Exercise 13

Articulations and
Body Movements

Articulations

- Articulations, or joints, are points where a bone is connected to one or more other bones.
- Articulations hold the skeleton together.
- Articulations also allow the skeleton to be flexible so that gross body movements can occur.

Articulations

- Articulations can be classified by two different methods: structurally and functionally.
- The three primary structural categories are fibrous, cartilaginous, and synovial.
- The three primary functional categories are synarthroses, amphiarthroses, and diarthroses.

Structural Categories: Fibrous

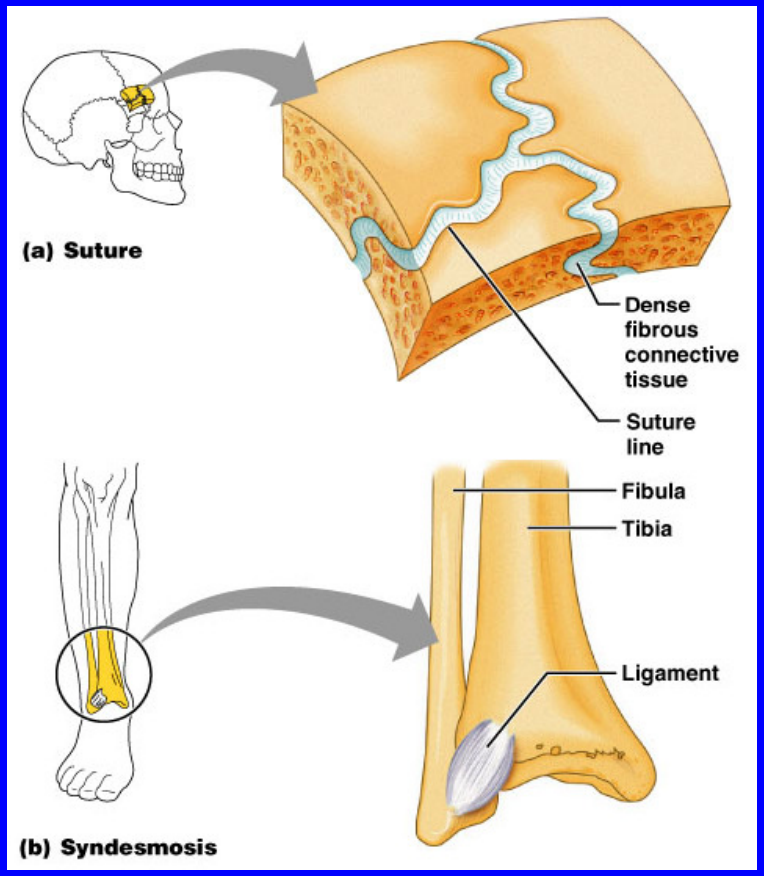
- Fibrous joints are held together by fibrous connective tissue.
- Fibrous joints can be further subdivided into sutures, syndesmoses, and gomphoses.
- Sutures are joints where the irregular edges of two bones interlock with short fibers holding them together.
- Syndesmoses are joints where the edges of the bones do not interlock, and are held together by short ligaments.

Structural Categories: Fibrous

- Gomphoses are articulations between the teeth and the tooth sockets of the mandible and maxillae.
- Gomphoses are secured by the periodontal ligaments.

Structural Categories: Fibrous

- Most of the joints of the skull are sutures, and the joint between the distal ends of the fibula and tibia is a syndesmosis.

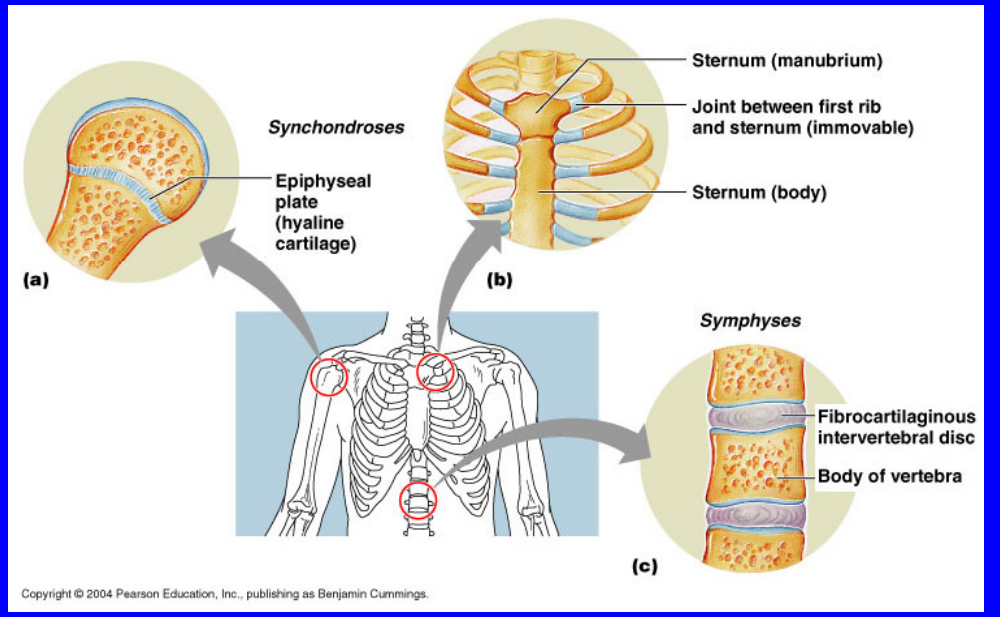


Structural Categories: Cartilaginous

- In cartilaginous joints, the bones are connected by a pad or plate of cartilage.
- Cartilaginous joints can be further subdivided into symphyses, and synchondroses.
- In a symphysis, bones are connected by a broad, flat plate of fibrocartilage.
- In a synchondrosis, bones are connected by hyaline cartilage.

Structural Categories: Cartilaginous

- Examples of symphyses include the intervertebral disks and the pubic symphysis.
- Examples of synchondroses include the costal cartilages and the epiphyseal plates of long bones.

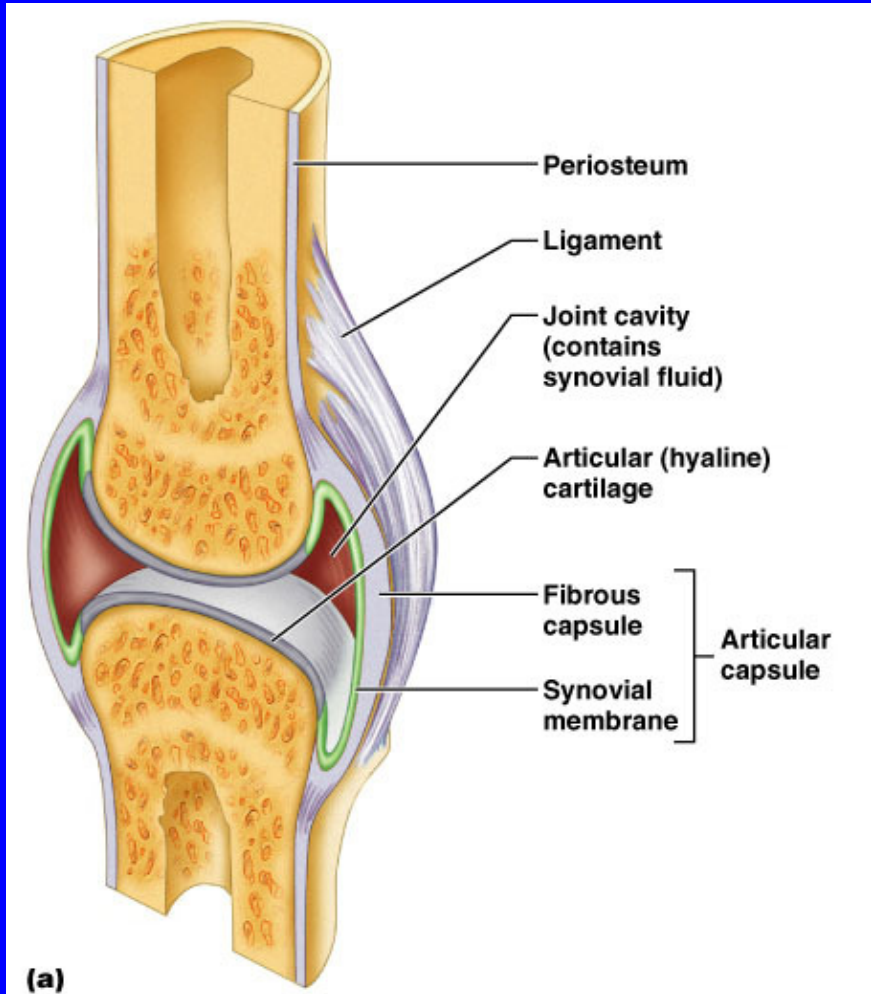


Structural Categories: Synovial

- In synovial joints, the bones are separated by a joint cavity filled with synovial fluid.
- Synovial joint are usually stabilized by ligaments and muscles.
- Synovial joints have a characteristic structure.

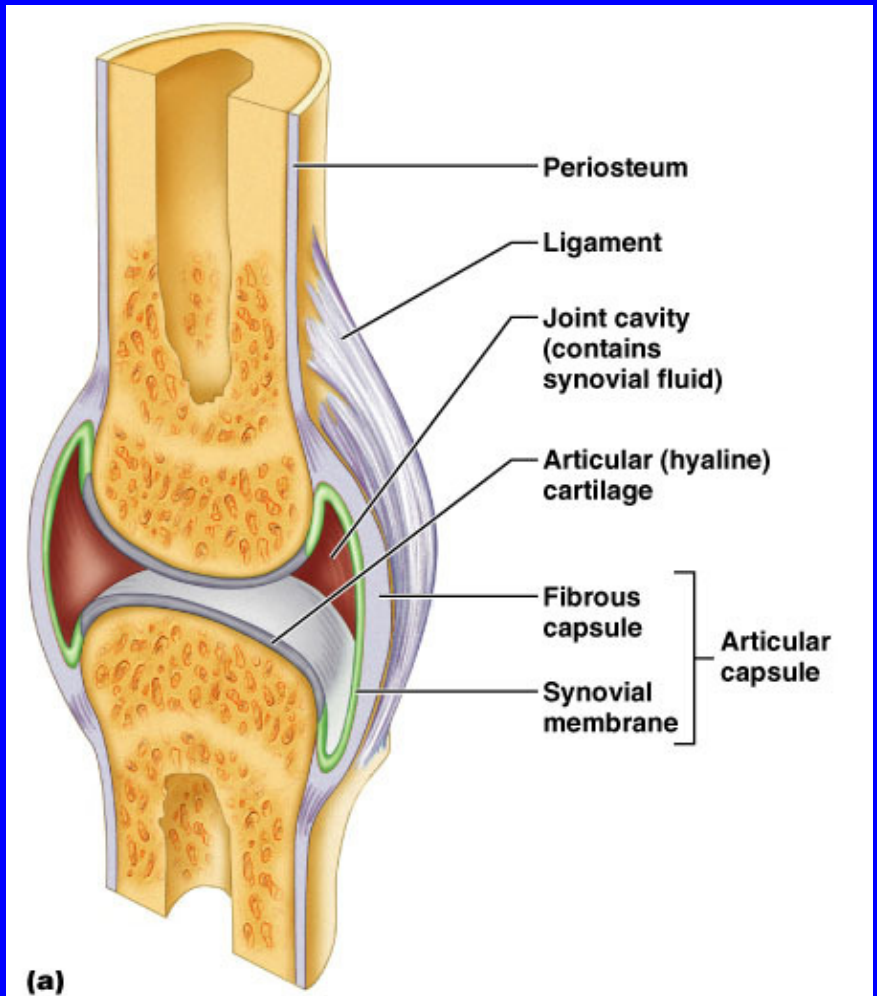
Structural Categories: Synovial

- The ends of the bones usually are covered by hyaline cartilage.
- The walls of the synovial cavity are covered by a synovial membrane that generates synovial fluid.



Structural Categories: Synovial

- The synovial membrane and an outer fibrous capsule together comprise an articular capsule.
- The whole structure is stabilized by ligaments, and often by the surrounding muscles.



Structural Categories: Synovial

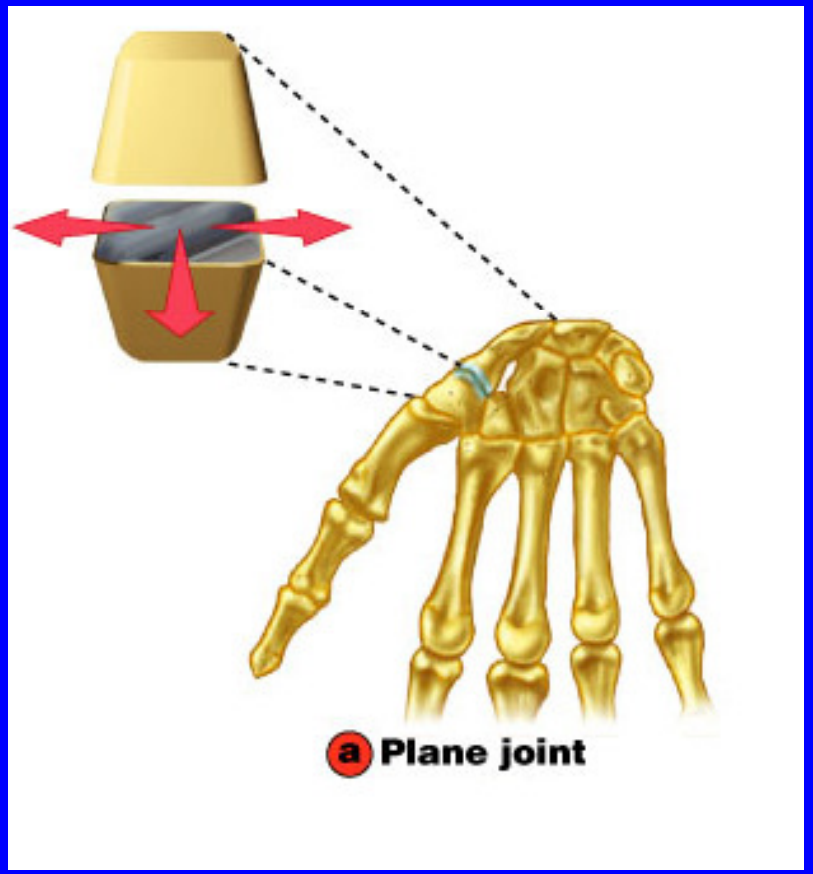
- Synovial joints are further subdivided into six categories by the type of movement that is possible at the joint.
- Plane, or gliding, joints allow sliding movement in one or two planes.
- Hinge joints allow movement in one plane
- Pivot joints allow movement around an axis.

Structural Categories: Synovial

- Condyloid (ellipsoidal) joints allow movement in two directions, and are structurally similar to ball and socket joints.
- Saddle joints allow movement in two directions, with interlocking convex and concave surfaces.
- Ball and socket joints allow movement in more than two directions.

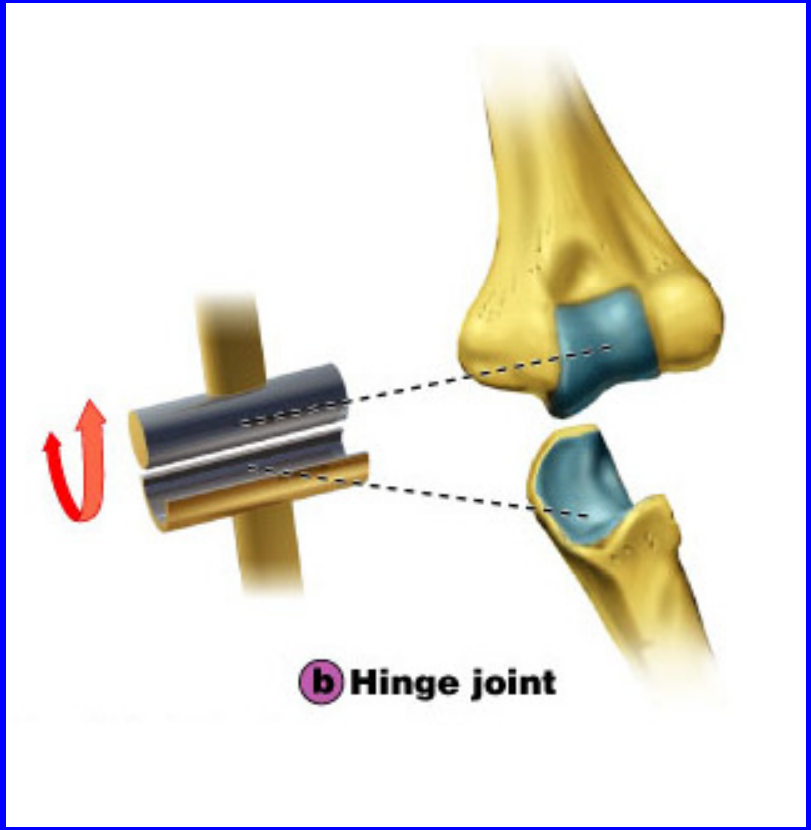
Synovial: Plane

- Plane joints are nonaxial, meaning that no bending, only gliding, occurs at the joint.
- The joints between the carpal bones are plane joints.



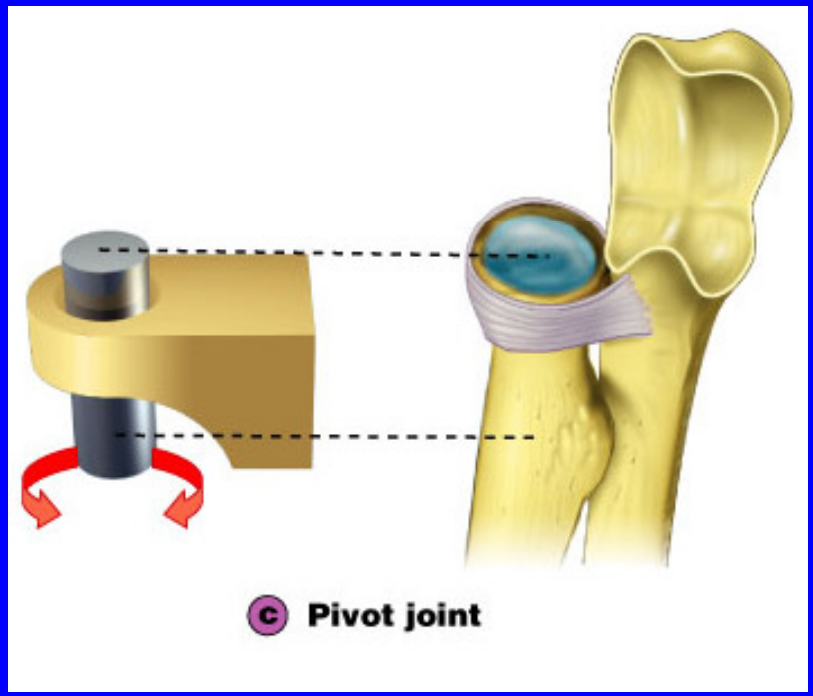
Synovial: Hinge

- Hinge joints are uniaxial, meaning that bending occurs around only one axis.
- The elbow and knee joints are hinge joints, as are the joints between adjacent phalanges.



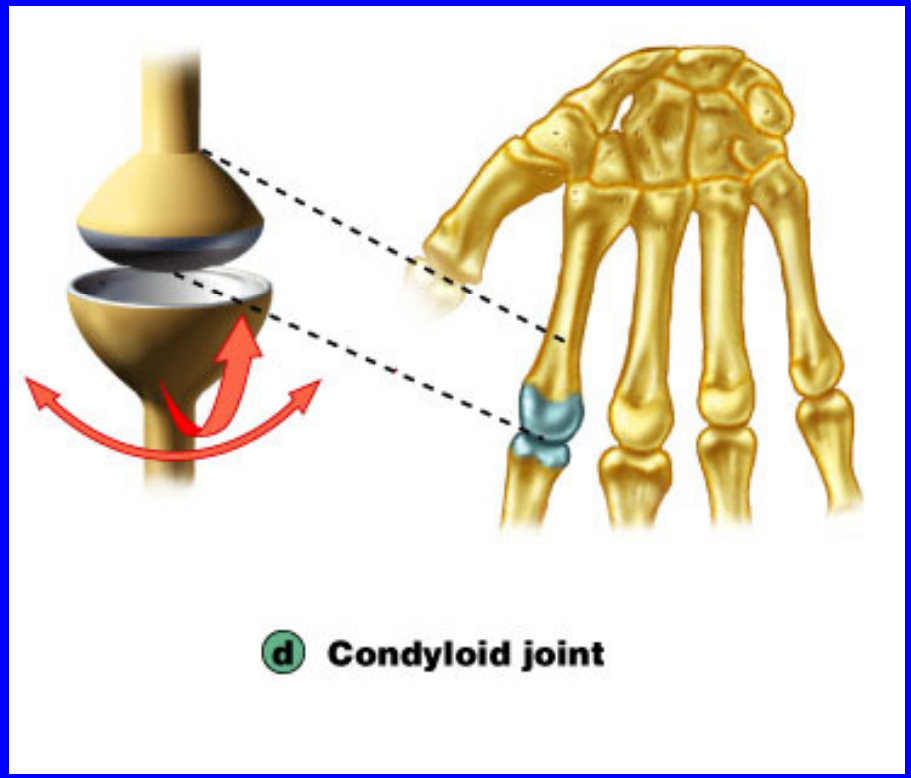
Synovial: Pivot

- Pivot joints are uniaxial, since rotation occurs around only one axis.
- The joints between the radius and the ulna, and between the atlas and axis are both pivot joints.



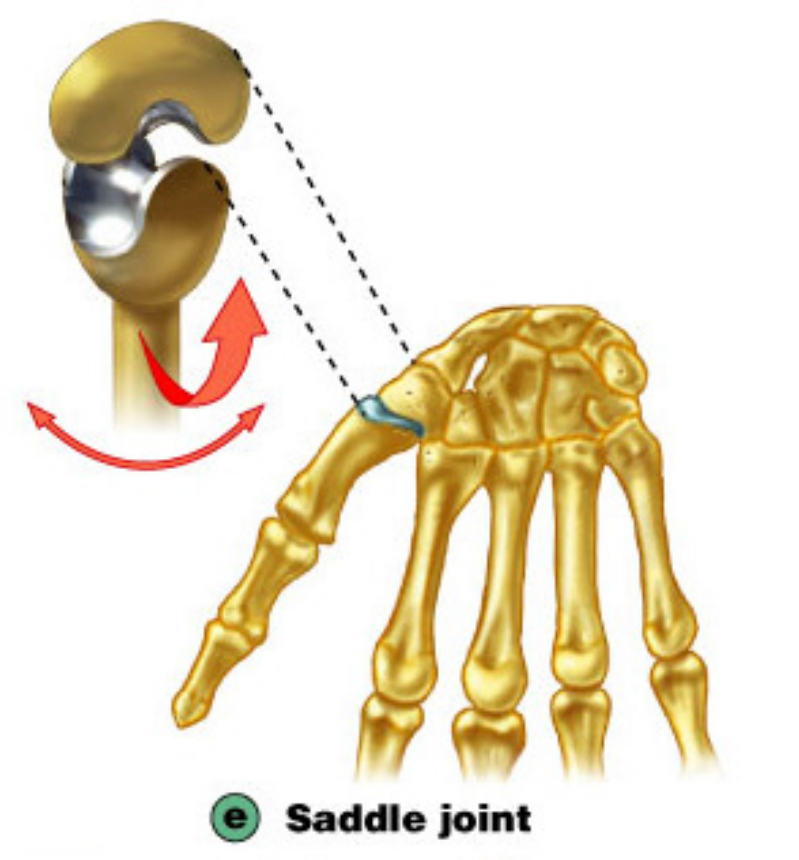
Synovial: Condyloid

- Condyloid joints are biaxial, since bending occurs around two axes.
- The joints between the metacarpals and phalanges are condyloid joints.



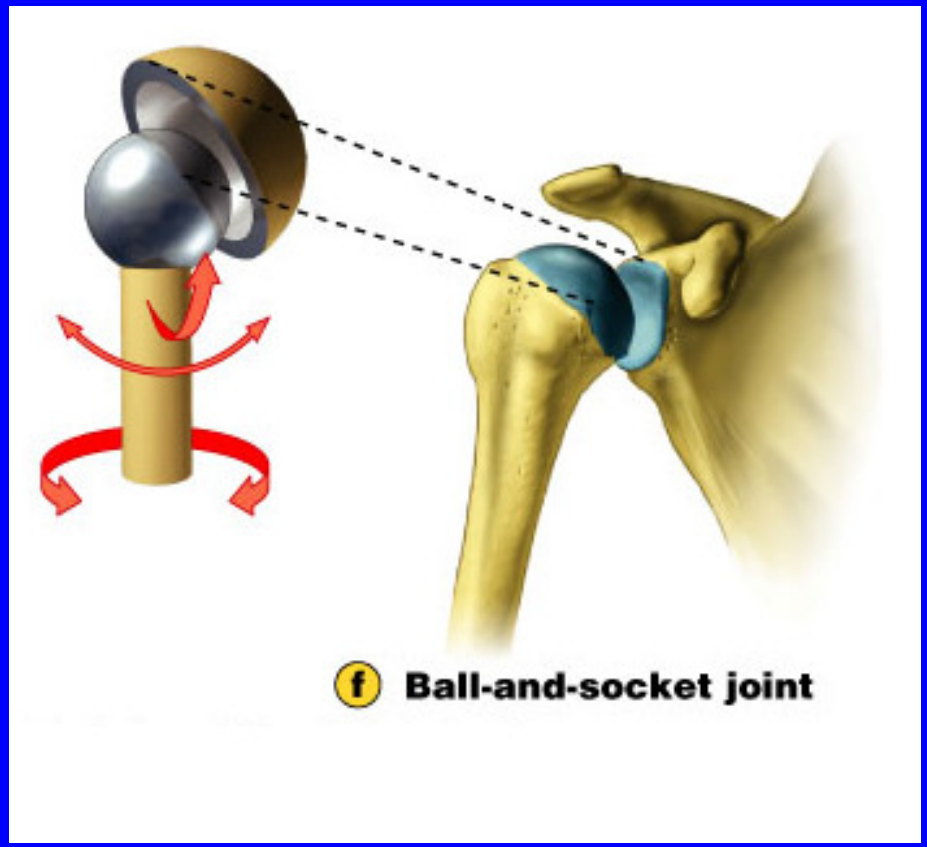
Synovial: Saddle

- Saddle joints are biaxial, since bending occurs around two axes.
- The joint between the first metacarpal and trapezium is a saddle joint.



Synovial: Ball and Socket

- Ball and socket joints are multiaxial, since bending occurs around more than two axes.
- The shoulder and hip joints are both ball and socket joints, although the shoulder allows more freedom of movement than the hip.



Functional Categories

- Synarthroses are joints that allow little or no movement.
- Sutures, syndesmoses, gomphoses, and synchondroses are synarthrotic
- Amphiarthroses are joints that allow some movement.
- Symphyses are amphiarthrotic.

Functional Categories

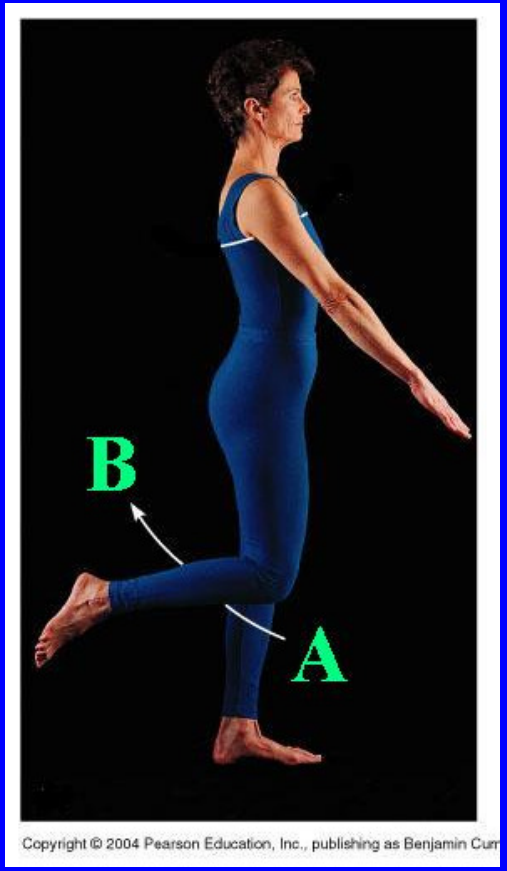
- Diarthroses are freely moveable joints.
- All synovial joints are diarthrotic.
- You should know the definitions of all of the structural and functional categories
- You should also know at least one example of each structural and functional category.

Body Movements

- All of the body movements described are a result of movement around a diarthrotic joint.
- Often, people will refer to movement in terms of movement of a particular structure, e.g. “flexion of the forearm”. However, it is more correct to refer to movement at a joint, e.g. “flexion at the elbow”.

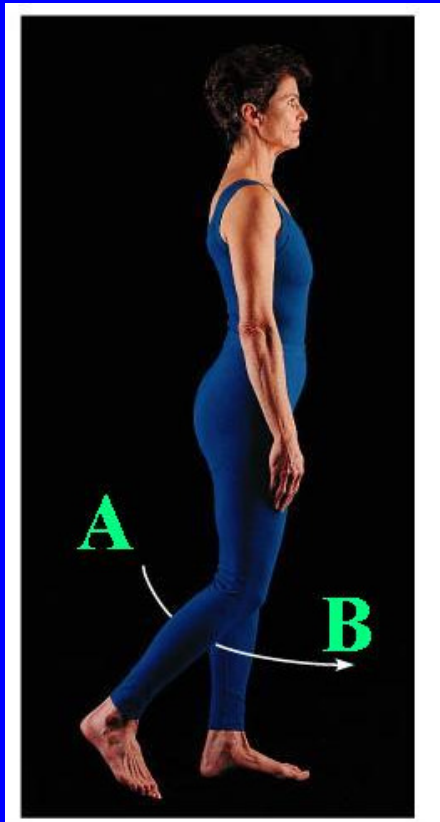
Flexion

- Flexion is a movement around a single axis that decreases the angle at a joint.
- Flexion commonly occurs at hinge joints.
- Flexion is the opposite of extension.
- The figure illustrates flexion at the knee.



Extension

- Extension is a movement around a single axis that increases the angle at a joint.
- Extension commonly occurs at hinge joints.
- Extension is the opposite of flexion.
- The figure illustrates extension at the knee.

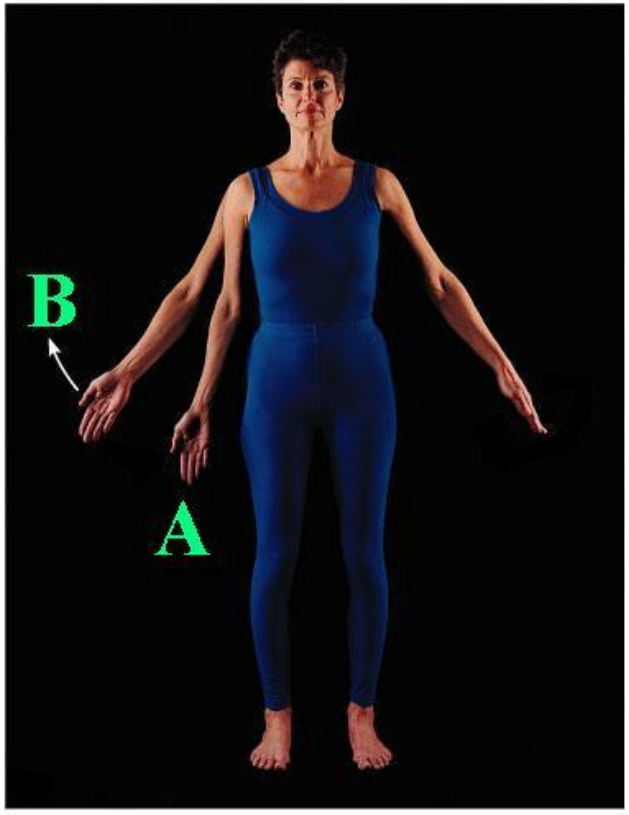


Hyperextension

- Extension greater than 180° is called hyperextension.
- Hyperextension occurs at hinge joints, but most hinge joints prevent hyperextension.
- The figure illustrates hyperextension of the neck.

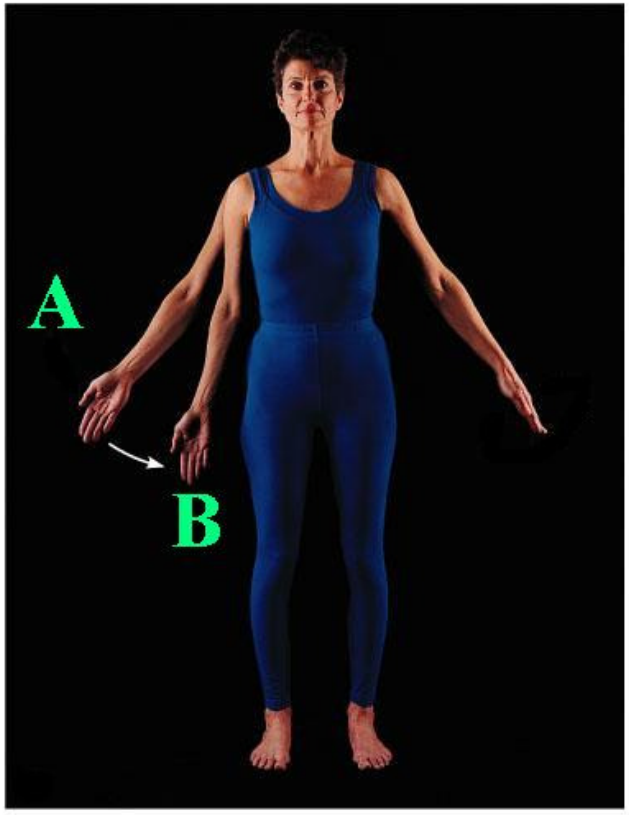
Abduction

- Abduction is movement of a limb away from the midline of the body.
- Abduction also refers to fanning of the fingers and toes (away from the midline of the hand or foot).
- The figure illustrates abduction at the shoulder.



Adduction

- Adduction is movement of a limb towards the midline of the body.
- Adduction is the opposite of abduction.
- The figure illustrates adduction at the shoulder.



Rotation

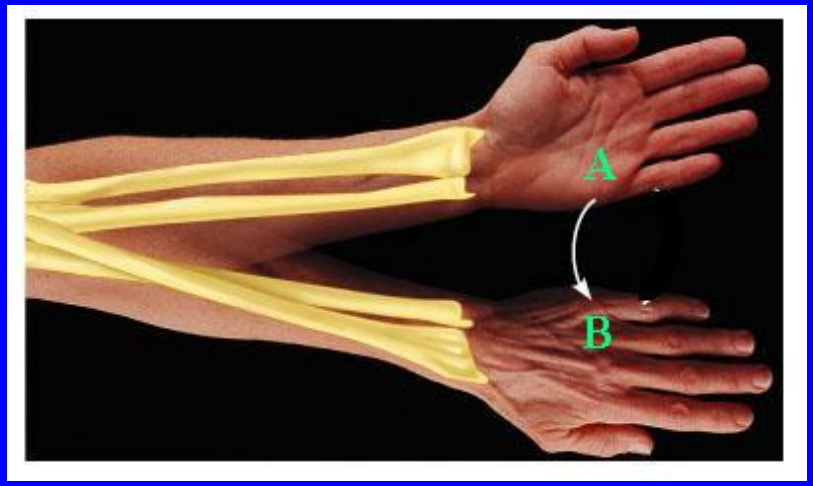
- Rotation describes movement of a structure around its longitudinal axis.
- Rotation does not involve lateral or medial displacement.
- The figure illustrates rotation at the atlanto-axial joint.

Circumduction

- Circumduction describes a combination of flexion, extension, abduction, and adduction.
- The proximal end of the structure remains stationary while the distal end describes a circle.
- The figure illustrates circumduction at the shoulder.

Pronation

- Pronation describes movement of the hand from the anterior or upward position to the posterior or downward position.
- During pronation, the radius crosses over the ulna.
- The joint involved is the proximal radio-ulnar joint.



Supination

- Supination describes movement of the hand from the posterior or downward position to the anterior or upward position.
- During supination, the radius and ulna are parallel.
- The joint involved is the proximal radio-ulnar joint.

Inversion

- Inversion describes the movement of the foot so that the sole faces medially.
- Inversion involves gliding motion between the tarsal bones.

Eversion

- Eversion describes the movement of the foot so that the sole faces laterally.
- Eversion involves gliding motion between the tarsal bones.

Dorsiflexion

- Dorsiflexion describes flexion at the ankle so that the top of the foot is displaced dorsally (upwards).

Plantar Flexion

- Plantar flexion describes flexion at the ankle so that the top of the foot is displaced ventrally (downwards).

The Knee Joint

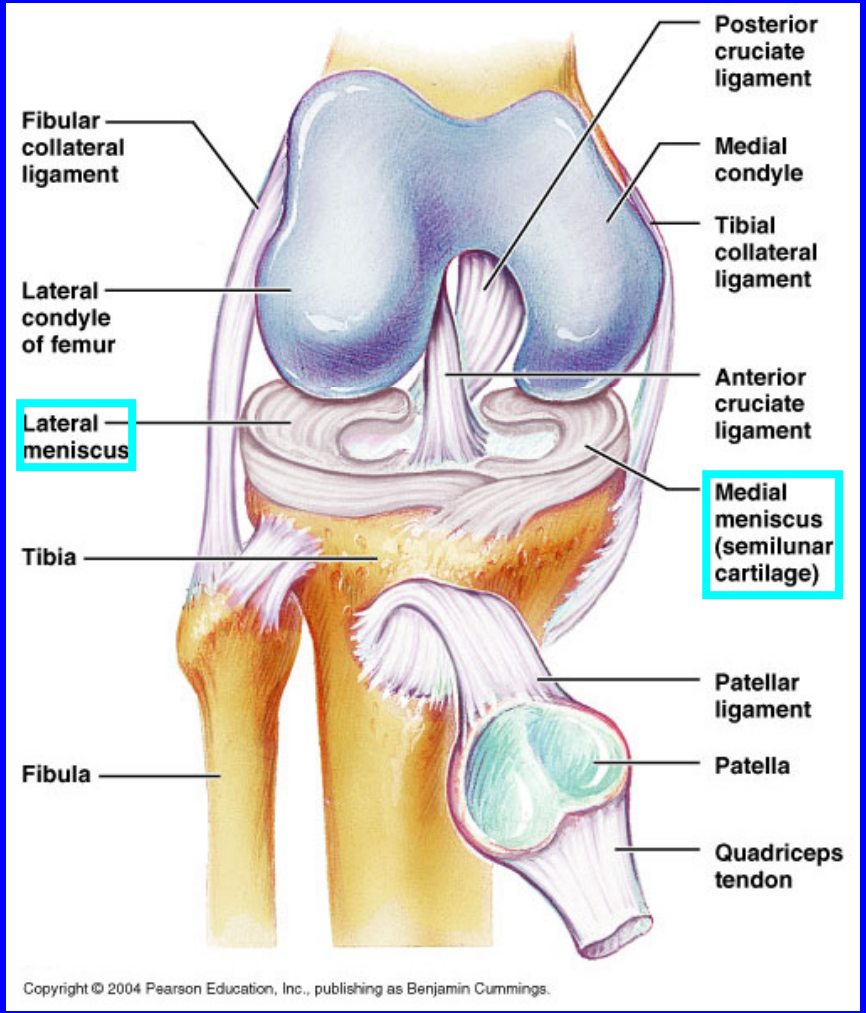
- The knee joint is a synovial hinge joint.
- It displays all of the general features of a synovial joint.
- It also has certain specialized features that are of particular interest.
- We will examine the knee joint in detail.

The Knee Joint

- The knee joint actually consists of three separate joints: the two tibiofemoral joints and the femoropatellar joint.
- The tibiofermoral joints involve the femoral condyles and the tibial condylar surfaces.
- Between these surfaces lie pads of fibrous cartilage called the medial and lateral menisci.

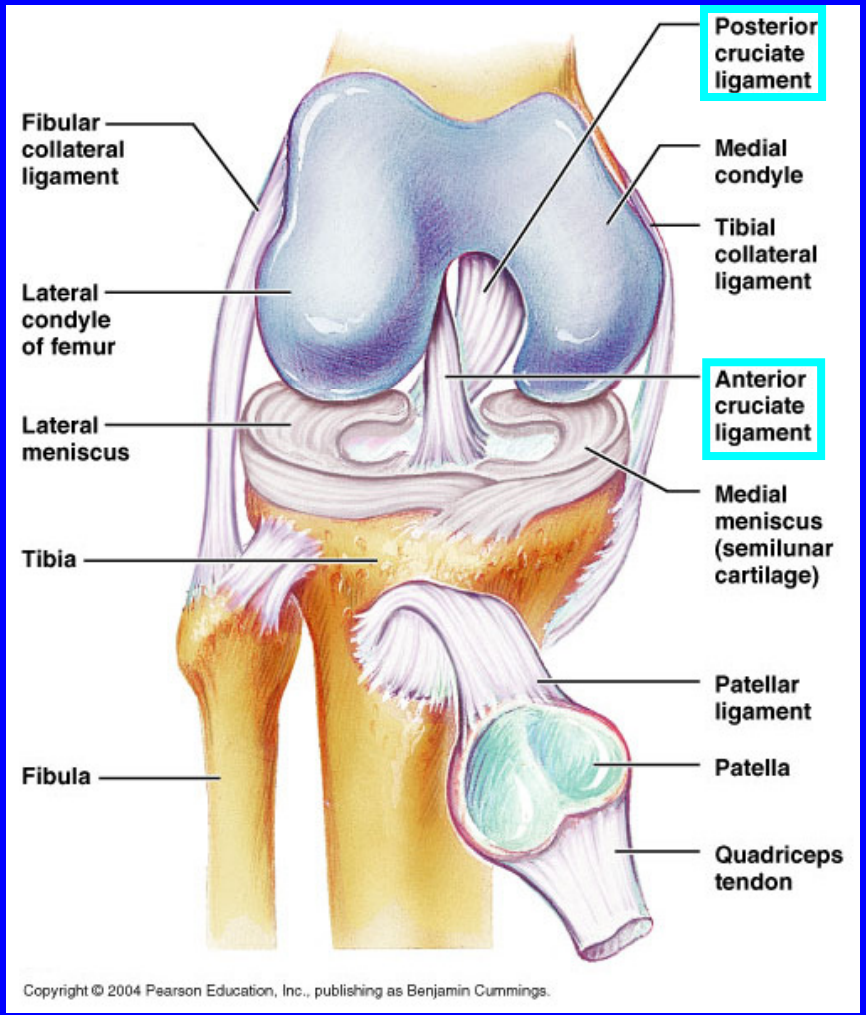
The Knee Joint

- The medial and lateral menisci cushion the joint and prevent lateral or medial motion at the joint.
- The menisci also help prevent rotation at the joint.



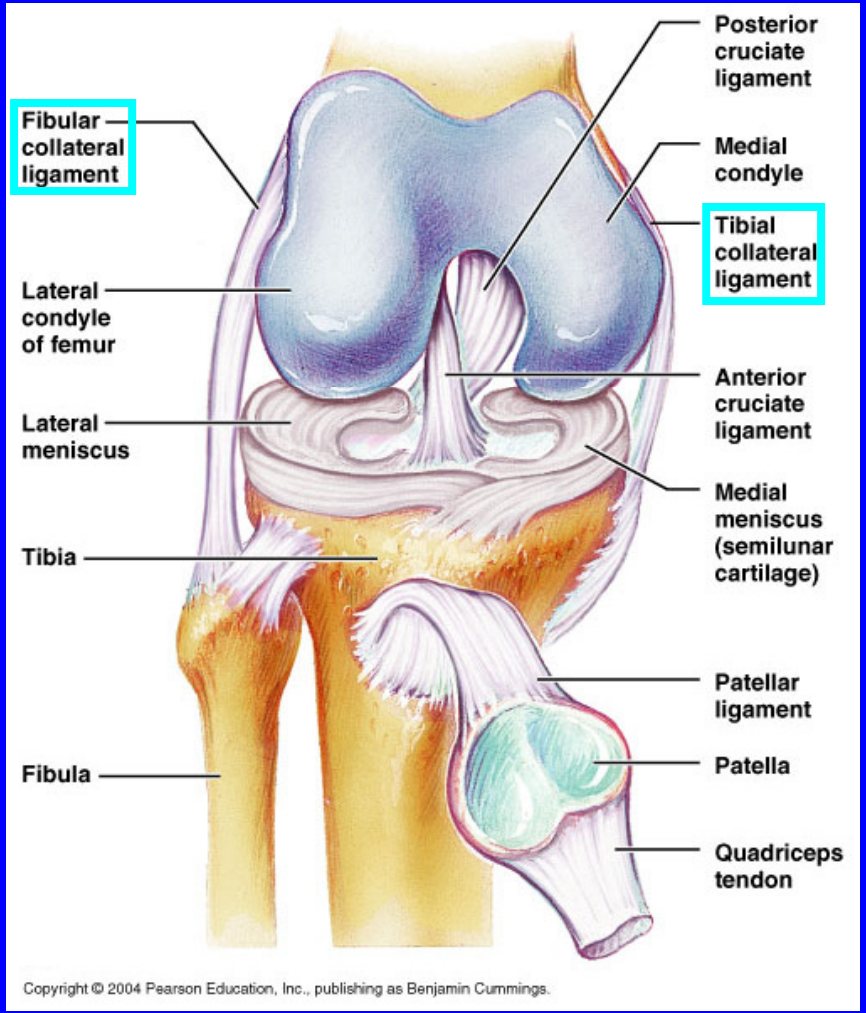
The Knee Joint

- Anterior and posterior slippage of the joint is prevented by the anterior and posterior cruciate ligaments.
- These ligaments also help prevent hyperextension or overflexion of the joint.



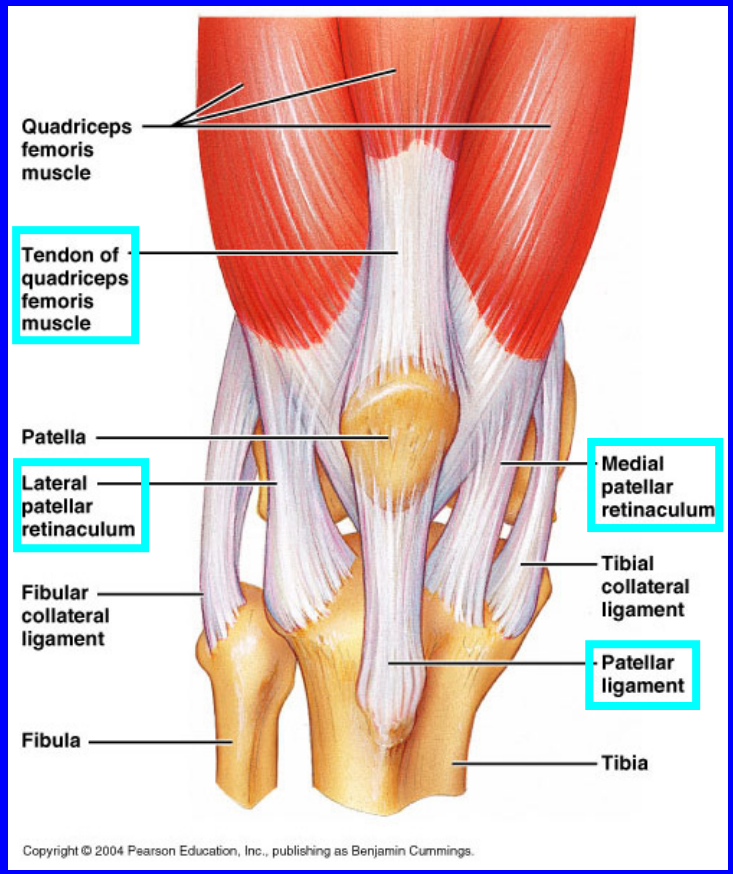
The Knee Joint

- Lateral and medial slippage of the joint are also prevented by the fibular and tibial collateral ligaments.
- These ligaments also prevent rotation at the knee.



The Knee Joint

- The knee lacks an articular capsule anteriorly.
- The knee joint is enclosed anteriorly by the femoropatellar joint.
- This includes the quadriceps tendon, the patellar ligament, and the medial and lateral patellar retinacula.

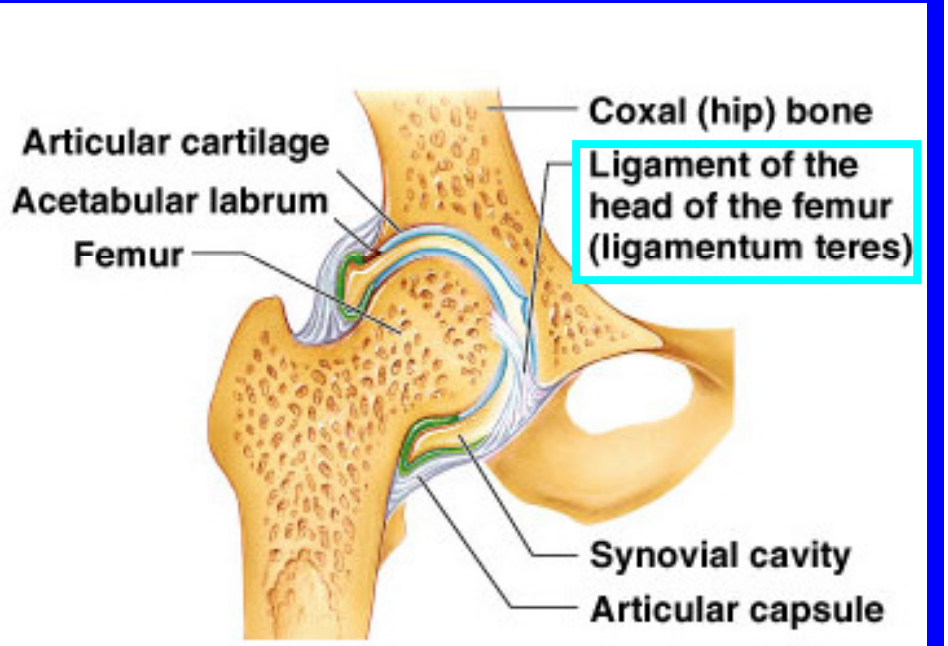


The Hip Joint

- The hip joint is a synovial ball and socket joint.
- The ball is the head of the femur.
- The socket is formed by the acetabulum, the articular capsule, and the acetabular labrum.
- The acetabular labrum is a band of fibrous cartilage that runs around the superior rim of the acetabulum.

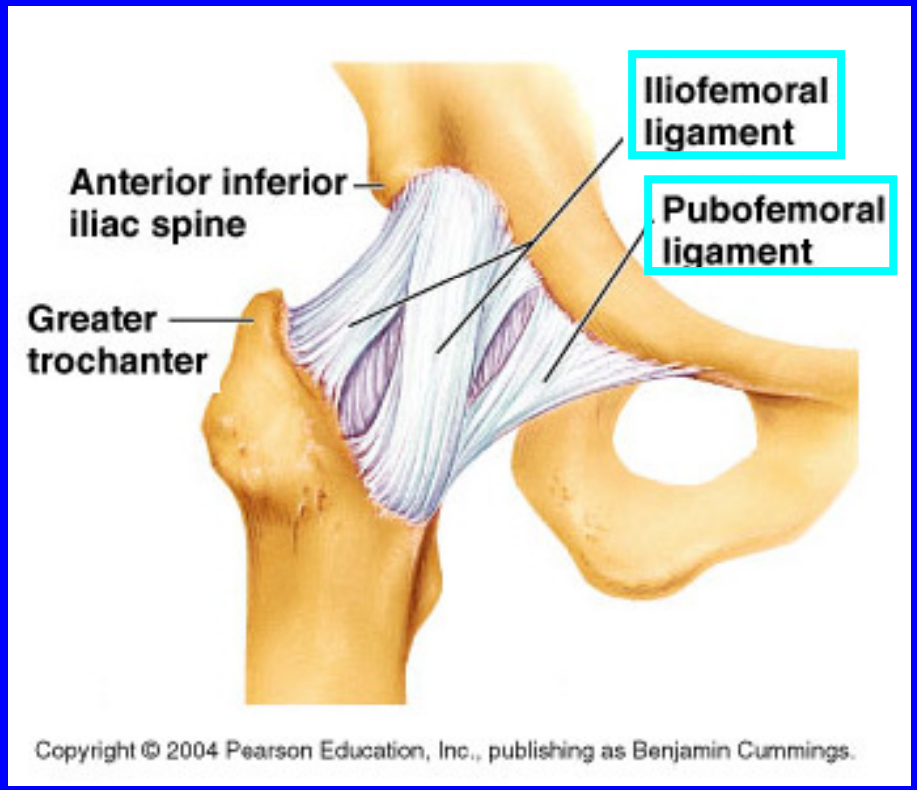
The Hip Joint

- The hip joint is stabilized by four ligaments: the ligamentum teres, the iliofemoral, the ischiofemoral, and the pubofemoral.
- The ligamentum teres is a short ligament connecting the fovea capitis of the femur to the acetabulum.



The Hip Joint

- The iliofemoral, ischiofemoral, and pubofemoral ligaments wrap obliquely around the joint.
- This figure is an anterior view of the hip joint.



The Hip Joint

- This corkscrew arrangement prevents significant rotation at the hip joint.
- This figure is a posterior view of the hip joint.