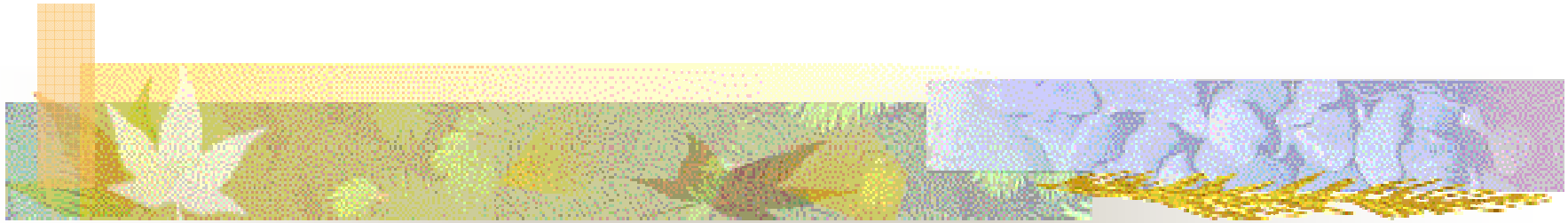


Joints

Articulation

- The junction of two or more bones
- Security determined by:
  - Close fitting parts
  - Ligaments
  - Muscles crossing joints (muscle tone)

Functional Categories of Joints

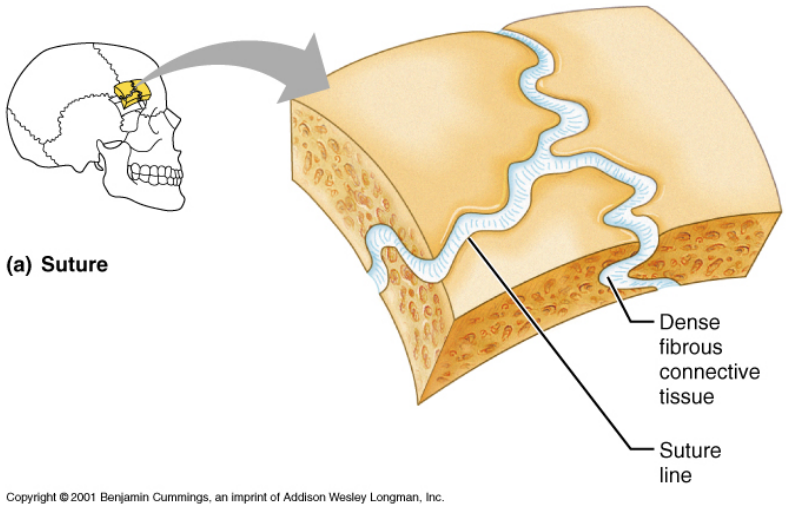
- Based upon degree of movement
  - Synarthroses (-is) – immovable
  - Amphiarthroses (-is) – slightly movable
  - Diarthroses (-is) – freely movable

3 Major Structural Categories of Joints:

- **Fibrous joints** – bones held together by fibrous c.t.
  - No joint cavity
- **Cartilaginous joints** – bones united by cartilage
  - No joint cavity
- **Synovial joints** – possess synovial cavity
  - Diarthroses (freely movable)

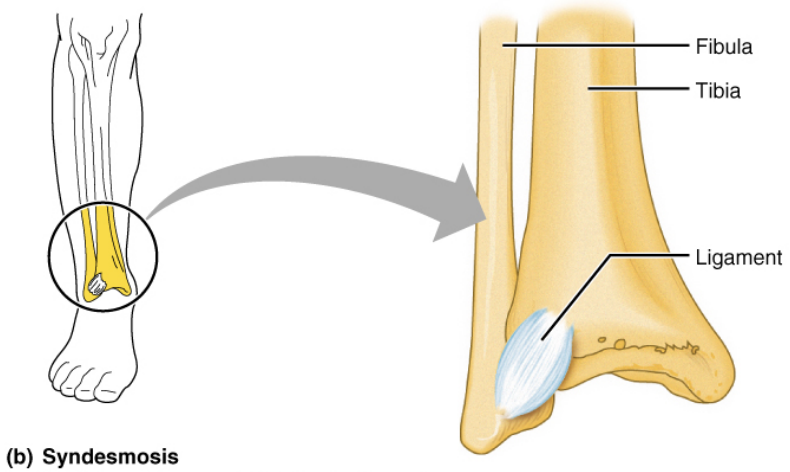
Types of Fibrous Joints:

- Sutures –synarthroses
  - Only in skull
  - Minimum c.t.
  - Some types:
    - **Dentate** –saggital
    - **Limbose** – toothed & beveled (coronal)
    - **Squamous** –beveled , not toothed
    - **Plane** –flat parts



Types of Fibrous Joints:

- Syndesmoses
  - Bones connected by ligament, cord or band of c.t.
  - Usually amphiarth.
  - Ex.: Distal ends of tibia & fibula
    - amphiarthrotic



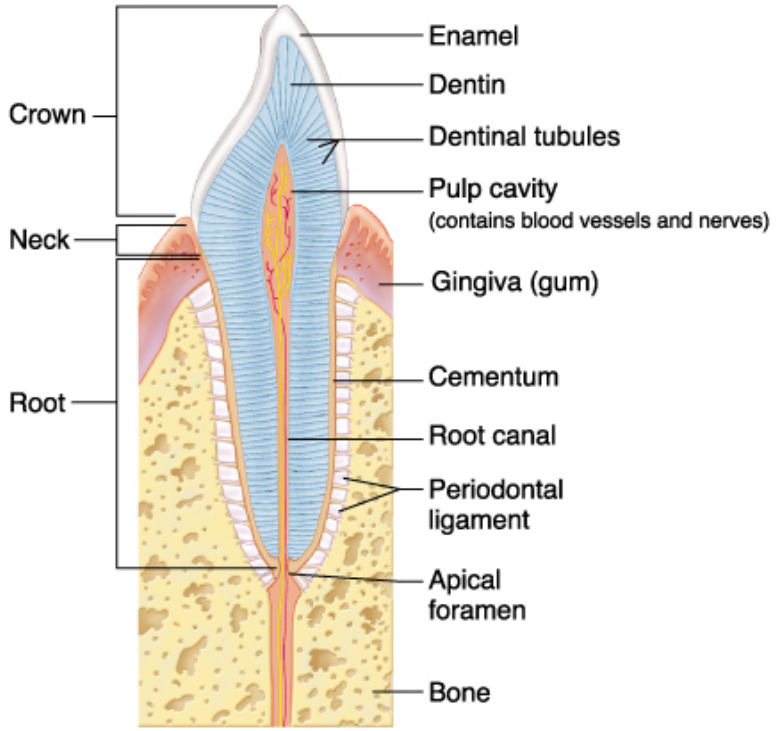
(b) Syndesmosis

Types of Fibrous Joints:

- Syndesmoses cont.'d
  - Ex.: between radius & ulna (**interosseous membrane**)
    - More than just slight movement

Types of Fibrous Joints:

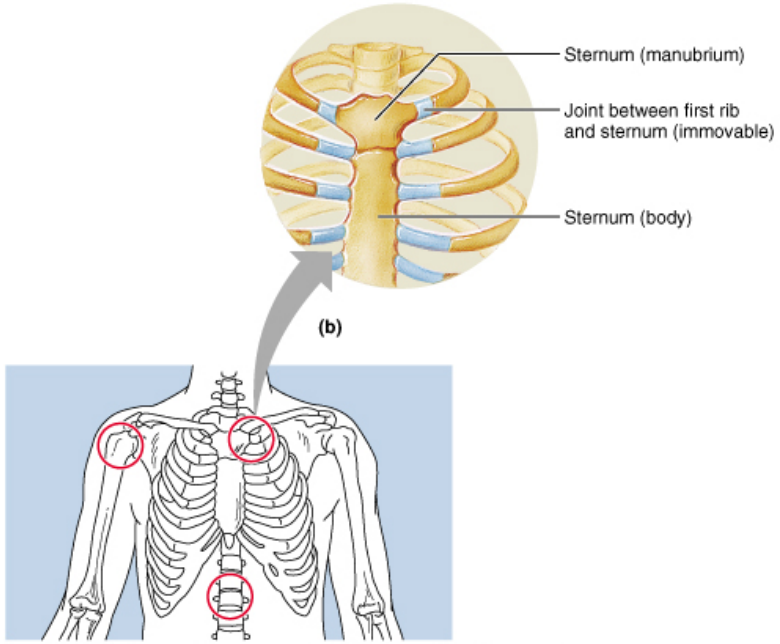
- Gomphosis (-es) – a peg in socket fibrous joint
  - Teeth in sockets
    - **Periodontal ligament**



8

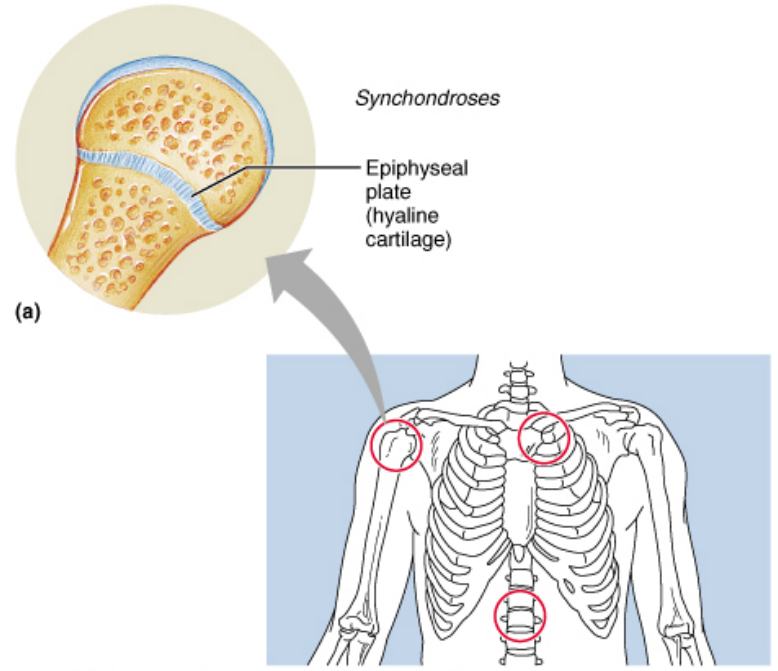
Types of Cartilaginous Joints (2)

- Synchondroses (-is) – bones united by hyaline cartilage, no joint cavity
  - Synarthrosis
  - Ex.: Costal cartilage



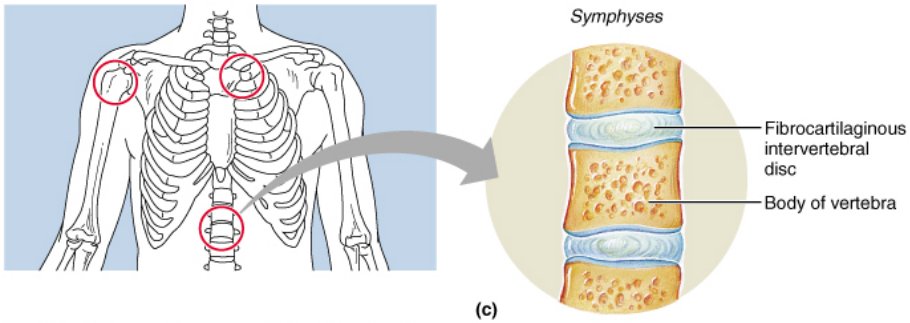
Types of Cartilaginous Joints (2)

- Synchondroses (-is) – bones united by hyaline cartilage, no joint cavity
  - Synarthrosis
  - Ex.: Costal cartilage
  - Ex: Epiphyseal plate



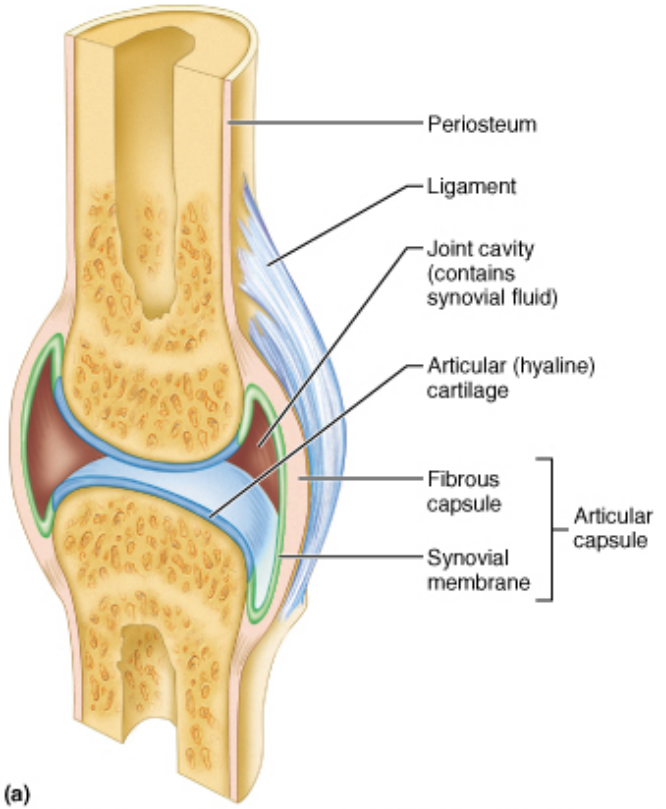
Types of Cartilaginous Joints (2)

- Symphysis – bones joined by fibrocartilage
  - Amphiarthrosis
  - Ex.: Intervertebral disk
  - Ex.: Symphysis pubis



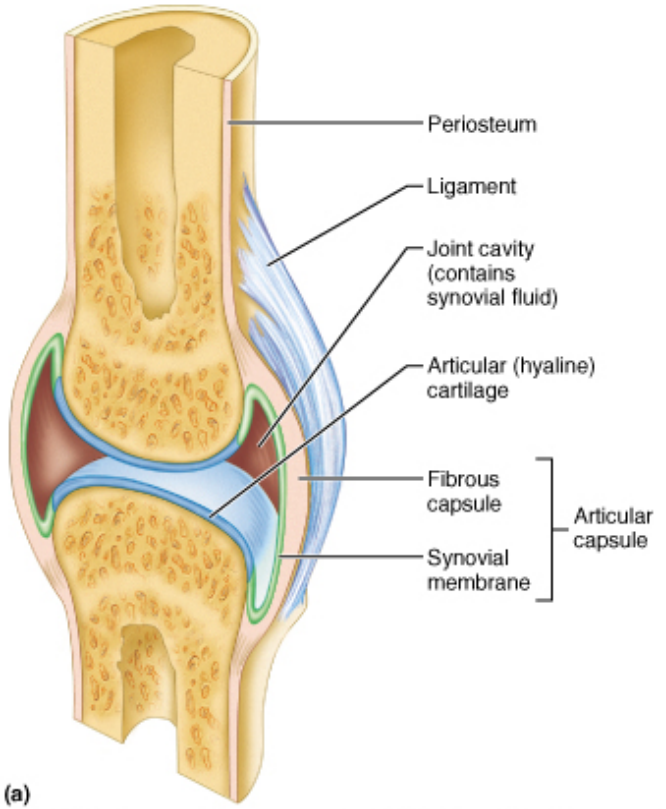
Synovial Joints

- Possess a **synovial cavity**
- **Synovial membrane** lines cavity
  - Produces **synovial fluid** (~100 ml. total in adult)
    - Lubricates joint
    - A blood filtrate with hyaluronic acid



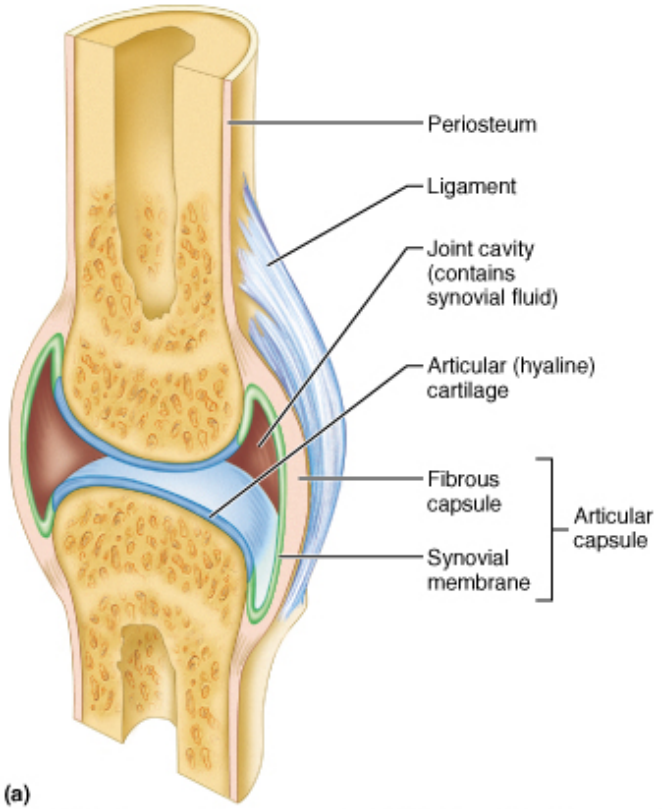
Synovial Joints

- Articular cartilage
  - Not covered by synovial membrane
  - Hyaline cartilage
  - Absorbs compression
  - Nourished by synovial fluid



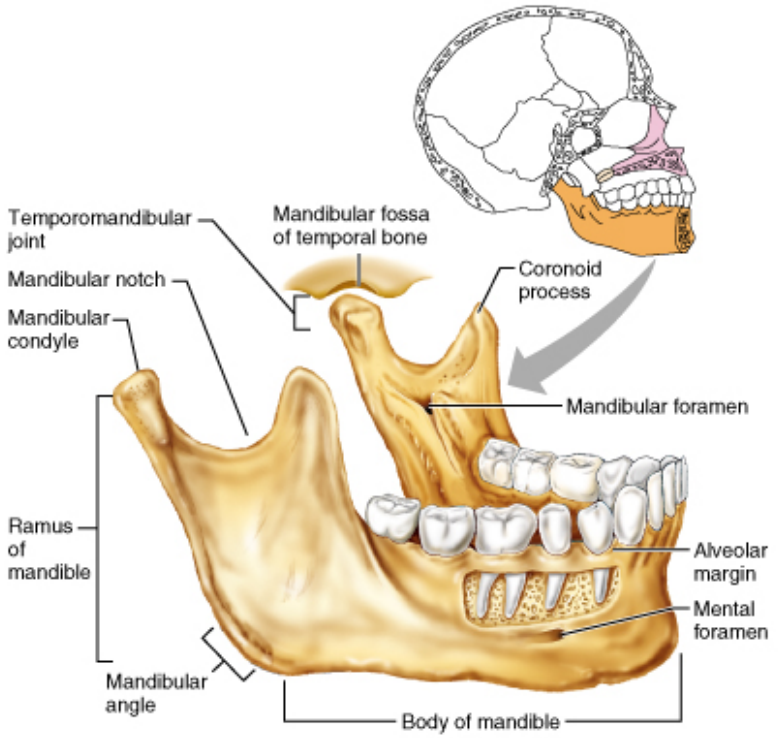
Synovial Joints

- Articular capsule
  - 2 layers:
    - Inner synovial membrane
      - Loose c.t.
    - Outer fibrous capsule
      - Dense Irreg. c.t.
      - Continuous with periostea



Synovial Joints

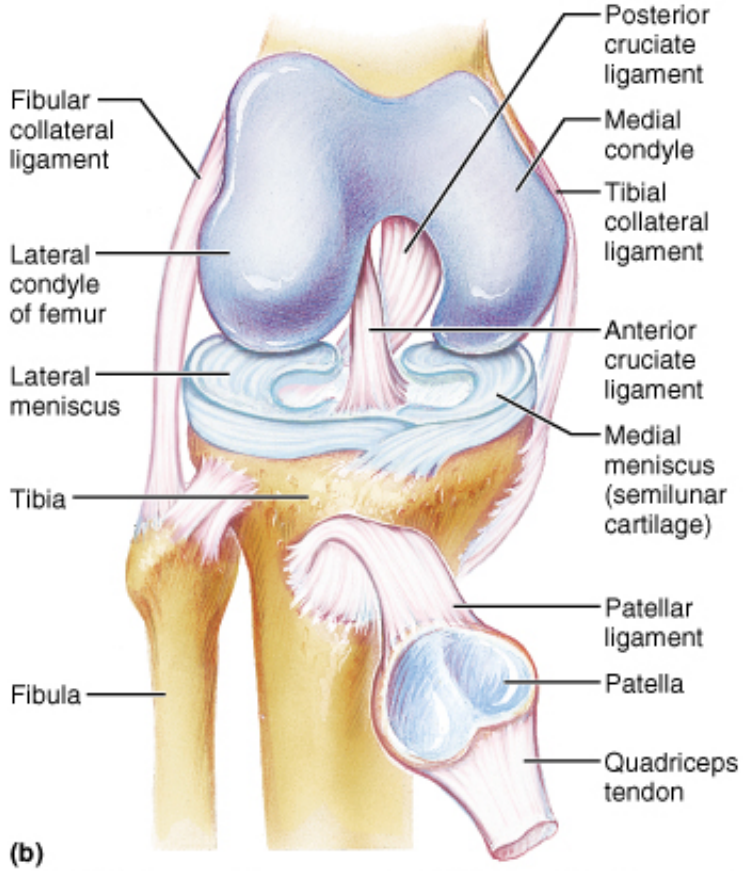
- Articular discs (menisci)
  - Discs or wedges of fibrocartilage
  - Ex.: Temporomandibular joint



(a) Mandible

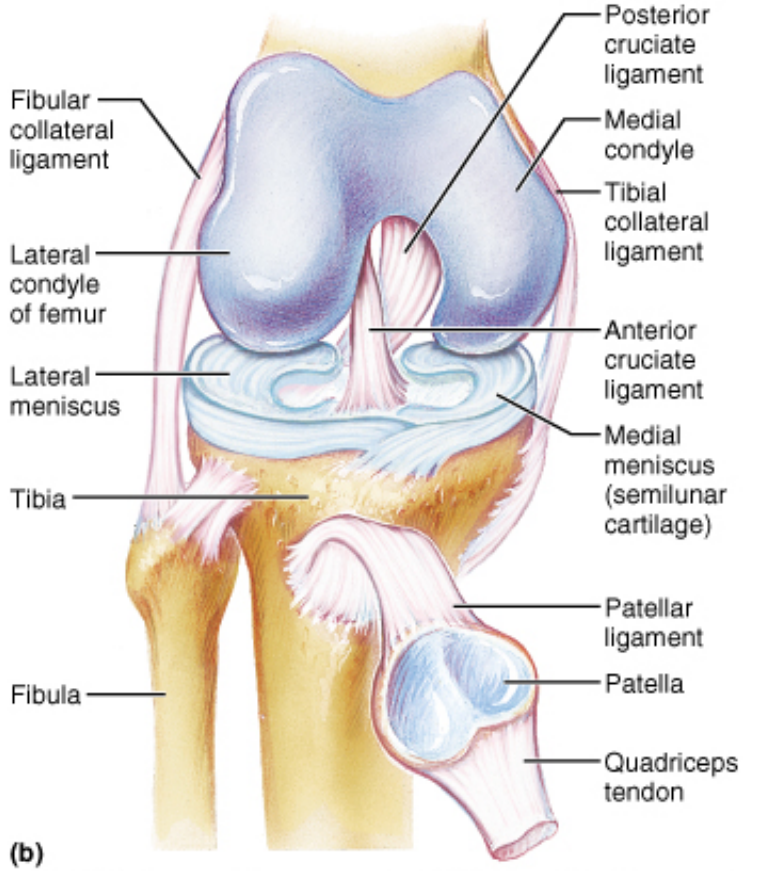
Synovial Joints

- Articular discs (menisci)
  - Ex.: Knee joint
    - Lateral & medial menisci (-us)



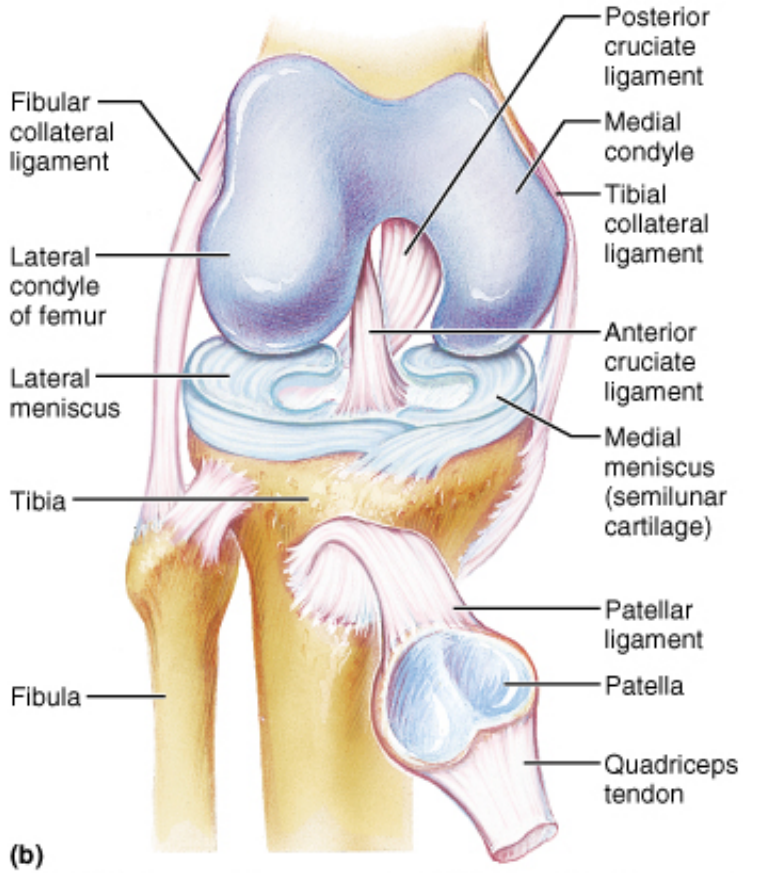
Synovial Joints

- Articular discs (menisci)
  - Ex.: Knee joint
    - Lateral & medial menisci (-us)



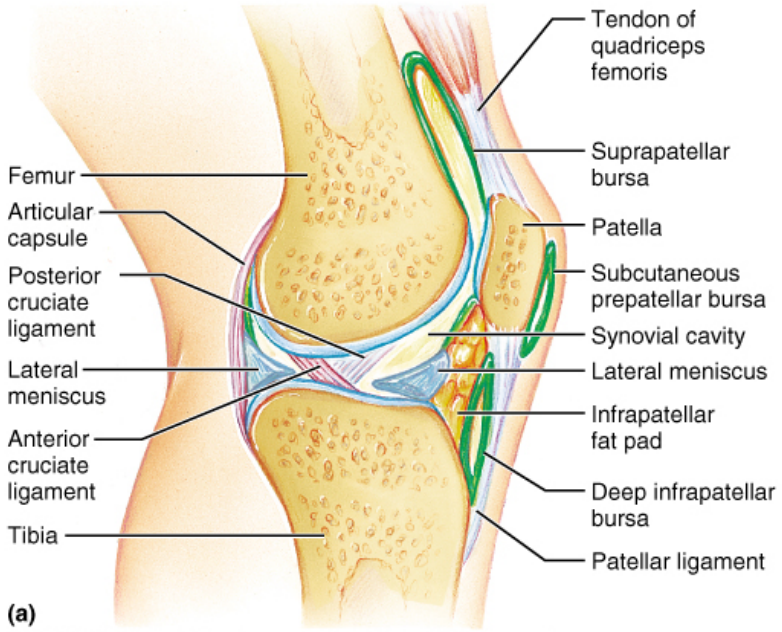
Synovial Joints – Ligament Types:

- Intrinsic (capsular) – thickened part of capsule
- Extracapsular – found outside the capsule
  - Collateral ligaments
- Intracapsular – within the capsule
  - Ant & post. cruciate



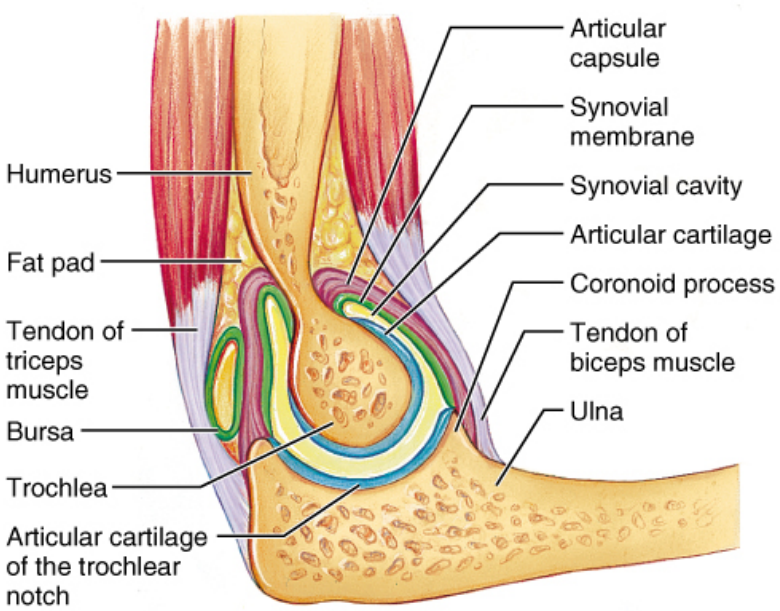
Other Synovial Membrane Structures: The Bursa (-ae)

- Flattened synovial sacs
  - Fibrous sac lined with synov. membr.
  - Contains synovial fluid
  - Reduce friction & cushion
  - Some connect with synovial cavity



Bursitis

- Inflammation of a bursa



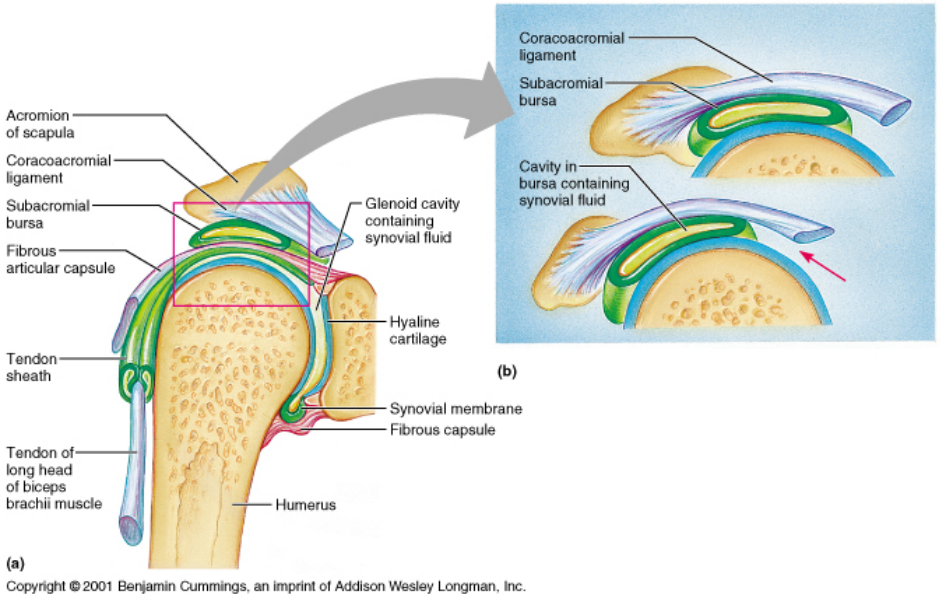
(a)

Bursitis

- Some causes:
  - Injury to joint
  - Rheumatoid arthritis (R.A.)
  - Gout
  - Infection

Other Synovial Membrane Structures: Tendon Sheath

- Synovial sacs wrapped around a tendon
  - Reduce friction between adjacent tendons
    - **Tendonitis**



Range Of Movement At Synovial Joints

- **Nonaxial movement** – slipping movements only, no axis around which movement can occur
- **Uniaxial movement** – movement in one plane
- **Biaxial movement** – movement in 2 planes
- **Multiaxial movement** – in or around all 3 planes of movement

General Types of Movement at Synovial Joints:

- Gliding, Angular, Rotation, Special
  - **Gliding** – flat or nearly flat surface surface glides over similar surface
    - Intercarpal or intertarsal joints
  - **Angular** – Increase or decrease angle between two bones
    - **Flexion** vs. **extension**
      - Of head, knee, shoulder & **lateral flexion** of trunk
    - **Hyperextension** – backward beyond upright
      - Shoulder, hip

General Types of Movement At Synovial Joints:

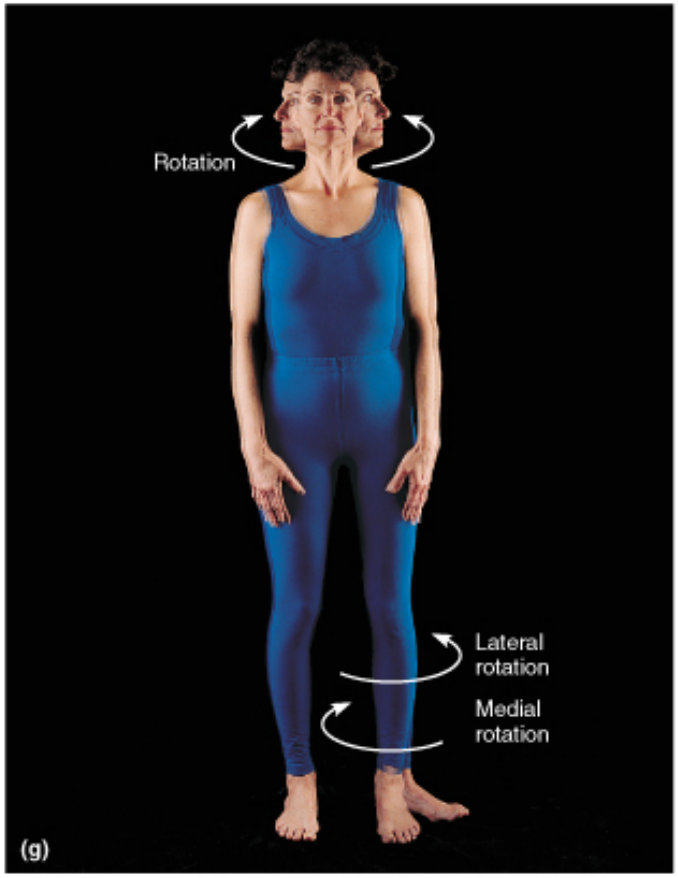
- **Dorsiflexion** – lifting foot so that superior surface approaches shin
- **Plantarflexion** – opposite above, pointing the toes

General Types of Movement At Synovial Joints:

- **Abduction** vs. **Adduction** – from or toward midline, respectively
- **Circumduction** – movement of limb describes cone in space
  - Shoulder & hip joint

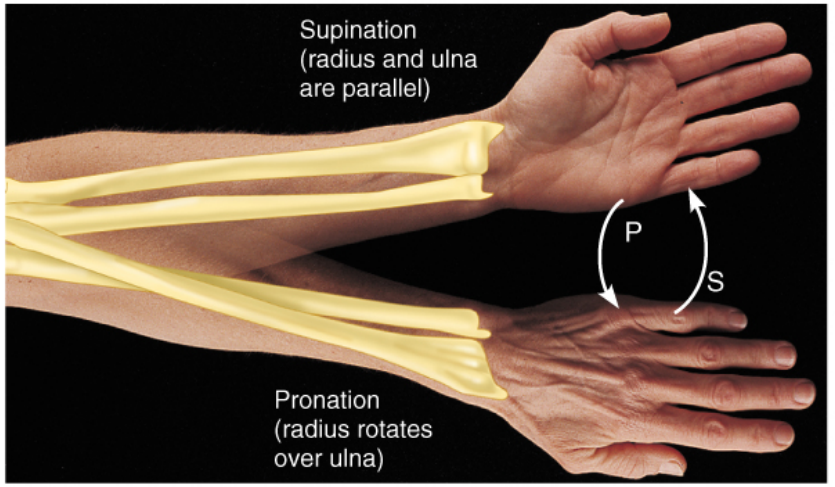
General Types of Movement At Synovial Joints

- **Rotation** – turning of bone along its long axis
  - Atlas on axis
  - **Medial rotation**
    - Ant. Surface moves toward midline
      - Femur, humerus
  - **Lateral rotation**
    - Opposite medial



General Types of Movement At Synovial Joints

- **Special movements**
  - **Supination** – to palm forward position
  - **Pronation** – to palm posterior position
    - Radius & ulna cross
  - **Inversion** – plantar surface faces medially
  - **Eversion** – opposite above



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

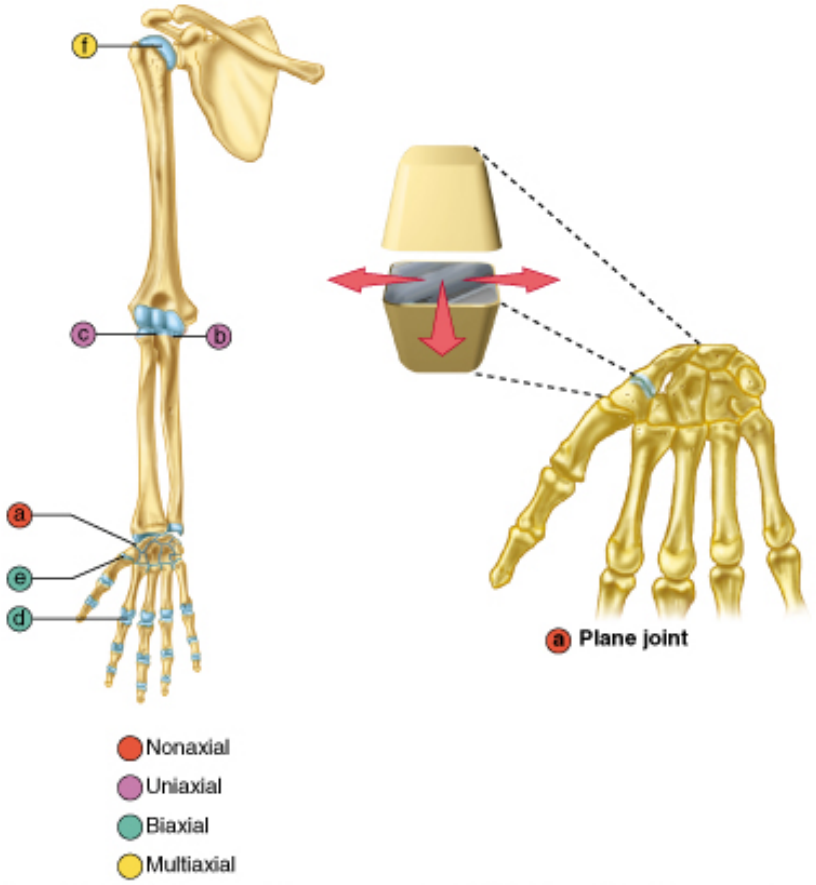
General Types of Movement At Synovial Joints

- **Special movements**
  - **Protraction** – jaw juts out
  - **Retraction** – jaw back to normal position
  - **Elevation** – lifting body part superiorly
  - **Depression** – moving elevated part inferiorly
  - **Opposition** – joint between metacarpal and carpal (thumb to finger tip)

(c) Protraction and retraction

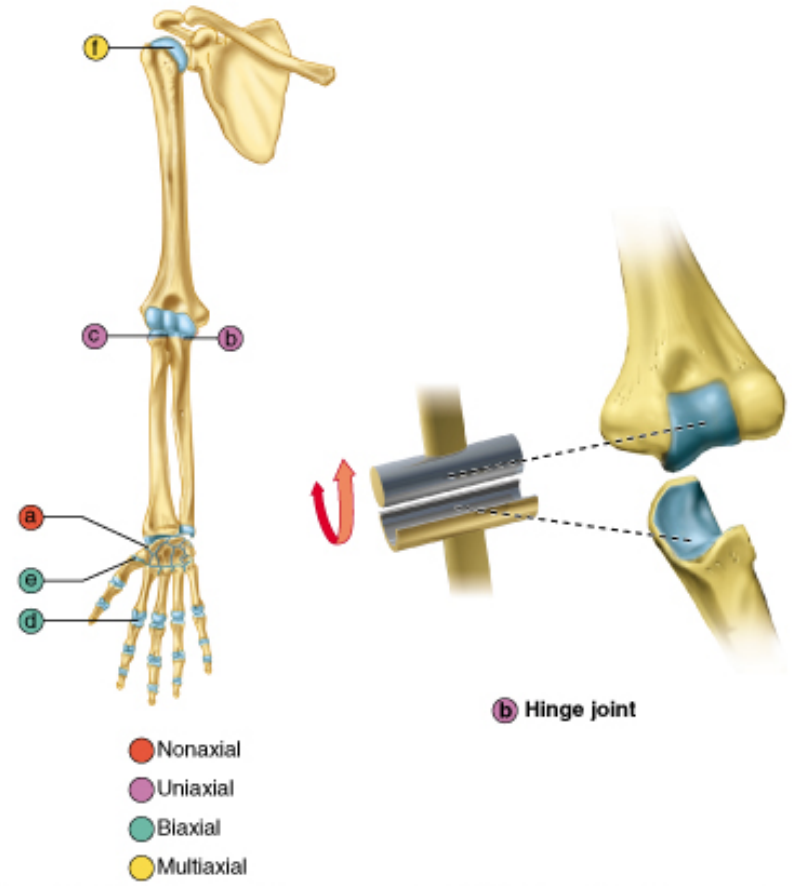
Types of Synovial Joints – Based on Shape of Articular Surfaces:

- 1 **Plane joints** – essentially flat
  - Gliding, no rotation, nonaxial
  - Examples:
    - Intercarpal & inter-tarsal
    - Between vertebral articulations



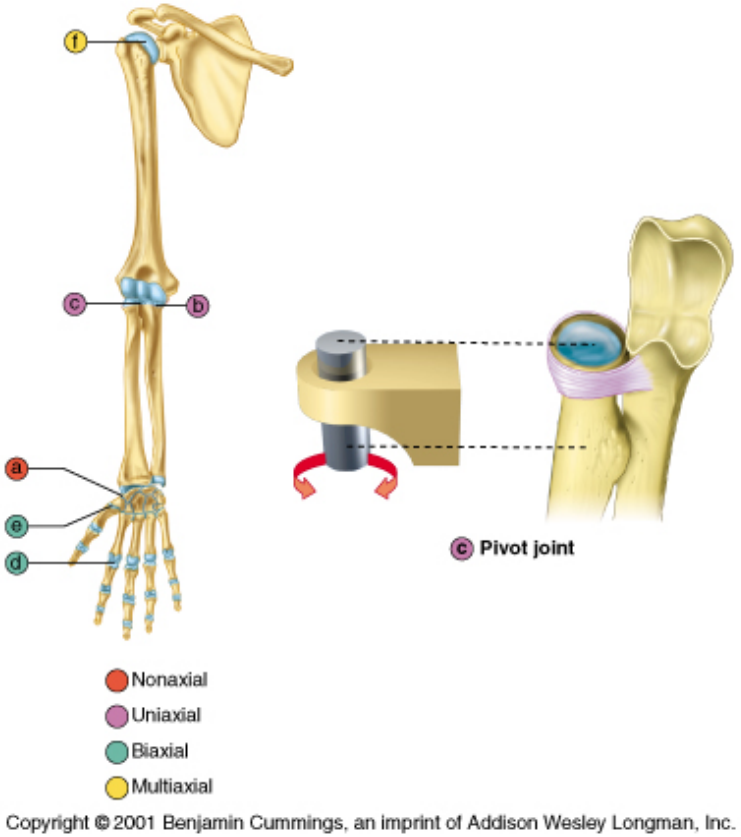
Types of Synovial Joints – Based on Shape of Articular Surfaces:

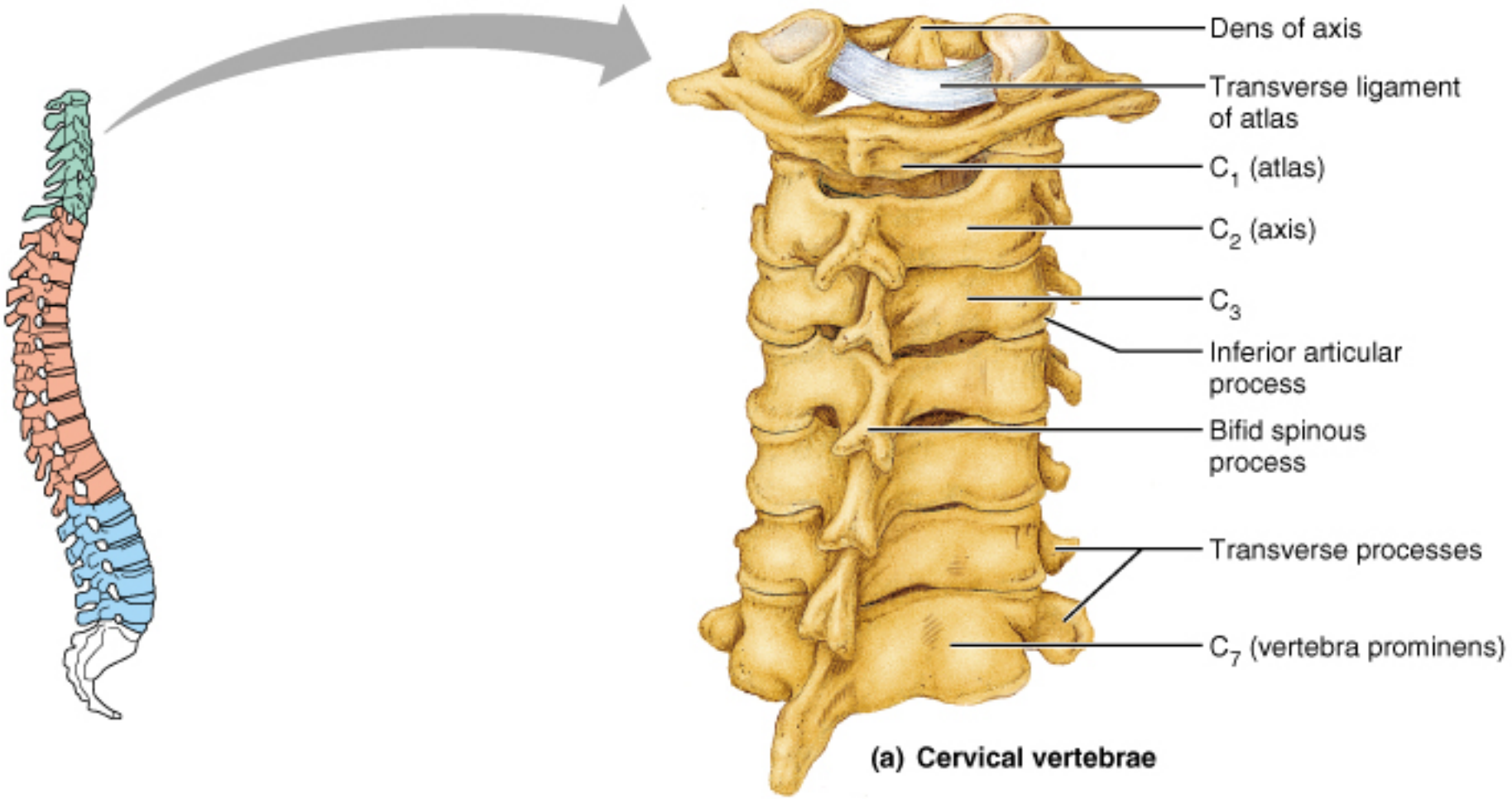
- 2 **Hinge joints** – cylindrical projection fits trough-shaped surface
  - Uniaxial
  - Examples:
    - Elbow
    - Knee
    - Interphalangeal



Types of Synovial Joints – Based on Shape of Articular Surfaces:

- 3 **Pivot joints** – rounded end into "sleeve" or ring (bone or ligament)
  - Uniaxial rotation
  - Examples:
    - Prox. radioulnar jt.
    - Atlas (fovea dentis) & axis (dens)

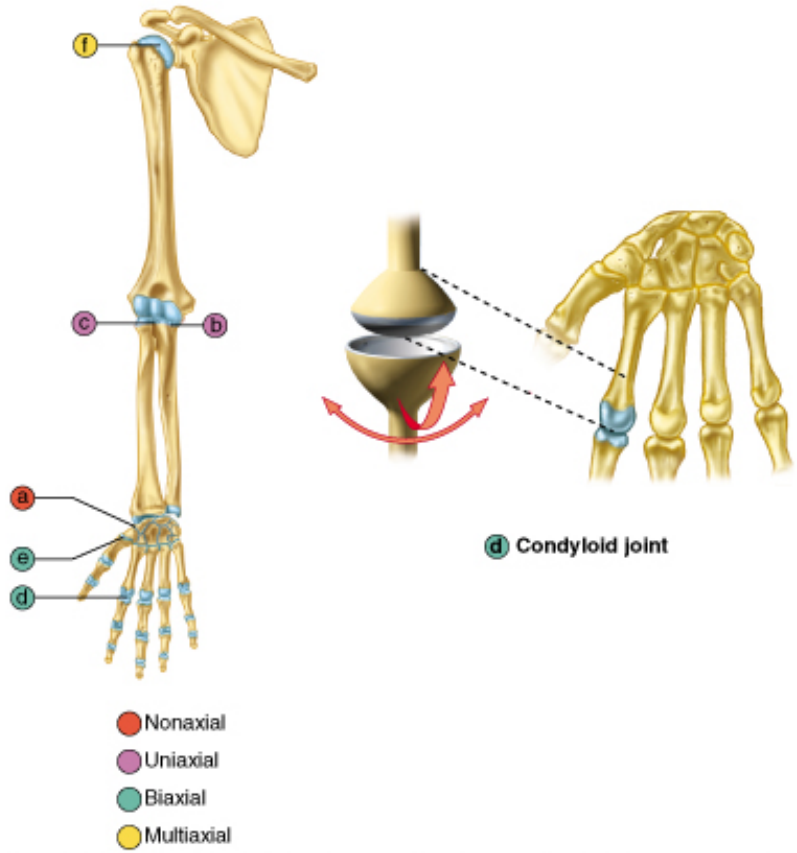


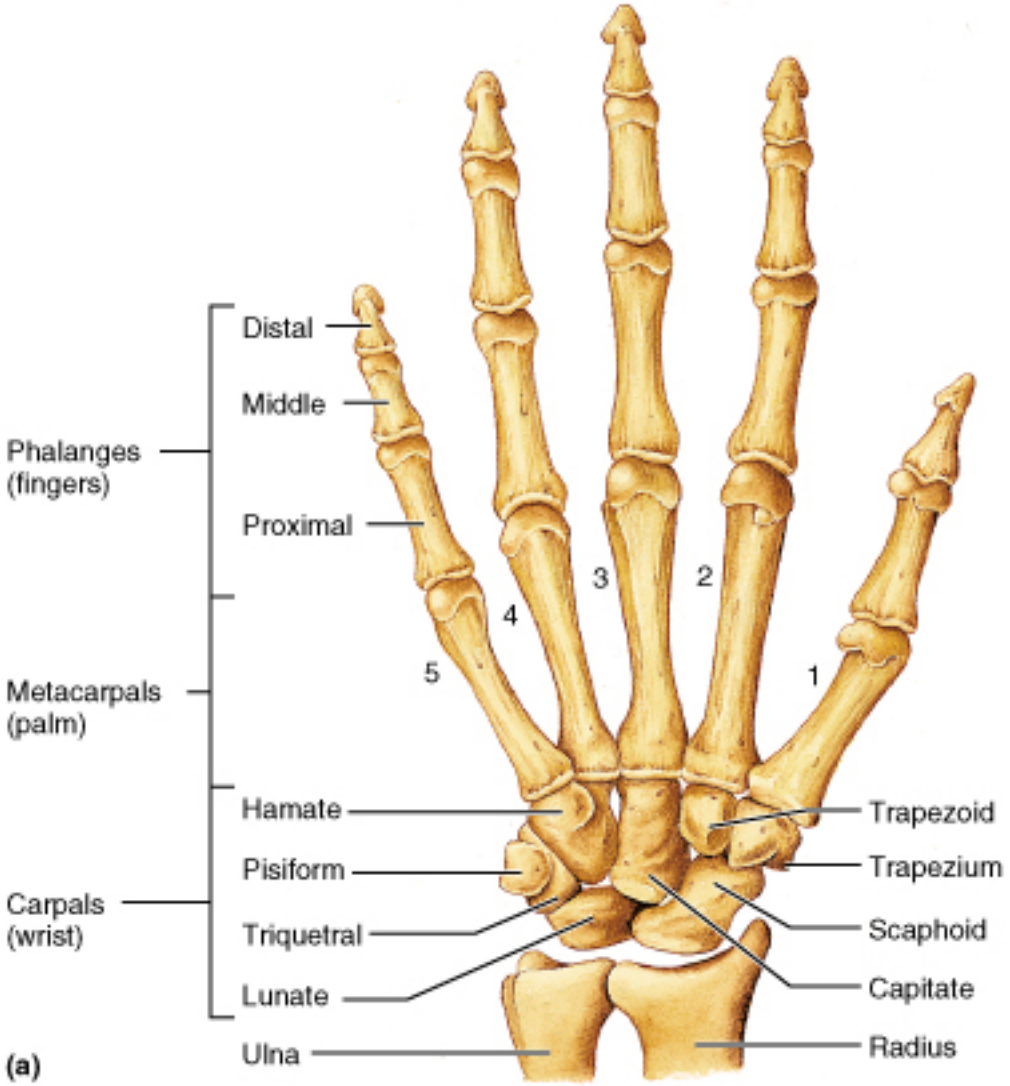


(a) Cervical vertebrae

Types of Synovial Joints – Based on Shape of Articular Surfaces:

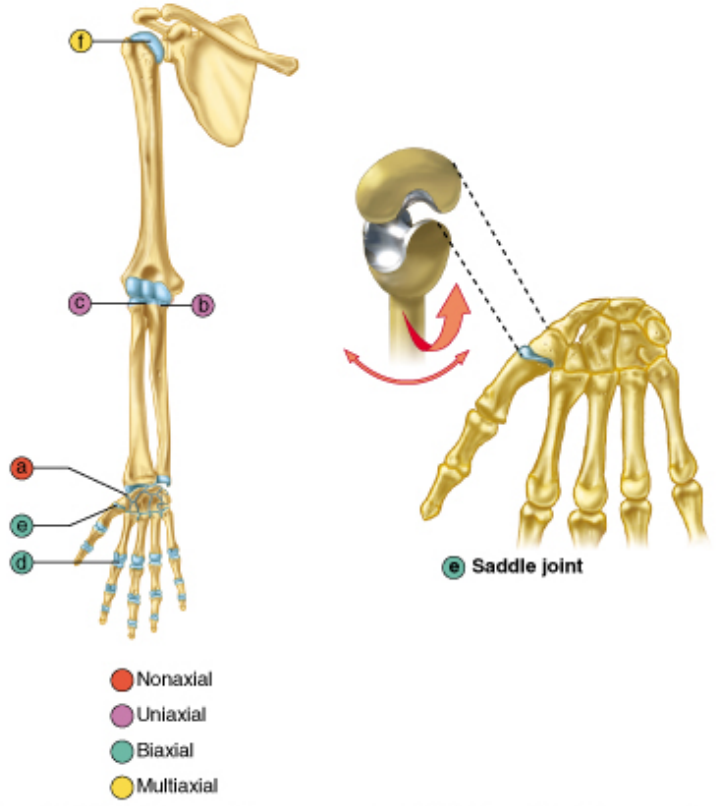
- 4 **Condyloid joints** – two oval surface
  - Biaxial jt., flex.-ext., ab-.-adduction
  - Examples:
    - Metacarpalphalangeal jt.
    - Radiocarpal jts. (scaphoid with radius)





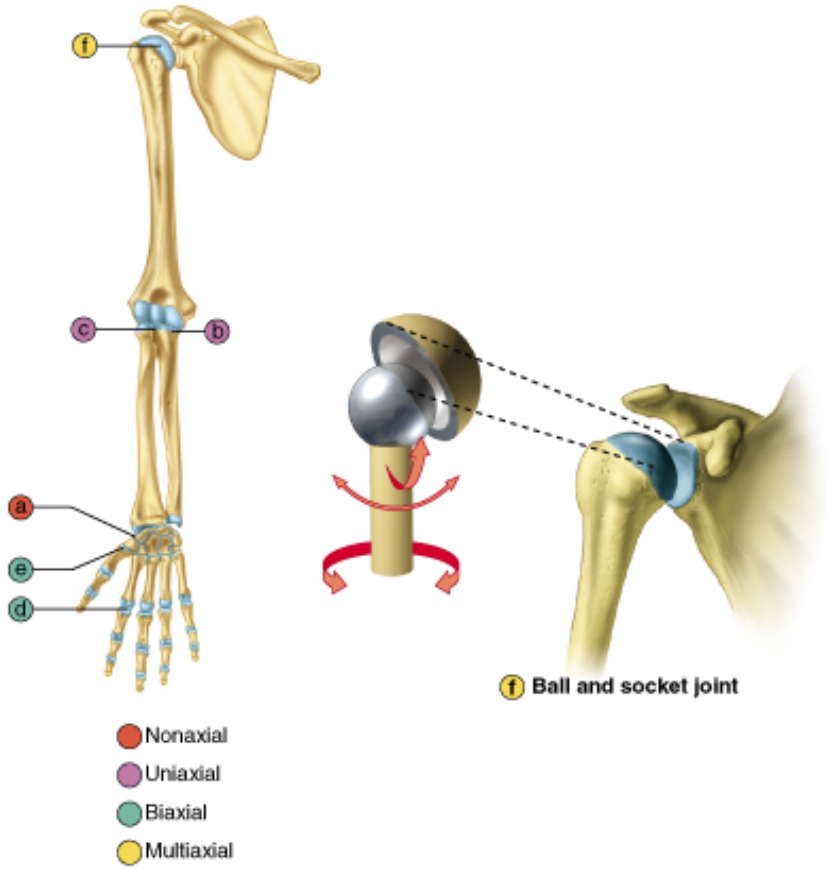
Types of Synovial Joints – Based on Shape of Articular Surfaces:

- 5 **<u>Saddle joints</u>** – each articular surface with both concave & convex surfaces
  - Biaxial
  - Example:
    - Trapezium & 1st metacarpal
      - Twiddling of thumb



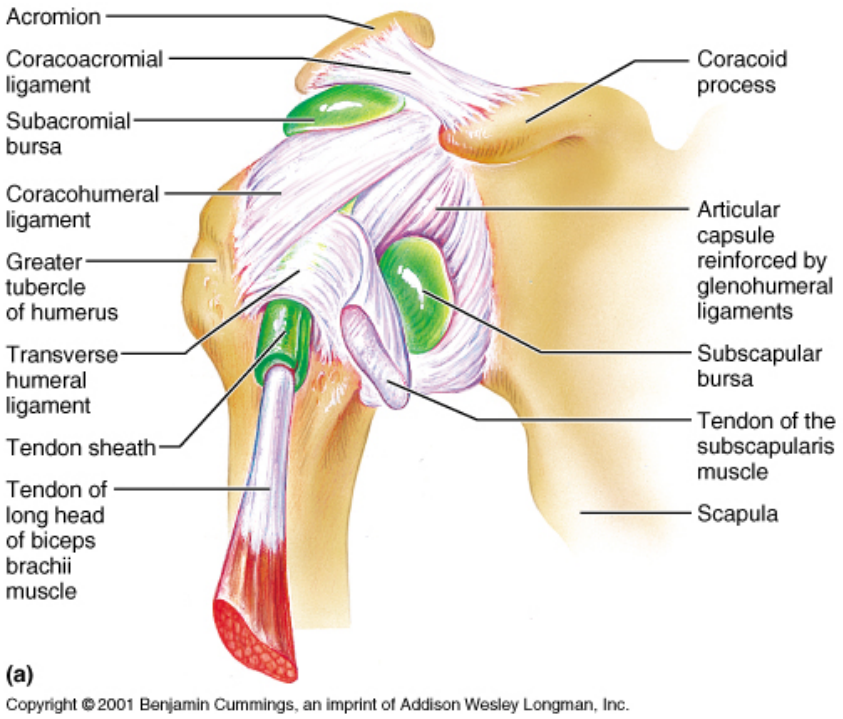
Types of Synovial Joints – Based on Shape of Articular Surfaces:

- 6 **<u>Ball-and-socket</u>** jt. – spherical or hemi-spherical head into cuplike socket
  - Multiaxial – in all axes and planes
  - All axes & planes, including rotation
  - Shoulder & hip jts.



Selected Synovial Joints – The Shoulder (glenohumeral)

- Most freely movable
- Ball-and-socket (head of humerus & glenoid cavity)
- Features:
  - **Glenoid labrum** (fibrocartilage)
  - **Coracohumeral lig.**
  - **Biceps brachii long head**



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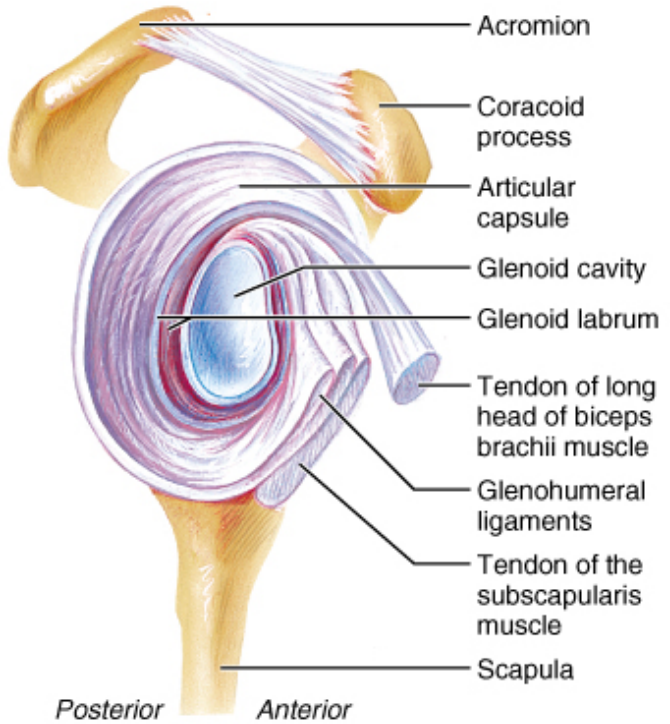
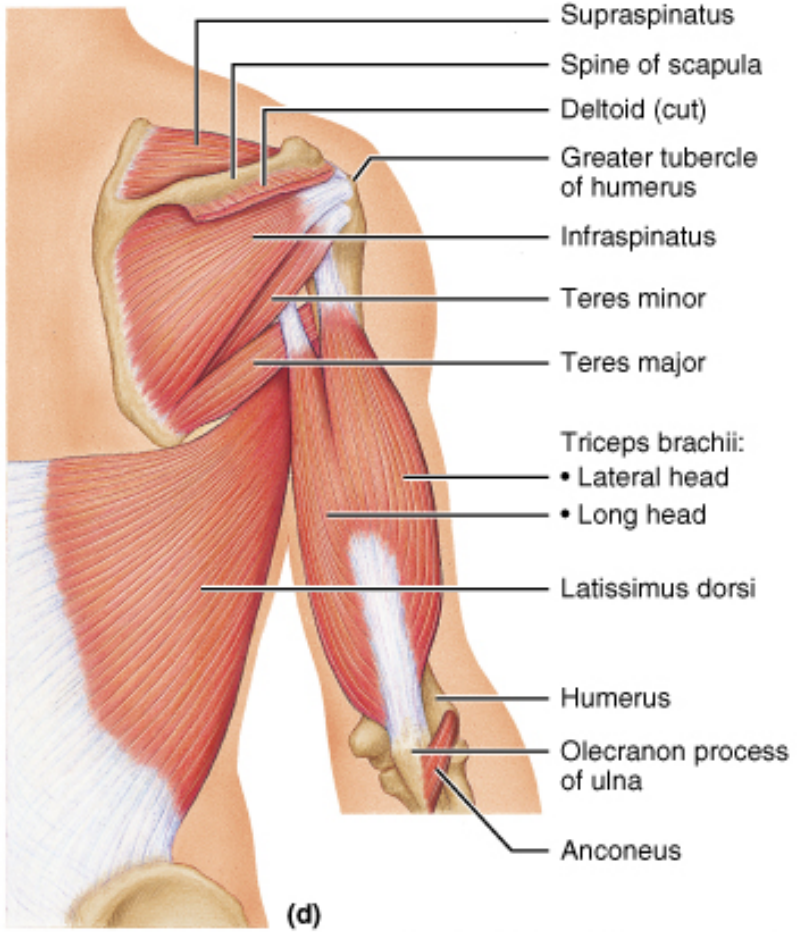


(b)

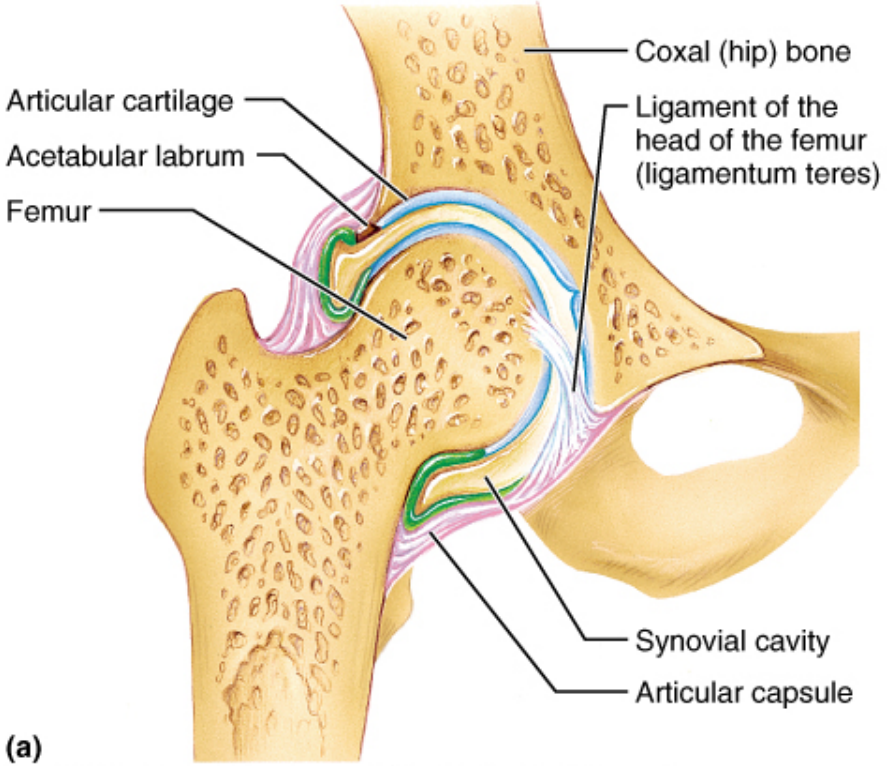
Selected Synovial Joints – The Shoulder (glenohumeral)

- Rotator cuff – four muscles & their tendons:
  - **Subscapularis**
  - **Supraspinatus**
  - **Infraspinatus**
  - **Teres minor**



Selected Synovial Joints – The Hip (Coxal)

- Ball-and-socket
- Deep socket
  - Acetabular labrum of fibrocartilage
- Strong ligaments
  - Iliofemoral(V-shape)
  - Pupofemoral
  - Ischiofemoral



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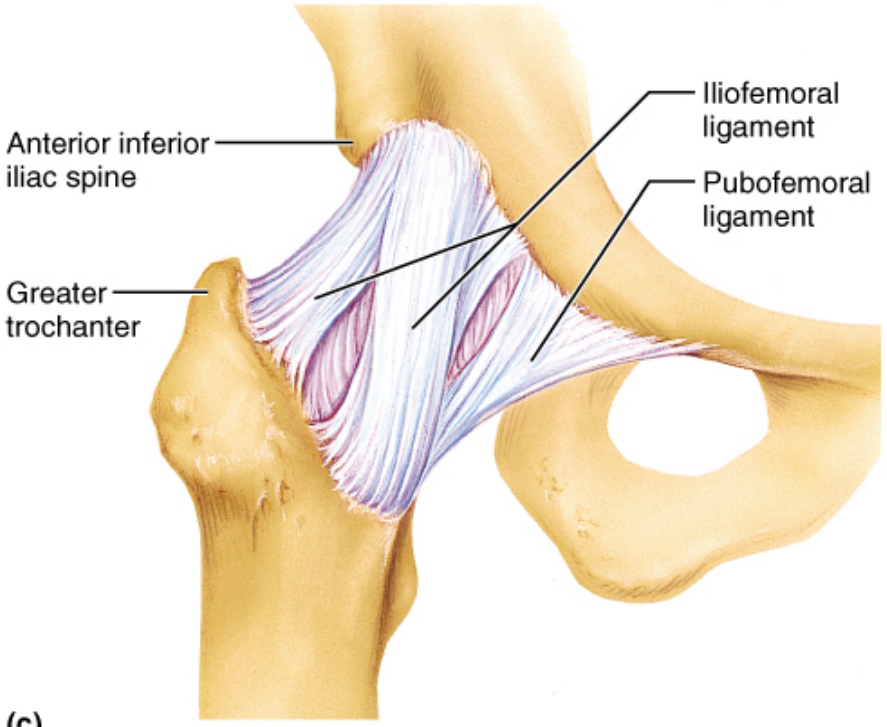
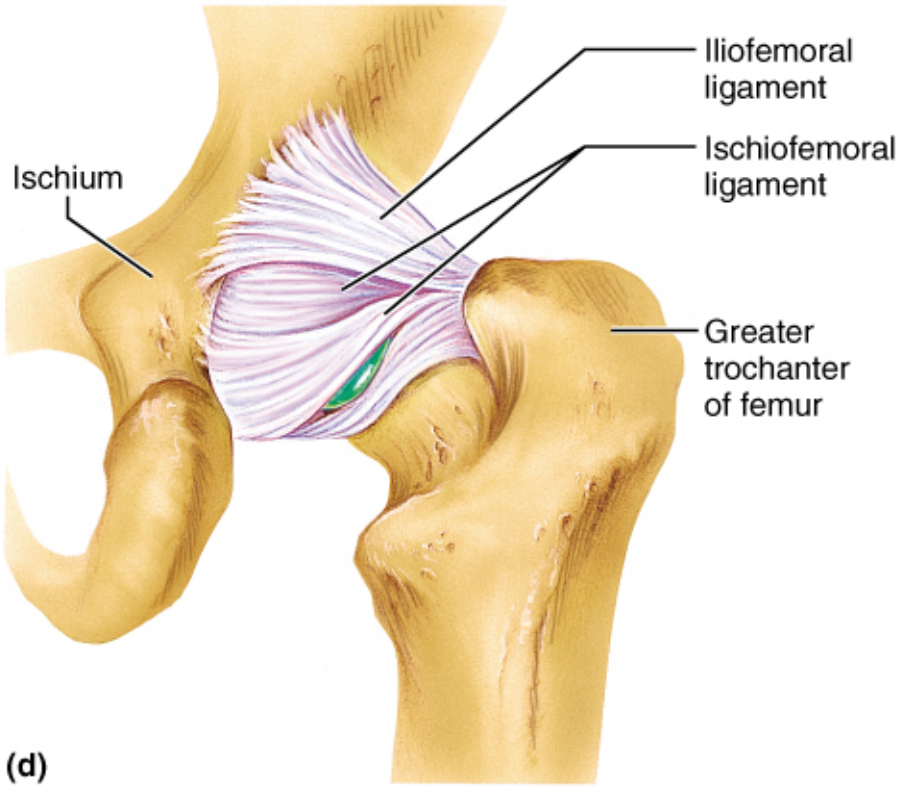


(c)

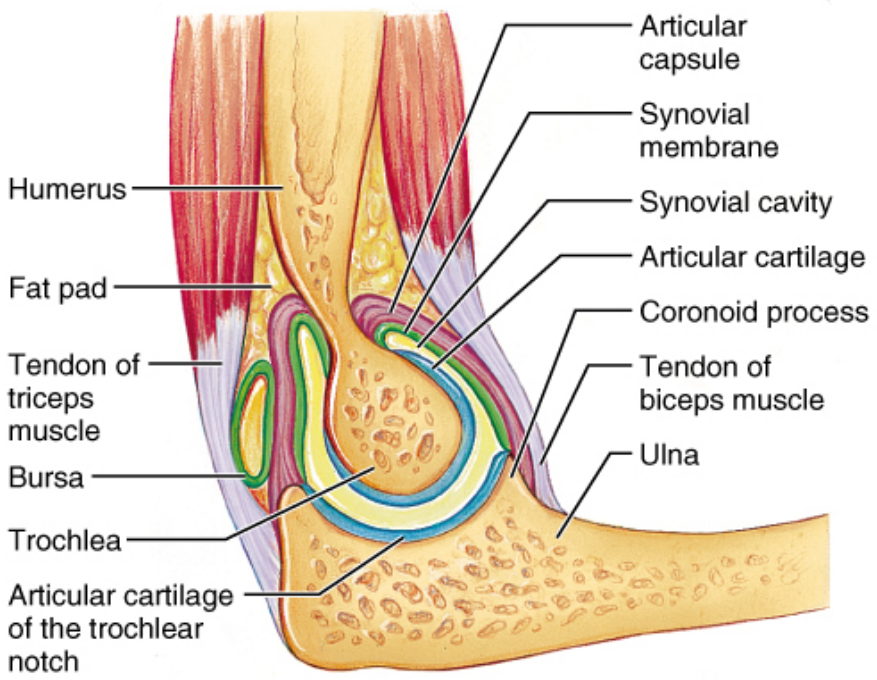
Selected Synovial Joints – The Hip (Coxal)

- Ligamentum teres
  - Damage to artery → severe arthritis
- Rarely disarticulated



Selected Synovial Joints – The Elbow

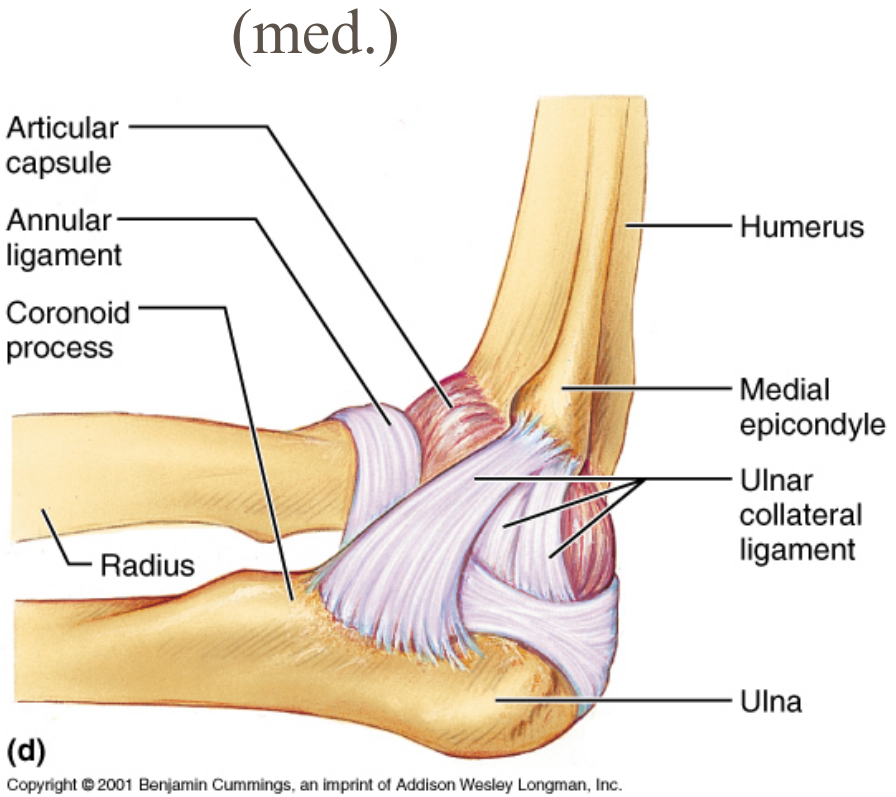
- Radius & ulna with condyles of humerus
  - Trochlea to trochlear notch
  - Annular ligament
  - Radial collateral(lat.)



(a)

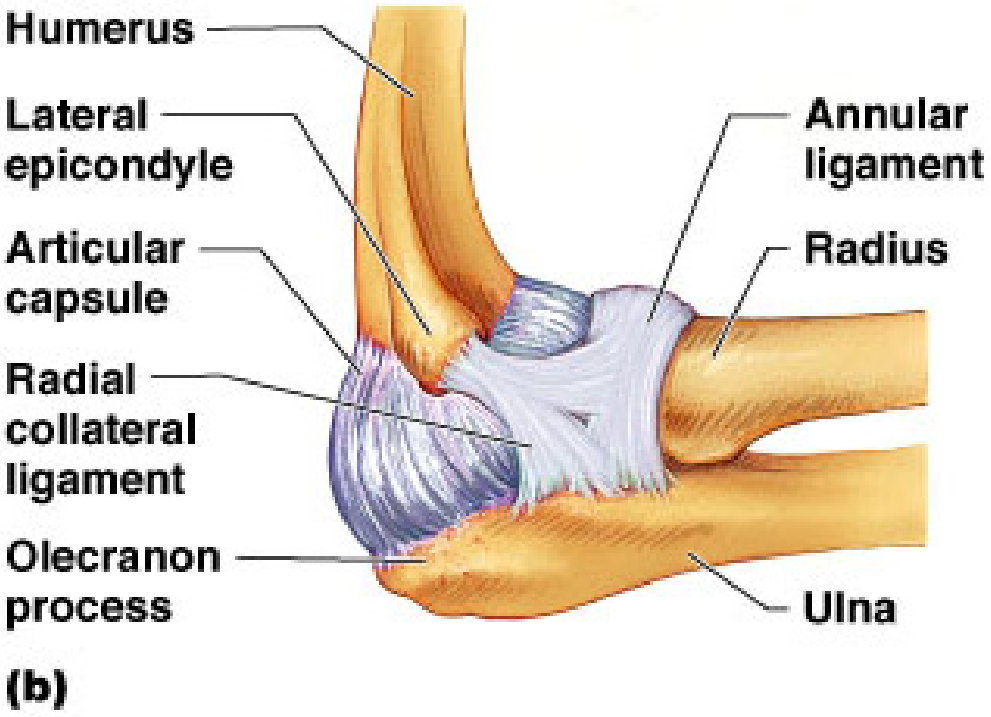
Selected Synovial Joints – The Elbow

- Radius & ulna with condyles of humerus
  - Trochlea to trochlear notch
  - Annular ligament
  - Ulnar collateral



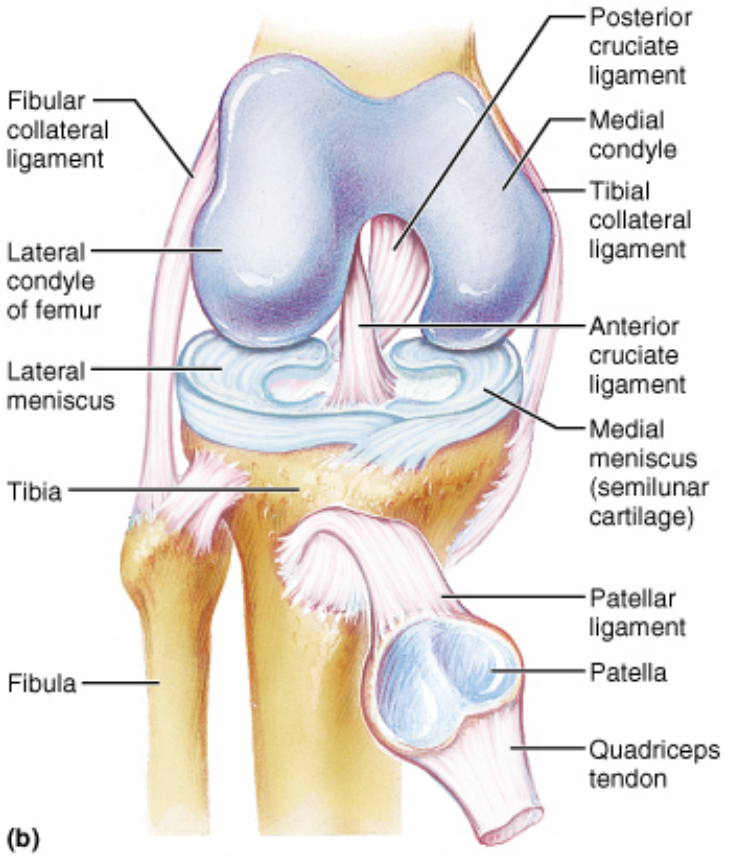
Selected Synovial Joints – The Elbow

- Radial collateral (lat.)



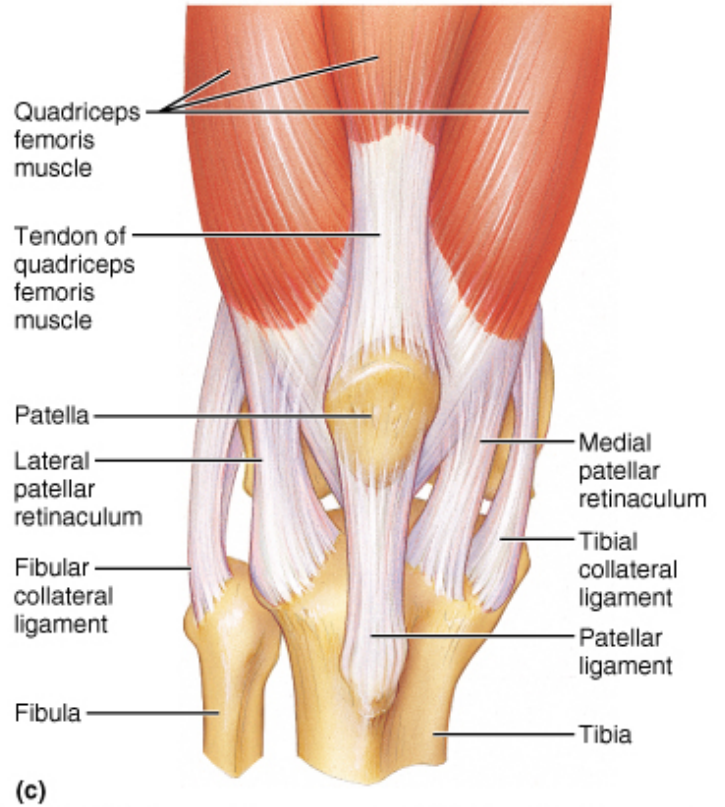
Selected Synovial Joints – The Knee

- Hinge
- Single jt. cav., 3 joints in one:
  - Femoropatellar
  - Lat. & medial tibiofemoral
    - Lat. & med. **menesci**
      - Help to prevent side-to –side rocking & absorb shock
  - Some rotation during partial flexion



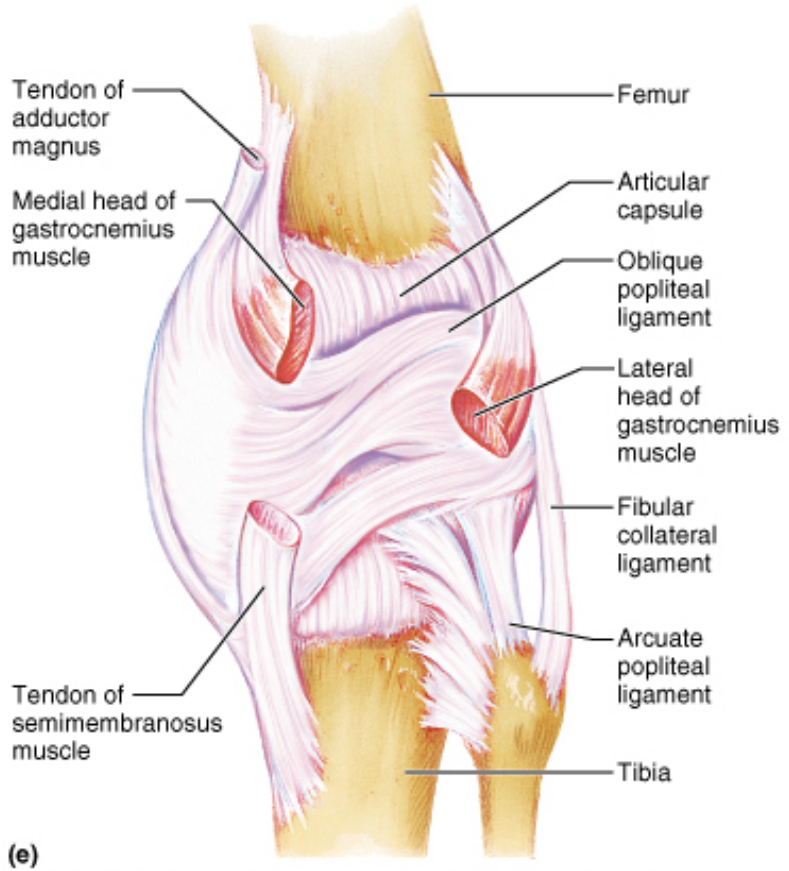
Selected Synovial Joints – The Knee

- 3 ligaments ant.
  - Patellar
  - Med. & lat. retinacula
- Quadriceps muscle
- Extracapsular lig.
  - Lat. & med. collateral ligaments



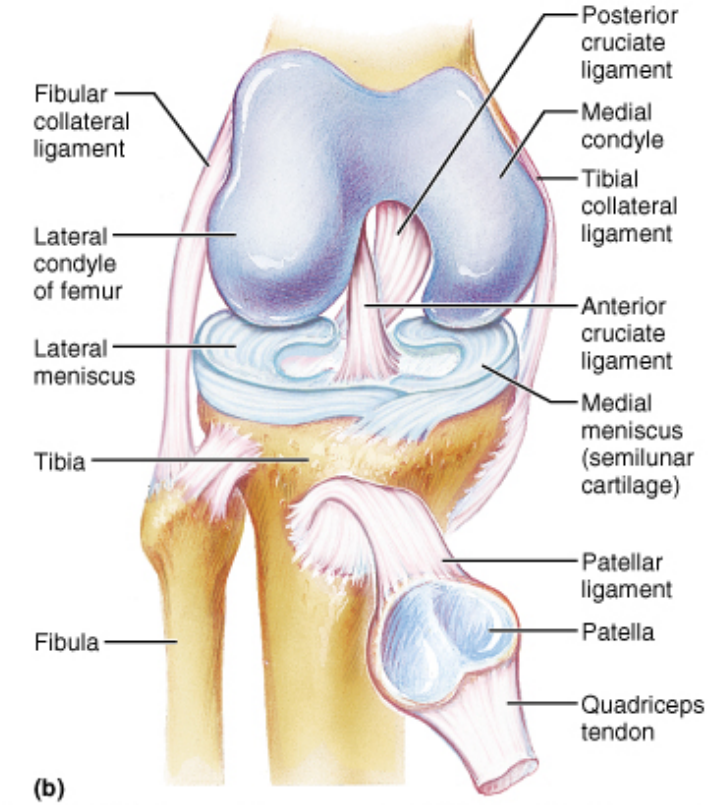
Selected Synovial Joints – The Knee

- Oblique popliteal lig.
- Arcuate popliteal



Selected Synovial Joints – The Knee

- Intracapsular ligaments:
  - Named for tibial attachment site
    - Ant. cruciate (ACL)
    - Post. cruciate



Selected Synovial Joints – The Knee

- Vulnerable to horizontal blows
  - Football injuries (lat. blows to extended knee)
    - Tear med. Collateral lig.
    - Crush med. Meniscus
    - Arthroscopic surgery
    - Tear ACL –poor healing
      - Grafting

Joint Problems:

- **Sprain** – ligament stretched & torn
  - Ankle, knee & lumbar region common
  - Pain, swelling, skin discoloration
- **Dislocation** (luxation, separation) – loss of joint structure continuity
  - Most be reduced
- **Subluxation** – partial dislocation, less severe

Joint Problems
Arthritis

- 100+ different types
- An inflammatory disease of the joint/s
- Pain, stiffness & swelling
- **Acute bacterial arthritis** (**septic arthritis**)
  - Due to bacterial invasion
  - Synovial membrane thickens, decreased synovial fluid production, friction, pain
  - Antibiotic treatment

Joint Problems
Arthritis

- Osteoarthritis (OA) – chronic,pain, swelling, stiffness of weight bearing joints
  - Normal jt. Use → release of **metalloproteinase** → damaged cartilage → when damage exceeds repair → eroded articular cartilage
  - Overgrowth at bone margins (**spurs**)
  - Usually after age 40, normal aging change
  - **Heberden's nodes** – terminal phalangeal jts.
    - Women

Joint Problems
Arthritis

- Osteoarthritis (OA) or DJD Cont.'d
  - Long term twisting & enlargement of digits
  - Joint Replacement, anti-inflammatory agents
    - **Ibuprofin** and others – GI bleeding & cartilage destruction
  - Asprin, acetaminophen, magnetic therapy
  - **SAM-e** (S-adenyosylmethionine) –1999
    - Antidepressant, builds up cartilage matrix, stems tide
  - St. John's wort (depression) ?, glucosamine ?

Joint Problems
Arthritis

- **Rheumatoid Arthritis** (RA) – an autoimmune c.t. disorder that affects skin, b.v., lungs, and joints
  - Rheumatoid factor (Ab) in blood
  - Early: synovitis with excess synovial fluid & inflammation
  - Later: pannus – synovial membrane thickening with erosion of articular cartilage

Joint Problems
Arthritis

- **Rheumatoid Arthritis** (RA) Cont.'d
  - Scar tissue formation connects bone ends
  - Ossification, with bone end fusion
  - Result: ankylosis ("stiff condition") – bent, deformed fingers
  - Usually symmetrical (bilateral)
  - 3% women, 1% men
  - Treatment: rest, asprin, steroids, prosthesis
    - **Embrel**- absorbs excess **tumor necrosis factor** (TNF) from immune cells that promotes tissue inflammation

Joint Problems
Arthritis

- **Gouty Arthritis** – error in purine (A, G) metabolism
  - Genetic, but more common in males
  - Increased **uric acid** production with crystal deposits in tissues
    - In joints, kidney, other soft tissues
    - Toes, instep, heals, ankles, knees, wrists
  - Intense pain & swelling, possible kidney stones

Joint Problems
Arthritis

- **Gouty Arthritis** , Cont.'d
  - Colchicine, allopurinol,, glucocorticoids
  - Avoid: alcohol & foods high in purines:
    - Liver, kidney, sardines, red meats, shell fish, spinach, beans, peas, nuts