

Chapter 8

Articulations & Movement

Chapter 8 Outline

- I. Naming joints
- II. Classes of joints
- III. Types of movement
- IV. Range of motion
- V. Description of selected joints
- VI. Effects of aging on the joints

I. Naming of joints

Joints are named according to the bones or parts of the bones involved in making the articulation (joint)

II. Classes of joints

II. Classes of joints

2 primary ways to classify joints



Structure (anatomy)

- Dependent on the CT type holding bones together or presence or absence of a fluid-filled capsule
- I. Fibrous
- II. Cartilaginous
- III. Synovial

Function (physiology)

- Based on the degree of motion present at each joint.
- I. Synarthrosis
 - Non-mobile joint
- II. Amphiarthrosis
 - Slightly mobile joint
- III. Diarthrosis
 - Freely mobile joint

II. Classes of joints

Structural Classification: Fibrous Joints

❖ *Consist of:*

- *2 bones united by fibrous CT,*
- *No joint cavity*
- *Exhibiting little to no movement*

1. Sutures

2. Syndesmoses

3. Gomphoses

II. Classes of joints

Structural Classification: Fibrous Joints

1. Suture

- Seams between bones of the skull that often interdigitate (have interlocking fingerlike processes).
 - These add considerable stability to sutures
- Between bones is DRCollagenousCT & the periosteum of adjacent bones is continuous over the joint (Combined make the sutural ligament)
- Margins of the bones within sutures are sites of continuous intramembranous growth, w/ many eventually becoming ossified (synostosis)

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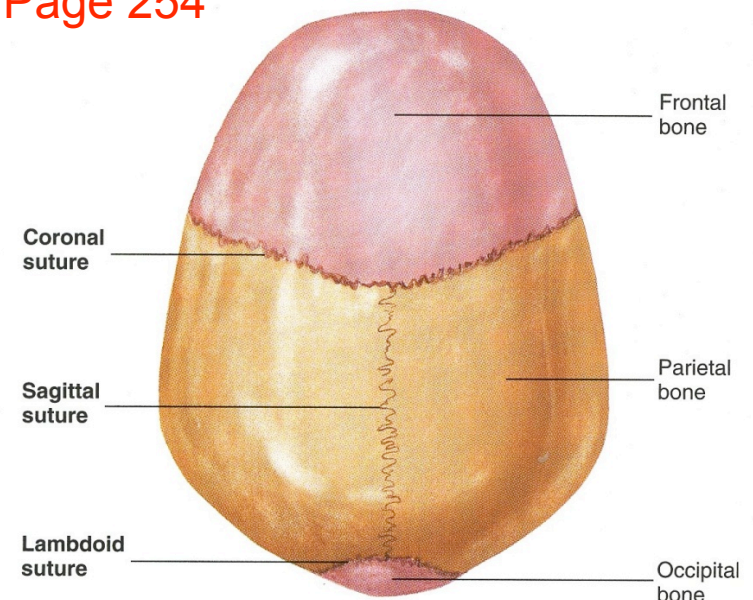
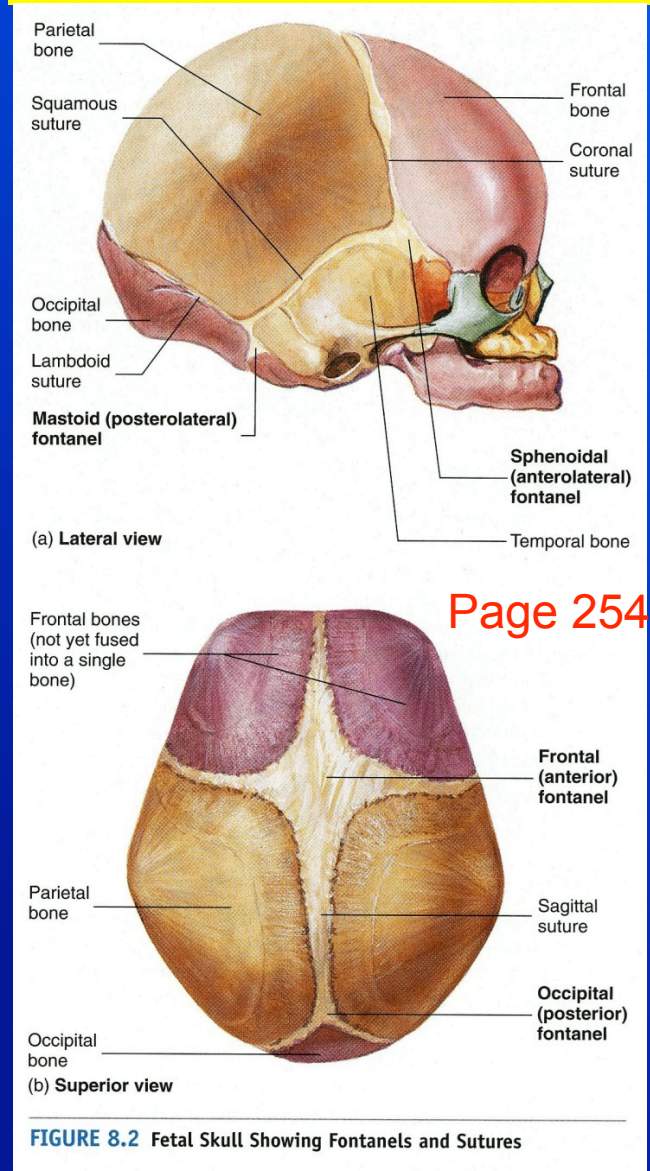


FIGURE 8.1 Sutures, Superior View

II. Classes of joints

Structural Classification: *Fibrous Joints*

- In a newborn, a membranous area present in some of the suture areas that makes the skull flexible during the birthing process & allows for growth of the head after birth

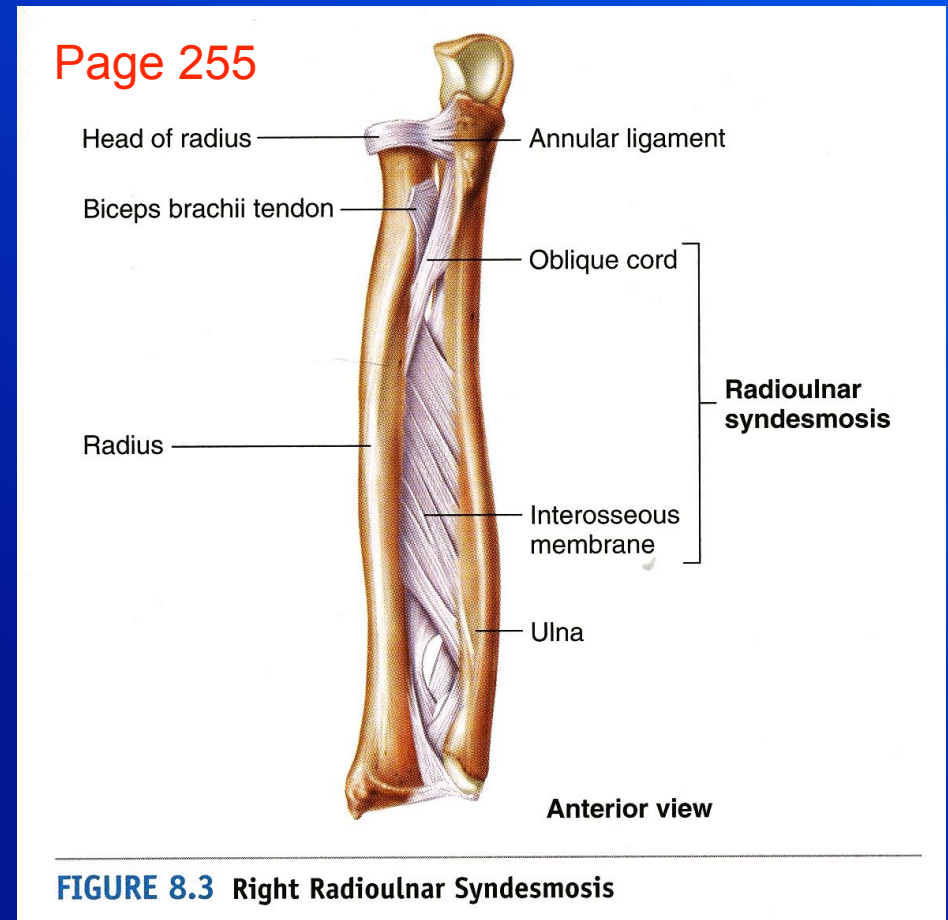


II. Classes of joints

Structural Classification: Fibrous Joints

2. Syndesmoses

- Fibrous joint in wh/ distant bone are joined by ligaments
- Some movement may occur in this joint because of the flexibility of the ligaments.



II. Classes of joints

Structural Classification: Fibrous Joints

3. Gomphoses

- Specialized joints consisting of pegs that fit into sockets & are held in place by fine bundles of regular collagenous CT.
- (Teeth in both mandible & maxilla)
- Periodontal Ligaments
 - Slight amount of “give” during mastication (chewing)

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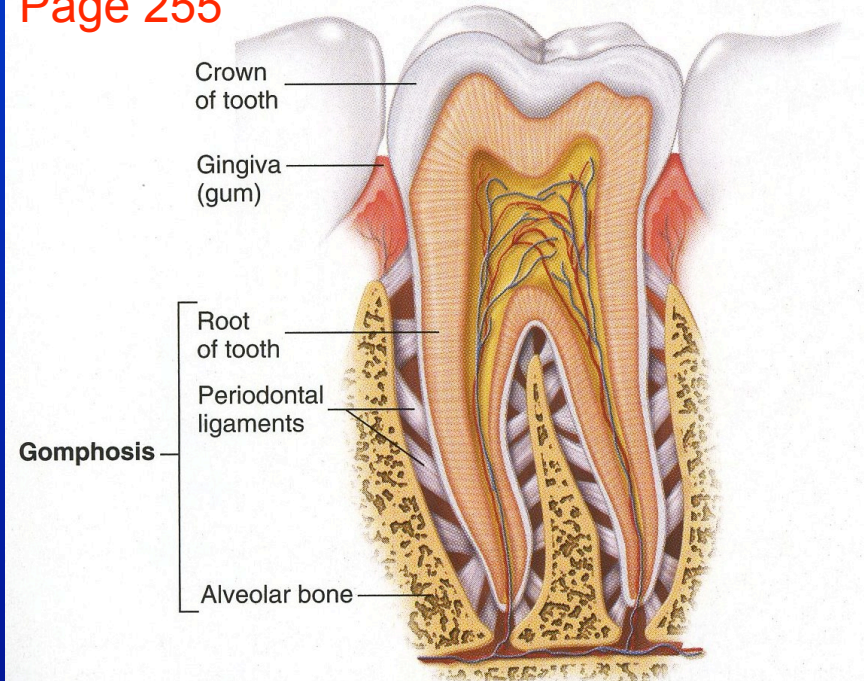


FIGURE 8.4 Gomphosis Between a Tooth and Alveolar Bone of the Mandible

II. Classes of joints

Structural Classification:

Cartilaginous Joints

❖ *Unite 2 bones by either hyaline cartilage or fibrocartilage.*

2 major types



1. Synchondroses

2. Symphysis

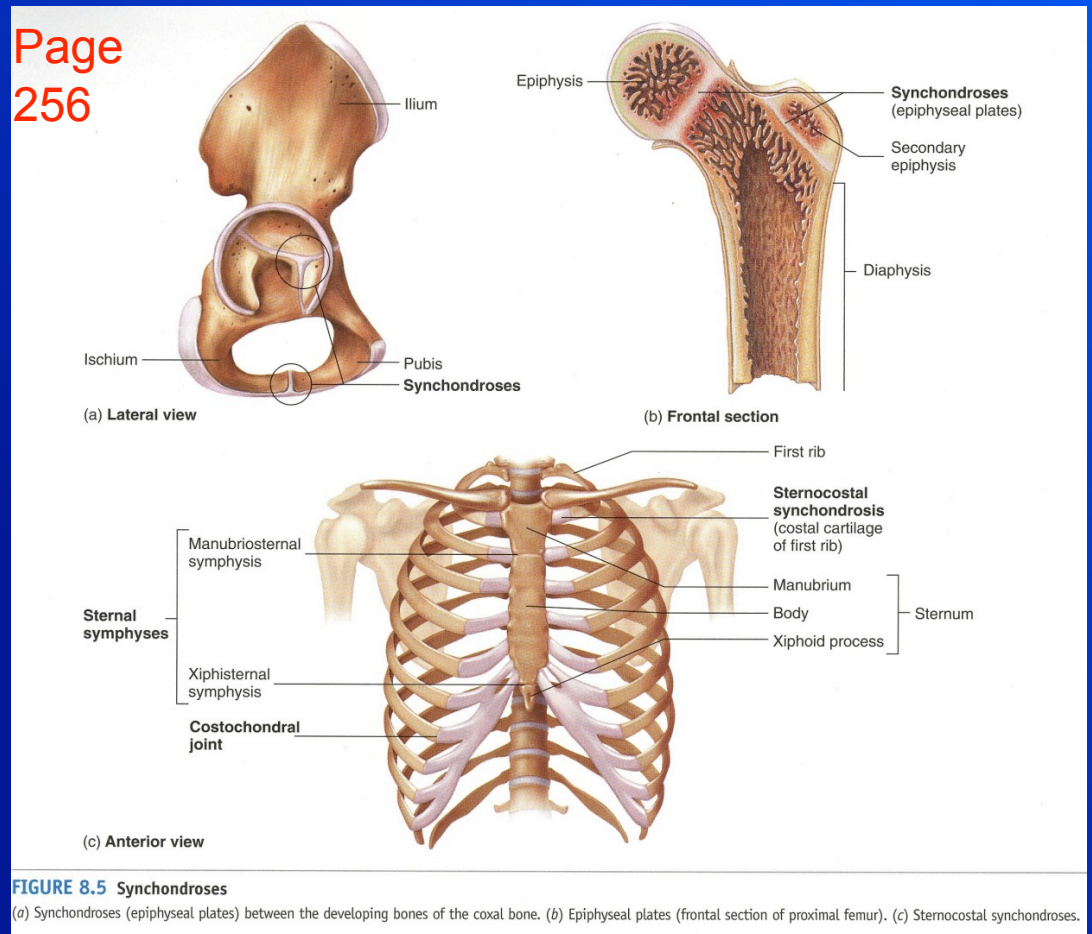
II. Classes of joints

Structural Classification:

Cartilaginous Joints

1. Synchondroses

- Immovable joints joined by hyaline cartilage
- Most are temporary with cartilage eventually going thru synostoses, but some persist thru-out life

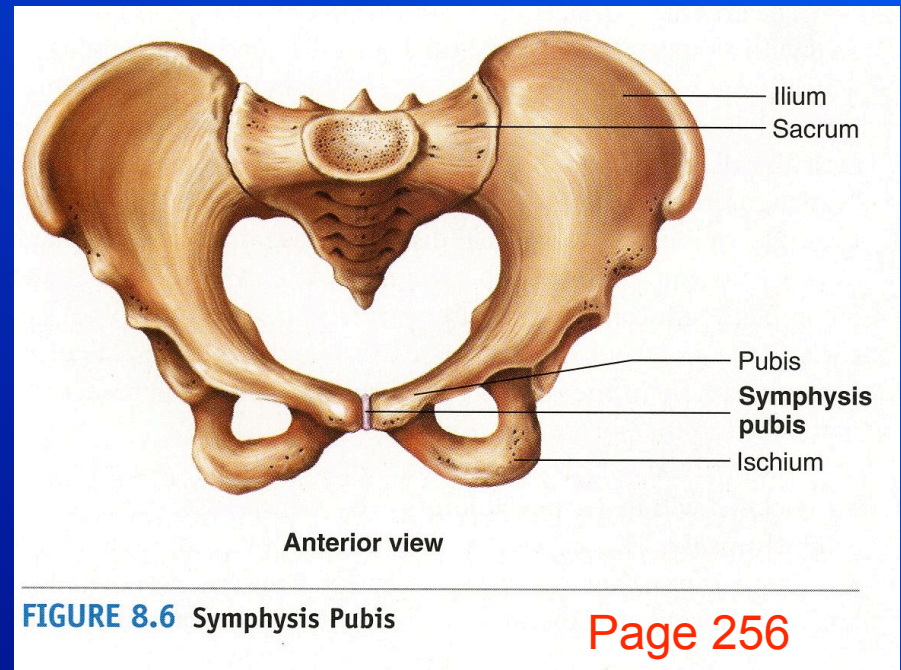


II. Classes of joints

Structural Classification: Cartilaginous Joints

Symphysis

- Consist of fibrocartilage joining bones.
- Some are slightly movable because of the nature of fibrocartilage



II. Classes of joints

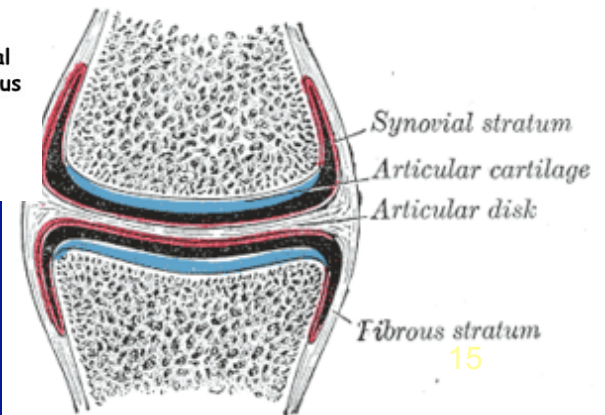
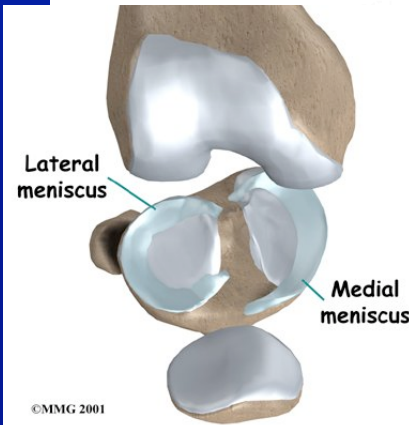
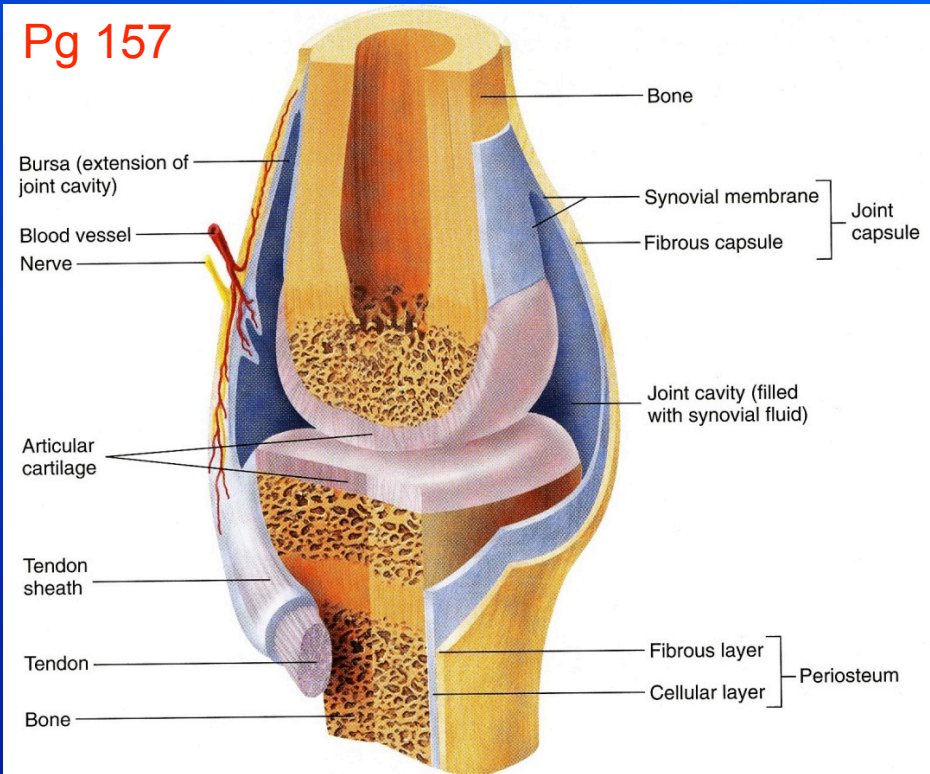
Structural Classification: Synovial Joints

- ❖ *Contain synovial fluid which allow considerable movement between articulating bones*
- ❖ *These are more anatomically complex than either fibrous or cartilaginous joints.*

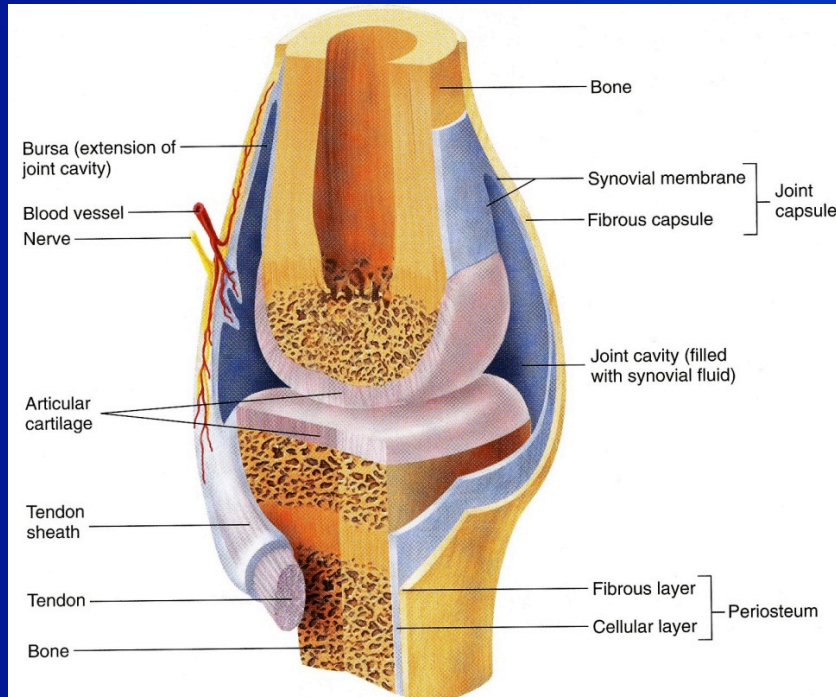
Synovial Joints Anatomy

- Articular Cartilage: hyaline cartilage that covers the ends of articulating bones providing a smooth surface where bones meet
- Articular Disk: (in some bones) a flat plate of fibrocartilage located between the articular cartilage (circumference is attached to the fibrous capsule)
- Meniscus: an incomplete crescent shaped fibrocartilage pad (knee/wrist) with a hole in the center (circumference is attached to the fibrous capsule)

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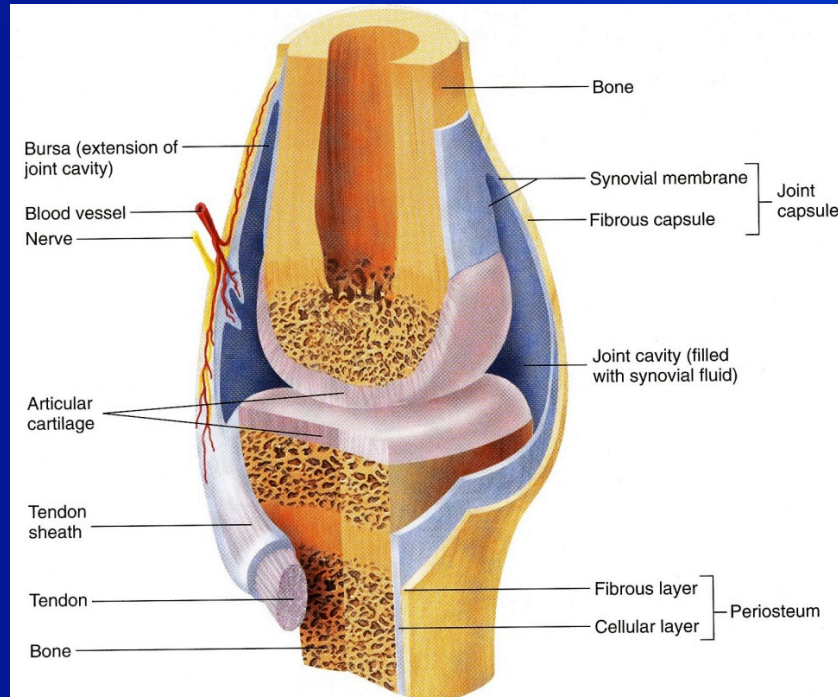


Synovial Joints Anatomy



- Articulating bones are encased in a synovial joint cavity which is surrounded by a joint capsule.
 - Joint capsule helps hold bones together while allowing for movement
 - 2 layers:
 - a) Fibrous capsule (outer)
 - DRCT and continuous with the fibrous layer of the periosteum
 - b) Synovial membrane (inner)
 - Thin delicate membrane that lines cavity except over the articular cartilage
 - Cells secrete synovial fluid which is made of serum filtrate & secretions from synovial cells to make it slick.

Synovial Joints Anatomy



- **Synovial membrane**
 - Bursa: extension of the synovial joints that protect skin, tendons or bone from structures that can rub against them.
- Outer margins of the joint have blood vessels & nerves running through them but not into the capsule.
- Nerves can enter the fibrous or synovial membrane to indicate pain, position, or degree of joint movement

Types of Synovial Joints

- 6 types based on shape of articulating surfaces
 - 1) Plane
 - 2) Saddle
 - 3) Hinge
 - 4) Pivot
 - 5) Ball & socket
 - 6) Ellipsoid
- Movements of synovial joints are described as:
 - 1) Uniaxial: movement in 1 plane
 - 2) Biaxial: occurring around 2 axes situated at right angles from each other
 - 3) Multiaxial: along several axes

Types of Synovial Joints

1. Plane/gliding joints

- 2 opposed flat surfaces in wh/a slight amount of gliding motion can occur between bones
- Considered uniaxial because some rotation can occur but is limited by ligaments & adjacent bone

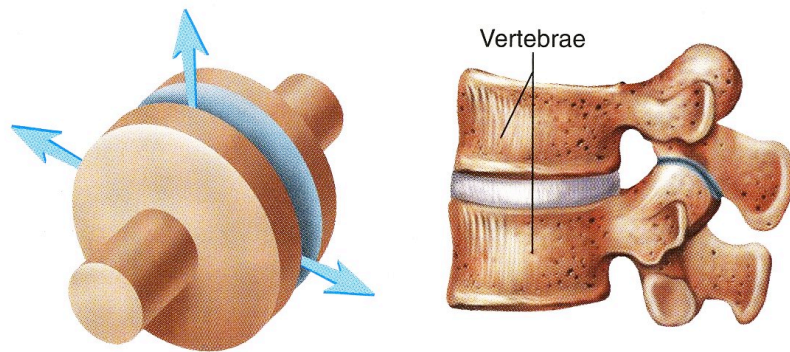


FIGURE 8.8 Plane Joint

2. Saddle Joints

- 2 saddle shaped articulating surfaces oriented at right angles so they fit together.
- Considered Biaxial

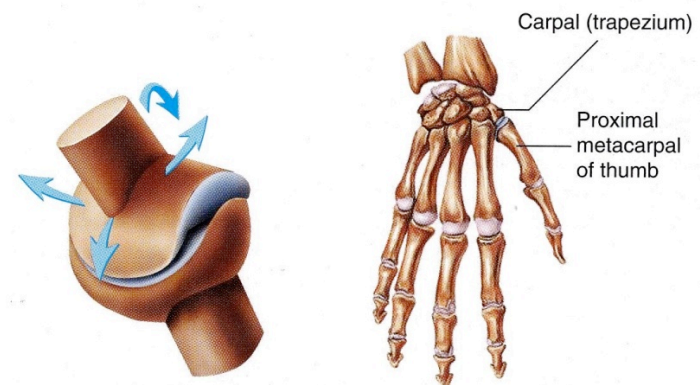


FIGURE 8.9 Saddle Joint

Types of Synovial Joints

3. Hinge Joint

- Convex cylinder of one bone fitting into a concave portion on another
- Uniaxial

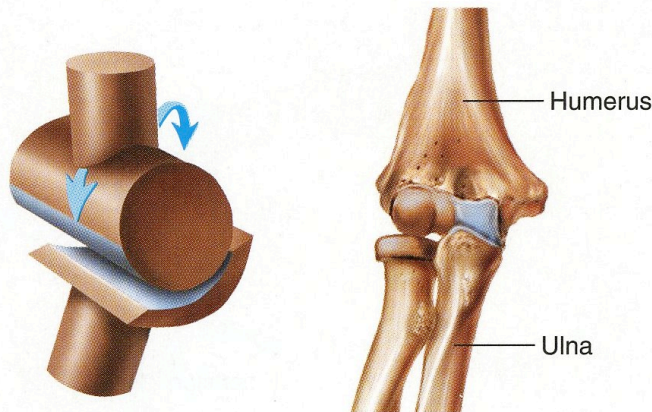


FIGURE 8.10 Hinge Joint

4. Pivot Joint

- Relatively cylindrical bony process that rotates within a ring composed partly of bone & partly ligament.
- Uniaxial that restrict movement to rotation along 1 axis

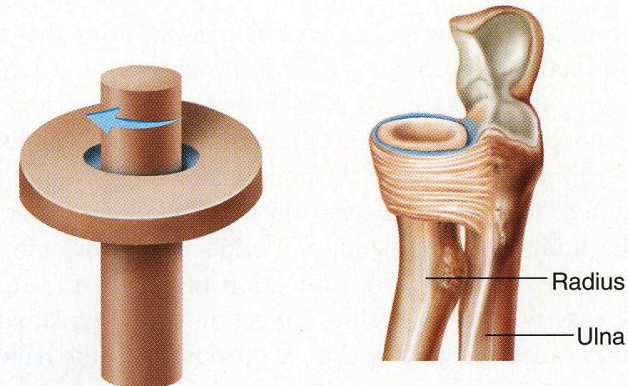


FIGURE 8.11 Pivot Joint

Types of Synovial Joints

5. Ball & Socket

- A ball at the end of one bone that fits into the socket of the adjacent bone
- Multiaxial joint allowing for a wide range of movement in almost any direction

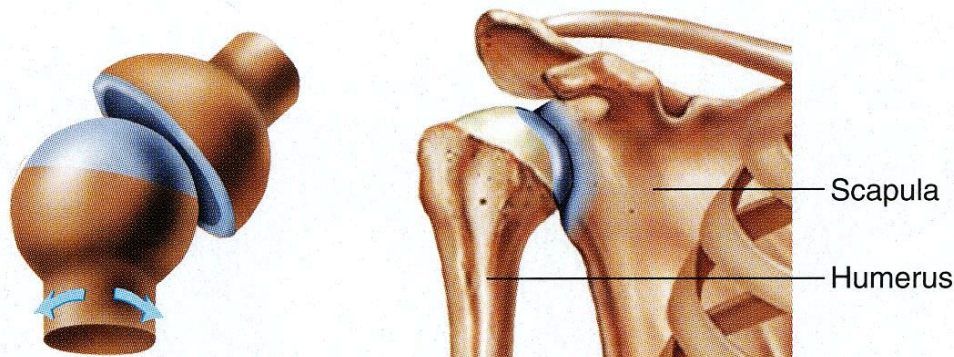


FIGURE 8.12 Ball-and-Socket Joint

6. Ellipsoid/condyloid Joint

- Modified ball & socket joints where the articular surface is an oval shape
- Biaxial because the shape of the joint limits its motion

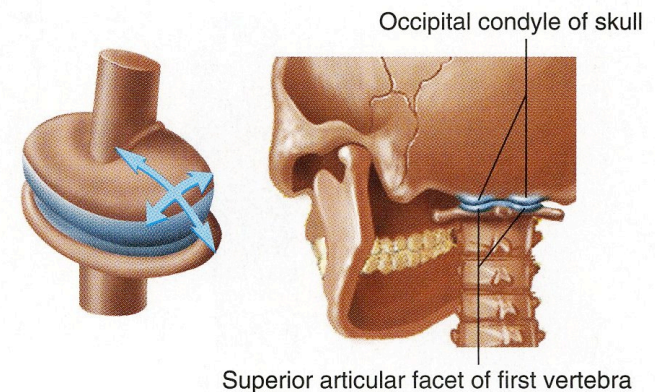


FIGURE 8.13 Ellipsoid Joint

III. Types of Movement

Joint's structure relates to the movements that occur at that specific joint.

Most movements are paired because they oppose each other

III. Types of movement

1. Gliding Movements

2. Angular Movements

- Flexion & Extension
- Abduction & Adduction

3. Circular Movements

- Rotation
- Pronation & Supination

4. Special Movements

- Elevation & Depression
- Protraction & retraction
- Excursion
- Opposition & reposition
- Inversion & eversion

1. Gliding Movements

- Simplest of all movement types
- Two flat surfaces that slide/glide over each other line Plane Joints
- Only slight movement

2. Angular Movements

- Movements in wh/ 1 part of a linear structure is bent relative to another part of the structure, thus Δ ing the angle between them.
- It can also mean that the angle with the trunk of the body has Δ ed

A. Flexion & Extension

- Bend (flex) & straighten (extend)
- Coronal Plane:
 - anterior to the coronal plane → flexion
 - Posterior to the coronal plane → Extension

B. Abduction & Adduction

- Take away (Abduct) & bring together (adduct)
- Abduction is movmt from the median plane
- Adduction is movement toward the medial plane

Flexion & Extension

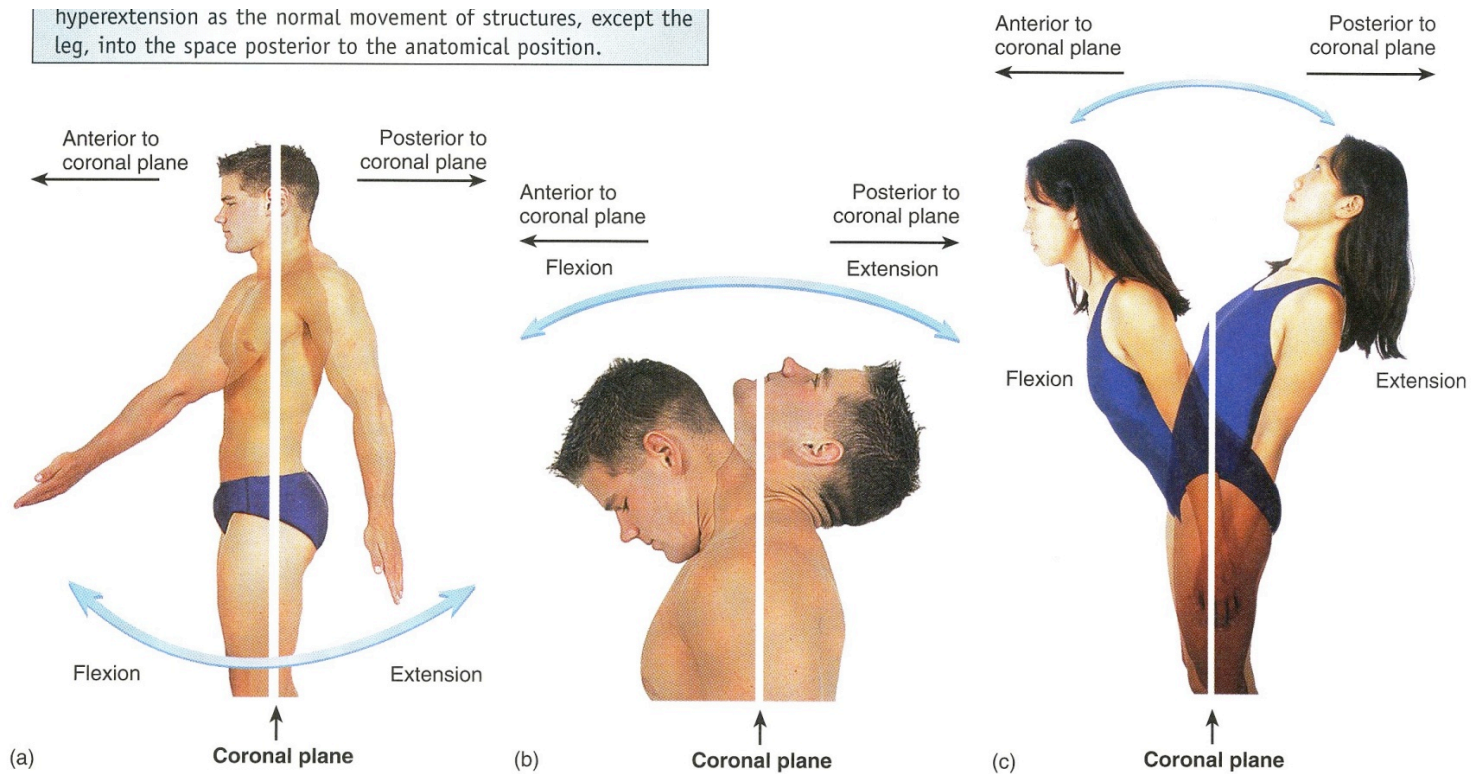


FIGURE 8.15 Flexion and Extension Defined According to the Coronal Plane

Flexion and extension of (a) the shoulder, (b) the neck, and (c) the trunk.

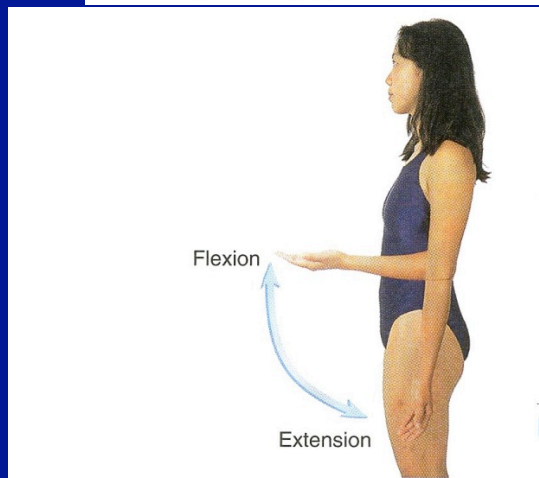


FIGURE 8.14 Flexion and Extension of the Elbow

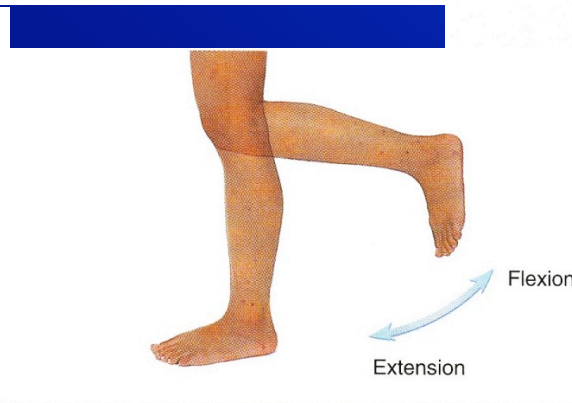


FIGURE 8.16 Flexion and Extension of the Knee

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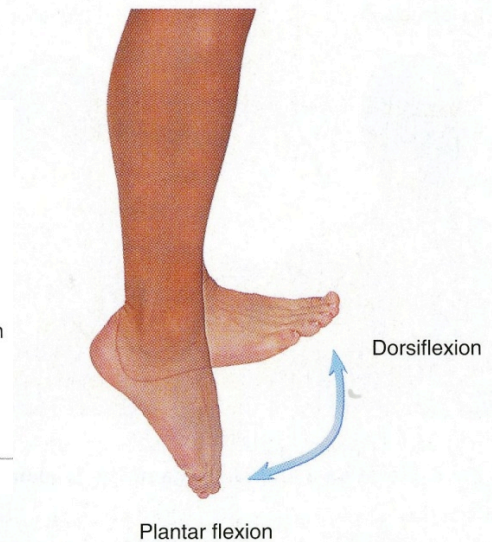


FIGURE 8.17 Dorsiflexion and Plantar Flexion of the Foot

Abduction & Adduction

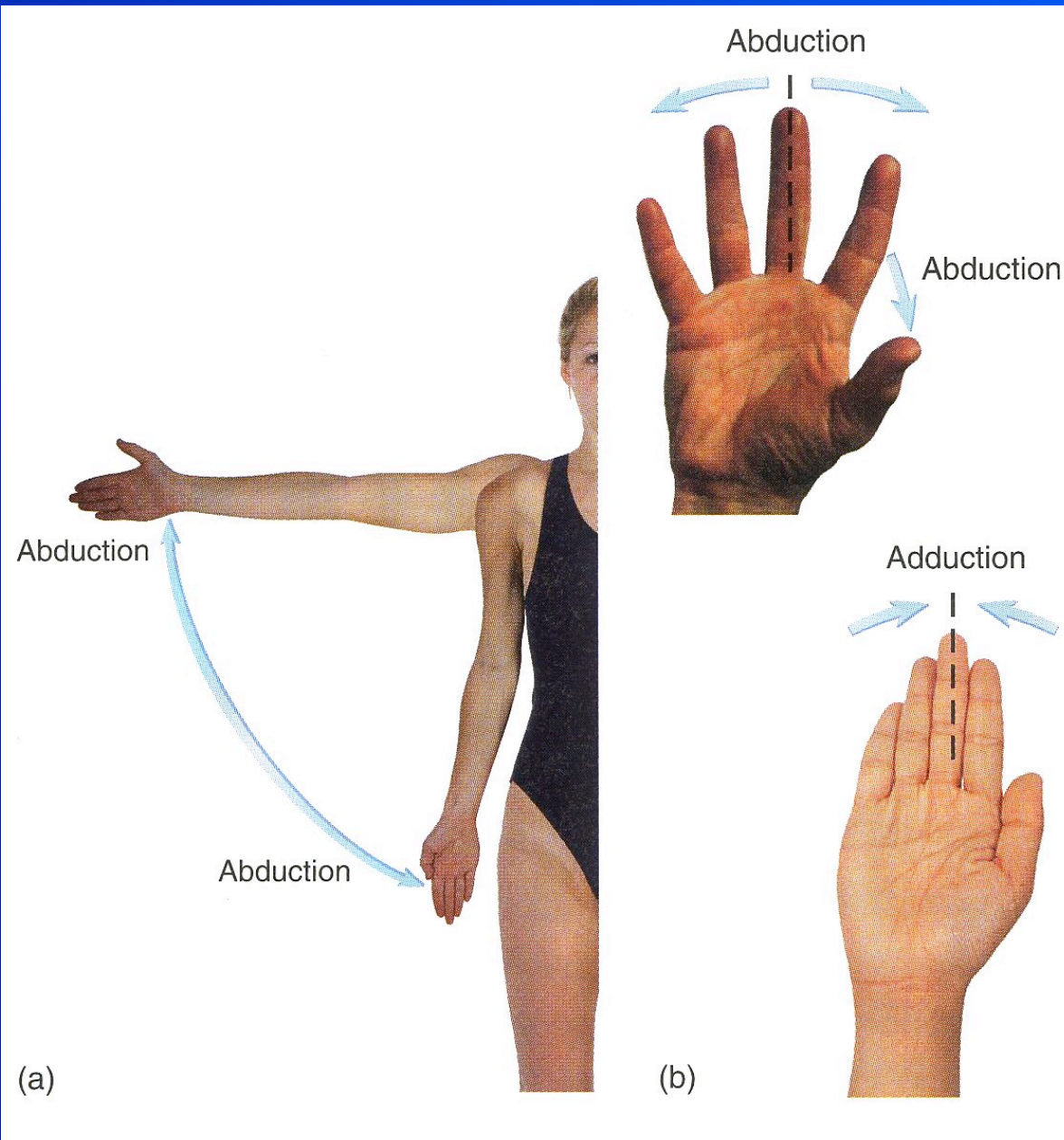


FIGURE 8.18 Abduction and Adduction

Abduction and adduction of (a) the upper limb and (b) the fingers.

3. Circular Movements

- Movement of a structure around an axis or in an arc.
 - A. Rotation**
 - Turning of a structure around its long axis
 - B. Pronation & Supination**
 - Unique rotation of the forearm.
 - Pronation (prone-lying face down) rotation so the palm faces posteriorly in anatomical position.
 - If elbow is bent palm is down
 - Radius & Ulna are crossed over each other
 - Supination (Supine- lying face up) rotation so the palm faces anteriorly in anatomical position.
 - If elbow is bent palm is up
 - Radius & ulna are parallel
 - C. Circumduction:**
 - Combo of A & B from above

3. Circular Movements

A. Rotation

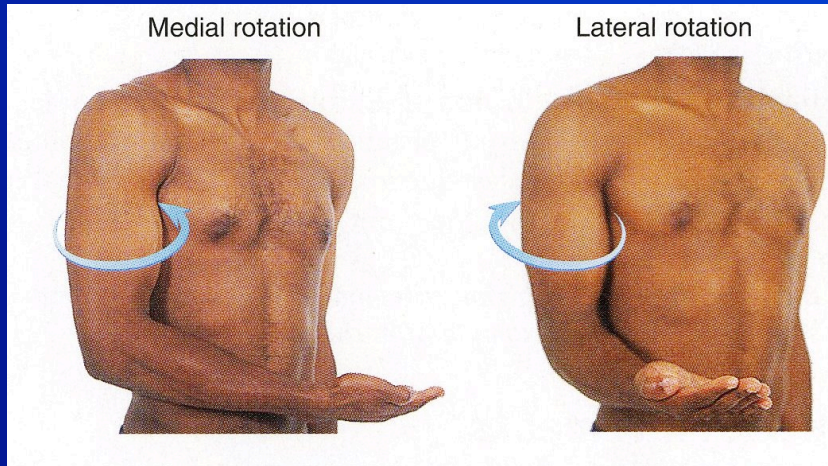


FIGURE 8.19 Medial and Lateral Rotation of the Arm

B. Pronation & Supination

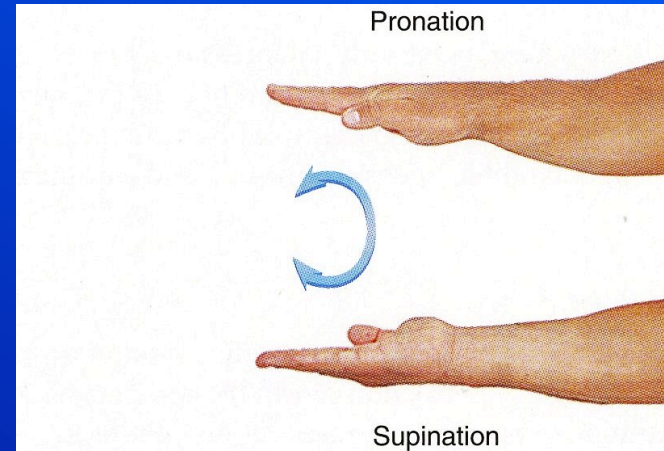


FIGURE 8.20 Pronation and Supination of the Hand

C. Circumduction

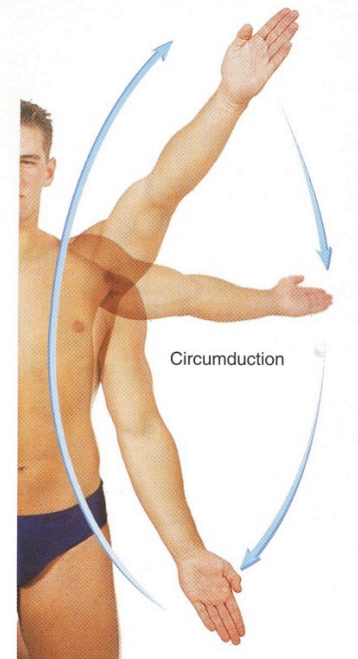


FIGURE 8.21 Circumduction

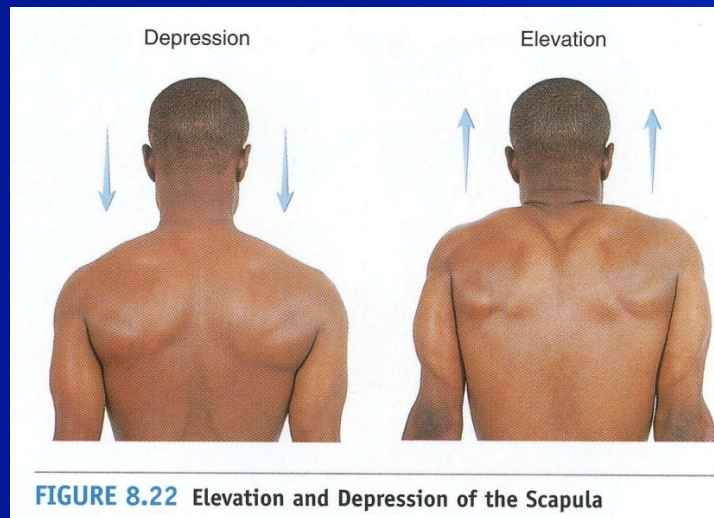
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3. Special Movements

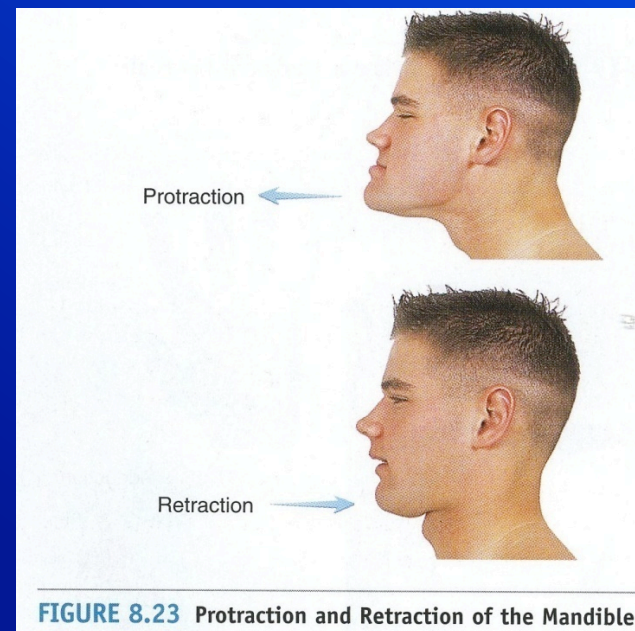
- Movements unique to 1 or 2 joints
 - These do not fit into the other categories
- A. Elevation & Depression
 - Elevation (move superiorly)
 - Depression (move inferiorly)
 - B. Protraction & Retraction
 - Protraction: move a structure in a gliding motion anteriorly
 - Retraction: move a structure in a gliding motion posteriorly (back to normal or further)
 - C. Excursion
 - Move laterally & medially
 - D. Opposition & Reposition
 - Thumb & pinky touching across the palm (OP) and returning (RP)
 - E. Inversion & Eversion
 - (IN) sole of the foot faces medially (EV) sole of the foot faces laterally

Special Movements

Elevation & Depression



Protraction & Retraction



Special Movements

Excursion

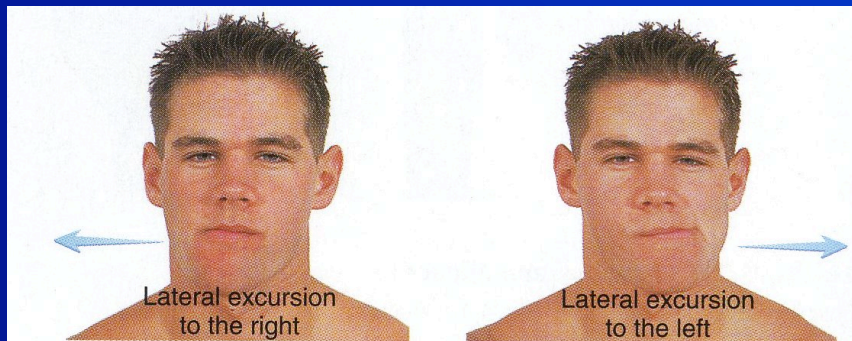


FIGURE 8.24 Excursion of the Mandible

Opposition & Reposition

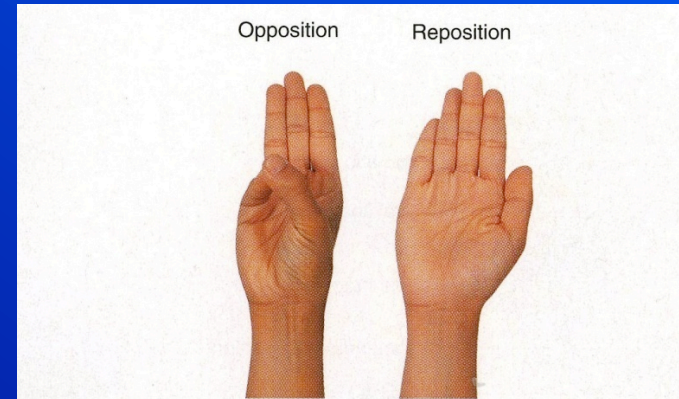


FIGURE 8.25 Opposition and Reposition of the Thumb and Little Finger

Inversion & Eversion

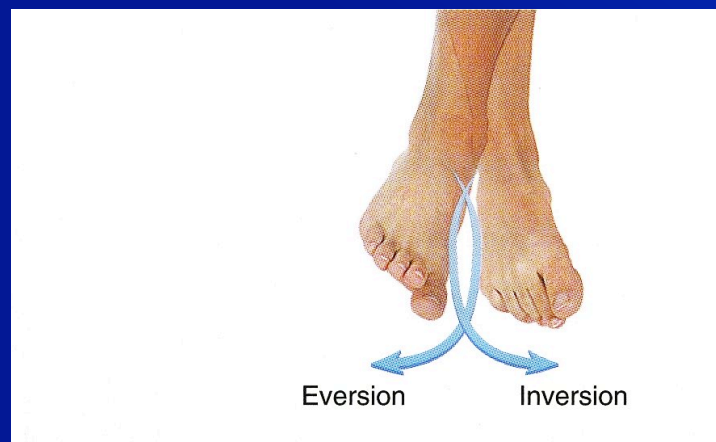


FIGURE 8.26 Inversion and Eversion of the Foot

IV. Range of Motion

Amount of movement, active or passive, that can occur at a joint.

IV. Range of Motion (RoM)

- **Active RoM**

- amount of movement that can be accomplished by contraction of the muscles that normally act across a joint

- **Passive RoM**

- Amount of movement that can be accomplished when moved by an outside force (Therapist)

- **RoM influenced by:**

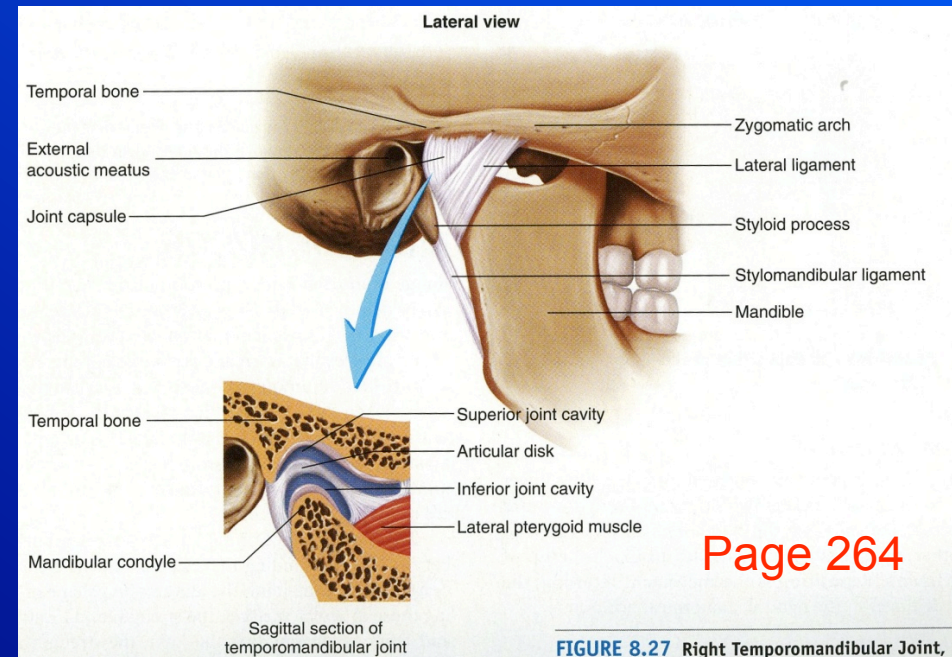
- a) Shape of articulating surfaces
- b) Amount & shape of articular cartilage covering the articular surfaces
- c) Strength & location of ligaments & tendons surrounding the joint
- d) Strength & location of the muscles associated with the joint
- e) Amount of fluid in & around the joint
- f) Pain in & around the joint
- g) Amount of use or disuse of the joint over time

V. Description of Selected Joints

Representative joints have been chosen because of their representative structure, important fxn, & clinical significance

Temporomandibular Joint

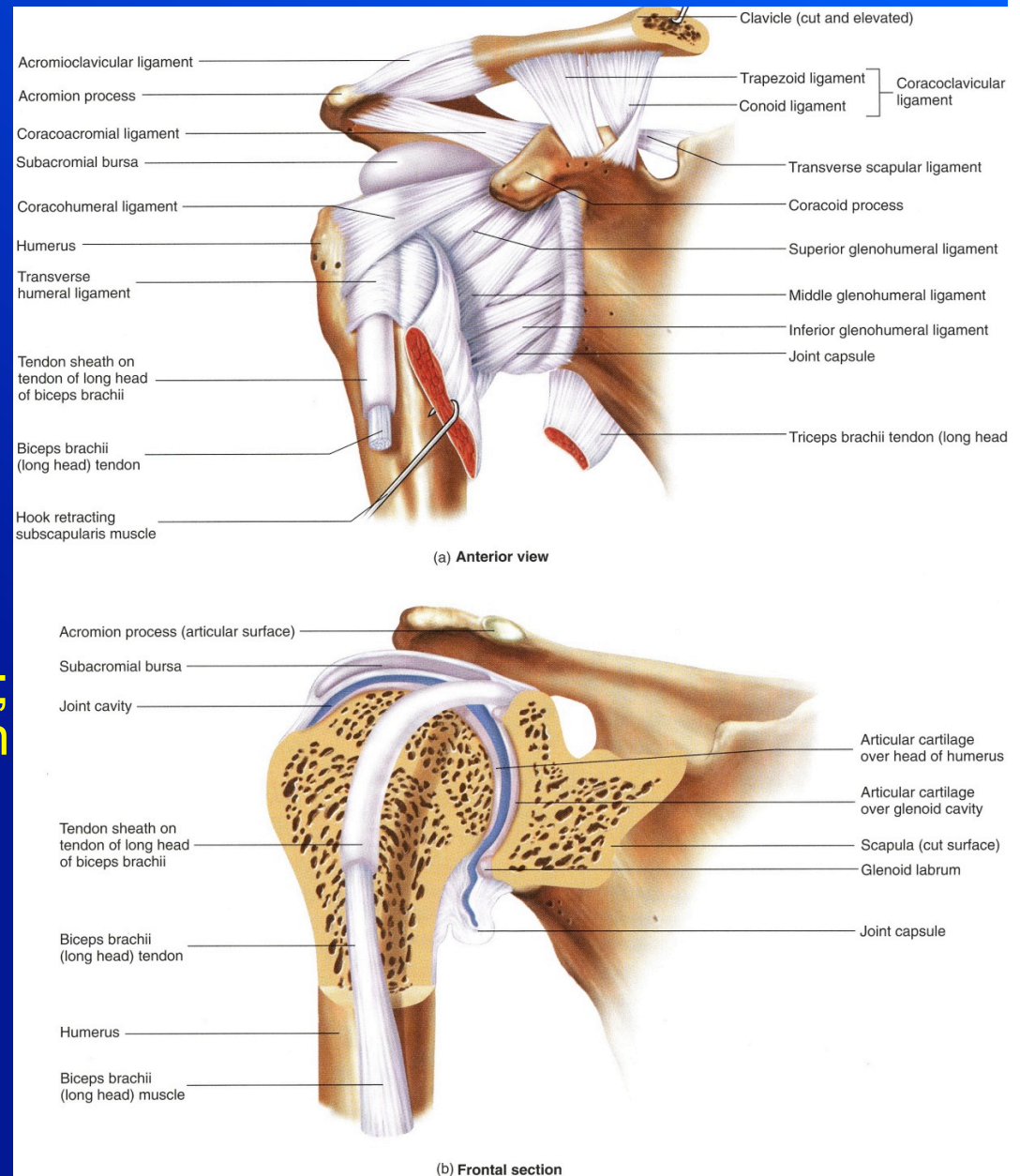
- Complex hinge & gliding joint between the temporal & mandibular bones.
- Capable of:
 - Elevation & Depression
 - Protraction & Retraction
 - Lateral & medial excursion



Shoulder Joint

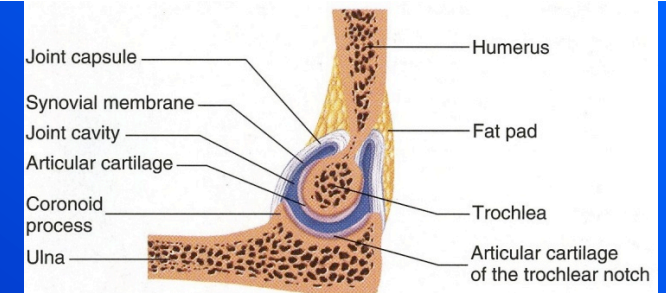
- Ball & socket between the head of the humerus & glenoid cavity of the scapula
- Permits a wide range of movements.
- Stability is maintained by 3 sets of ligaments & 4 muscles called the rotator cuff
- Capable of flexion/extension; abduction/adduction; rotation & circumduction
- Tendon from the biceps brachii supports the humerus by passing thru the capsule & attaching to the supraglenoid tubercle

Page 265 Figure 8.28

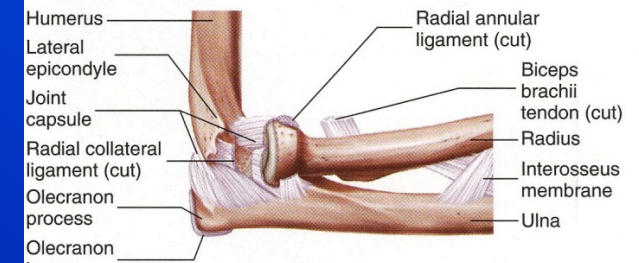


Elbow Joint

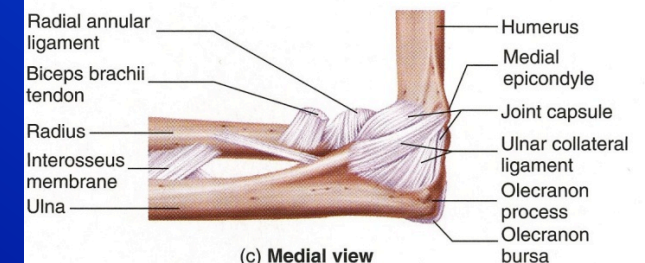
- Compound hinge joint between the humerus, ulna, & radius
 - Humeroulnar Joint
 - Humeroradial Joint
 - Proximal radioulnar Joint
- Movement is limited to flexion & extension
 - Because of the association of the trochlear notch with the trochlea of the humerus
- Pronation & supination of the hand
 - Rounded head of the radius & radial notch of the ulna against the capitulum of the humerus



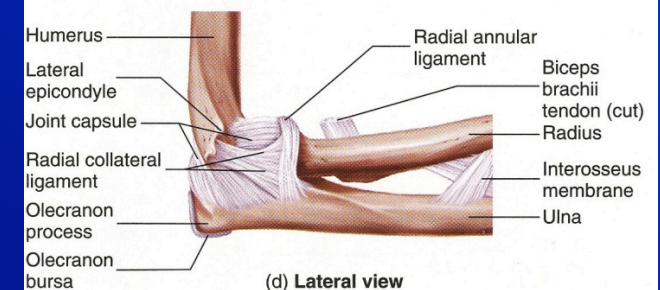
(a) Sagittal section



(b) Lateral view



(c) Medial view



(d) Lateral view

FIGURE 8.29 Right Elbow Joint

(a) Sagittal section showing the relation between the ulna and humerus. (b) Lateral view with ligaments cut to show the relation between the radial head, ulna, and humerus. (c) Medial view. (d) Lateral view.

Hip Joint

- Ball & socket joint between the head of the femur and the acetabulum of the coxal bone
- Greatly strengthened by ligaments
- Capable of a wide range of movements:
 - flexion/extension;
 - abduction/adduction;
 - rotation; & circumduction

Figure 8.30 page 267

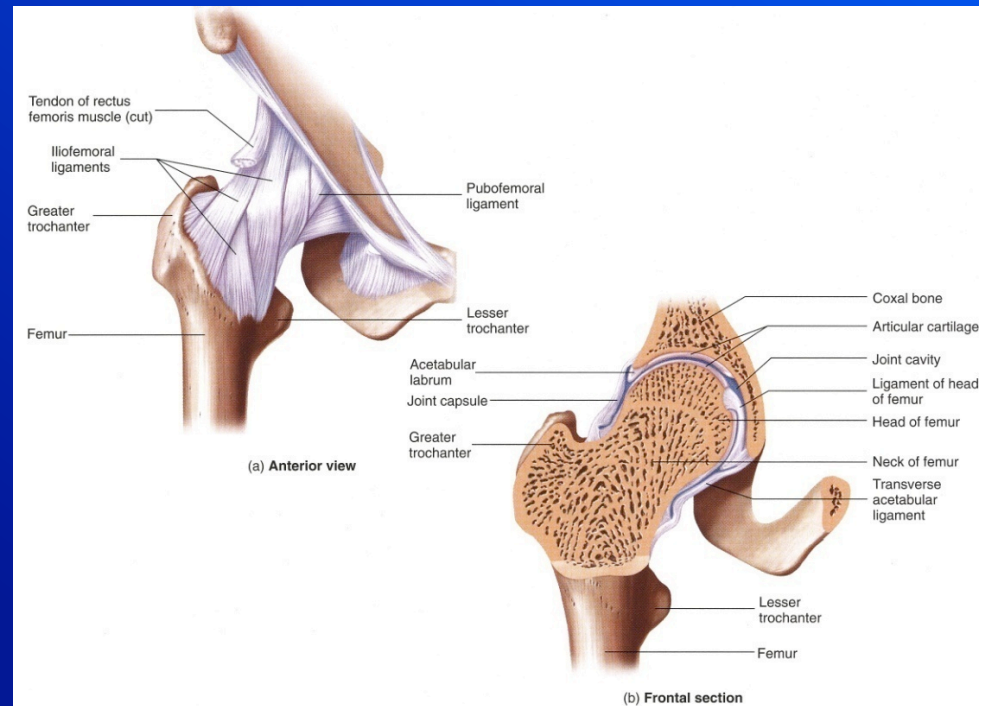
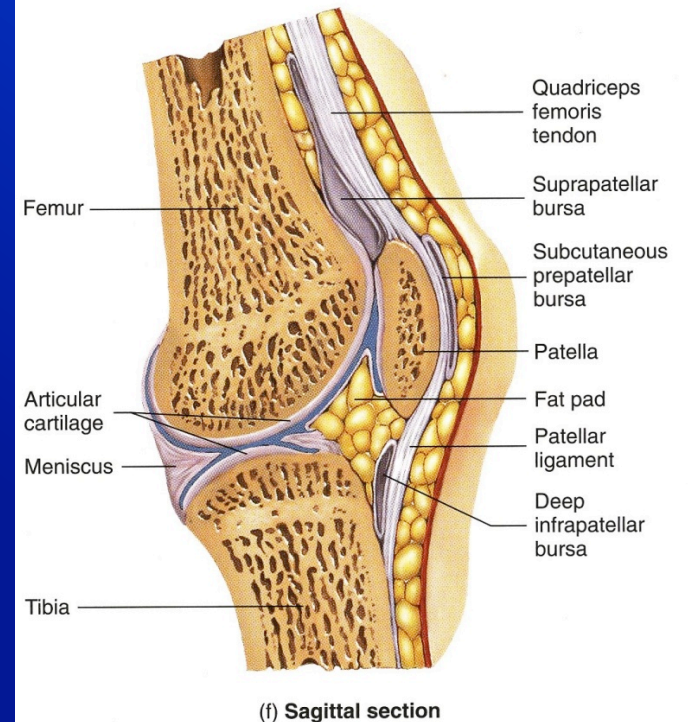
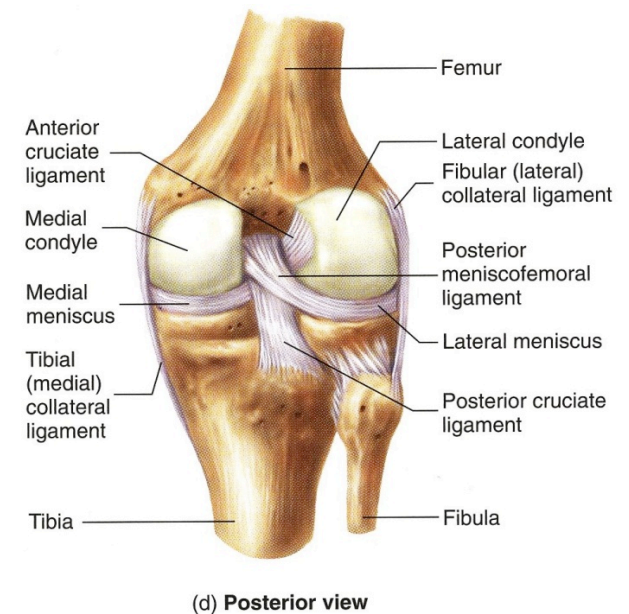
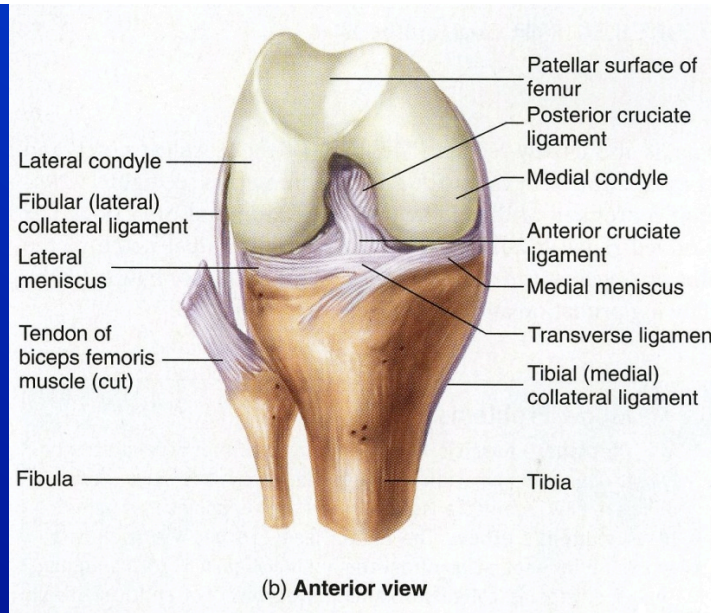


FIGURE 8.30 Right Coxal, or Hip, Joint

Knee Joint

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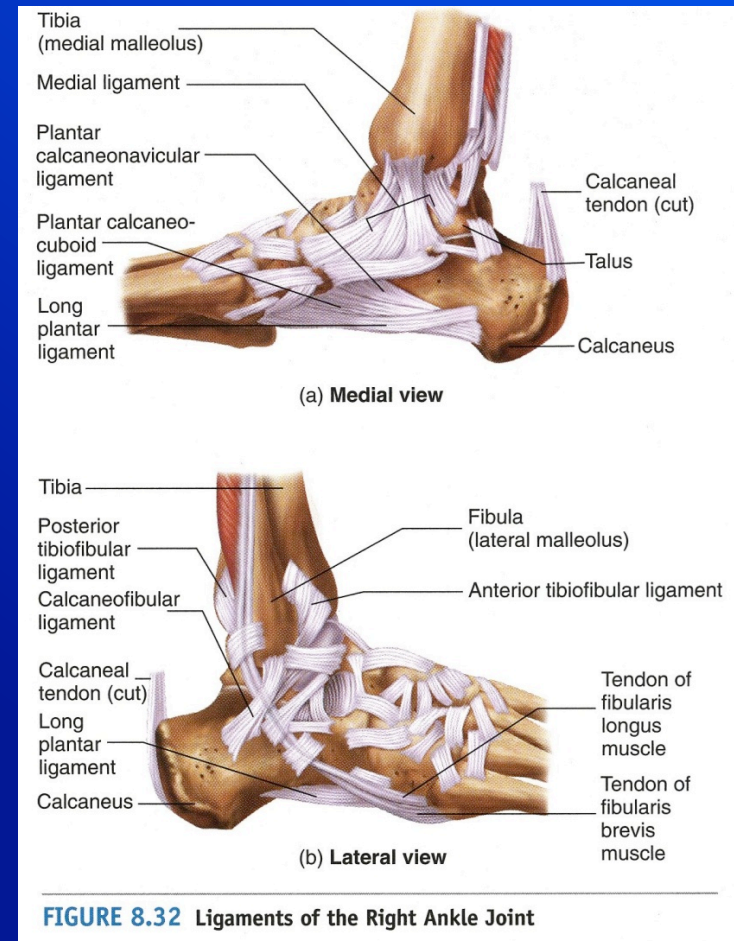
- Complex ellipsoid joint between the femur & the tibia supported by many ligaments
- Allows flexion & extension as slight rotation of the lower leg



The ankle joint & arches of the foot

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- Ankle joint is a unique hinge joint made-up of the tibia, fibula, & talus.
- Allows for dorsiflexion/ plantar flexion & Inversion/eversion
- Ligaments of the foot arches hold the bones in an arch & transfer weight in the foot.



VI. Effects of aging on the joints

VI. Effects of aging on the joints

- With age:
 - CT of joints becomes less flexible & elastic
 - Collagen & elastin have more cross-linking in their proteins
 - Rate of cell proliferation declines as does new blood vessel formation (can effect synovial joints most)
 - B/c articulating cartilage can wear down this is bad
 - Rate of synovial fluid production also declines wh/contributes to wear on the joint
 - Ligaments & tendons shorten & b/c less flexible with age decrease in RoM
 - Resulting joint rigidity increases rate of wear on articulating surfaces.
 - Δ in CT also reduced RoM
 - Muscle strength weakens (thus so does stability of some joints)
 - Activity decreases also resulting in joint stiffness

Reading Assignment

- Page 254 Gingivitis
- Page 255 Joint changes during pregnancy
- Page 260 Hyperextension
- Page 264 TMJ disorders
- Page 266 Shoulder Disorders
- Page 267 Elbow Problems
- Page 268 Hip Dislocation
- Page 271 Clinical Focus
- Page 272 Ankle Injury
- Page 272 Arch Problems
- Page 273-5 Clinical Focus