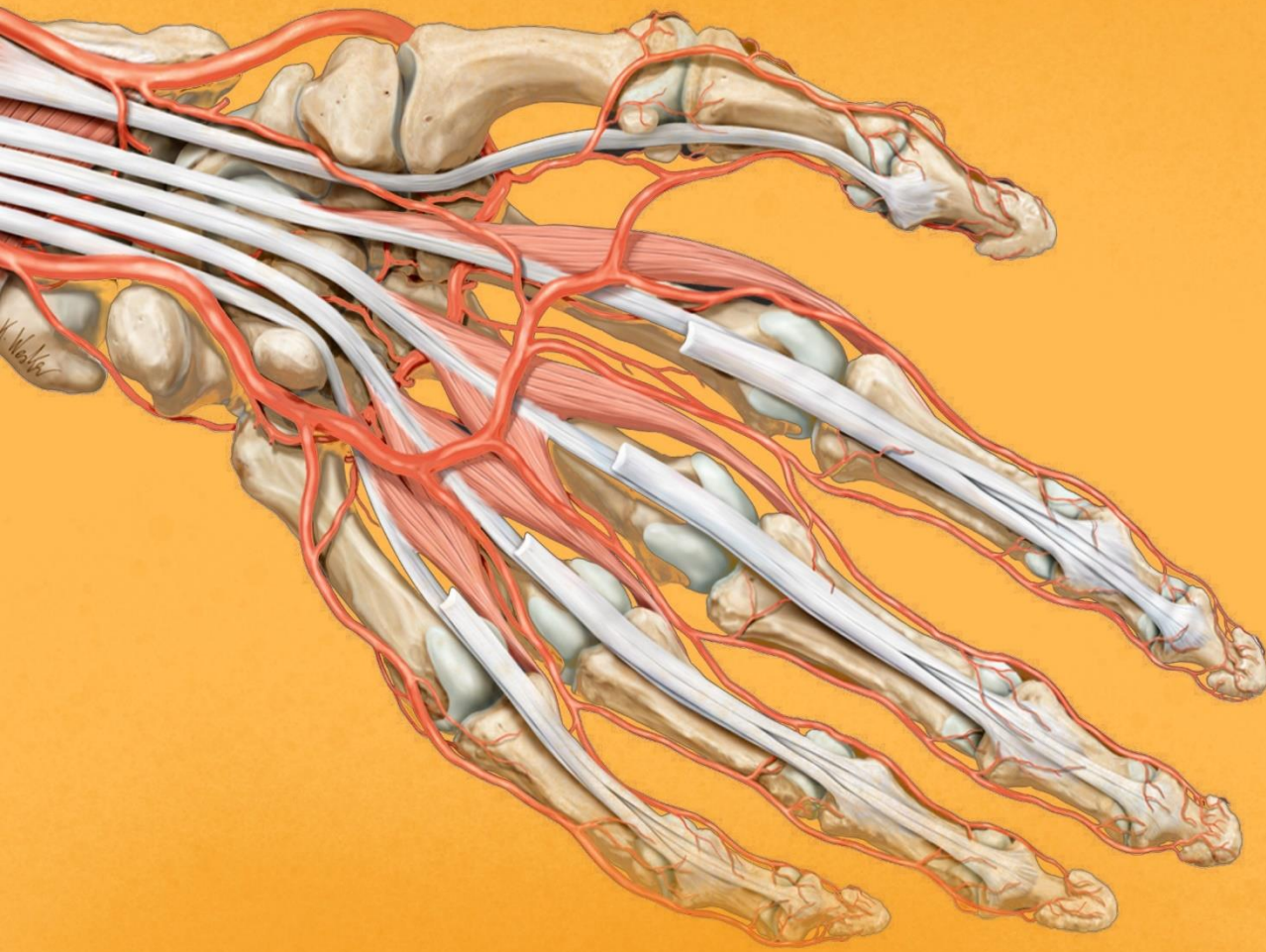


HATAHET ANATOMY



Joints & Articulations

Lecture: 6

Pages: 11

Lecture 8: Articulation (Joints)

- **Joints**: flexible CT that holds the point between: (2 bones / cartilage and bone / teeth and bone) where they contact
- **Arthrology**: the study of joints
- **Kinesiology**: the study of the motion of the joints

Classification of joints

❖ Based on the **Structure & Material** of the joints:

- Joints formed by **solid mass of CT**, categorized into:
 - ① **Cartilaginous joint**, made of cartilages: (hyaline / fibro / elastic)
 - ② **Fibrous joint**, made of fibrous tissue (dense irregular CT)
- Joints that incorporate a **Lubricated cavity**, including 1 type:
 - ③ **Synovial joint**, the most mobile type of joints, made of a hyaline cartilage and an articular capsule

Ligaments are classified as:

- ① **Intrinsic** → within the articulation point
- ② **Extrinsic** → outside the articulation point

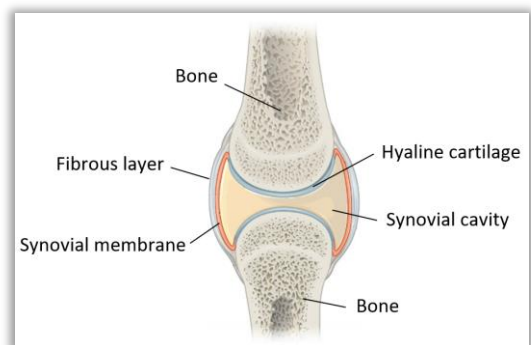
❖ Based on the **Function** of the joints:

- ① **Diarthrosis** → freely movable joints, example: (Shoulder joint)
- ② **Amphiarthrosis** → slightly movable joints, example: (Sternochondral joint)
- ③ **Synarthrosis** → immovable joints, example: (Sutures)

Synovial joints

- these joints are the most abundant type and the **most mobile in the body**
- they have a common order: (**Bone** - **Hyaline cartilage** - **Cavity** - **Hyaline cartilage** - **Bone**)
- a synovial joint is made of:
 - ① **Hyaline cartilage**, an articular cartilage that covers the articular surface of bone and provides smoothness, absorbing shocks, and preventing friction
 - ② **Articular capsule**, consists of 2 layers:
 - **Fibrous layer (Outer layer)**, dense irregular CT that covers the synovial cavity, also it has reinforcing ligaments to anchor the capsule and give the joint more stability; preventing dislocation
 - **Synovial membrane**, membrane that secretes synovial fluid into the synovial cavity, this membrane lines the walls of the synovial cavity and stops when it reaches the margins of the cavity which are the hyaline cartilages.

The synovial membrane may include accumulations of adipose tissue that varies in thickness, the thicker regions are called (**Fat pads**)

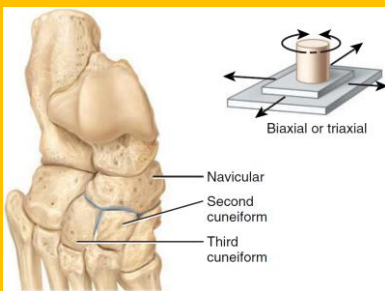


Types of Joints

Differences Joints	Description	Axial movement	Types of movements	Examples
Plane joint (Planar joint)	the surface of the bones that make that joint are flat	Bi-axial Tri-axial	Gliding movement: - anterior & posterior - medial & lateral - rotation	<ul style="list-style-type: none"> • Intercarpal joints • Intertarsal joints • Sternoclavicular joint • Acromioclavicular joint • Sternocostal joints • Vertebrocostal joints
Hinge joint (Ginglymus joint)	a convex surface of one bone fits into the concave surface of another bone	Uni-axial*	- flexion & extension - hyperextension	<ul style="list-style-type: none"> • Knee joint "modified" • Elbow joint • Ankle joint • Interphalangeal joint
Pivot joint (Trochoid joint)	a rounded pointed surface of a bone articulates with a ring formed by another bone or a ligament	Uni-axial*	- rotation only around the bone's longitudinal axis	<ul style="list-style-type: none"> • Atlantoaxial joint • Radioulnar joint
Condylar joint (Ellipsoidal joint)	oval-shaped projection of one bone fits into an oval-shaped depression of another bone	Bi-axial	- flexion & extension - adduction & abduction - limited circumduction	<ul style="list-style-type: none"> • Radiocarpal "wrist" joint • Metacarpophalangeal "Knuckles" joints
Saddle joint (Sellar joint)	articular surface of one bone is saddle-shaped and the articular surface of another bone fits the saddle	Bi-axial	- flexion & extension - adduction & abduction	<ul style="list-style-type: none"> • the one and only in the entire human body is the Carpometacarpal joint of the thumb between the base of the 1st metacarpal and the Trapezium
Ball & Socket joint (Sphenoid joint)	a ball-like articular surface of a bone sits into a cup-like depression of another bone	Multi-axial	- flexion & extension - adduction & abduction - circumduction - rotation	<ul style="list-style-type: none"> • Hip joint • Shoulder joint

Illustrations

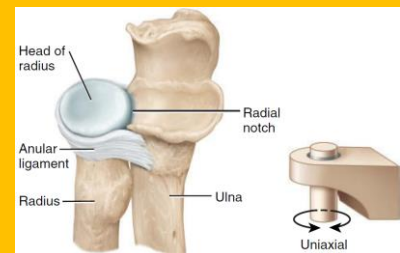
Plane Joint



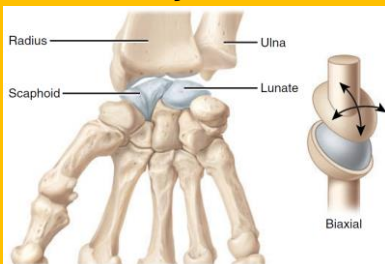
Hinge Joint



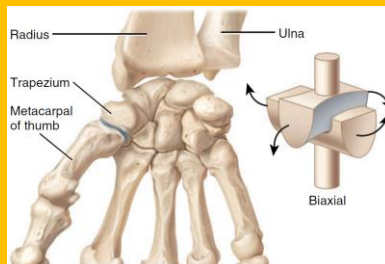
Pivot Joint



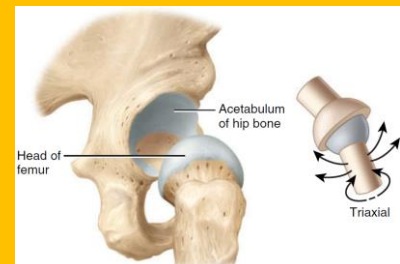
Condylar Joint



Saddle Joint



Ball-and-Socket Joint



*Uni-axial joints are also called (Axial joints)

Fibrous joints

- these joints join the adjacent bones together by dense irregular CT
- the CT tissue can be **small fibers**, **thick bands**, or **extensive sheets**
- they have a common order: (**Bone - Fibrous joint - Bone**) **B F B**
- there are 3 types of fibrous joints in the body:

[1] **Sutures**, consist of thin layer of CT that strongly connect the bones of the skull and **allow no movement**

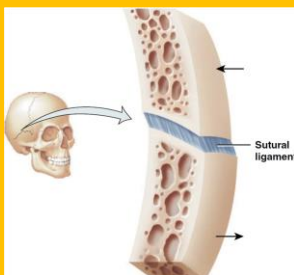
[2] **Syndesmoses**, found where there is a greater distance between 2 articular surfaces than sutures. Examples:

- ♦ **Distal tibiofibular joint**, by the anterior tibiofibular ligament
- ♦ **Gomphosis (Periodontal ligament - PDL)**, a special cone-shaped joint that joins a tooth (alveolar process) into its socket, permits no or little movement, this joint becomes harder when permanent teeth replace milk -primary- teeth

[3] **Interosseus membrane**, sheets of dense irregular CT that bind neighboring long bones together, allows little movement, found in 2 places in the body:

- ♦ between **Radius and Ulna**
- ♦ between **Tibia and Fibula**

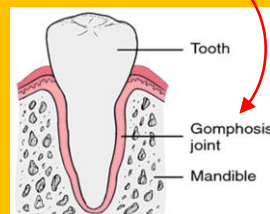
Sutures



Syndesmosis



Gomphosis



Interosseus memb.



Cartilaginous joints

- these joints join bones together by solid CT that allow **very little movement**
- there are 3 types of cartilaginous tissue in the body:

[1] **Synchondrosis**, consists of hyaline cartilage, slightly mobile joints, like:

- ♦ (1st Rib - **Costal cartilage** - Manubrium sterni)

[2] **Symphysis**, joints present in the midline of the body, like:

- ♦ **Intervertebral discs** ♦ **Pubic symphysis** ♦ **Sternomanubrial joint**

[3] **Epiphyseal cartilages**, which are the **growth plates** where the diaphysis and metaphysis of a long bone meet, like:

- ♦ **Epiphyseal plate of the humerus & femur**

❖ The cartilaginous joints have 2 types based on the **Components order of the joints**:

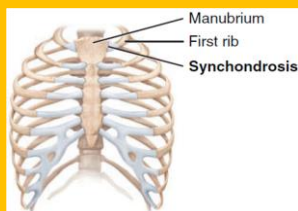
❶ **Primary cartilaginous joints**, bones are united by a **hyaline cartilage** in the order:

[Bone - Hyaline cartilage - Bone] **B H B** 🔄 Examples → (Synchondrosis & Epiphyseal cartilages)

❷ **Secondary cartilaginous joints**, bones are united by **fibrocartilage between 2 hyaline cartilages** in this order:

[Bone - Hyaline cartilage - Fibrous cartilage - Hyaline cartilage - Bone] **B H F H B** 🔄 Examples → (Symphyses)

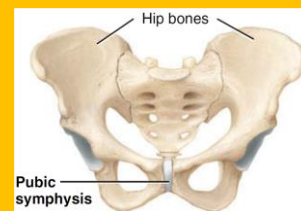
Synchondrosis



Epiphyseal cartilage



Symphysis



Types of movements of the joints

➤ Movements of joints can be classified into:

- **General movements**, occurs in multiple joints - **Special movements**, occurs at specific joints

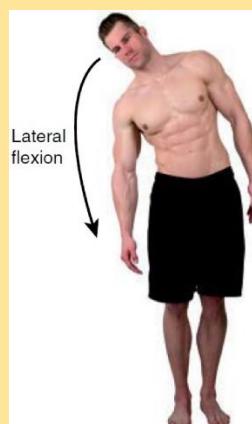
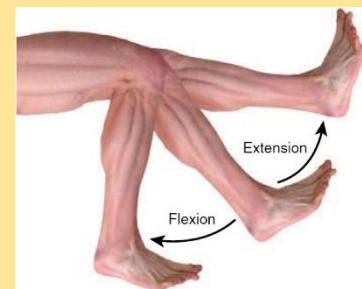
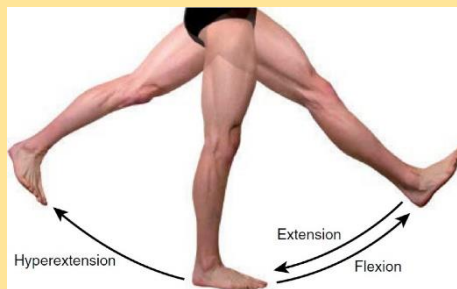
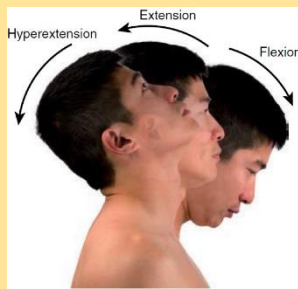
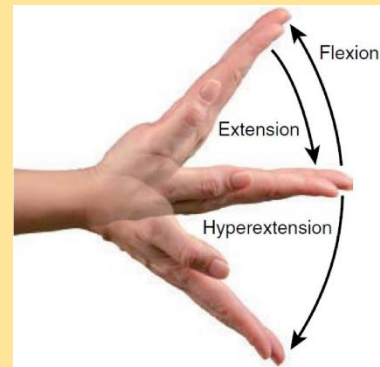
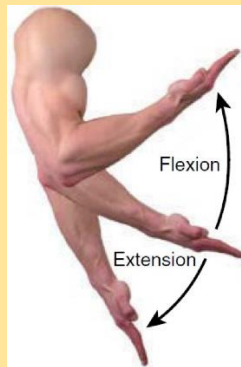
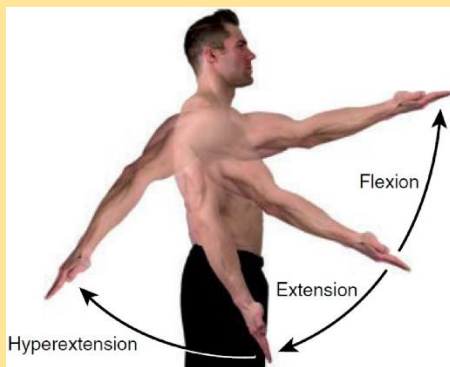
➤ All movements of the body joints are listed in the table below:

General movements		
Gliding movement	moving side-by-side or back-and-forth respectively with little to no change in the angle	
Angular movement	Adduction	moving the bone towards the midline; returning to the standard anatomical position
	Abduction	moving the bone away from the midline
	Flexion	decreasing the angle between 2 bones
	Extension	increasing the angle between 2 bones
	Lateral flexion	movement of the trunk in frontal plane
	Hyperextension	over extension; extension beyond anatomical position
	Circumduction	the movement in which the distal end of a bone moves in a circle while the proximal end remains stable
Rotation	Rotation	movement of a joint located along the midline around the midline, neither medial nor lateral
	Medial (Internal) rotation	moving the limb around its axis toward the midline (to the inside)
	Lateral (External) rotation	moving the limb around its axis away from the midline (to the outside)

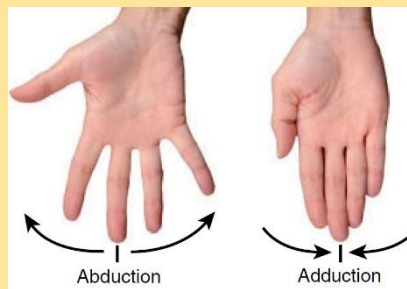
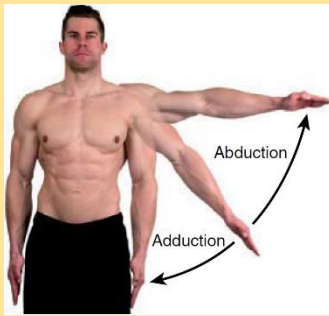
Special movement

Dorsiflexion	bending the ankle joint so foot moves in a dorsal direction, as you stand on your heels
Plantar flexion	bending the ankle joint so foot moves in a plantar direction, as you stand on your toes
Eversion	moving the sole of the foot laterally so they (the feet) face away from each other
Inversion	moving the sole of the foot medially so they (the feet) face each other
Supination	the palm of the hand is facing anteriorly [Radius & Ulna are parallel]
Pronation	the palm of the hand is facing posteriorly [Radius & Ulna are crossed]
Opposition	when the thumb touches the tip of the other fingers
Elevation	upward movement of the mandible to close the mouth, or the scapula
Depression	downward movement of the mandible to open the mouth, or the scapula
Protraction	moving the mandible or shoulder girdle anteriorly along the transverse plane
Retraction	moving the mandible or shoulder girdle posteriorly along the transverse plane

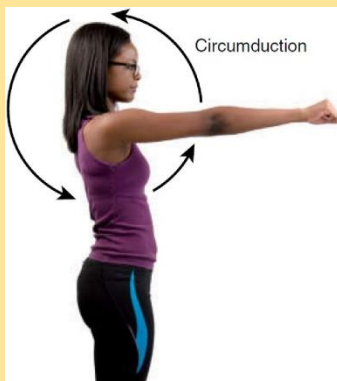
Flexion & Extension



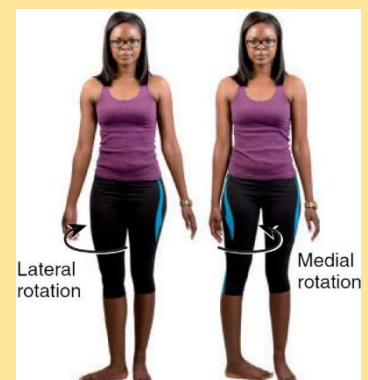
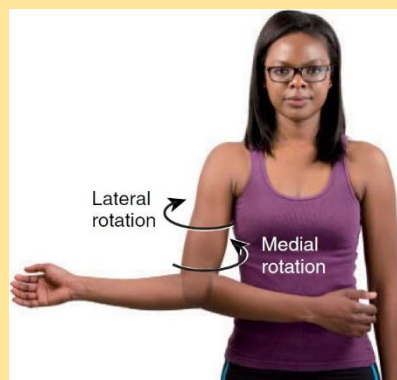
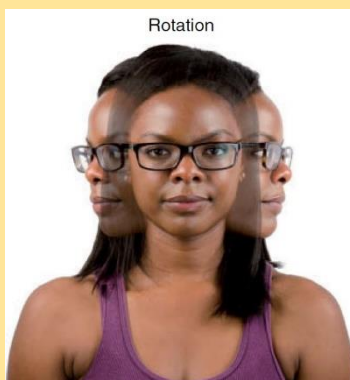
Adduction & Abduction



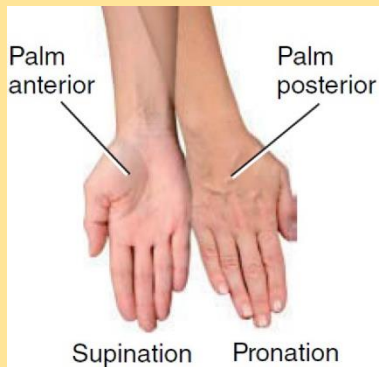
Circumduction



Rotation



Supination & Pronation



Eversion & Inversion



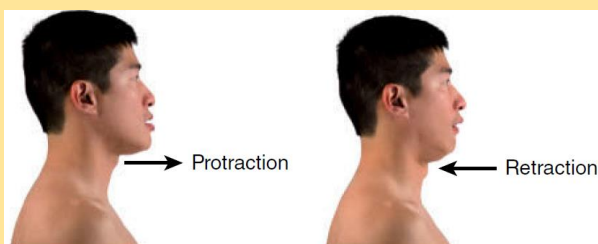
Dorsiflexion & Plantar flexion



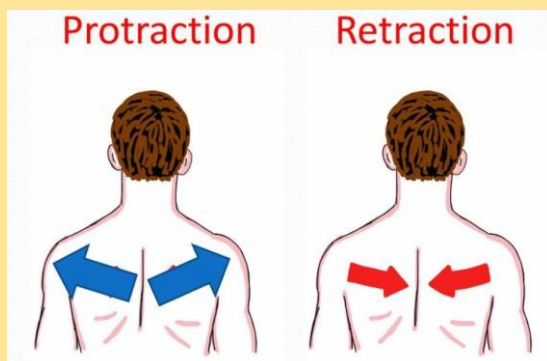
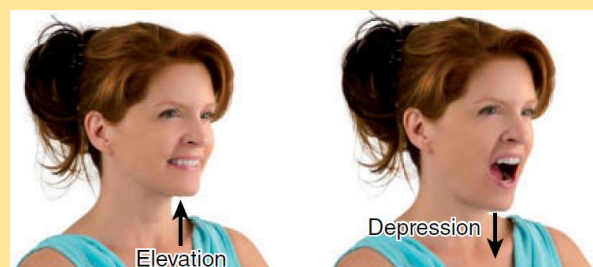
Opposition



Protraction & Retraction



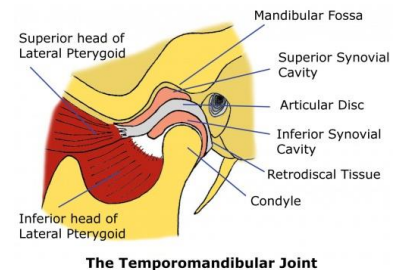
Elevation & Depression



Accessory structures of joints

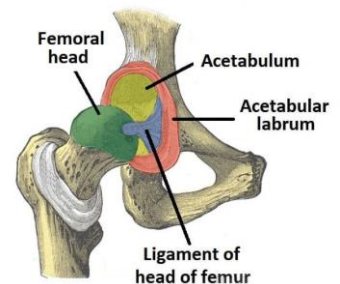
Articular discs

- **Articular discs:** fibrocartilage structures that divide the synovial cavity into 2 smaller cavities
 - they are not covered by the synovial membrane & attached peripherally to the fibrous membrane
 - this result for 2 separate movements to occur in each half
 - **example:** **Articular disc of TMJ, Medial & lateral Menisci**



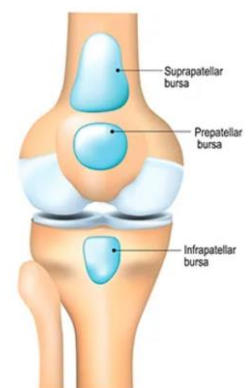
Labra

- **Labrum:** fibrocartilaginous lip that extends from the edges of a joint socket
 - they are exclusive to the ball-and-socket joints
 - their main function is to deepen the joint socket and increase the stability of the joint
 - **example:** **Acetabular labrum**



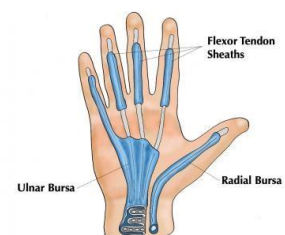
Bursae

- **Bursae:** sac-like structures located between bones and (skin, muscle, ligament, another bone)
 - their main function is to reduce friction around the joints during movement
 - they resemble the synovial capsule; as they:
 - consist of outer fibrous layer & inner synovial membrane
 - contain a small amount of fluid similar to the synovial fluid
 - **example:** **bursae of the knee joint**



Tendon/Synovial sheaths

- **Tendon sheath:** tube-like bursa that wraps around muscle tendons
 - they protect all sides of the tendon from friction within the tunnel
 - **example:** **tendon sheath of forearm muscles in the carpal tunnel**



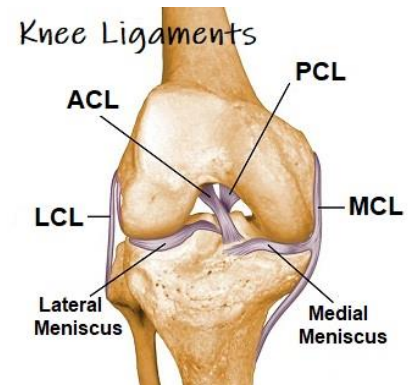
Accessory ligaments

❖ Intracapsular ligaments

- located within the articular capsule BUT excluded from the synovial cavity by folds of synovial membrane
- example: **Anterior & Posterior cruciate ligaments of knee joint**

❖ Extracapsular ligaments

- lie outside the synovial capsule
- example: **Medial & Lateral collateral ligaments of knee joint**



Blood & Nerve supply

- **Blood supply** → Branches of several different arteries join together around the joint before penetrating the capsule
- **Nerves** → branches of the same nerves that supply the skeletal muscles

Factors affecting synovial joint mobility

- 1) Structure & Shape of articulating bones
- 2) Strength and toughness of the joint's ligaments
- 3) Arrangement of muscle groups
- 4) Contact of soft parts, like belly fat or big biceps brachii, which can impair some movements
- 5) Hormones, like placental relaxins in mothers during delivery (giving birth)
- 6) Disuse, the less we use a joint, the more viscous the synovial fluid will become, making it harder to use this joint
"Use it or lose it"

INFORMATION from previous lectures:

There are other anatomical positions the patient may take, these are:

- **Supination** → the patient is lying face-up
- **Pronation** → the patient is lying face-down



Questions

1) Radiocarpal joint is an example of which type of joints?

- A. Cartilaginous joint
- B. Pivot joint
- C. Hinge joint
- D. Condylar joint

2) The definition “fibrocartilaginous extension from the edges of a joint socket; deepening it” is for:

- A. Labrum
- B. Bursa
- C. Articular disc
- D. Tendon sheath

3) moving the sole of the foot laterally so they (the feet) face away from each other

- A. Dorsiflexion
- B. Inversion
- C. Plantarflexion
- D. Eversion

4) One of the following joints is classified as a Synarthrosis joint:

- A. Elbow joint
- B. Lambdoidal suture
- C. Pubic symphysis
- D. Thumb joint

5) One of the following pairs is mis-matched regarding the corresponding information:

- A. Joints innervation - branches of the same nerves that supply the skeletal muscles
- B. the Carpometacarpal joint of the thumb - the only saddle joint (sellar joint) in the human skeleton
- C. Collateral ligaments of knee joint - intracapsular ligaments
- D. All the pairs are correctly matched with the corresponding information

6) Which of the following statements about the Circumduction is TRUE?

- A. the movement in which the distal end of a bone moves in a circle while the proximal end remains stable
- B. the summation of Adduction, Flexion, Abduction, Extension
- C. it is an angular movement of the joints
- D. All the statements are true

7) One of the following statements is TRUE about the cartilaginous joints:

- A. the primary cartilaginous joints are composed of (Bone - Hyaline cartilage - Bone) in that order
- B. they are made of dense irregular CT tissue that can vary from small fibers, thick bands, or extensive sheets
- C. Sternomanubrial joint is an example on a synchondrosis cartilaginous joint
- D. All of the statements are true

8) The correct definition of a Condylar joint is:

- A. a rounded pointed surface of a bone articulates with a ring formed by another bone or a ligament
- B. a convex surface of one bone fits into the concave surface of another bone
- C. oval-shaped projection of one bone fits into an oval-shaped depression of another bone
- D. the surface of the bones that make that joint are flat

9) The least mobile (most stable) synovial joint of the following is the

- A. Pivot joint
- B. Condylar joint
- C. Saddle joint
- D. Ball & Socket joint

10) Bursae are primarily located between bones and a bone, muscle, or skin, serving to reduce friction around the joints during movement, and they resemble the synovial capsule in their structure and fluid content. This statement is:

- A. False
- B. True

Answers

1	2	3	4	5	6	7	8	9	10
D	A	D	B	C	D	A	C	A	B