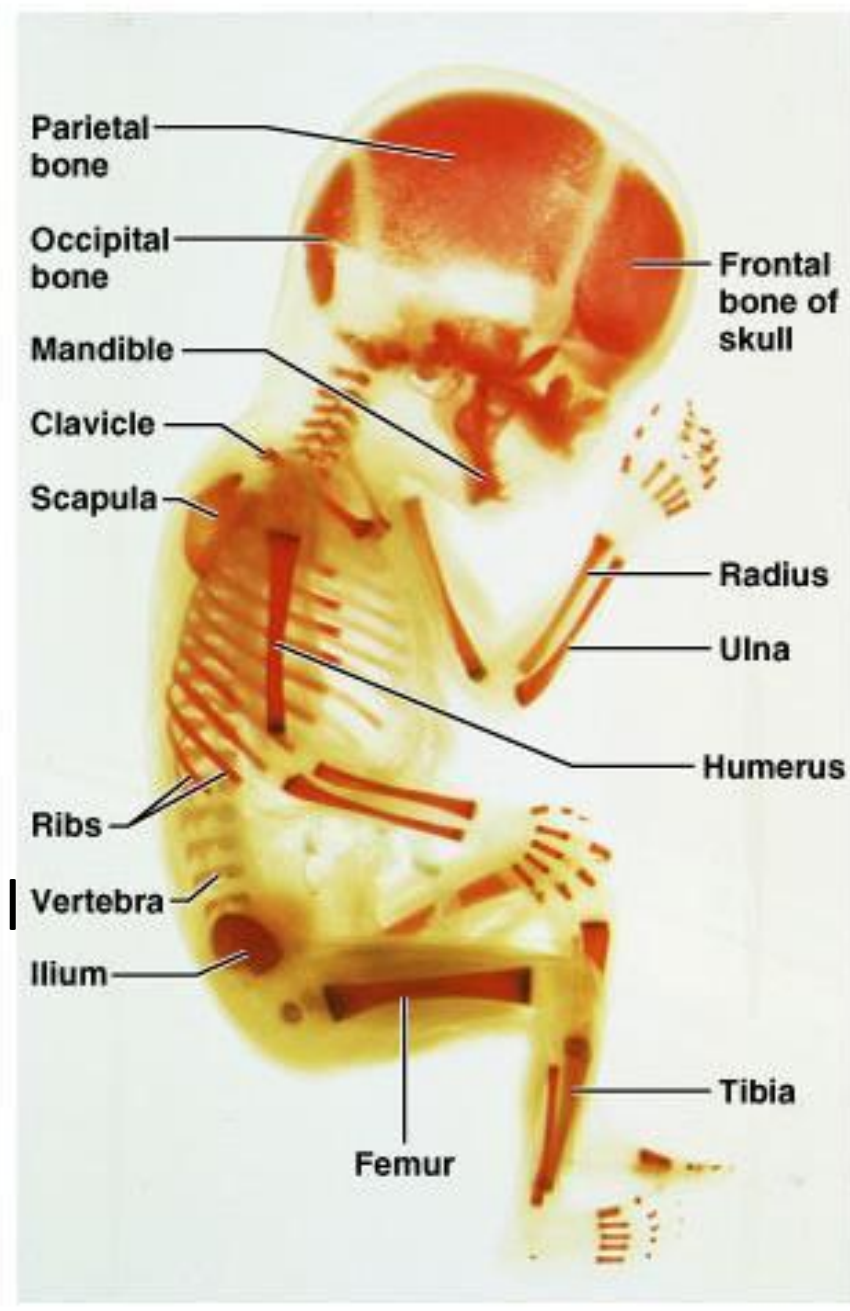
Cartilage

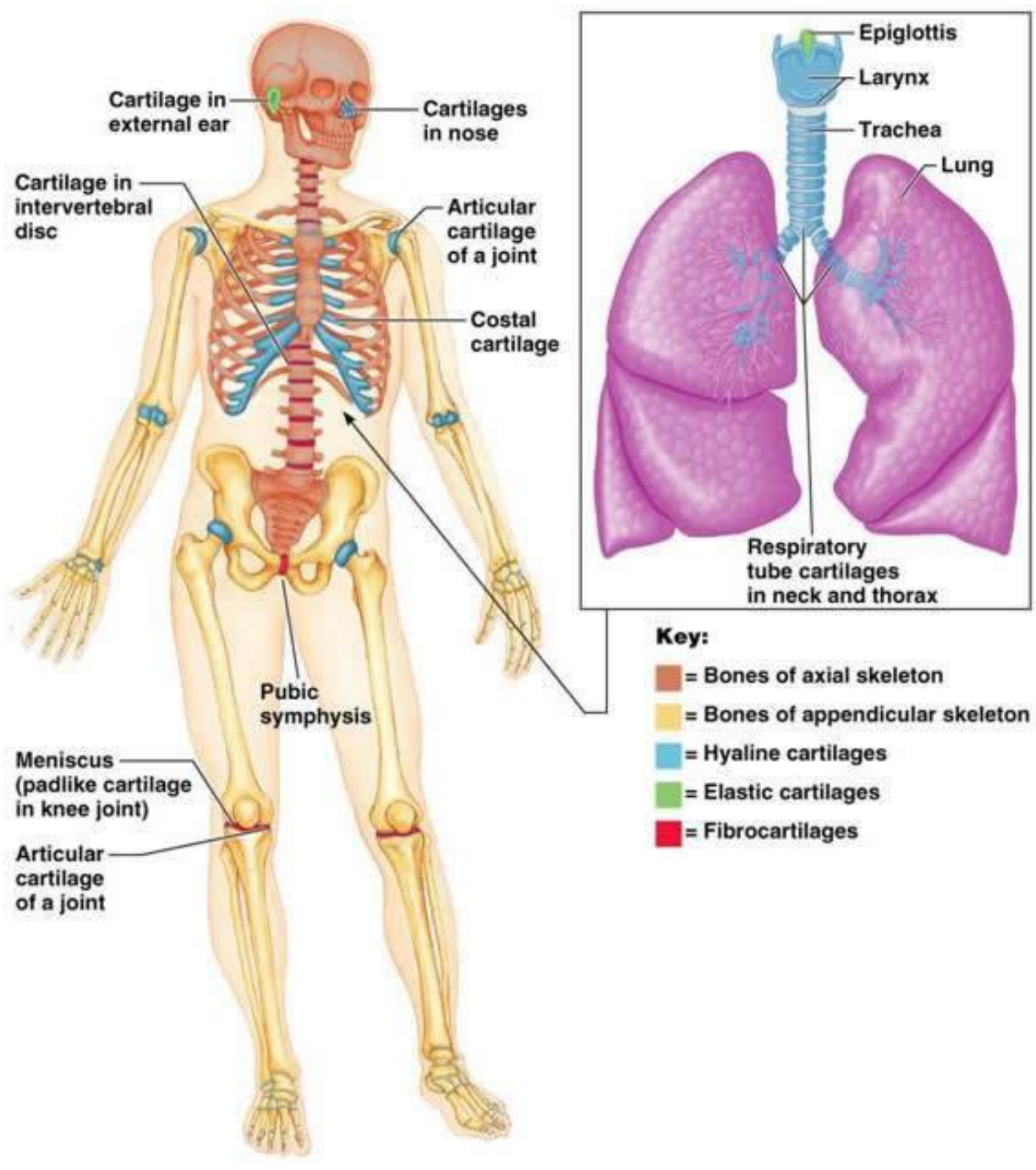
In Developing Embryo
More prevalent than in adult

Skeleton initially mostly cartilage

Bone replaces cartilage in fetal and childhood periods.

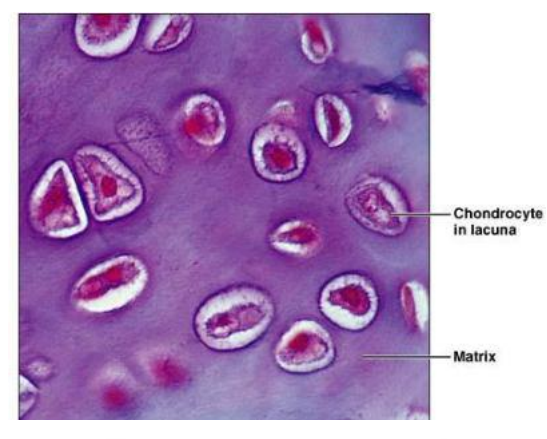


Cartilage is connective tissue.

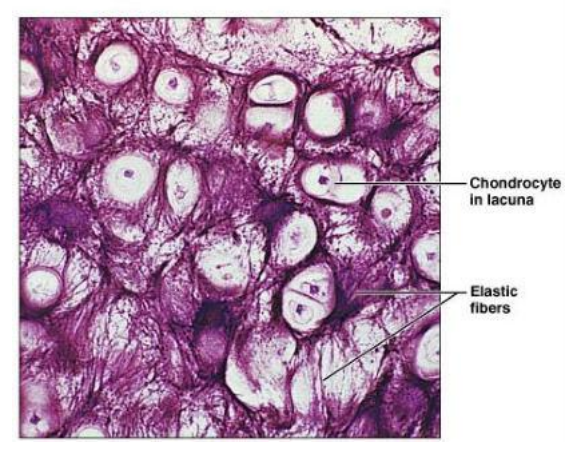


Types of cartilage

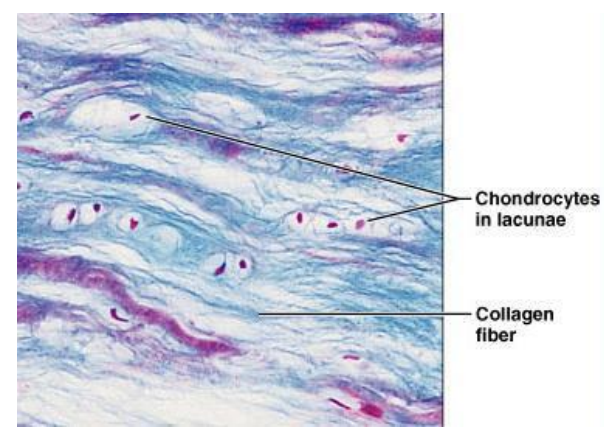
1. **Hyaline cartilage**



2. **Elastic cartilage**



3. **Fibrocartilage**

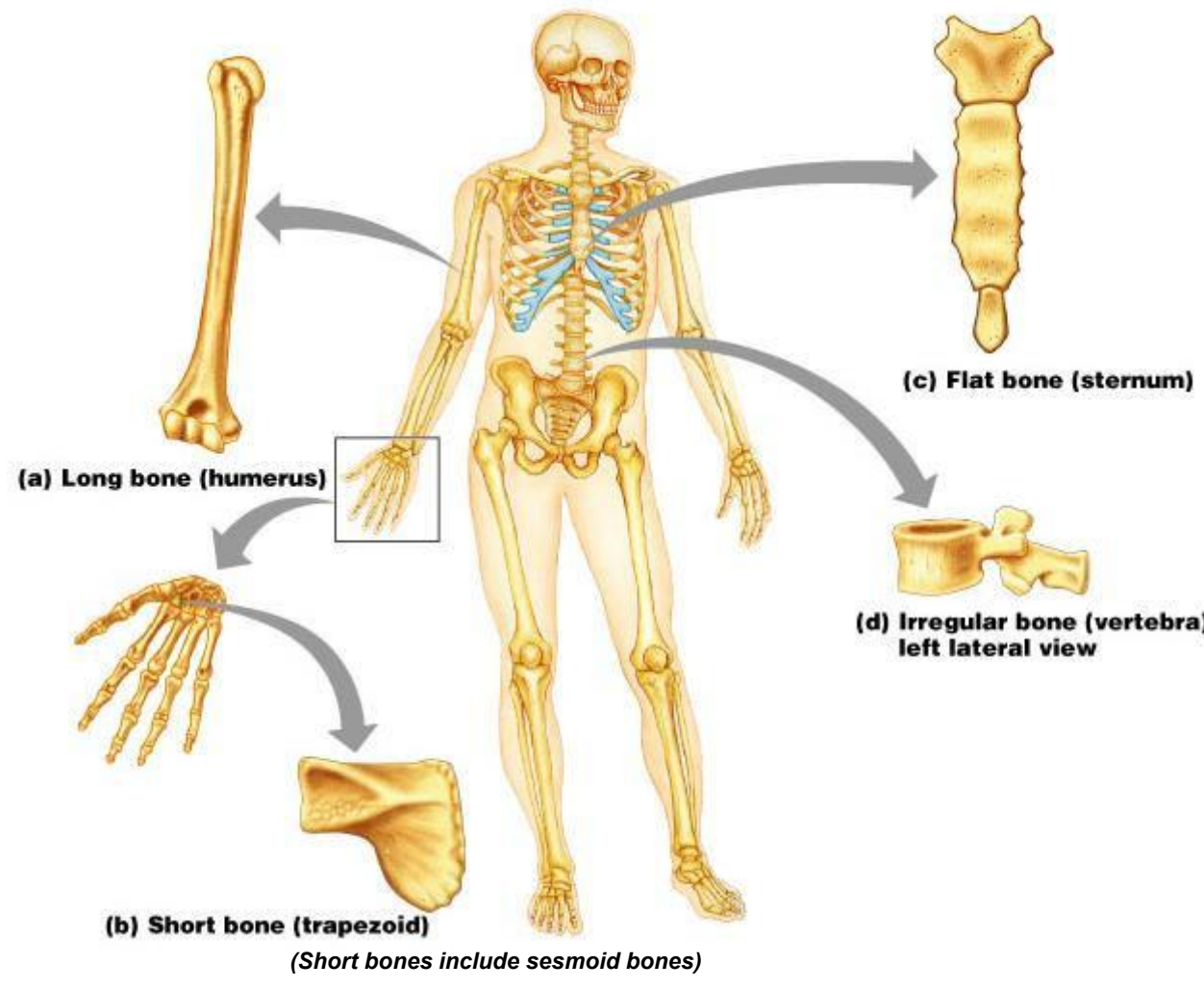


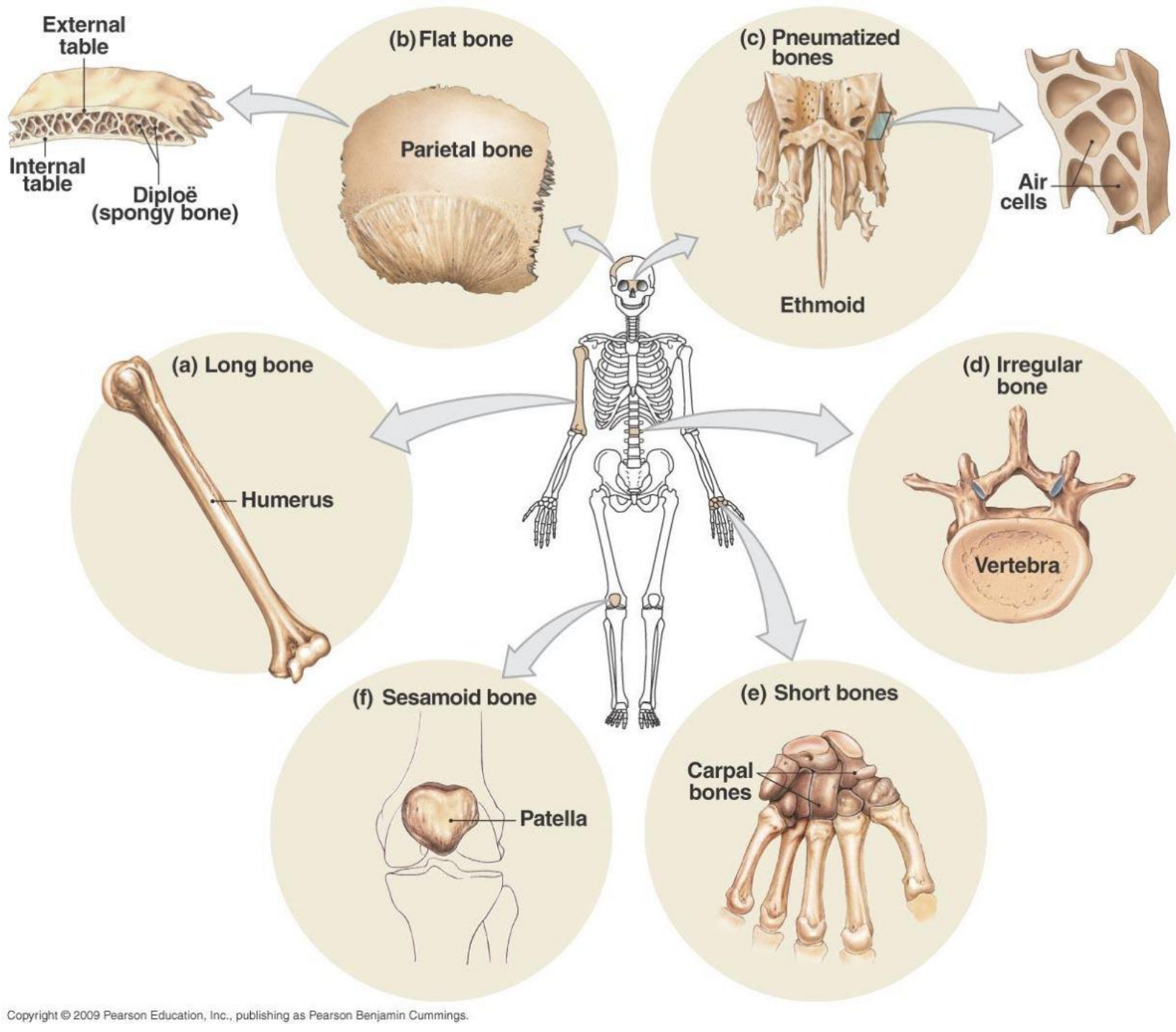
Bones

- 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

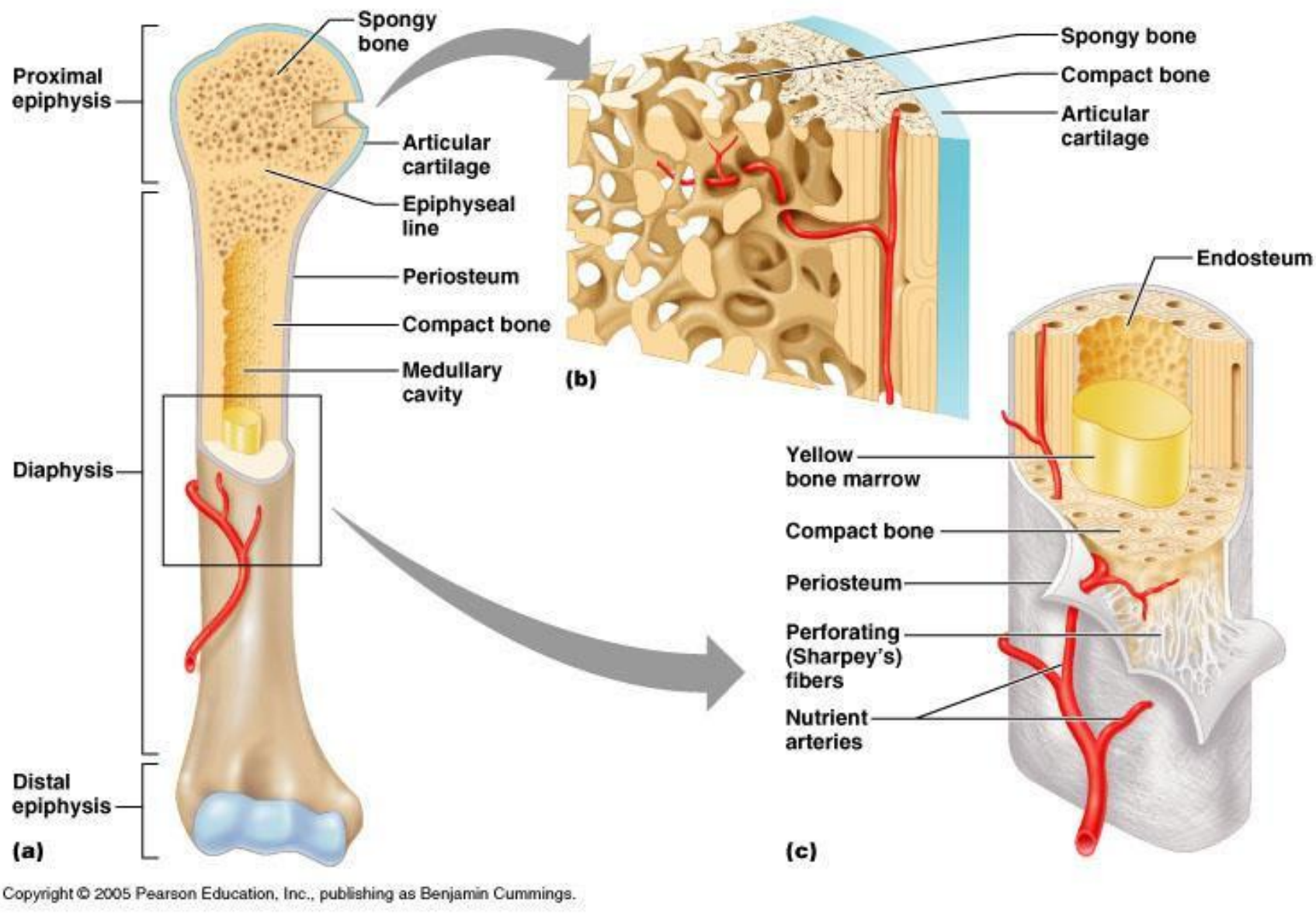
Classification of bones by shape

- 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

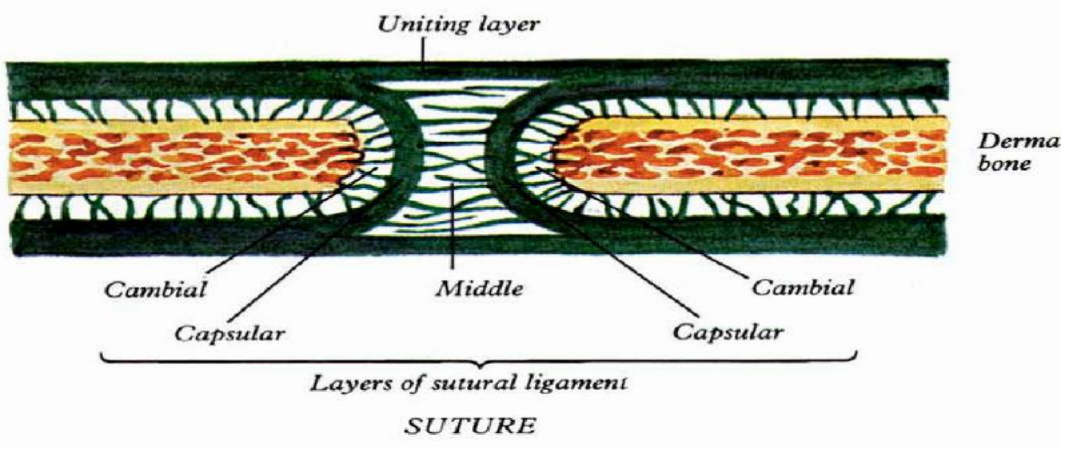
Movements

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

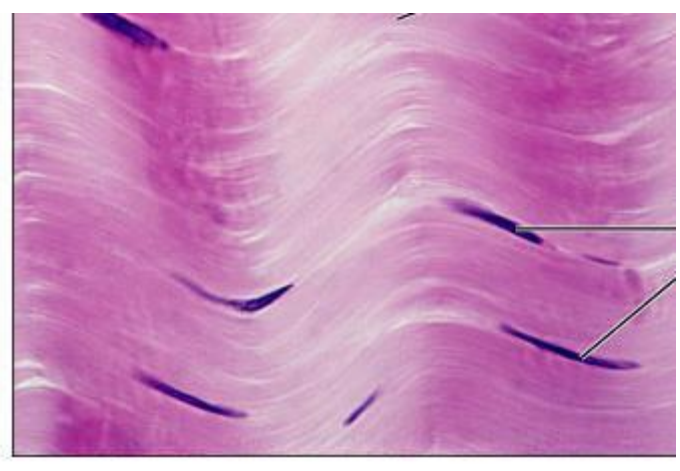
SYNARTHROSES / FIBROUS JOINTS

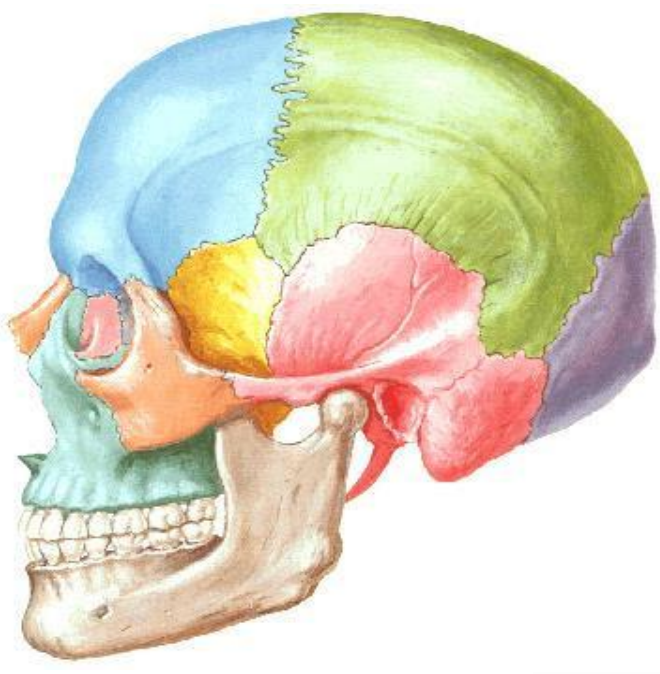
- Bones connected by fibrous tissue: dense regular connective tissue
- No joint cavity
- Slightly movable or immovable

BONE— fibrous connective tissue—BONE



SUTURE


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

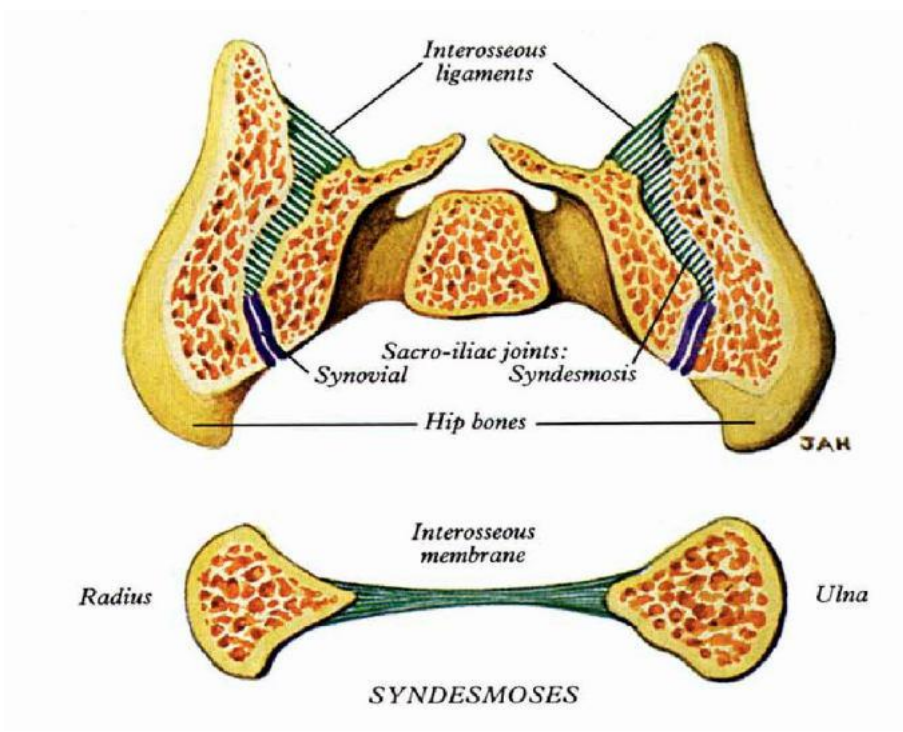


SUTURES

SCHINDYLESIS
(Ridge and groove)

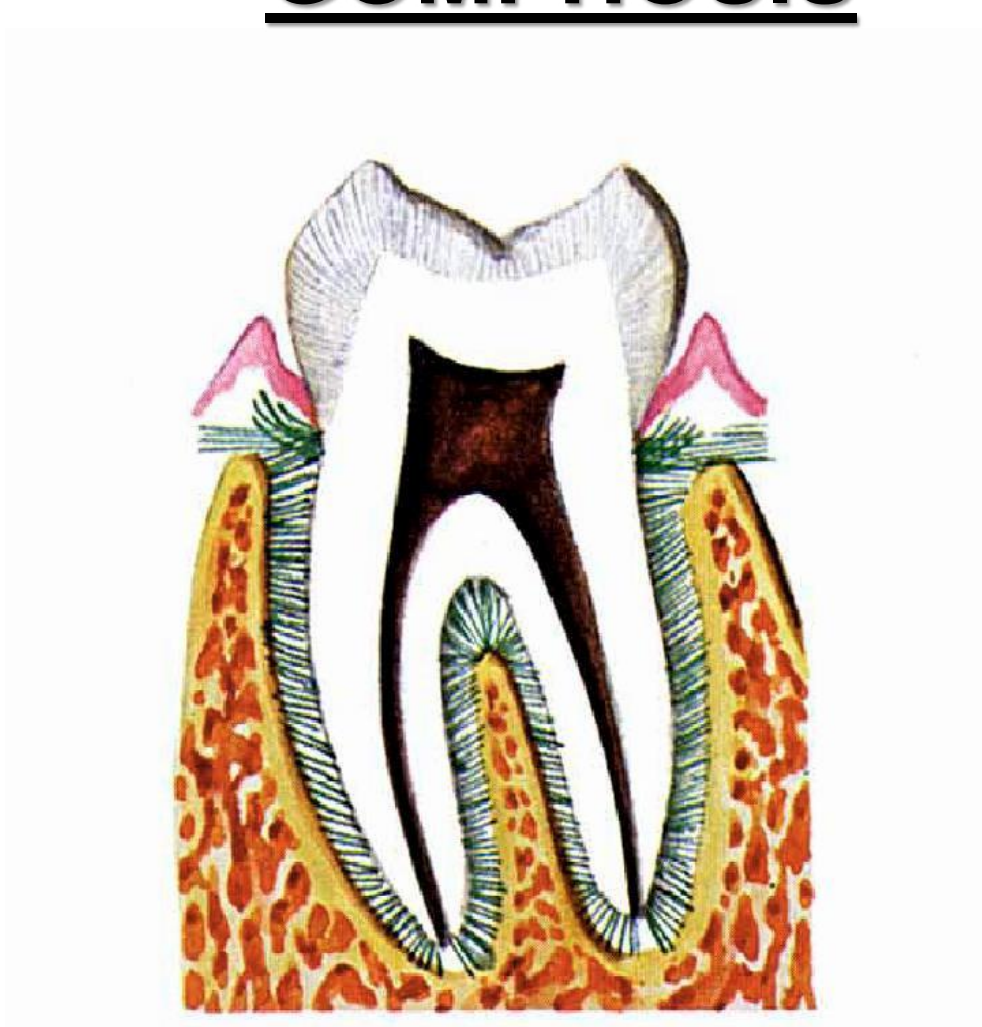
SCHINDYLESIS

SYNDESMOSIS



SYNDESMOSES

GOMPHOSIS


GOMPHOSIS
(Dentoalveolar joint)

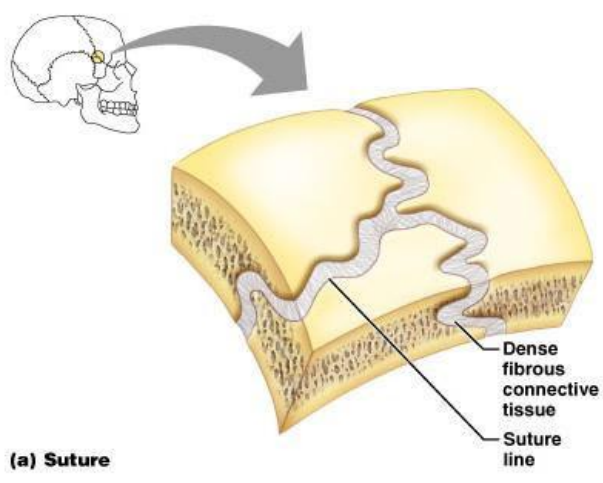
SUTURES

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**"



TYPES OF SUTURES

PLANE SUTURE

•Simple apposition of contiguous surfaces,

• usually rough and reciprocally irregular,

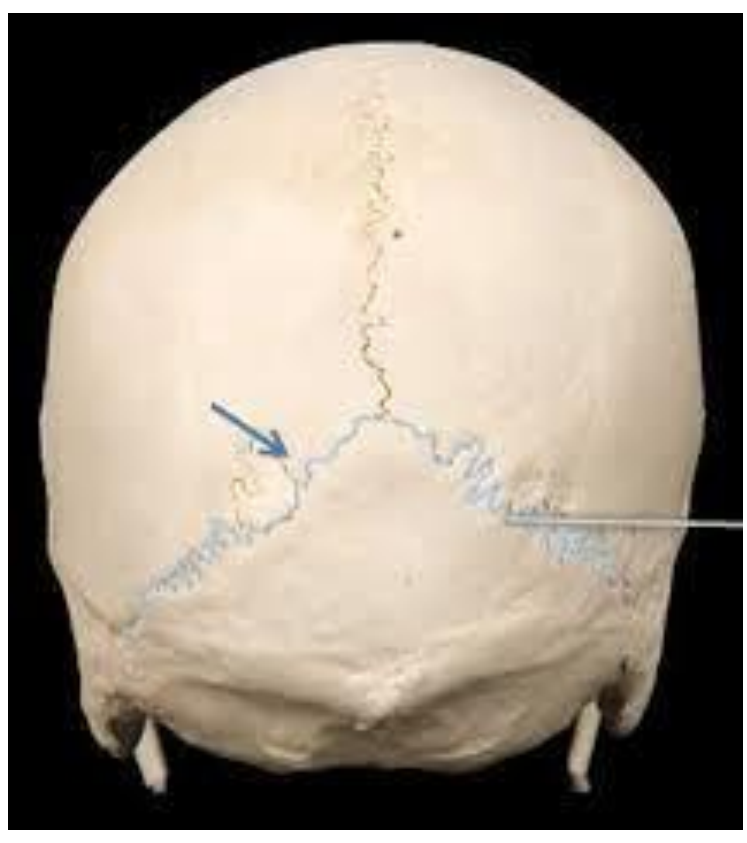
Examples

• sutures between the palatine bones,

• between the maxillae and at the palatomaxillary sutures.

Denticulate Suture

Has small tooth like projections, often widening towards their ends to provide effective interlocking.

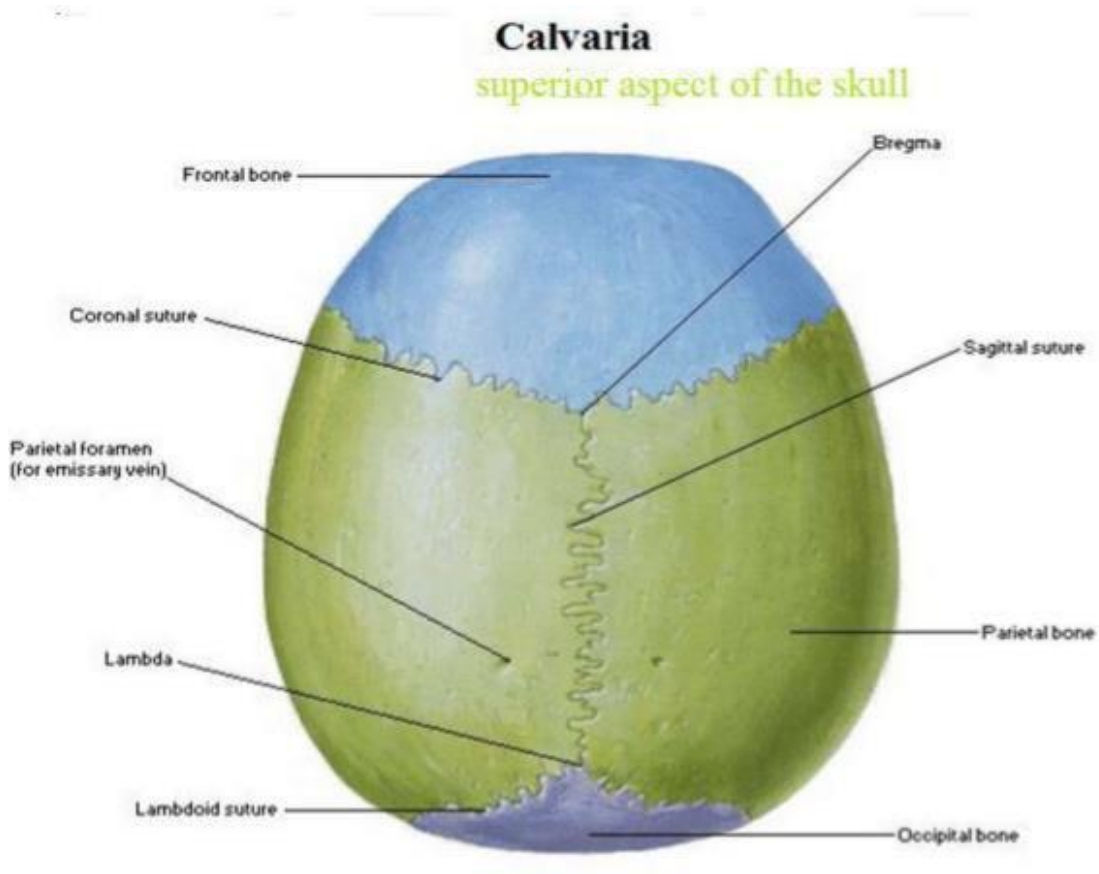


When united by sutural ligament and periosteum, such sutures are almost completely immobile

The lambdoid suture is a denticulate suture.

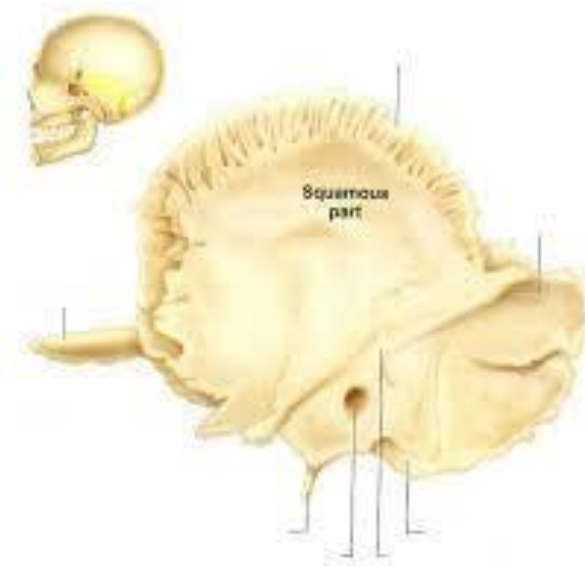
SERRATED SUTURE

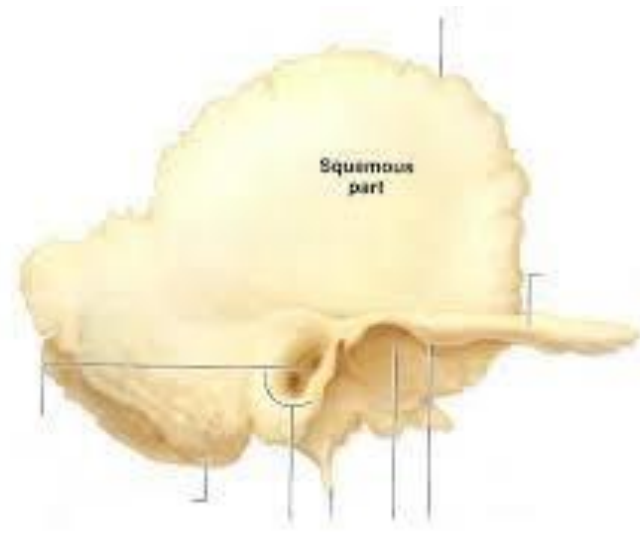
The sagittal suture is serrated.



Squamous suture

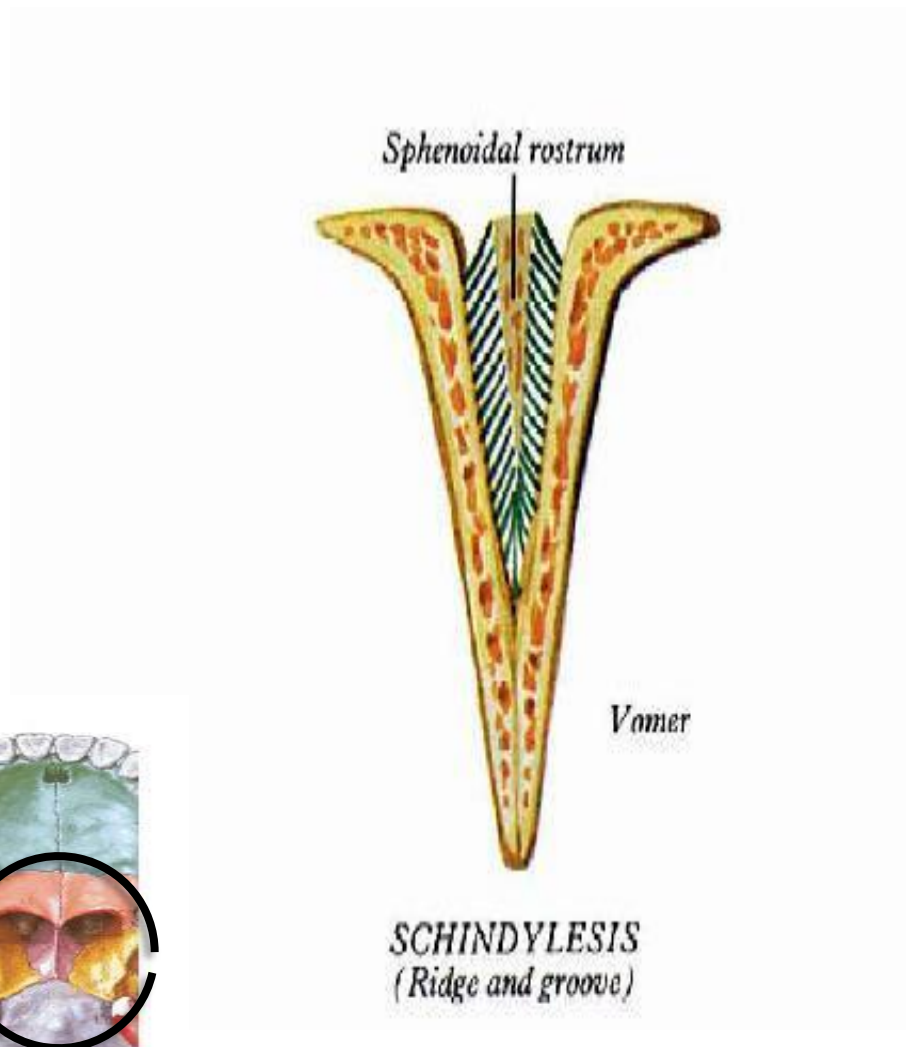
Where bones overlap, as at the temporo-parietal suture, a squamous suture is formed; the adjacent bone surfaces are reciprocally bevelled.





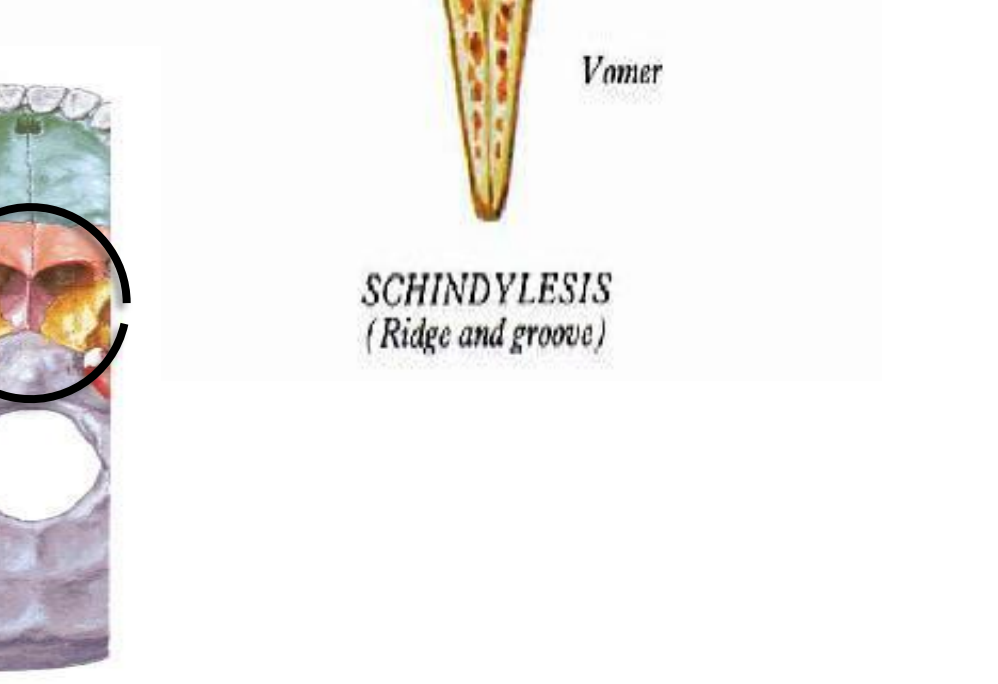
Schindylesis

- Between Ala of Vomer and
- Rostrum of Sphenoid



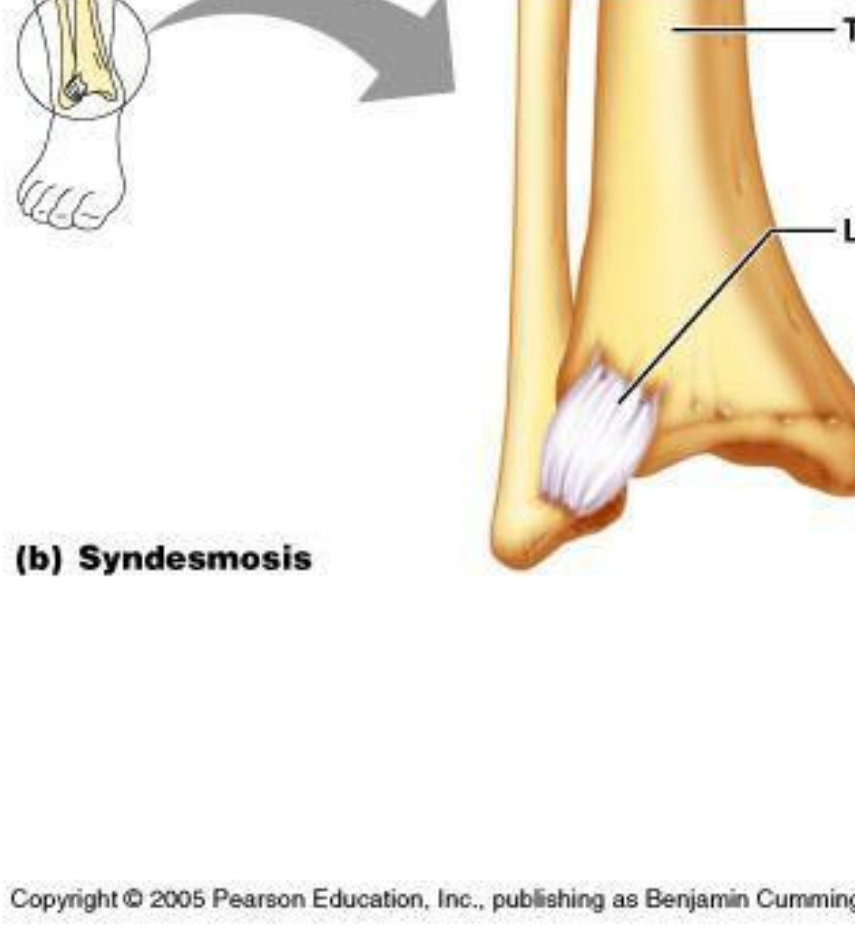
Syndesmoses

- 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

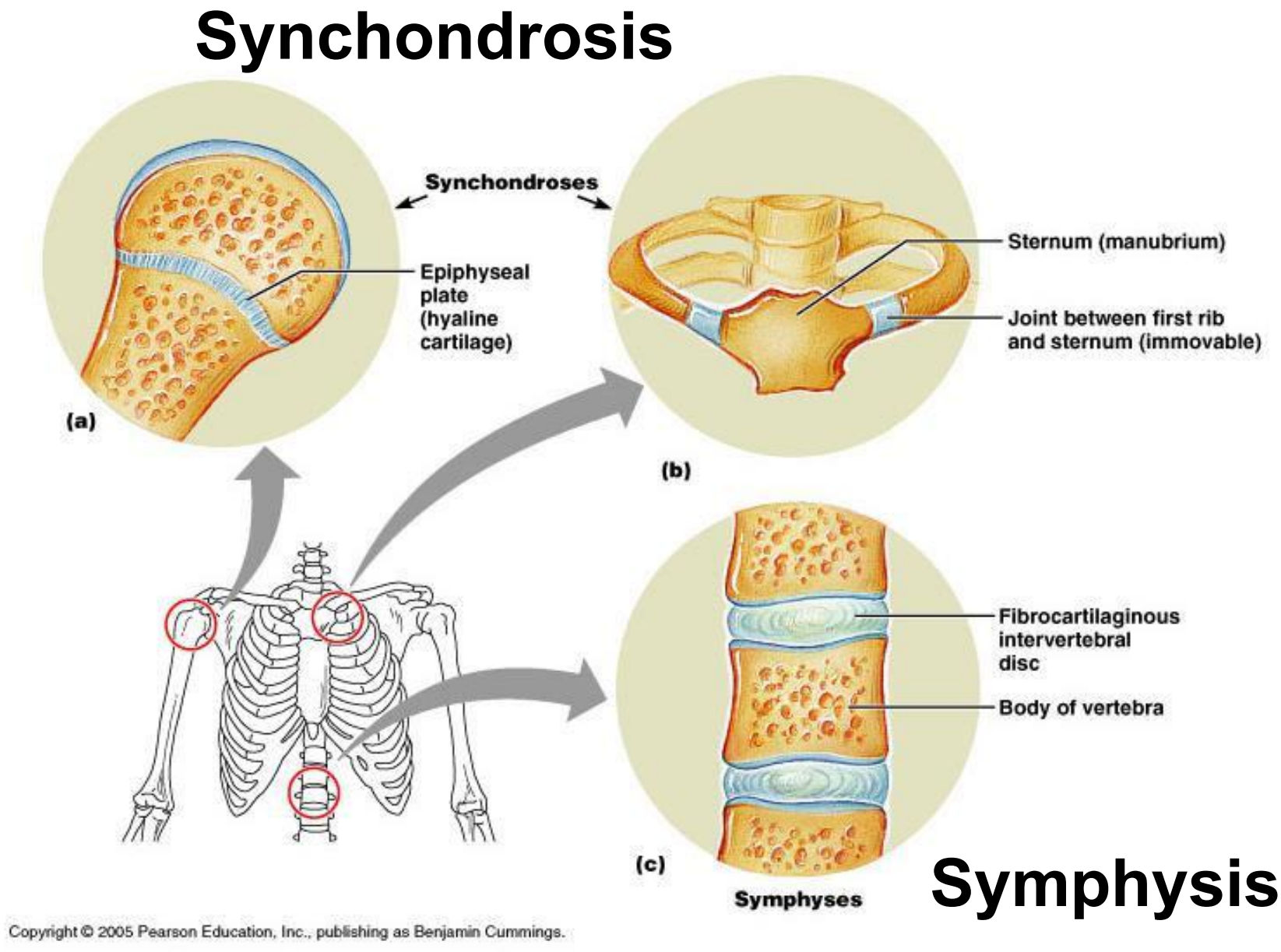


Cartilagenous joints

- 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



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

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D. Repair of bone fractures

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

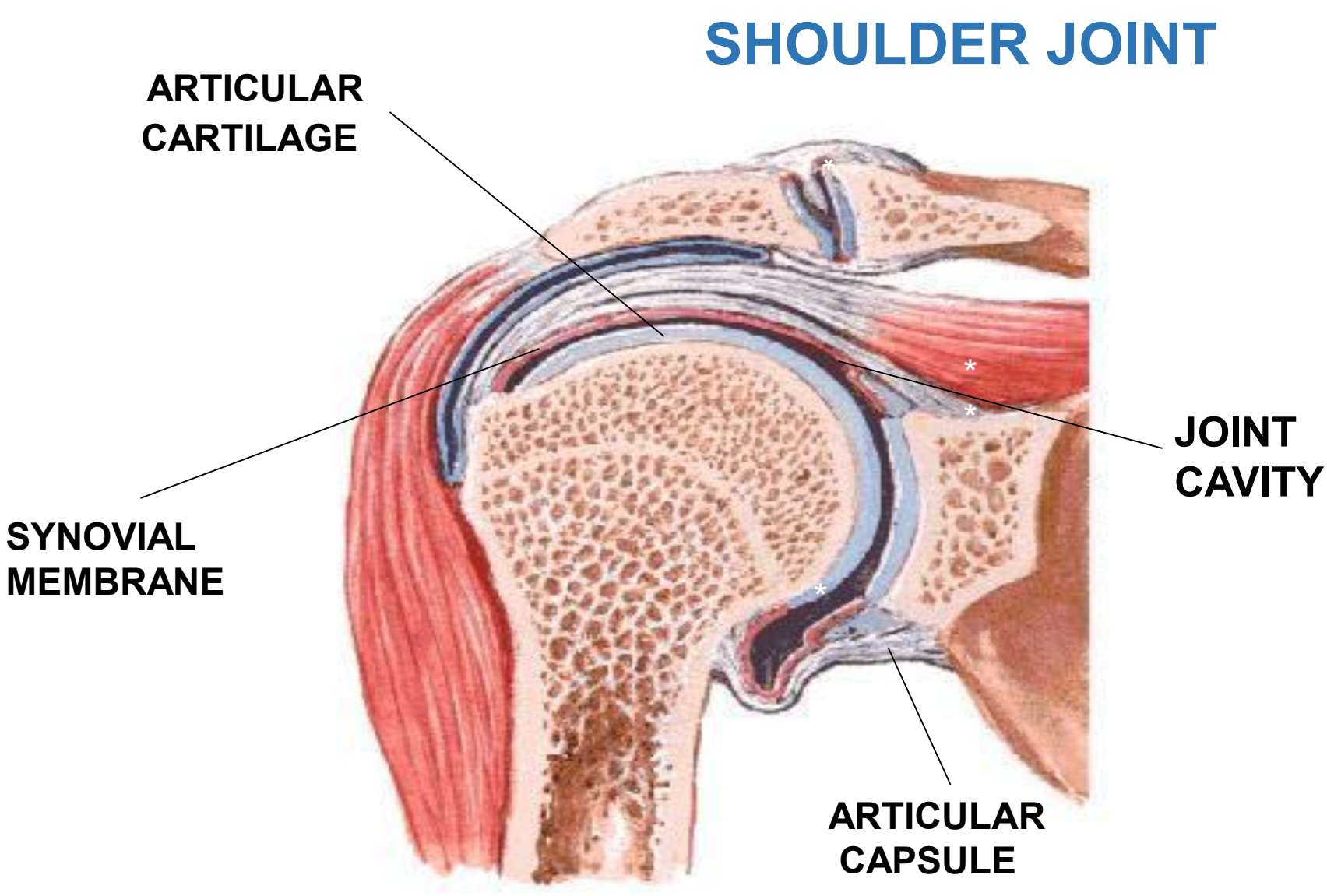
Synovial joints

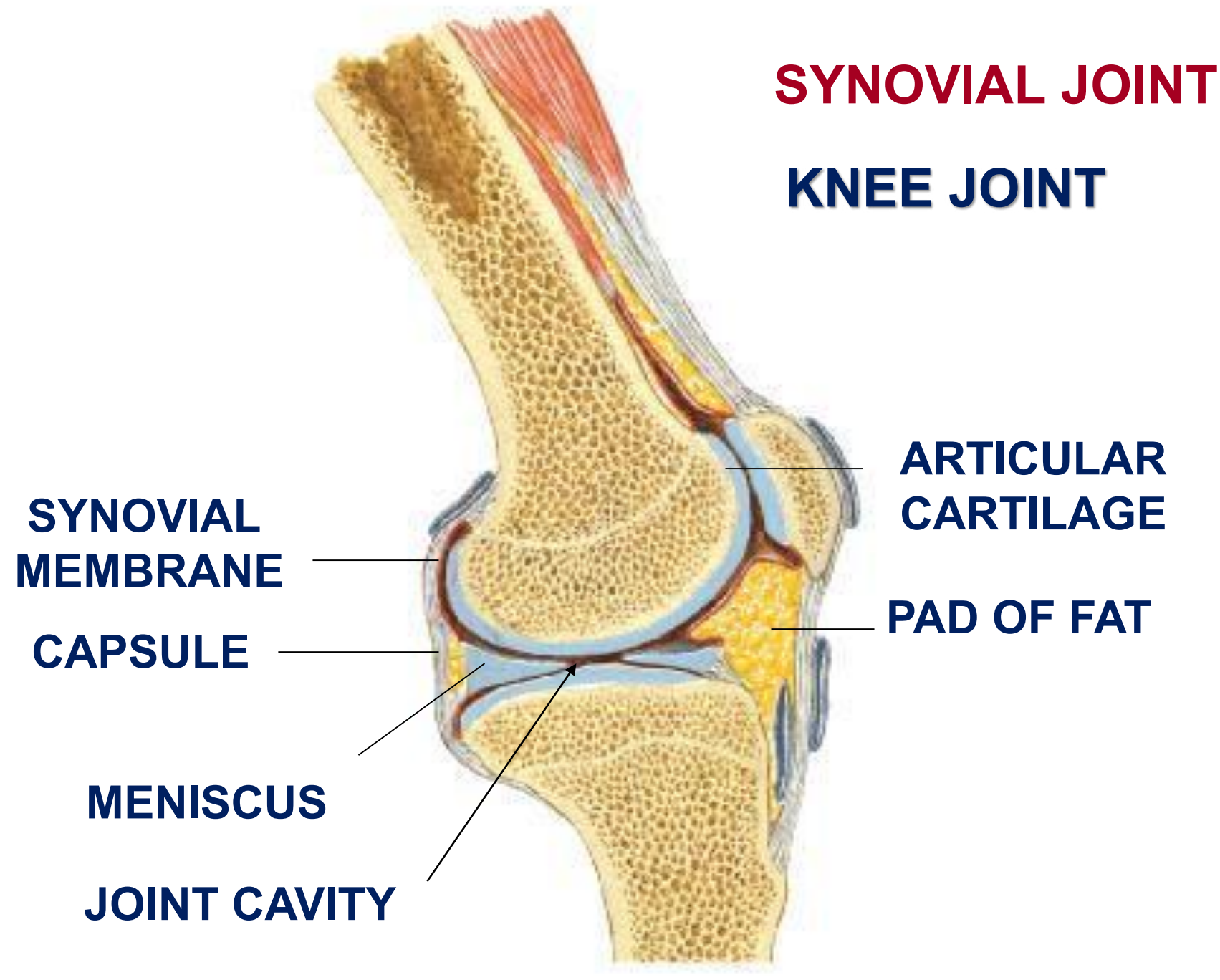
DIARTHROSES

- **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

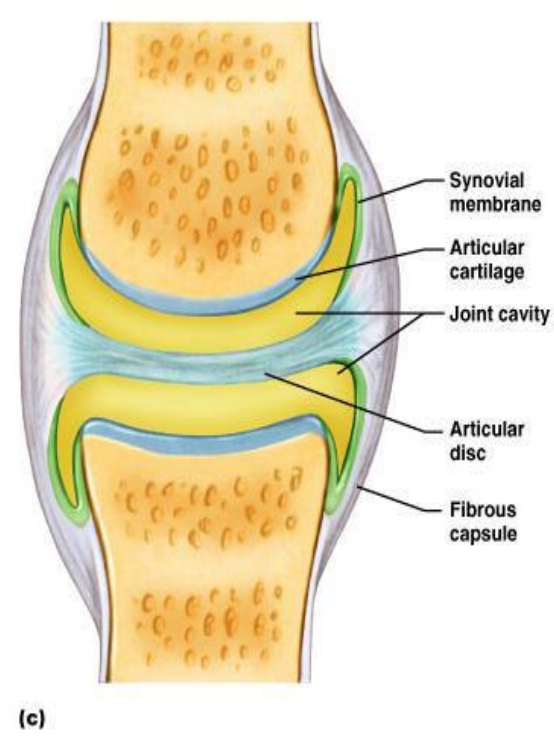




General Structure of Synovial Joints

1. **Articular cartilage**
   - Hyaline
   - Spongy cushions absorb compression
   - Protects ends of bones from being crushed

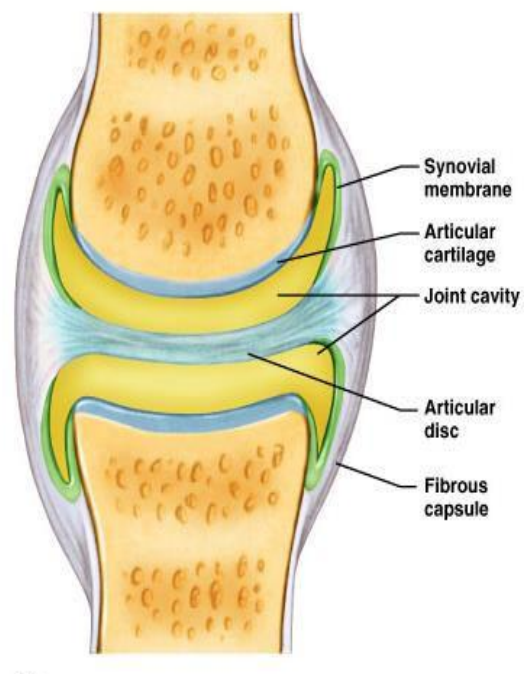
2. **Joint (synovial) cavity**
   - Potential space
   - Small amount of synovial fluid



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 surfaces *except the* cartilages*

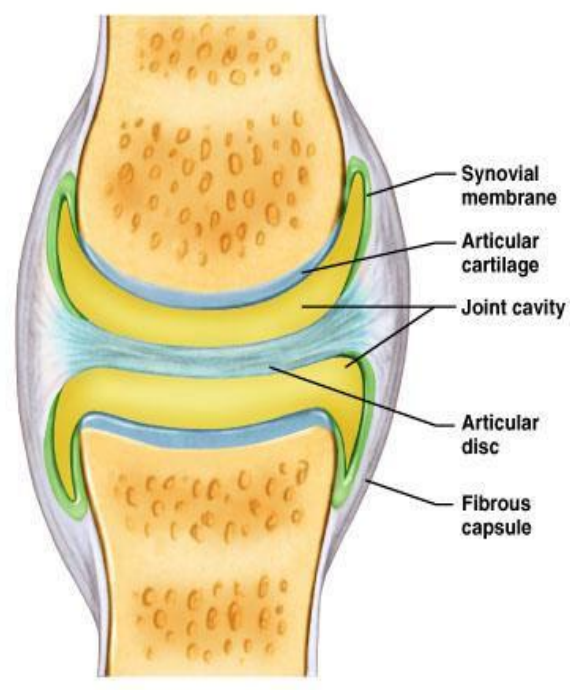


4. Synovial fluid

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

5. Reinforcing ligaments

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



6. Nerves

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

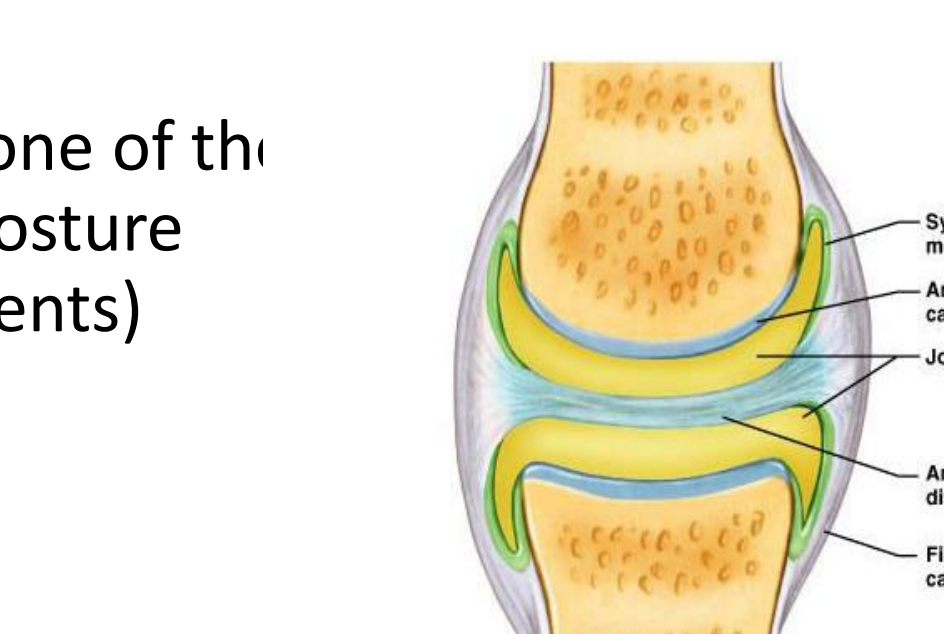
7. Blood vessels

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

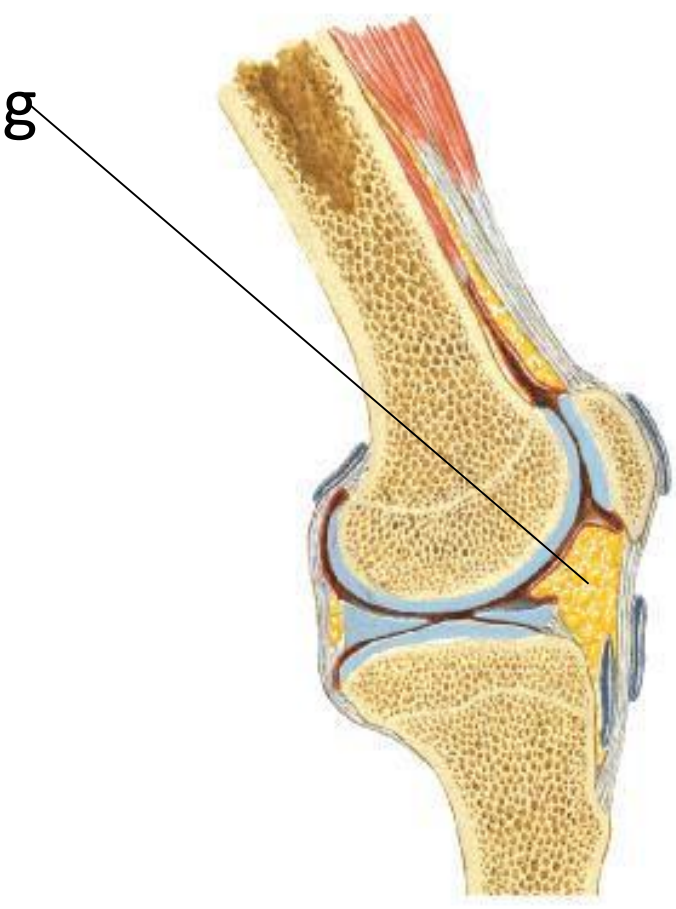
Articular disc or meniscus

(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



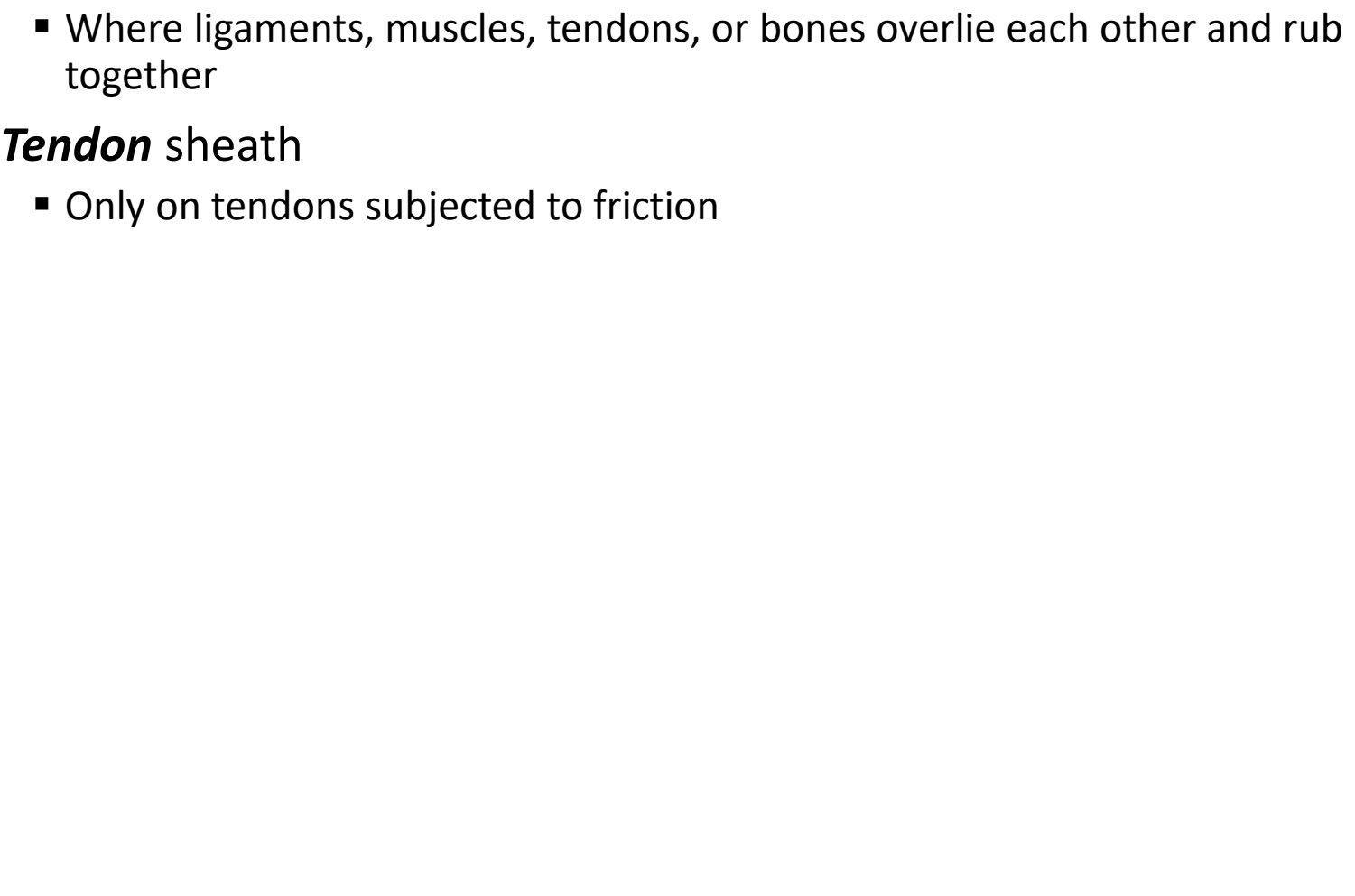
- **Fatty pads** are found in some synovial joints lying between the synovial membrane and the fibrous capsule or bone.
- Examples are found in the hip and knee joints.



Bursae and tendon sheaths

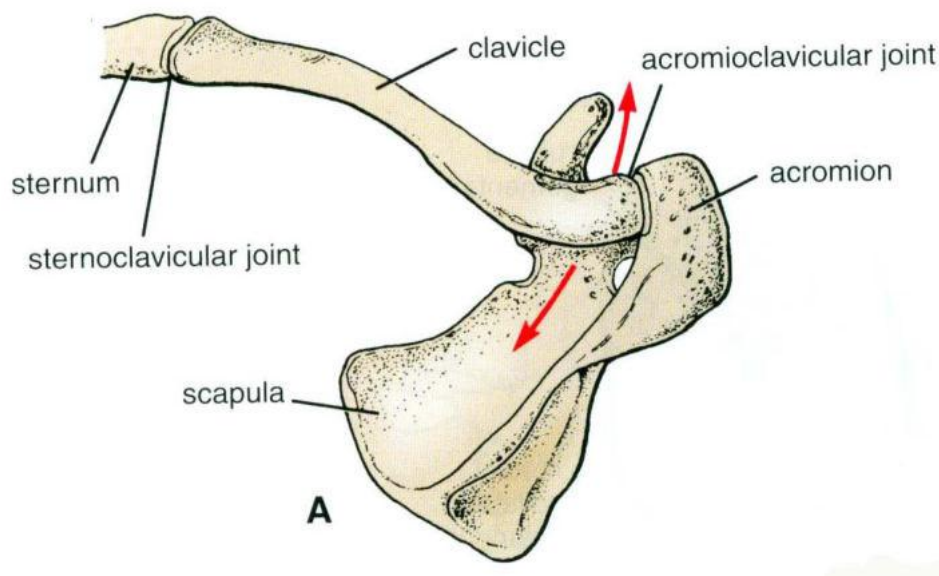
- Contain synovial fluid
- Not joints but often associated with them
- Act like ball bearings
- ***Bursa*** means “purse” in Latin
  - Flattened sac lined by synovial membrane
  - Where ligaments, muscles, tendons, or bones overlie each other and rub together
- ***Tendon*** sheath
  - Only on tendons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

Bursae and tendon sheaths



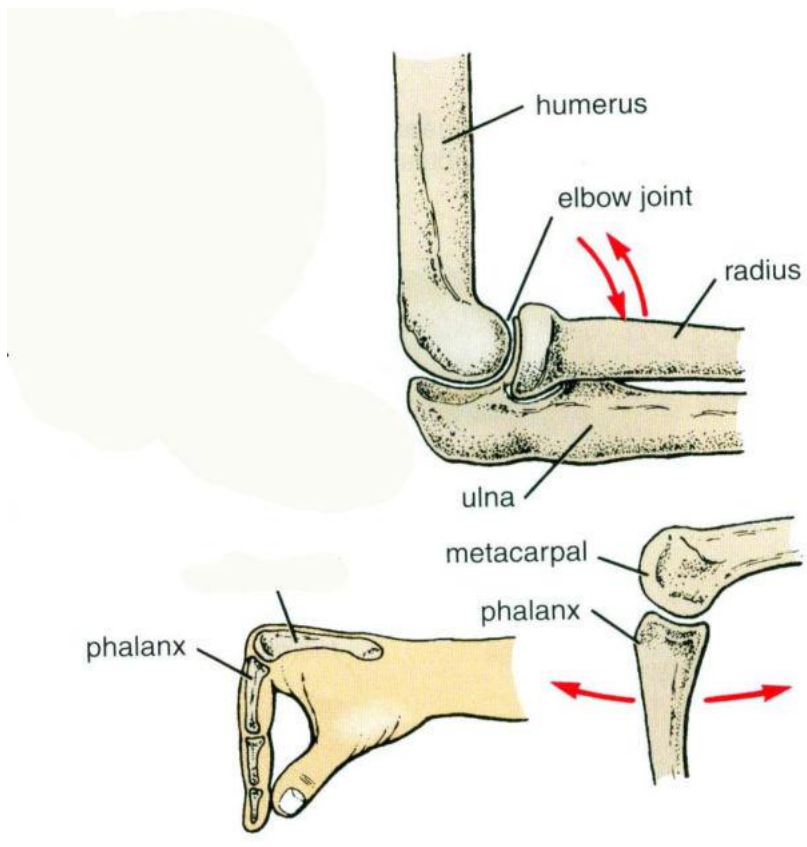
UNI-AXIAL	**Hinge Joint , Pivot Joint, Condylar Joint**
BI-AXIAL	**Condylar Joint, Ellipsoid Joint, Saddle Joint**
MULTI-AXIAL	**Ball and Socket**
NON-AXIAL	**Plane Joint**

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

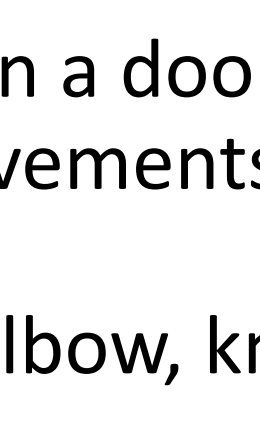
Hinge joints:



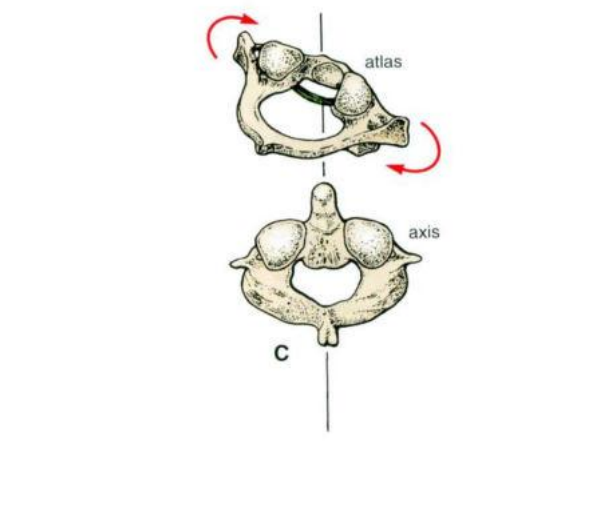
- Hinge joints resemble the hinge on a door, so that **flexion and extension** movements are possible.
  Examples of these joints are the elbow, knee, and ankle joints

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

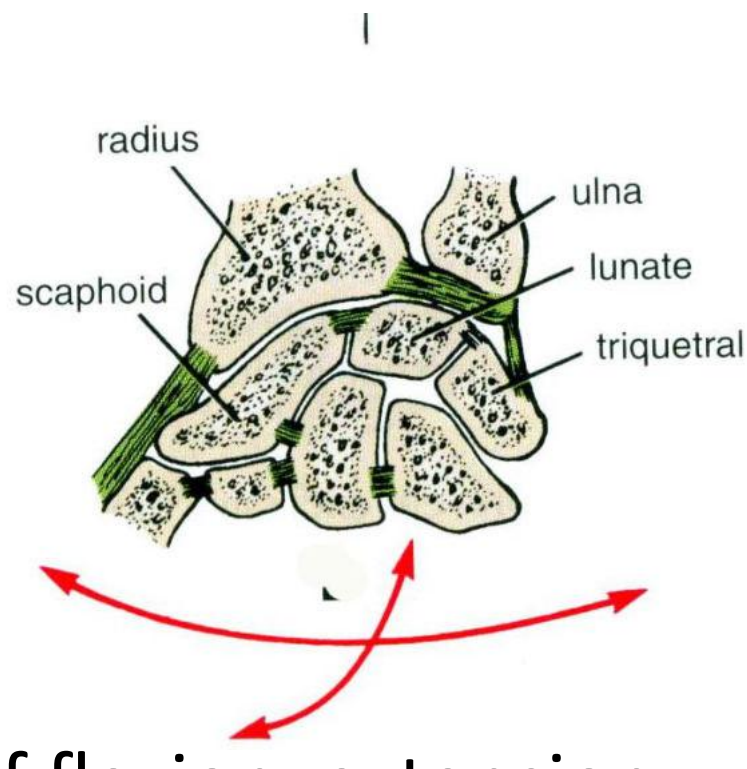


Condylar joints



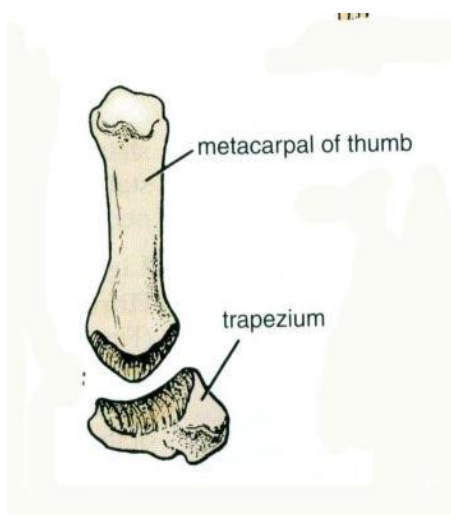
- Condyloid joints have two distinct convex surfaces that articulate with two concave surfaces.
- The movements of **flexion, extension,** with a small amount of **rotation**.
- E.g. knee joint , temporo-mandibular joint

Ellipsoid joints



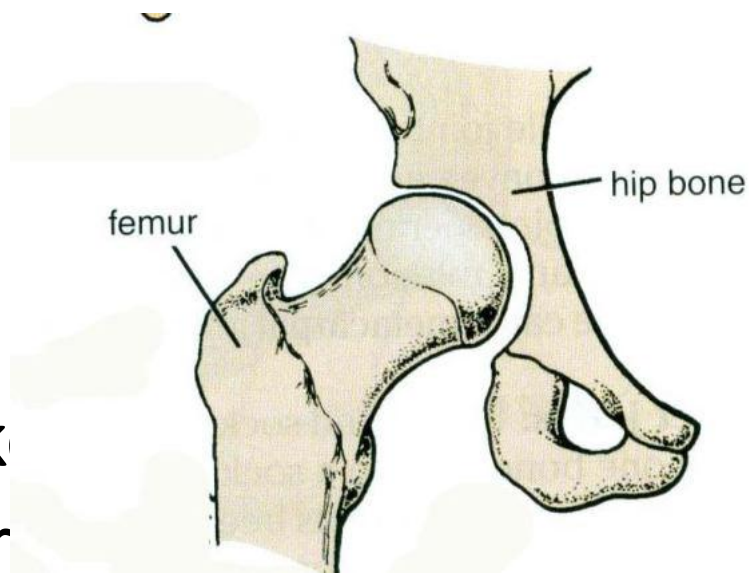
- In ellipsoid joints, an elliptical convex articular surface fits into an elliptical concave articular surface. The movements of flexion, extension, abduction, adduction and circumduction can take place, but rotation is impossible.
- E.g. wrist joint, metacarpophalangeal joint

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:

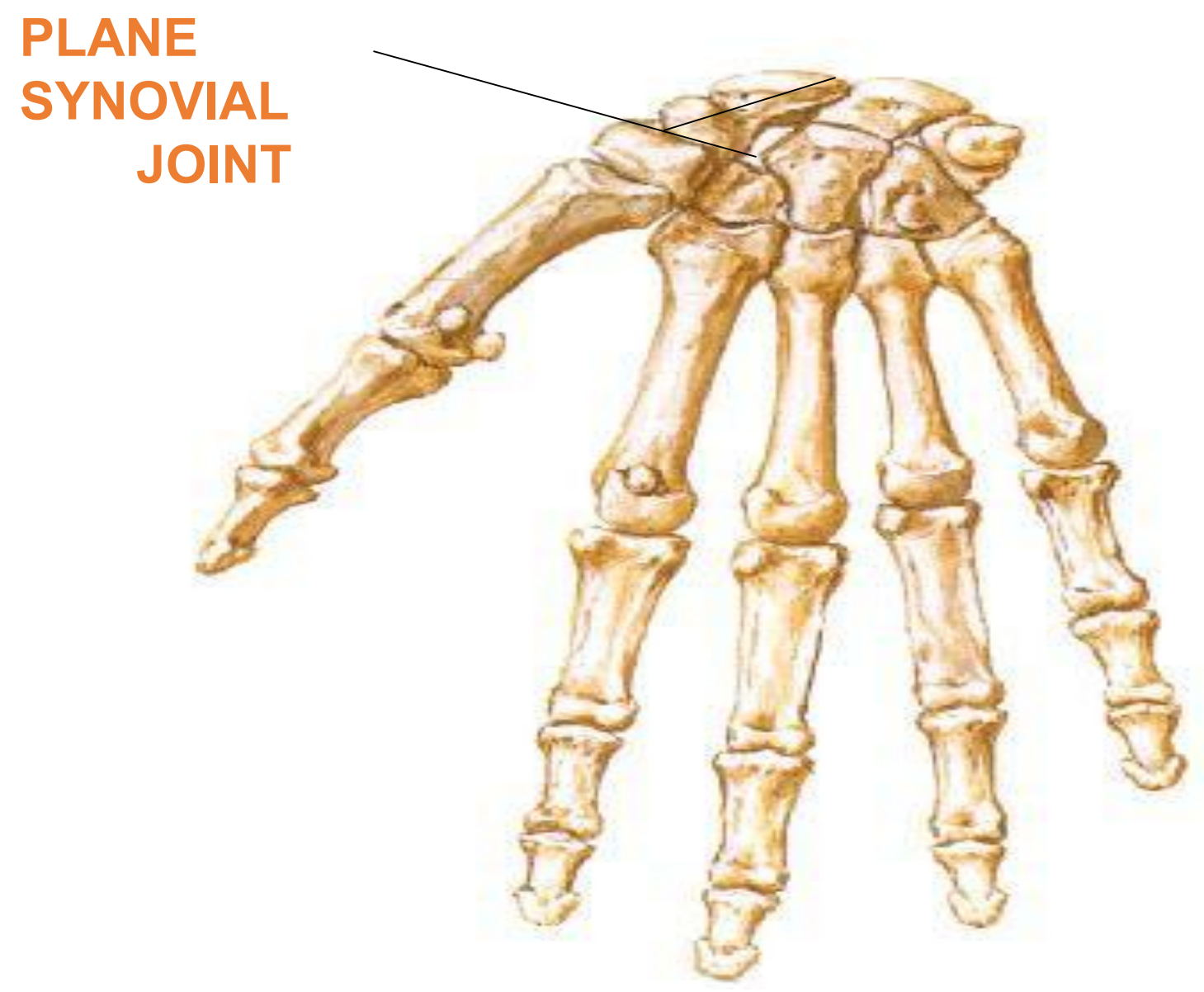
- the shape,
- size,
- arrangement of the articular surfaces;
- the ligaments;
- and the tone of the muscles around the joint.

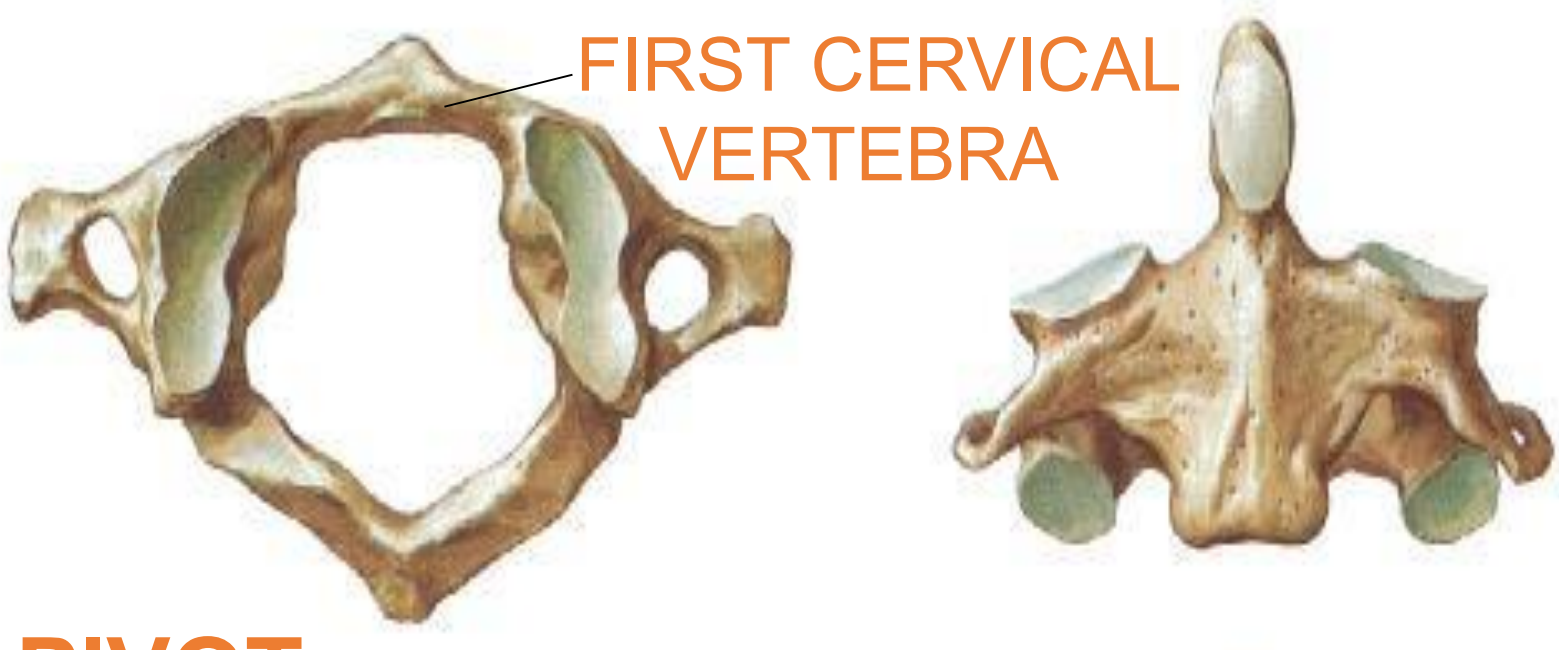
MECHANISM OF LUBRICATION OF SYNOVIAL JOINT

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

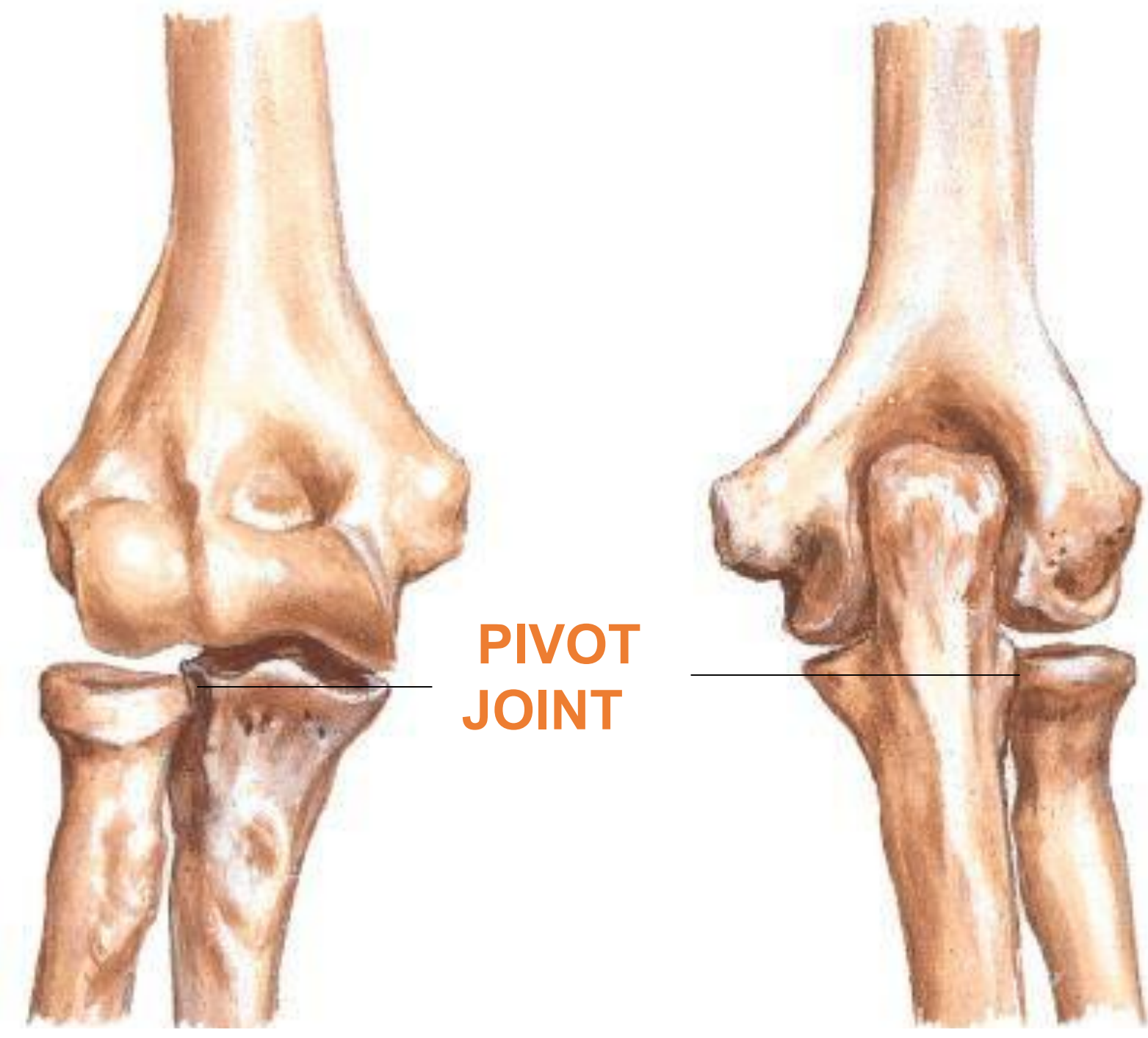
Nerve Supply of Joints

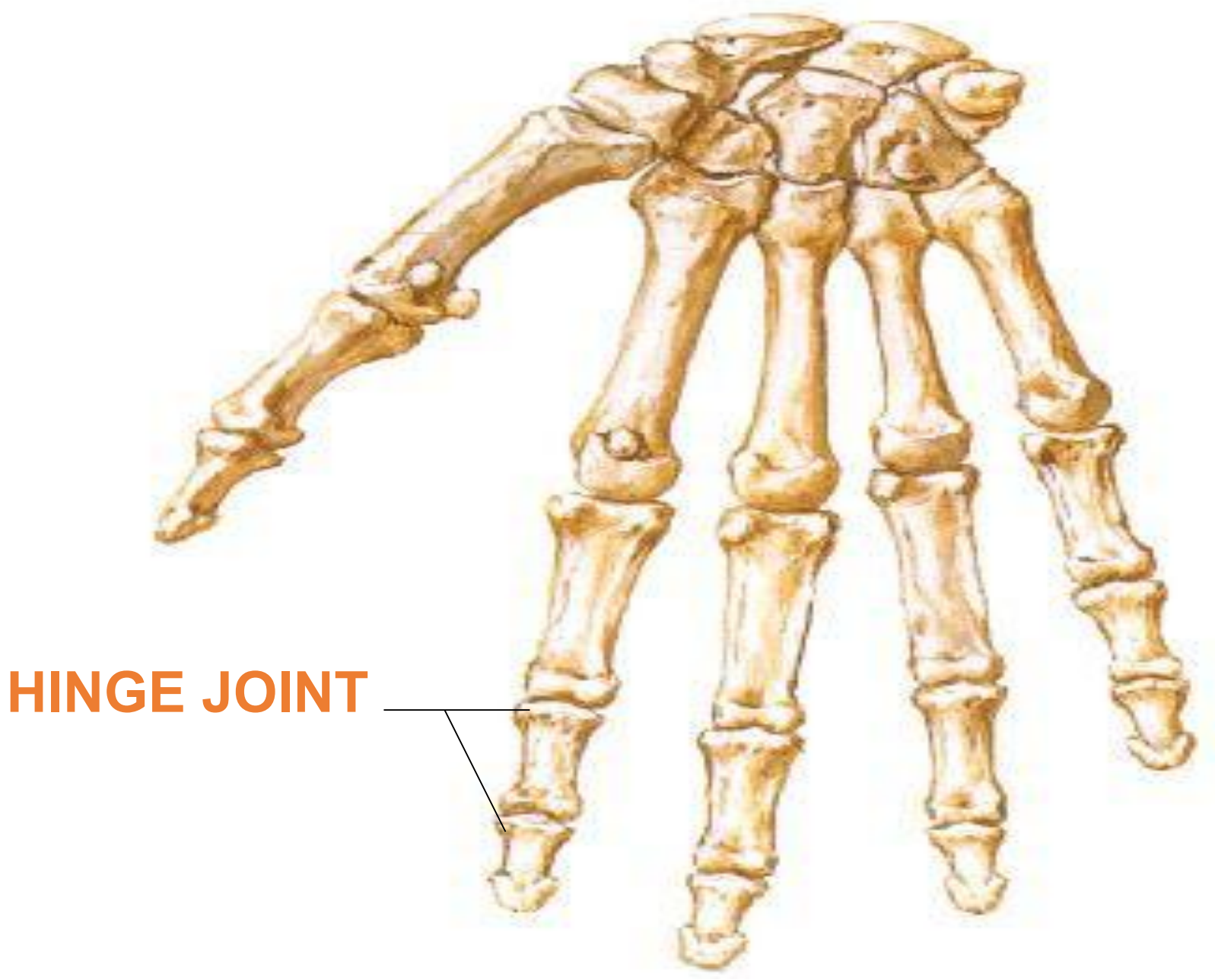
- The capsule and ligaments receive an **abundan**t sensory nerve supply.
- A sensory nerve supplying a joint also supplies the muscles moving the joint and the skin overlying the insertions of these muscles, a fact that has been codified as **Hilton's law.**

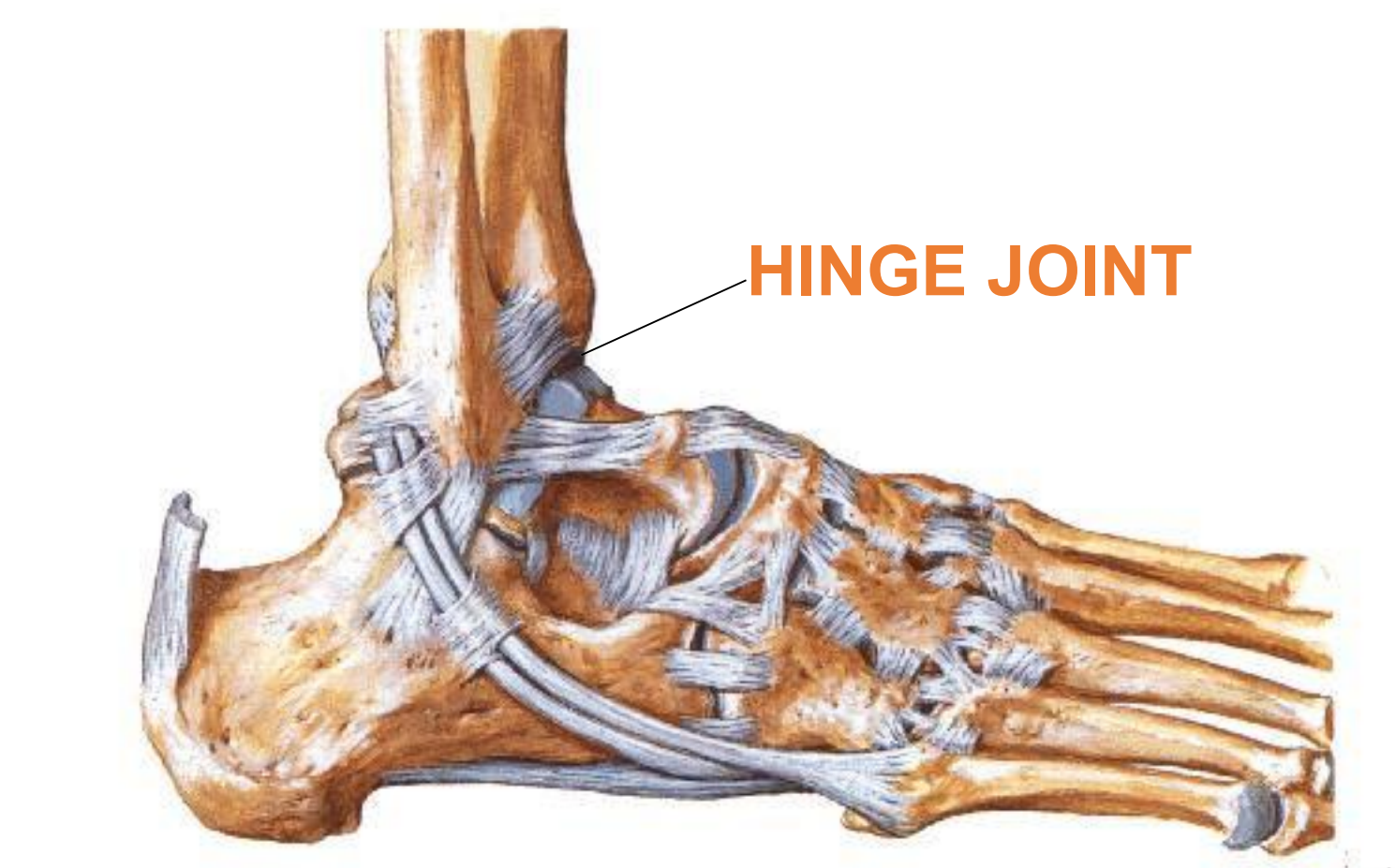


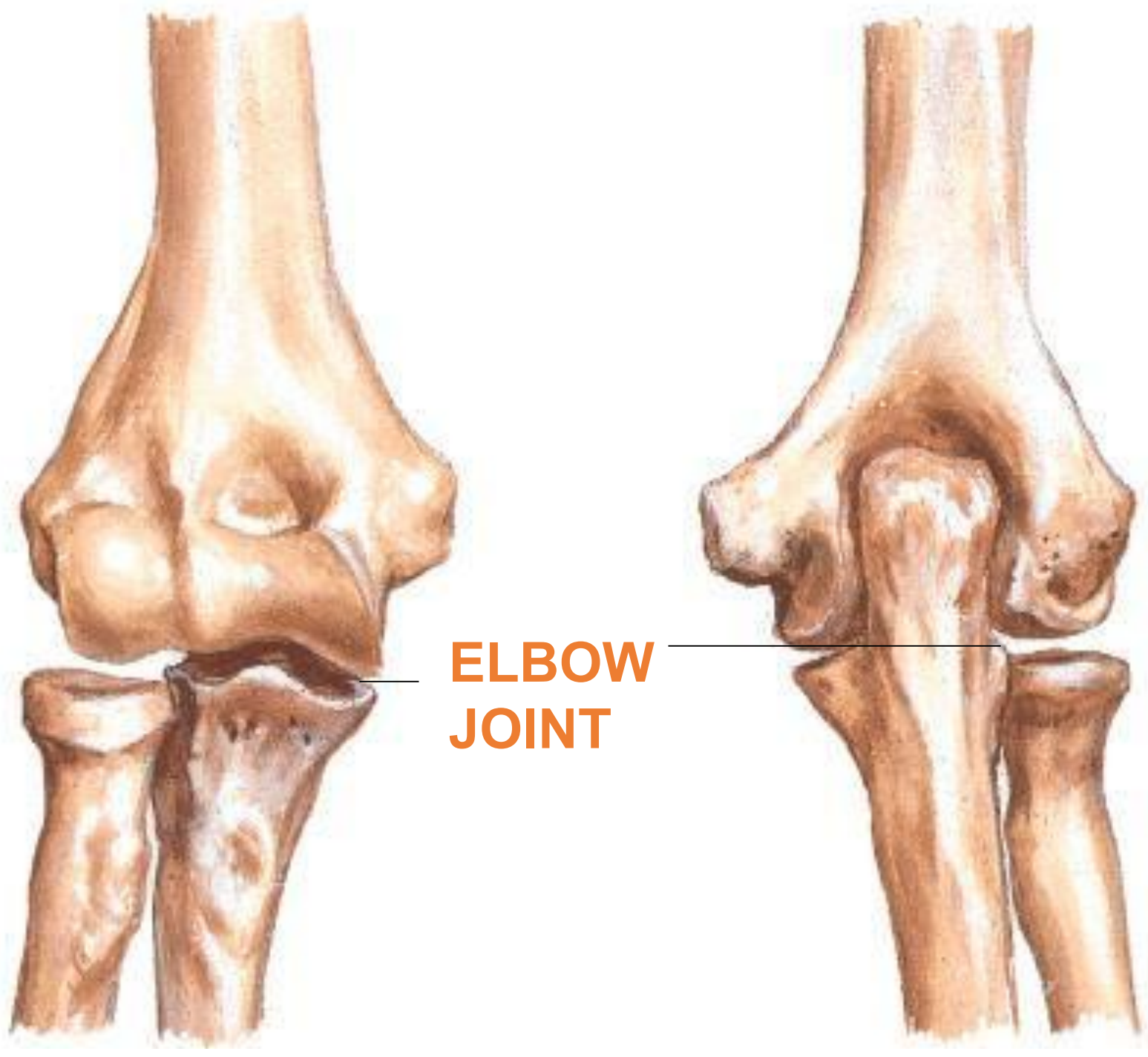


PIVOT





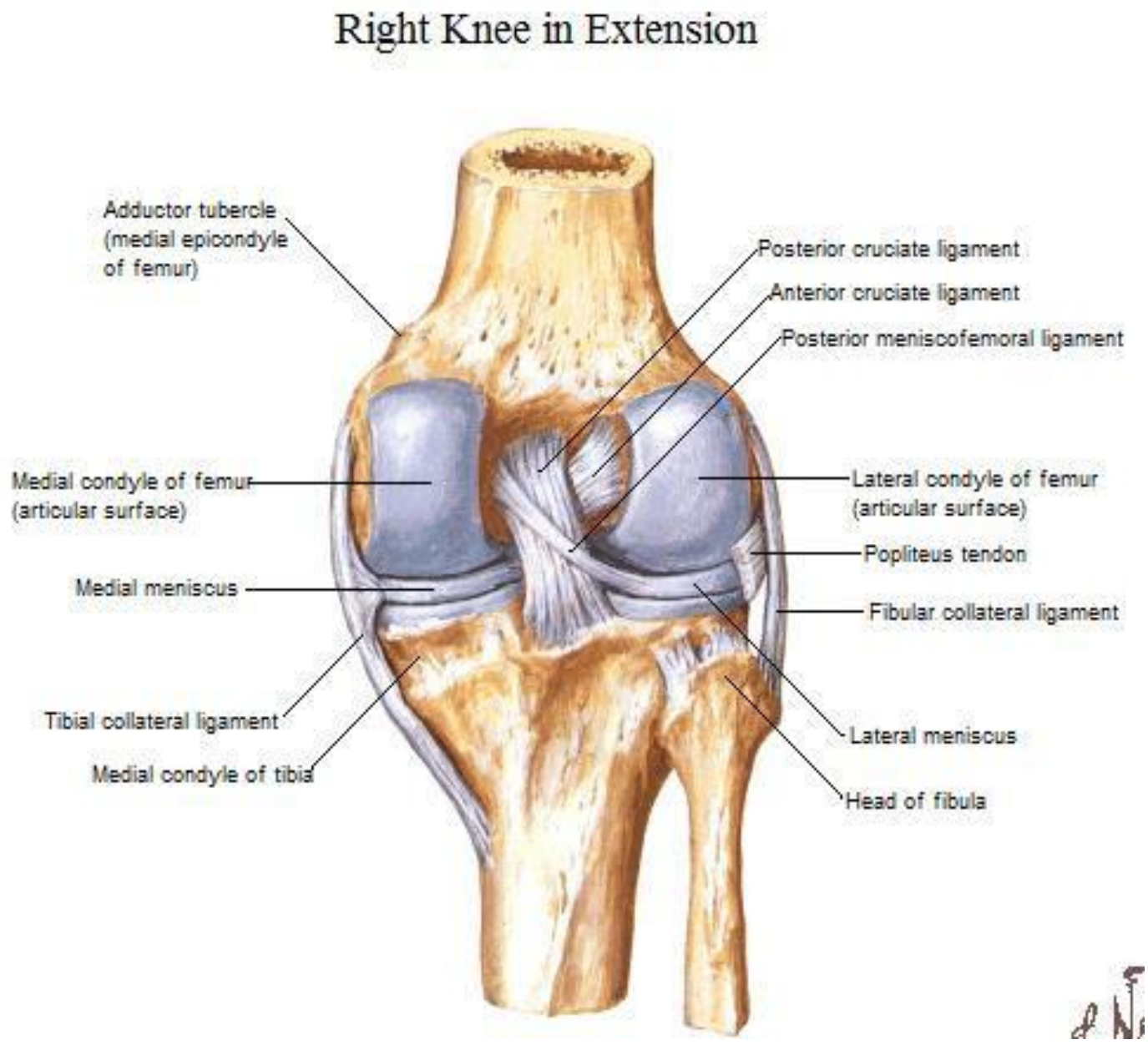




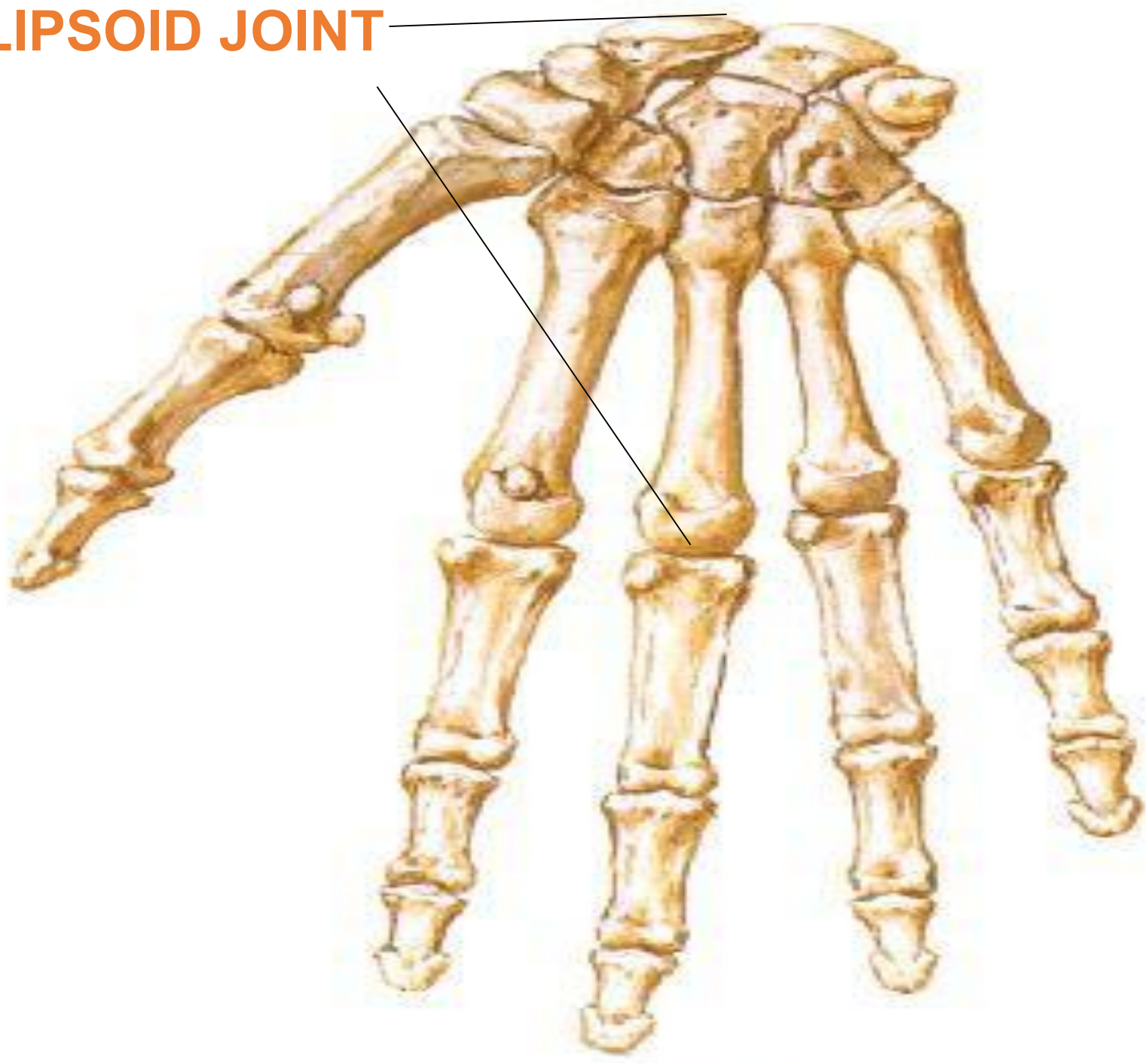
ELBOW JOINT

BIAXIAL

CONDYLAR JOINT

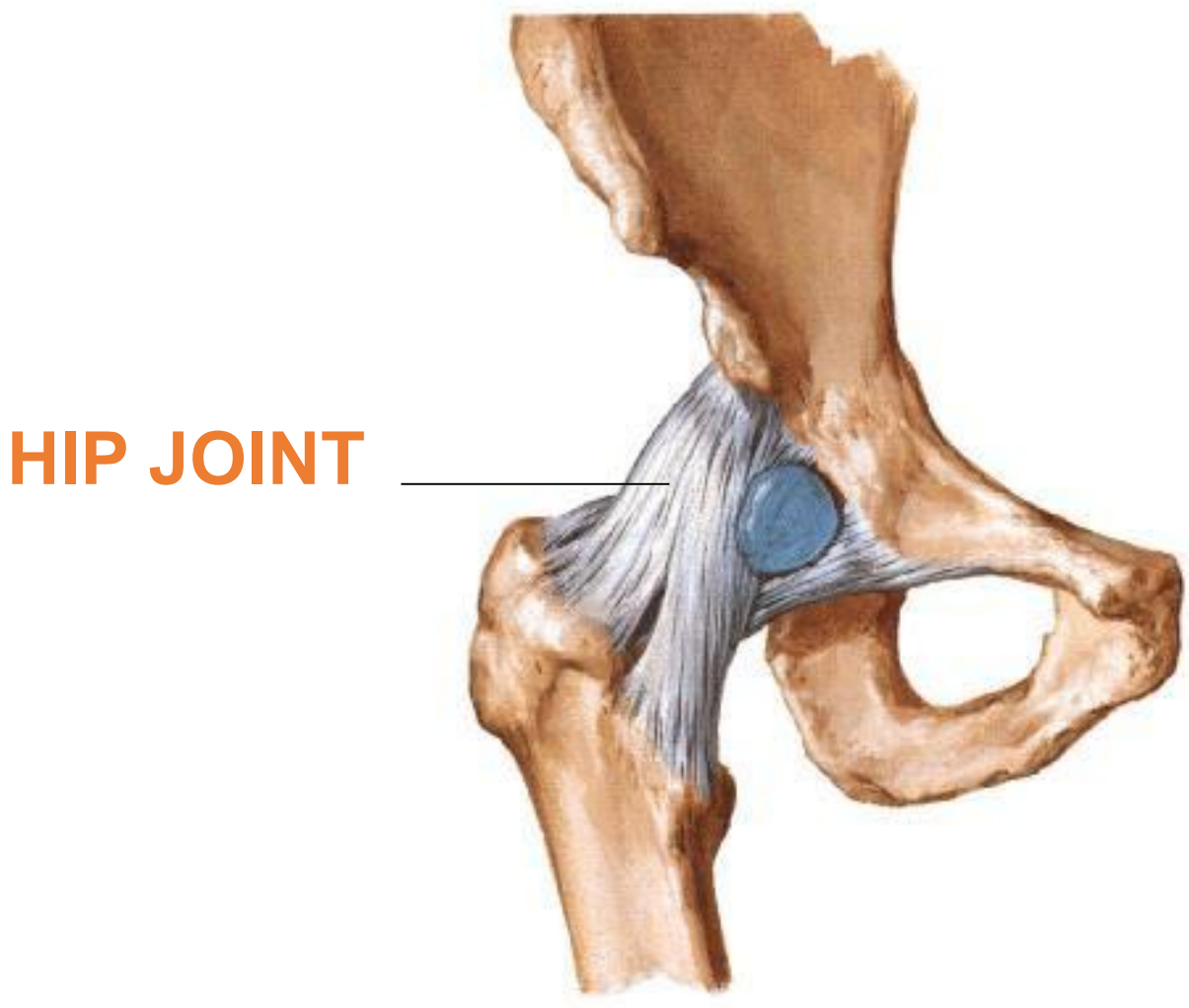


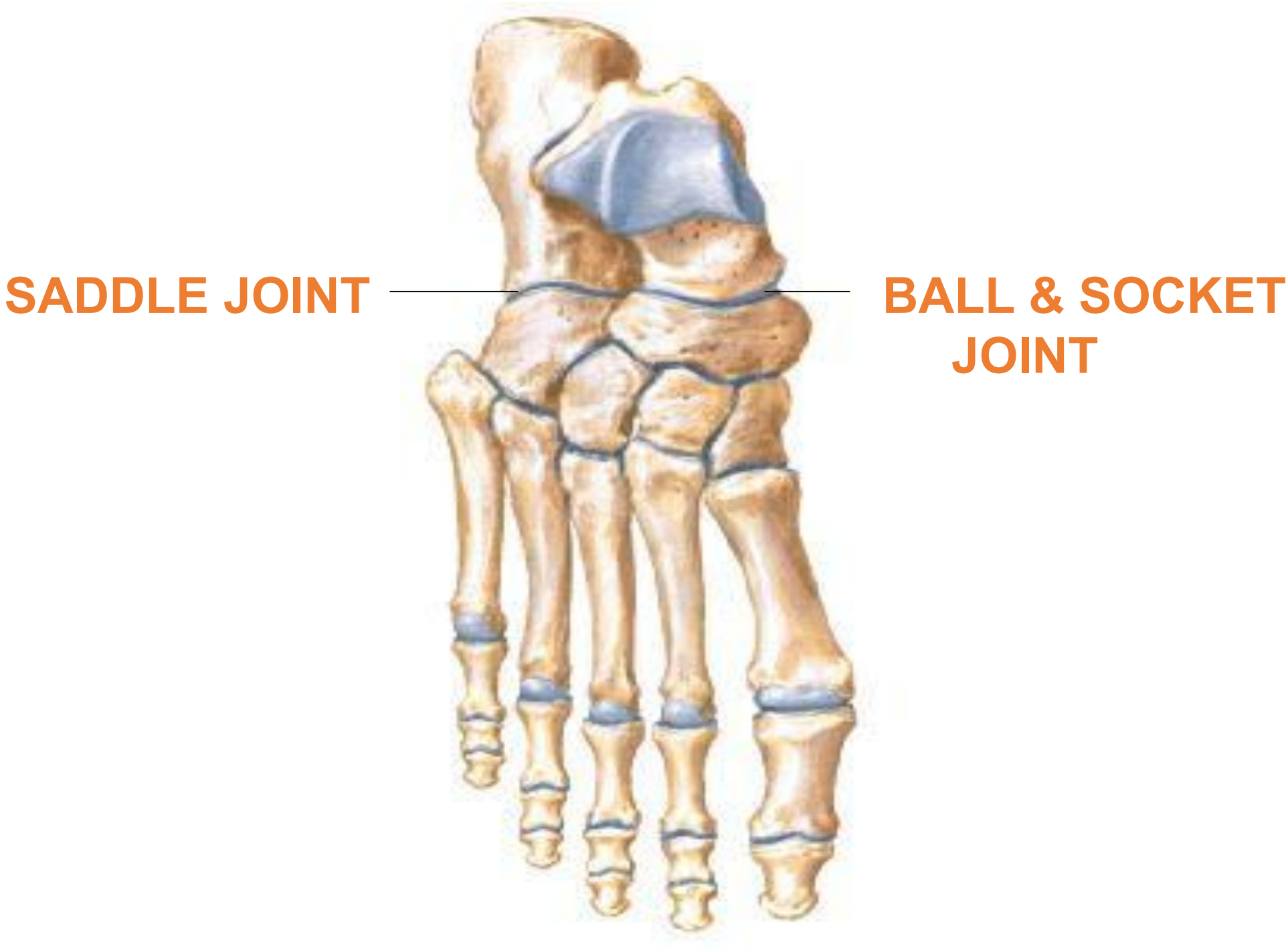
ELLIPSOID JOINT

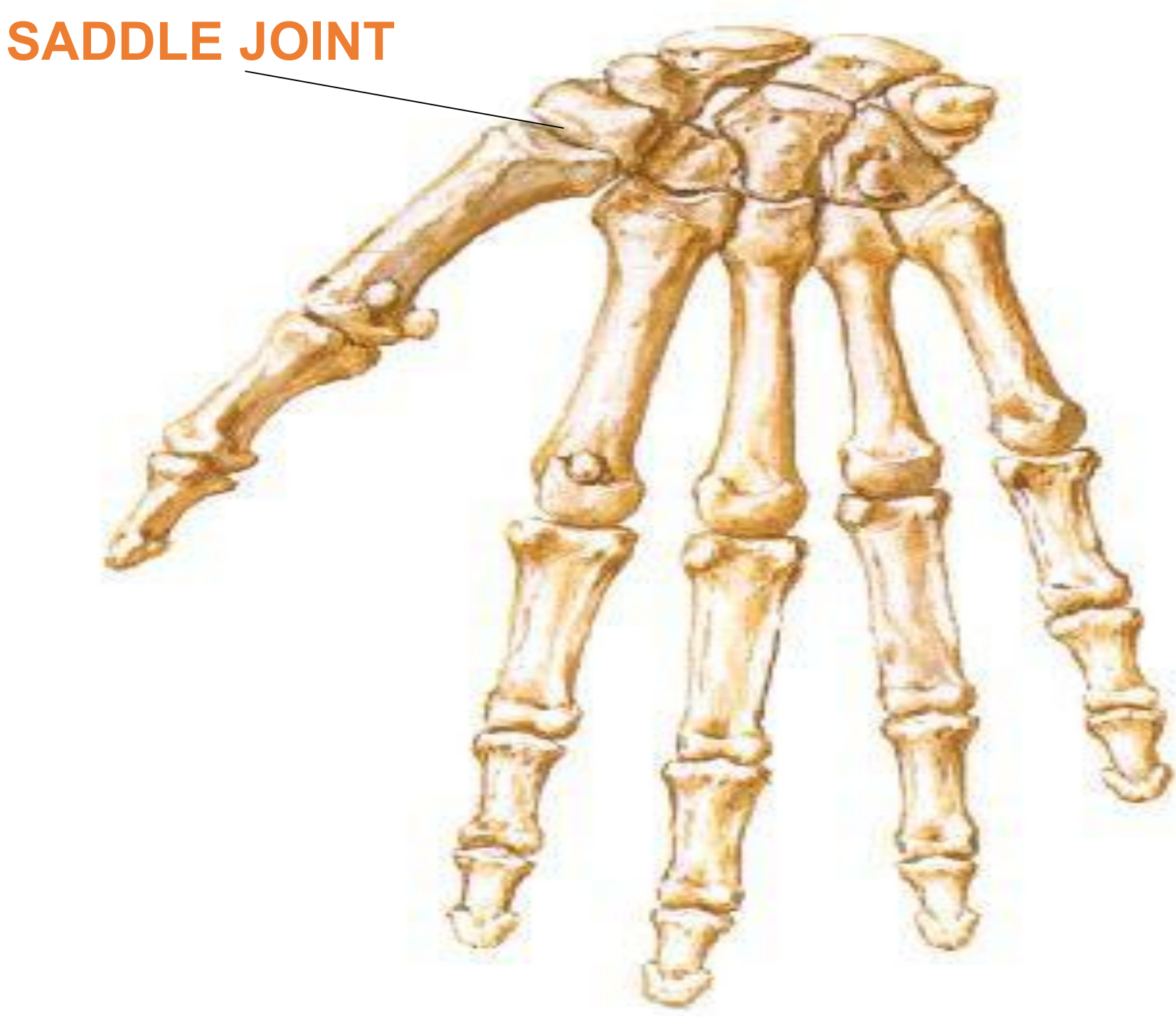


MULTIAXIAL JOINT

SHOULDER 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