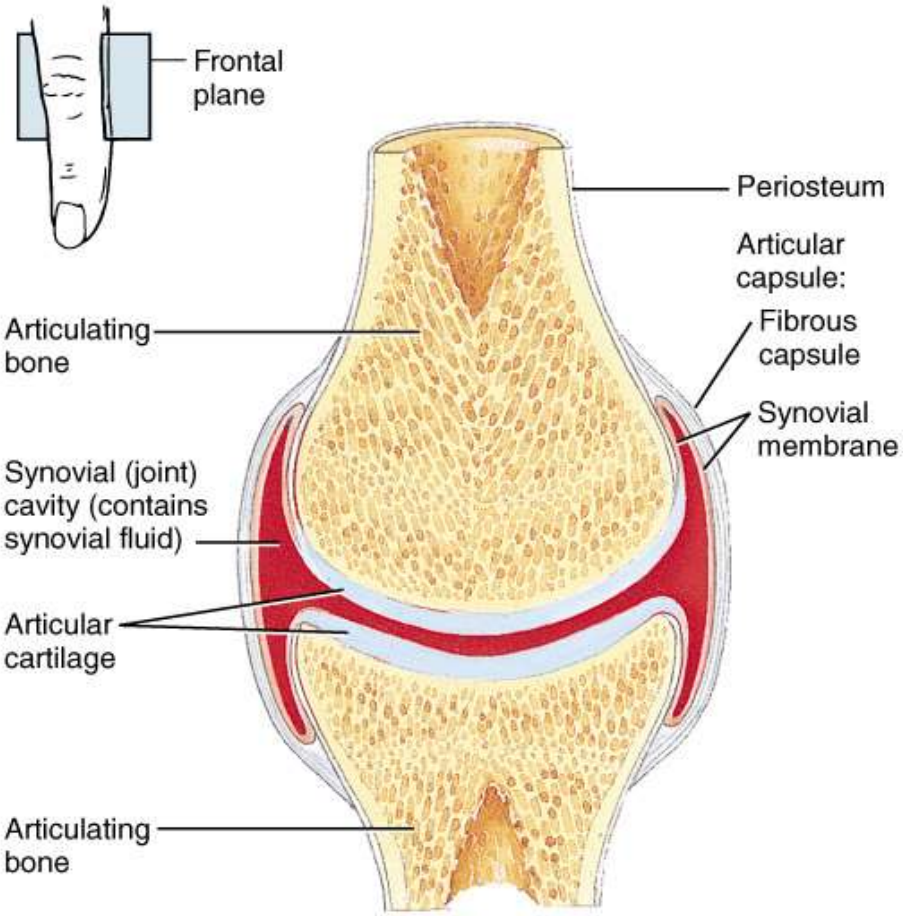
Articulations
(Joints)

Articulations (Joints)

- Joints hold bones together but permit movement (with a few exceptions)
- Point of contact
  - between 2 bones
  - between cartilage and bone
  - between teeth and bones
- Arthrology = study of joints
- Kinesiology = study of motion



Classification of Joints

- Structural classification
  1. Fibrous
  2. Cartilaginous
  3. Synovial

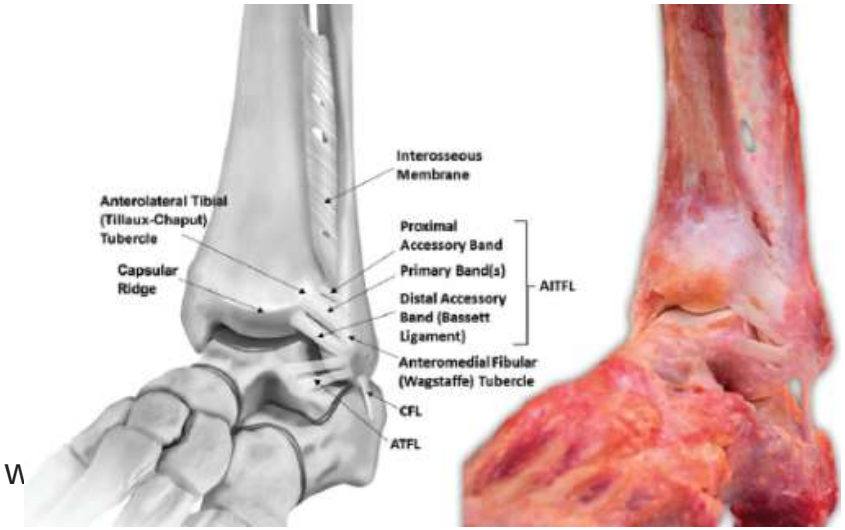
- Functional classification based upon movement:
  - immovable = synarthrosis
  - slightly movable = amphiarthrosis
  - freely movable = diarthrosis

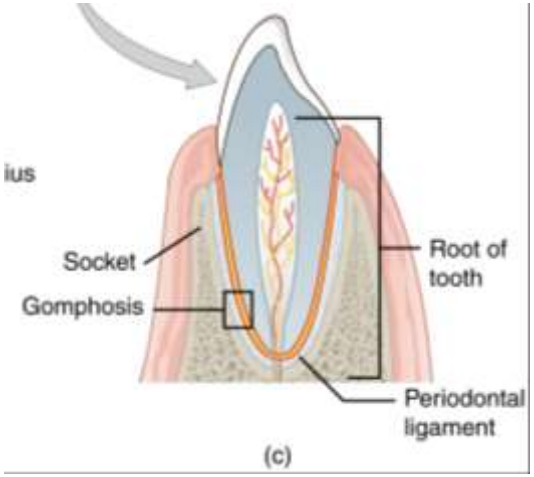
Structural Classification
1. Fibrous Joints

- Lack a synovial cavity
- Bones held close
- Little (amphiarthroses) or no movement (synarthroses)

Structural Classification
1.Fibrous Joints

- 2 structural types of fibrous joint
  1. sutures
  2. Syndesmoses
     - A syndesmosis is defined as a fibrous joint in w two adjacent bones are linked by a strong membrane or ligaments. This definition also applies for the distal tibiofibular syndesmosis*.
     - Interosseous membrane may be found between two bones forming a syndesmosis joint.
     - Gomphoses – special case - tooth in the socket



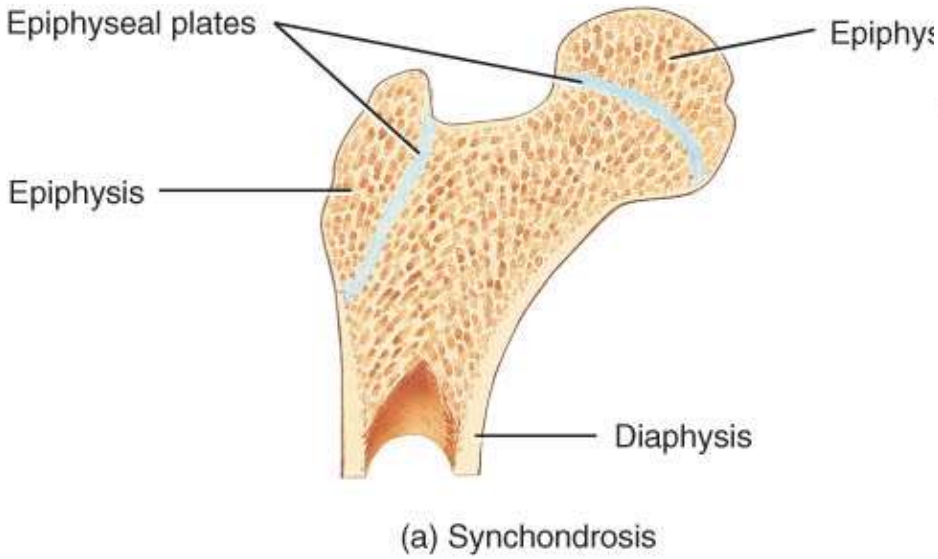


*Hermans JJ, Beumer A, de Jong TA, Kleinrensink GJ. Anatomy of the distal tibiofibular syndesmosis in adults: a pictorial essay with a multimodality approach. J Anat. 2010 Dec;217(6):633-45. doi: 10.1111/j.1469-7580.2010.01302.x. PMID: 21108526; PMCID: PMC3039176.

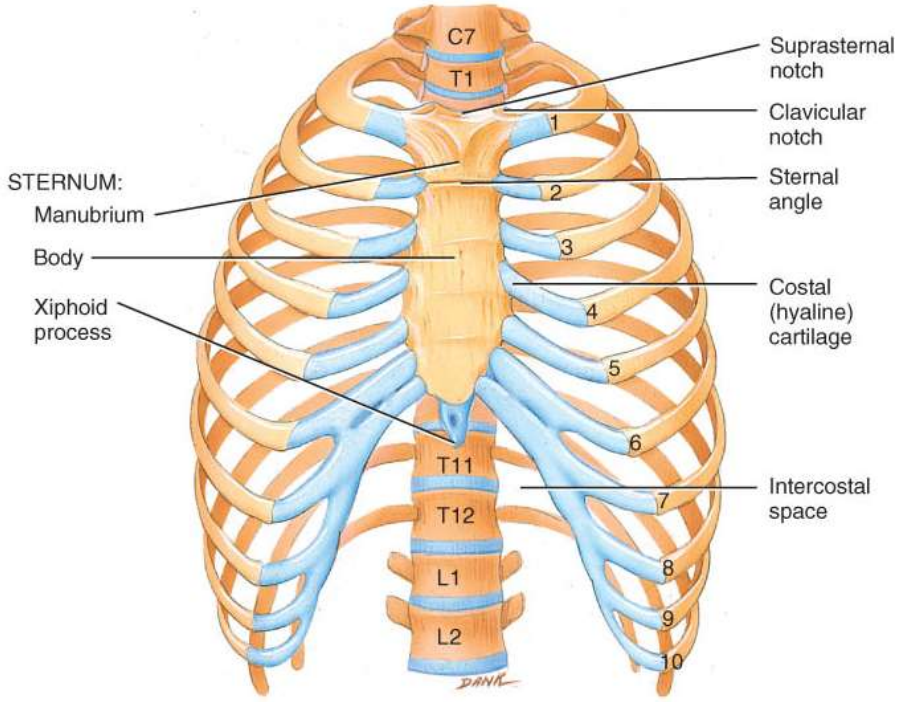
Structural Classification
2. Cartilaginous Joints

- Lacks a synovial cavity
- Allows little (amphiarthroses) or no movement (synarthroses)
- Bones tightly connected by fibrocartilage or hyaline cartilage
- 2 types
  - synchondroses
  - symphyses

2. Cartilaginous Joint - Synchondrosis



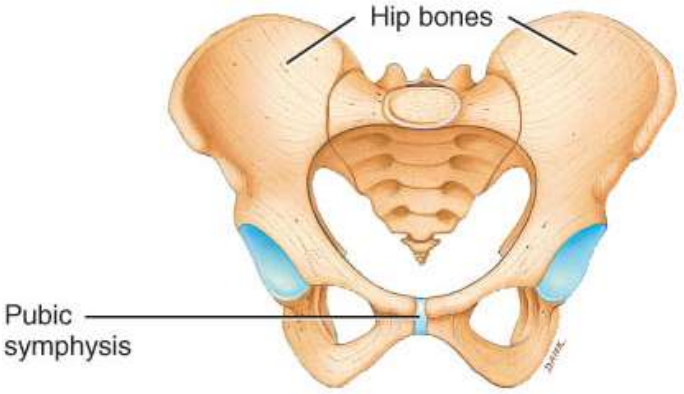
(a) Synchondrosis



- Connecting material is hyaline cartilage
- Immovable (synarthrosis)
- Epiphyseal plate or joints between ribs and sternum

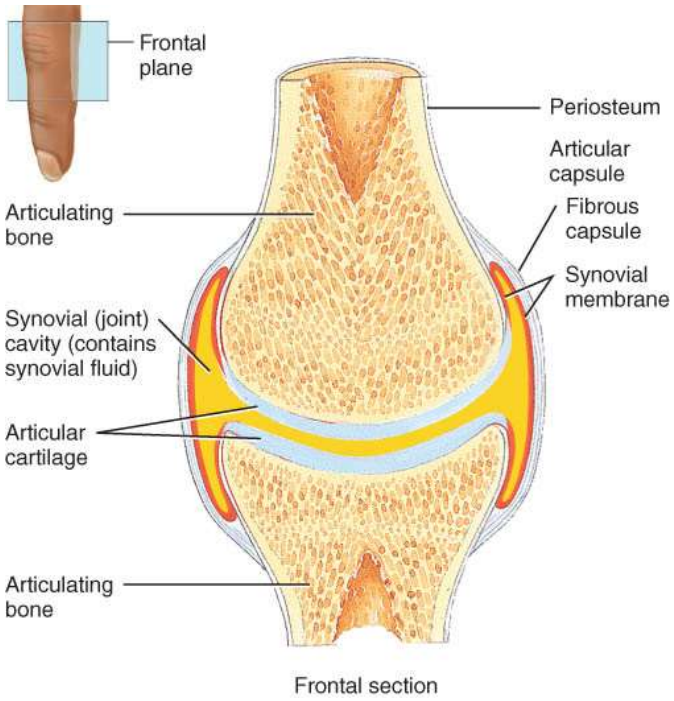
2. Cartilaginous Joint - Symphysis

- Ends of the articulating bones are covered with hyaline cartilage but fibrocartilage is connecting material
- Slightly movable (amphiarthroses)
- Intervertebral discs and pubic symphysis



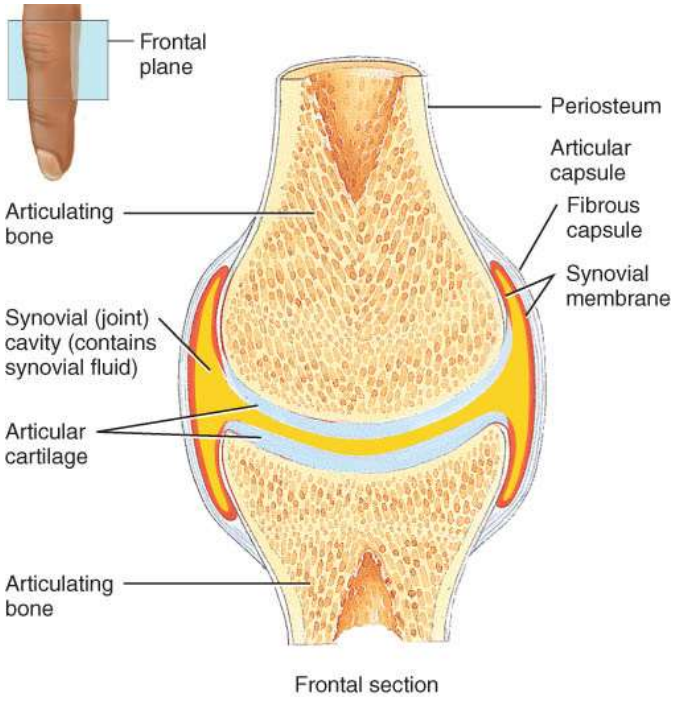
Structural Classification
3.Synovial Joints

- Synovial cavity separates articulating bones
- Freely moveable (diarthroses)
- Articular cartilage
  - Hyaline cartilage
  - reduces friction
  - absorbs shock
- Articular capsule
  - surrounds joint
  - thickenings in fibrous capsule called ligaments
- Synovial membrane
  - inner lining of capsule



Structural Classification
3.Synovial Joints

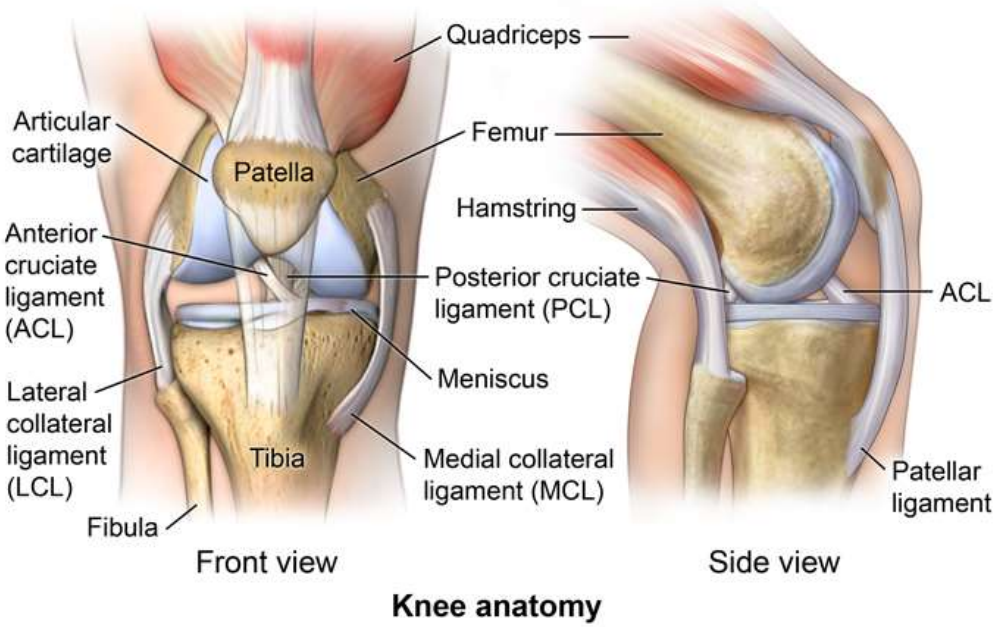
- Synovial Fluid
  - Secreted by the synovial membrane
  - contains slippery hyaluronic acid
  - Functions:
    - Reduces friction
    - Absorbs shocks
    - Supplies oxygen and nutrients
    - Removes carbon dioxide and wastes
    - Has phagocytic cells
  - Fun fact:
    - When a synovial joint is immobile for a while…..



Structural Classification
3.Synovial Joints – Special Features

- Accessory ligaments
  - extracapsular ligaments
    - outside joint capsule
    - Fibular and tibial collalateral ligaments
  - intracapsular ligaments
    - within capsule
    - ACL and PCL

- Articular discs or menisci
  - attached around edges to capsule
  - allow 2 bones of different shape to fit tightly
  - increase stability of knee - torn cartilage



Knee anatomy

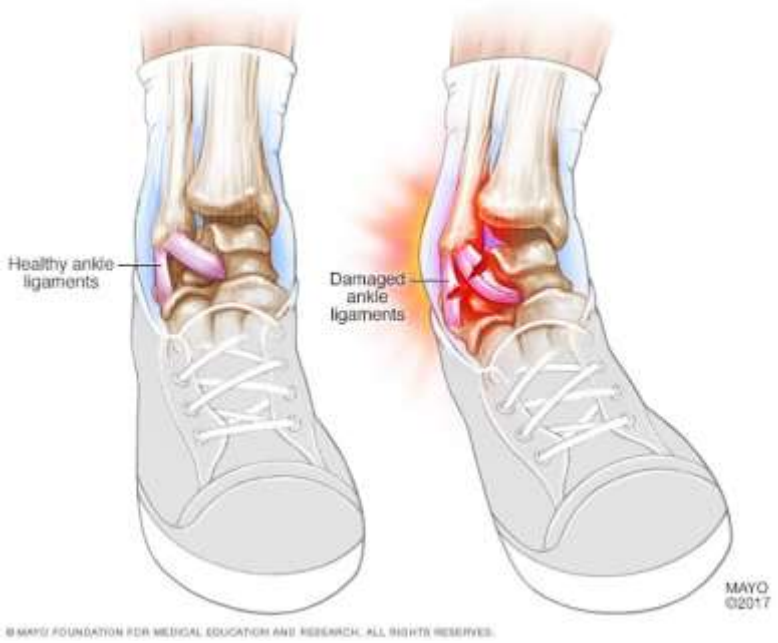
Nerve and Blood Supply

- Nerves to joints are branches of nerves to nearby muscles
- Joint capsule and ligaments contain pain fibers and sensory receptors
- Blood supply to the structures of a joint are branches from nearby structures

Sprain versus Strain

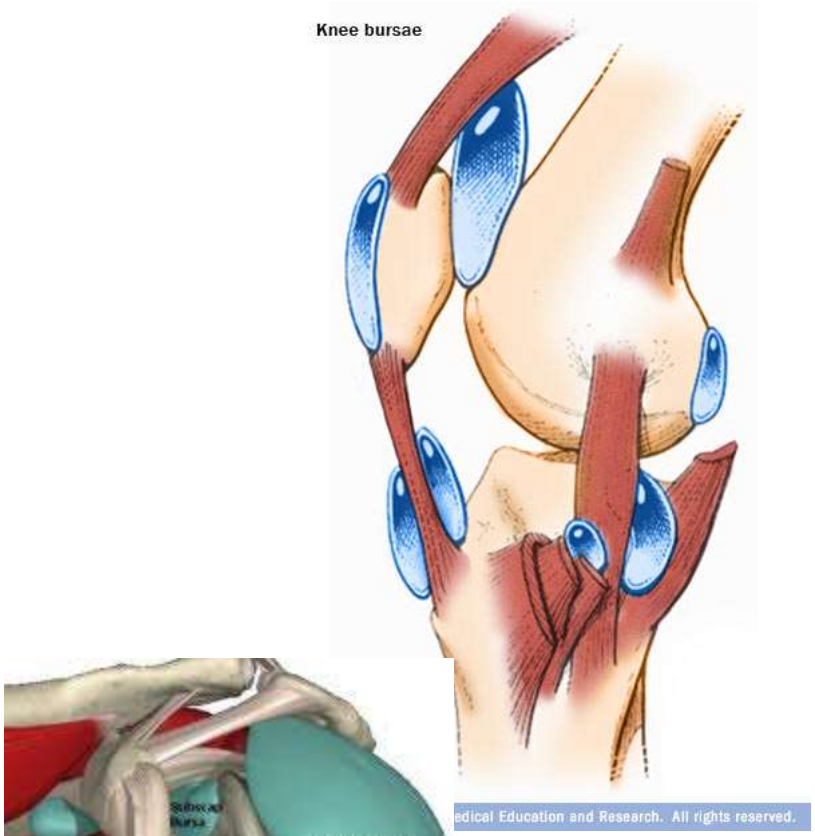
- Sprain
  - twisting of joint that stretches or tears ligaments
  - may damage nearby blood vessels
  - swelling & hemorrhage from blood vessels

- Strain
  - overstretched or partially torn muscle or muscle tendon



Bursae and Tendon Sheaths

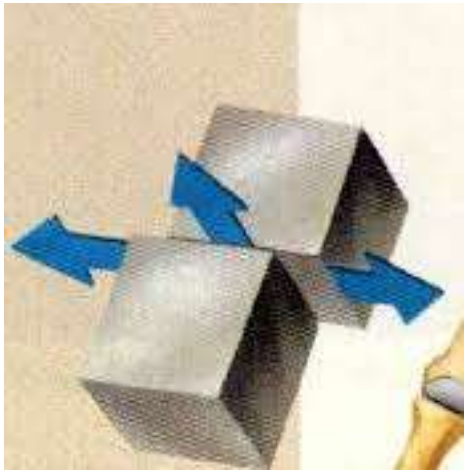
- Bursae
  - fluid-filled saclike extensions of the joint capsule
  - reduce friction between moving structures
- Tendon sheaths
  - tubelike bursae that wrap around tendons at wrist and ankle where many tendons come together in a confined space
- Bursitis
  - chronic inflammation of a bursa



Types of Movement at Synovial Joints

- *Gliding movements* occur when relatively flat bone surface move back and forth and from side to side with respect to one another.

- Examples: carpals and tarsals



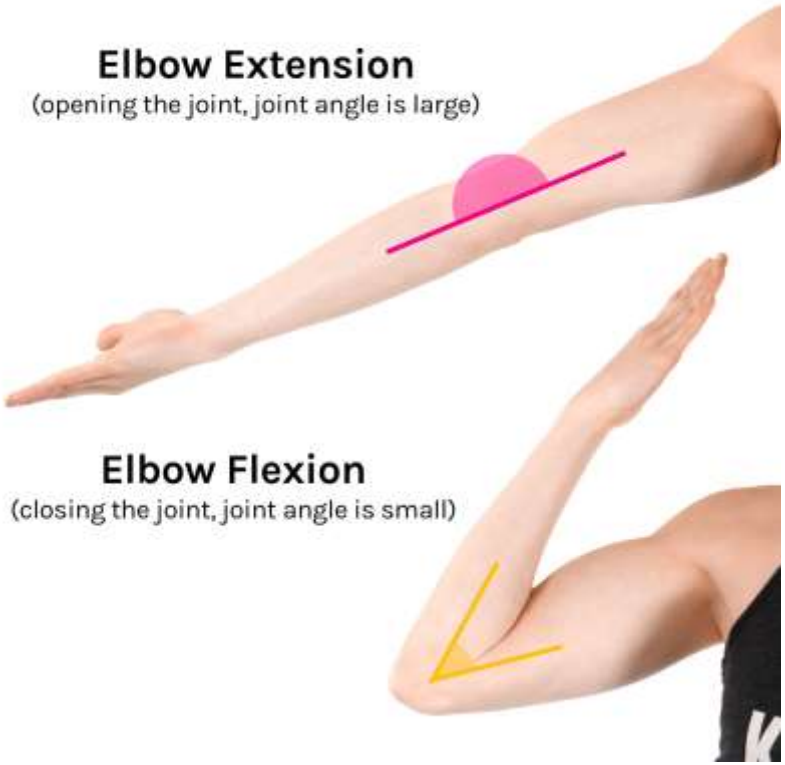
Types of Movement at Synovial Joints

- In *angular movements* there is an increase or a decrease in the angle between articulating bones.
- *Flexion* results in a decrease in the angle between articulating bones.

https://mammothmemory.net/

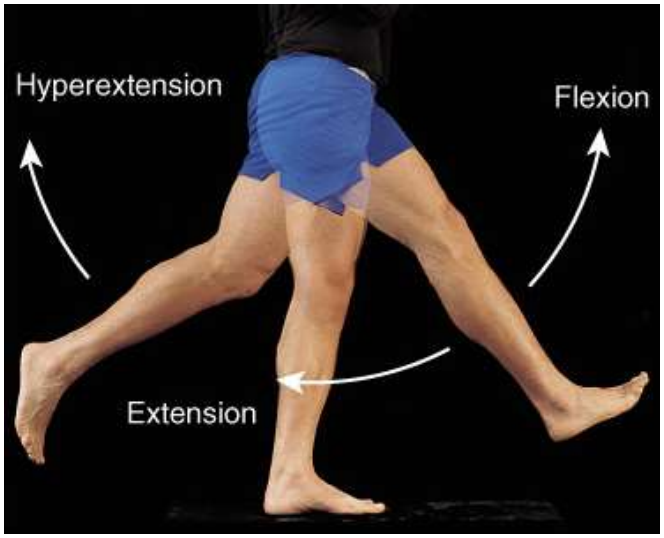
Types of Movement at Synovial Joints

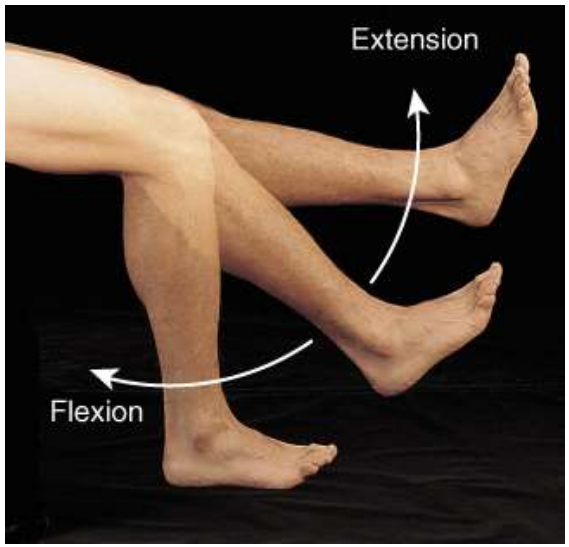
- In *angular movements* there is an increase or a decrease in the angle between articulating bones.
- *Extension* results in an increase in the angle between articulating bones.

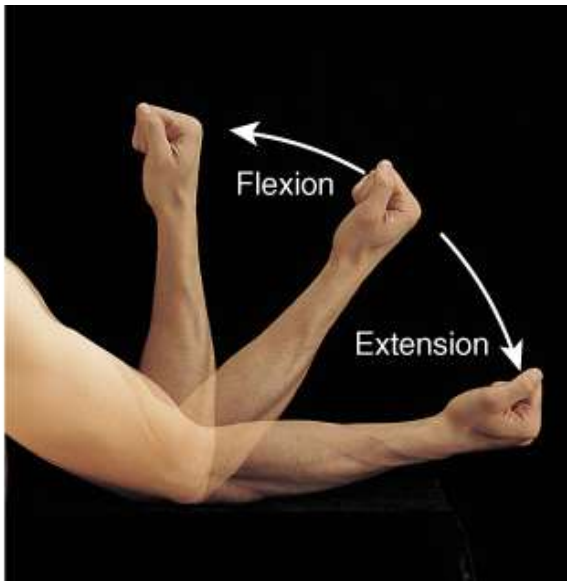


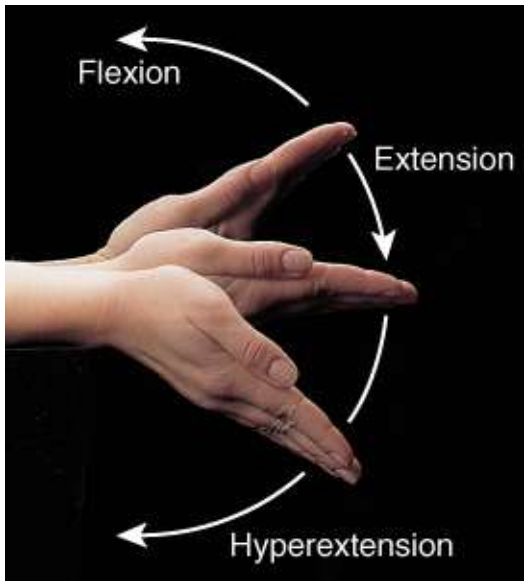
https://tommorrison.uk/blog/flexion--extension-in-detail

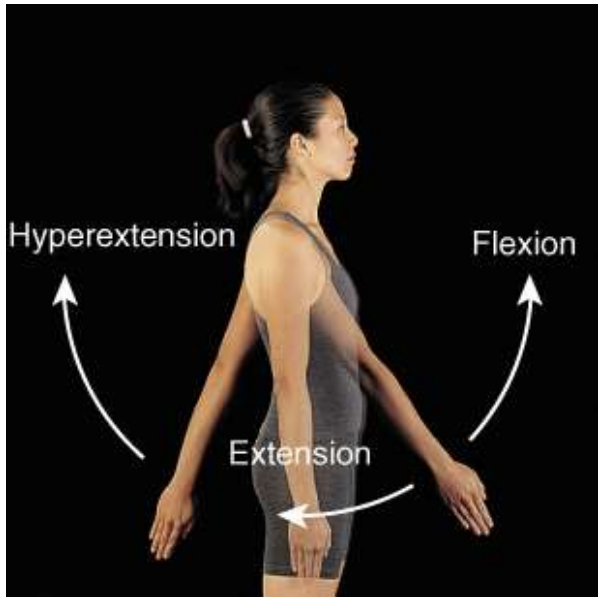
Flexion, Extension & Hyperextension



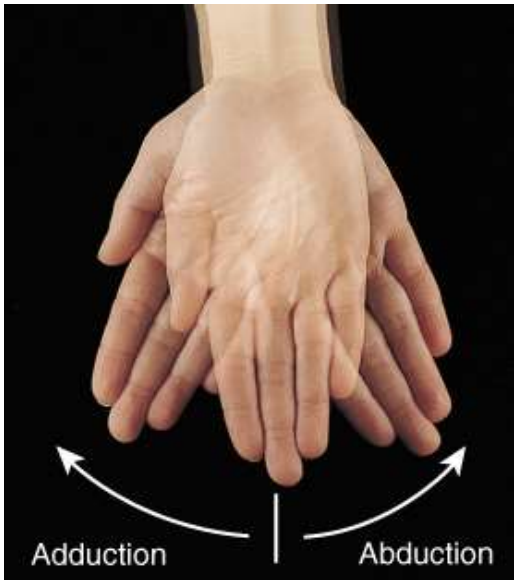


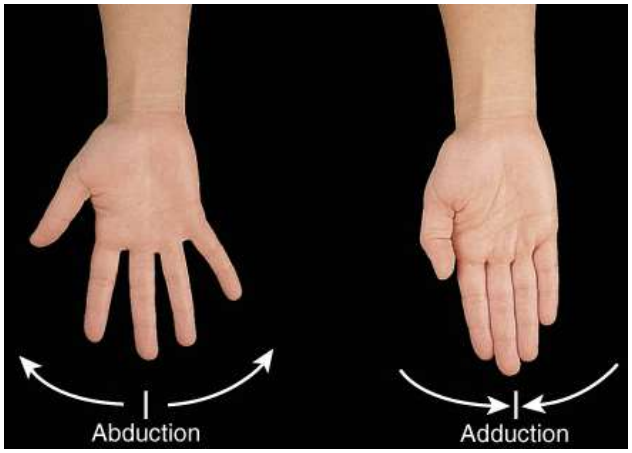






Abduction and Adduction



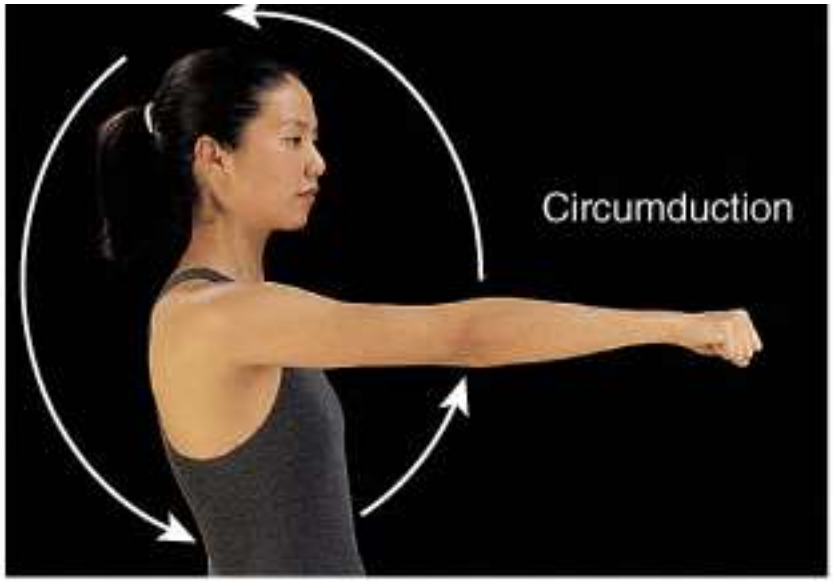


Condyloid joints

Ball and Socket joints

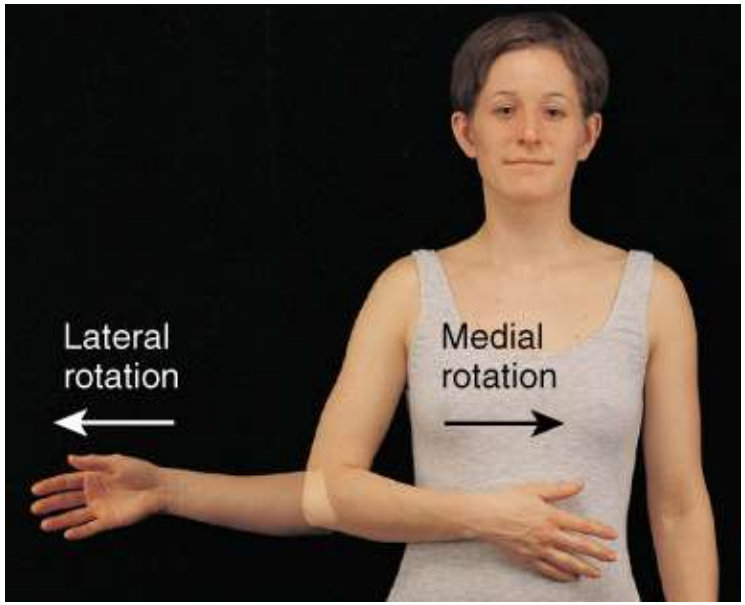
Circumduction

- Movement of a distal end of a body part in a circle
- Combination of flexion, extension, adduction and abduction
- Occurs at ball and socket, saddle and condyloid joints

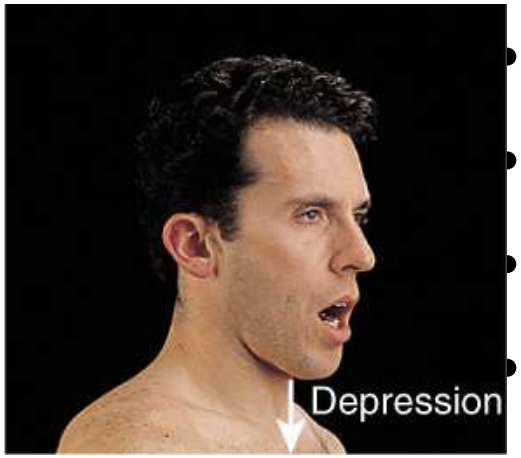


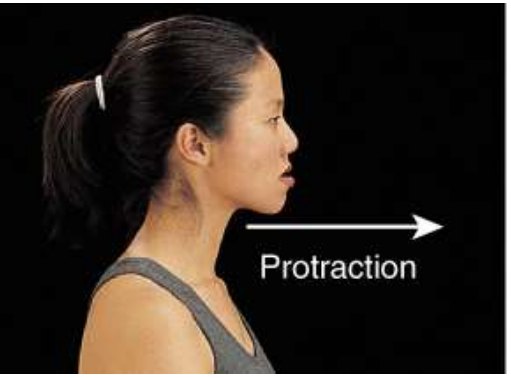
Rotation

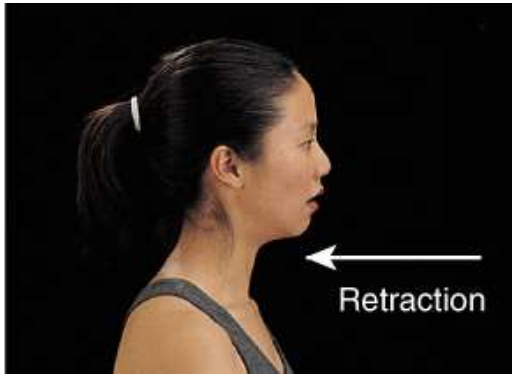
- Bone revolves around its own longitudinal axis
  - medial rotation is turning of anterior surface in towards the midline
  - lateral rotation is turning of anterior surface away from the midline
- At ball & socket and pivot type joints



Special Movements of Mandible







- Elevation = upward
- Depression = downward
- Protraction = forward
- Retraction = backward

Special Movement terms for hand and foot

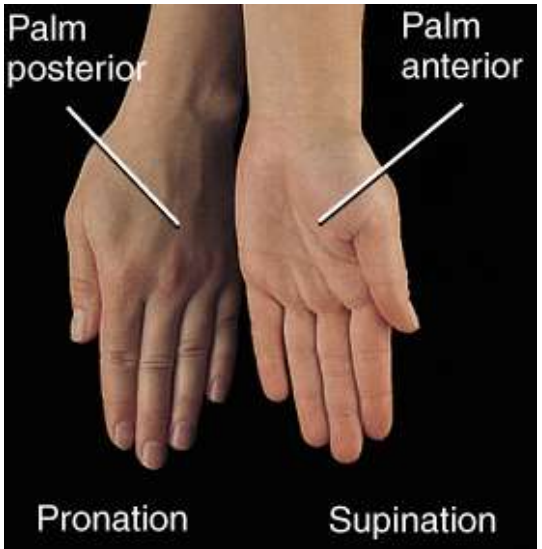
- *Inversion/supination* is movement of the soles medially at the intertarsal joints so that they face toward each other.
- *Eversion/pronation* is a movement of the soles laterally at the intertarsal joints so that they face away from each other.

- *Dorsiflexion* refers to bending of the foot at the ankle in the direction of the superior surface.
- *Plantar flexion* involves bending of the foot at the ankle joint in the direction of the plantar surface.

- *Pronation* refers to rotation of the hand and forearm so that the palm faces backwards or downwards
- *Supination* refers to rotation of the hand and forearm so that the palm faces forwards or upwards

Special Hand & Foot Movements

- Inversion/supination
- Eversion/pronation
- Dorsiflexion
- Plantarflexion
- Pronation
- Supination



Special Movement terms for hand and foot

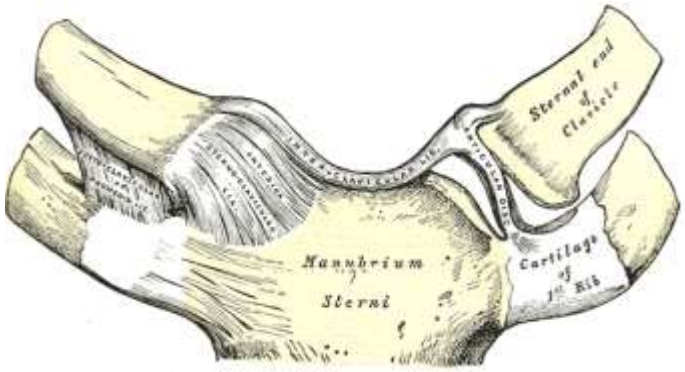
- *Opposition* is the movement of the thumb at the carpometacarpal joint in which the thumb moves across the palm to touch the tips of the finger on the same hand.

TYPES OF SYNOVIAL JOINTS and MOVEMENTS

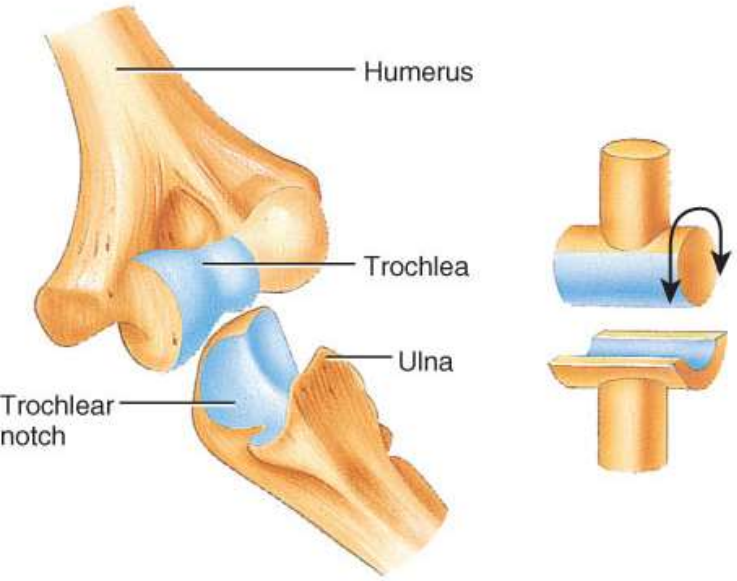
1. Planar joint
2. Hinge joint
3. Pivot joint
4. Condyloid or Ellipsoidal joint
5. Saddle joint
6. Ball and Socket joint

Planar Joint

- Planar *joints* permit mainly gliding movements
  - side-to-side and back-and-forth
- Bone surfaces are flat or slightly curved
- Rotation prevented by ligaments
- Examples
  - intercarpal or intertarsal joints
  - sternoclavicular joint
  - vertebrocostal joints



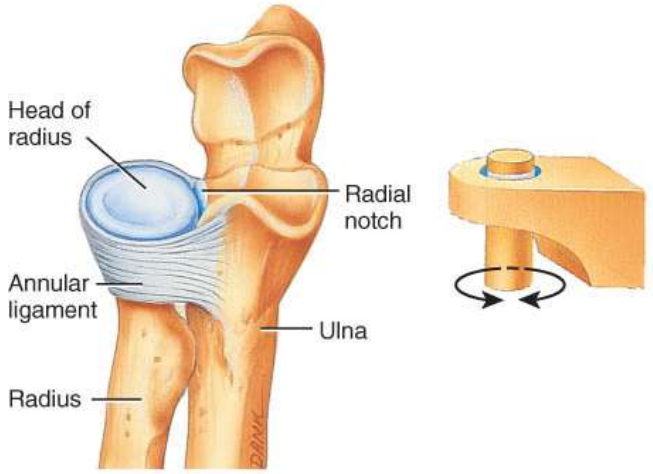
Hinge Joint



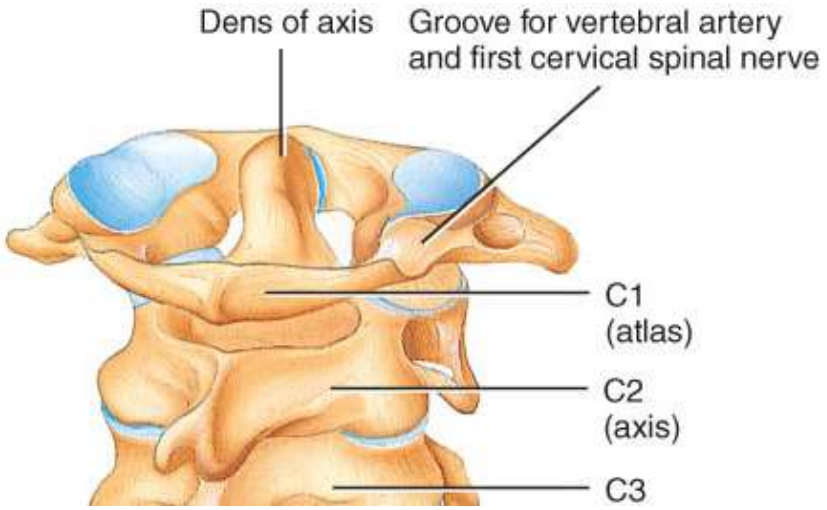
(b) Hinge joint between trochlea of humerus and trochlear notch of ulna at the elbow

- Convex surface of one bones fits into concave surface of 2nd bone
- Uniaxial like a door hinge
- Examples
  - Knee, elbow, ankle, interphalangeal joints
- Movements produced
  - flexion = decreasing the joint angle
  - extension = increasing the angle
  - hyperextension = opening the joint beyond the anatomical position

Pivot Joint

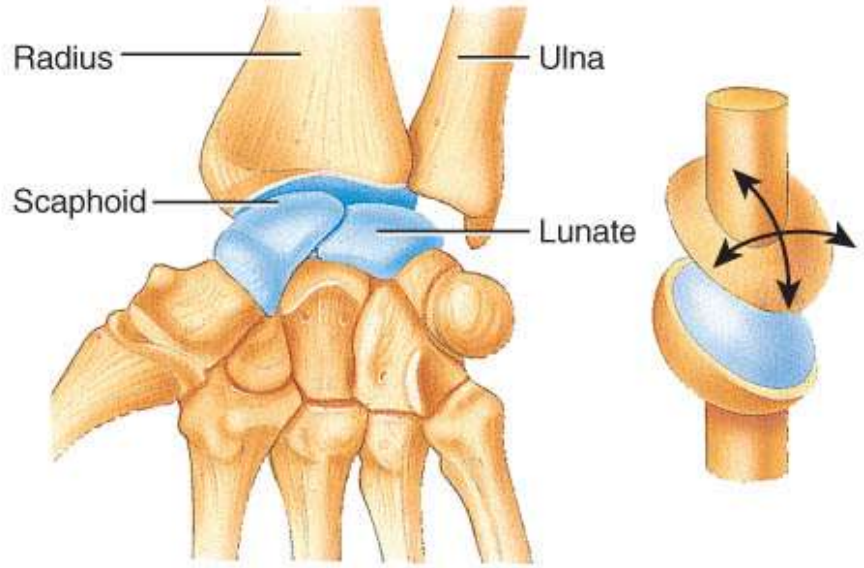


(c) Pivot joint between head of radius and radial notch of ulna



- Rounded surface of bone articulates with ring formed by 2nd bone & ligament
- Uniaxial since it allows only rotational movement around longitudinal axis
- Examples
  - Proximal radioulnar joint
    - supination
    - pronation
  - Atlanto-axial joint
    - turning head side to side “no”

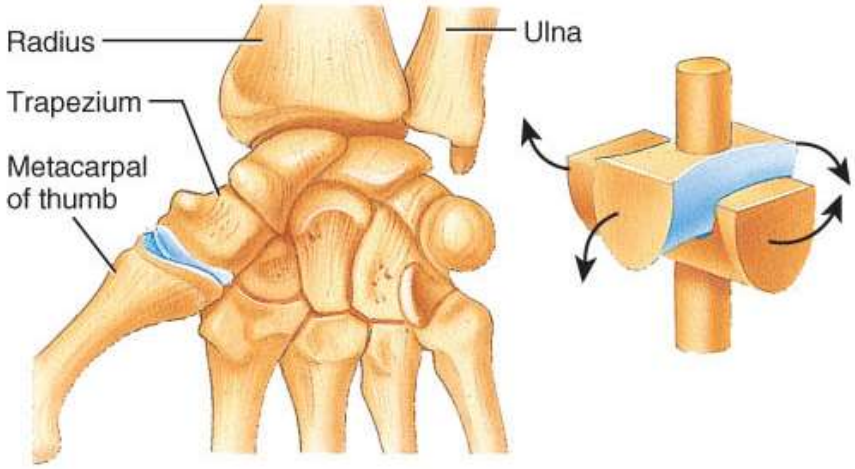
Condyloid or Ellipsoidal Joint



(d) Condyloid joint between radius and scaphoid and lunate bones of the carpus (wrist)

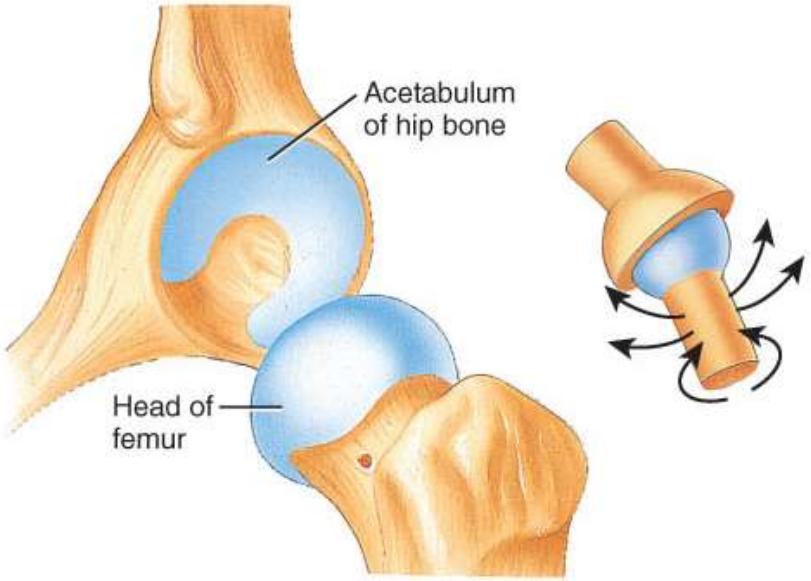
- Oval-shaped projection fits into oval depression
- Biaxial = flex/extend or abduct/adduct is possible
- Examples
  - wrist and metacarpophalangeal joints for digits 2 to 5

Saddle Joint



- One bone saddled-shaped; other bone fits as a person would sitting in that saddle
- Biaxial
  - Circumduction allows tip of thumb travel in circle
  - *Opposition* is the movement of the thumb at the carpometacarpal joint in which the thumb moves across the palm to touch the tips of the finger on the same hand.
- Example
  - trapezium of carpus and metacarpal of the thumb

Ball and Socket Joint



- Ball fitting into a cuplike depression
- Multiaxial
  - flexion/extension
  - abduction/adduction
  - Rotation
  - Circumduction
- Examples (only two!)
  - shoulder joint
  - hip joint

Summary of the types of movements

- Gliding
- Angular
  - Flexion
  - Extension
  - Hyperextension
- Rotation
- Abduction and Adduction
- Circumduction

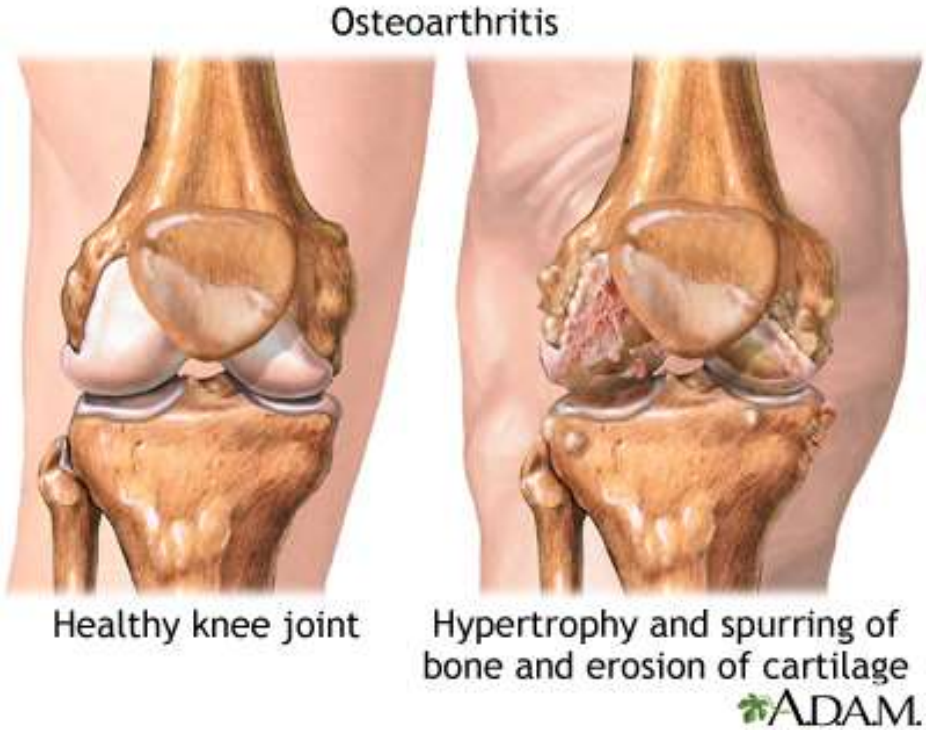
FACTORS AFFECTING RANGE OF MOTION AT SYNOVIAL JOINTS

- Structure and shape of the articulating bone
- Strength and tautness of the joint ligaments
- Arrangement and tension of the muscles
- Contact of soft parts
- Hormones
- Disuse

AGING AND JOINTS

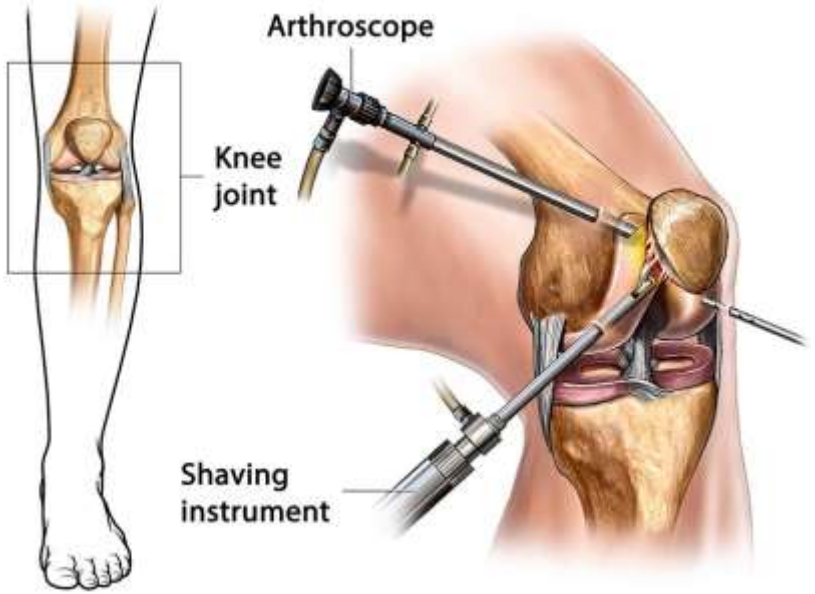
- Various aging effects on joints include decreased production of synovial fluid, a thinning of the articular cartilage, and loss of ligament length and flexibility.

- The effects of aging on joints are due to genetic factors as well as wear and tear on joints.



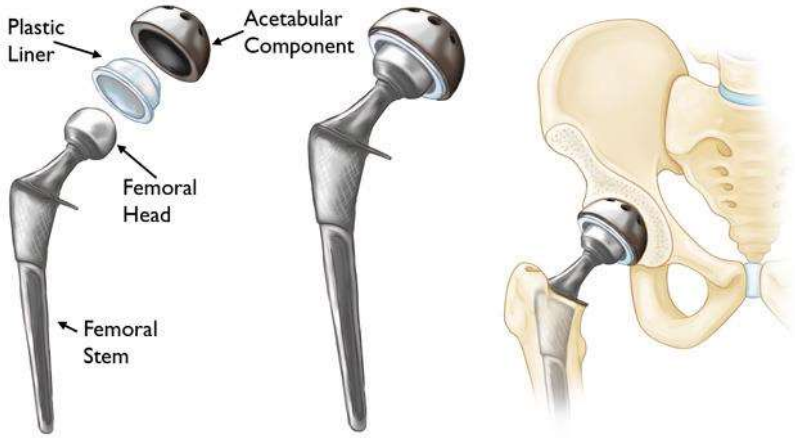
Arthroscopy

- Arthroscopy = examination of joint
  - instrument size of pencil
  - remove torn knee cartilages & repair ligaments
  - small incision only



Arthroplasty

- Arthroplasty = replacement of joints
  - total hip replaces acetabulum & head of femur
  - knee replacement common



Three Types of Arthritis

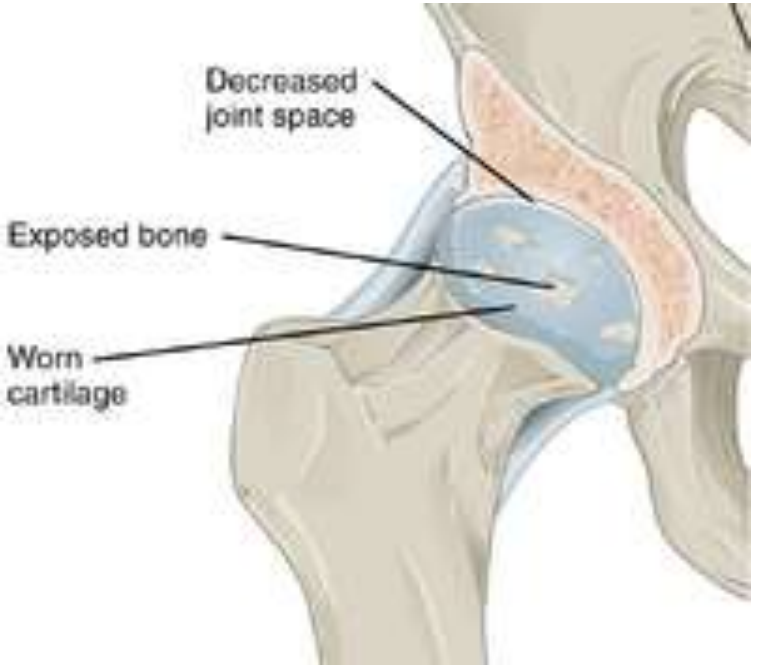
1. Rheumatoid arthritis
2. Osteoarthritis
3. Gout

Rheumatoid Arthritis

- Autoimmune disorder
- Cartilage attacked
- Inflammation, swelling & pain
- Final step is fusion of joint

Osteoarthritis

- Degenerative joint disease
  - aging, wear & tear
- Noninflammatory---no swelling
  - only cartilage is affected not synovial membrane
- Deterioration of cartilage produces bone spurs
  - restrict movement
- Pain upon awakening--disappears with movement



Gouty Arthritis

- Urate crystals build up in joints---pain
  - waste product of DNA & RNA metabolism
  - builds up in blood
  - deposited in cartilage causing inflammation & swelling
- Bones fuse
- Middle-aged men with abnormal gene

Special Movements of Scapula

This slide is just for your review