# Temporomandibular Joint Anatomy and Histology

DEPARTMENT OF ORAL AND MAXILLOFACIAL PATHOLOGY & ORAL MICROBIOLOGY

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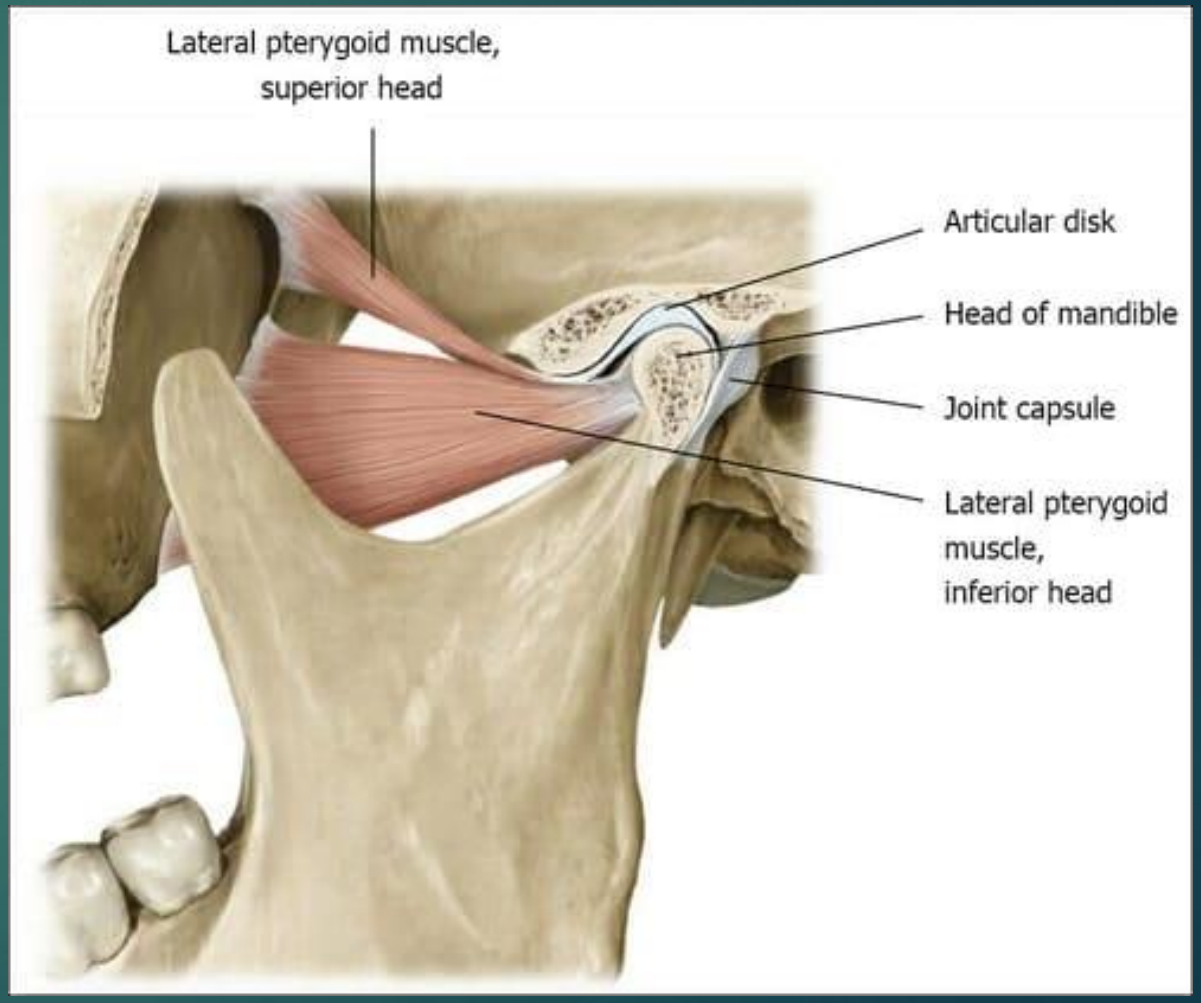


# Introduction

- The temporomandibular Joint (TMJ) is formed by the articulation between the articular eminence and the anterior part of the glenoid fossa of the temporal bone above and the condylar head of the mandible below.
- It is also called bi-lateral synovial joint, complex joint and ginglymodiarthrodial joint
- it has a relatively sliding type of movements ,in addition to hinge movement.

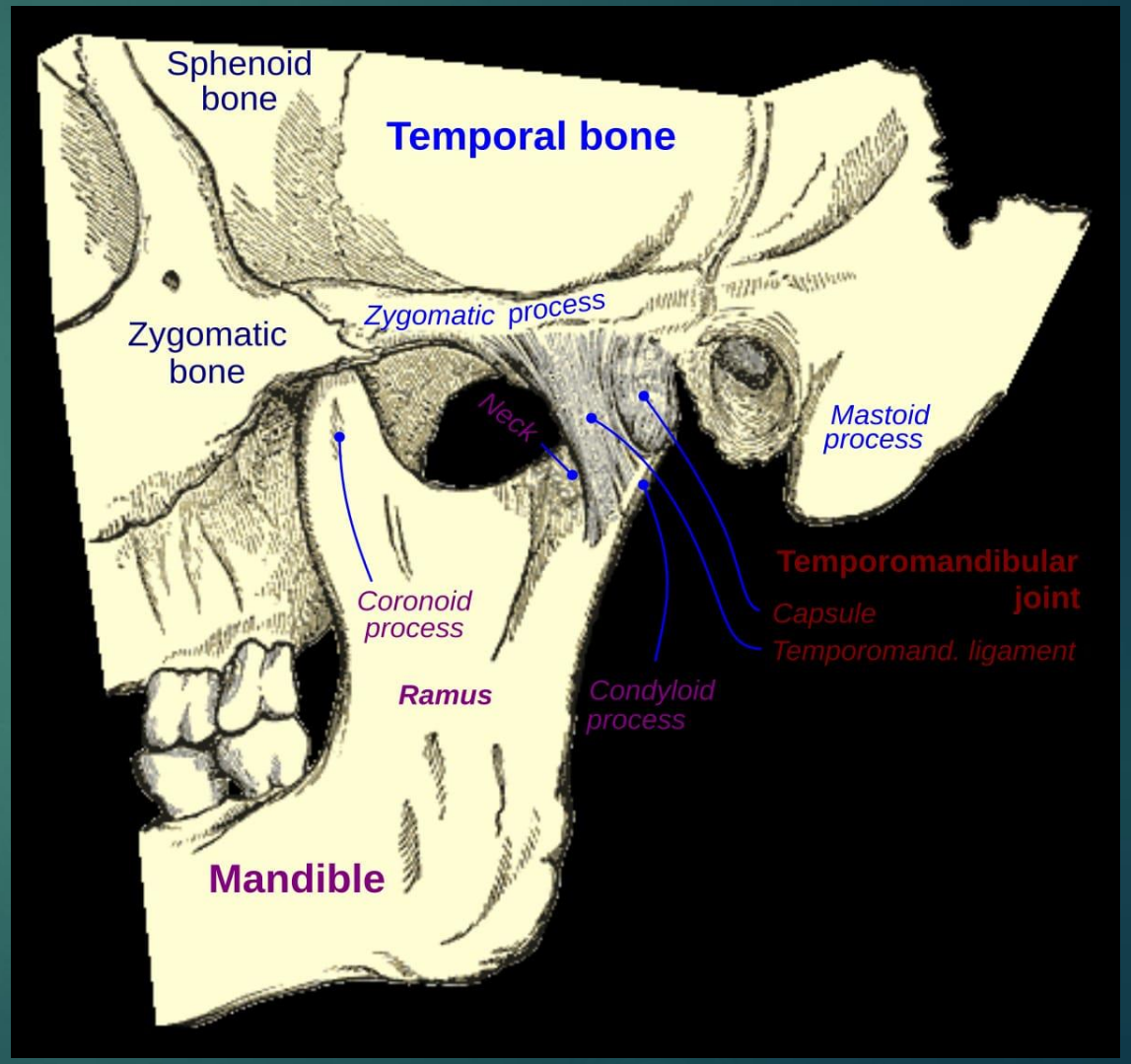
# Characteristics features of TMJ

1. Bilateral diarthrosis- right & left function together .
2. Articular surface covered by fibrocartilage instead of hyaline cartilage.
3. Only joint in human body to have a rigid end point of closure that of closure that of the teeth making occlusal contact.
4. In contrast to other diarthrodial joint, TMJ is last joint to start develop, in about $7^{th}$ week in utero.
5. Develops from distinct blastema.

# Anatomy of TMJ

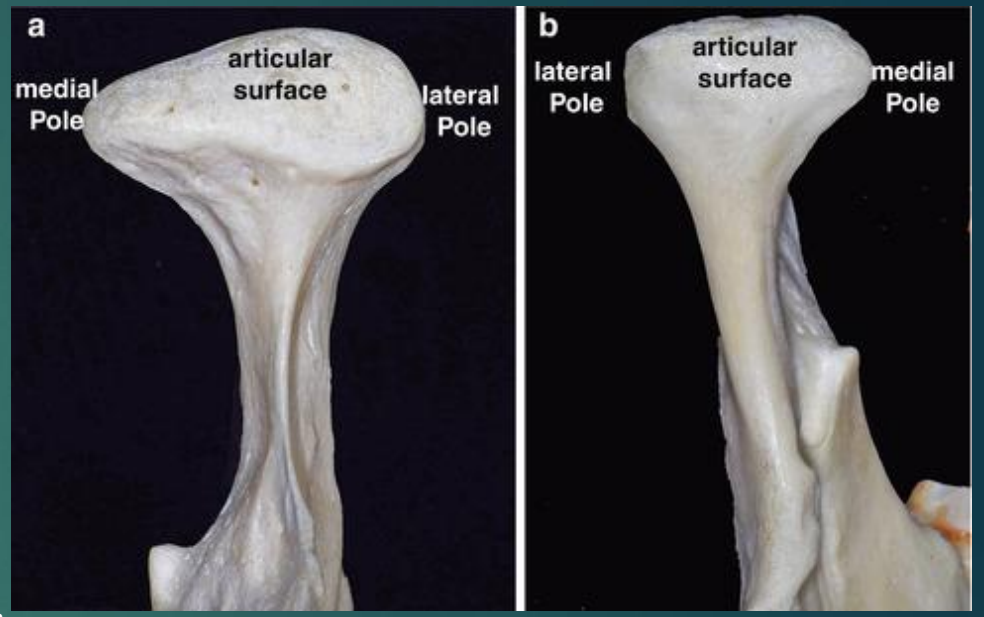
## Components:

- **Hard Tissue**
  i. Mandibular Condyle
  ii. Glenoid Fossa
  iii. Articular eminence
- **Soft Tissue**
  i. Capsule
  ii. Articular disc
  iii. Ligaments
  iv. Muscular component



# THE MANDIBULAR CONDYLE

- Its the articulating surface of the mandible.
- It is convex in all directions but wider later-medially than antero-posteriorly.
- It has lateral and medial poles:
  - The medial pole is directed more posteriori
  - The long axis of the two poles deviate posteriorly and meets at the anterior border of the foramen magnum.

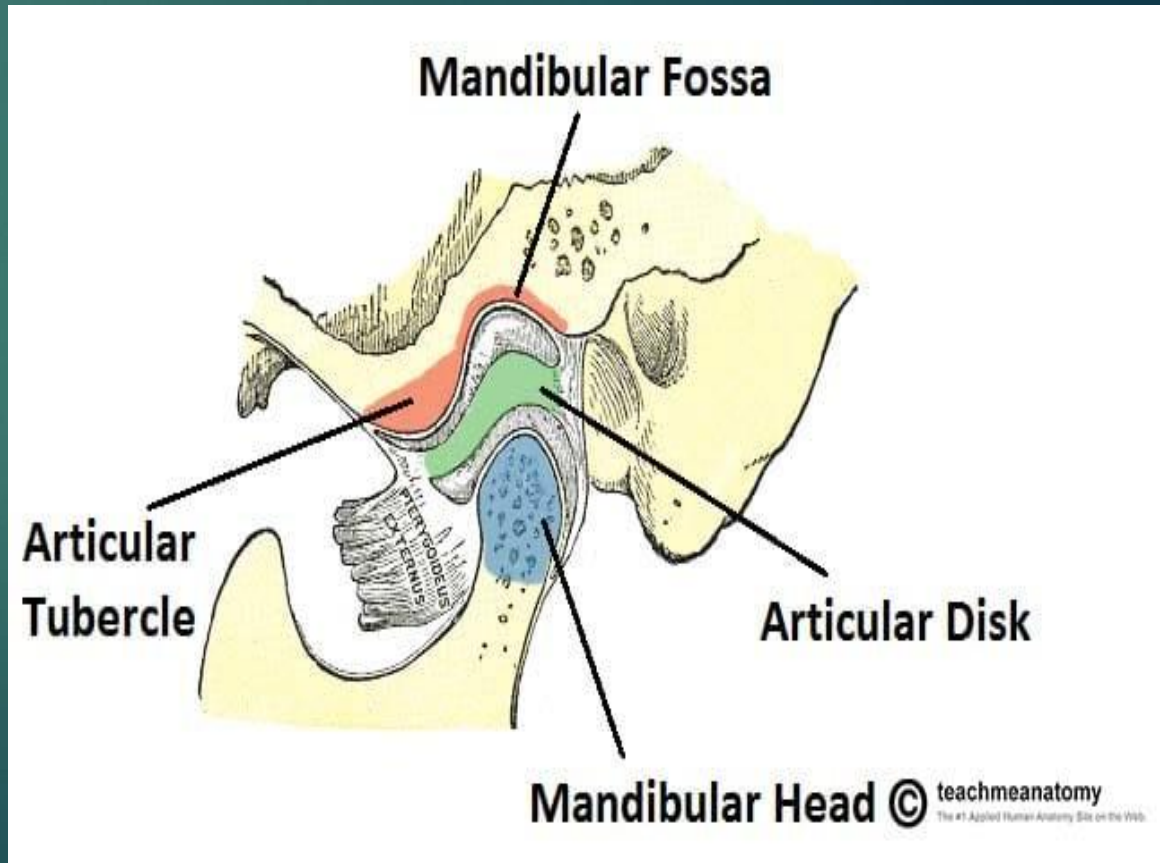


# MANDIBULAR (GLENOID) FOSSA AND ARTICULAR EMINENCE

- **Glenold fossa**
  - Posteriorly limited by the squamotympanic fissure.
  - Anterioly bounded by the articular eminence.
  - Roof: thin layer of compact bone separating the middle cranial fossa.
- **Articular eminence:**
  - Composed of: Spongy bone covered by thin layer of compact bone.
  - Chondroid tissues commonly seen in the eminence.

# Cont..

- Fibrous layer covering the articulating surface of temporal bone.
  - Thin on the articular fossa and thickens on the posterior slope of the eminence
  - Over the eminence the fibrous tissues are arranged in 3 zones:
    1. Inner zone - fibers arranged at right angle to surface
    2. Outer zone - fibers run parallel to the bone surface
    3. Intermediate zone - transitional zone. Fibers are interlaced.

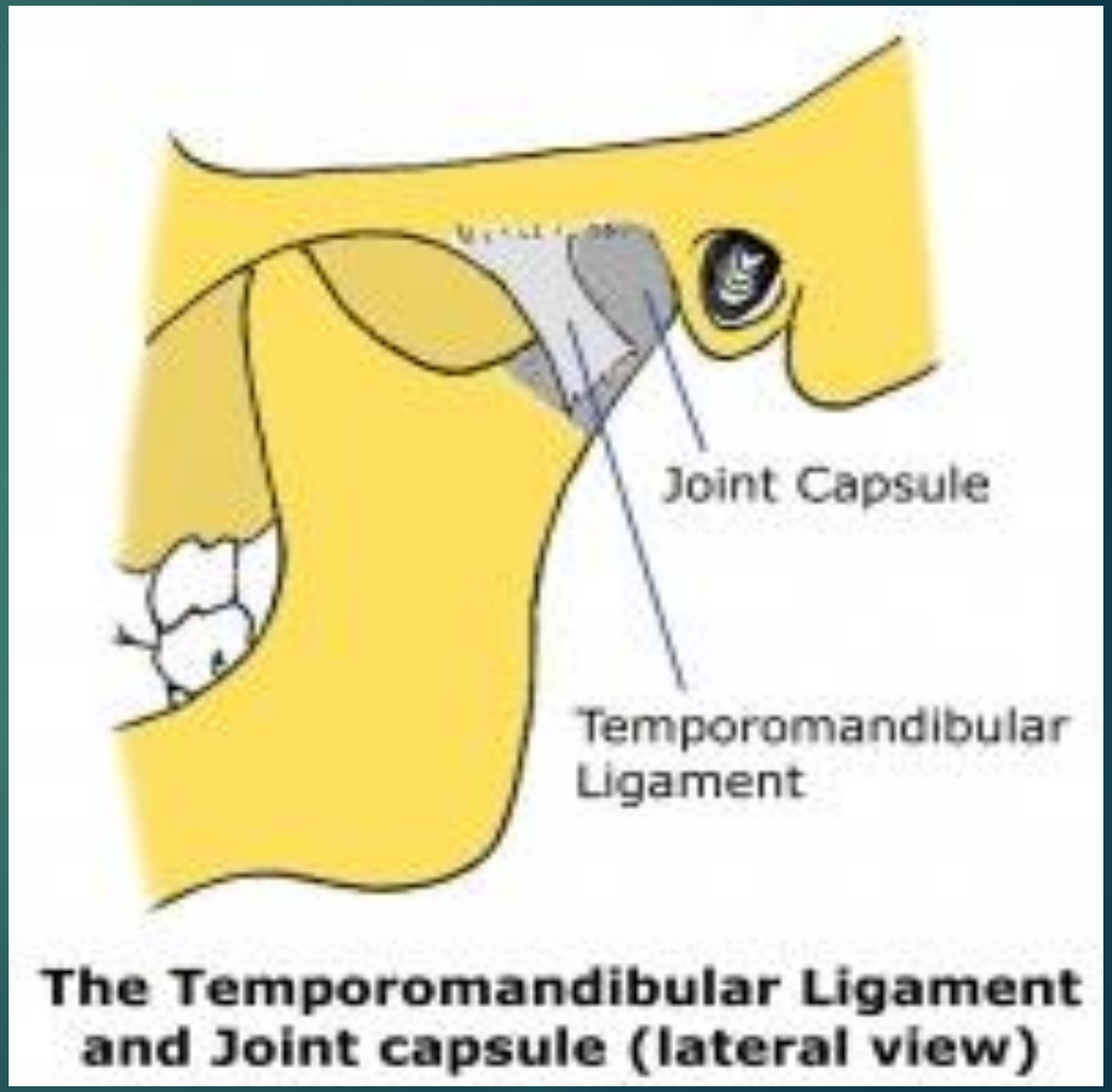


# Articular Capsule

- A thin sleeve of tissue completely surrounding the joint.
- Extends from the circumference of the cranial articular surface to the neck of the mandible.
- **ATTACHMENTS:**
  - ANTEROLATERALLY: Articular tubercle
  - LATERALLY: Lateral rim of mandibular fossa.
  - POSTEROLATERALLY: Postglenoid process
  - POSTERIORLY: Posterior articular ridge
  - MEDIALLY: Medial margin of temporal bone at its suture with greater wing of sphenoid.
  - ANTERIORLY: Preglenoid plane
- **RELATIONS:**
  - LATERALLY AND MEDIALLY: Capsule blends with condylodiscal ligaments.
  - MORE LATERALLY: Temporomandibular ligament
  - ANTERIORLY: Capsule has an orifice through which lateral pterygoid tendon passes.

# Cont..

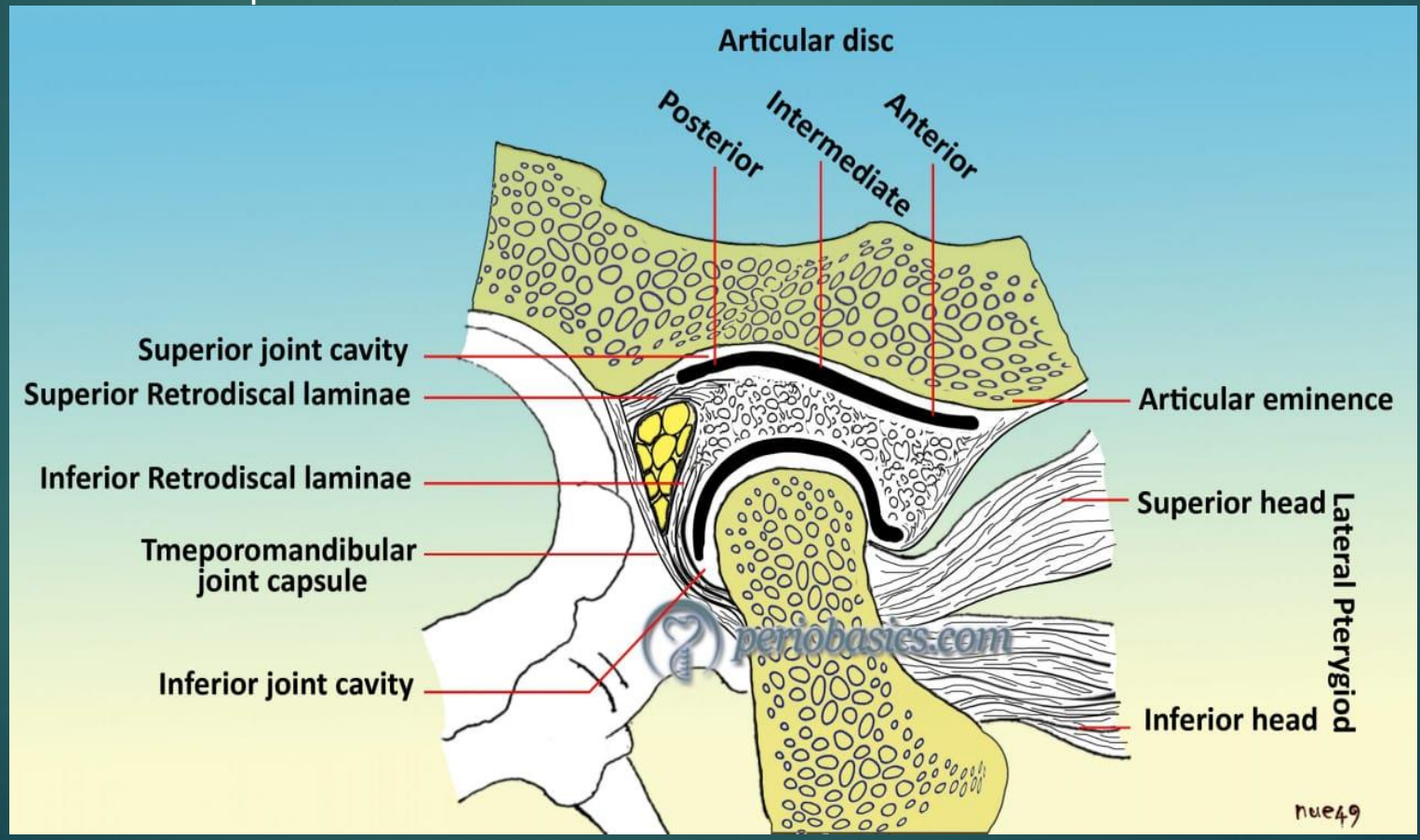
- Synovial membrane:
  - Covers all infra-articular surfaces except the pressure bearing fibro-cartilage.




**The Temporomandibular Ligament and Joint capsule (lateral view)**

# INTERARTICULAR DISC (MENISCUS)

- Disk is fibrous. avascular non inverted plate
- Shape is oval, biconcave in sagittal section. It is thin in central part and thick at posterior borders.



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- Posterior border divides into upper and lower lamellae
  - The upper lamella is fibrous and elastic and fuses with the capsule and is inserted in the squamotympanic fissure.
  - The lower lamella, non elastic. attaches to the back of the condyle.

# Cont..

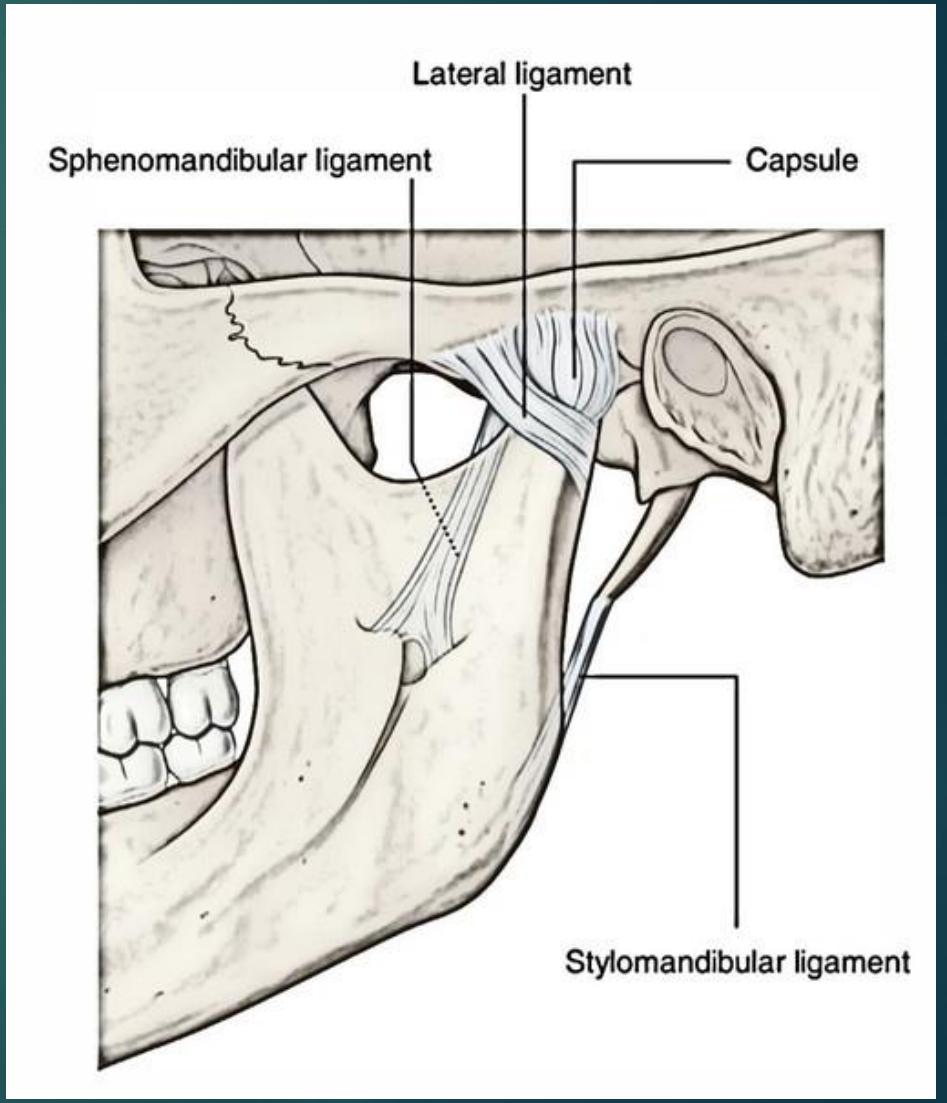
- Anterior border divides into upper and lower lamellae that run forward.
- The upper lamella fuses with the anterior slope of the articular eminence.
- The lower lamella attaches to the front of the neck of the condyle.
- Fibers of the superior head of the lateral pterygoid muscle is attached to the anterior border.
- Attachment: Medial and lateral poles of the condyle by medial and lateral ligaments.
- Divide the joint into: Upper (larger) compartment and lower (smaller) compartment.

# Ligaments

This consists of the fibrous capsule and the major and minor ligaments.

## Major ligament:

- Temporomandibular or Lateral ligament: It attached below to the posterolateral aspect of neck of mandible. wide fan shaped, fibers are directed downwards and backwards.



# Cont..

- **Minor ligaments:**
  - Sphenomandibular ligament: Accessory ligament attached superiorly to the spine of sphenoid and inferiorly to the lingula of mandibular foramen.- fibers are directed downward and outward.
  - stylomandibular ligament: It is a thickened part of the deep cervical fascia which separates the parotid and summand. Salivary gland. attached to the styloid process above and ramus of mandible below.

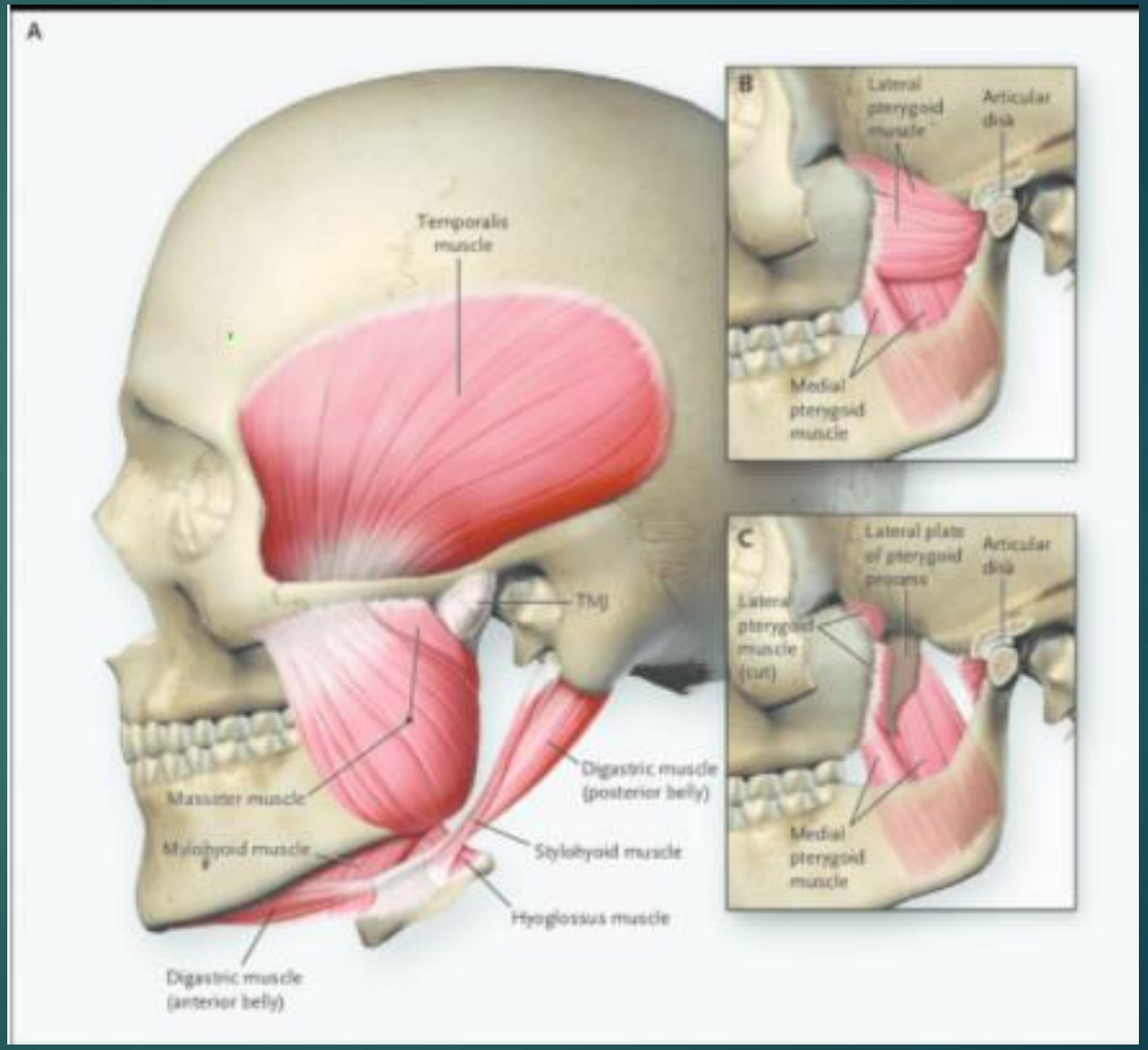
# Muscles

Masseter

Temporalis

Medial Pterygoids

Lateral pterygoid



# TMJ MOVEMENTS

- Depression Of Mandible

Lateral pterygoid

Digrastric

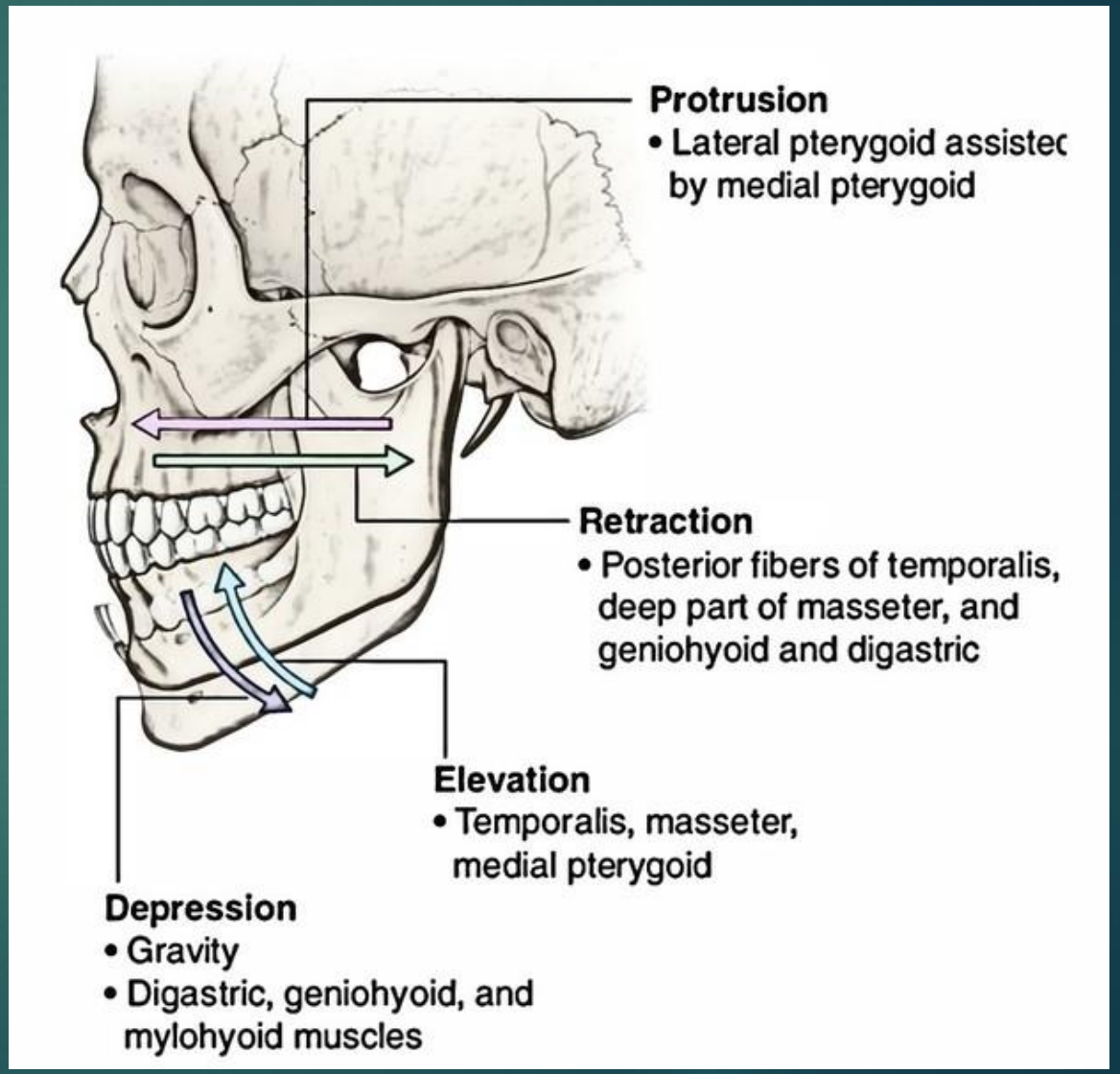
Geniohyoid

- Elevation of Mandible

Temporalis

Masseter

Medial Pterygoid



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- Translatory movement:  in the superior part of the joint as the disc and the condyle traverse anteriorly along the inclines of the anterior tubercle to provide an anterior and inferior movement of the mandible.
- Hinge movement: the inferior portion of the joint between the head of the condyle and the lower surface of the disc permit opening of the mandible.
- Protrusion of Mandible Lateral Pterygoid Medial Pterygoid.
- Retraction of Mandible Posterior fibers of Temporalis.

# INNERVATION OF TMJ

- Most innervation is provided by the auriculotemporal nerve as it leaves the mandibular nerve behind the joint and ascends laterally and superiorly to wrap around the posterior region of the joint.
- Additional innervations by — deep temporal and masseteric nerve.

# Cont..

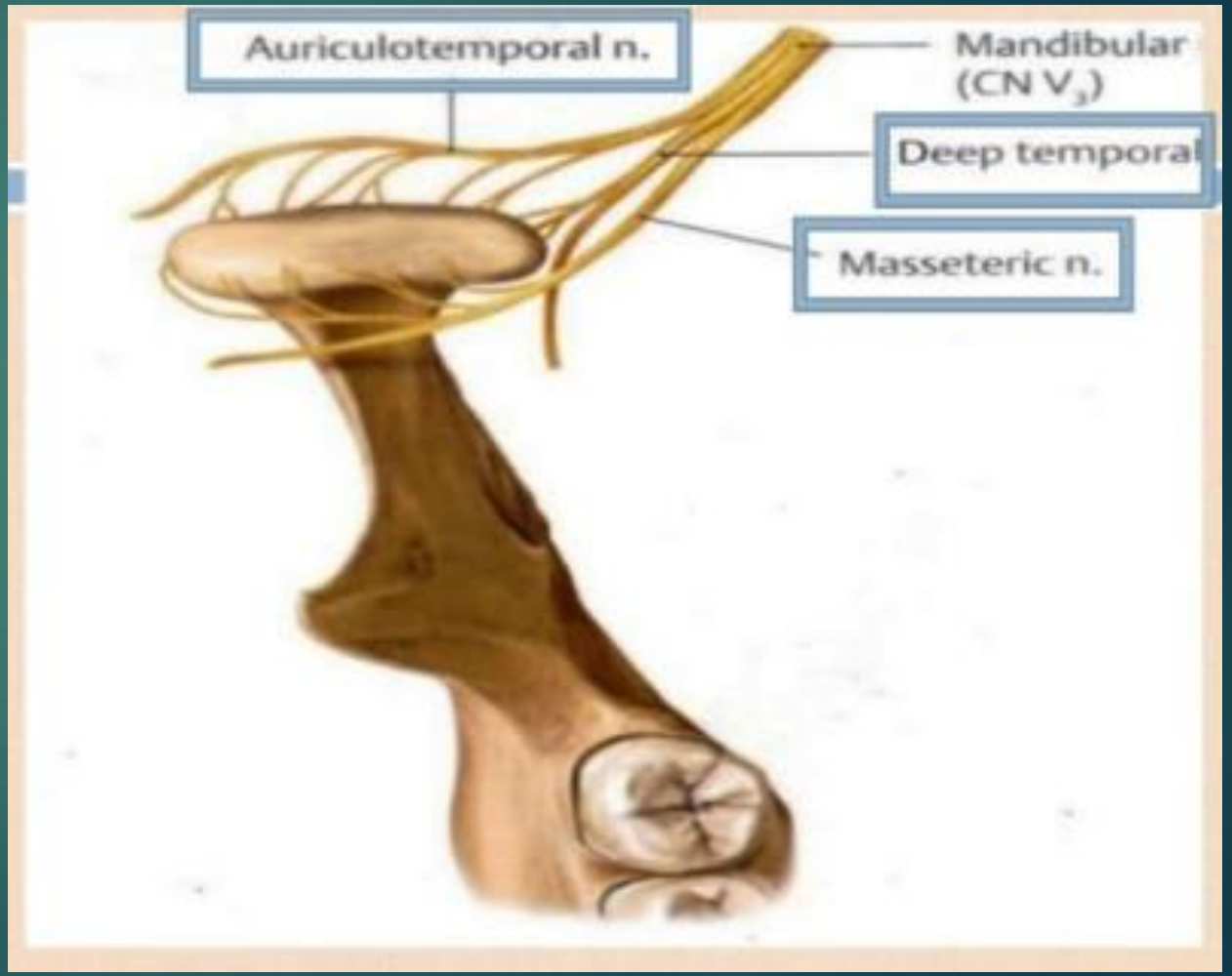
- Protrusion of Mandible

Lateral Pterygoid

Medial Pterygoid

- Retraction of Mandible

Posterior fibers of Temporalis



# VASCULARIZATION OF TMJ

- Predominant vessels are ( branches of the external carotid artery )

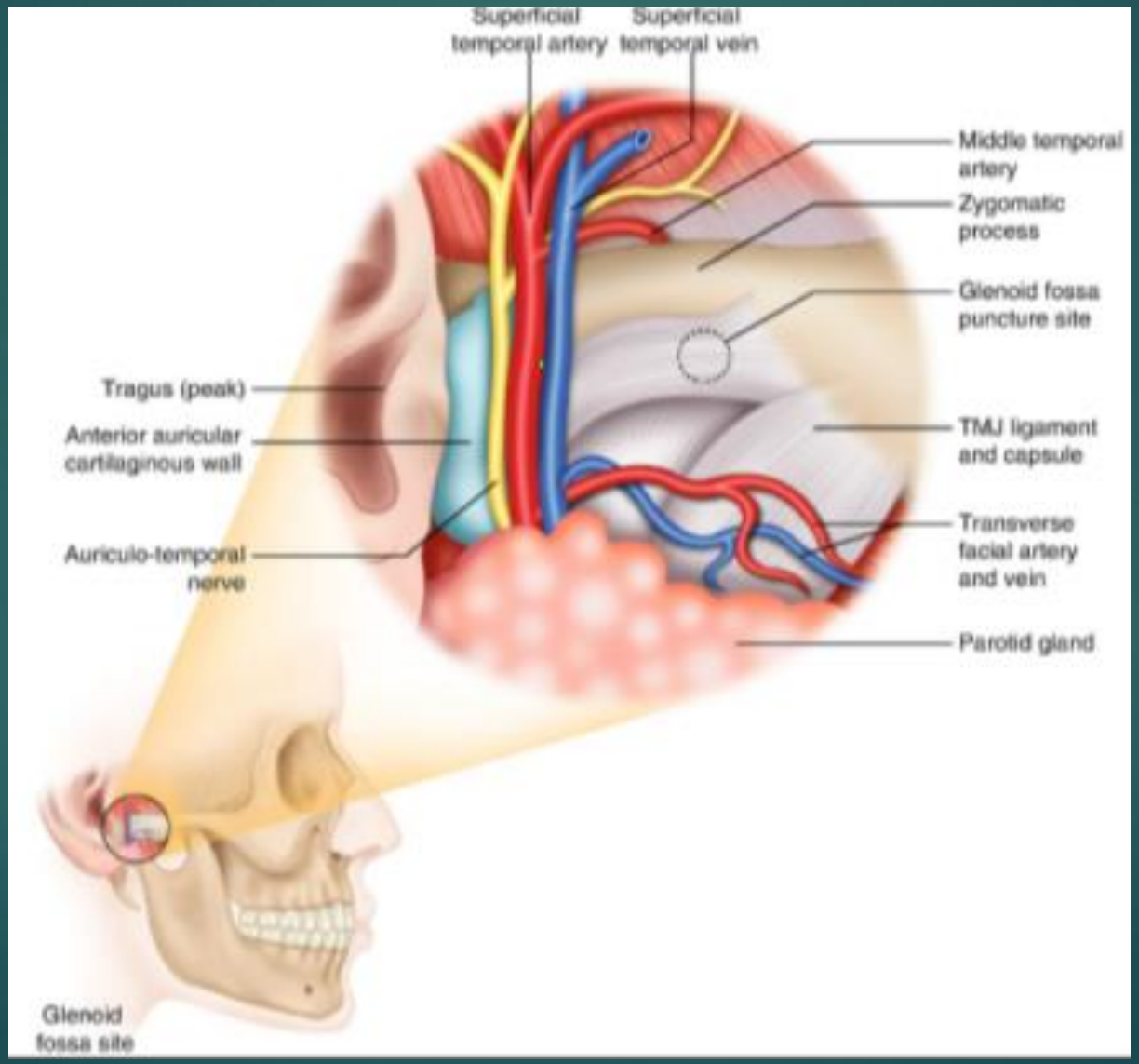
Superficial temporal artery

Middle meningeal artery

Internal maxillary artery

- Other important arteries are the deep auricular ,anterior tympanic and ascending pharyngeal arteries.
- The condyle — through marrow spaces by way of the inferior alveolar artery .

# Figure: Vascularization of TMJ



# HISTOLOGY

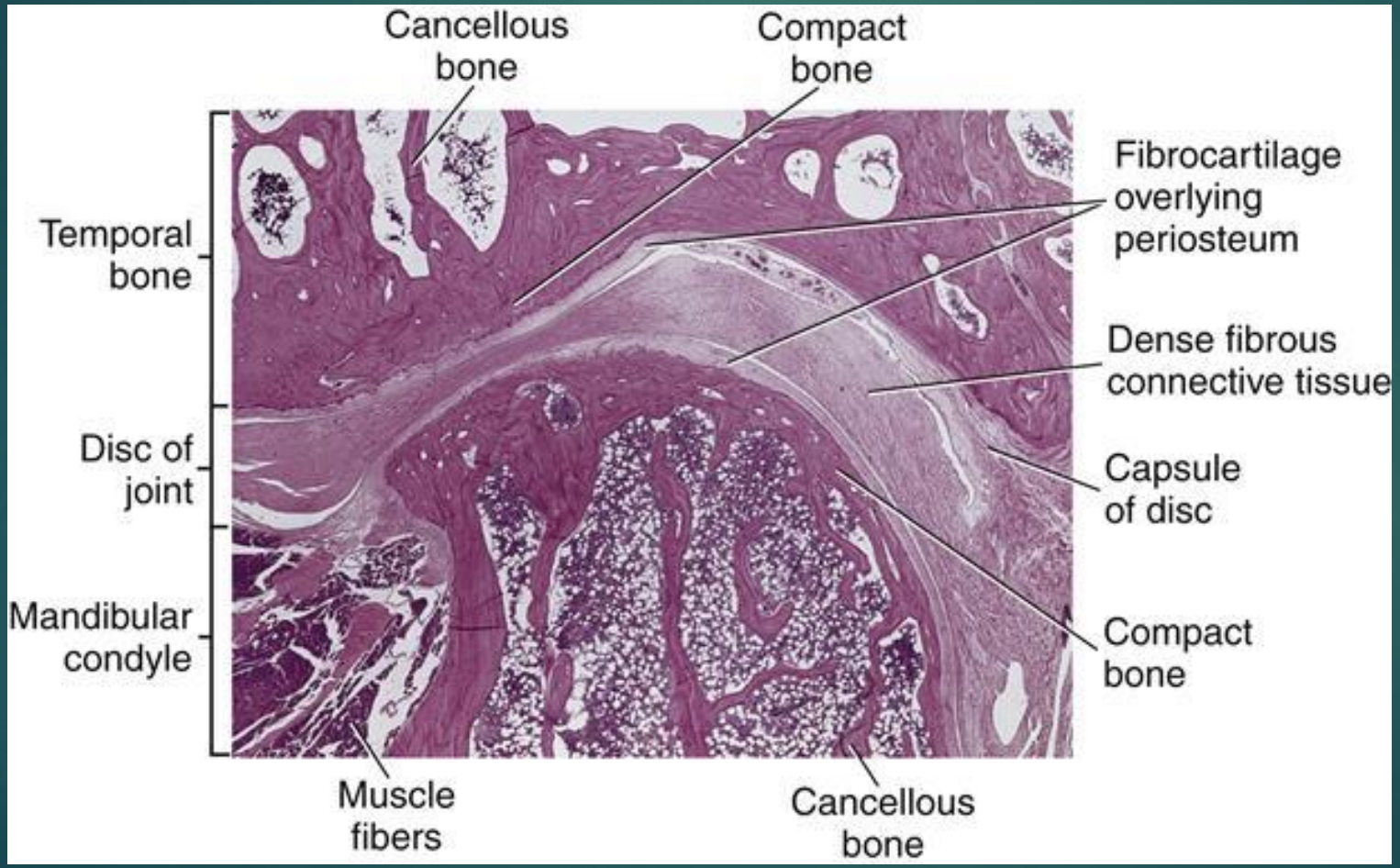
**CONDYLE:**

- Cancellous bone covered by a thin layer of compact bone.
- Trabeculae radiate from the neck of mandible and rich the cortex of right angles, giving maximal strength to the condyle. •
- As age progresses, trabeculae thickens, decreasing the size of large marrow spaces.
- Red marrow is of myeloid or cellular type which is replaced by fatty marrow in older individuals.

**ROOF OF GLENOID FOSS:**

- Thin compact layer of bone.
- Articular eminence is composed of spongy bone covered with a thin layer of compact bone.
- Areas of chondroid bone are commonly seen in articular eminence.

# Figure: Histology of TMJ



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## ATICULAR SURFACE OF MANDIBULAR CONDYLE AND FOSSA

- Lined with dense fibrous connective tissue with some elastic fibers.
- Composed of four distinct layers/zones:

  Articular

  Proliferative

  Fibrocartilaginous

  Calcified cartilage

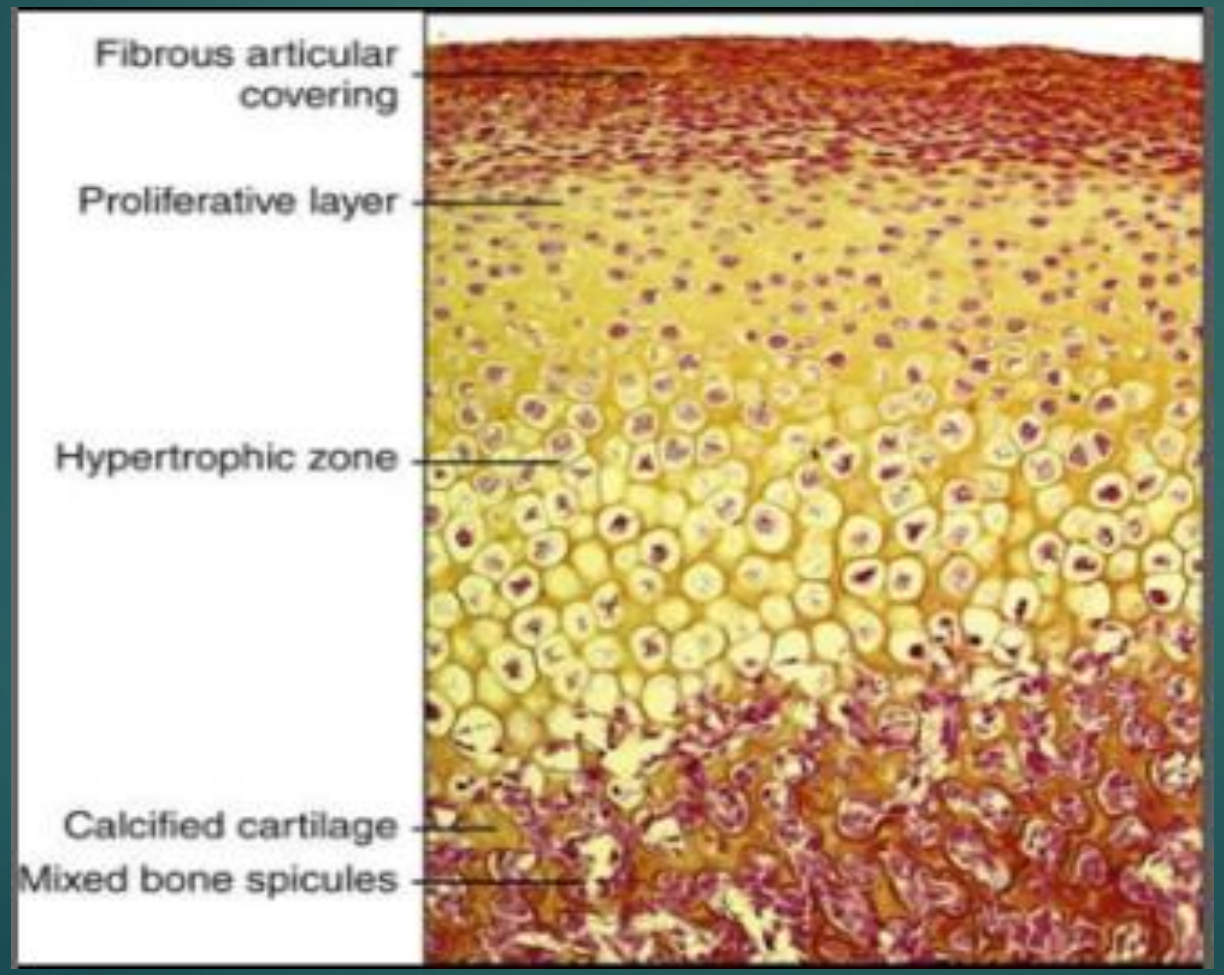
## ARTICULAR ZONE

- Most superficial layer, found adjacent to the joint cavity.
- Covered with a layer of fibrous tissue.
- Tightly packed collagen bundles oriented parallel to the articular surfaces, allowing them to withstand the forces of movement.
- Adv of fibrous cartilage: less susceptible to the effects of ageing.

## PROLIFERATIVE ZONE

- Mainly cellular, consisting of undifferentiated mesenchymal cells, that are responsible for the proliferation of articular cartilage in response to functional demands.

# Figure: Articular surface of mandibular condyle and fossa



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## FIBROCARTILAGINOUS ZONE

- Collagen fibers arranged in bundles in a crossing pattern.
- Provides a 3-dimensional network that provides resistance to compressive and lateral forces.

## CALCIFIED CARTILAGE

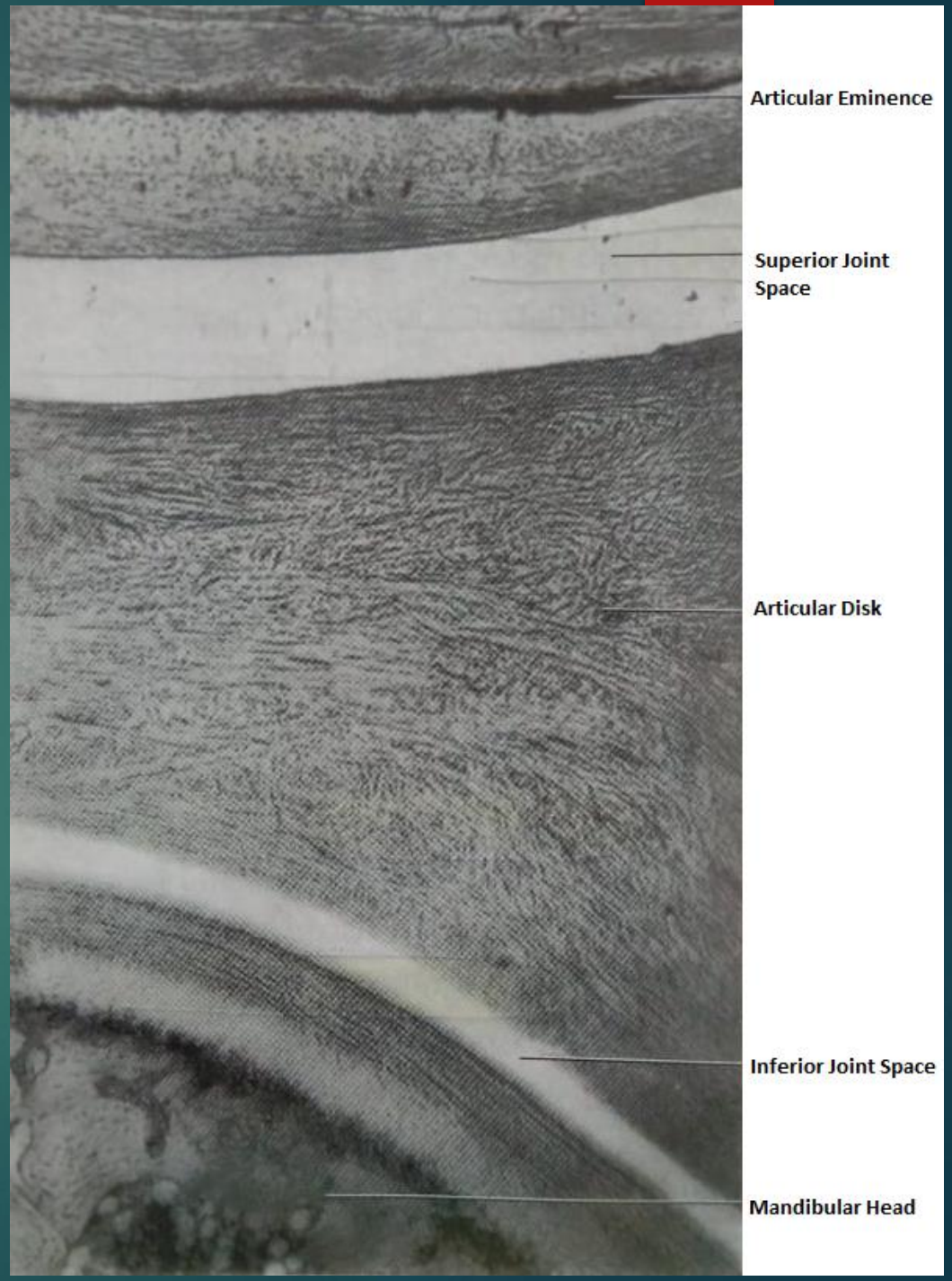
- Fourth and the deepest zone.
- Made up of chondroblasts and chondrocytes distributed throughout the articular cartilage.
- Chondrccytes become hypertrophic and die, causing their cytoplasm to be evacuated, forming bone cells from within the medullary cavity.

# Cont..

**ARTICULAR DISK:**

- Dense, collagenous fibrous pad between condylar heads and articular surfaces.
- Fibroblasts are elongated and send flat cytoplasmic processes into the interstices between the adjacent bundles.
- Thinnest centrally, and thickens in the periphery.
- Devoid of any blood vessels and nerves , except for extreme periphery which is slightly innervated.
- 80% type I collagen and 5% glycosaminoglycans of its dry weight.
- Of the 5%  GAGs, 80% is chondroitin sulphate and 15% is dermatan sulphate.
- Small amount of type III collagen in posterior attachment region.

# Figure:
# Higher Magnification of Articular Disk



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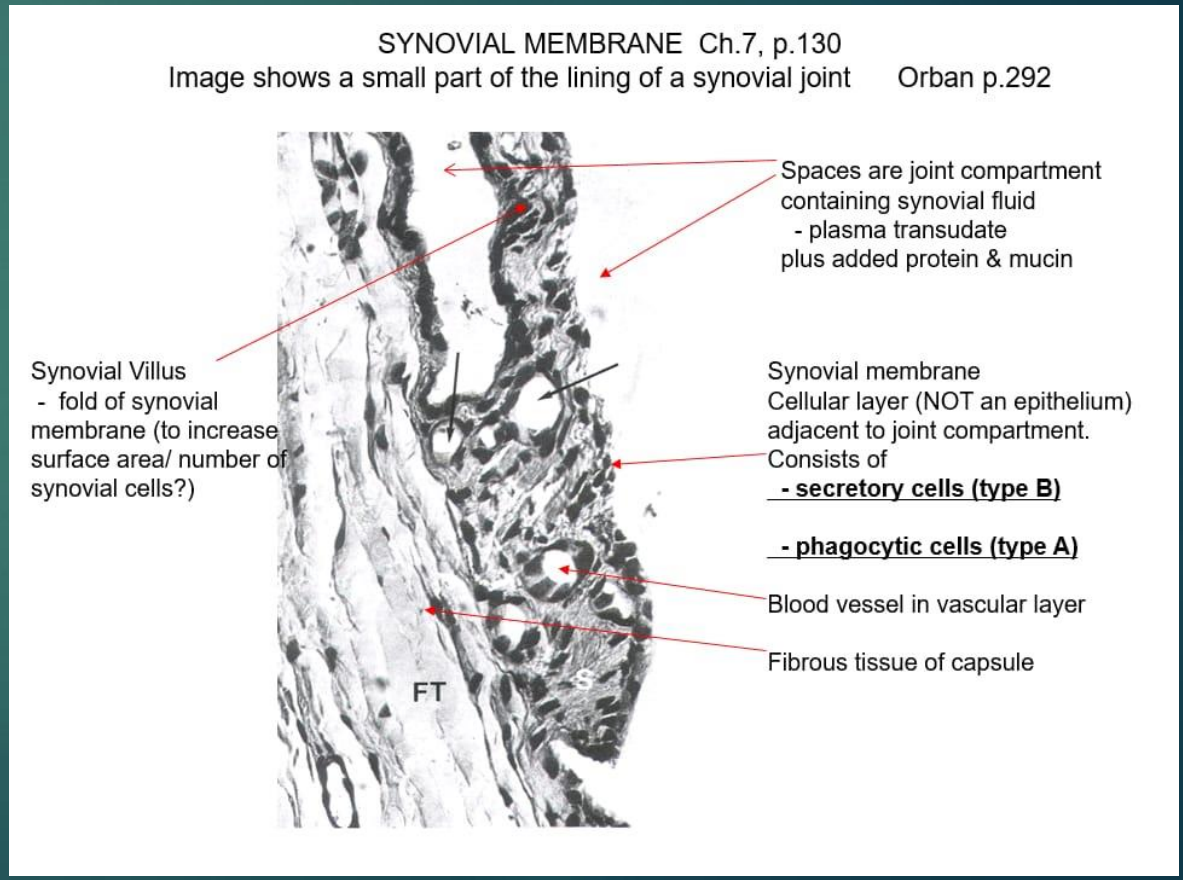
**SYNOVIAL MEMBRANE:**

- Lines the inner surface of the joint capsule.
- Folds to form synovial vile which project into the spaces.
- Made up of an intimal layer of synovial cells from 1-4 cells in depth resting over basely organized subintimal connective tissue layer.
- Connective tissue layer has extensive plexus of nerves and vessels and numerous fibroblasts, mast cells and macrophages.



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Synovial layer lacks a distinct basement membrane: rapid diffusion of substances M and out of joint cavities.

Synovial Fluid: dialysate of plasma.

**Types of synovial cells:**

- Type A: synthesis and transport of hyaluronidase and are involved in active phagocytosis.
- Type B: synthesis and transport of proteins into the synovial fluid.

**Functions of synovial fluid:**

- Lubrication of the joint.
- Essential nutrients for chondrocytes within the cartilage matrix.
- Aid in the phagocytosis and elimination of particulate and dissolved substances.
- Provide necessary vehicle for transport and diffusion of substances in and out of joint cavities.

# THANK YOU