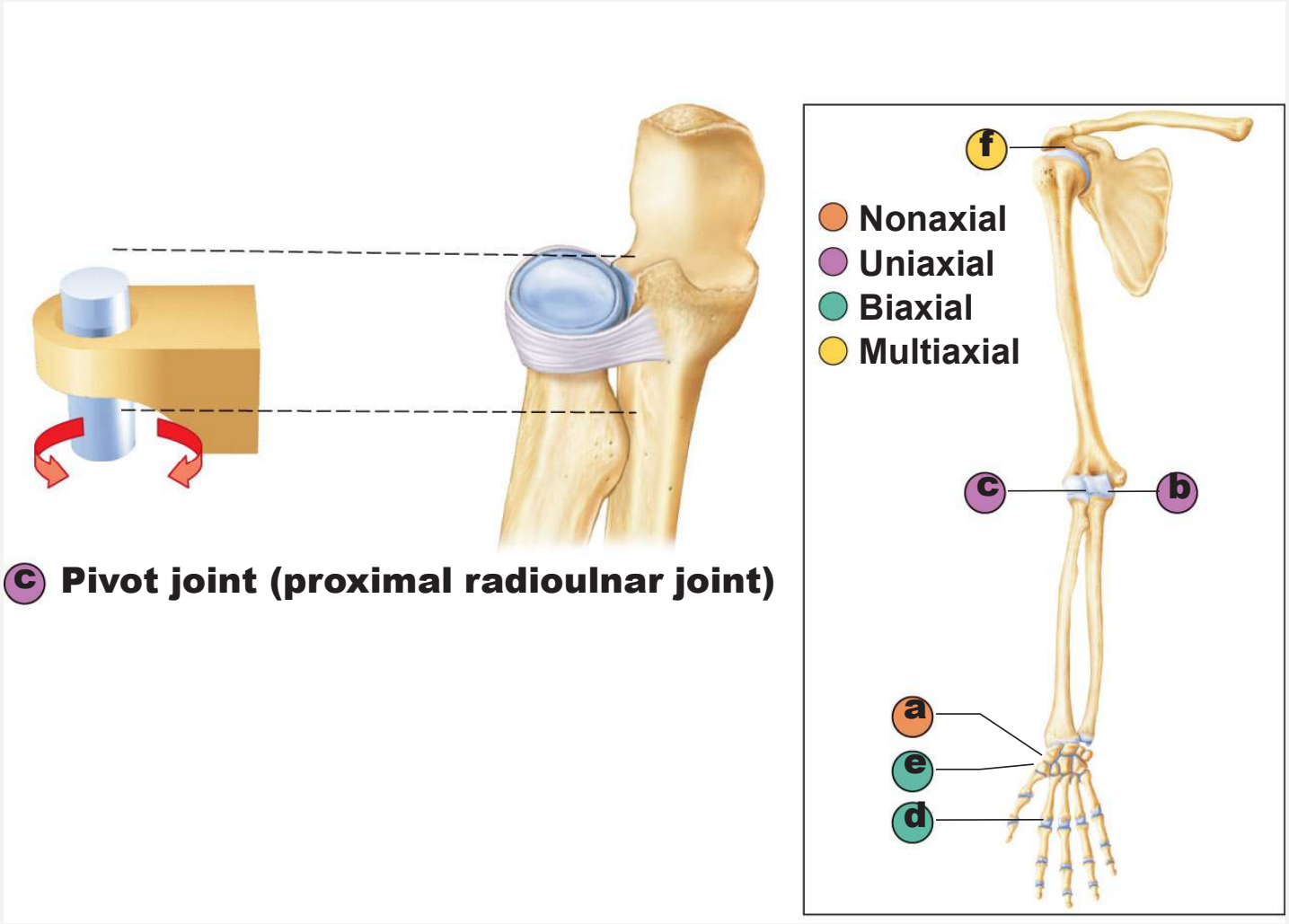


FIGURE 8.7D TYPES OF SYNOVIAL JOINTS.

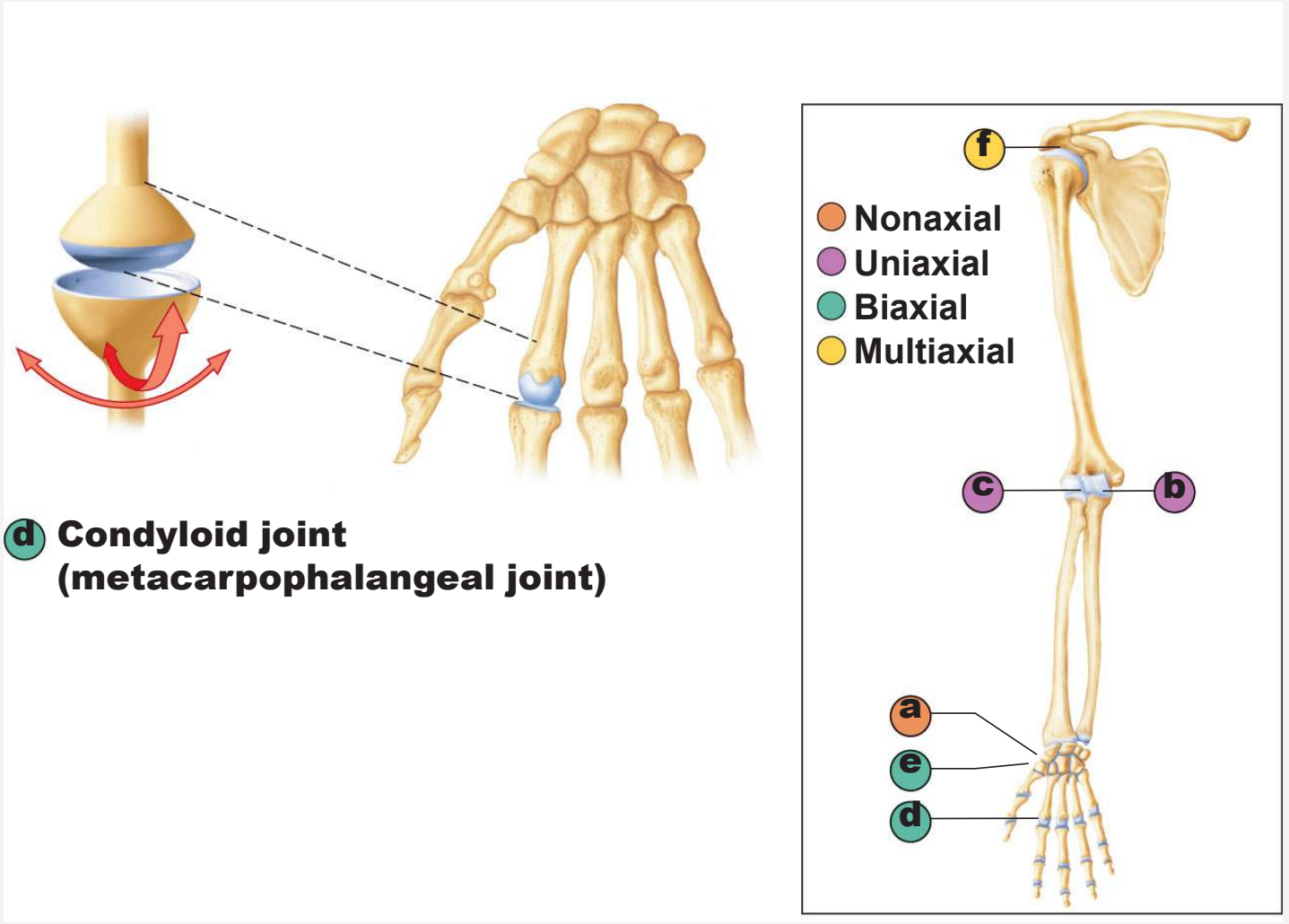


FIGURE 8.7E TYPES OF SYNOVIAL JOINTS.

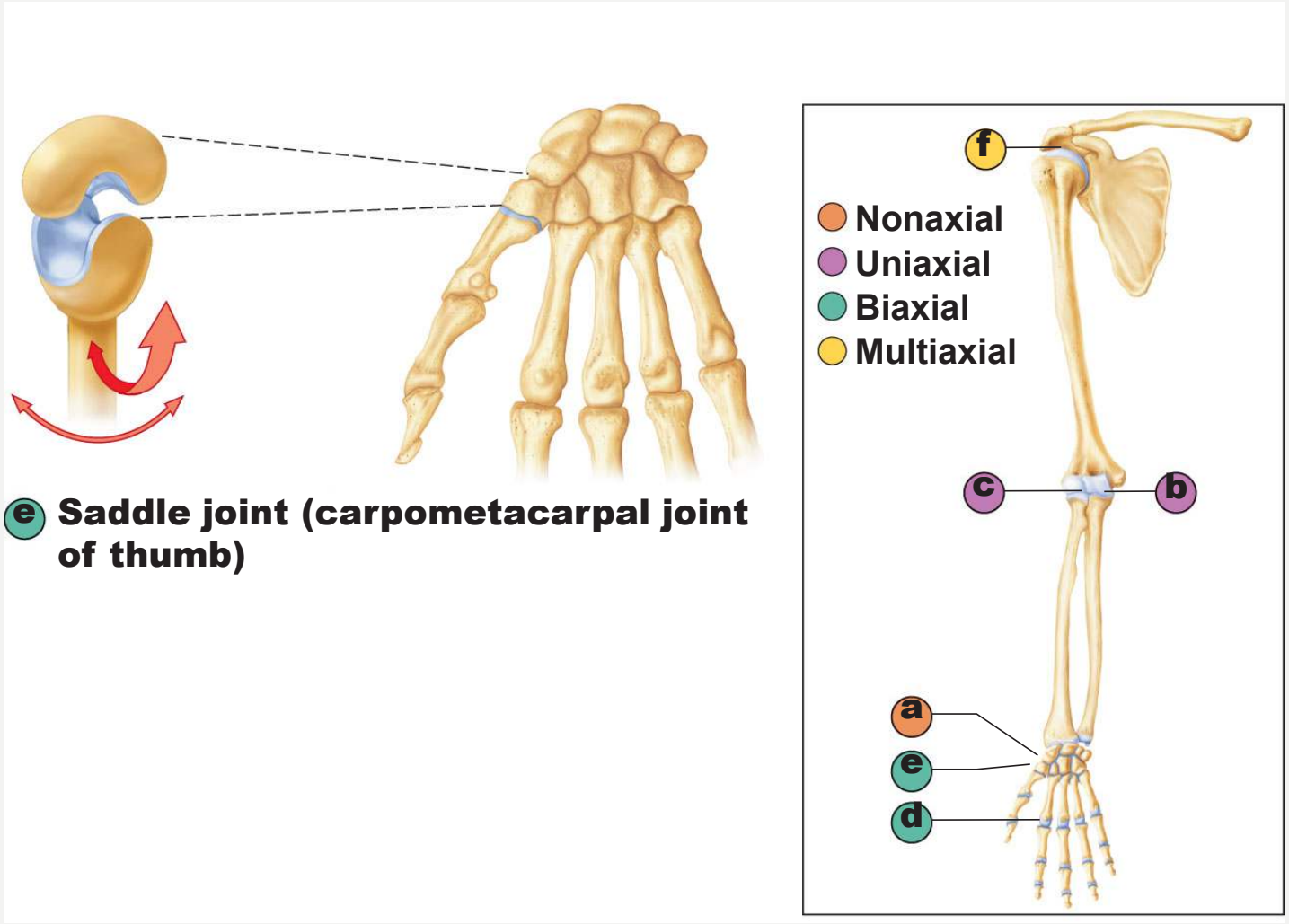


FIGURE 8.7F TYPES OF SYNOVIAL JOINTS.

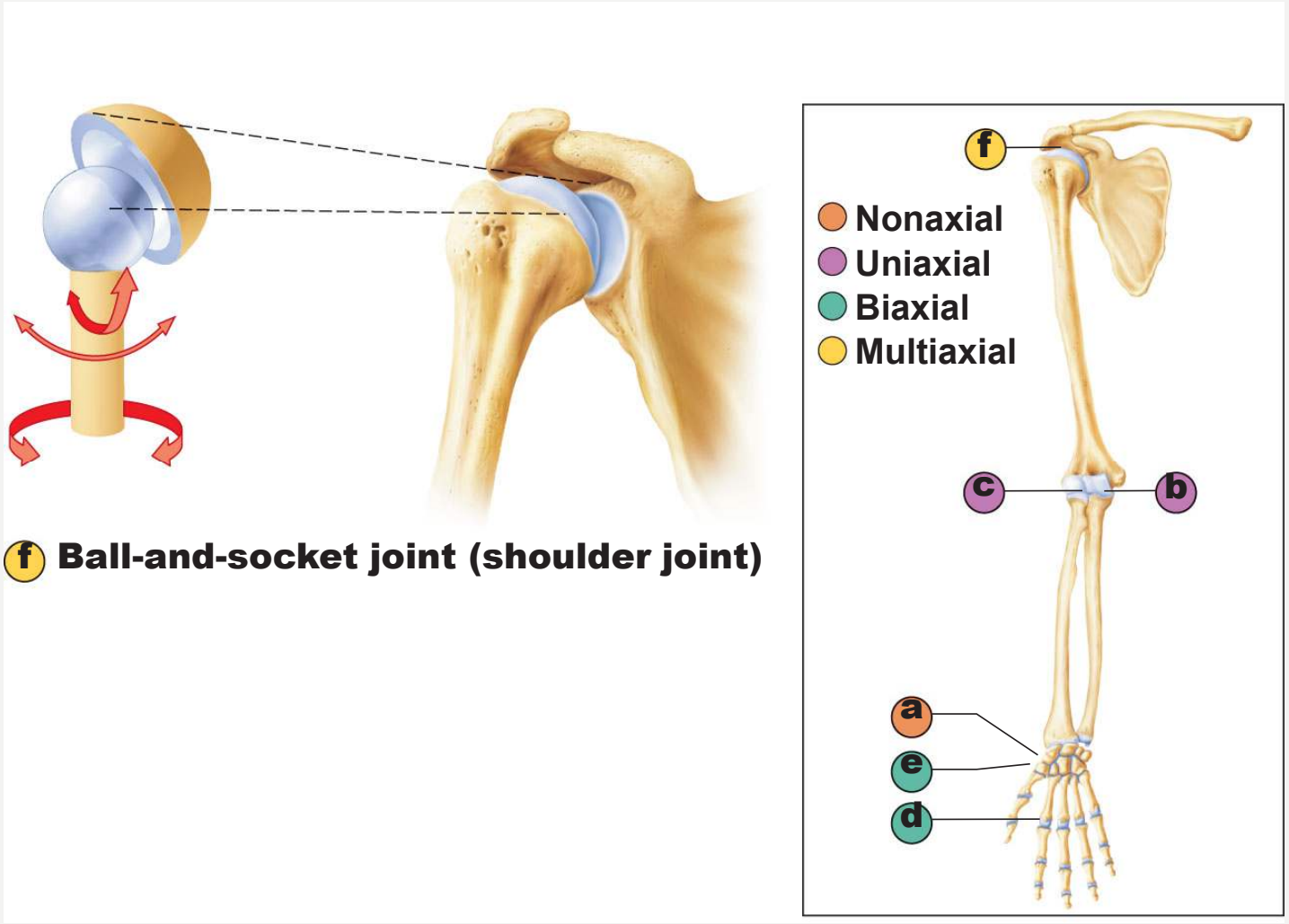
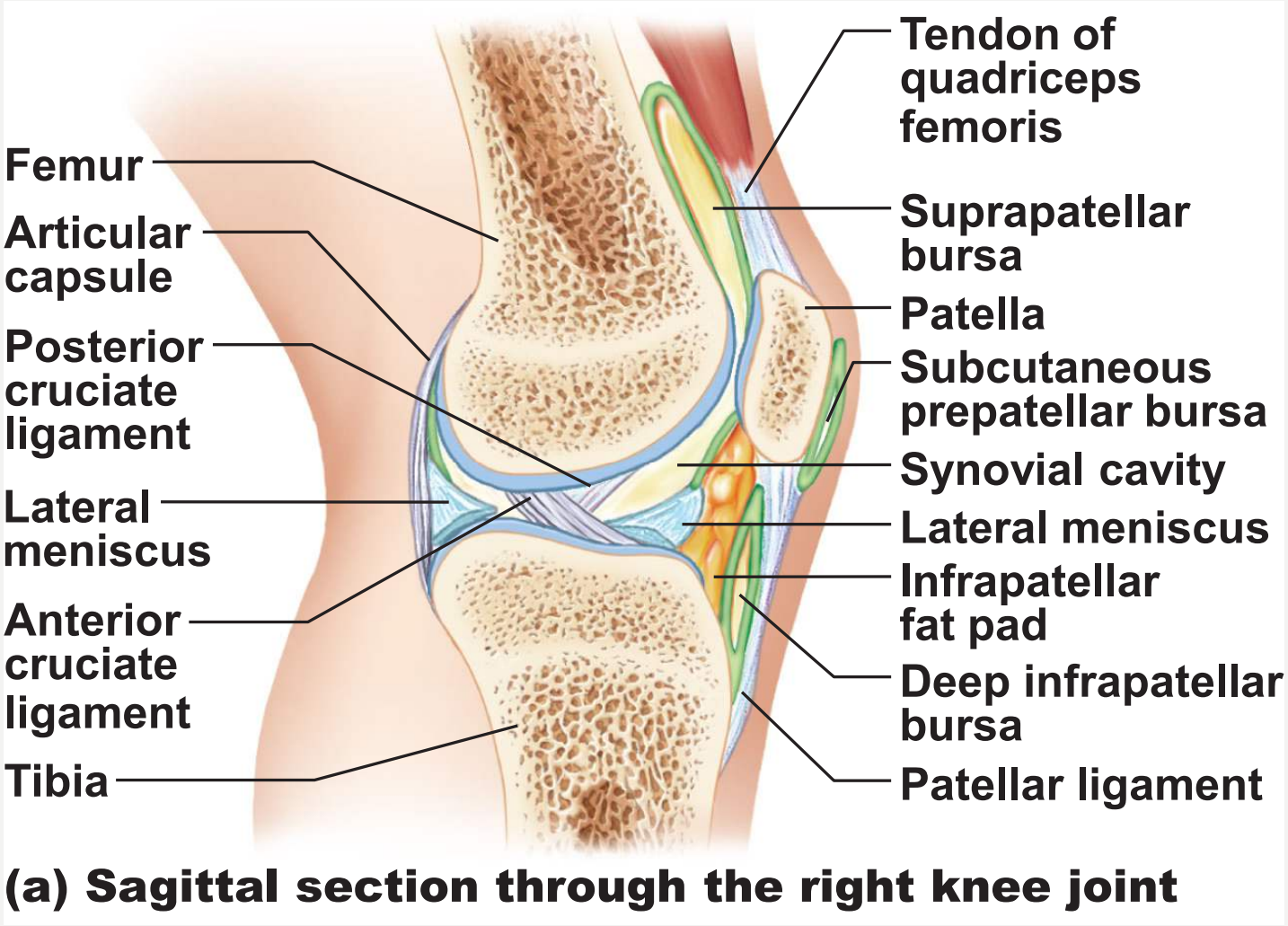
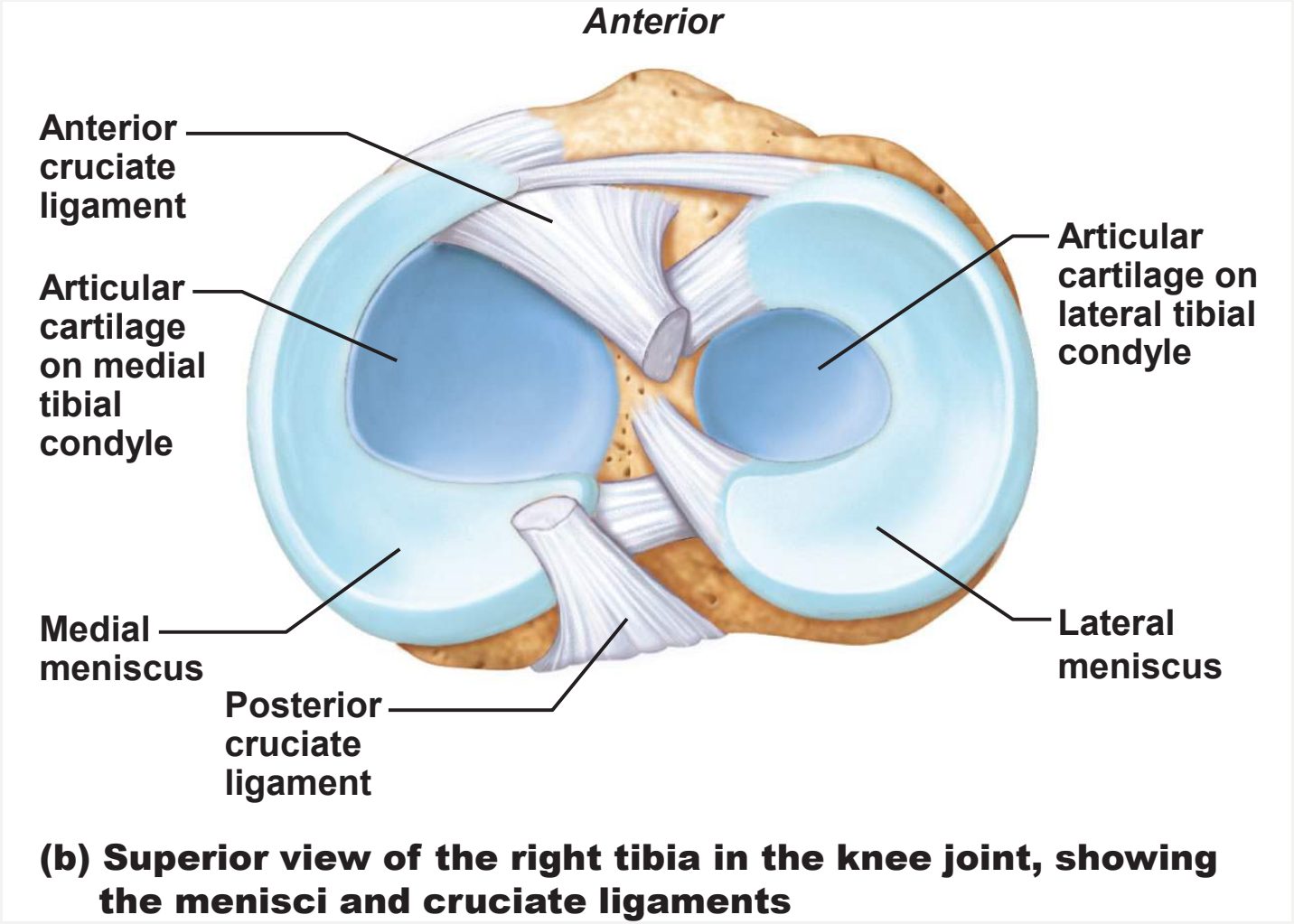


FIGURE 8.8A THE KNEE JOINT.



(a) Sagittal section through the right knee joint

FIGURE 8.8B THE KNEE JOINT.



(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments

FIGURE 8.8C THE KNEE JOINT.

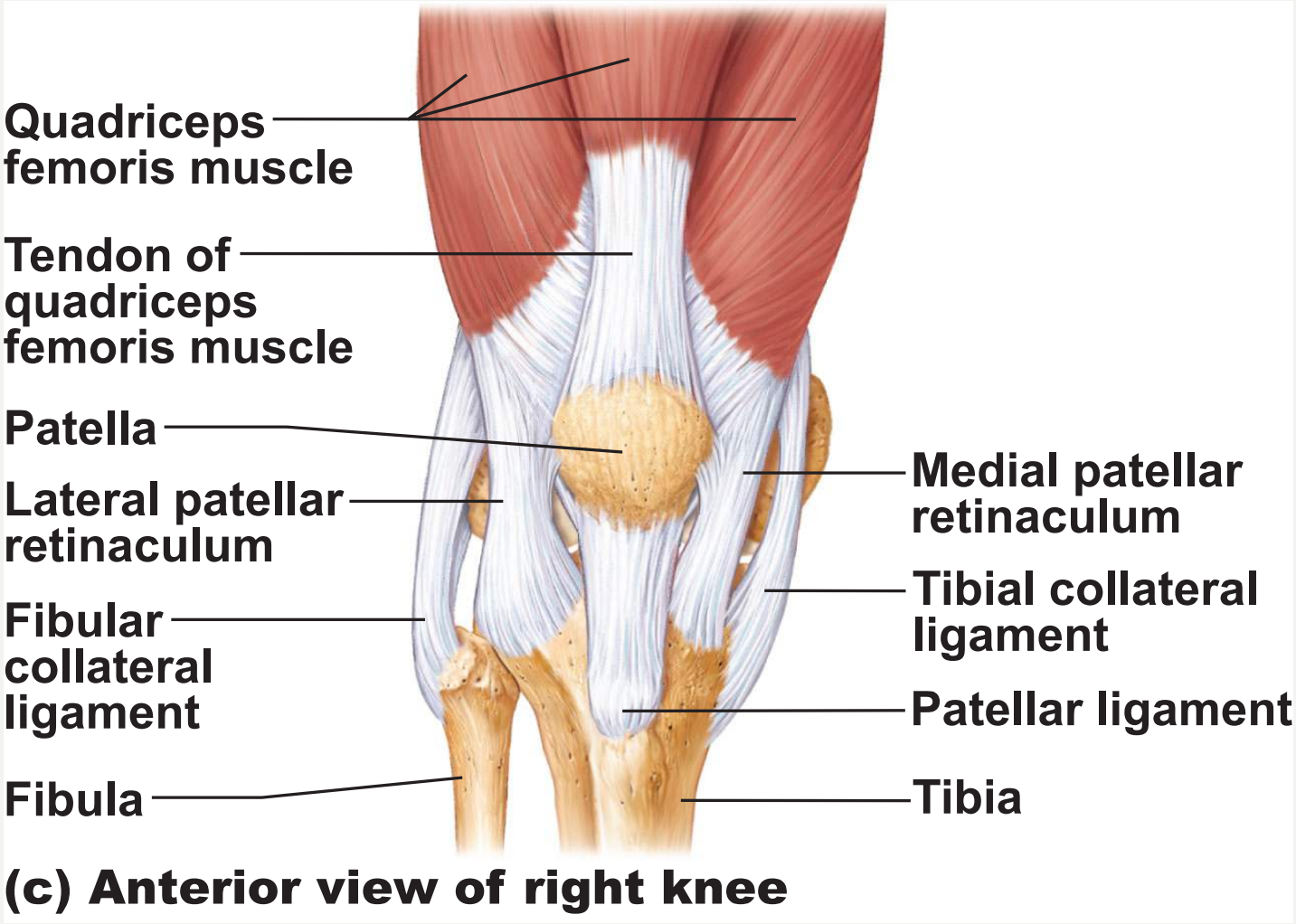
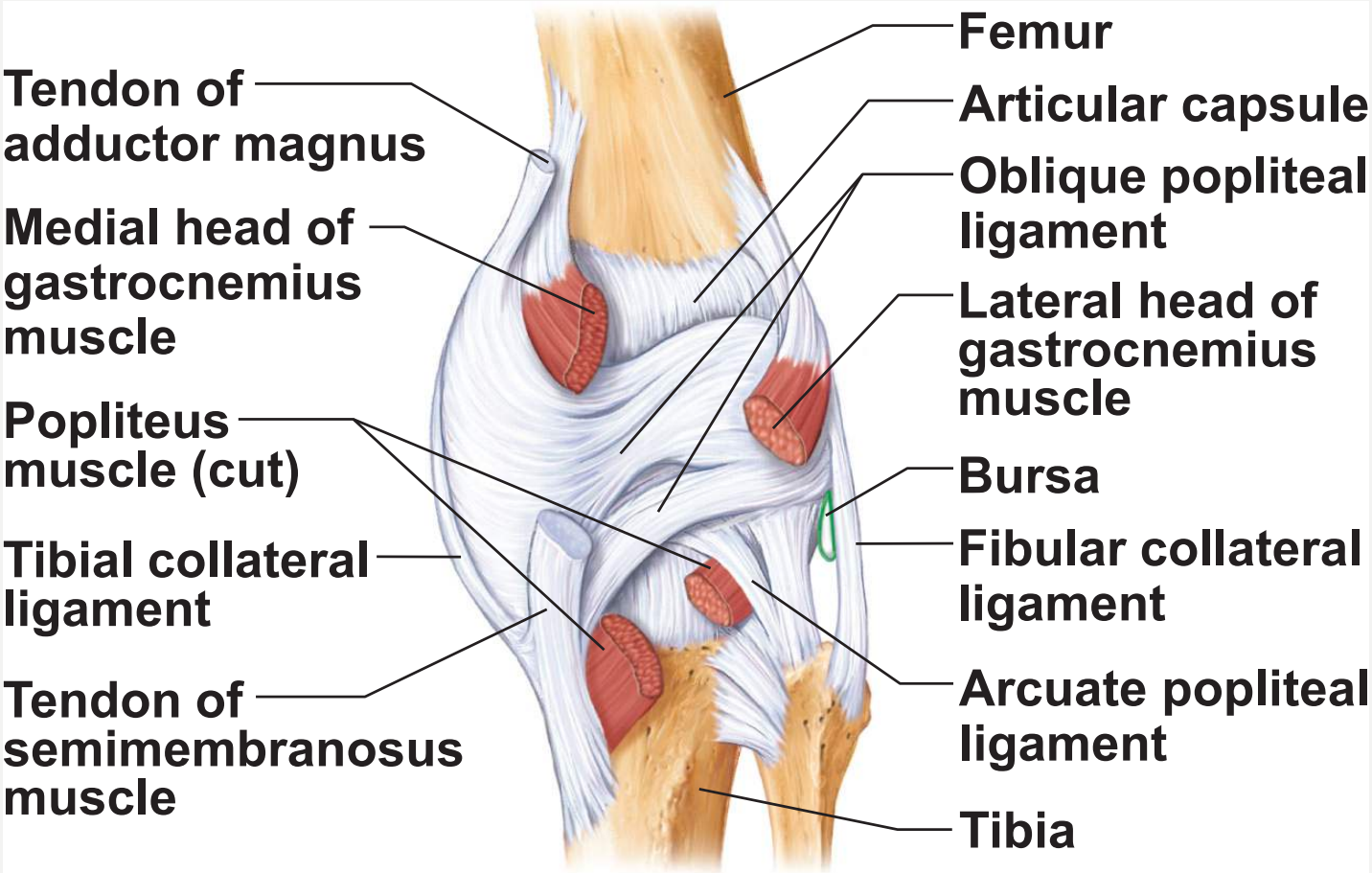
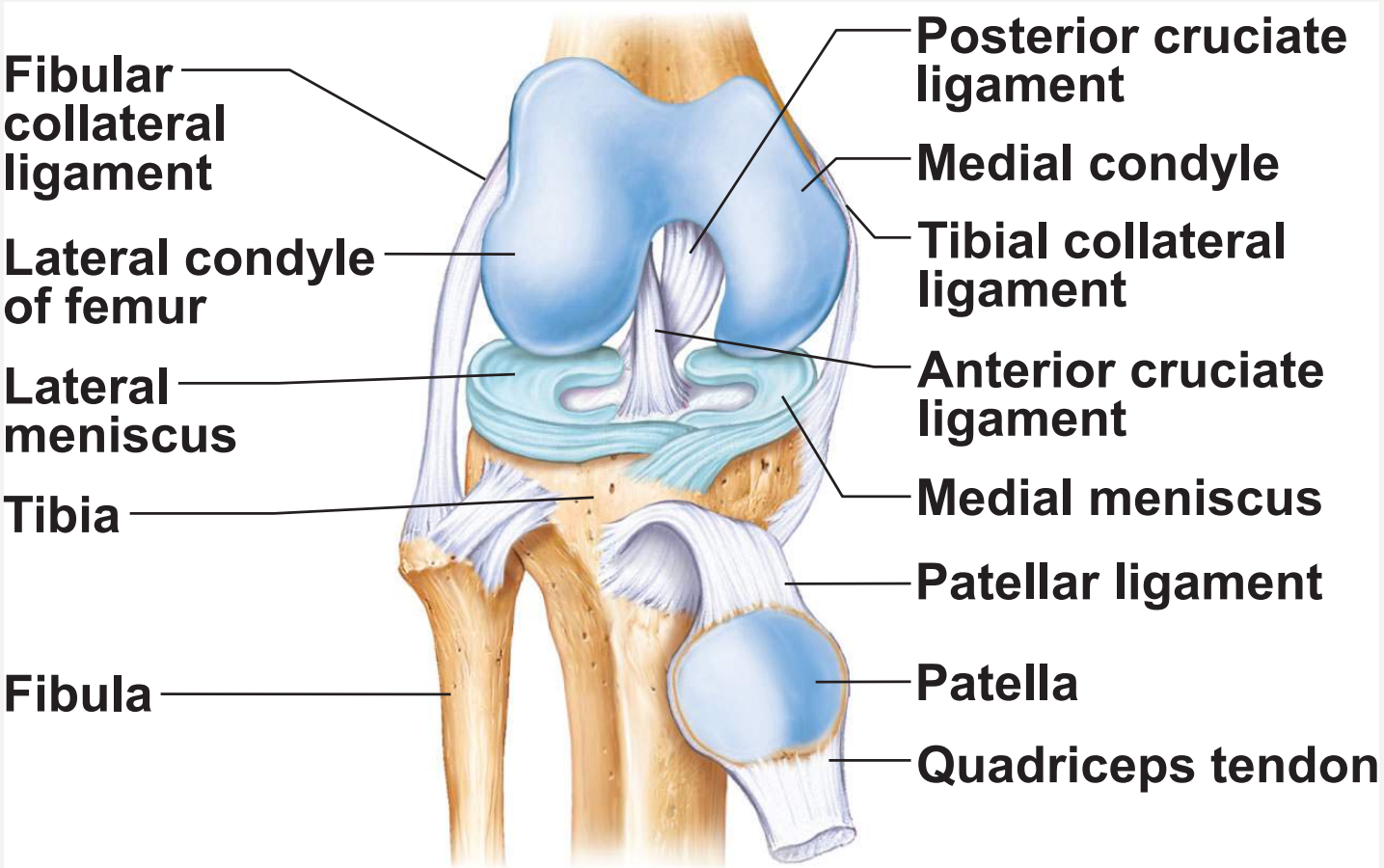


FIGURE 8.8D THE KNEE JOINT.



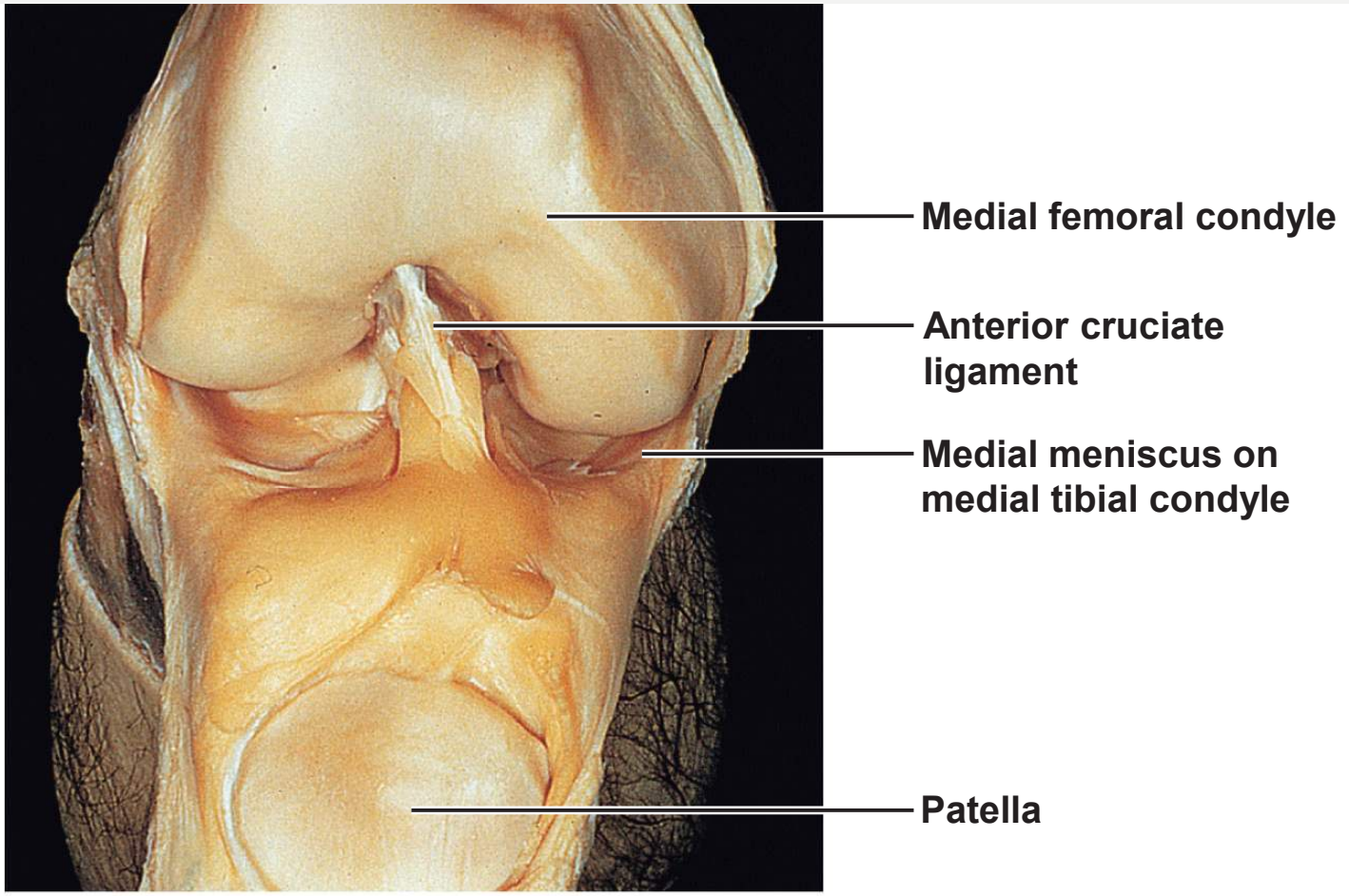
(d) Posterior view of the joint capsule, including ligaments

FIGURE 8.8E THE KNEE JOINT.



(e) Anterior view of flexed knee, showing the cruciate ligaments (articular capsule removed, and quadriceps tendon cut and reflected distally)

FIGURE 8.8F THE KNEE JOINT.



(f) Photograph of an opened knee joint; view similar to (e)

FIGURE 8.9 A COMMON KNEE INJURY.

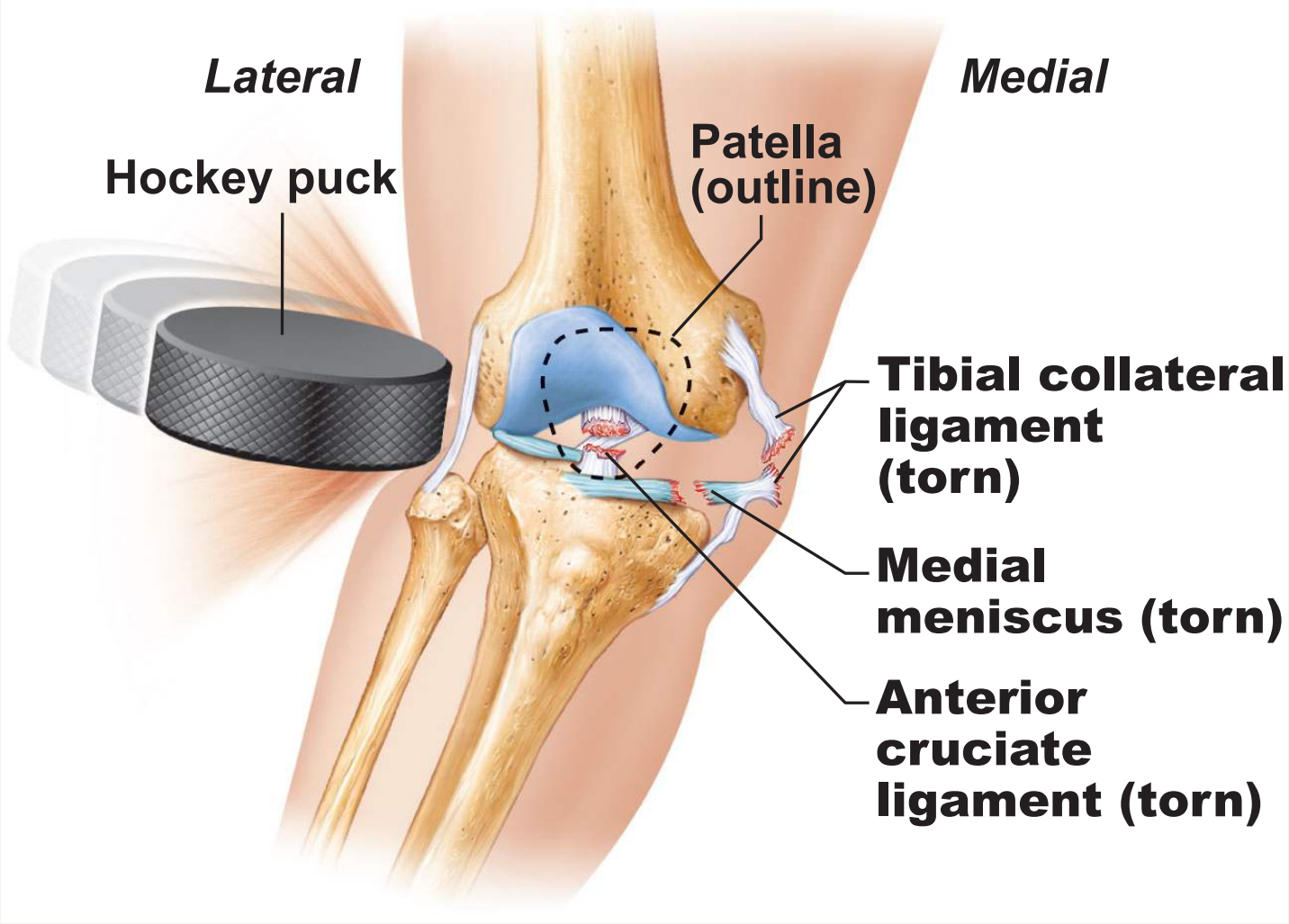
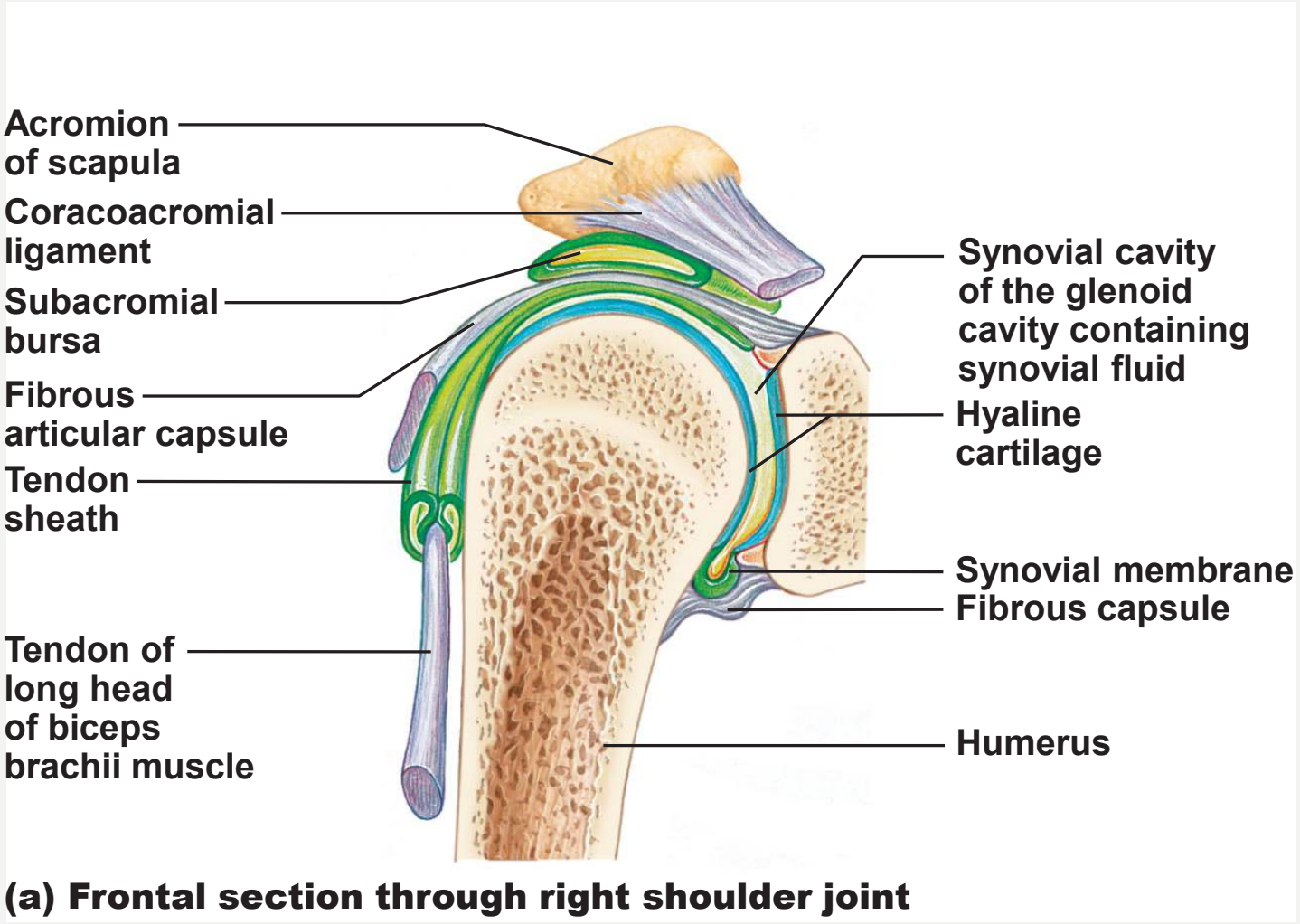
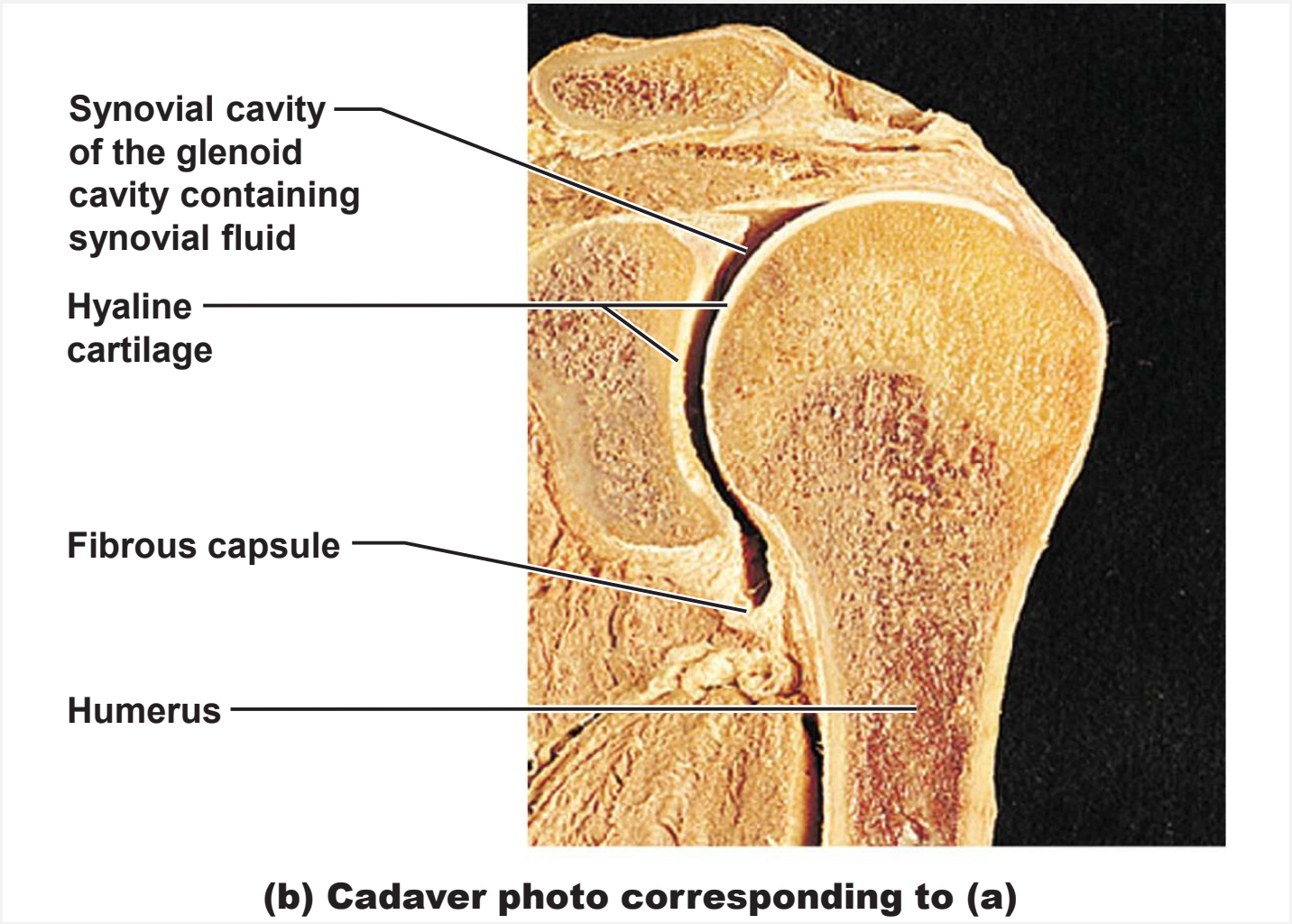


FIGURE 8.10A THE SHOULDER JOINT.



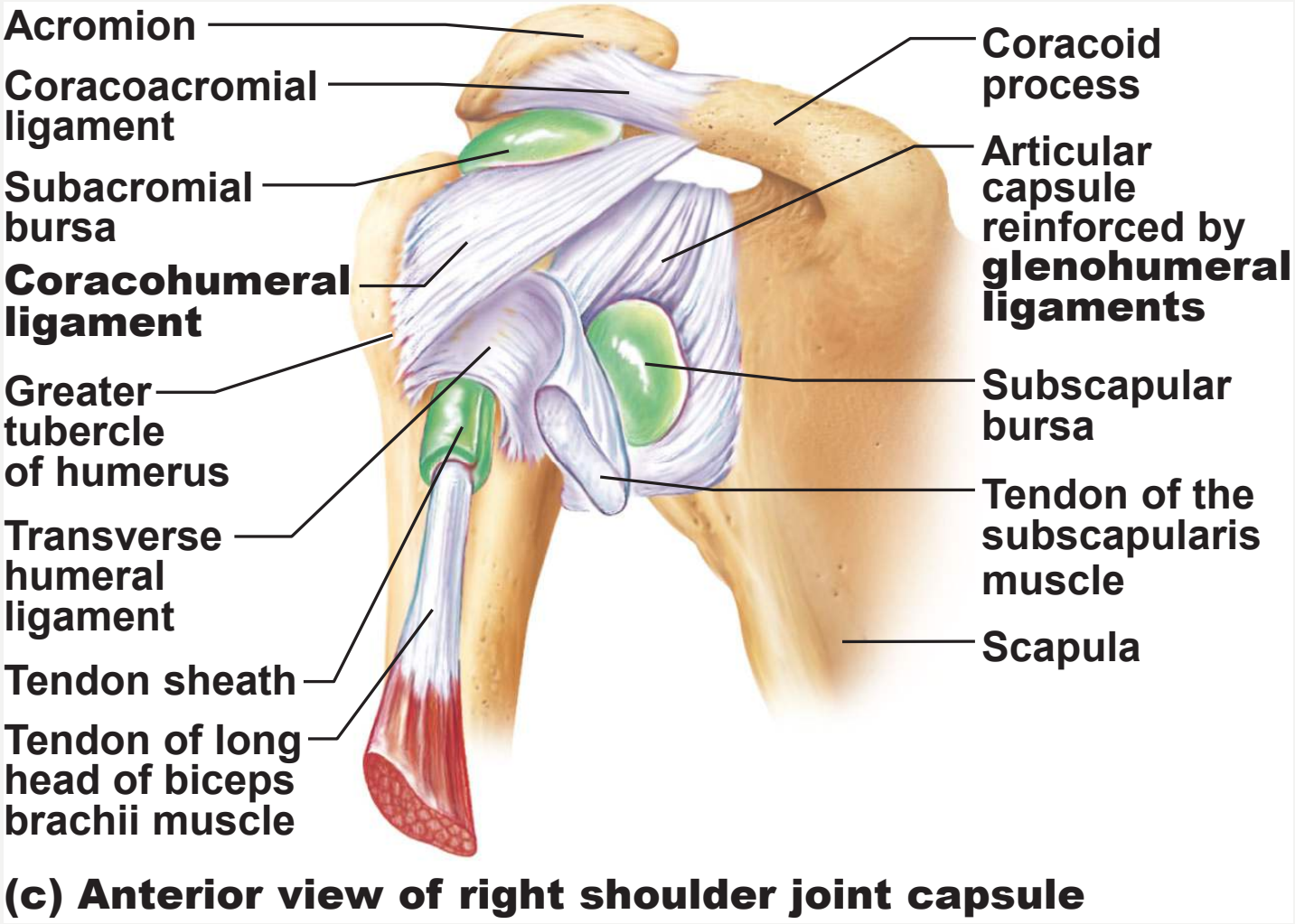
(a) Frontal section through right shoulder joint

FIGURE 8.10B THE SHOULDER JOINT.



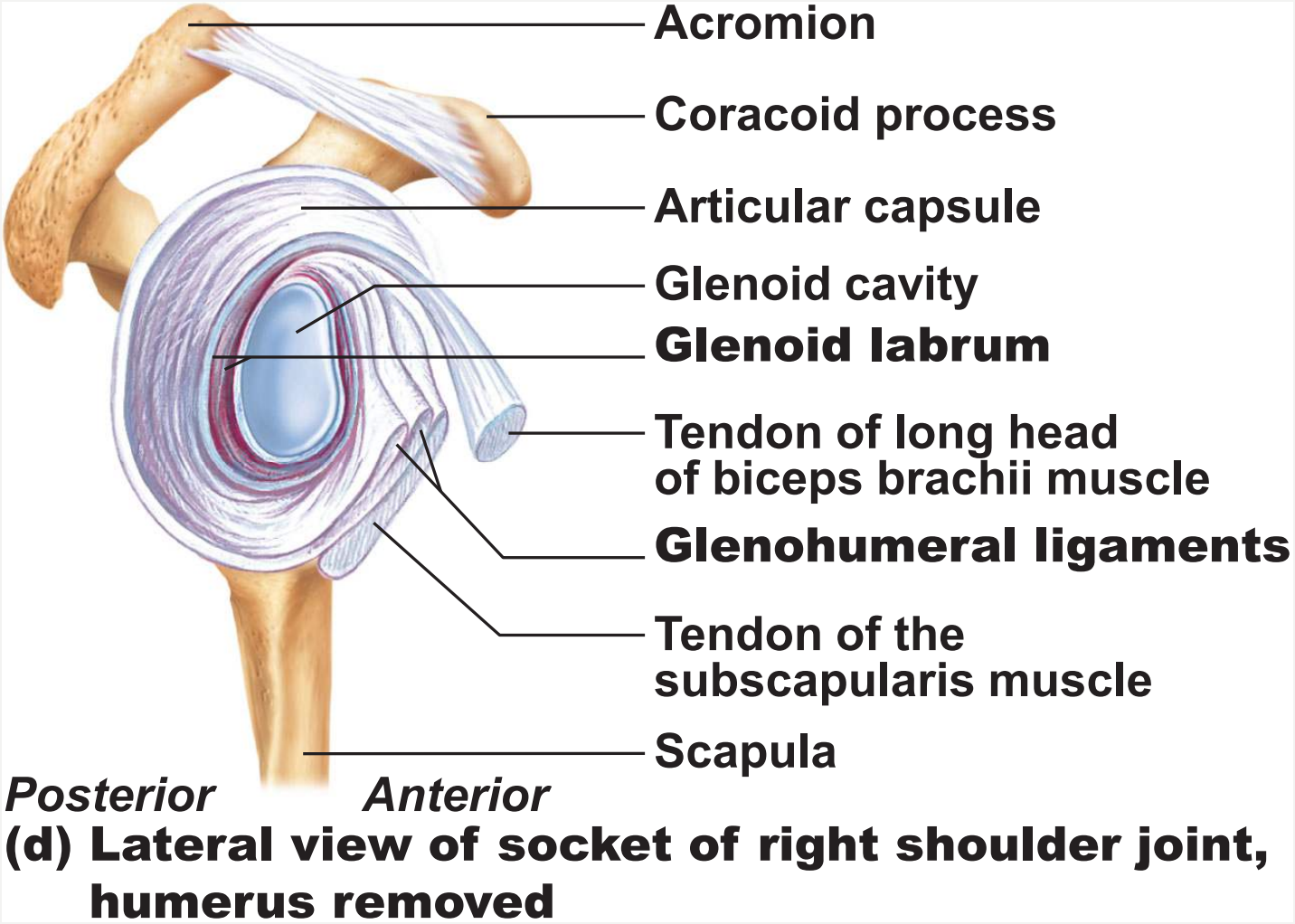
(b) Cadaver photo corresponding to (a)

FIGURE 8.10C THE SHOULDER JOINT.



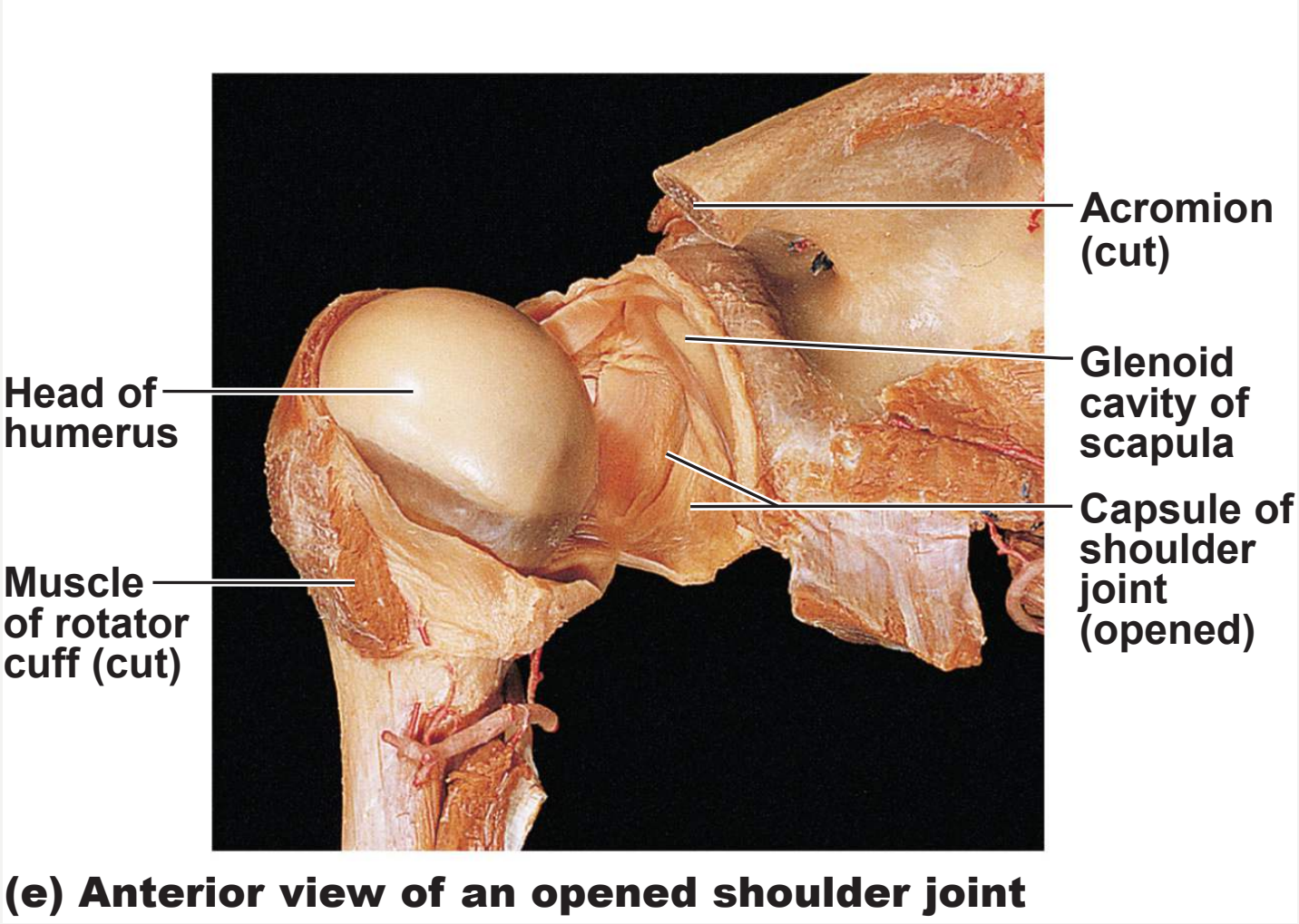
(c) Anterior view of right shoulder joint capsule

FIGURE 8.10D THE SHOULDER JOINT.



(d) Lateral view of socket of right shoulder joint, humerus removed

FIGURE 8.10E THE SHOULDER JOINT.



(e) Anterior view of an opened shoulder joint

FIGURE 8.11A THE ELBOW JOINT.

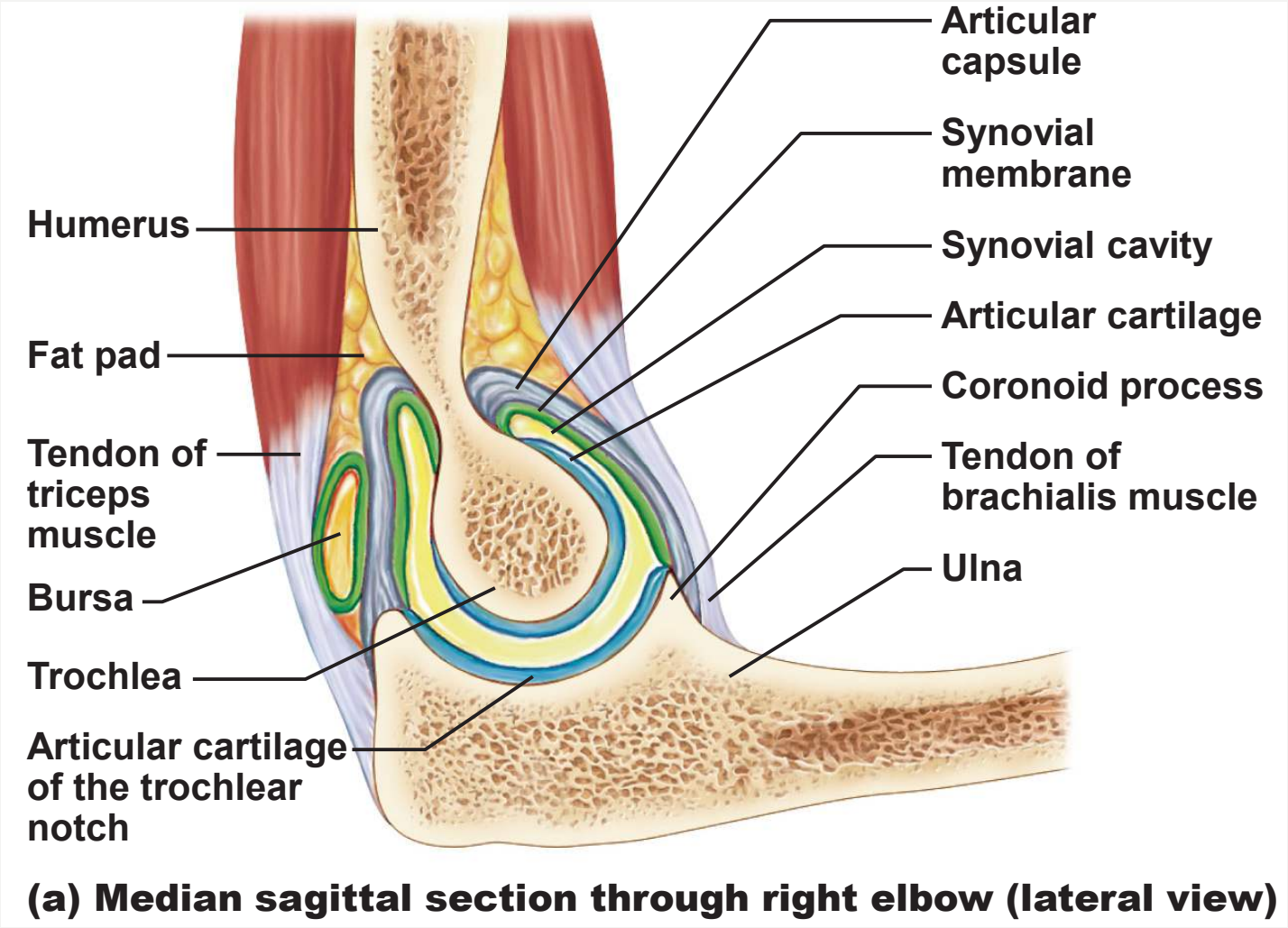


FIGURE 8.11B THE ELBOW JOINT.

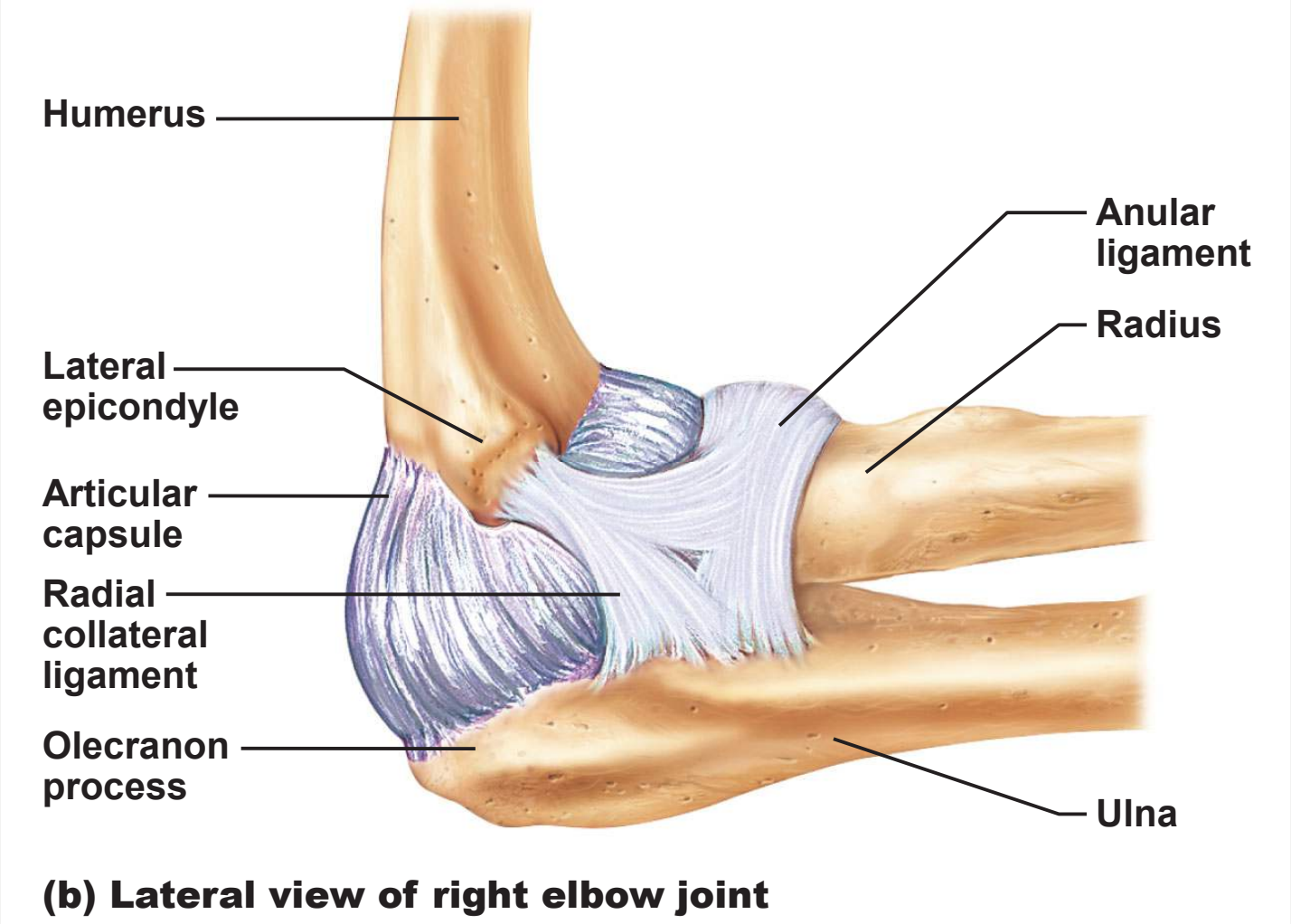


FIGURE 8.11C THE ELBOW JOINT.

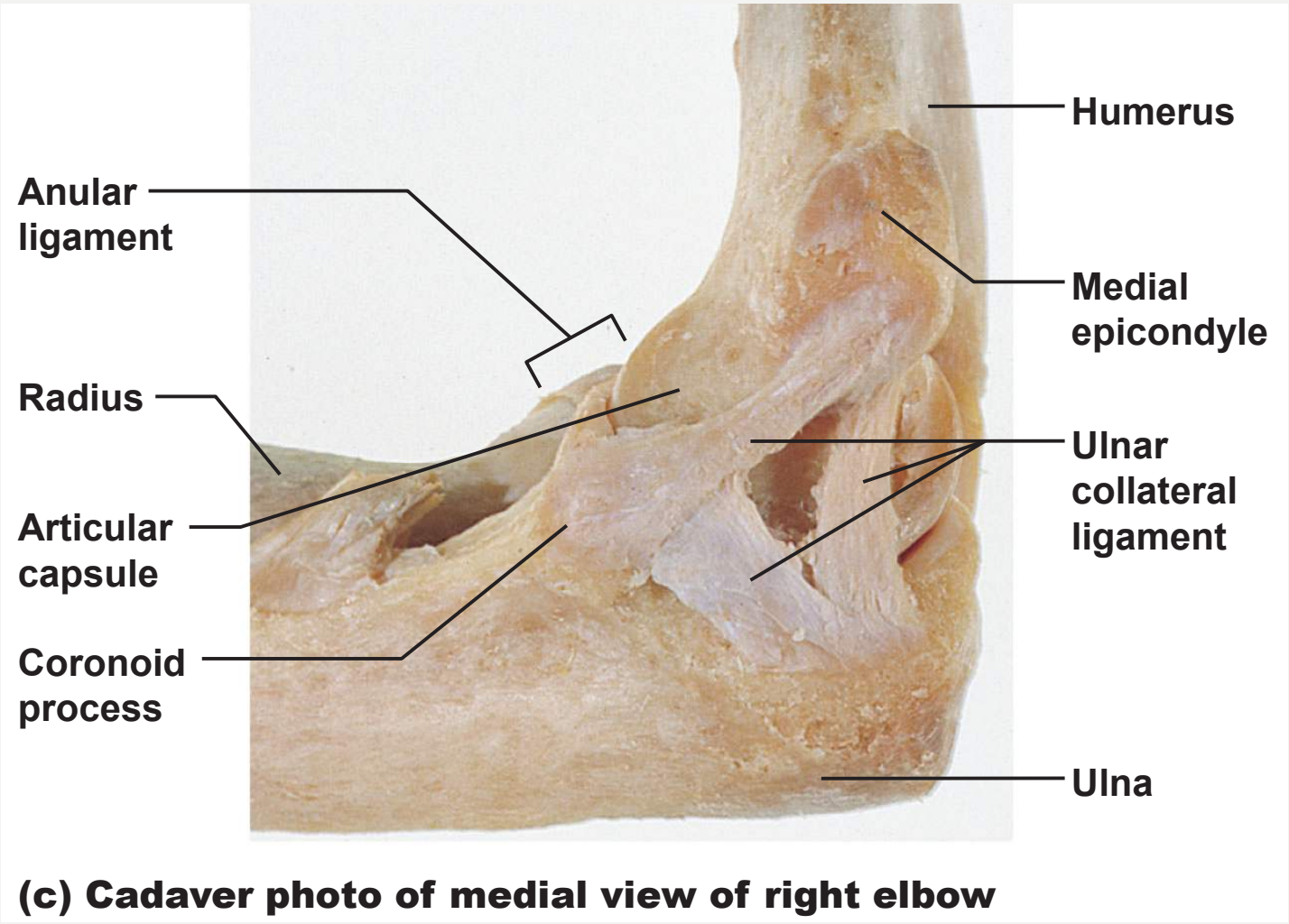
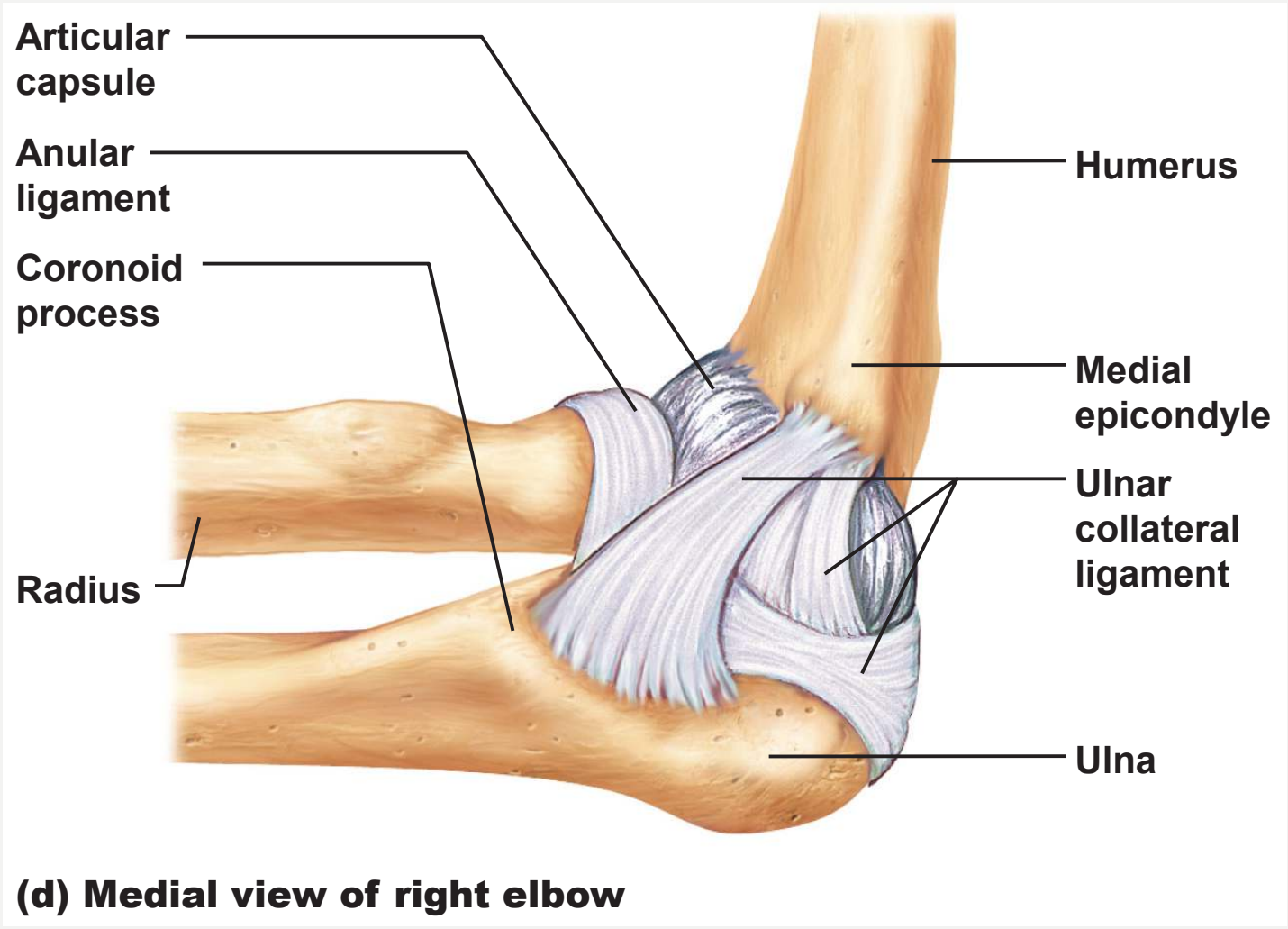


FIGURE 8.11D THE ELBOW JOINT.



(d) Medial view of right elbow

FIGURE 8.12A THE HIP JOINT.

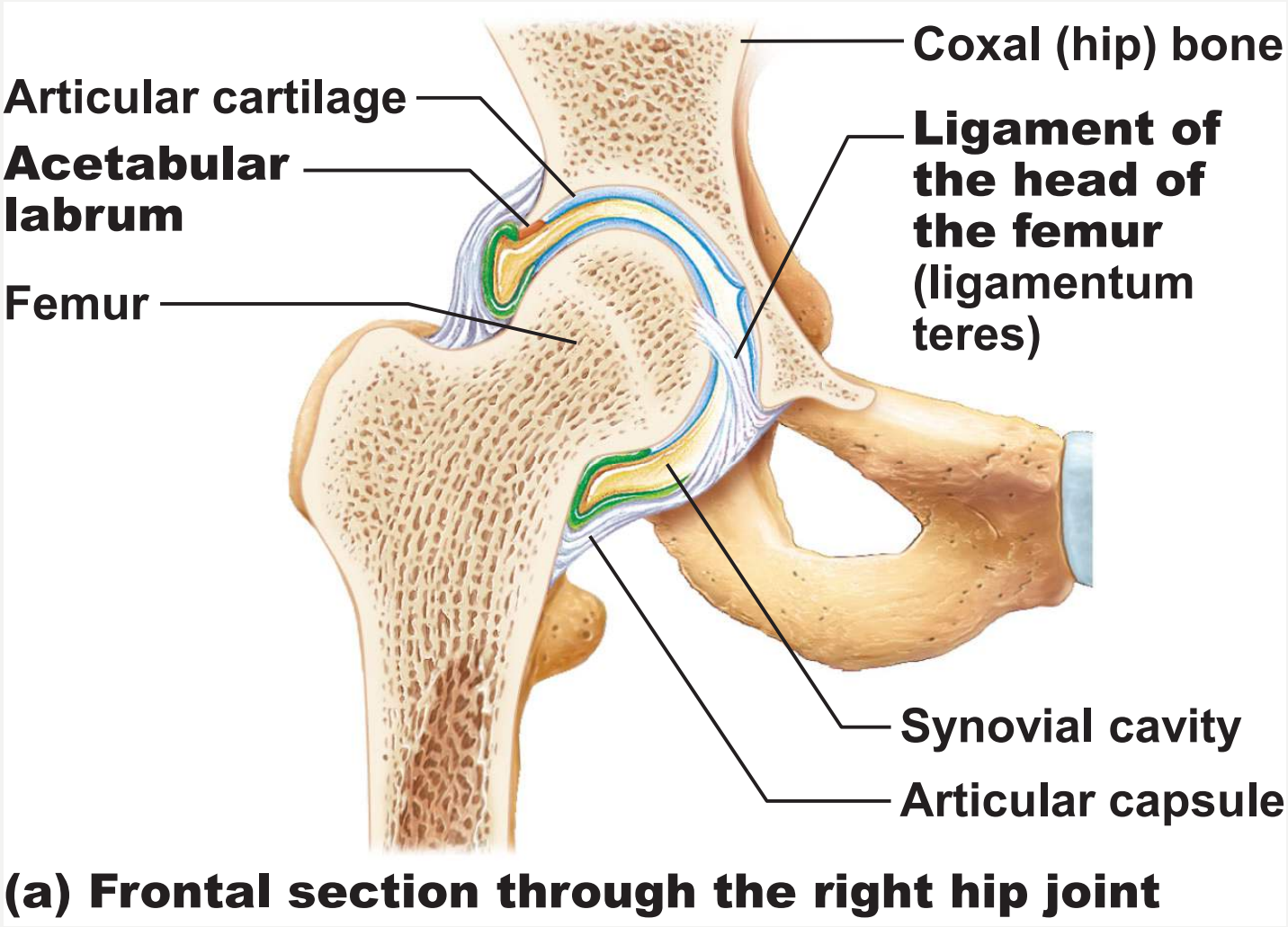
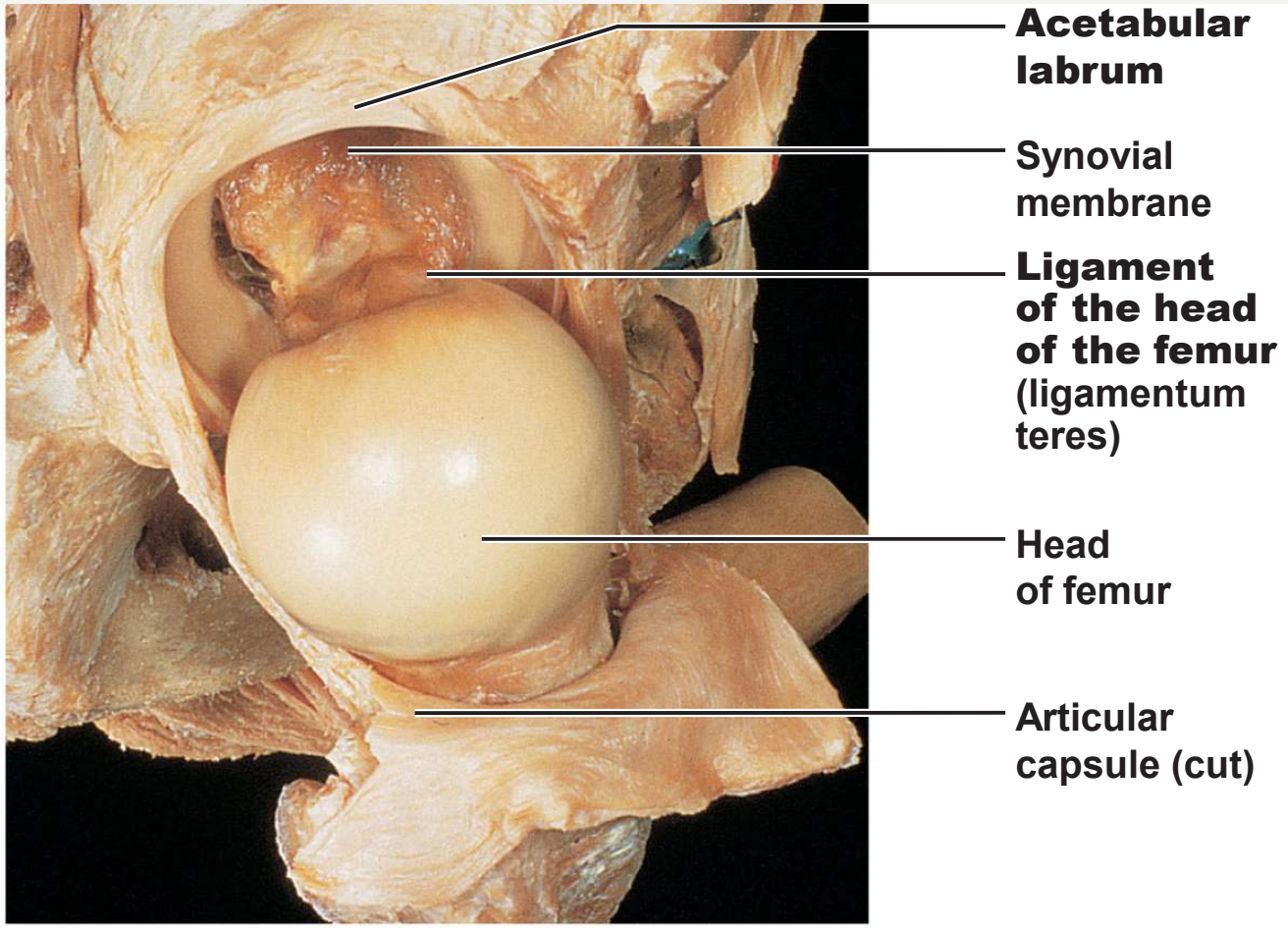
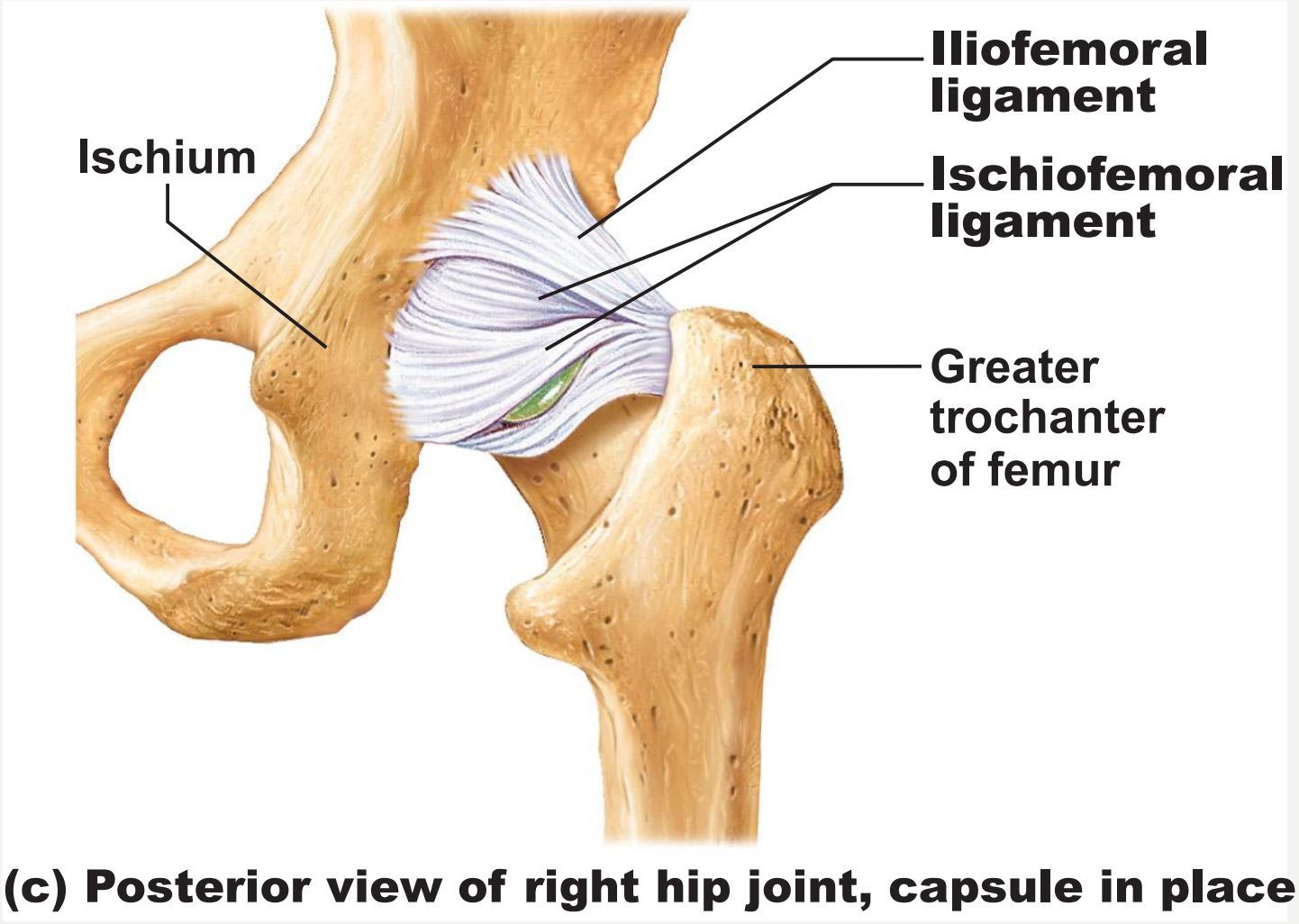


FIGURE 8.12B THE HIP JOINT.



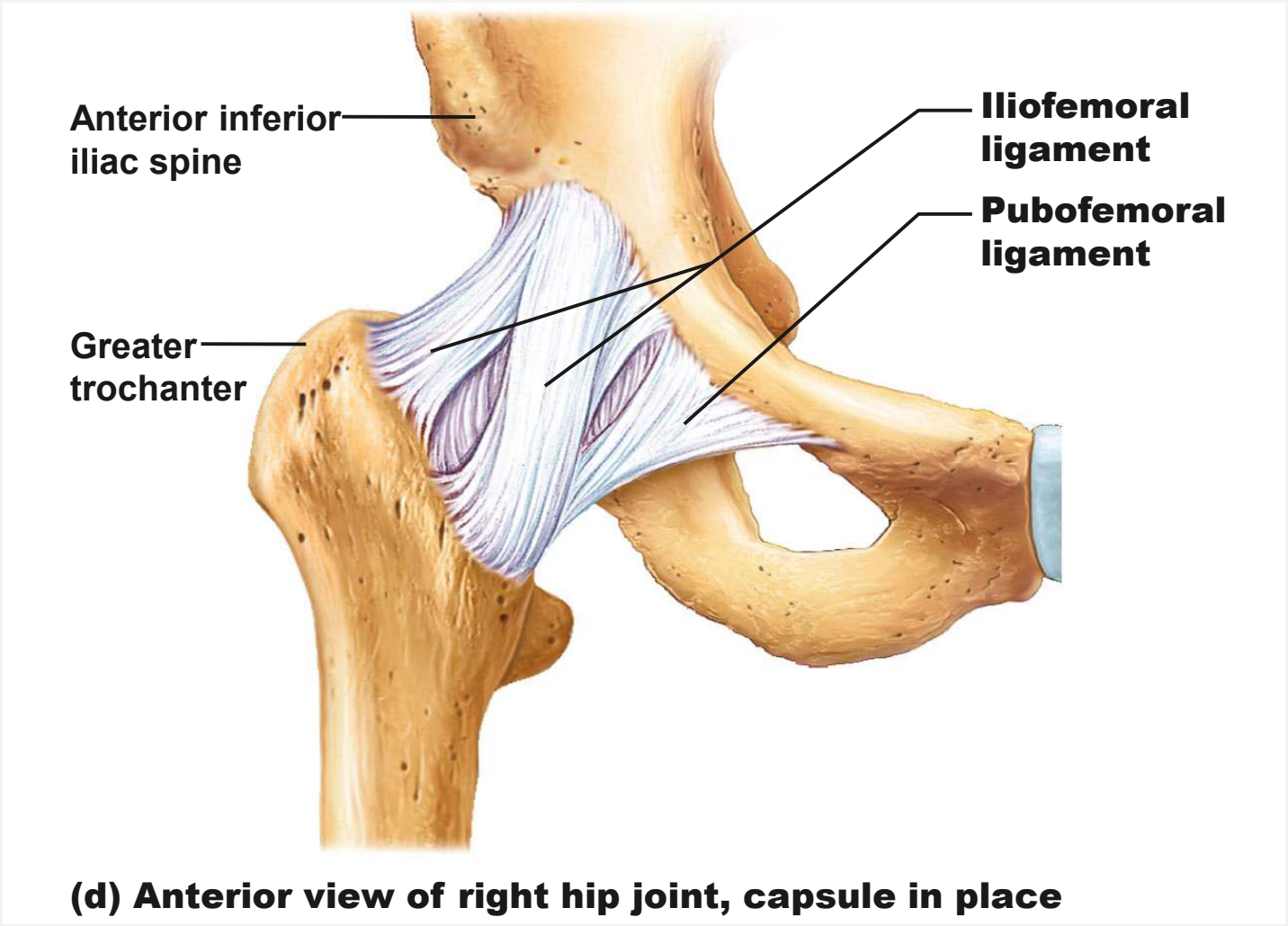
(b) Photo of the interior of the hip joint, lateral view

FIGURE 8.12C THE HIP JOINT.



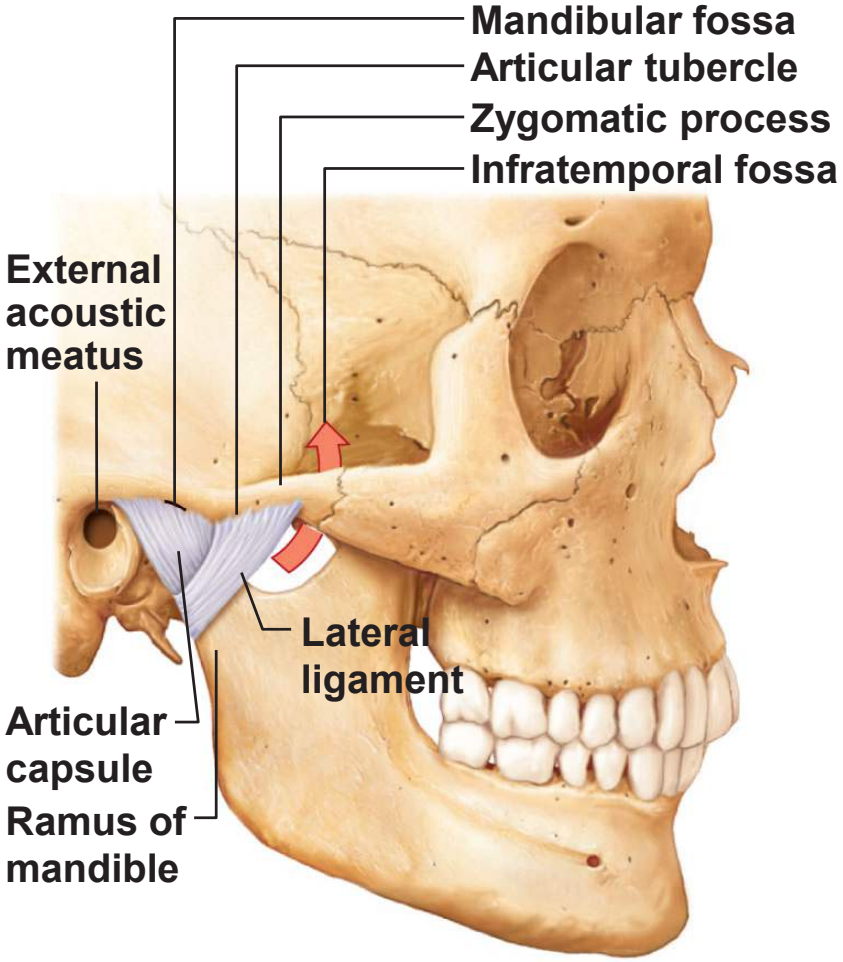
(c) Posterior view of right hip joint, capsule in place

FIGURE 8.12D THE HIP JOINT.



(d) Anterior view of right hip joint, capsule in place

FIGURE 8.13A THE TEMPOROMANDIBULAR (JAW) JOINT.



(a) Location of the joint in the skull

FIGURE 8.13B THE TEMPOROMANDIBULAR (JAW) JOINT.

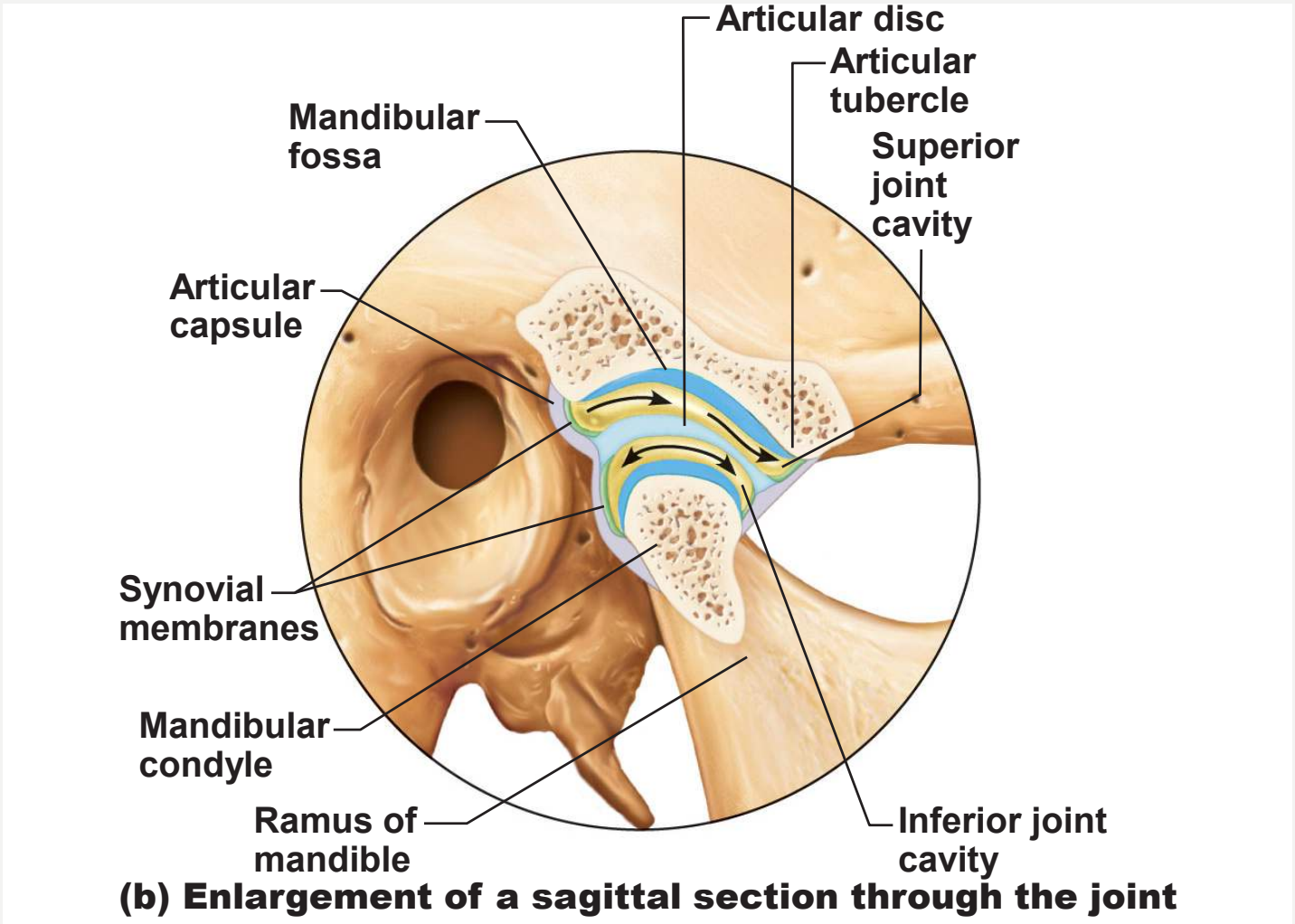
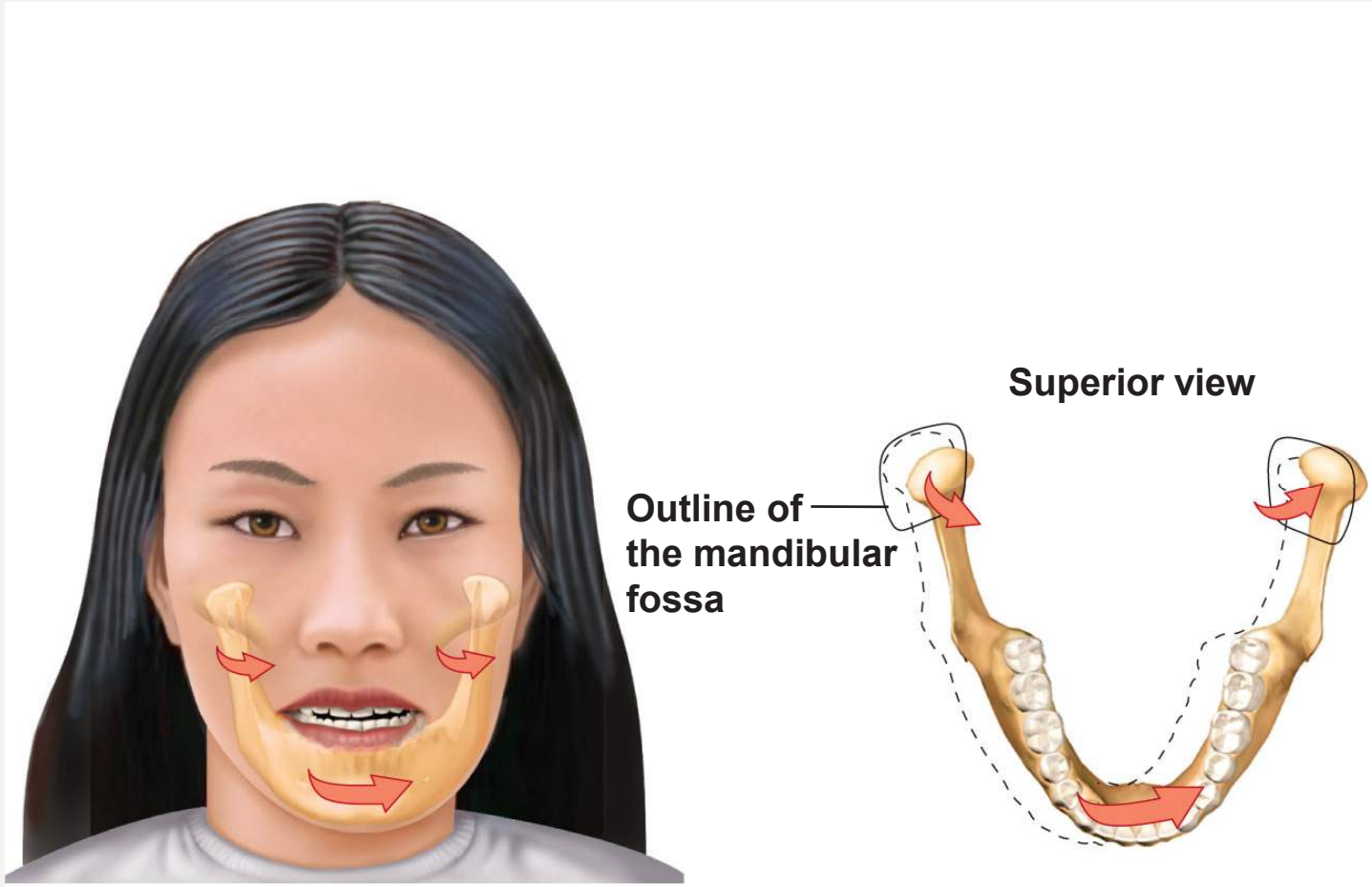
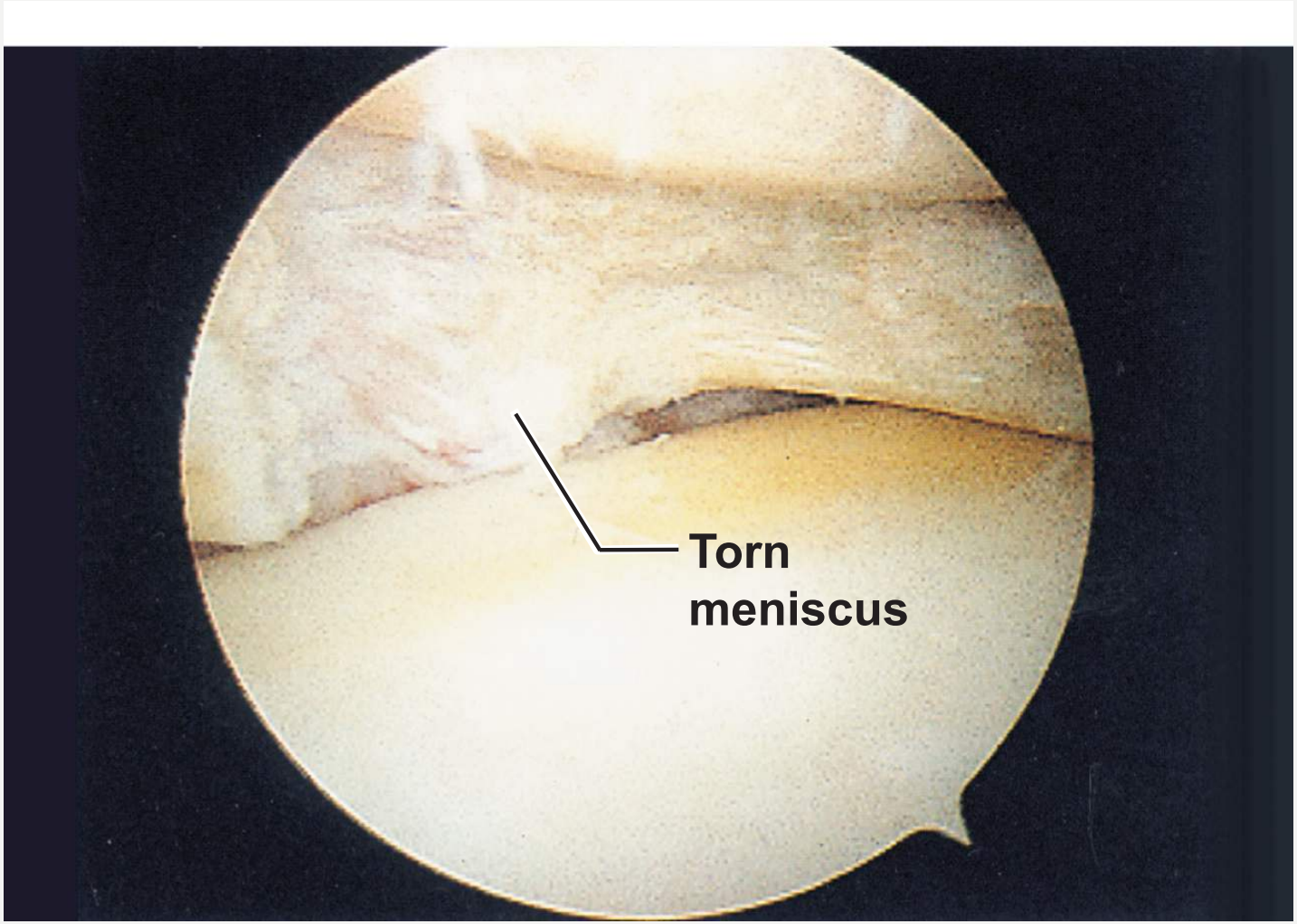


FIGURE 8.13C THE TEMPOROMANDIBULAR (JAW) JOINT.



(c) Lateral excursion: lateral (side-to-side) movements of the mandible

FIGURE 8.14 ARTHROSCOPIC PHOTOGRAPH OF A TORN MEDIAL MENISCUS.



E 8.15 X RAY OF A HAND DEFORMED BY RHEUMATOID ARTHRITIS.

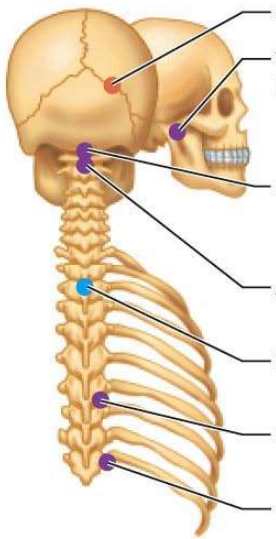
8.1 SUMMARY OF JOINT CLASSES

TABLE 8.1 Summary of Joint Classes

STRUCTURAL CLASS	STRUCTURAL CHARACTERISTICS	TYPES	MOBILITY
Fibrous	Bone ends/parts united by collagen fibers	Suture (short fibers)	Immobile (synarthrosis)
		Syndesmosis (longer fibers)	Slightly mobile (amphiarthrosis) and immobile
		Gomphosis (periodontal ligament)	Immobile
Cartilaginous	Bone ends/parts united by cartilage	Synchondrosis (hyaline cartilage)	Immobile
		Symphysis (fibrocartilage)	Slightly movable
Synovial	Bone ends/parts covered with articular cartilage and enclosed within an articular capsule lined with synovial membrane	(1) Plane, (2) Hinge, (3) Pivot, (4) Condyloid, (5) Saddle, (6) Ball and socket	Freely movable (diarthrosis; movements depend on design of joint)

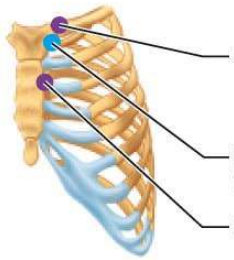
8.2 STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF BODY JOINTS (1 OF 4)

TABLE 8.2 Structural and Functional Characteristics of Body Joints

ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Skull	Cranial and facial bones	Fibrous; suture	Synarthrotic; no movement
	Temporo-mandibular	Temporal bone of skull and mandible	Synovial; modified hinge† (contains articular disc)	Diarthrotic; gliding and uniaxial rotation; slight lateral movement, elevation, depression, protraction, and retraction of mandible
	Atlanto-occipital	Occipital bone of skull and atlas	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, lateral flexion, circumduction of head on neck
	Atlantoaxial	Atlas (C_1) and axis (C_2)	Synovial; pivot	Diarthrotic; uniaxial; rotation of the head
	Intervertebral	Between adjacent vertebral bodies	Cartilaginous; symphysis	Amphiarthrotic; slight movement
	Intervertebral	Between articular processes	Synovial; plane	Diarthrotic; gliding
	Vertebrocostal	Vertebrae (transverse processes or bodies) and ribs	Synovial; plane	Diarthrotic; gliding of ribs

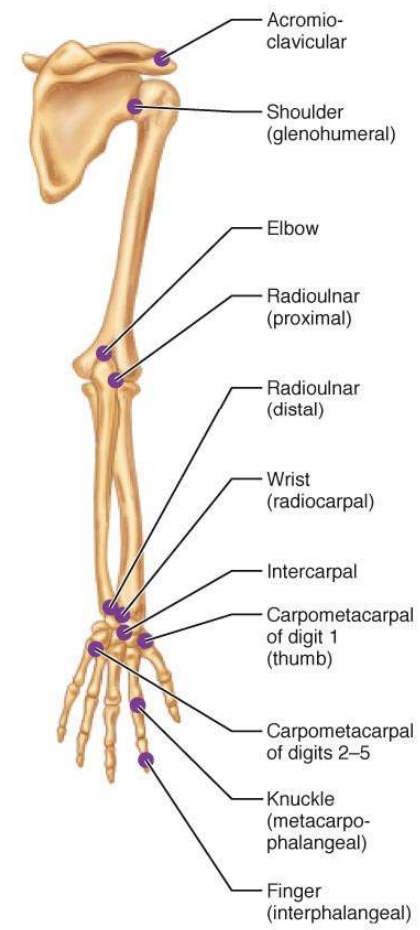
8.2 STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF BODY JOINTS (2 OF 4)

TABLE 8.2 Structural and Functional Characteristics of Body Joints

ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Sternoclavicular	Sternum and clavicle	Synovial; shallow saddle (contains articular disc)	Diarthrotic; multiaxial (allows clavicle to move in all axes)
	Sternocostal (first)	Sternum and rib 1	Cartilaginous; synchondrosis	Synarthrotic; no movement
	Sternocostal	Sternum and ribs 2–7	Synovial; double plane	Diarthrotic; gliding

8.2 STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF BODY JOINTS (3 OF 4)

TABLE 8.2 Structural and Functional Characteristics of Body Joints



JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
Acromio-clavicular	Acromion of scapula and clavicle	Synovial; plane (contains articular disc)	Diarthrotic; gliding and rotation of scapula on clavicle
Shoulder (glenohumeral)	Scapula and humerus	Synovial; ball and socket	Diarthrotic; multiaxial; flexion, extension, abduction, adduction, circumduction, rotation of humerus
Elbow	Ulna (and radius) with humerus	Synovial; hinge	Diarthrotic; uniaxial; flexion, extension of forearm
Radioulnar (proximal)	Radius and ulna	Synovial; pivot	Diarthrotic; uniaxial; rotation of radius around long axis of forearm to allow pronation and supination
Radioulnar (distal)	Radius and ulna	Synovial; pivot (contains articular disc)	Diarthrotic; uniaxial; rotation (convex head of ulna rotates in ulnar notch of radius)
Wrist (radiocarpal)	Radius and proximal carpals	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of hand
Intercarpal	Adjacent carpals	Synovial; plane	Diarthrotic; gliding
Carpometacarpal of digit 1 (thumb)	Carpal (trapezium) and metacarpal 1	Synovial; saddle	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction, opposition of metacarpal 1
Carpometacarpal of digits 2–5	Carpal(s) and metacarpal(s)	Synovial; plane	Diarthrotic; gliding of metacarpals
Knuckle (metacarpo-phalangeal)	Metacarpal and proximal phalanx	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of fingers
Finger (interphalangeal)	Adjacent phalanges	Synovial; hinge	Diarthrotic; uniaxial; flexion, extension of fingers

8.2 STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF BODY JOINTS (4 OF 4)

TABLE 8.2 Structural and Functional Characteristics of Body Joints

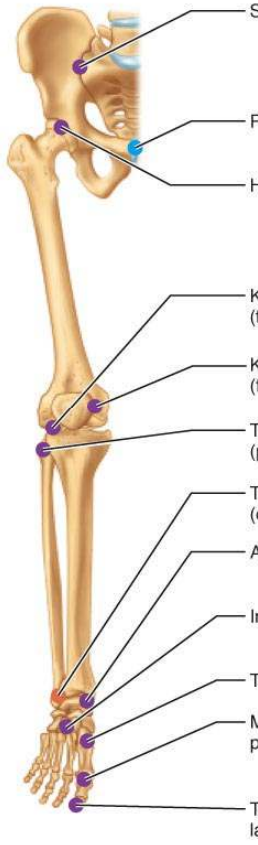
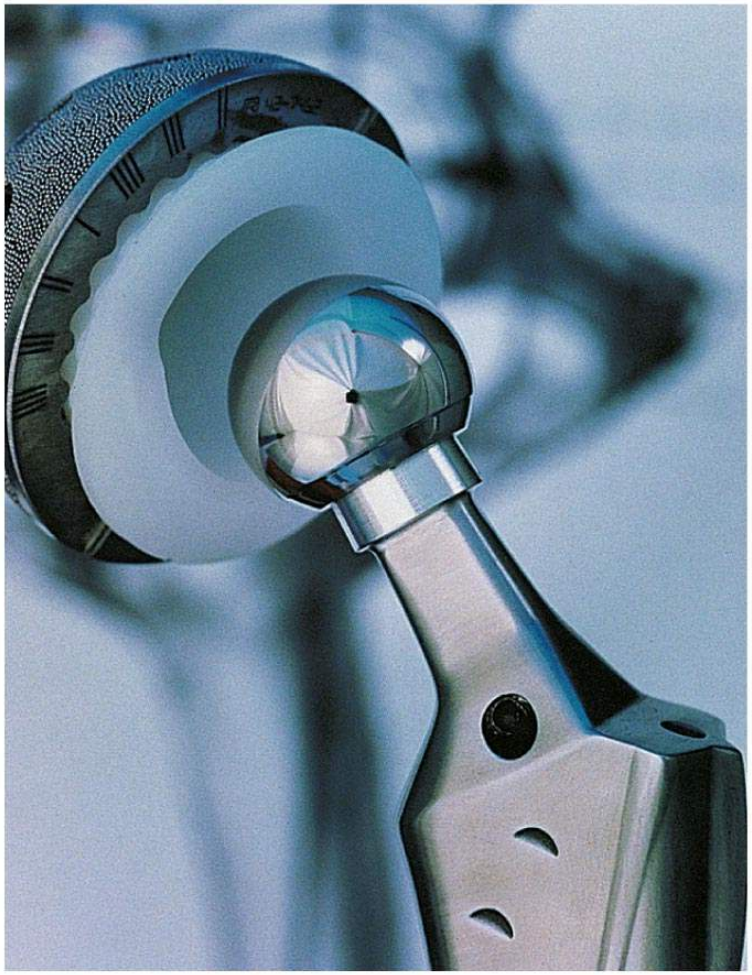


ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Sacroiliac	Sacrum and coxal bone	Synovial; plane in childhood, increasingly fibrous in adult	Diarthrotic in child; amphiarthrotic in adult; (more movement during pregnancy)
	Pubic symphysis	Pubic bones	Cartilaginous; symphysis	Amphiarthrotic; slight movement (enhanced during pregnancy)
	Hip (coxal)	Hip bone and femur	Synovial; ball and socket	Diarthrotic; multiaxial; flexion, extension, abduction, adduction, rotation, circumduction of thigh
	Knee (tibiofemoral)	Femur and tibia	Synovial; modified hinge† (contains articular discs)	Diarthrotic; biaxial; flexion, extension of leg, some rotation allowed in flexed position
	Knee (femoropatellar)	Femur and patella	Synovial; plane	Diarthrotic; gliding of patella
	Tibiofibular (proximal)	Tibia and fibula (proximally)	Synovial; plane	Diarthrotic; gliding of fibula
	Tibiofibular (distal)	Tibia and fibula (distally)	Fibrous; syndesmosis	Synarthrotic; slight "give" during dorsiflexion
	Ankle	Tibia and fibula with talus	Synovial; hinge	Diarthrotic; uniaxial; dorsiflexion, and plantar flexion of foot
	Intertarsal	Adjacent tarsals	Synovial; plane	Diarthrotic; gliding; inversion and eversion of foot
	Tarsometatarsal	Tarsal(s) and metatarsal(s)	Synovial; plane	Diarthrotic; gliding of metatarsals
	Metatarsophalangeal	Metatarsal and proximal phalanx	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of great toe
	Toe (interphalangeal)	Adjacent phalanges	Synovial; hinge	Diarthrotic; uniaxial; flexion; extension of toes

* **Fibrous joints** indicated by orange circles; **cartilaginous joints** by blue circles; **synovial joints** by purple circles.
† These modified hinge joints are structurally bicondylar.

A CLOSER LOOK 8.1A JOINTS: FROM KNIGHTS IN SHINING ARMOR TO BIONIC HUMANS



A hip prosthesis.

A CLOSER LOOK 8.1B: JOINTS: FROM KNIGHTS IN SHINING ARMOR TO BIONIC HUMANS

X ray of right knee showing total knee replacement prosthesis (co-designed by Kenneth Gustke, M.D., of Florida Orthopedic Institute).