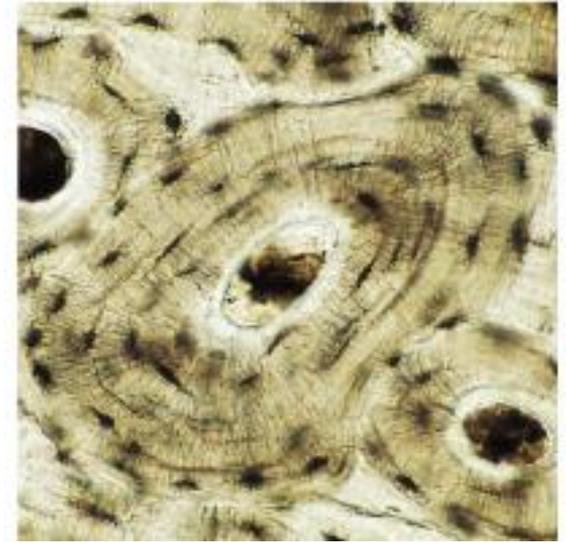
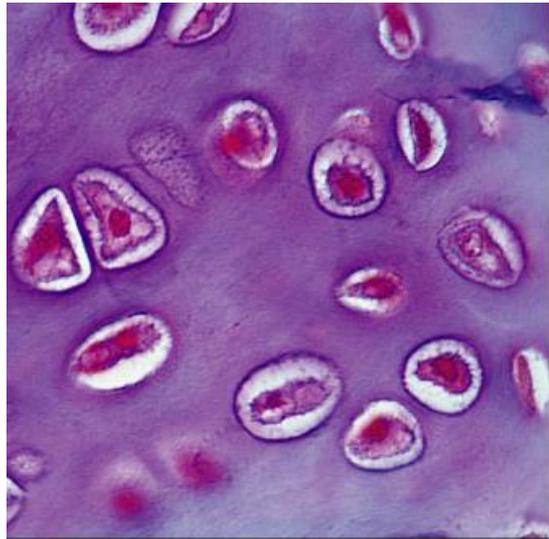


SKELETAL SYSTEM



CARTILAGE

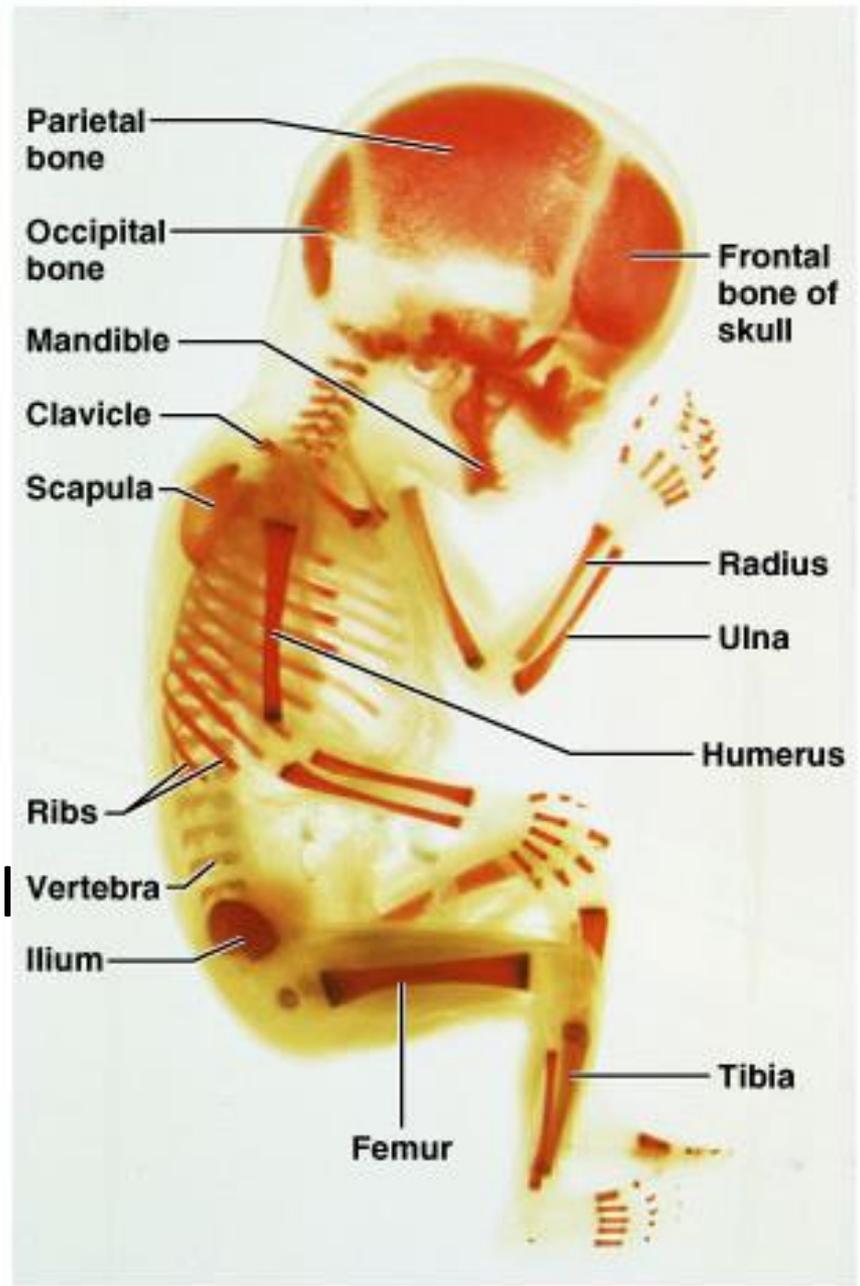
BONE

Cartilage

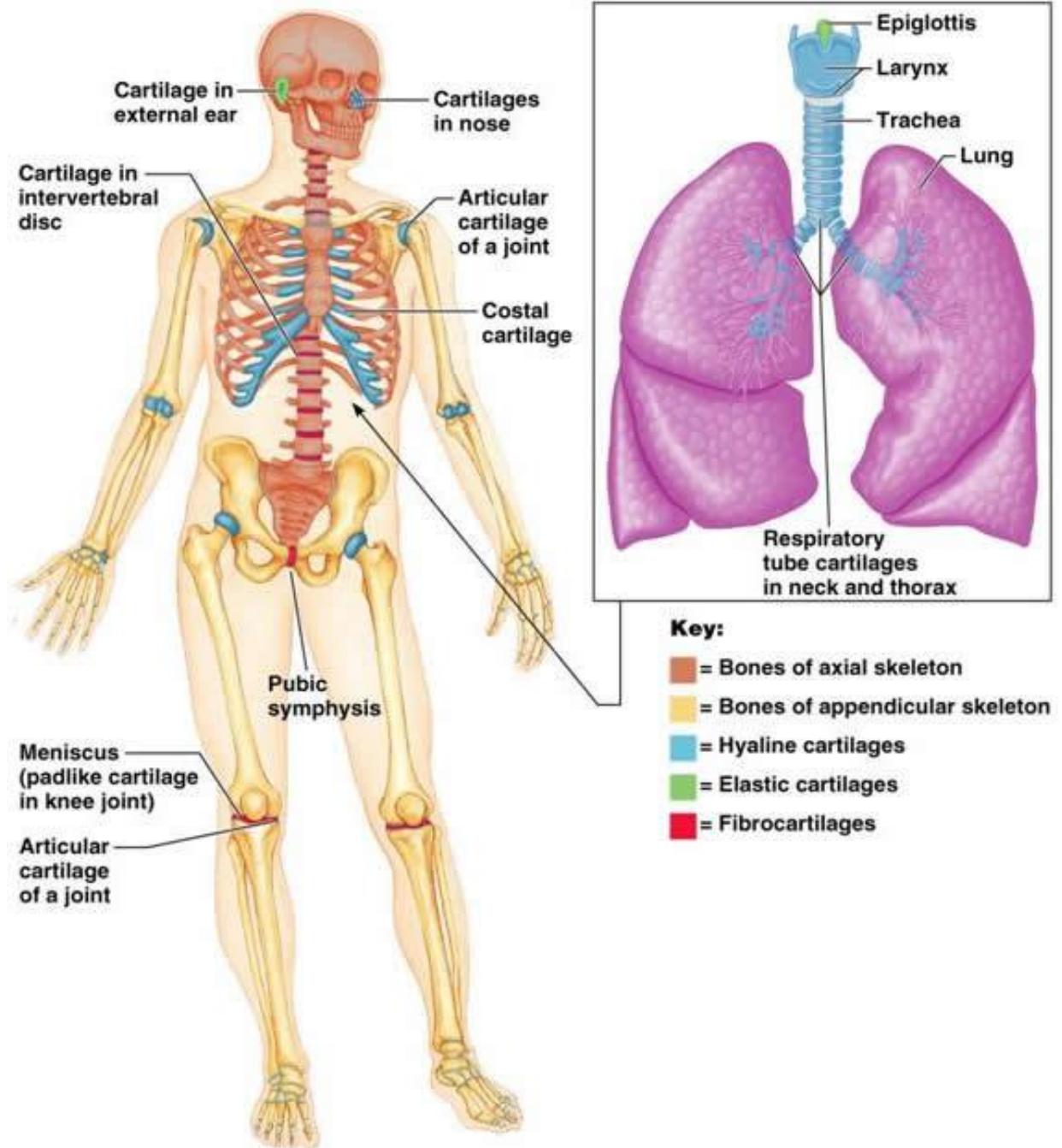
In Developing Embryo
More prevalent than in adult

Skeleton initially mostly
cartilage

Bone replaces cartilage in fetal
and childhood periods.

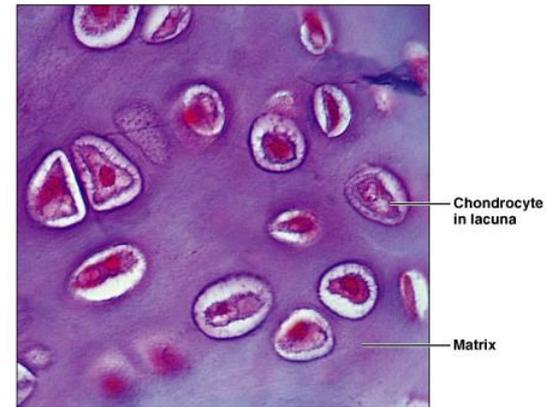


Cartilage is connective tissue.

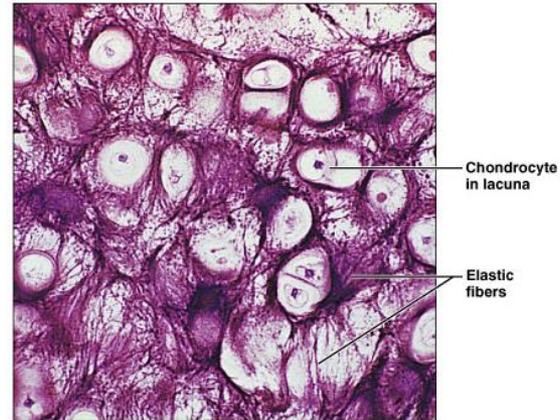


Types of cartilage

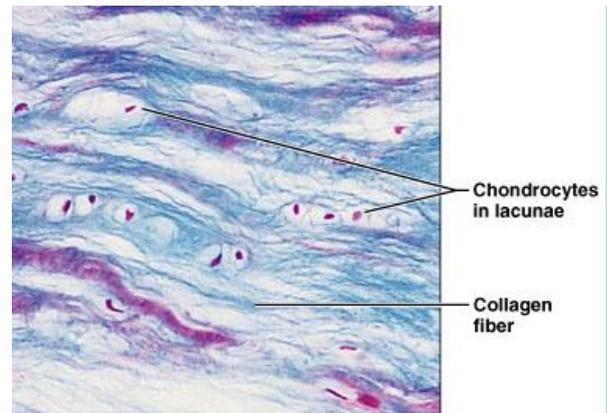
1. Hyaline cartilage



2. Elastic cartilage



3. Fibrocartilage

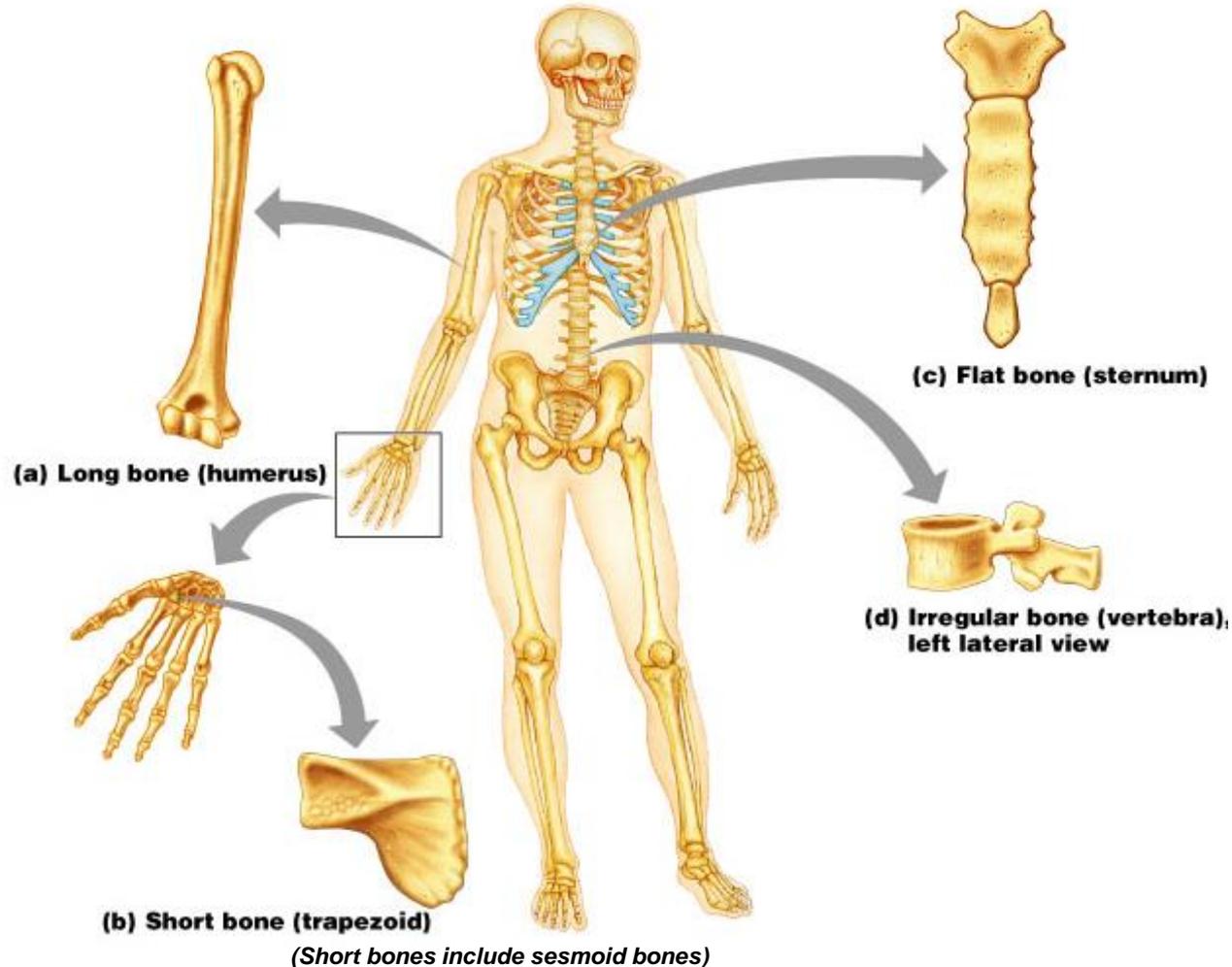


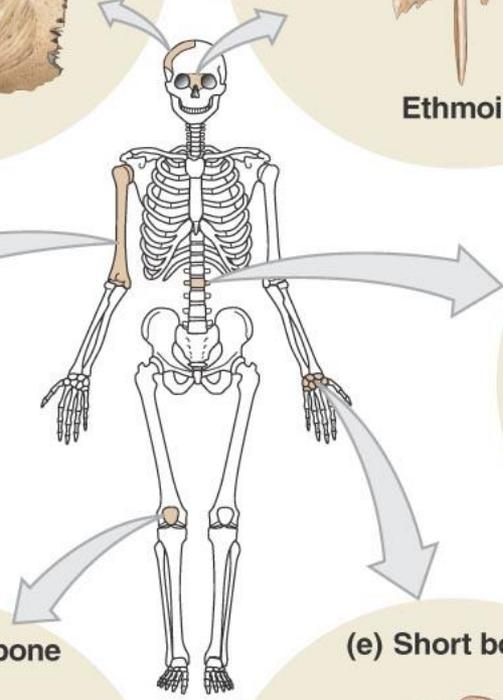
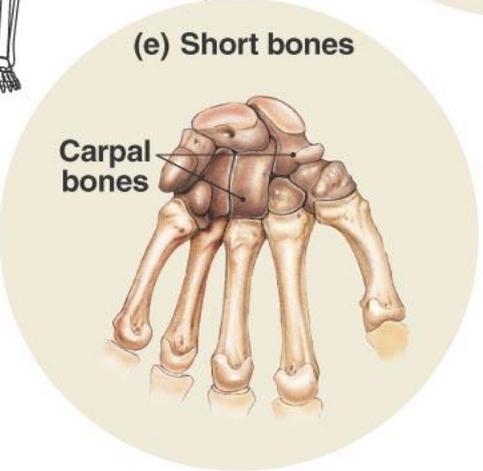
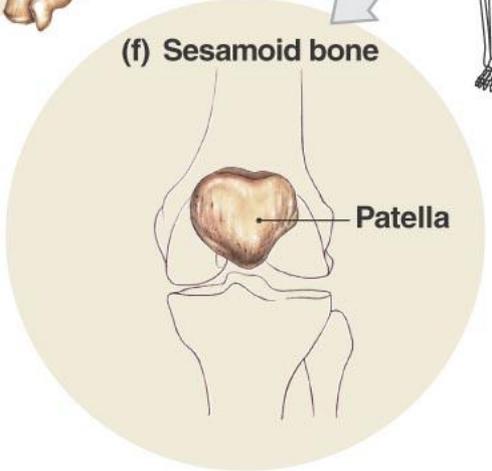
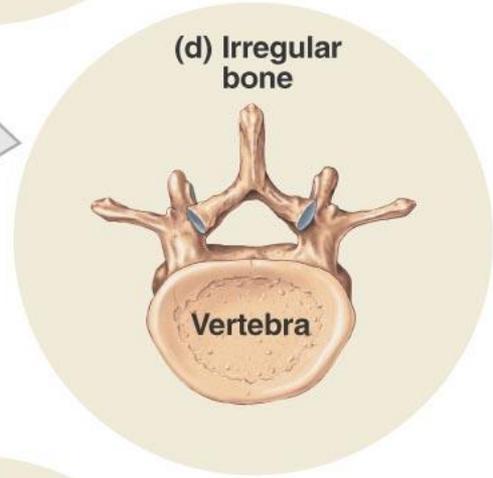
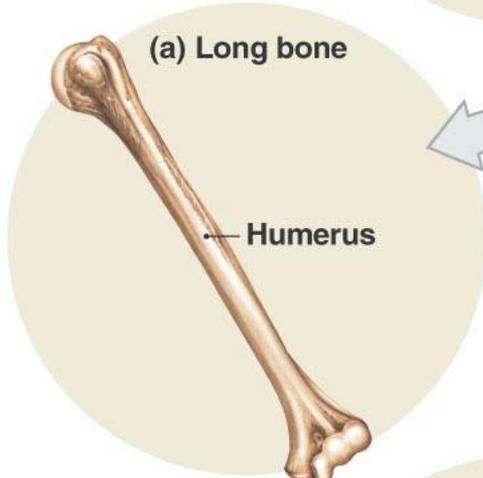
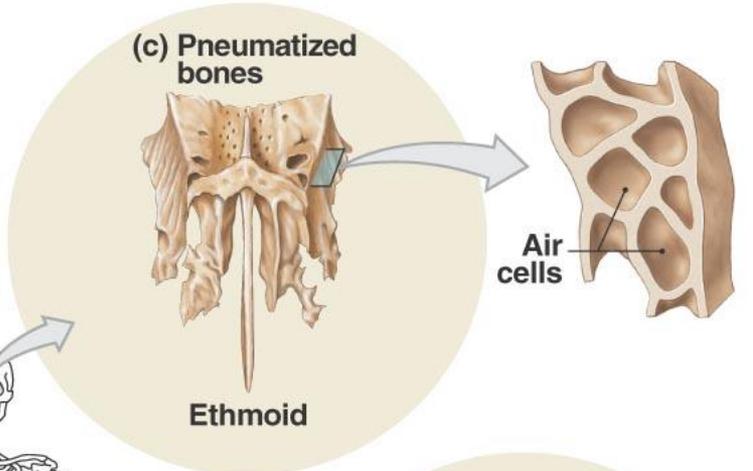
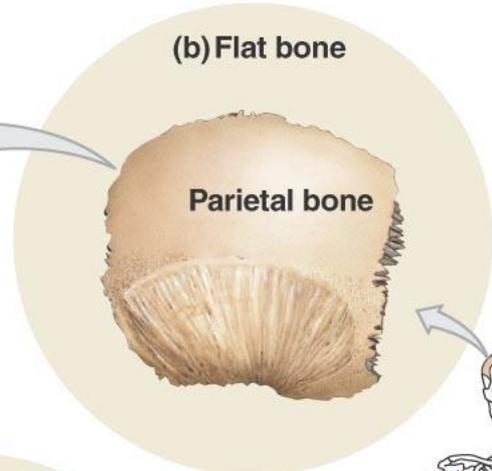
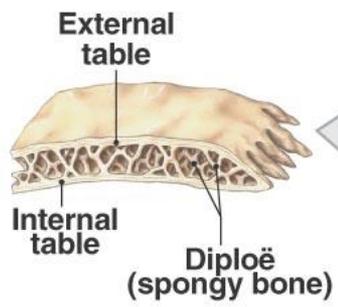
Bones

- Support
- **Movement:** muscles attach by tendons and use bones as levers to move body
- Protection
- Mineral storage
- Blood cell formation and energy storage
 - Bone marrow: red makes blood, yellow stores fat

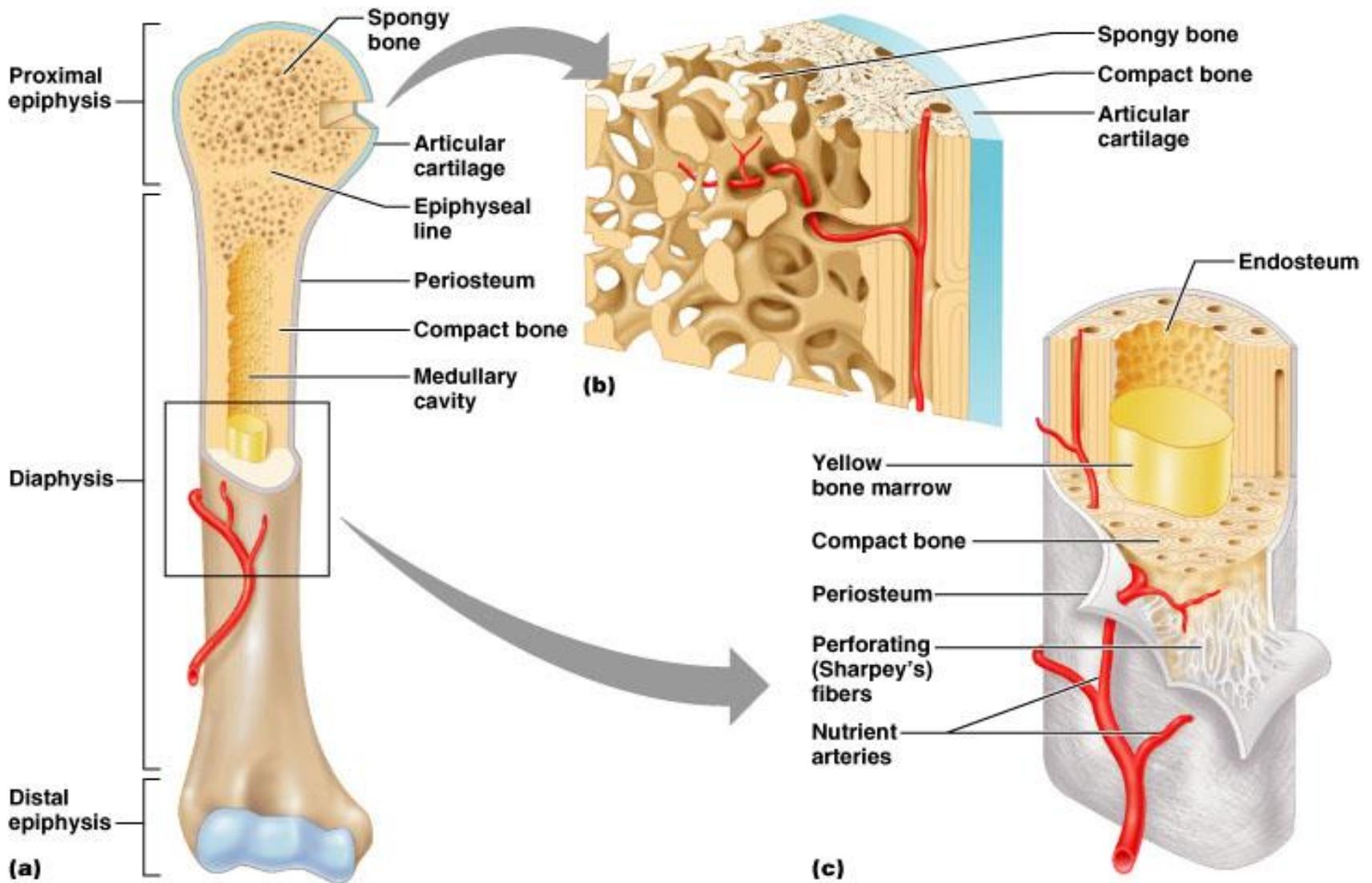
Classification of bones by shape

- Long bones
- Short bones
- Flat bones
- Irregular bones
- Pneumatic bones
- Sesamoid bones





Gross anatomy of bones



JOINTS

synonyms:

**articulations,
junctions**

A site where two or more bones come together, whether or not movement occurs between them, is called a joint.

JOINTS ARE CLASSIFIED ACCORDING TO

○ Range and type of movement they permit.

Immovable joints (SYNARTHROSIS)

Slightly movable joints (AMPHIARTHROSIS)

Movable joints (DIARTHROSIS)

○ Anatomical structure

Fibrous joints,

Cartilaginous joints,

Synovial joints.

Functions:

- **Permit movement**
- **Growth**
- **Molding during childbirth**
- **Concerned with differential growth**
- **Transmission of forces**

Structural Classification

a) Fibrous e.g. i) Sutures,

ii) Syndesmosis

iii) Gomphosis

b) Cartilaginous e.g. i) Primary Cartilaginous

ii) Secondary cartilaginous

c) Synovial e.g. i) Uniaxial: Hinge, Pivot

ii) Biaxial: Condylar, Ellipsoid

iii) Multiaxial: Ball & Socket, Saddle

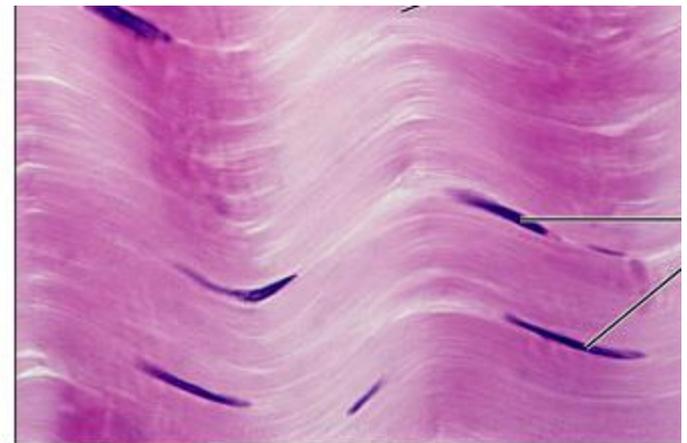
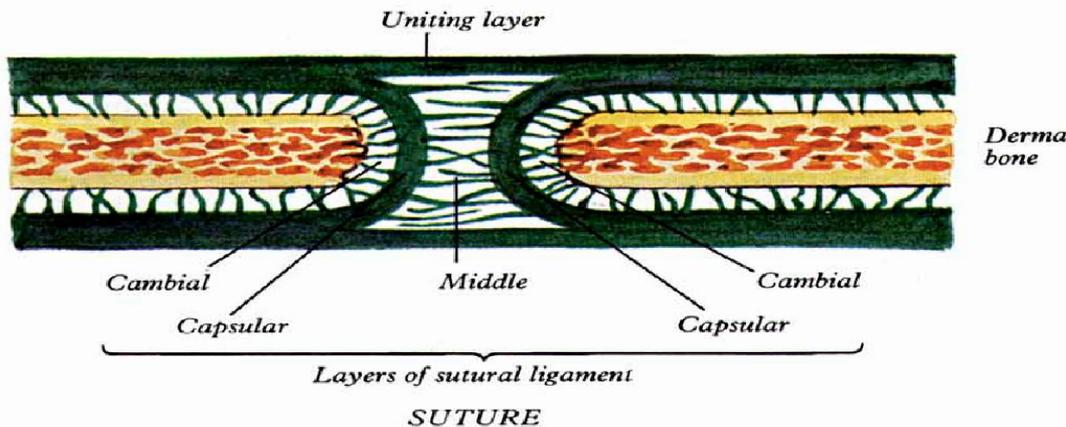
Movements

- Flexion
- Extension
- Adduction
- Abduction
- Circumduction
- Rotation

SYNARTHROSES / FIBROUS JOINTS

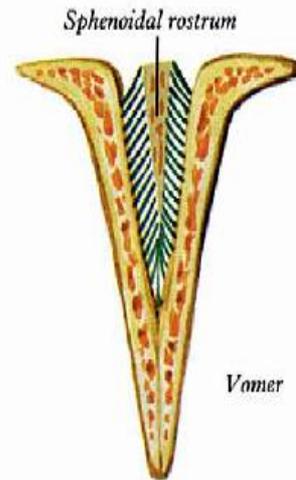
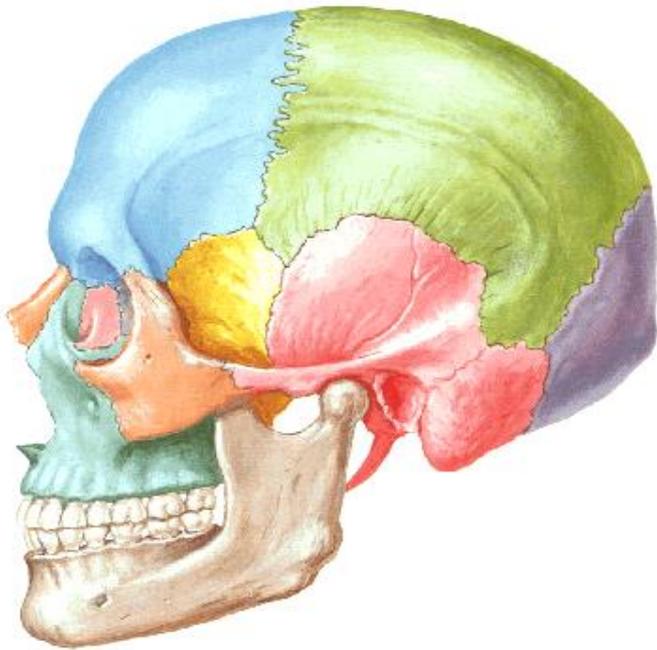
- Bones connected by fibrous tissue: dense regular connective tissue
- No joint cavity
- Slightly movable or immovable

BONE— fibrous connective tissue—BONE



Photomicrograph: Dense regular connective tissue from tendon (1000x).

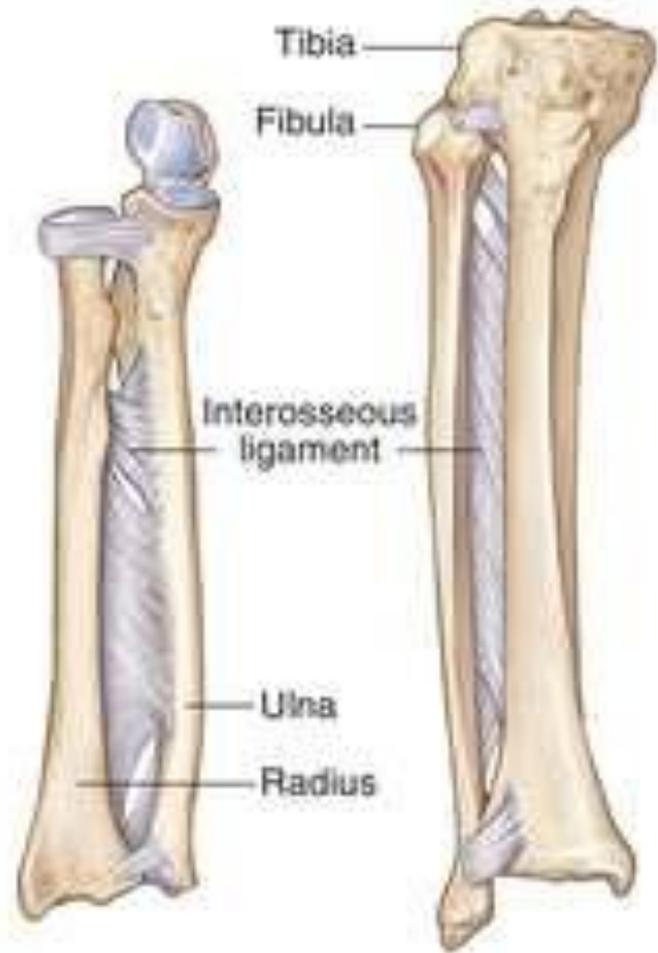
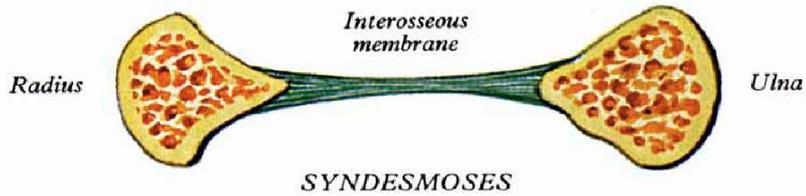
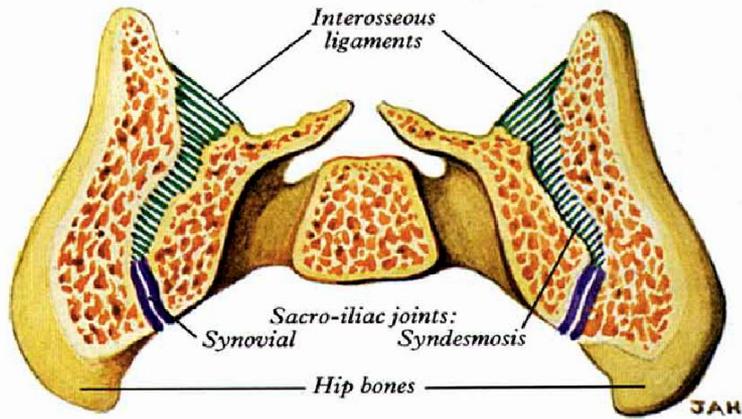
SUTURES



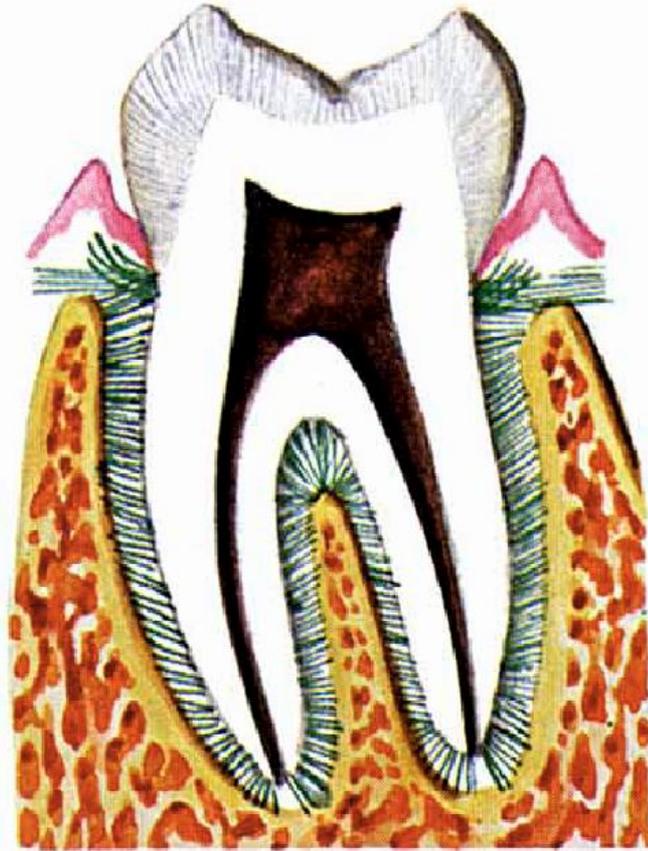
SCHINDYLESIS

*SCHINDYLESIS
(Ridge and groove)*

SYNDESMOSIS



GOMPHOSIS



GOMPHOSIS
(Dentoalveolar joint)

SUTURES

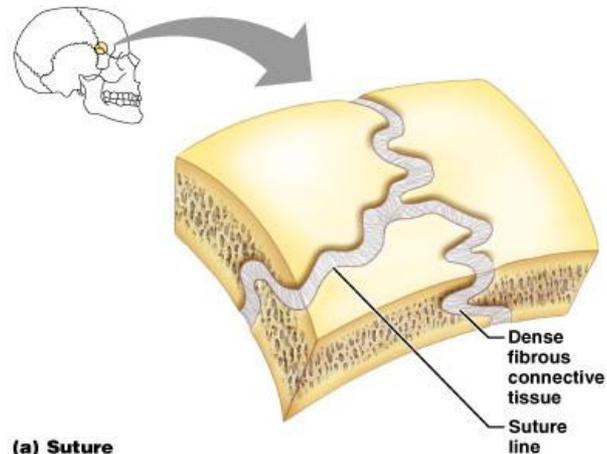
bone—collagenous sutural ligament—bone

-Present only between bones of skull.

-Fibrous tissue is continuous with

periosteum

-Sutures ossify and fuse in middle age:
Called “**synostoses**”



(a) Suture

TYPES OF SUTURES

PLANE SUTURE

- Simple apposition of contiguous surfaces,
- usually rough and reciprocally irregular,

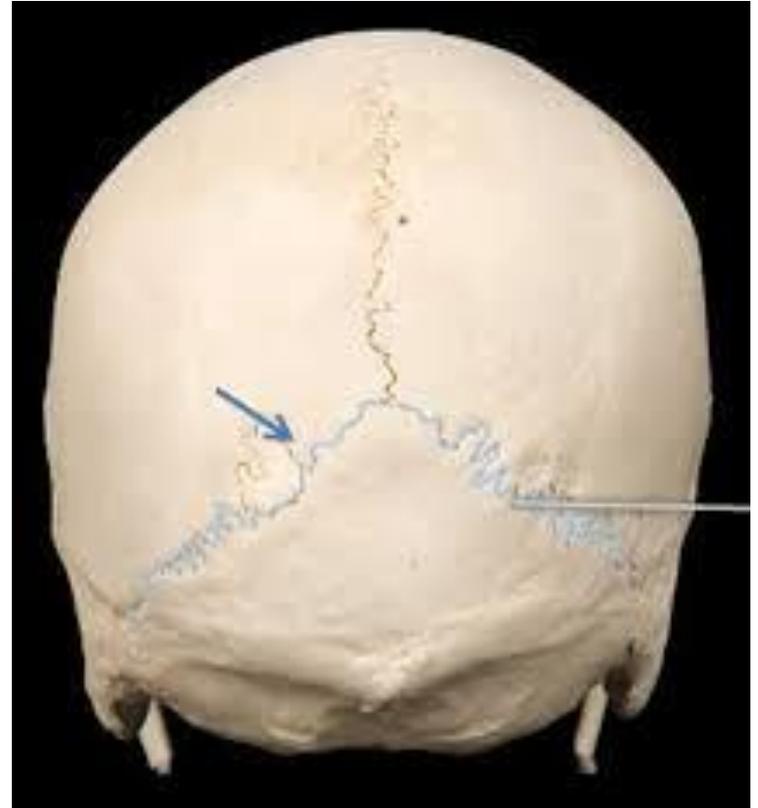
Examples

- sutures between the palatine bones,
- between the maxillae and at the palatamaxillary sutures.



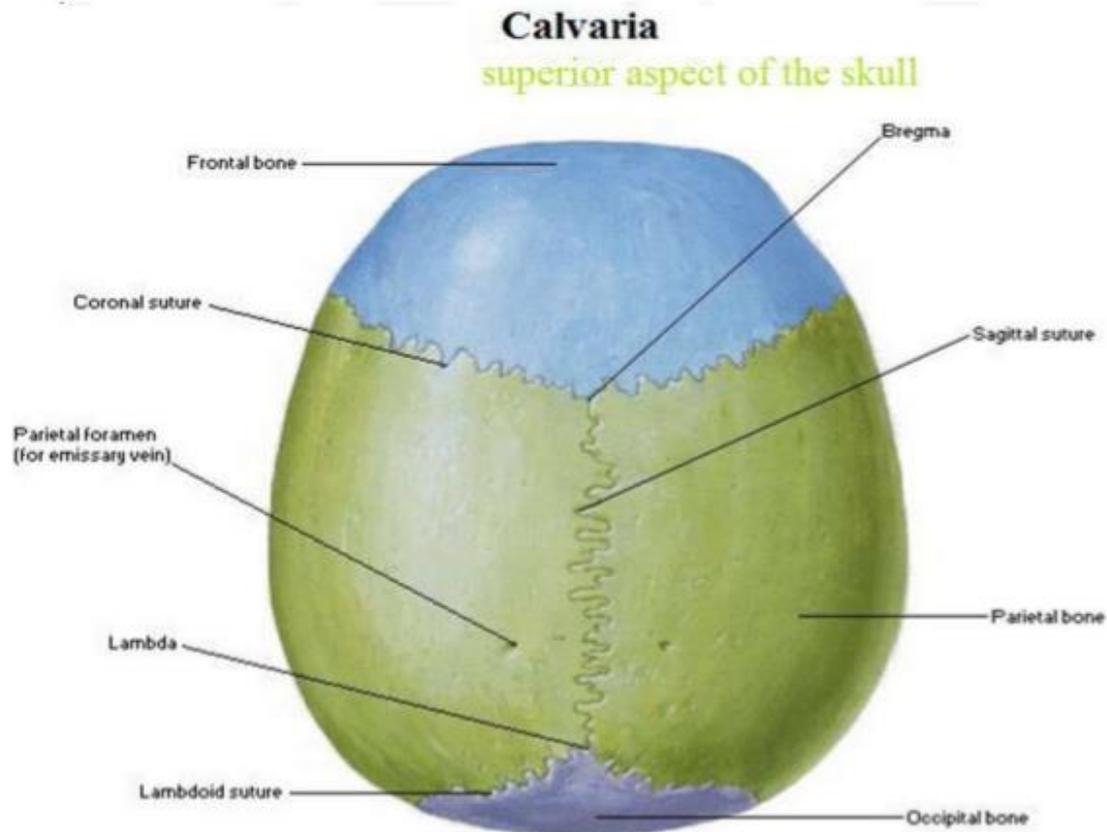
Denticulate Suture

- Has small tooth like projections, often widening towards their ends to provide effective interlocking.
- When united by sutural ligament and periosteum, such sutures are almost completely immobile
- The lambdoid suture is a denticulate suture.



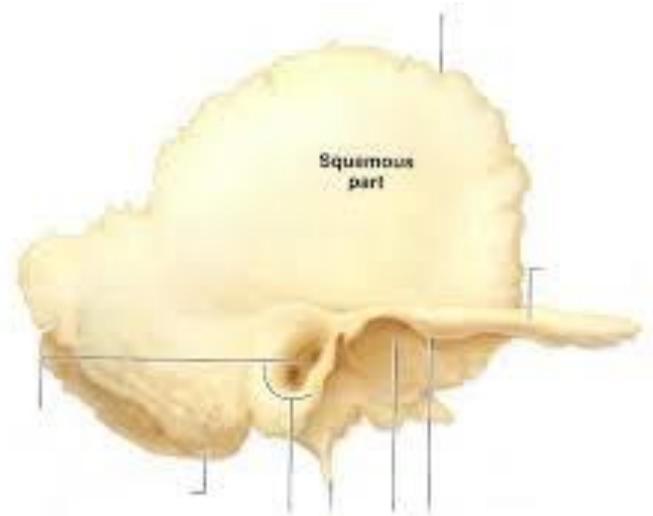
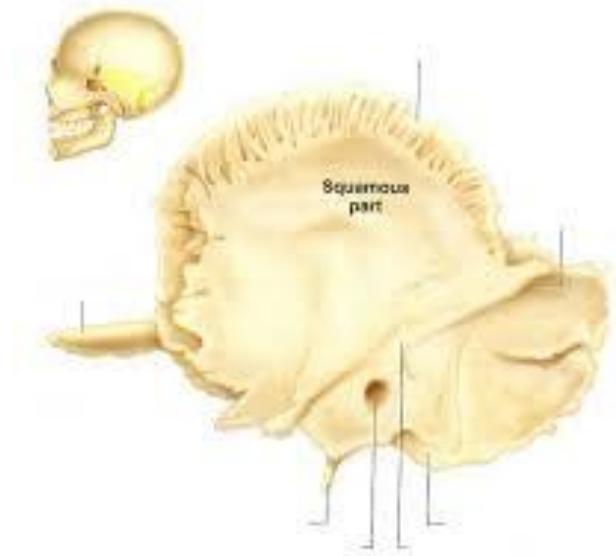
SERRATED SUTURE

The sagittal suture is serrated.



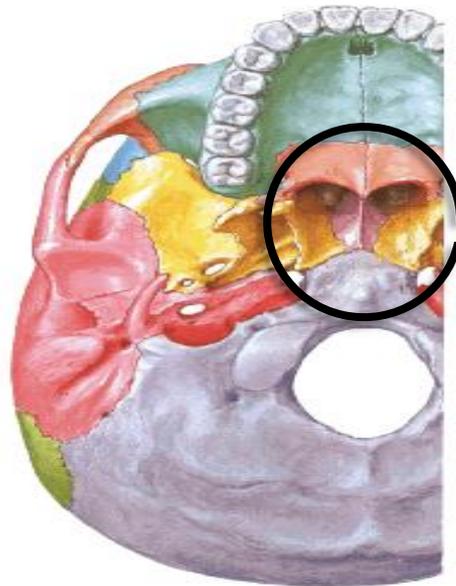
Squamous suture

Where bones overlap, as at the **temporo-parietal suture**, a squamous suture is formed; the adjacent bone surfaces are reciprocally bevelled.



Schindylesis

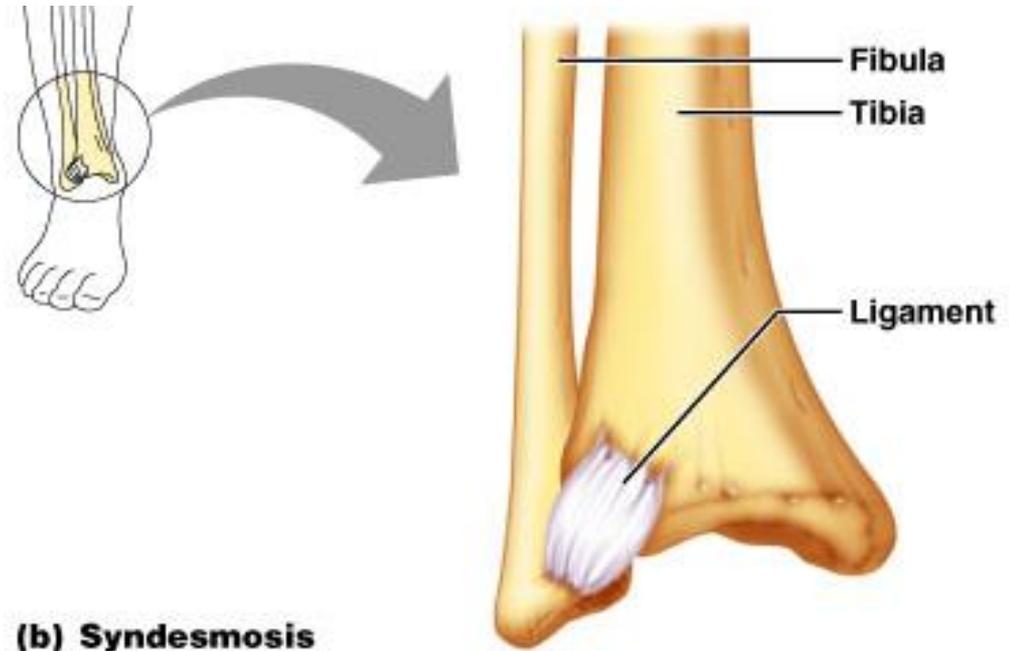
- Between Ala of Vomer and
- Rostrum of Sphenoid



SCHINDYLESIS
(Ridge and groove)

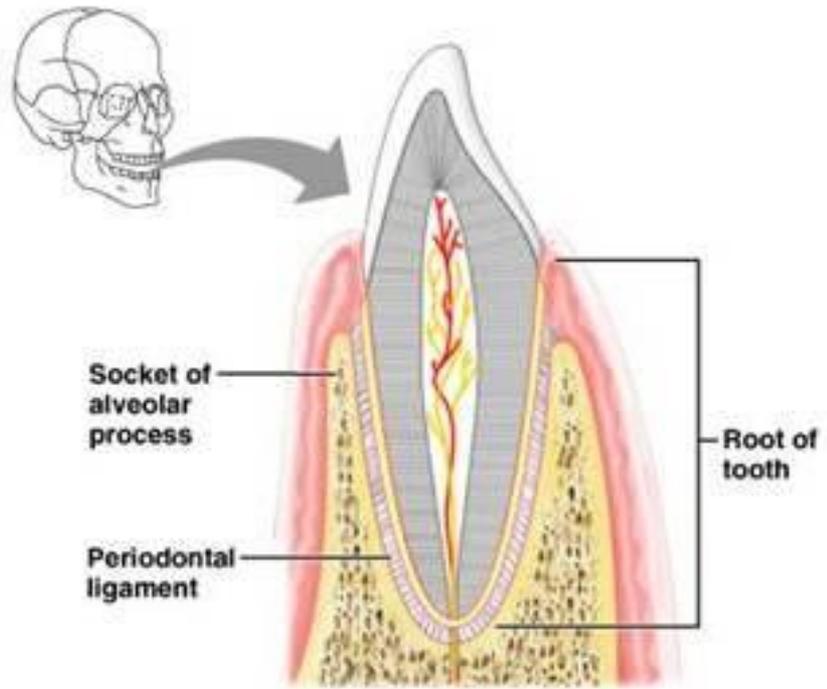
Syndesmoses

- In Greek: “ligament”
- Bones connected by ligaments only
- Amount of movement depends on length of the fibers: longer than in sutures



Gomphoses

- Is a “peg-in-socket”
- Only example is tooth with its socket
- Ligament is a short *periodontal* ligament



(c) Gomphosis

Cartilagenous joints

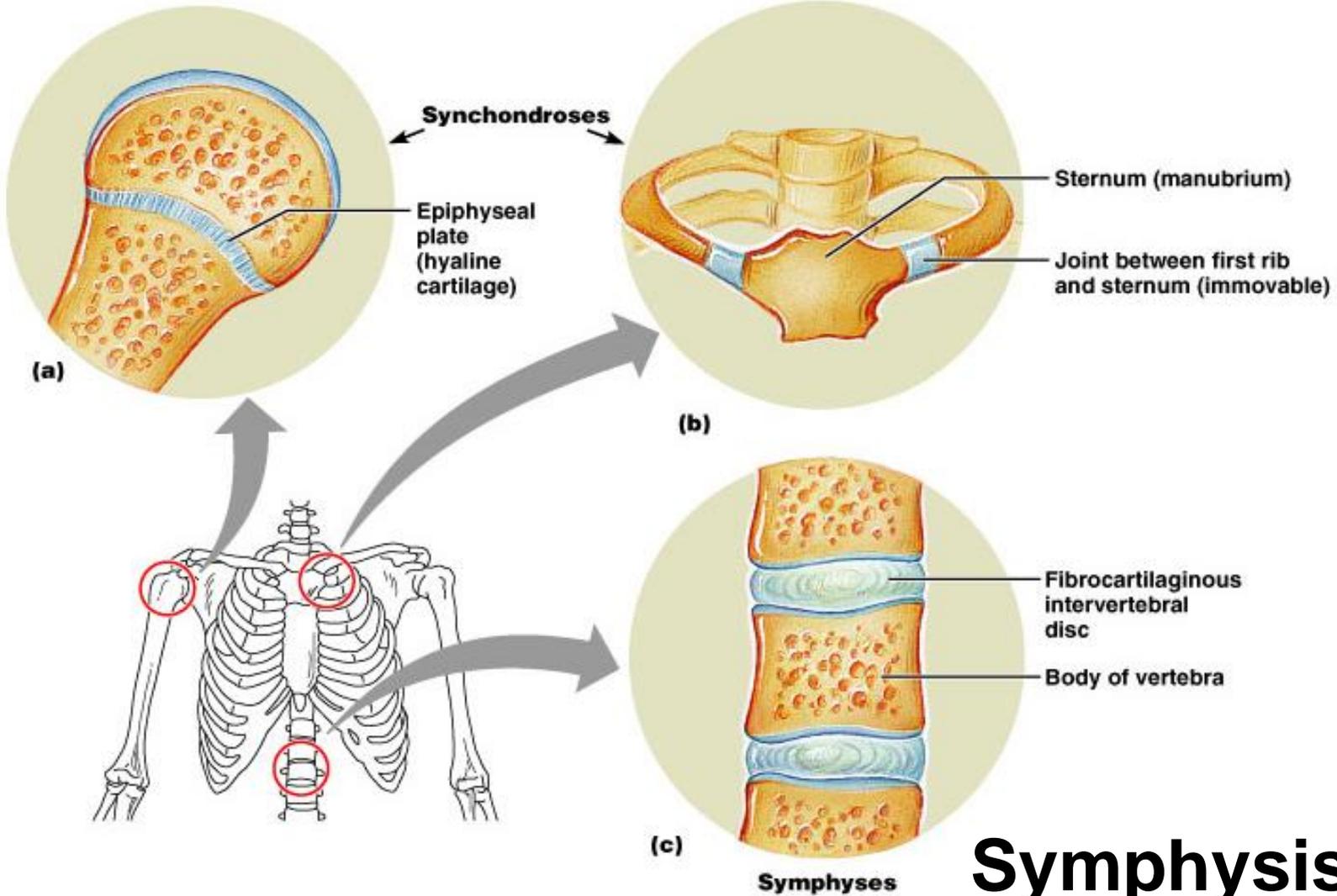
- Articulating bones united by **cartilage**
- Lack a joint cavity
- Not highly movable
- *Two types*
 - **Synchondroses** (singular: synchondrosis)
 - **Symphyses** (singular: symphysis)

Synchondroses

Primary Cartilaginous Joints

- Literally: “junction of cartilage”
- A plate or bar of Hyaline cartilage unites the bones
- Immovable (**synarthroses**)
- Examples:
 - Epiphyseal plates between epiphysis and diaphysis of growing bone.
 - Joint between first rib’s costal cartilage and manubrium of the sternum

Synchondrosis



Symphyses

Secondary Cartilaginous Joints

- Literally “growing together”
- **Fibrocartilage** unites the bones
 - Slightly movable (**amphiarthroses**)
 - Resilient shock absorber
 - Provide strength and flexibility
- Hyaline cartilage on articular surfaces of bones to reduce friction
- Examples
 - Intervertebral discs
 - Pubic symphysis of the pelvis

Symphysis



Intervertebral Disc



Pubic Symphysis

The lambdoid suture is an example of a(n)

- A. Diarthrosis
- B. Amphiarthrosis
- C. Synarthrosis
- D. Synarthrosis and fibrous

The lambdoid suture is an example of a(n)

- A. Diarthrosis
- B. Amphiarthrosis
- C. Synarthrosis
- D. Synarthrosis and fibrous**

Which of the following is an example of a synchondrosis?

- A. First sternocostal articulation
- B. Humeroscapular articulation
- C. Symphysis pubis
- D. Tibiofibular articulation

Which of the following is an example of a synchondrosis?

- A. First sternocostal articulation**
- B. Humeroscapular articulation
- C. Symphysis pubis
- D. Tibiofibular articulation

The procedure arthroscopy refers to:

- A. Examining interior of joint
- B. Reducing inflammation of a bursa
- C. Re-establishing blood supply of muscles
- D. Repair of bone fractures

The procedure arthroscopy refers to:

- A. Examining interior of joint**
- B. Reducing inflammation of a bursa
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Which of the following joints are held together by cartilage?

- A. Diarthrosis
- B. Gomphosis
- C. Symphysis
- D. Synovial

Which of the following joints are held together by cartilage?

- A. Diarthrosis
- B. Gomphosis
- C. Symphysis**
- D. Synovial

The radioulnar joint is an example of a

A. Hinge

B. Pivot

C. Planar

D. Synarthroses

The radioulnar joint is an example of a

A. Hinge

B. Pivot

C. Planar

D. Synarthroses

Synovial joints

DIARTHROSES

- **Structure:** **bone**—**articular cartilage**—**synovial fluid in cavity** — **articular cartilage**—**bone**
- **Bond** : surrounding sleeve of **collagenous fibrous capsule** lined by **synovial membrane**; **extrinsic and intrinsic ligaments**. Occasional **intracapsular ligaments, tendons, fat pads, fibrocartilaginous discs or menisci**.

Synovial Joint

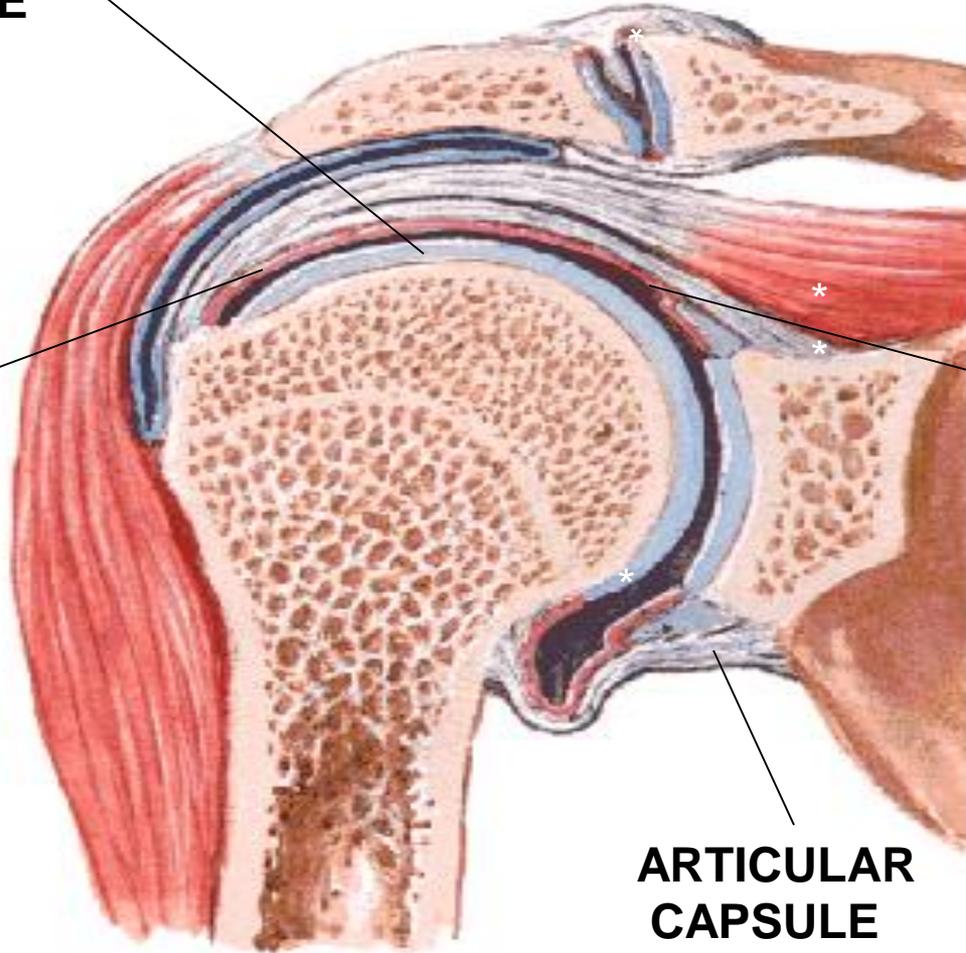
SHOULDER JOINT

ARTICULAR
CARTILAGE

SYNOVIAL
MEMBRANE

JOINT
CAVITY

ARTICULAR
CAPSULE



SYNOVIAL JOINT

KNEE JOINT

SYNOVIAL
MEMBRANE

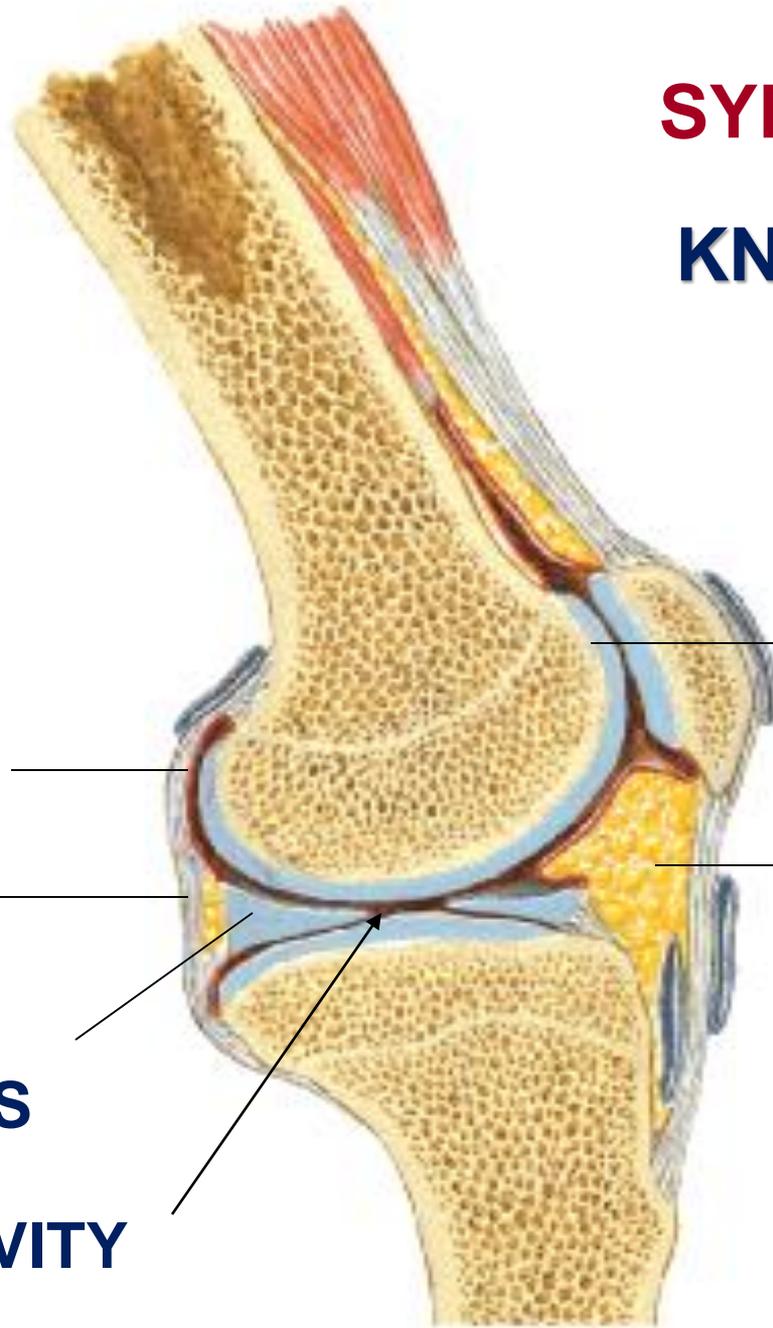
CAPSULE

MENISCUS

JOINT CAVITY

ARTICULAR
CARTILAGE

PAD OF FAT



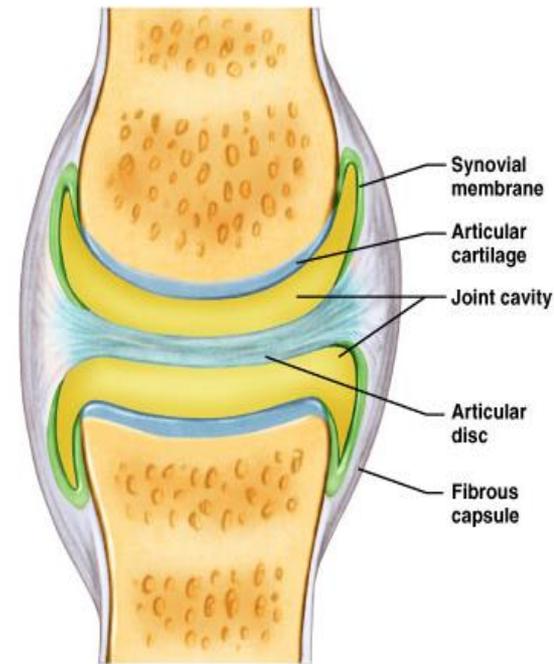
General Structure of Synovial Joints

1. Articular cartilage

- Hyaline
- Spongy cushions absorb compression
- Protects ends of bones from being crushed

2. Joint (synovial) cavity

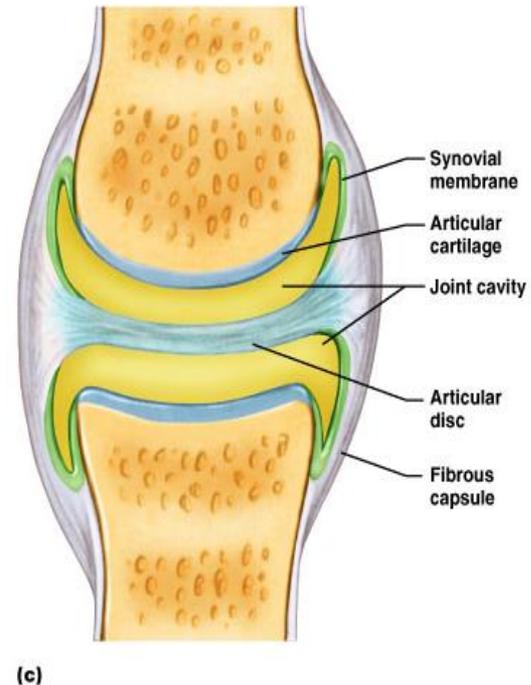
- Potential space
- Small amount of synovial fluid



(c)

3. Articular (joint) capsule

- Two layered
- Outer^{*}: fibrous capsule of dense irregular connective tissue continuous with periosteum.
- Inner^{*}: synovial membrane of loose connective tissue (makes synovial fluid)
Lines all internal joint surface, *except the cartilages*^{*}

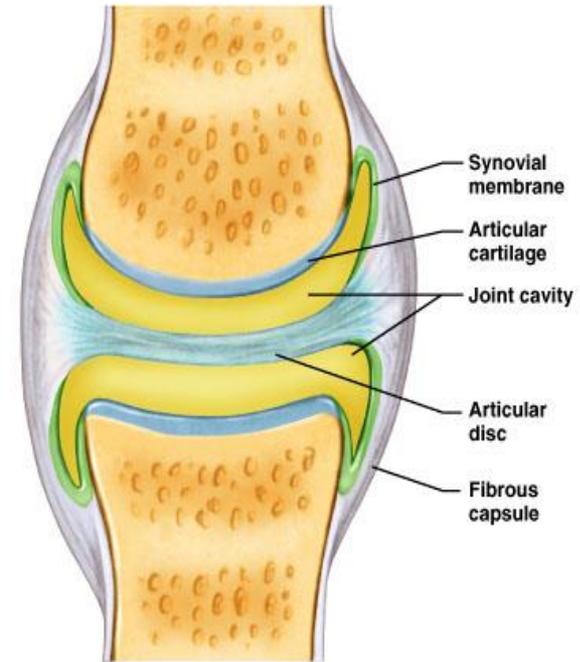


4. Synovial fluid

- Filtrate of blood
- Contains special glycoproteins
- Nourishes cartilage and functions as slippery lubricant

5. Reinforcing ligaments

- Capsular (most) – thickened parts of capsule
- Extracapsular
- Intracapsular



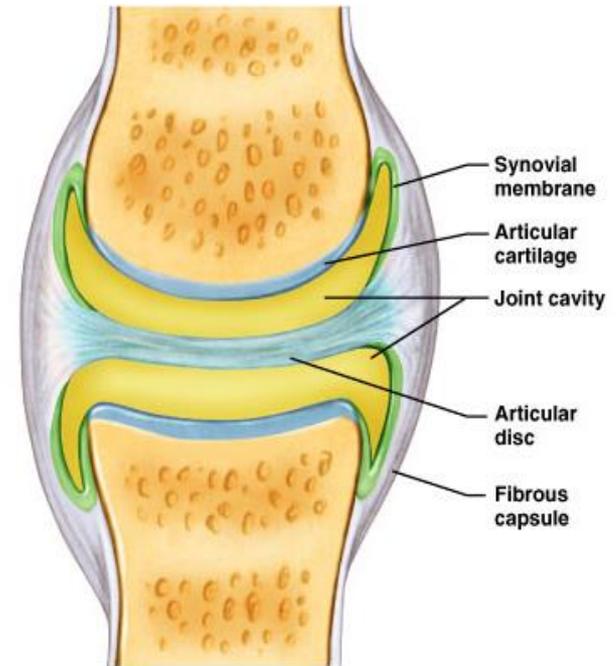
(c)

6. Nerves

- Detect pain
- Monitor stretch (one of the ways of sensing posture and body movements)

7. Blood vessels

- Rich blood supply
- Extensive capillary beds in synovial membrane (produce the blood filtrate)



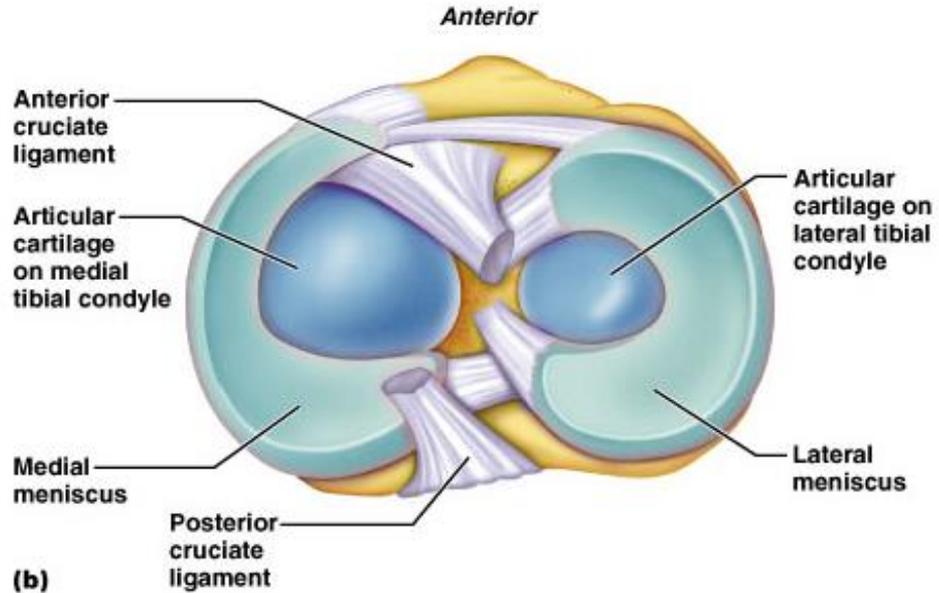
(c)

Articular disc or *meniscus*

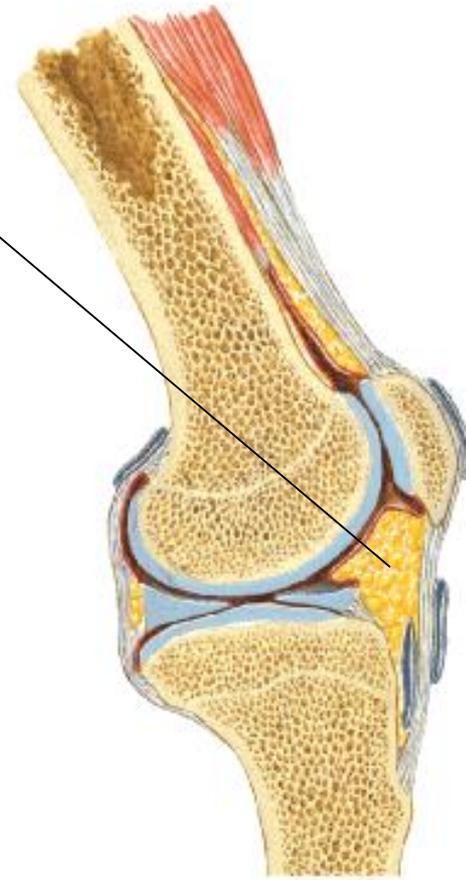
(literally “crescent”)

- Only some joints
- Those with bone ends of different shapes or fitting poorly,
- Some to allow two kinds of movement (e.g. jaw)
- Fibrocartilage
- Examples: knee

TMJ (Temporomandibular joint)
sternoclavicular joint



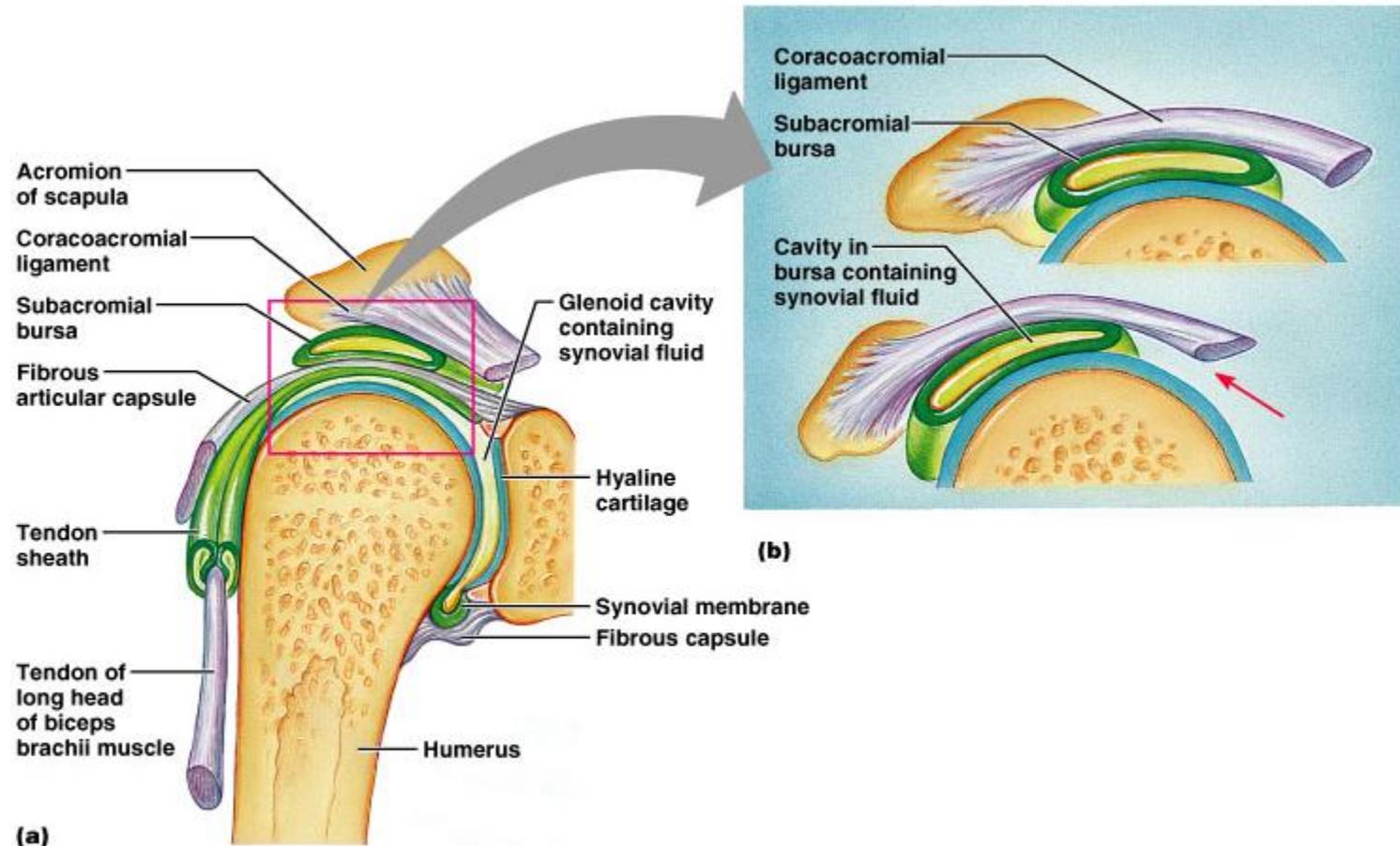
- **Fatty pads** are found in some synovial joints lying between the synovial membrane and the fibrous capsule or bone.
- Examples are found in the hip and knee joints.



Bursae and tendon sheaths

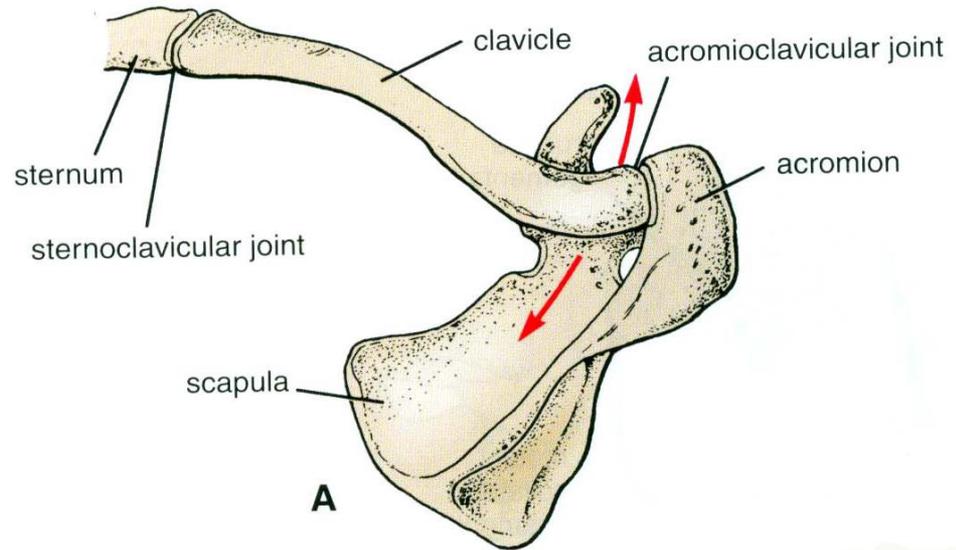
- Contain synovial fluid
- Not joints but often associated with them
- Act like ball bearings
- **Bursa** means “purse” in Latin
 - Flattened sac lined by synovial membrane
 - Where ligaments, muscles, tendons, or bones overlie each other and rub together
- **Tendon** sheath
 - Only on tendons subjected to friction

Bursae and tendon sheaths



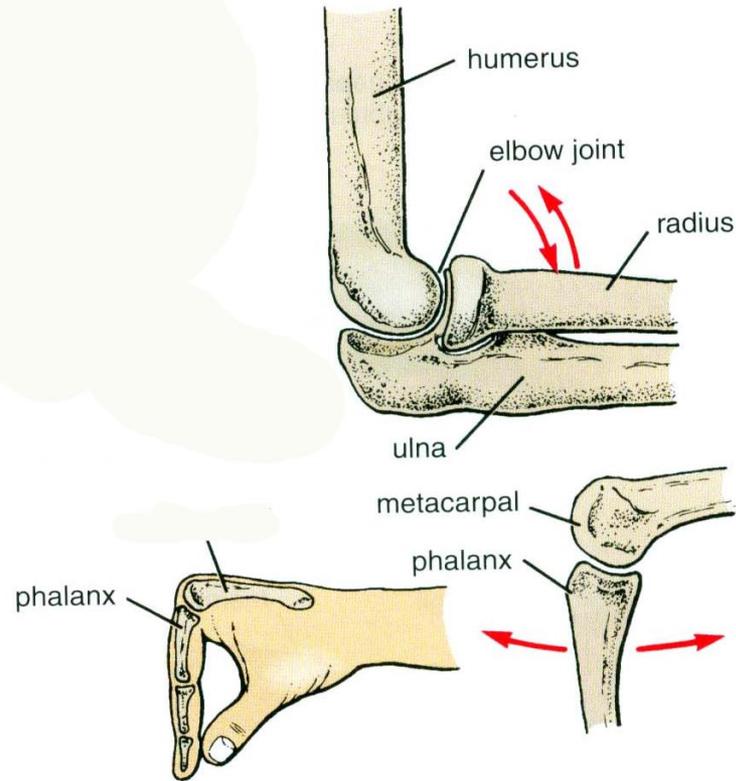
UNI-AXIAL	Hinge Joint , Pivot Joint, Condylar Joint
BI-AXIAL	Condylar Joint, Ellipsoid Joint, Saddle Joint
MULTI-AXIAL	Ball and Socket
NON-AXIAL	Plane Joint

Plane joints:



- In plane joints, the apposed articular surfaces are **flat** or almost flat, and this permits the bones to **slide** on one another.
- Examples of these joints are the sternoclavicular and acromioclavicular joints

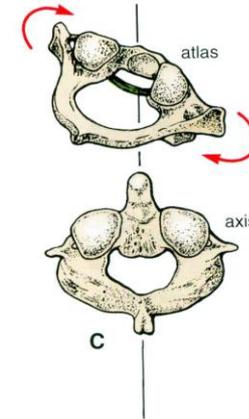
Hinge joints:



- Hinge joints resemble the hinge on a door, so that **flexion and extension** movements are possible. Examples of these joints are the elbow, knee, and ankle joints

Pivot joints:

- In pivot joints, a central bony pivot is surrounded by a bony-ligamentous ring and **rotation** is the only movement possible.
- E.g atlantoaxial and superior radioulnar joints



Condylar joints

- Condylar joints have two distinct convex surfaces that articulate with two concave surfaces.
- The movements of **flexion, extension**, with a small amount of **rotation**.
- E.g. knee joint , temporo-mandibular joint

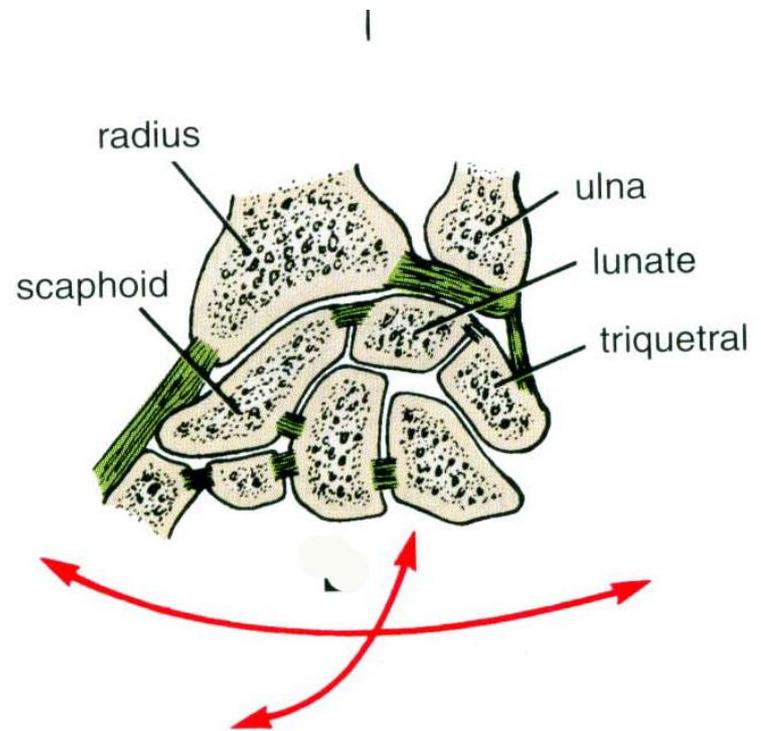


Ellipsoid joints

- In ellipsoid joints, an elliptical convex articular surface fits into an elliptical concave articular surface.

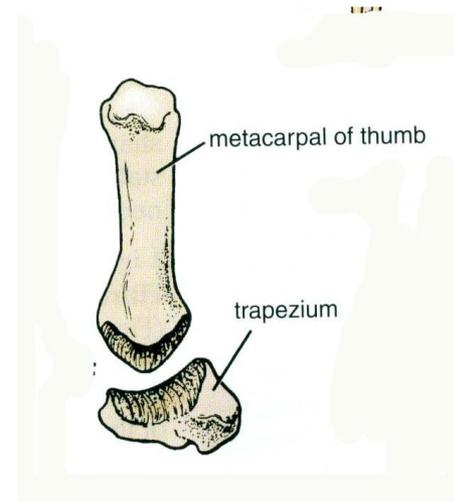
The movements of flexion, extension, abduction, adduction and circumduction can take place, but rotation is impossible.

- E.g. wrist joint, metacarpophalangeal joint



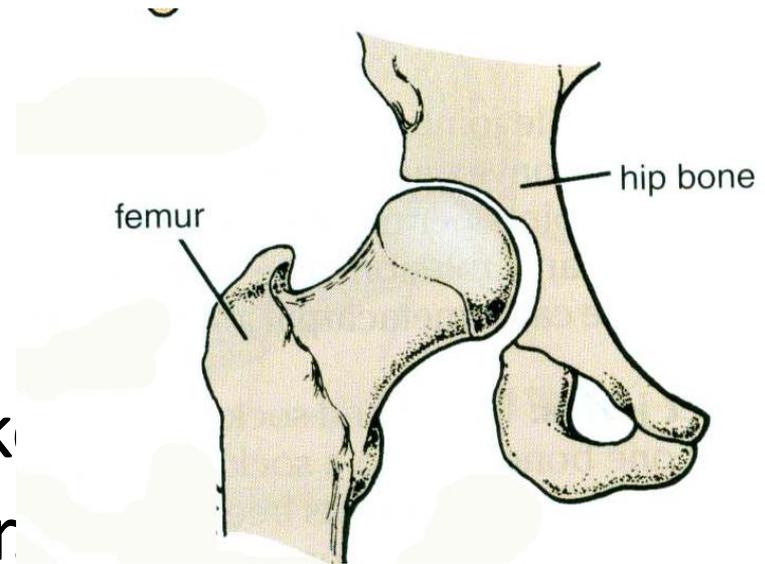
Saddle joints:

- The articular surfaces are reciprocally concavoconvex and resemble a saddle on a horse's back.
- These joints permit **flexion, extension, abduction, adduction, and rotation.**
- E.g. carpometacarpal joint of the thumb, sternoclavicular joint



Ball and socket joints:

- In ball-and-socket joints, a ball-shaped head of one bone fits into a sock like concavity of another
- This arrangement permits free movements, including flexion, extension, abduction, adduction, medial rotation, lateral rotation, and circumduction.
- E.g. shoulder and hip joints



Stability of Joints

The stability of a joint depends on three main factors:

- the shape,
- size,
- arrangement of the articular surfaces;
- the ligaments;
- and the tone of the muscles around the joint.

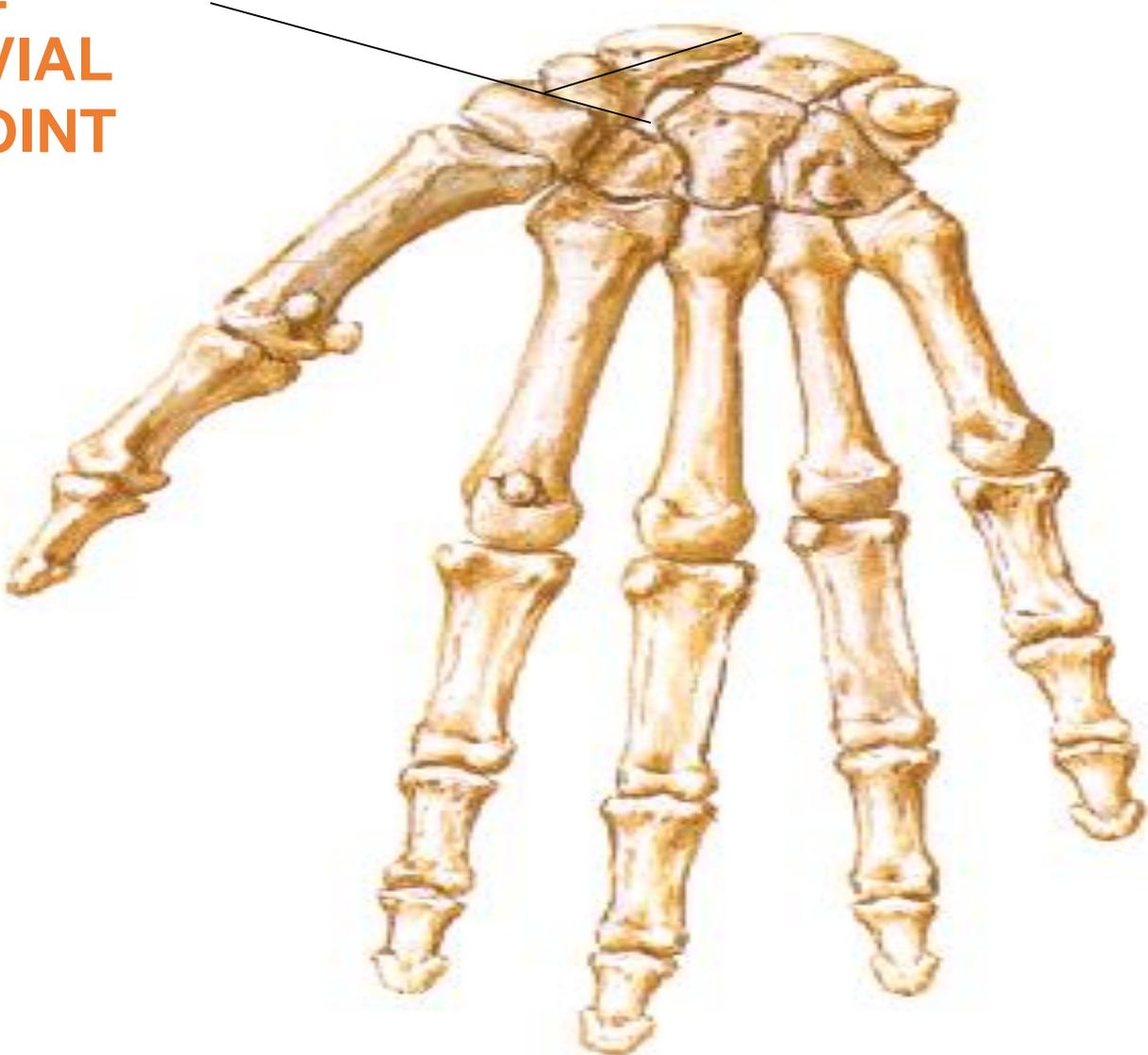
MECHANISM OF LUBRICATION OF SYNOVIAL JOINT

- Synovial fluid
- Hyaline cartilage
- Harvesian fatty pads
- Bursa

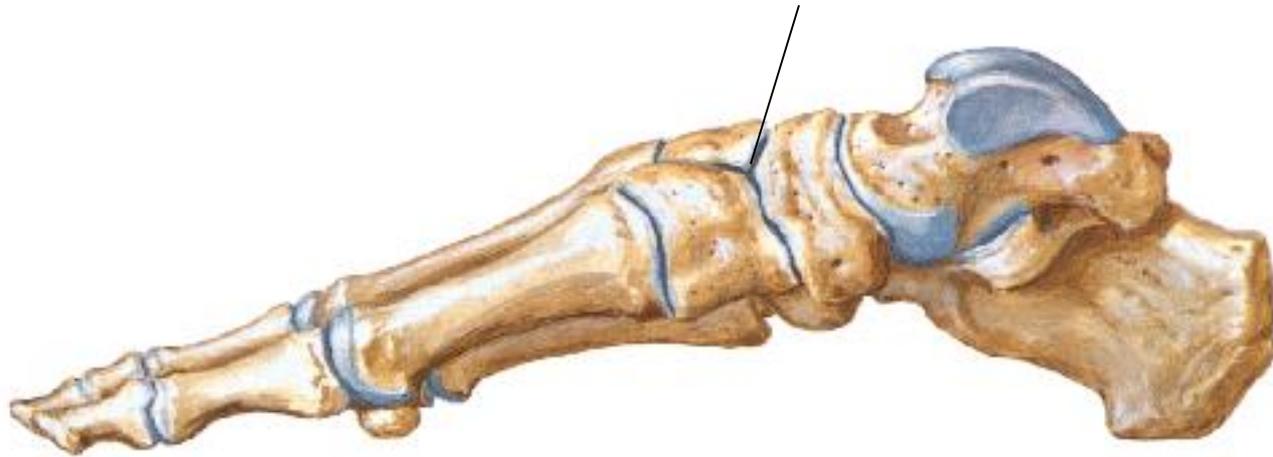
Nerve Supply of Joints

- The capsule and ligaments receive an **abundant** sensory nerve supply.
- A sensory nerve supplying a joint also supplies the muscles moving the joint and the skin overlying the insertions of these muscles, a fact that has been codified as **Hilton's law**.

**PLANE
SYNOVIAL
JOINT**



PLANE SYNOVIAL JOINT





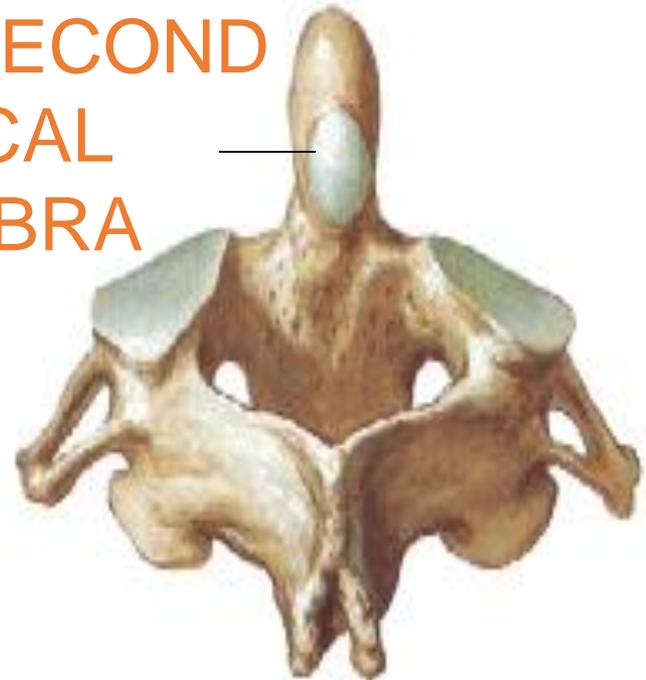
FIRST CERVICAL
VERTEBRA



PIVOT

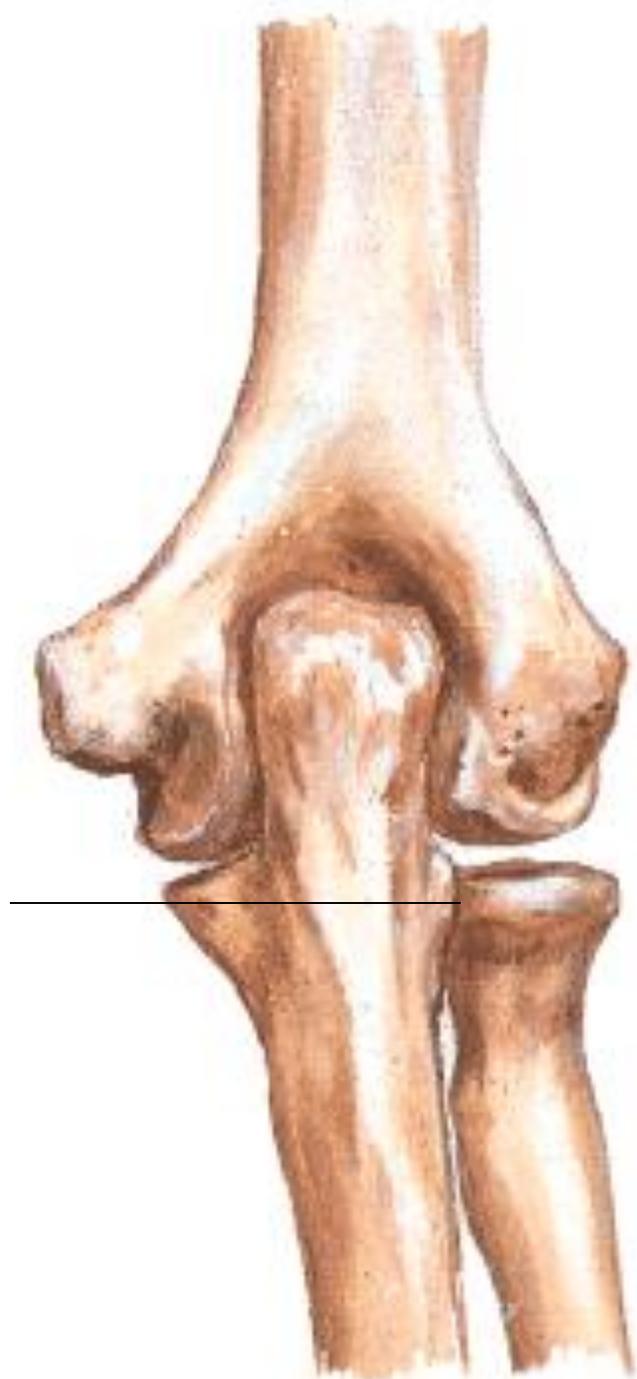


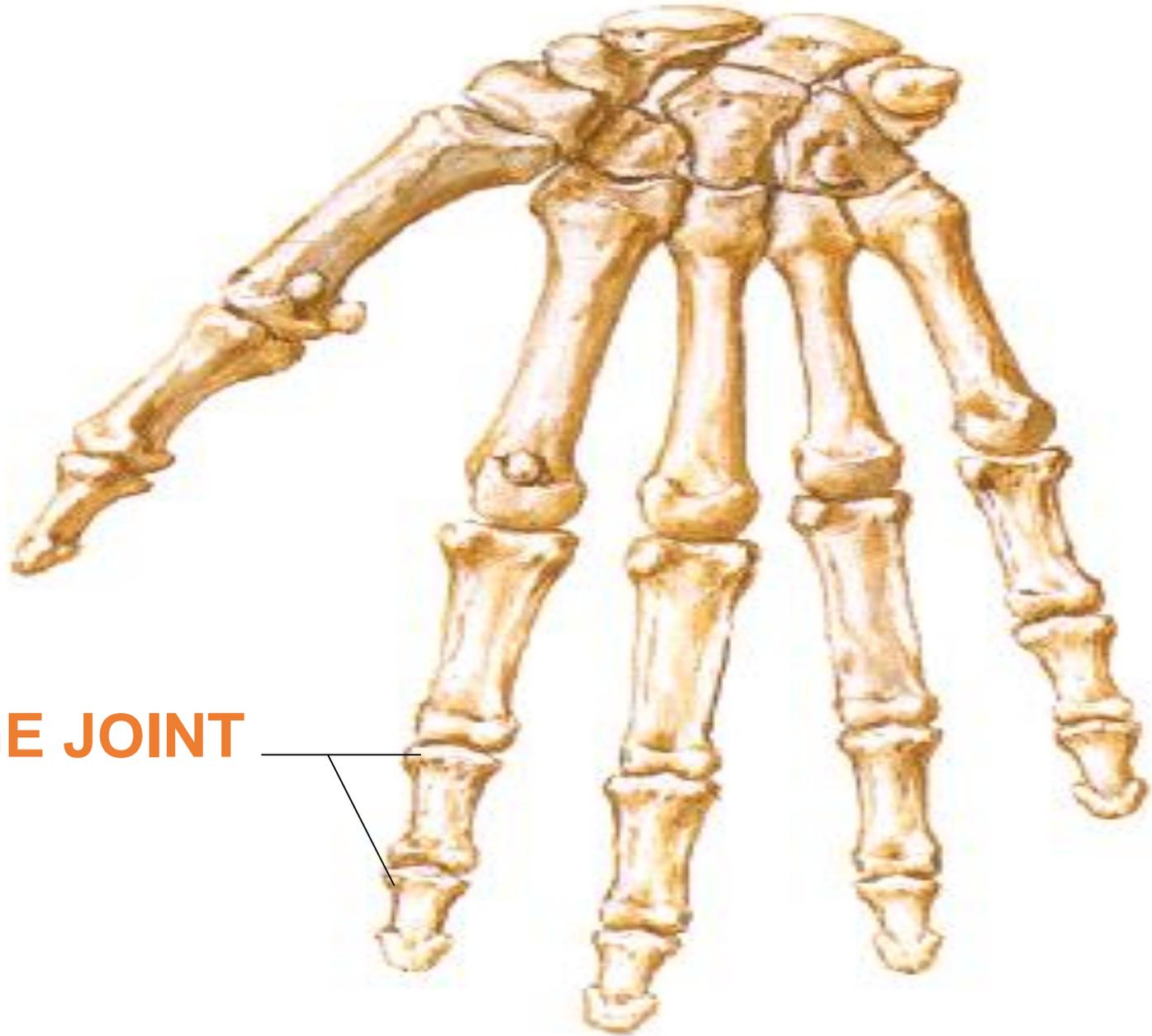
DENS OF SECOND
CERVICAL
VERTEBRA





**PIVOT
JOINT**





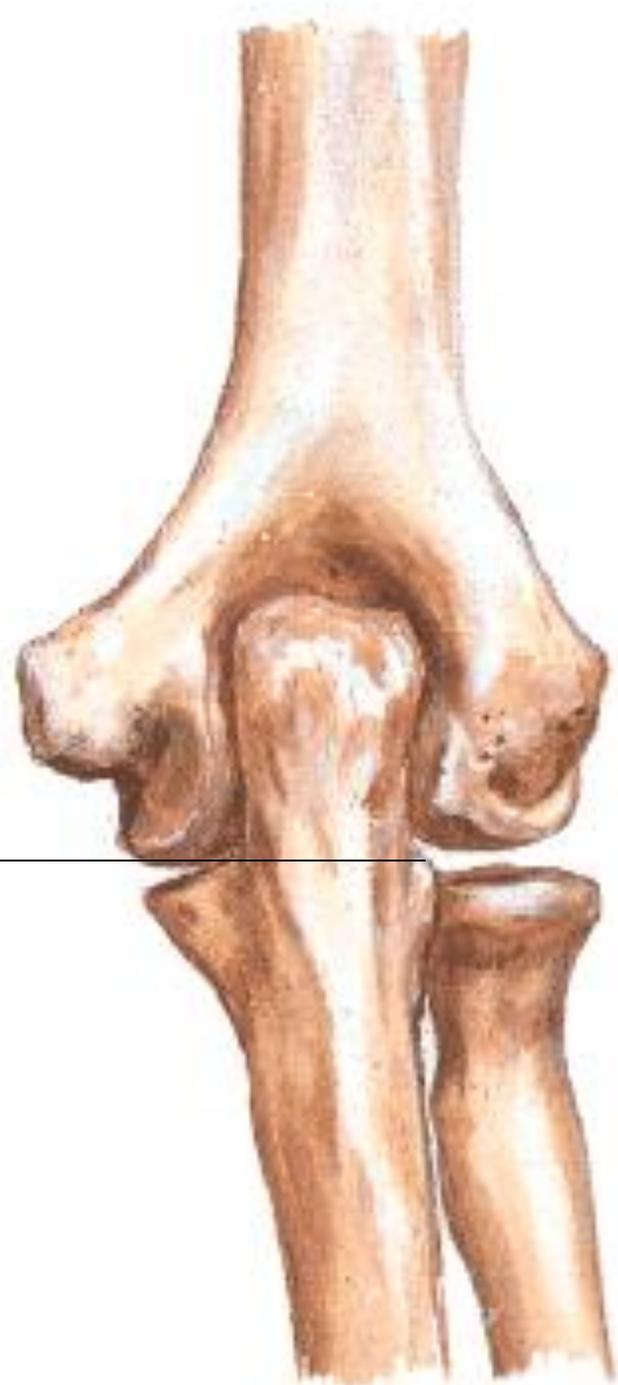
HINGE JOINT



HINGE JOINT



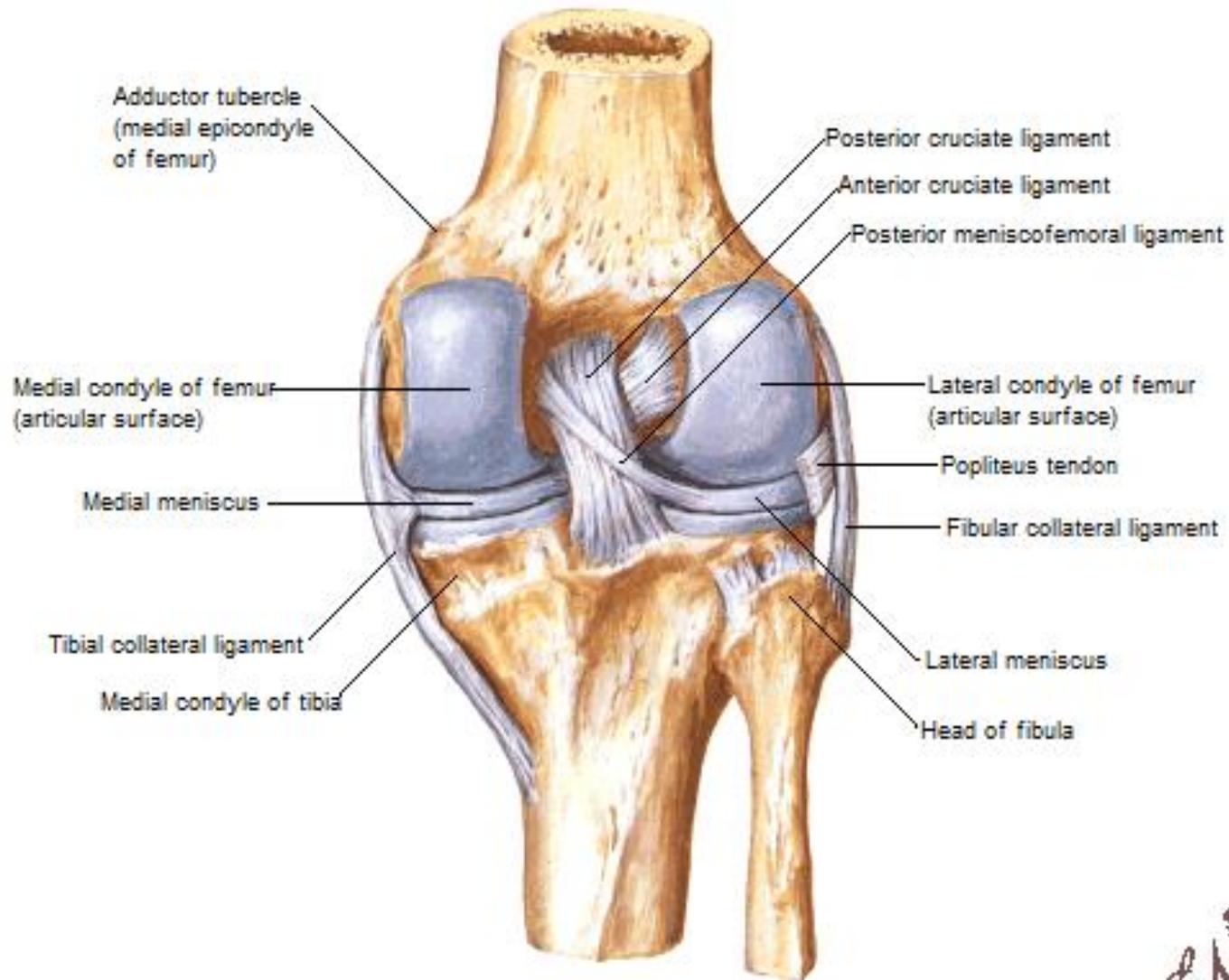
**ELBOW
JOINT**



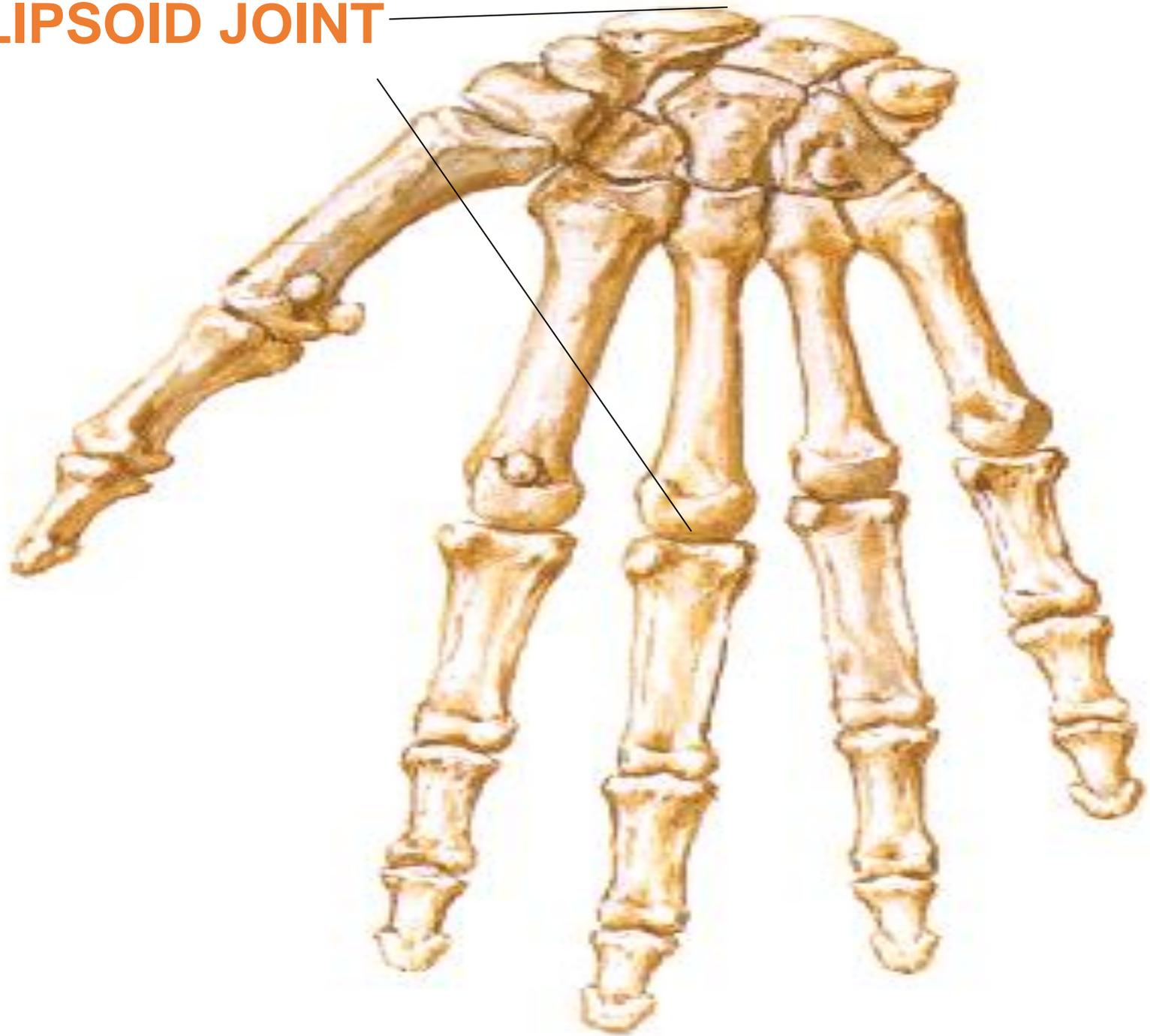
BIAXIAL

CONDYLAR JOINT

Right Knee in Extension



ELLIPSOID JOINT

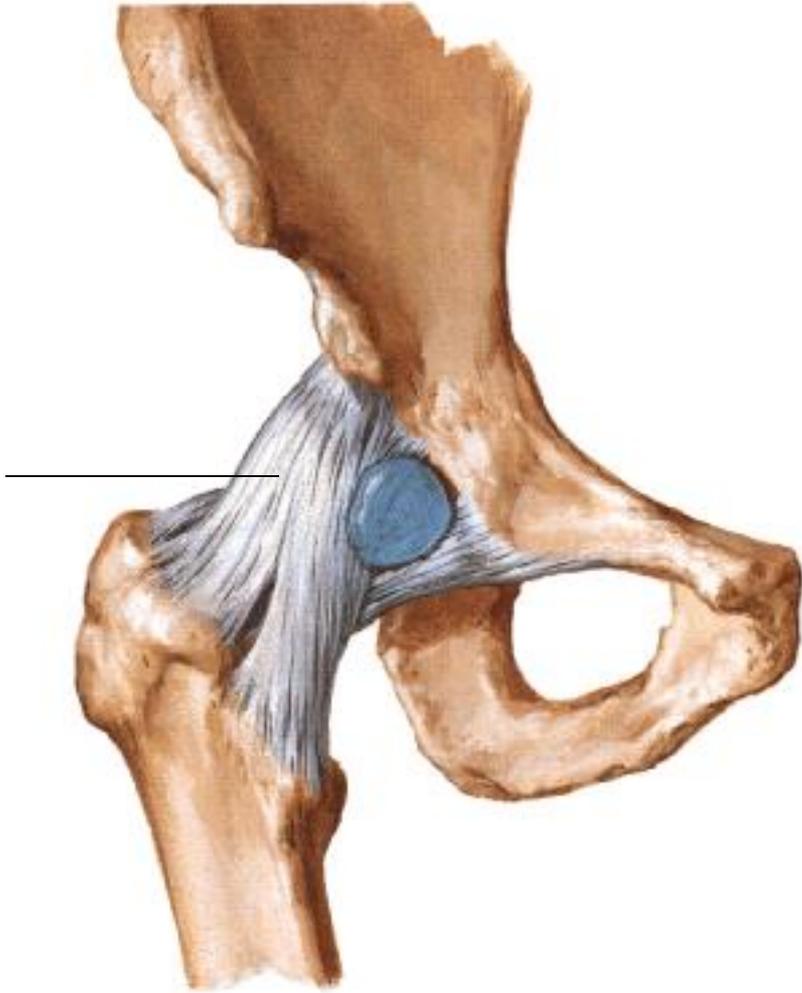


MULTIAXIAL JOINT

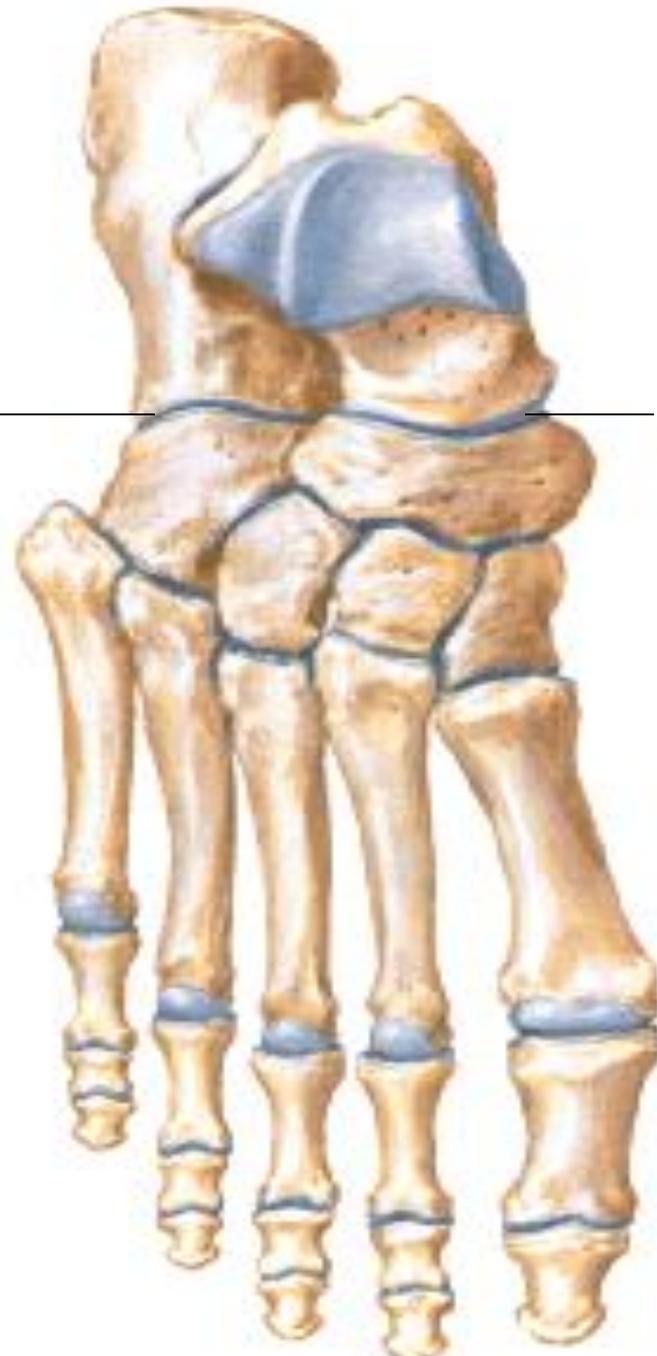
**SHOULDER
JOINT**



HIP JOINT

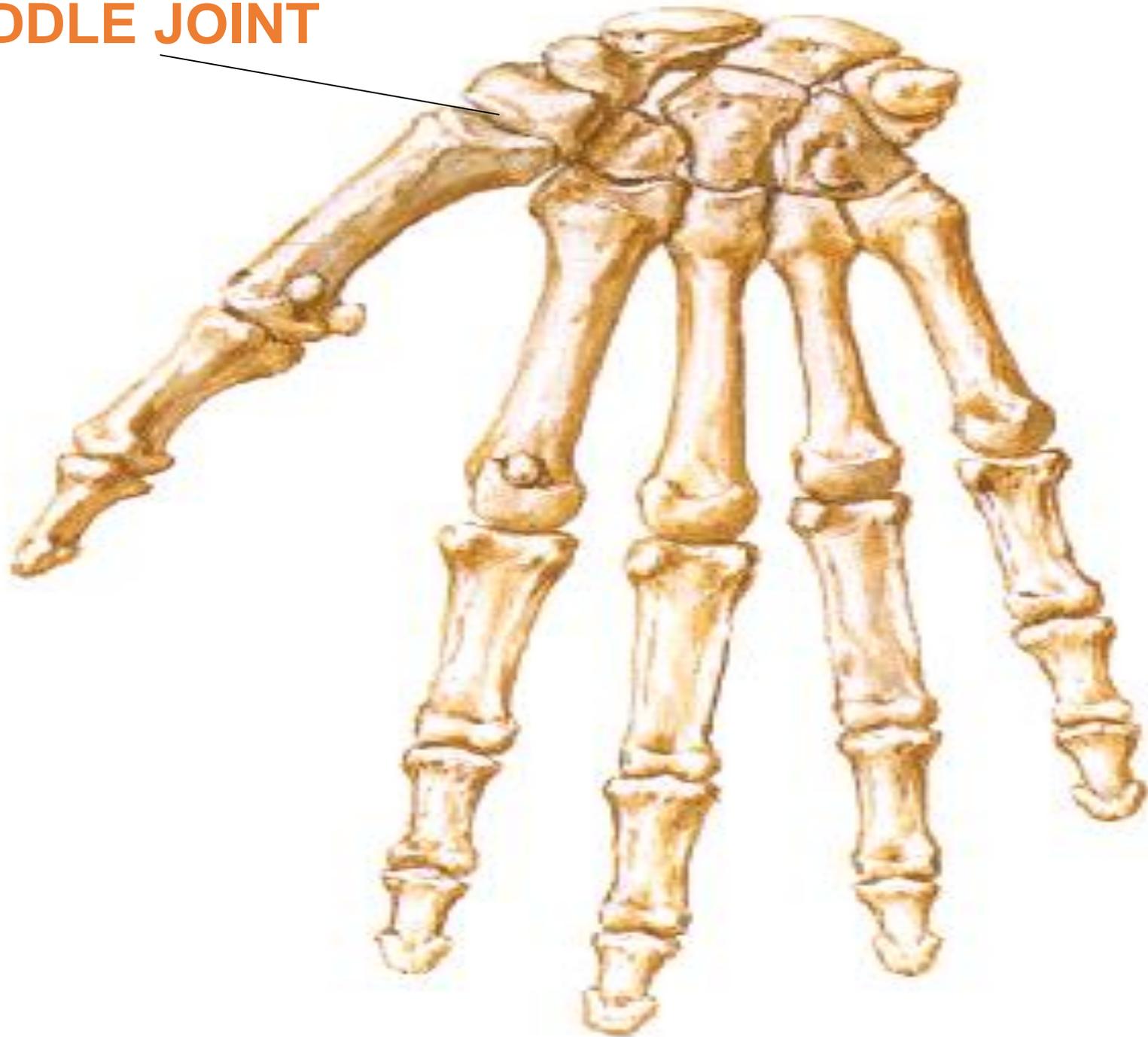


SADDLE JOINT



**BALL & SOCKET
JOINT**

SADDLE JOINT



Classification of Synovial Joints

(According to the number of bones)

- **SIMPLE JOINT** Interphalangeal joint
- **COMPOUND JOINT** elbow ,wrist
- **COMPLEX JOINT** temporomandibular joint

APPLIED ANATOMY

1. DISLOCATION OF JOINT

2. SPRAIN

3. ARTHRITIS

4. STIFFNESS OF JOINTS

5. NEUROPATHIC JOINTS