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Human Anatomy & Physiology

Ninth Edition

PowerPoint® Lecture Slides
prepared by
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Atlantic Cape Community
College

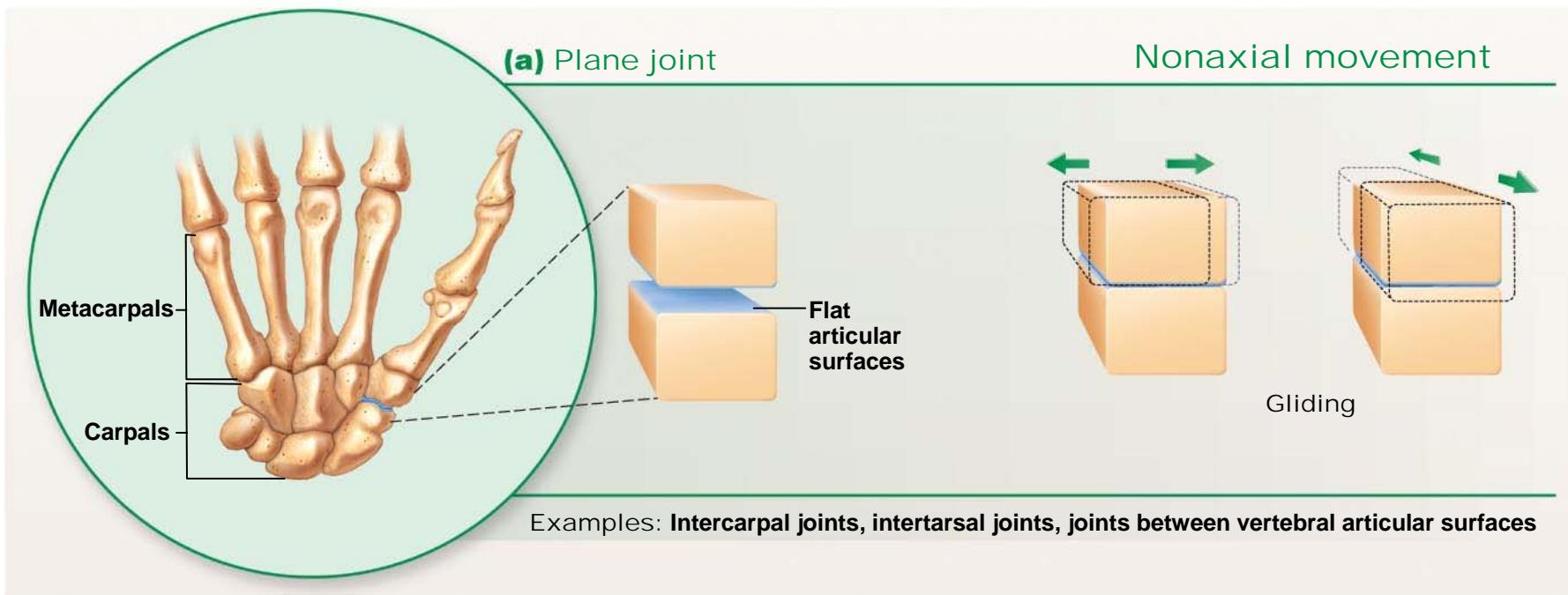
CHAPTER 8

Joints: Part B

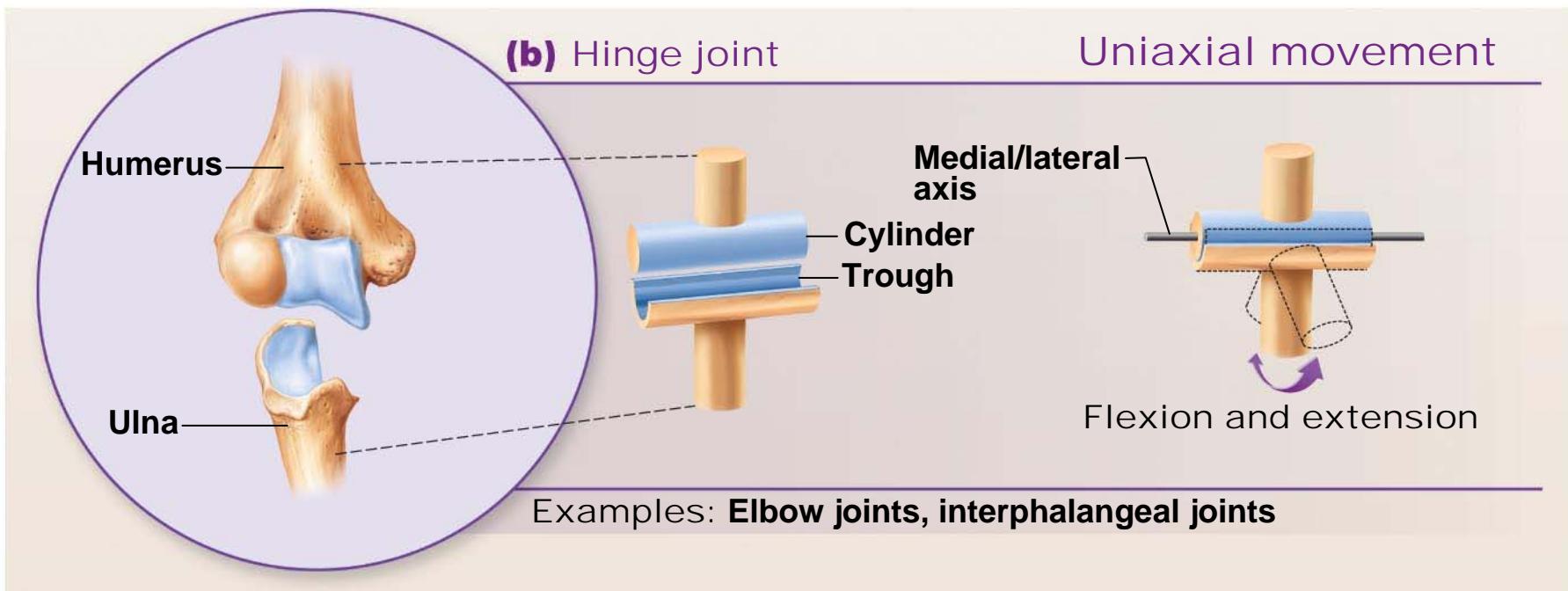
Types of Synovial Joints

- Six types, based on shape of articular surfaces:
 - **Plane**
 - **Hinge**
 - **Pivot**
 - **Condylar**
 - **Saddle**
 - **Ball-and-socket**

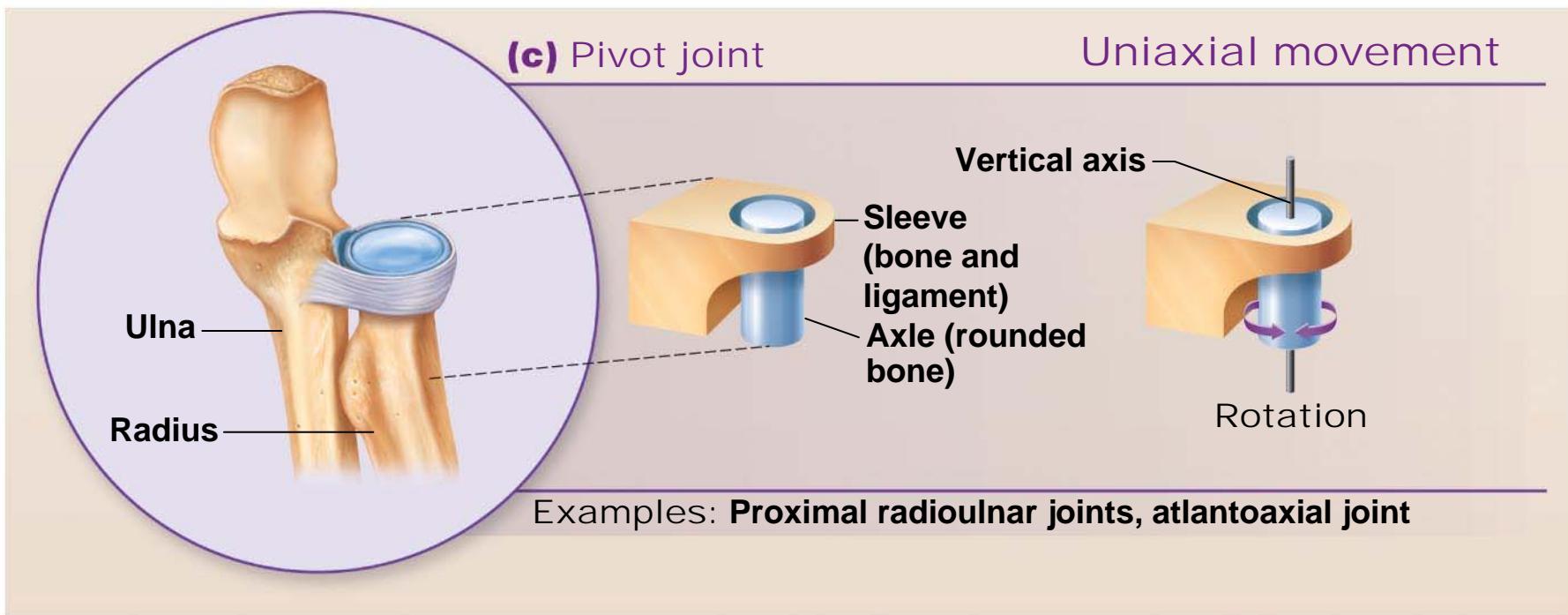
The shapes of the joint surfaces define the types of movements that can occur at a synovial joint; they also determine the classification of synovial joints into six structural types.



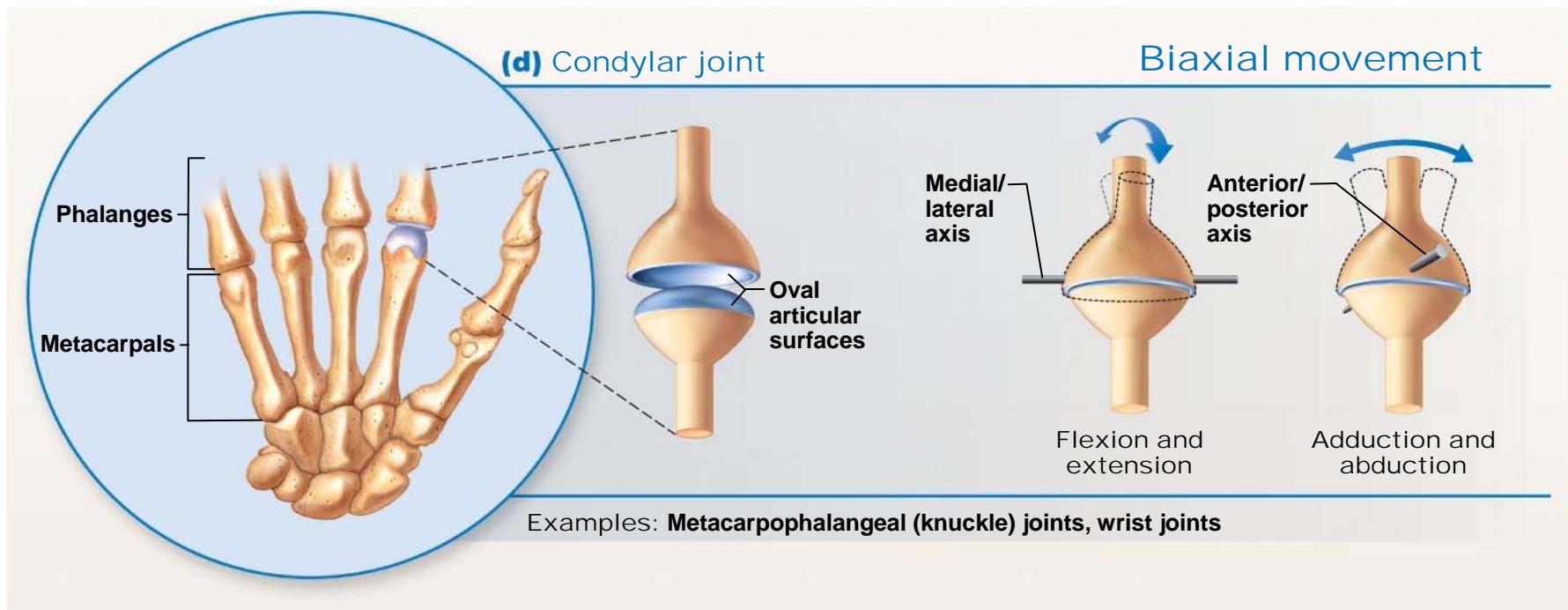
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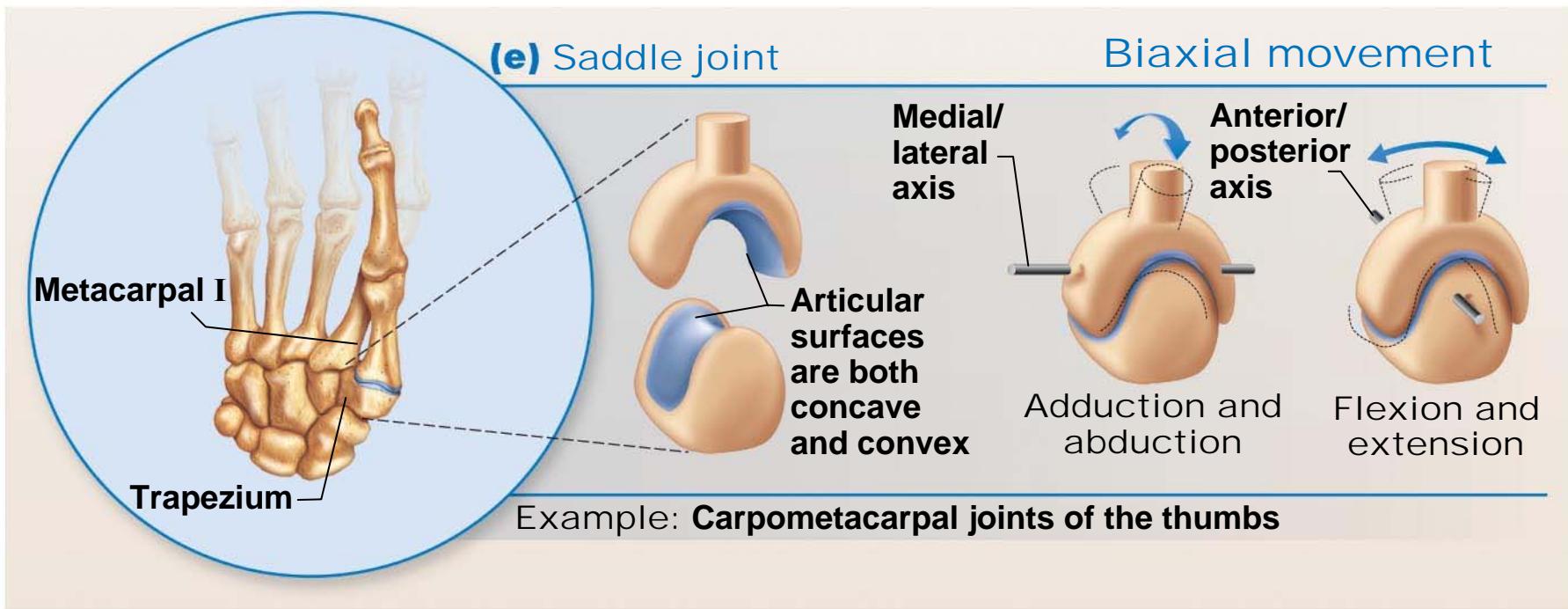
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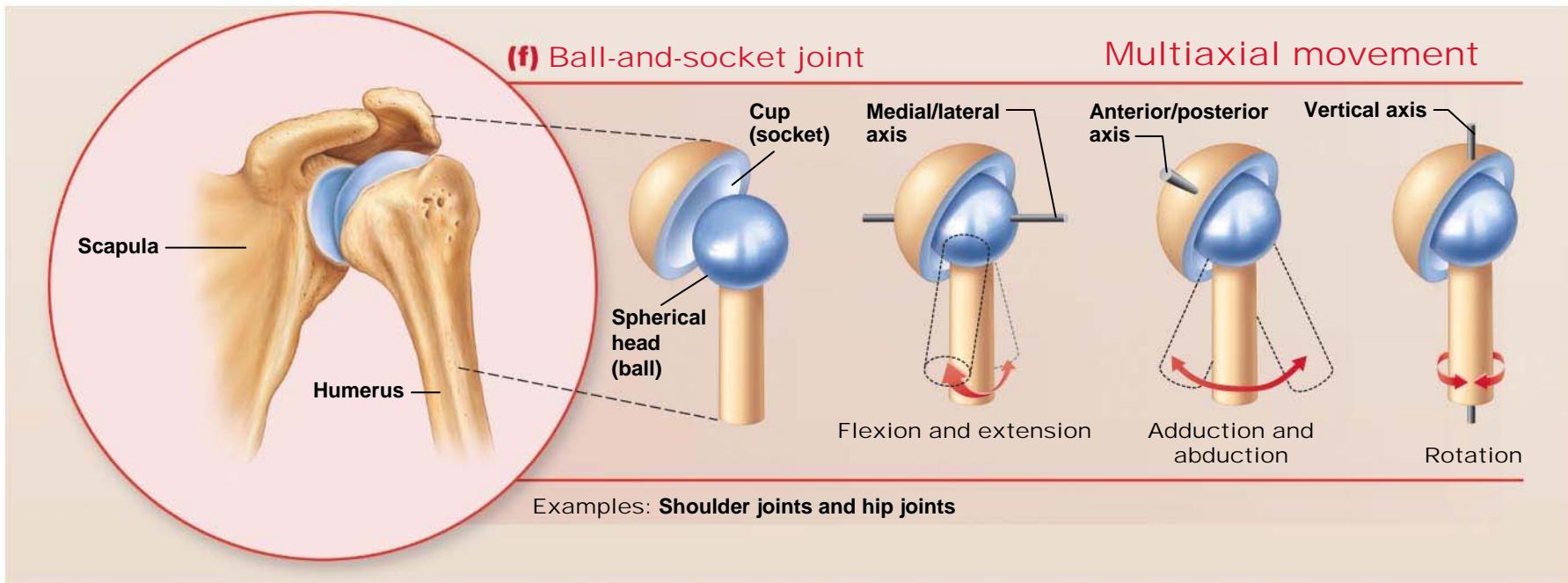
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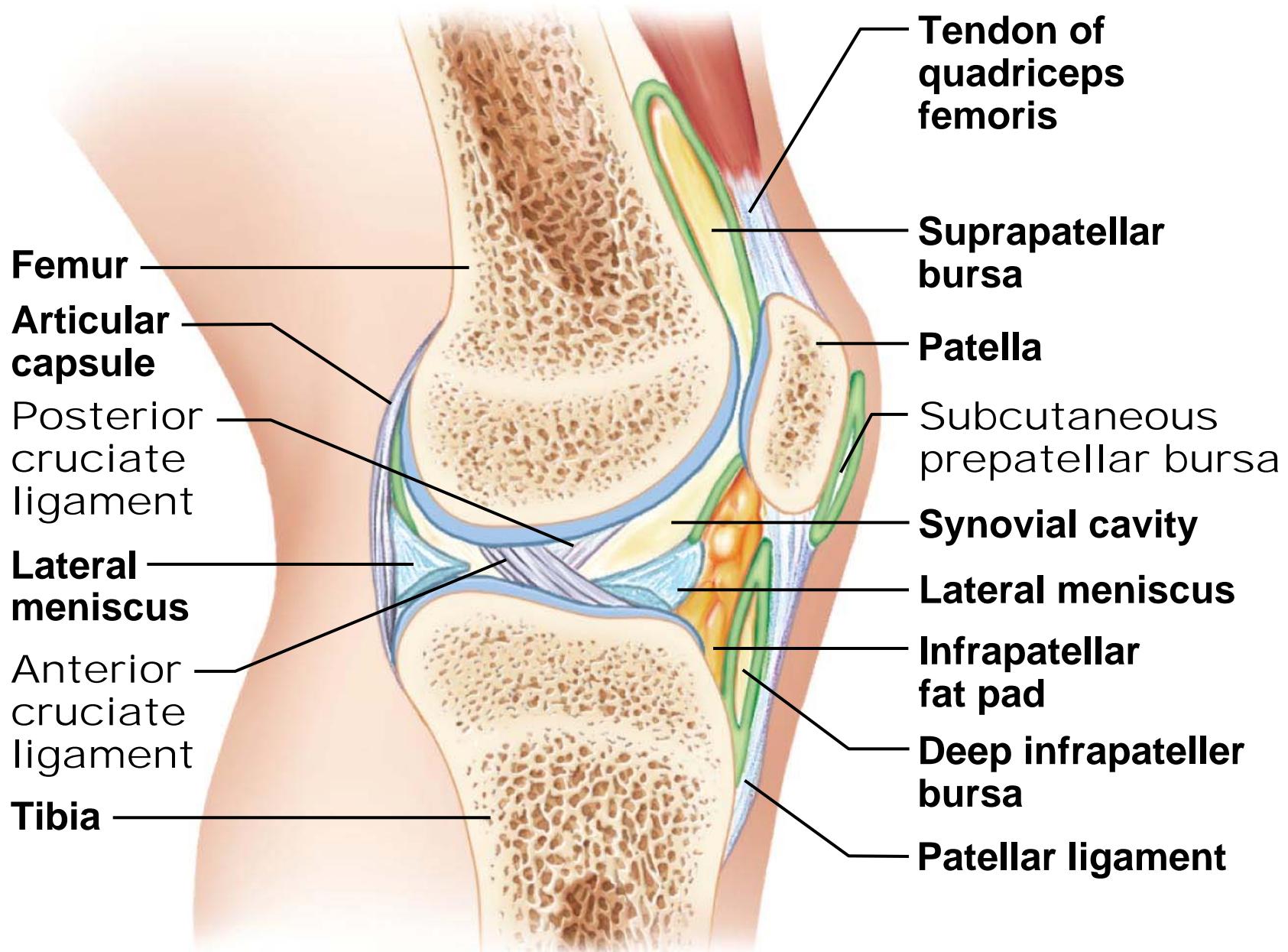


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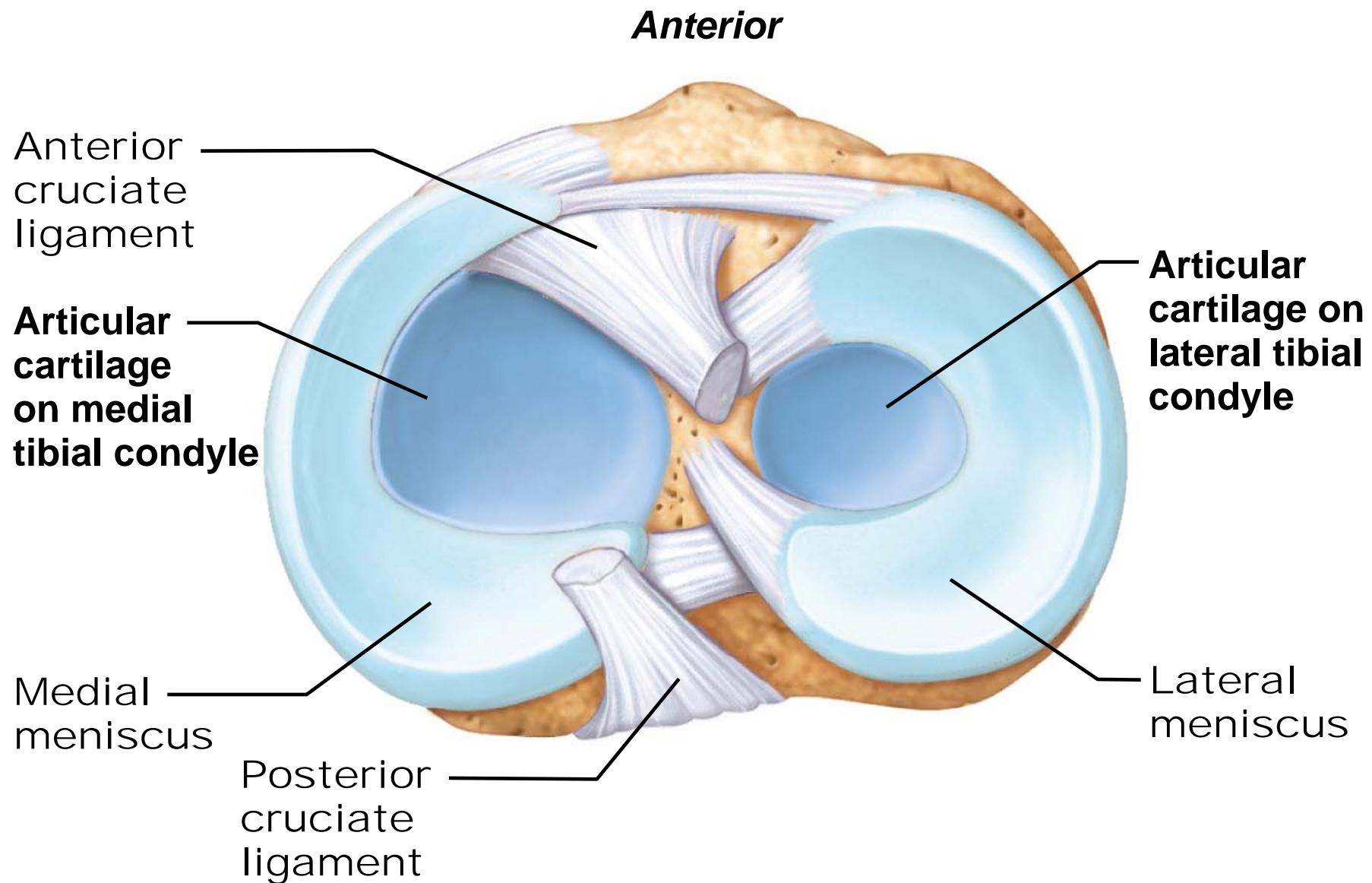


Knee Joint

- Largest, most complex joint of body
- Three joints surrounded by a single joint cavity
 - **Femoropatellar joint**
 - Plane joint
 - Allows gliding motion during knee flexion
 - **Lateral and medial tibiofemoral joints**
 - Femoral condyles with lateral and medial menisci of tibia
 - Allow flexion, extension, and some rotation when knee partly flexed



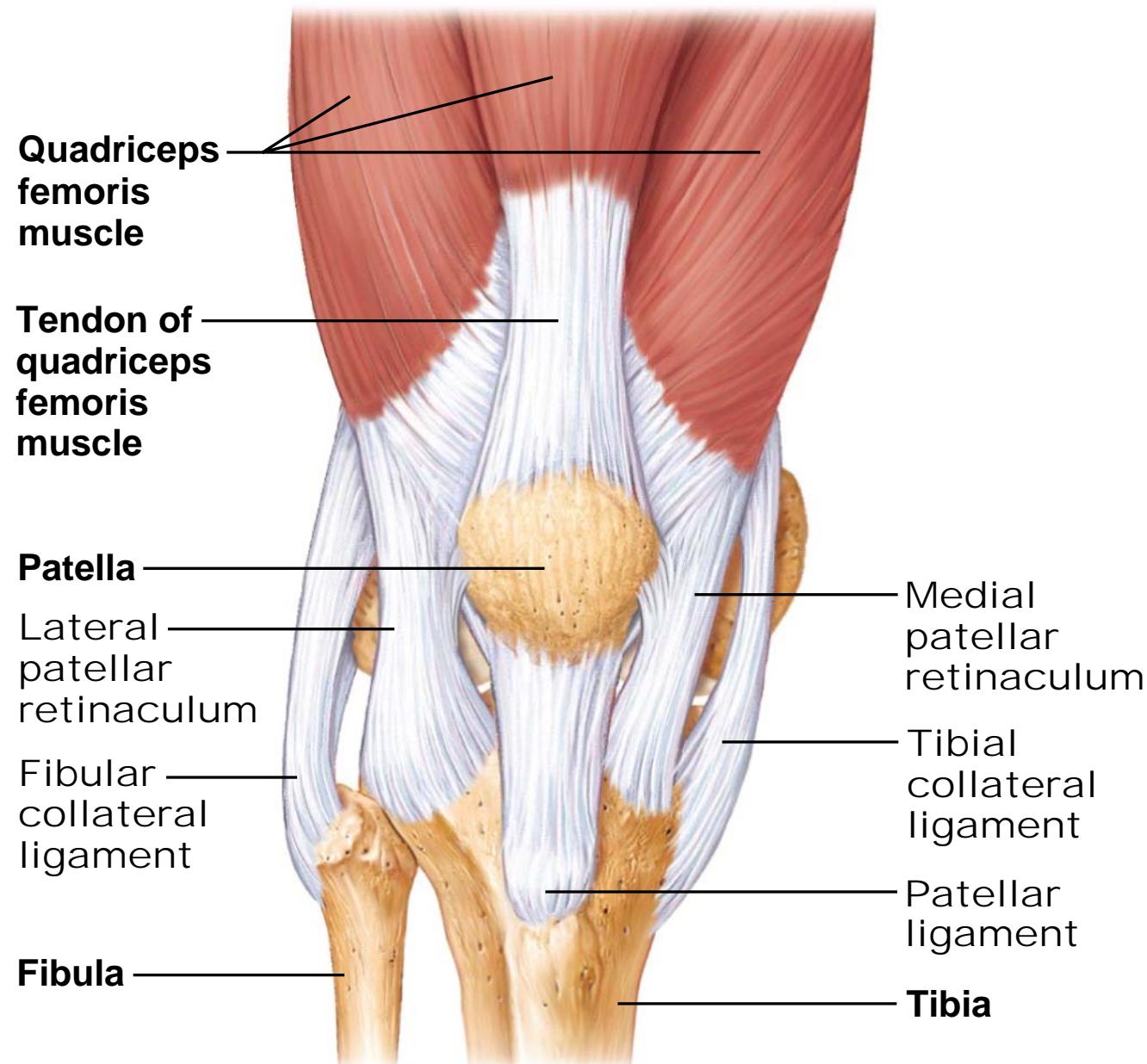
(a) Sagittal section through the right knee joint



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

Knee Joint

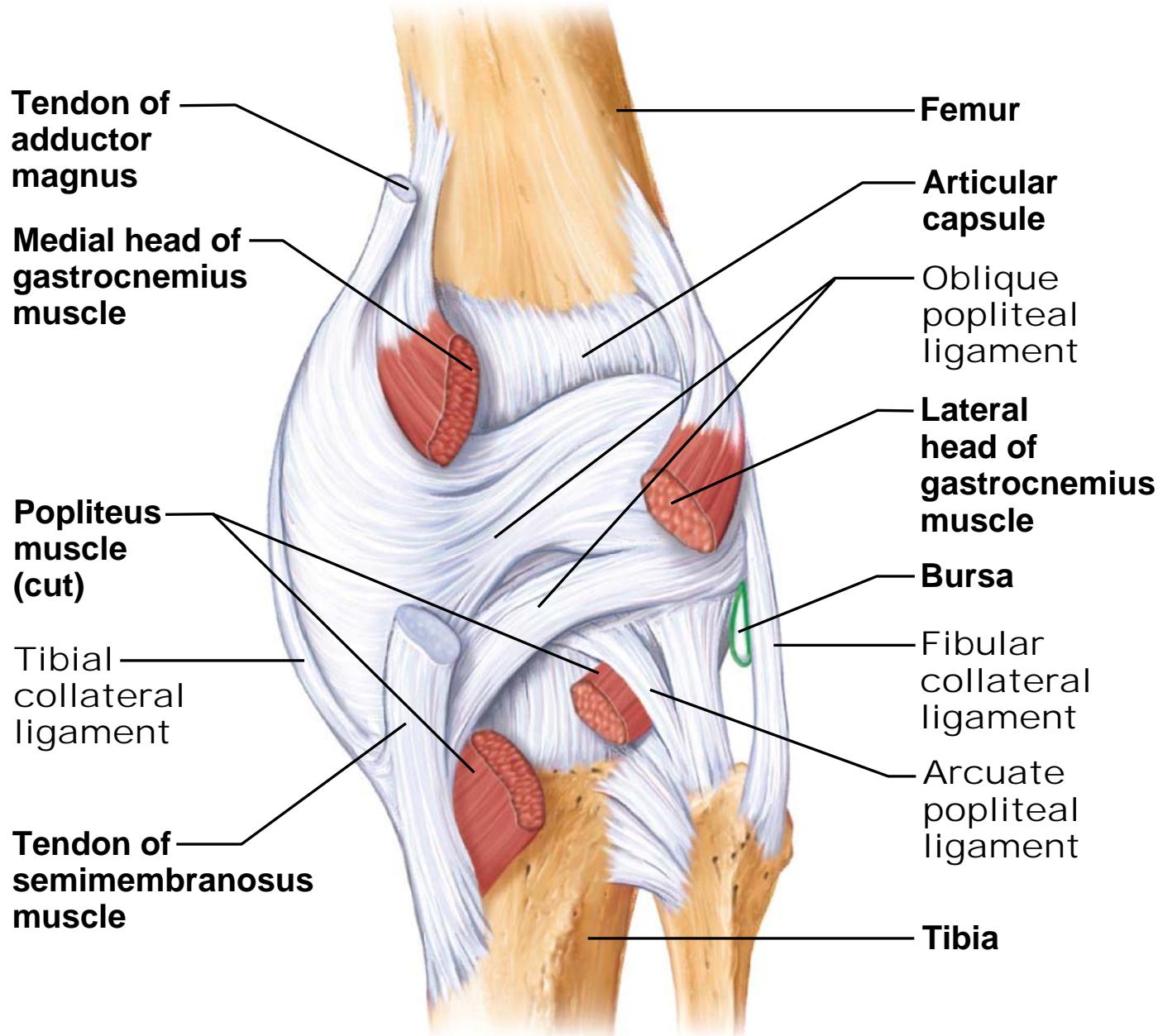
- At least 12 associated bursae
- Capsule is reinforced by muscle tendons
 - E.g., quadriceps and semimembranosus tendons
- Joint capsule is thin and absent anteriorly
- Anteriorly, quadriceps tendon gives rise to three broad ligaments
 - **Medial and lateral patellar retinacula**
 - **Patellar ligament**



(c) Anterior view of right knee

Ligaments Stabilizing Knee Joint

- Capsular and extracapsular ligaments
 - Help prevent hyperextension of knee
 - **Fibular and tibial collateral ligaments**
 - **Oblique popliteal ligament**
 - **Arcuate popliteal ligament**

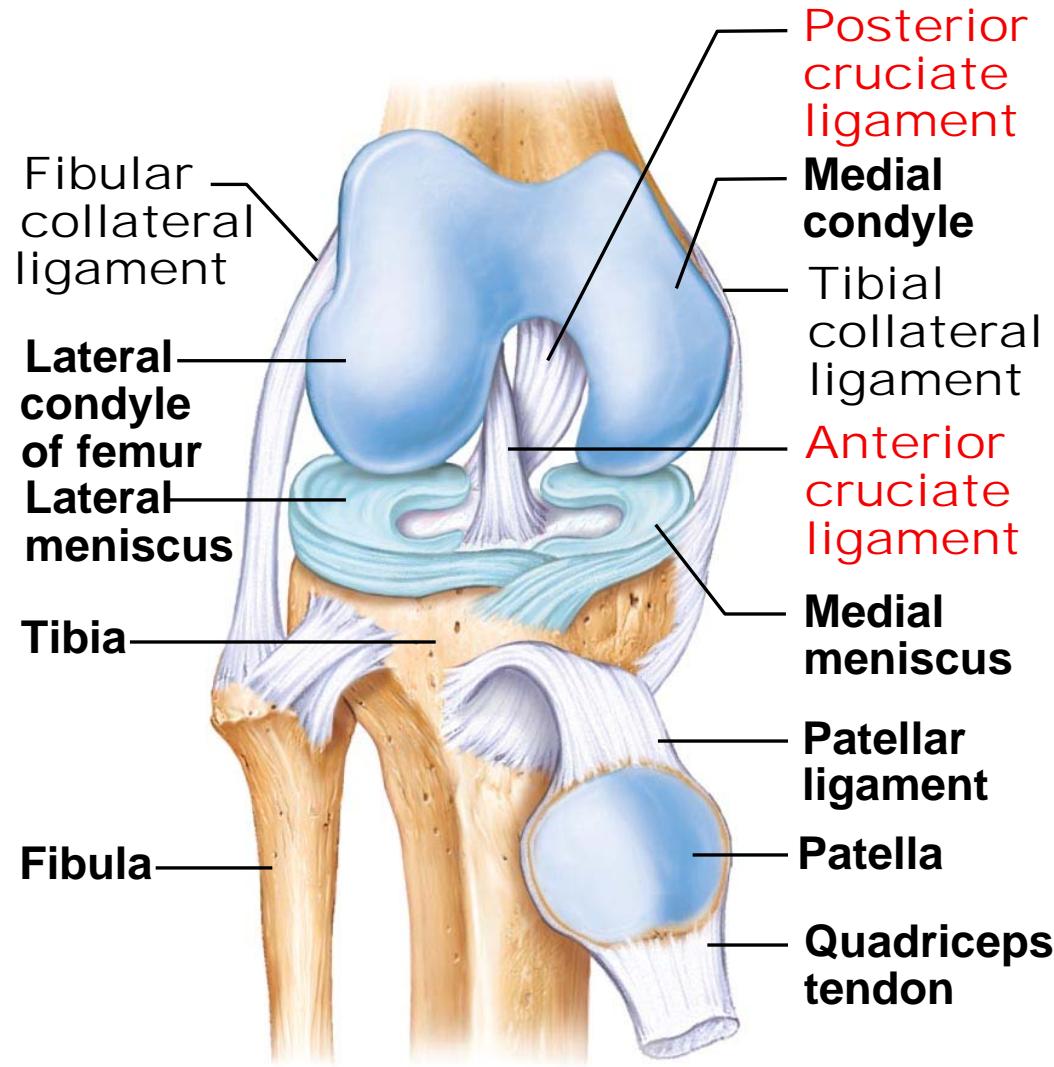


(d)

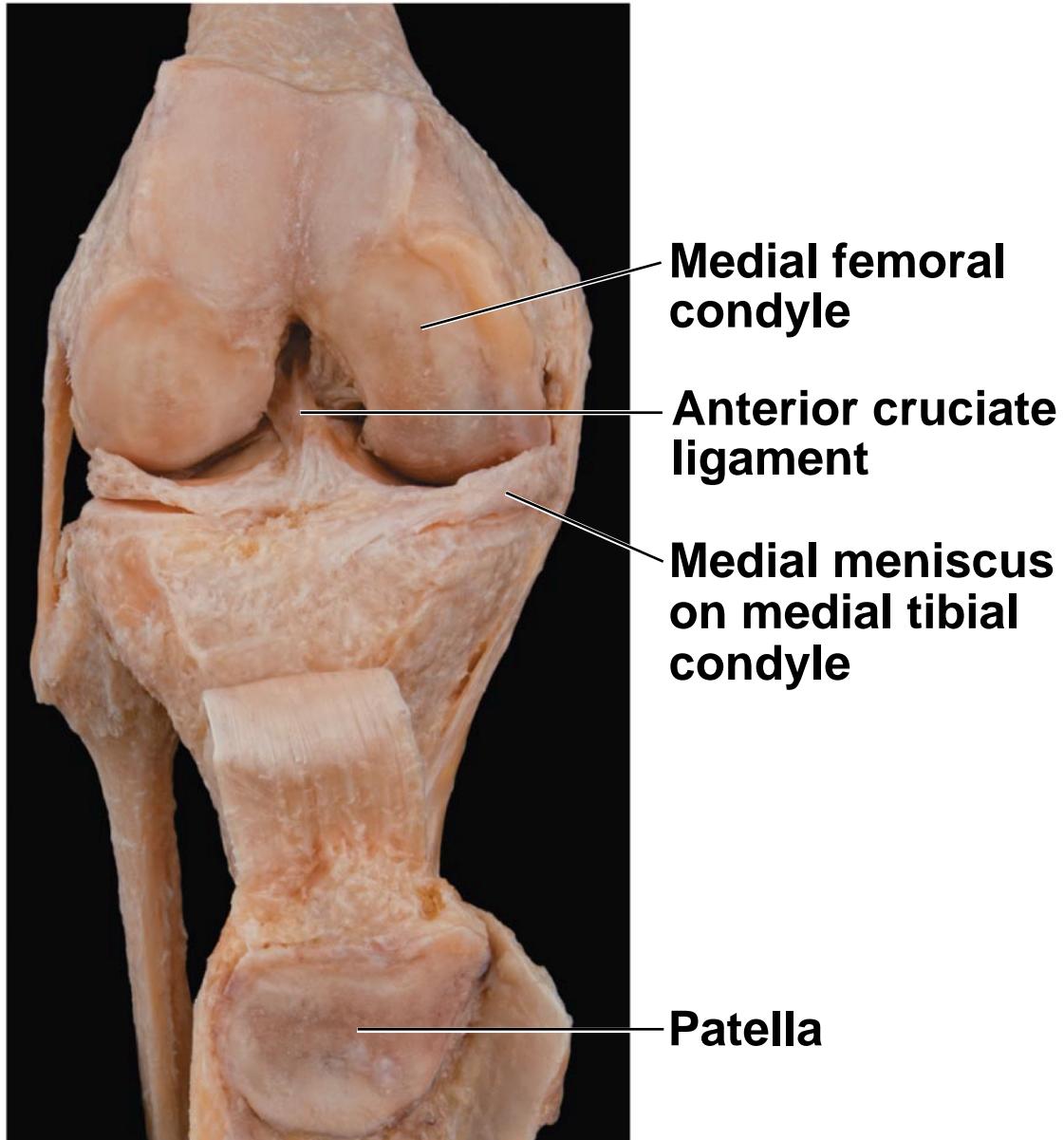
Posterior view of the joint capsule, including ligaments

Ligaments Stabilizing Knee Joint

- Intracapsular ligaments
 - Prevent anterior-posterior displacement
 - Reside outside synovial cavity
 - **Anterior cruciate ligament**
 - Attaches to anterior tibia
 - **Posterior cruciate ligament**
 - Attaches to posterior tibia



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

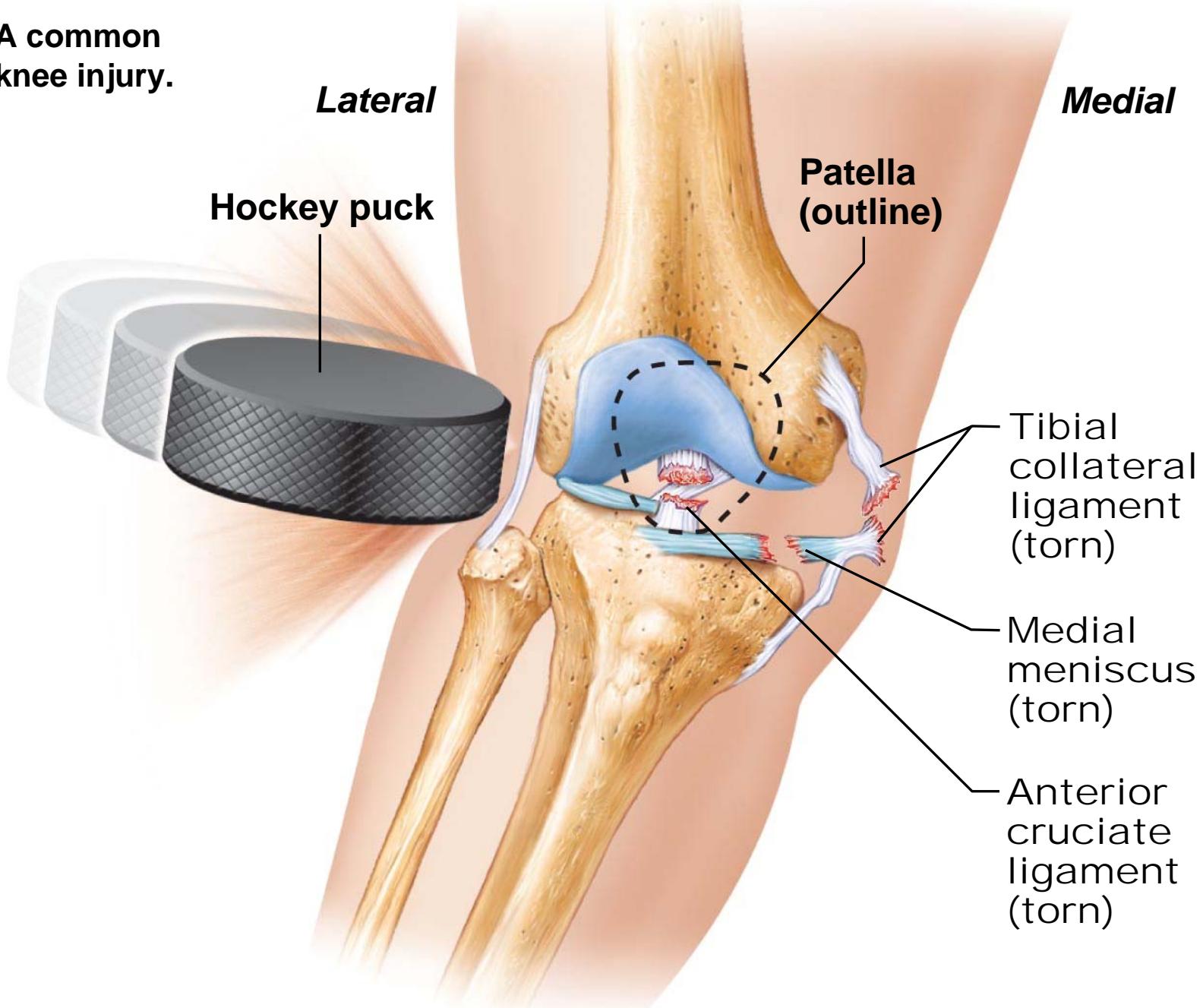


(f) Photograph of an opened knee joint;
view similar to (e)

Knee Joint Injuries

- Absorbs great vertical force
- Vulnerable to horizontal blows, especially laterally blows to extended knee
 - Three C's
 - Collateral ligaments
 - Cruciate ligaments
 - Cartilages

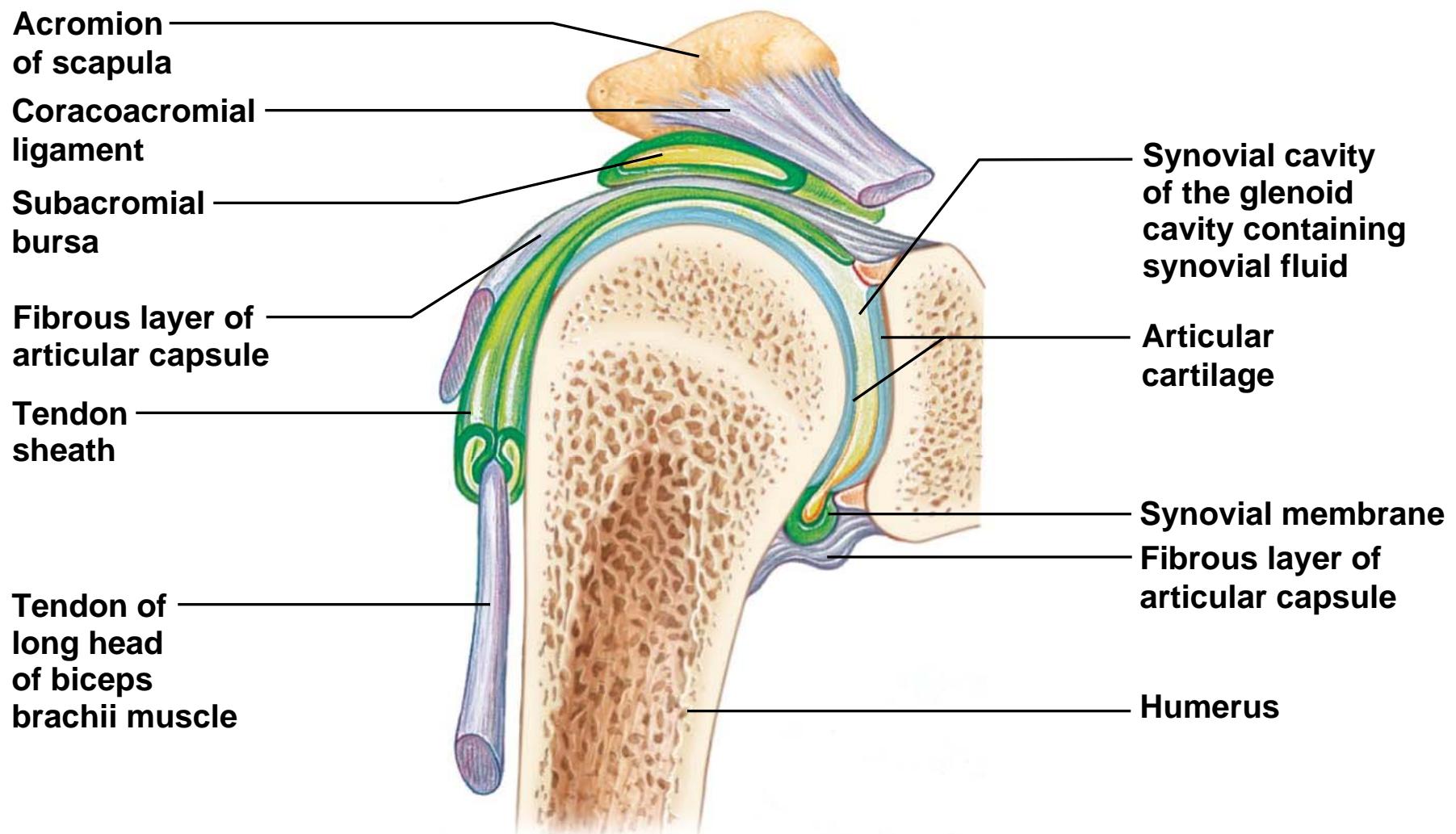
A common knee injury.



Shoulder (Glenohumeral) Joint

- Ball-and-socket joint
 - Head of humerus with glenoid cavity of scapula
- Most freely moving joint in body
 - Stability sacrificed

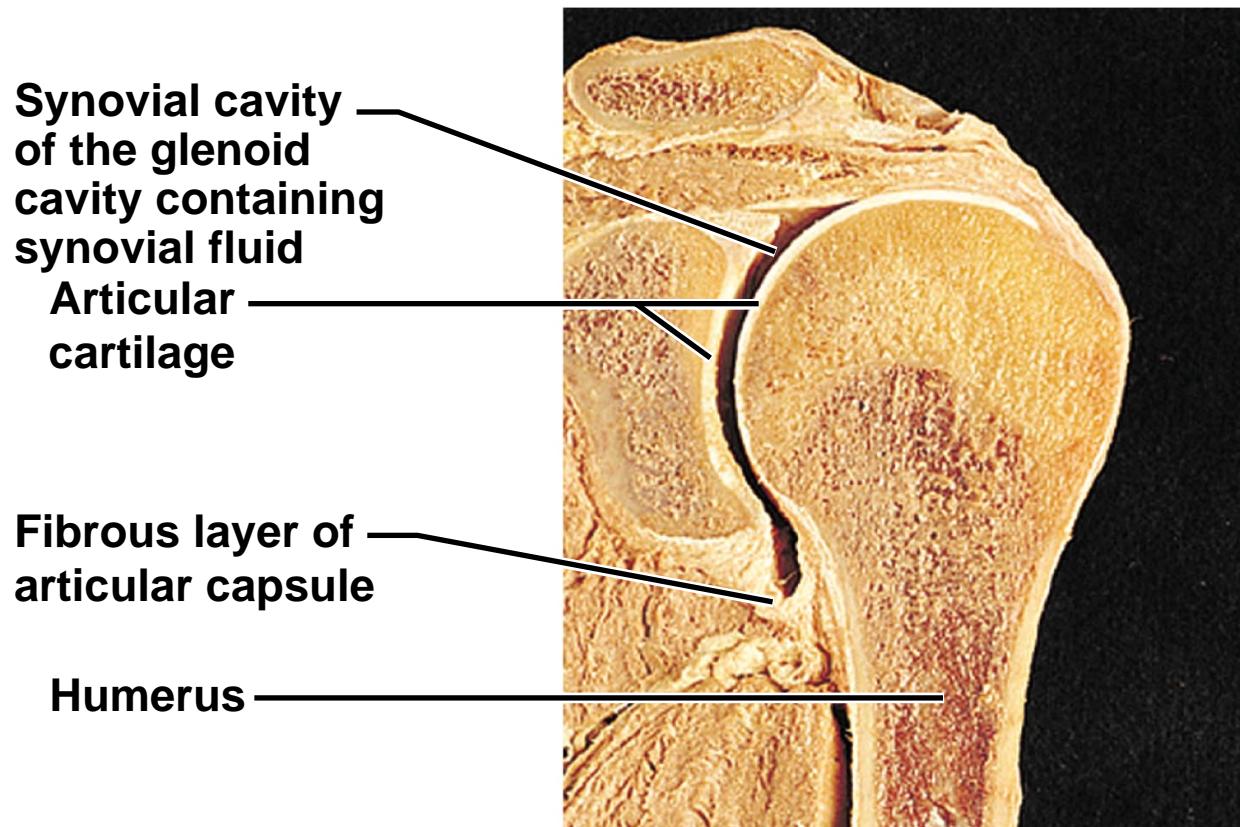
The shoulder joint.



(a)

Frontal section through right shoulder joint

The shoulder joint.



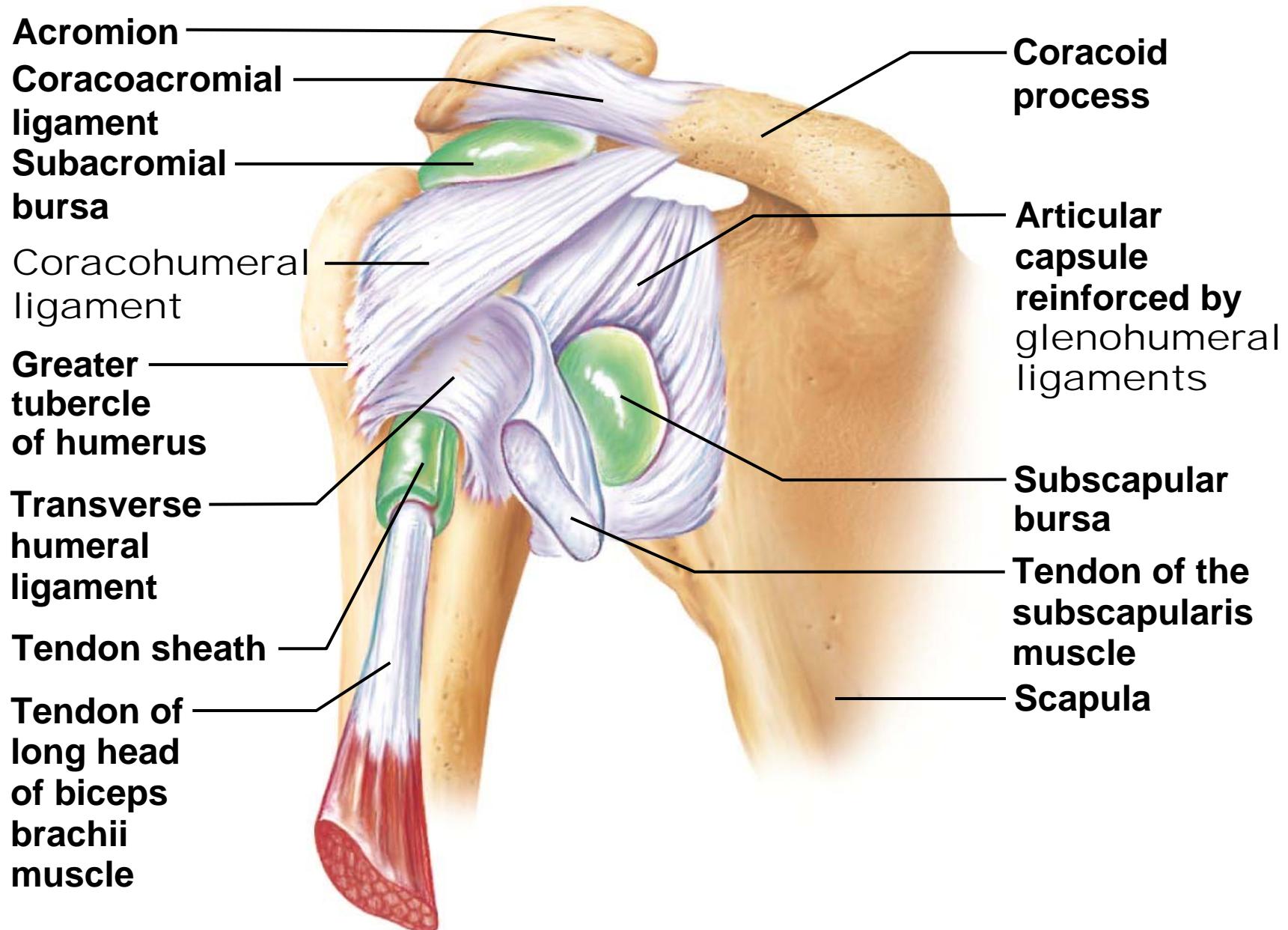
(b) Cadaver photo corresponding to (a)

Shoulder Joint

- Reinforcing ligaments
 - Primarily on anterior aspect
 - **Coracohumeral ligament**
 - Helps support weight of upper limb
 - Three **glenohumeral ligaments**
 - Weak and sometimes absent

Shoulder Joint

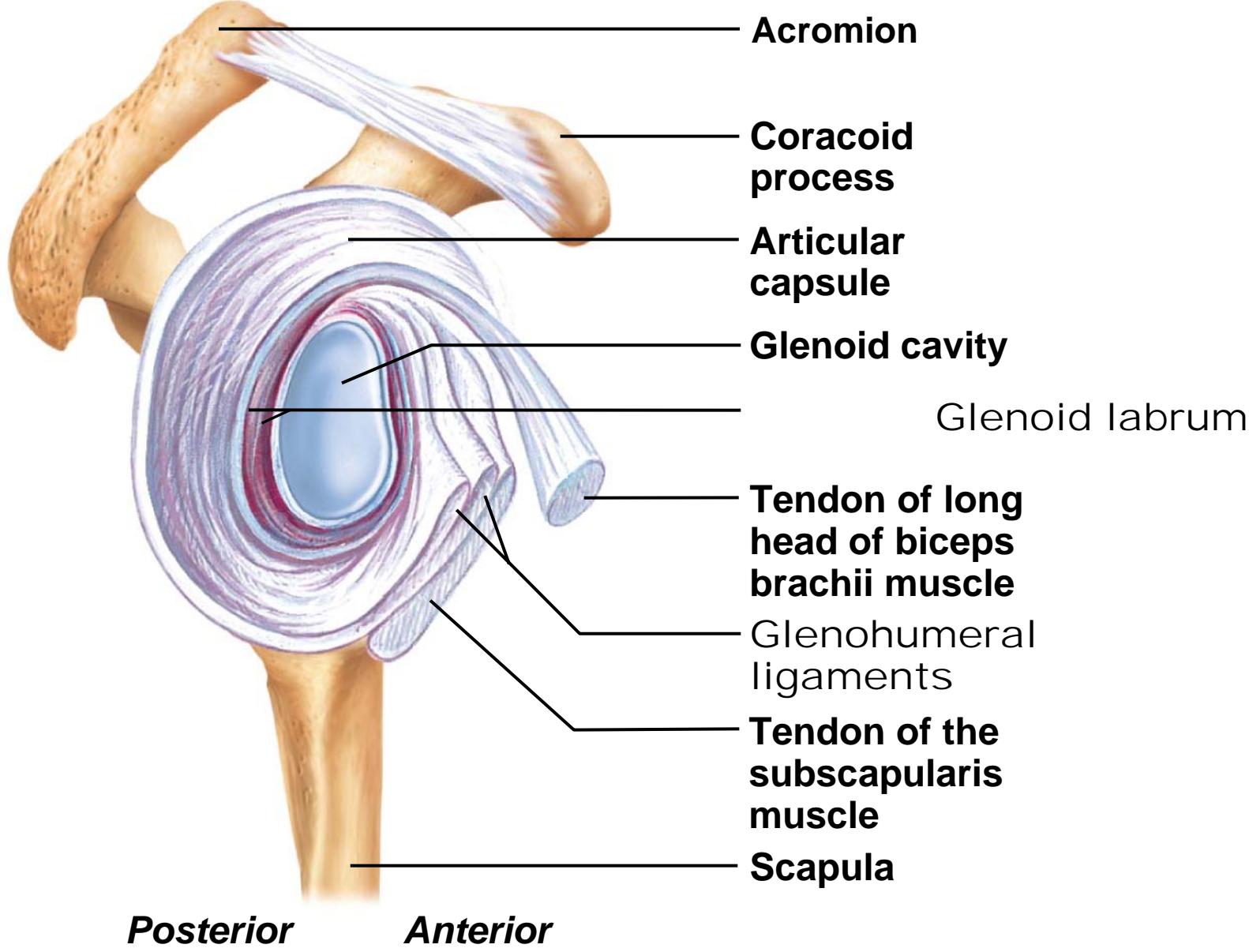
- Reinforcing muscle tendons
 - Tendon of long head of biceps brachii
 - Travels through the intertubercular sulcus
 - Secures humerus to glenoid cavity
 - Four **rotator cuff** tendons encircle the shoulder joint
 - Subscapularis
 - Supraspinatus
 - Infraspinatus
 - Teres minor



(c)

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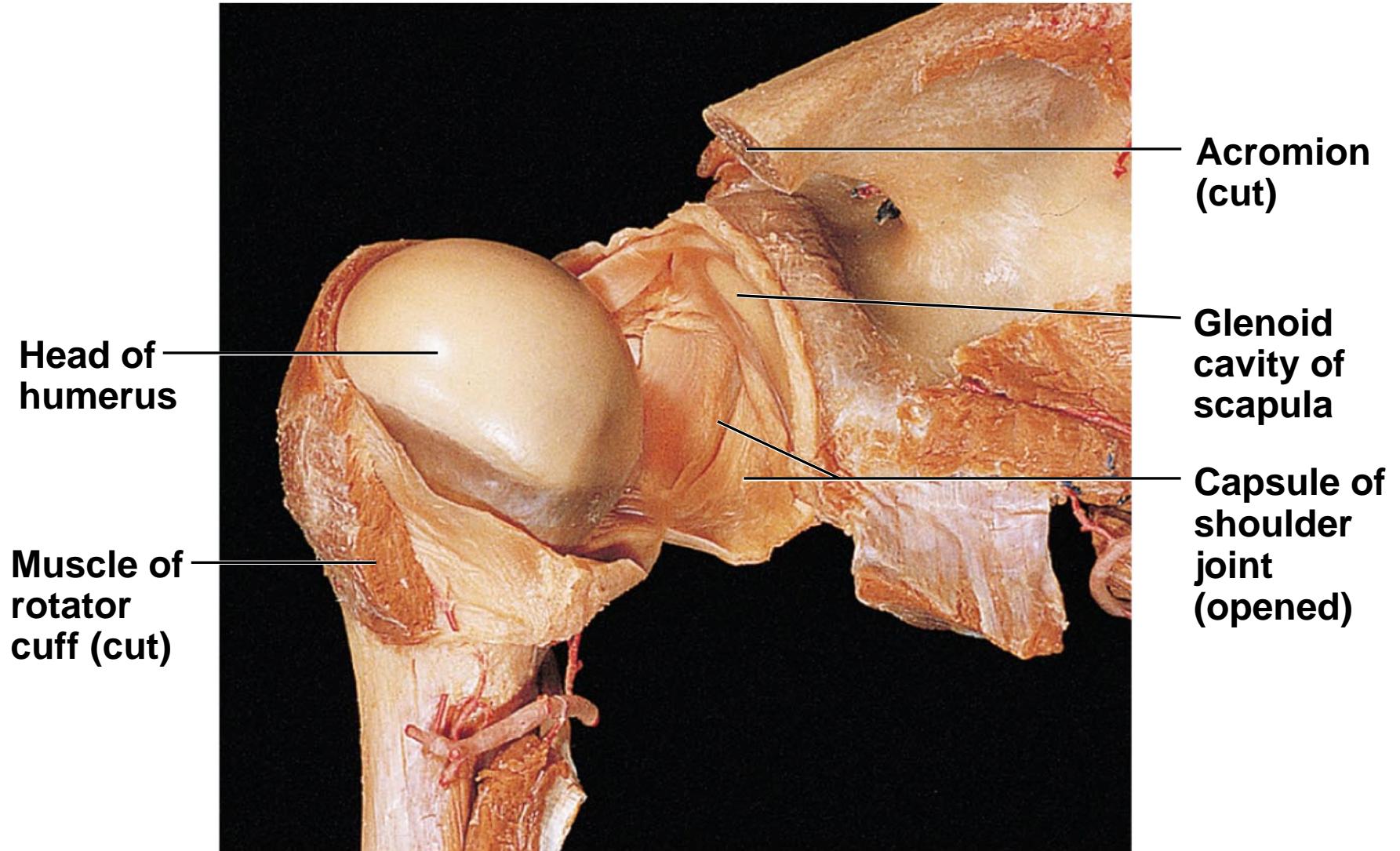
Anterior view of right shoulder joint capsule



(d)

Lateral view of socket of right shoulder joint, humerus removed

The shoulder joint.

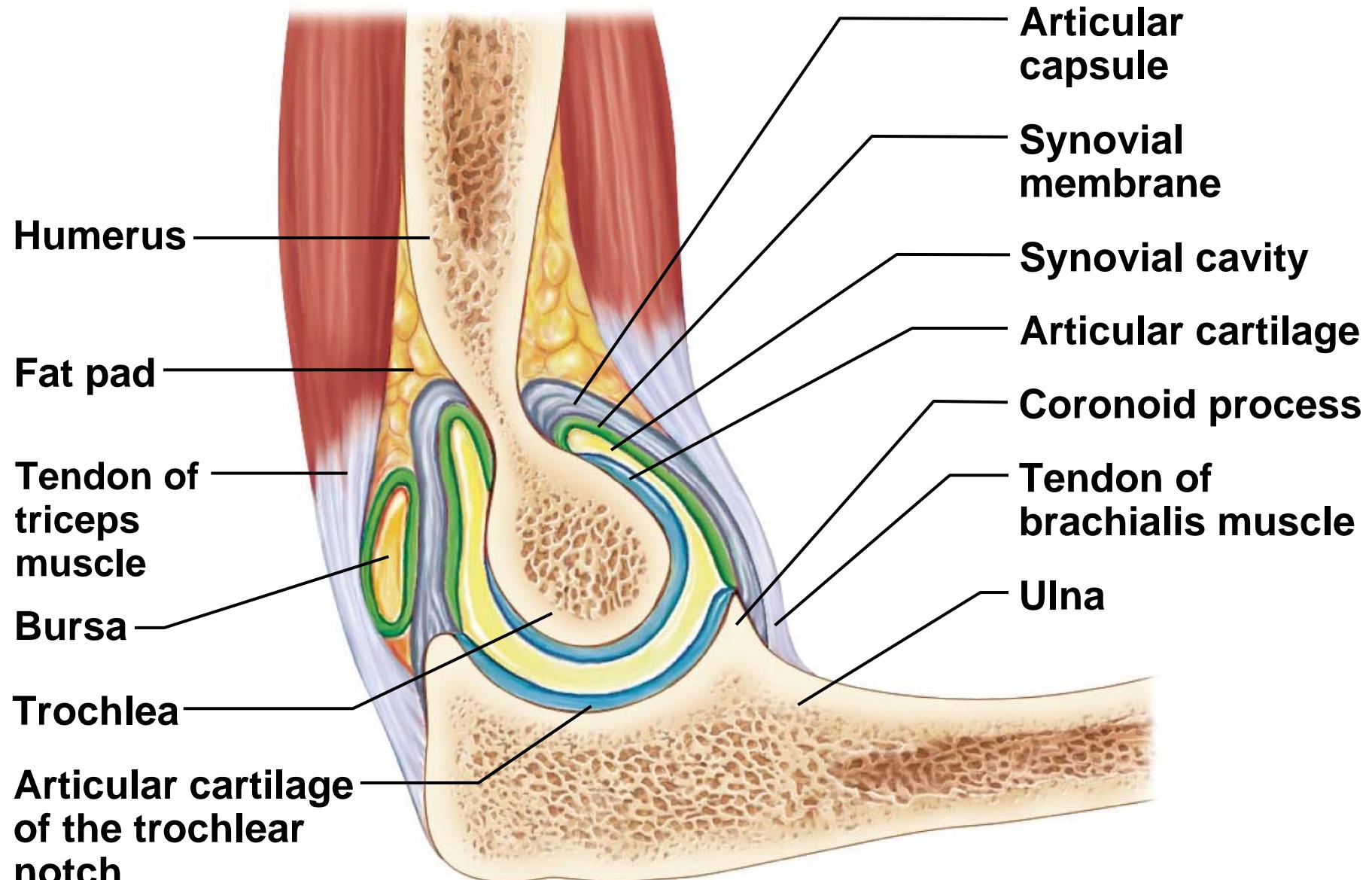


(e)

Anterior view of an opened shoulder joint

Elbow Joint

- Articulation of radius and ulna with humerus
- Hinge joint
 - Primarily trochlear notch of ulna with trochlea of humerus
 - Flexion and extension only

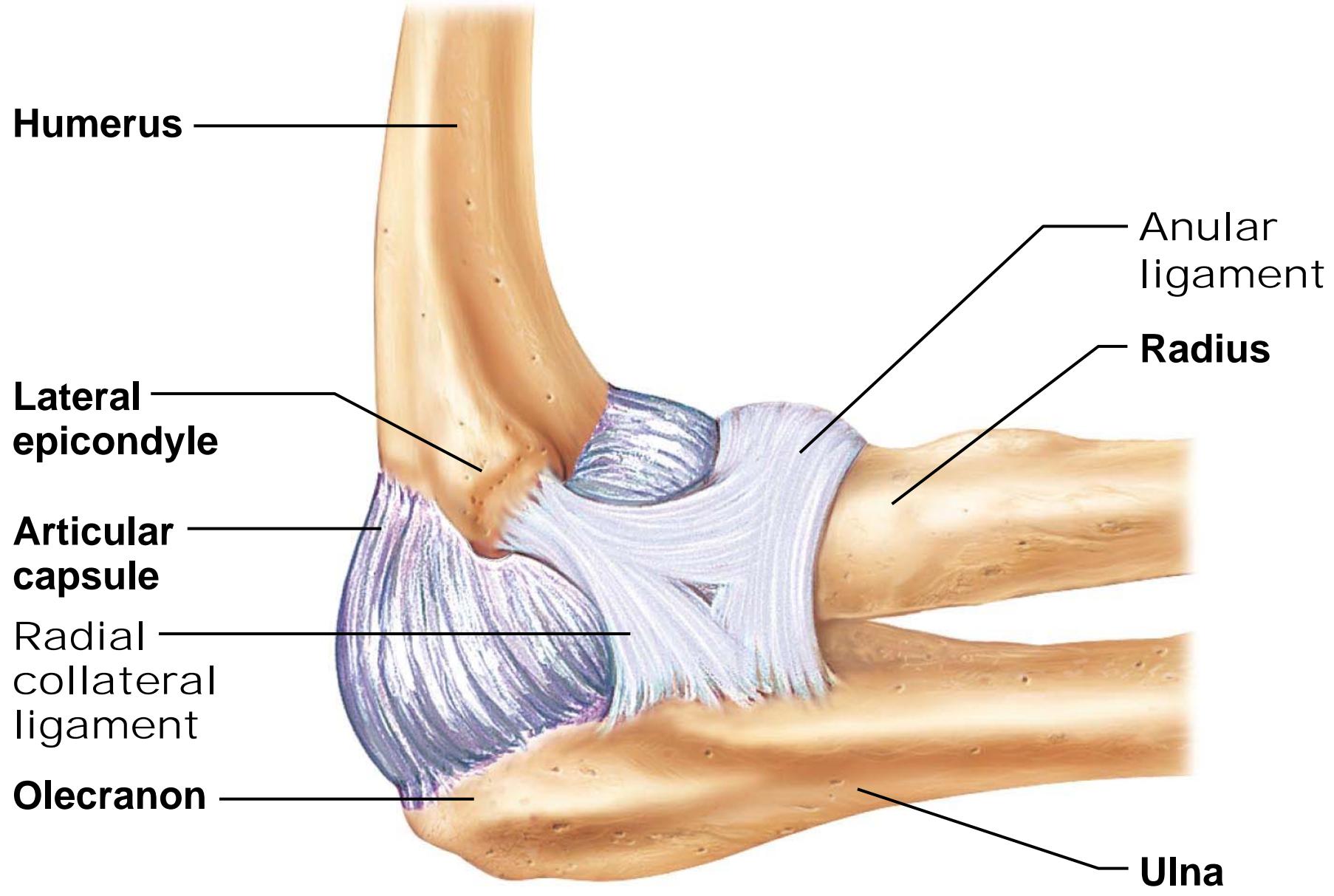


(a)

Median sagittal section through right elbow (lateral view)

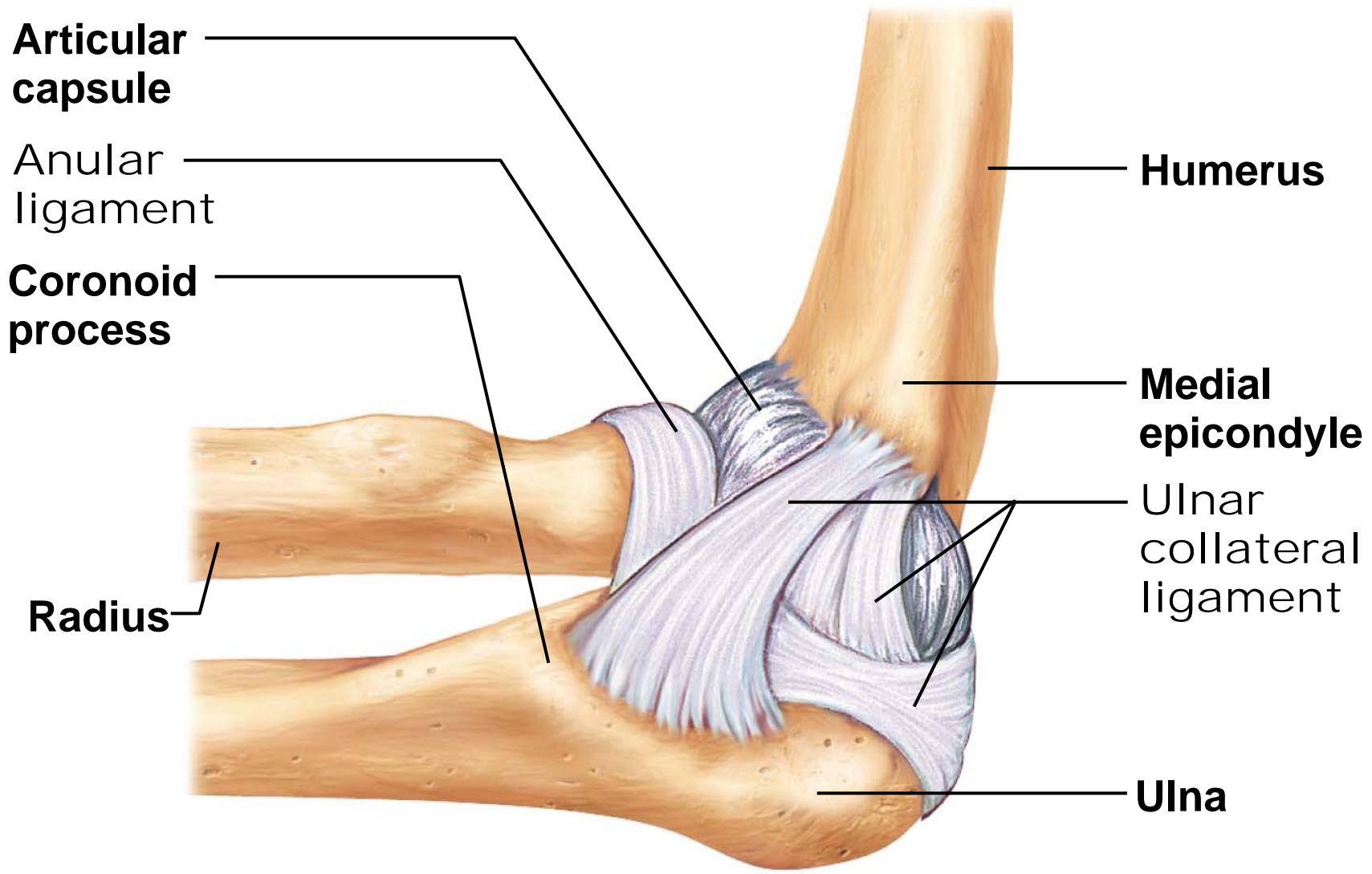
Elbow Joint

- **Anular ligament**
 - Surrounds head of radius
- Two capsular ligaments restrict side-to-side movement
 - **Ulnar collateral ligament**
 - **Radial collateral ligament**



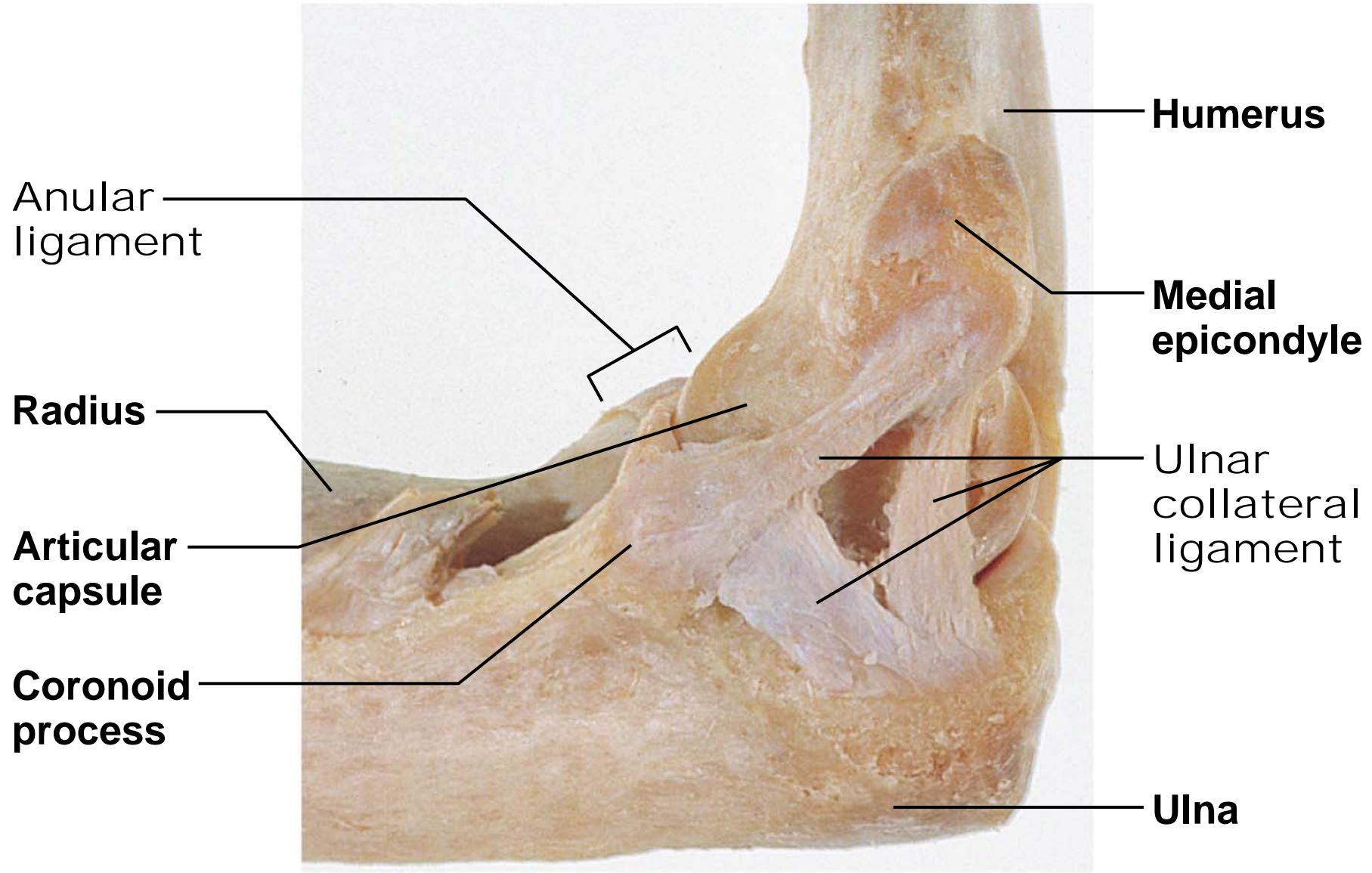
(b)

Lateral view of right elbow joint



(d)

Medial view of right elbow

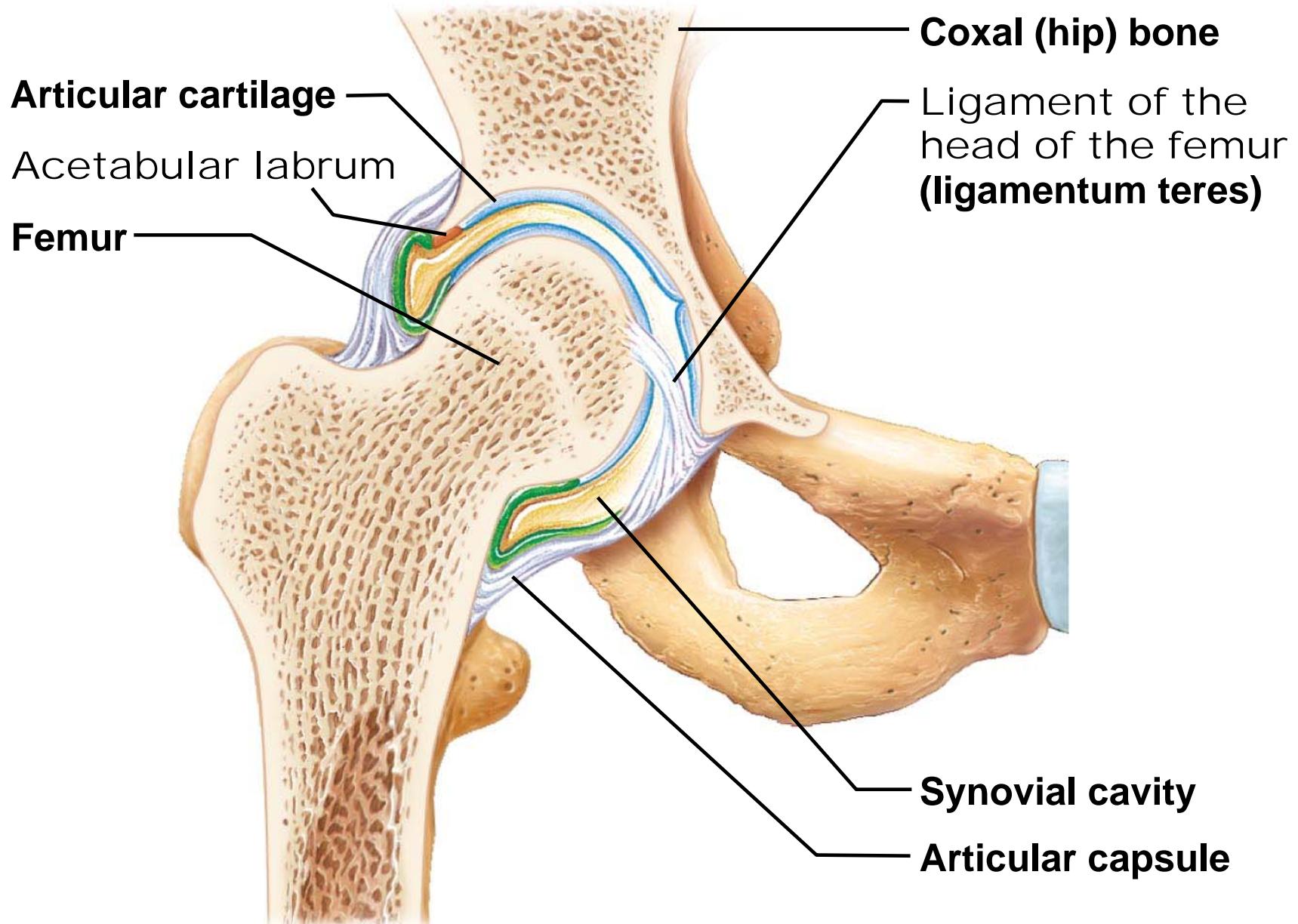


(c)

Cadaver photo of medial view of right elbow

Hip (Coxal) Joint

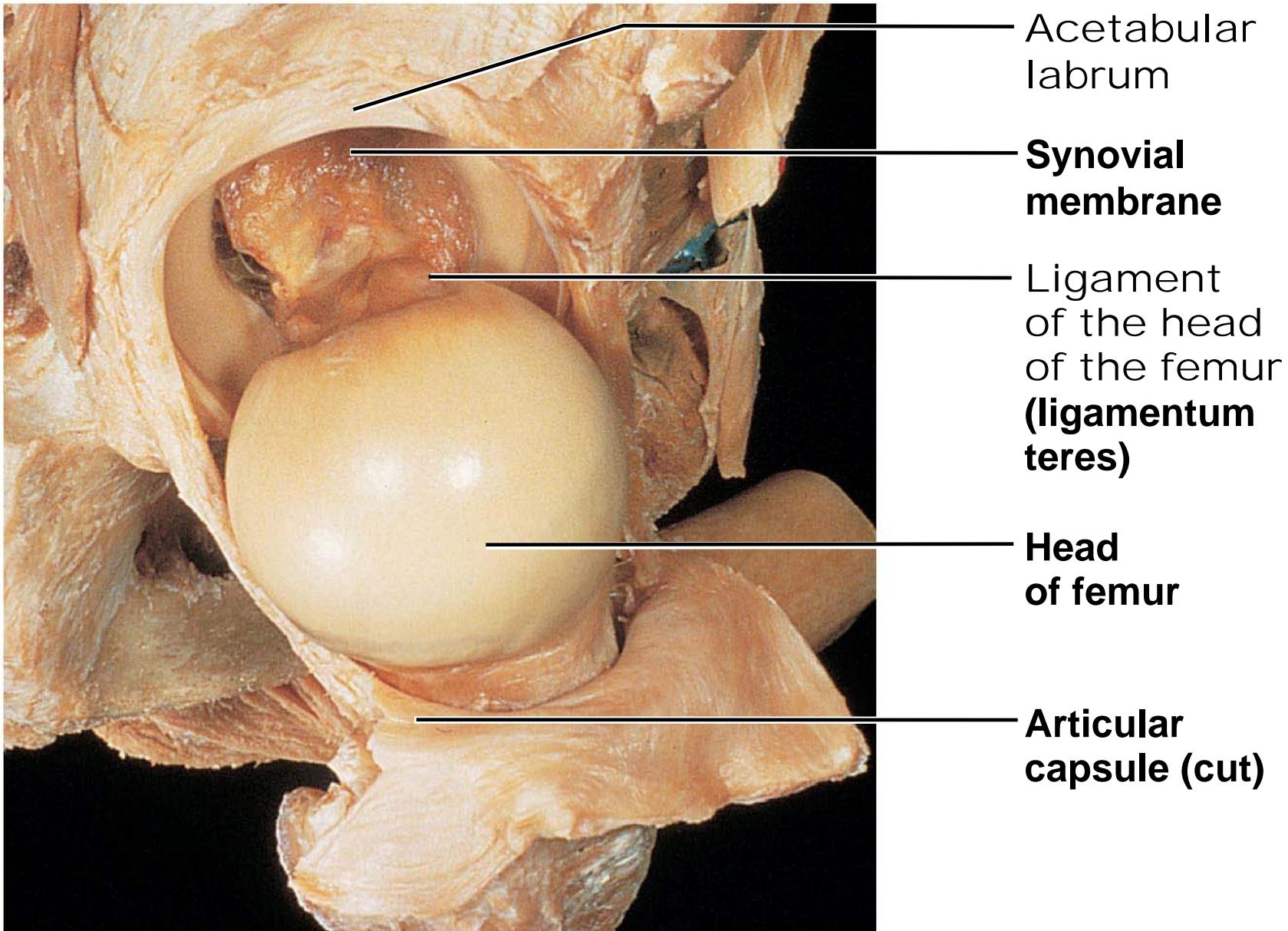
- Ball-and-socket joint
- Head of the femur articulates with acetabulum
- Good range of motion, but limited by the deep socket
 - Rim of fibrocartilage - **Acetabular labrum**
 - Enhances depth of socket so hip dislocations rare



(a)

Frontal section through the right hip joint

The hip joint.



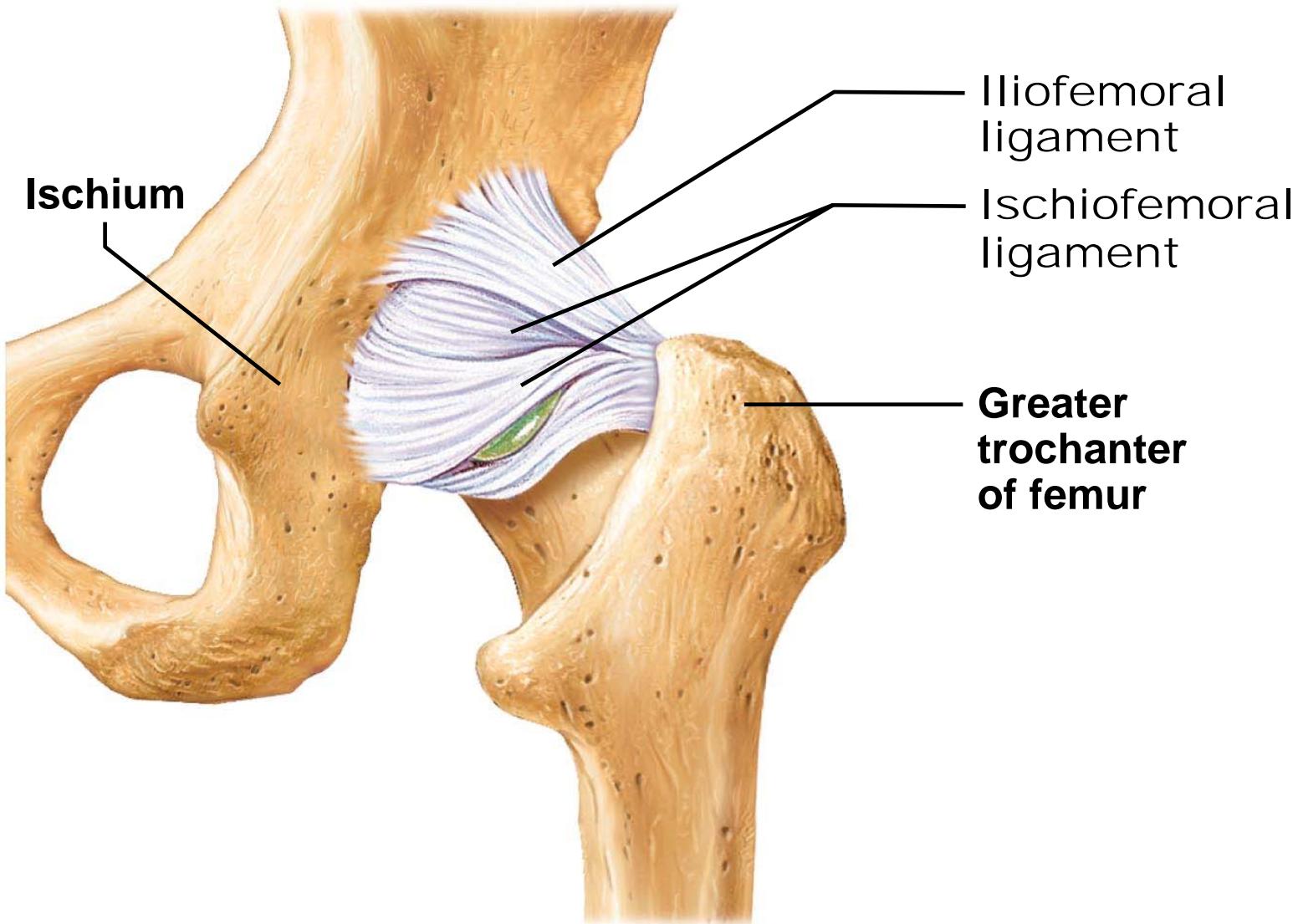
(b)

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Photo of the interior of the hip joint, lateral view

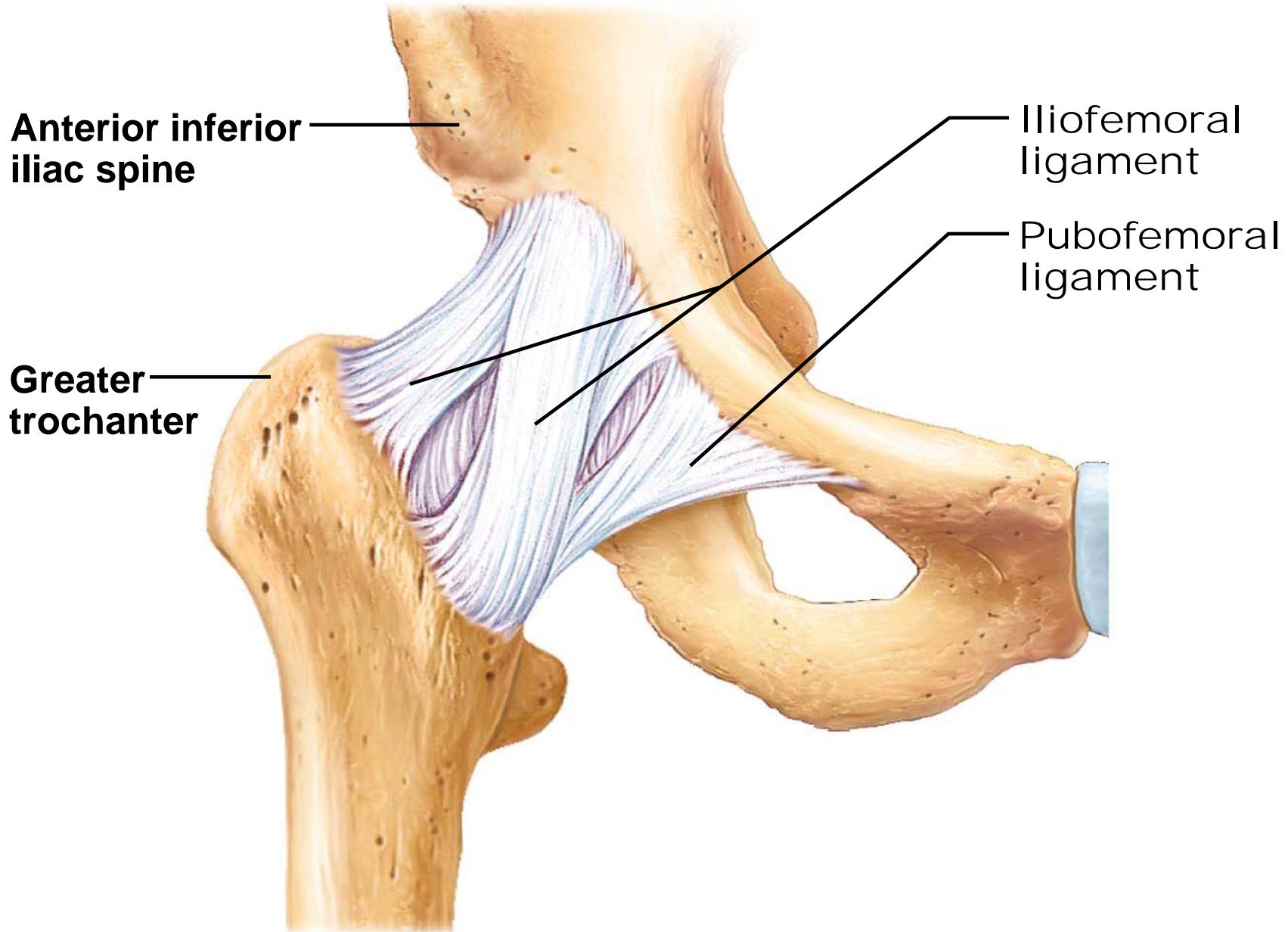
Hip Joint

- Reinforcing ligaments
 - Iliofemoral ligament
 - Pubofemoral ligament
 - Ischiofemoral ligament
 - Ligamentum teres



(c)

Posterior view of right hip joint, capsule in place



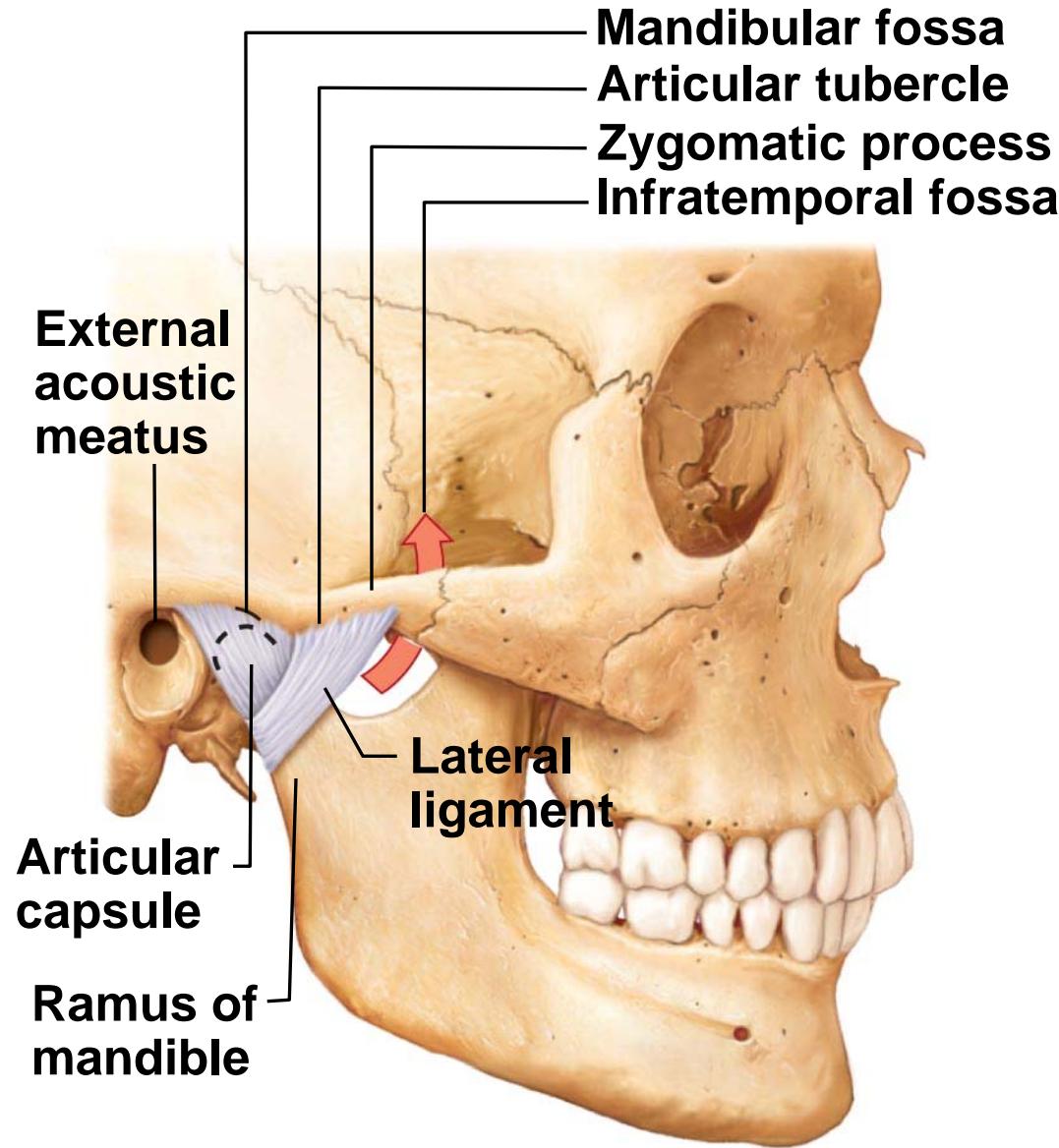
(d)

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Anterior view of right hip joint, capsule in place

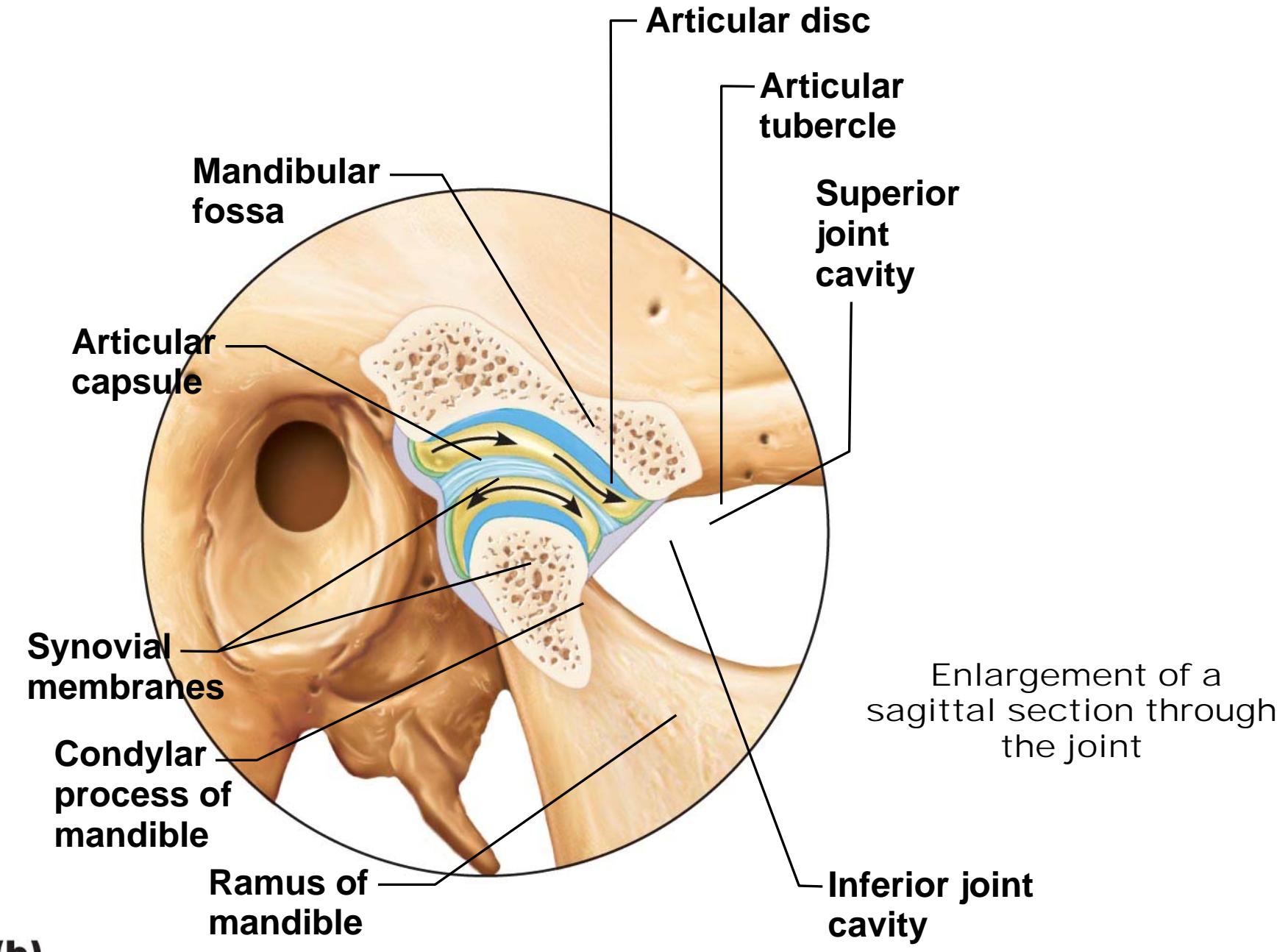
Temporomandibular Joint (TMJ)

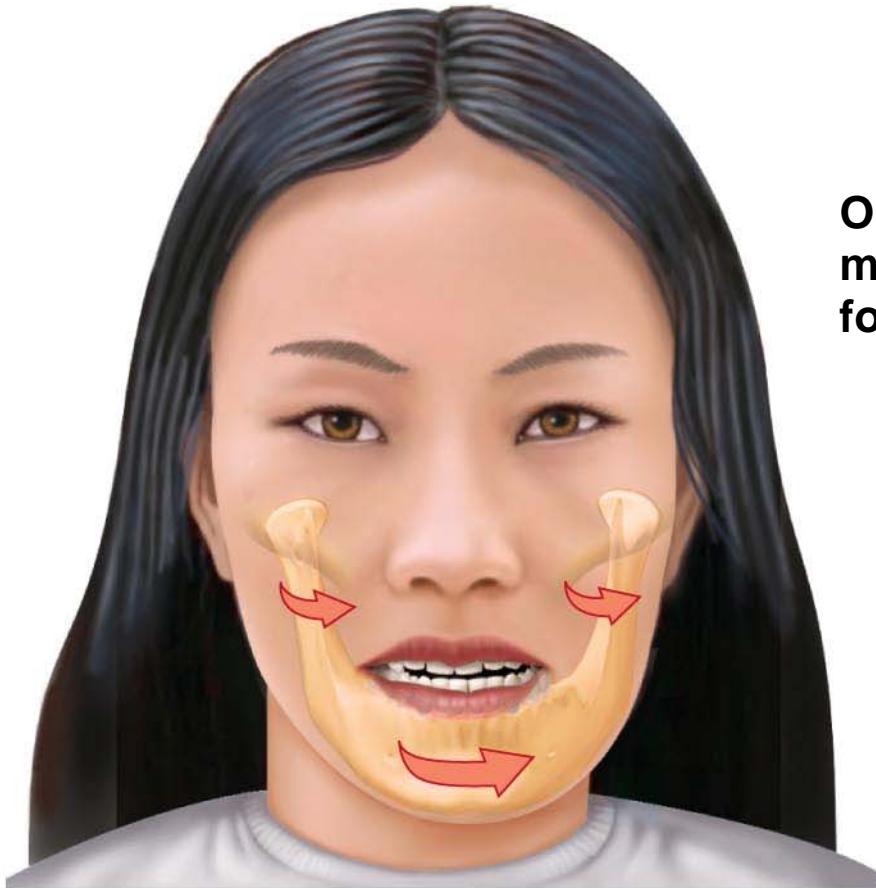
- Mandibular condyle articulates with temporal bone
- Two types of movement
 - **Hinge**—depression and elevation of mandible
 - **Gliding**—e.g., side-to-side (lateral excursion) grinding of teeth
- *Most easily dislocated joint in the body*



(a)

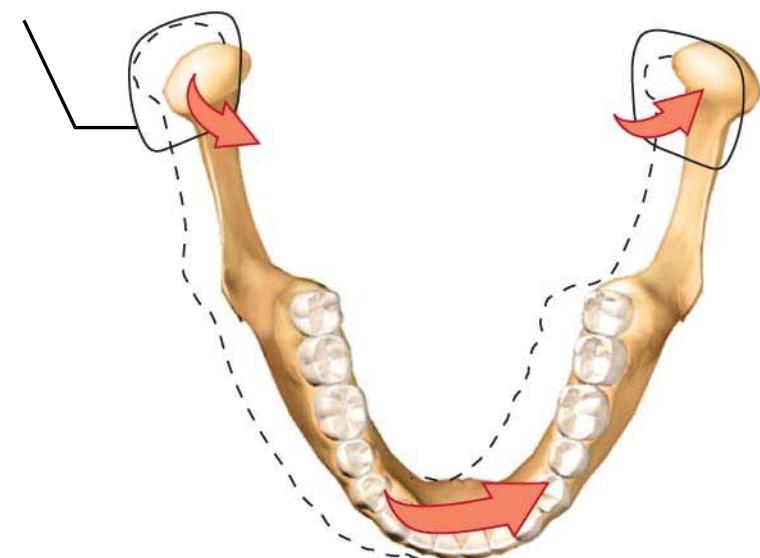
Location of the joint in the skull





Outline of the
mandibular
fossa

Superior view

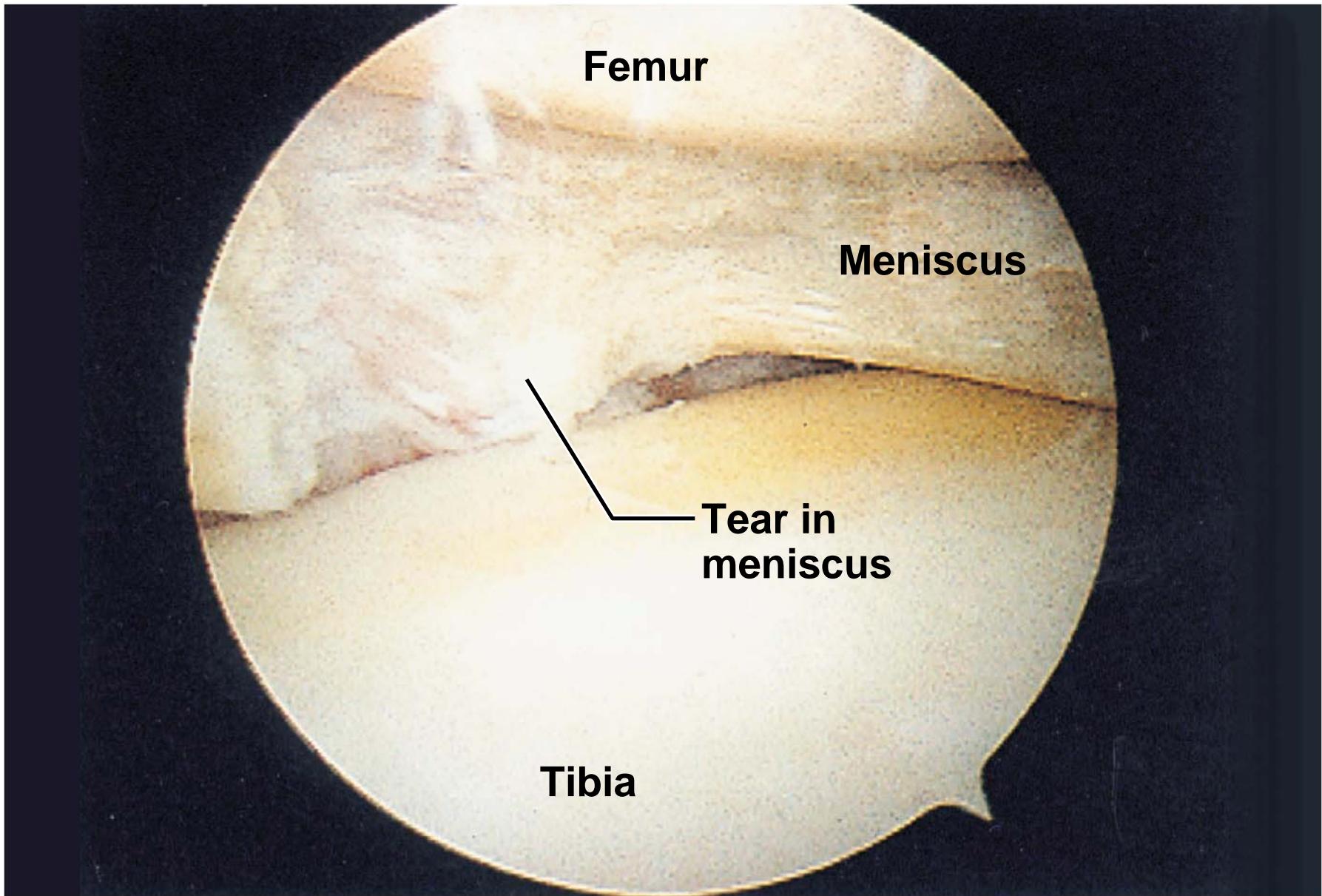


(c) Lateral excursion: lateral (side-to-side) movements of the mandible

Common Joint Injuries

- Cartilage tears
 - Due to compression and shear stress
 - Fragments may cause joint to lock or bind
 - Cartilage rarely repairs itself
 - Repaired with **arthroscopic surgery**
 - Ligaments repaired, cartilage fragments removed with minimal tissue damage or scarring
 - Partial menisci removal renders joint less stable but still mobile; complete removal leads to osteoarthritis
 - Meniscal transplant in younger patients
 - Perhaps meniscus grown from own stem cells in future

Arthroscopic photograph of a torn medial meniscus.



Common Joint Injuries

- Sprains
 - Reinforcing ligaments stretched or torn
 - Partial tears slowly repair heal
 - Poor vascularization
 - Three options if torn completely
 - Ends sewn together
 - Replaced with grafts
 - Time and immobilization

Common Joint Injuries

- **Dislocations (luxations)**
 - Bones forced out of alignment
 - Accompanied by sprains, inflammation, and difficulty moving joint
 - Caused by serious falls or contact sports
 - Must be reduced to treat
- **Subluxation**—partial dislocation of a joint

Inflammatory and Degenerative Conditions

- Bursitis
 - Inflammation of bursa, usually caused by blow or friction
 - Treated with rest and ice and, if severe, anti-inflammatory drugs
- Tendonitis
 - Inflammation of tendon sheaths typically caused by overuse
 - Symptoms and treatment similar to bursitis

Arthritis

- >100 different types of inflammatory or degenerative diseases that damage joints
- Most widespread crippling disease in the U.S.
- Symptoms: pain, stiffness, and swelling of joint
- Acute forms: caused by bacteria, treated with antibiotics
- Chronic forms: osteoarthritis, rheumatoid arthritis, and gouty arthritis

Osteoarthritis (OA)

- Common, irreversible, degenerative ("wear-and-tear") arthritis
- May reflect excessive release of enzymes that break down articular cartilage
- By age 85 half of Americans develop OA, more women than men
- Probably related to normal aging process

Osteoarthritis (OA)

- More cartilage is destroyed than replaced in badly aligned or overworked joints
- Exposed bone ends thicken, enlarge, form bone spurs, and restrict movement
- Treatment: moderate activity, mild pain relievers, capsaicin creams
 - Glucosamine, chondroitin sulfate, and nutritional supplements **not effective**

Rheumatoid Arthritis (RA)

- Chronic, inflammatory, **autoimmune disease** of unknown cause
 - Immune system attacks own cells
- Usually arises between ages 40 and 50, but may occur at any age; affects 3 times as many women as men
- Signs and symptoms include joint pain and swelling (usually bilateral), anemia, osteoporosis, muscle weakness, and cardiovascular problems

Rheumatoid Arthritis

- RA begins with **synovitis** of the affected joint
 - Inflammatory blood cells migrate to joint, release inflammatory chemicals that destroy tissues
 - Synovial fluid accumulates → joint swelling and inflamed synovial membrane which thickens → **pannus** that clings to articular cartilage
 - Pannus erodes cartilage, scar tissue forms and connects articulating bone ends (ankylosis)

Rheumatoid Arthritis: Treatment

- Disrupt destruction of joints by immune system
- Steroidal and nonsteroidal anti-inflammatory drugs decrease pain and inflammation
- Immune suppressants slow autoimmune reaction
- Some agents target **tumor necrosis factor** to block action of inflammatory chemicals
- Can replace joint with prosthesis

A hand deformed by rheumatoid arthritis.



Gouty Arthritis

- Deposition of uric acid crystals in joints and soft tissues, followed by inflammation
- High fructose leads to metabolic pathway with elevates uric acid crystals! (high fructose corn syrup)
- More common in men
- Typically affects joint at base of great toe
- In untreated gouty arthritis, bone ends fuse and immobilize joint
- Treatment: drugs, plenty of water, avoidance of alcohol

Lyme Disease

- Caused by bacteria transmitted by tick bites
- Symptoms: skin rash, flu-like symptoms, and foggy thinking
- May lead to joint pain and arthritis
- Treatment
 - Long course of antibiotics

Developmental Aspects of Joints

- By embryonic week 8, synovial joints resemble adult joints
- Joint's size, shape, and flexibility modified by use
- Advancing years take toll on joints
 - Ligaments and tendons shorten and weaken
 - Intervertebral discs more likely to herniate
 - Most people in 70s have some degree of OA
- Full-range-of-motion exercise key to postponing joint problems