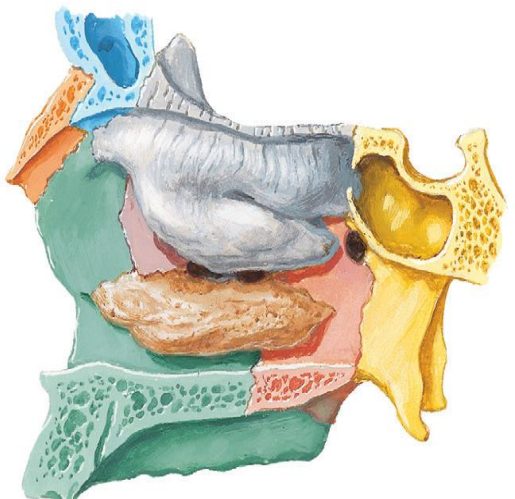
TEMPORAL INFRATEMPORAL & PTERYGOPALATINE FOSSAE



PRESENTER: Mr Mwape KABANGASHESHE

MODERATOR: Mrs H MWALE

INTRODUCTION

- **Temporal & infratemporal regions** include ***muscles of mastication***- develop from Mesoderm of first branchial arch.
- The muscles of mastication; innervated by ***Mandibular Branch*** of **Trigeminal Nerve.**

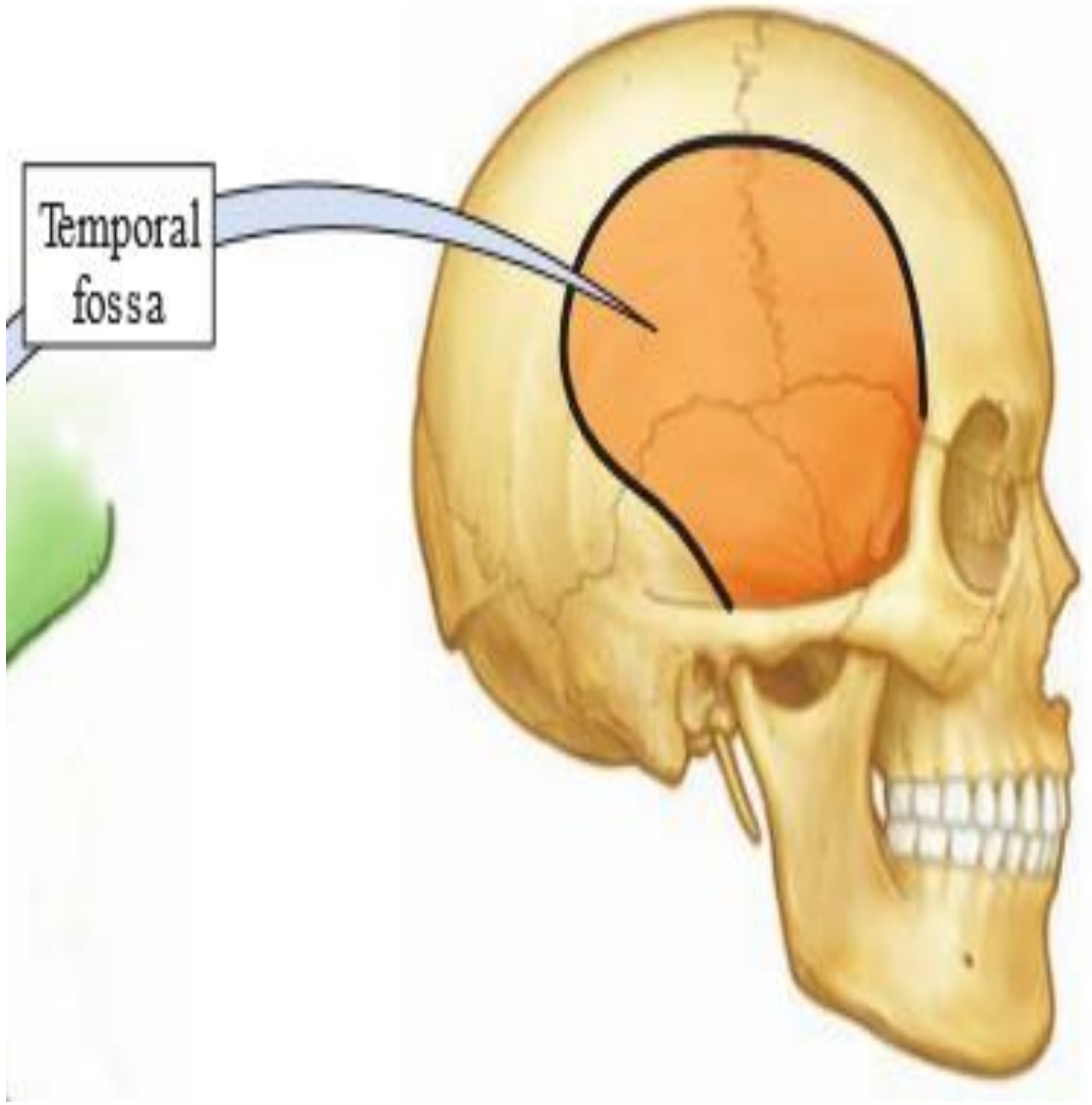
NB:, **Temporomandibular Joint** (Only joint of the area)-between base of skull & Mandible; allow Movements during ***Speech & Mastication.***

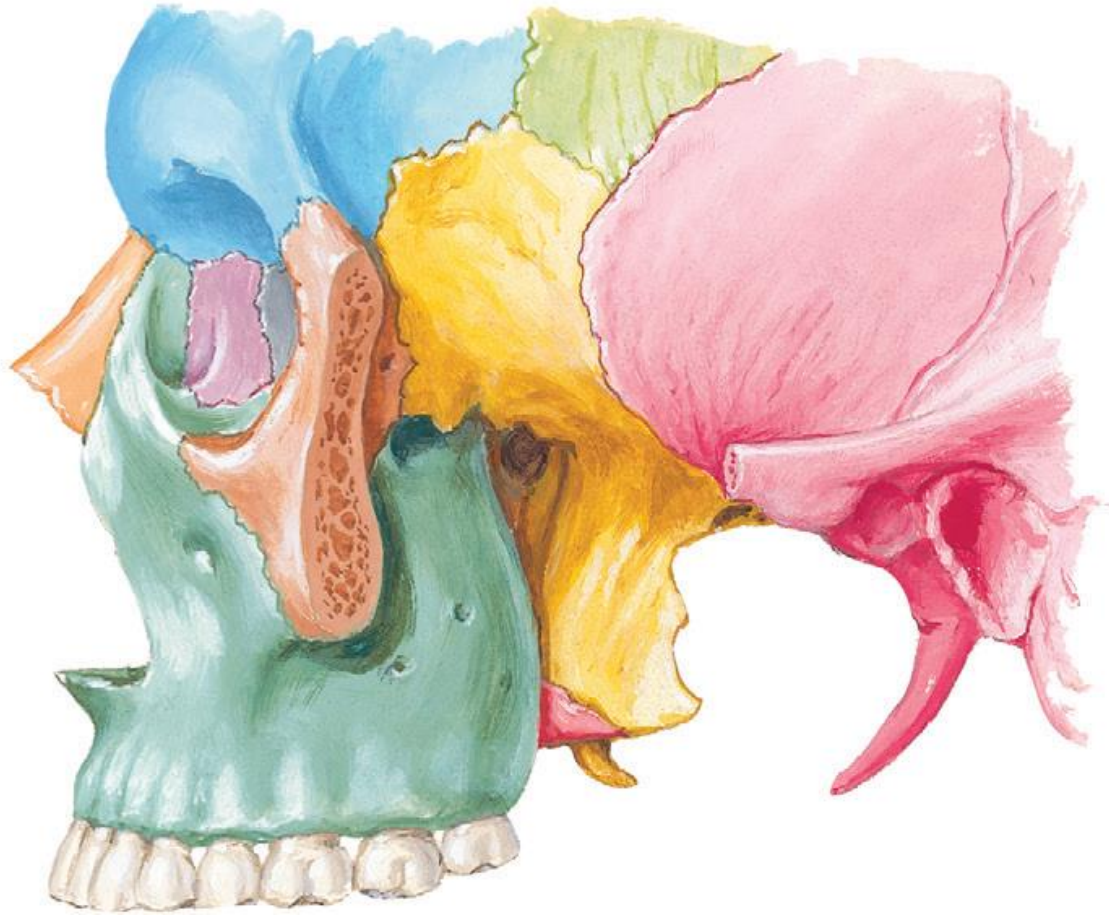
- The parasympathetic ganglion is the Otic ganglion (***Only ganglion with four roots***), i.e. *Sensory, Sympathetic, Motor & Secretomotor/Parasympathetic*.
- Blood supply is Via **Maxillary Artery;** Middle meningeal artery is its most important branch-its injury results in **Extradural Haemorrhage**

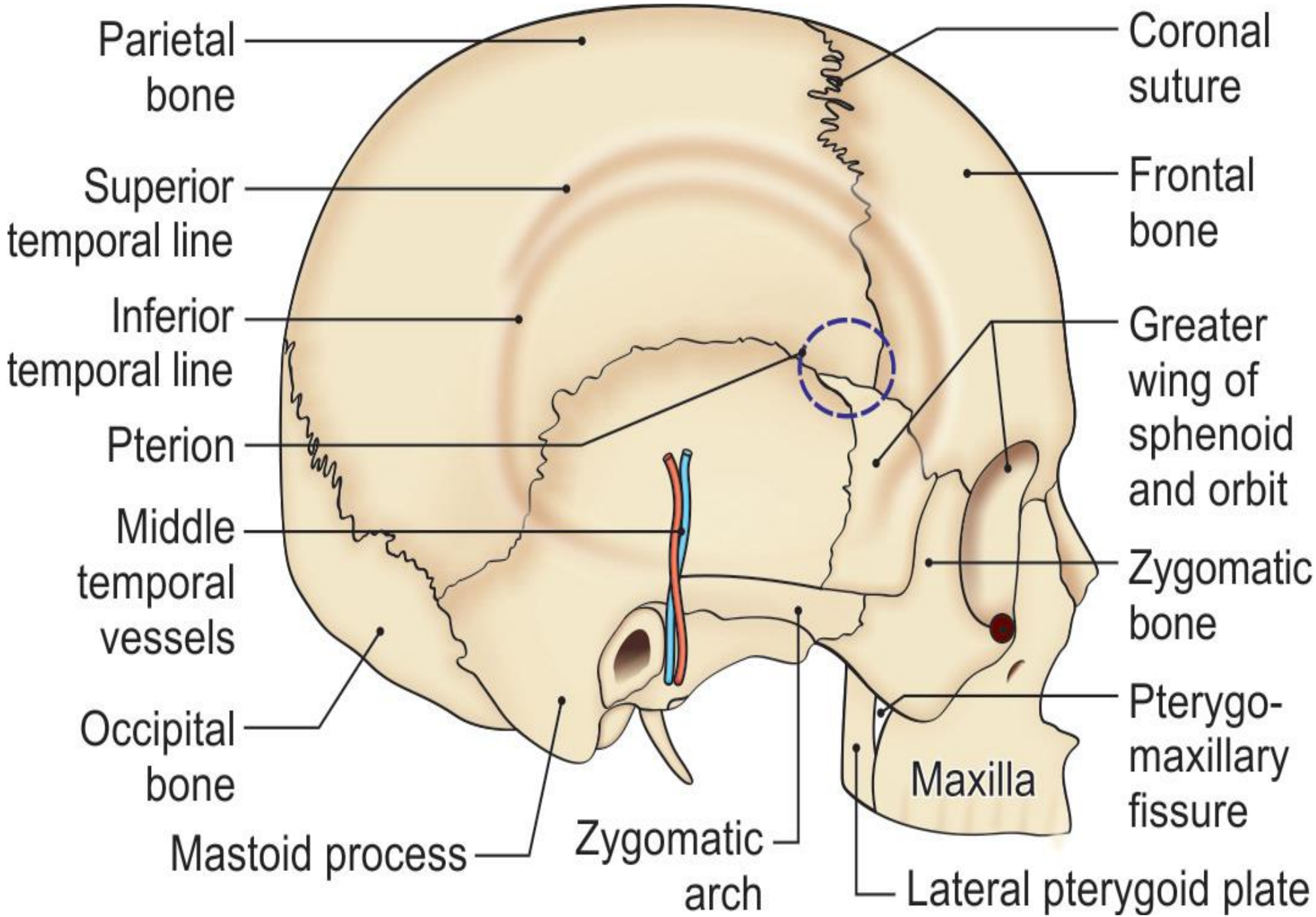
TEMPORAL FOSSA

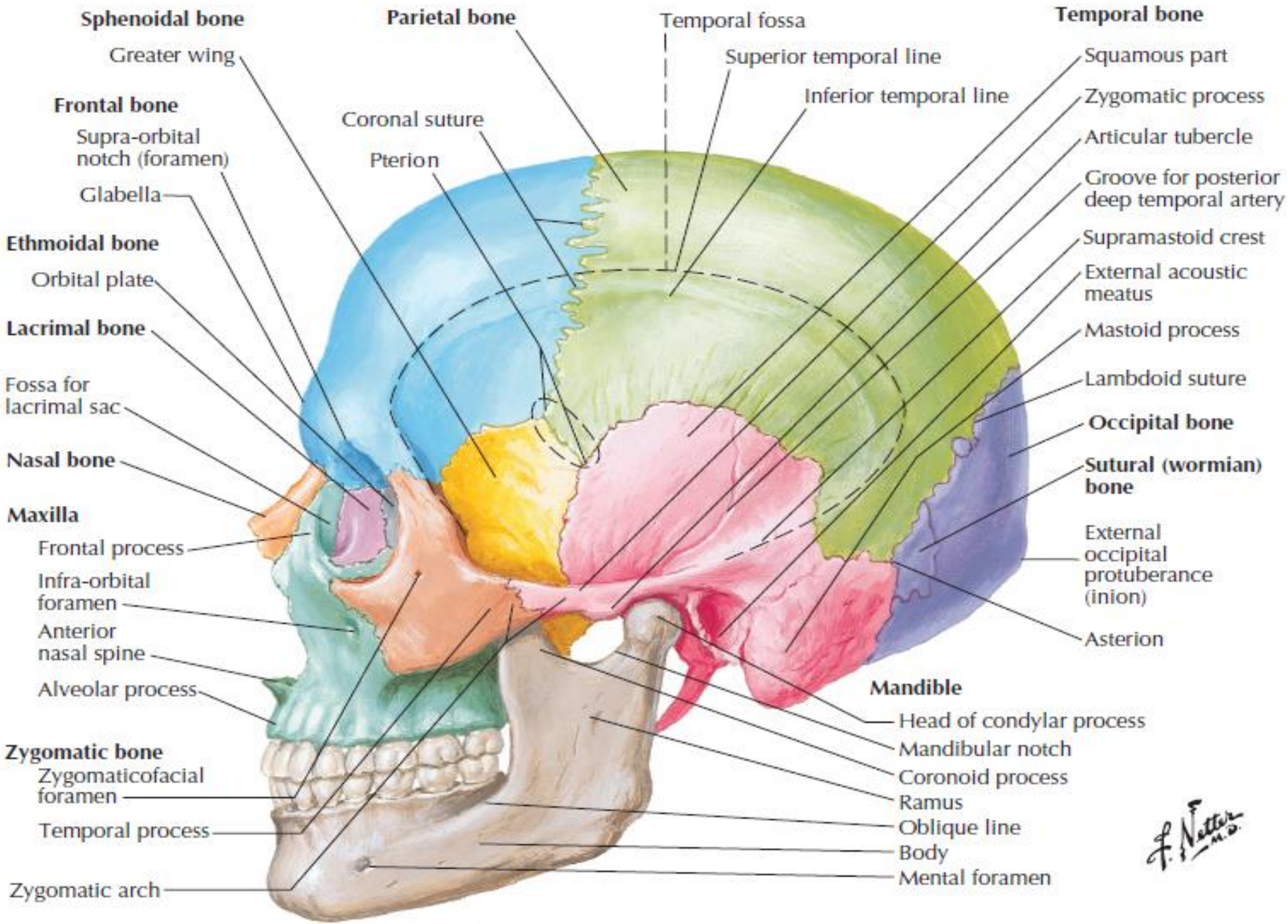
- **Anterior**: *Zygomatic & Frontal Bone*
- **Posterior**: *Inferior Temporal line & Supramastoid Crest*
- **Superior**: *Superior Temporal Line*
- **Inferior**: *Zygomatic arch*
- **Floor**: *Parts of Frontal, Parietal, Temporal & Greater Wing of Sphenoid*.

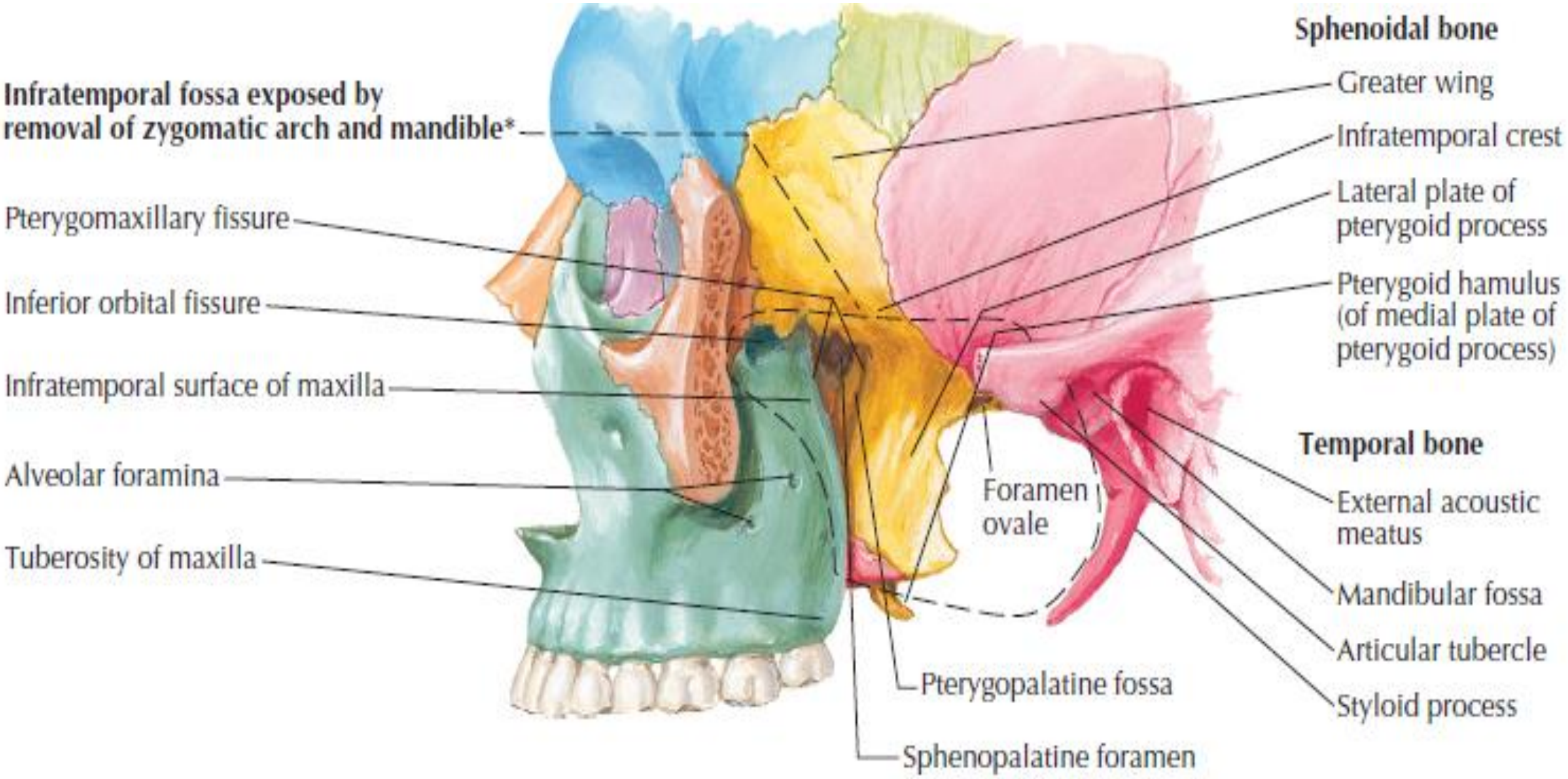
NB: Temporalis is attached to the Floor & Inferior Temporal line.






Parietal bone
Superior temporal line
Inferior temporal line
Pterion
Middle temporal vessels
Occipital bone
Mastoid process
Zygomatic arch
Lateral pterygoid plate
Maxilla
Pterygo-maxillary fissure
Zygomatic bone
Greater wing of sphenoid and orbit
Frontal bone
Coronal suture


Sphenoidal bone
Greater wing
Frontal bone
Supra-orbital notch (foramen)
Glabella
Ethmoidal bone
Orbital plate
Lacrimal bone
Fossa for lacrimal sac
Nasal bone
Maxilla
Frontal process
Infra-orbital foramen
Anterior nasal spine
Alveolar process
Zygomatic bone
Zygomaticofacial foramen
Temporal process
Zygomatic arch
Parietal bone
Coronal suture
Pterion
Temporal fossa
Superior temporal line
Inferior temporal line
Temporal bone
Squamous part
Zygomatic process
Articular tubercle
Groove for posterior deep temporal artery
Supramastoid crest
External acoustic meatus
Mastoid process
Lambdoid suture
Occipital bone
Sutural (wormian) bone
External occipital protuberance (inion)
Asterion
Mandible
Head of condylar process
Mandibular notch
Coronoid process
Ramus
Oblique line
Body
Mental foramen


Infratemporal fossa exposed by removal of zygomatic arch and mandible*
Pterygomaxillary fissure
Inferior orbital fissure
Infratemporal surface of maxilla
Alveolar foramina
Tuberosity of maxilla
Sphenoidal bone
Greater wing
Infratemporal crest
Lateral plate of pterygoid process
Pterygoid hamulus (of medial plate of pterygoid process)
Foramen ovale
Temporal bone
External acoustic meatus
Mandibular fossa
Articular tubercle
Styloid process
Pterygopalatine fossa
Sphenopalatine foramen

CONTENTS OF THE TEMPORAL FOSSA

1. Temporalis Muscle
2. Middle Temporal Artery
3. Zygomaticotemporal Nerve & Artery
4. Deep Temporal Nerve
5. Deep Temporal Artery

INFRATEMPORAL FOSSA

- Lies deep to the Ramus of the Mandible.
- It communicates with the :

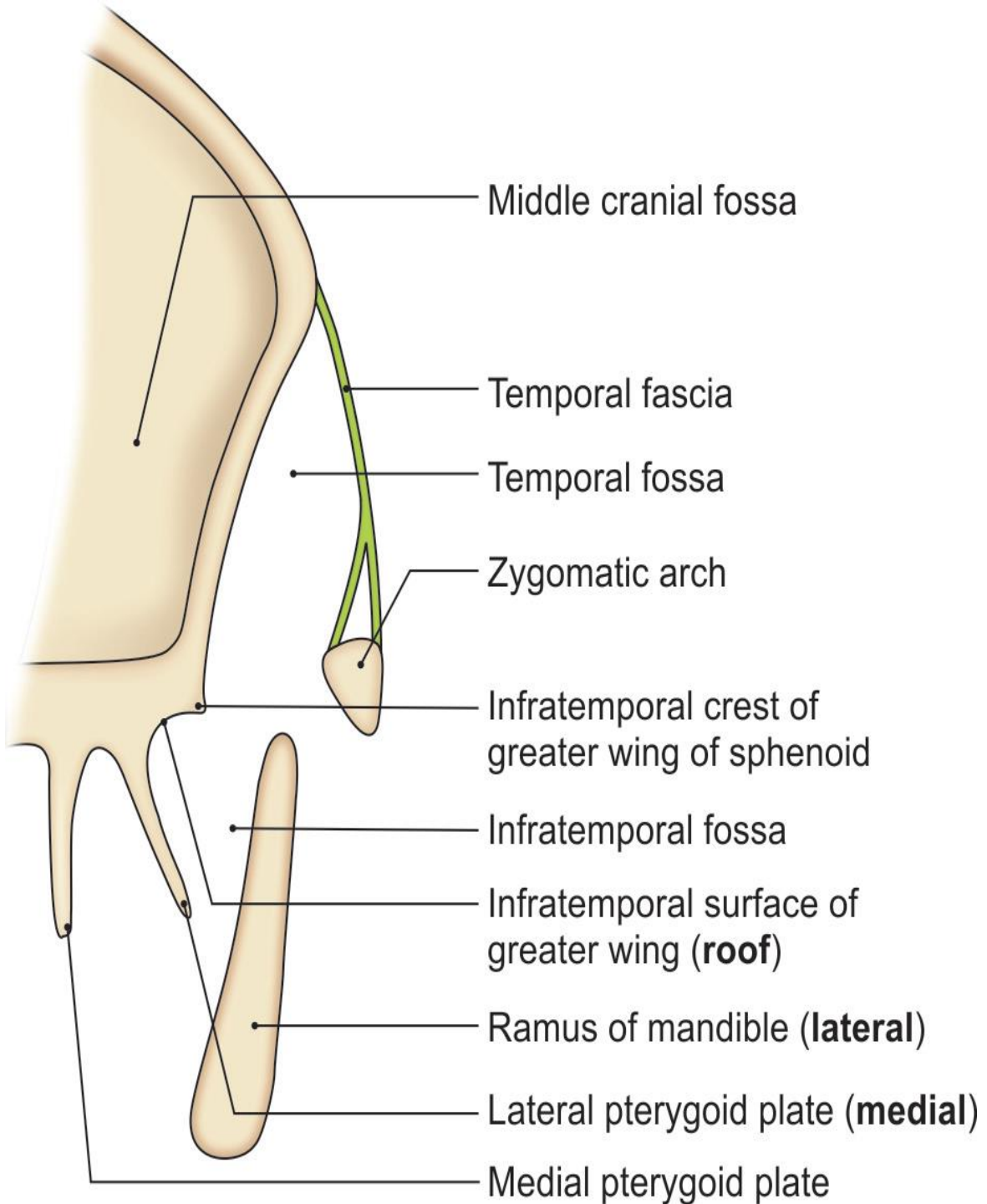
A) **Temporal Fossa superiorly** deep to the *zygomatic arch.*

B) **Orbit Anteriorly** through the *inferior orbital fissure*

C) **Pterygopalatine fossa medially** through the *Pterygomaxillary fissure.*

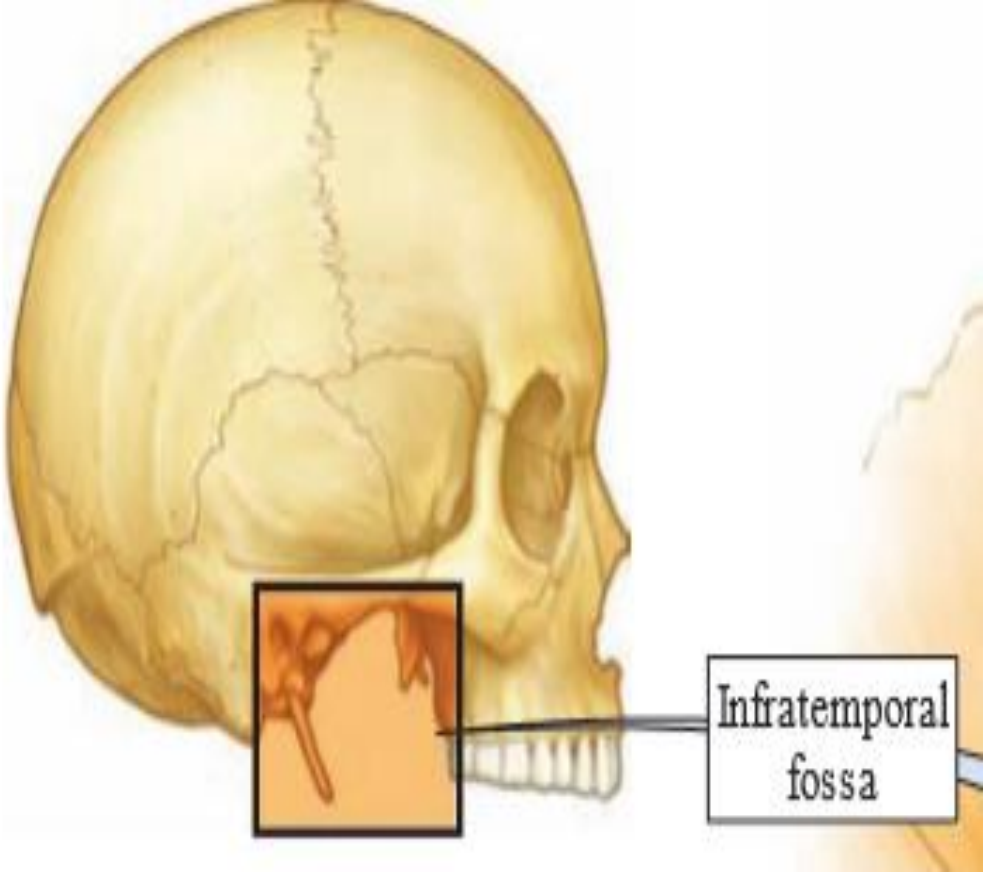
D) **Middle Cranial Fossa** through the *foramina ovale & spinosum.*

NB: *Temporal Fossa* is superior to the **Zygomaticus Arch** where as *Infratemporal Fossa* is inferior



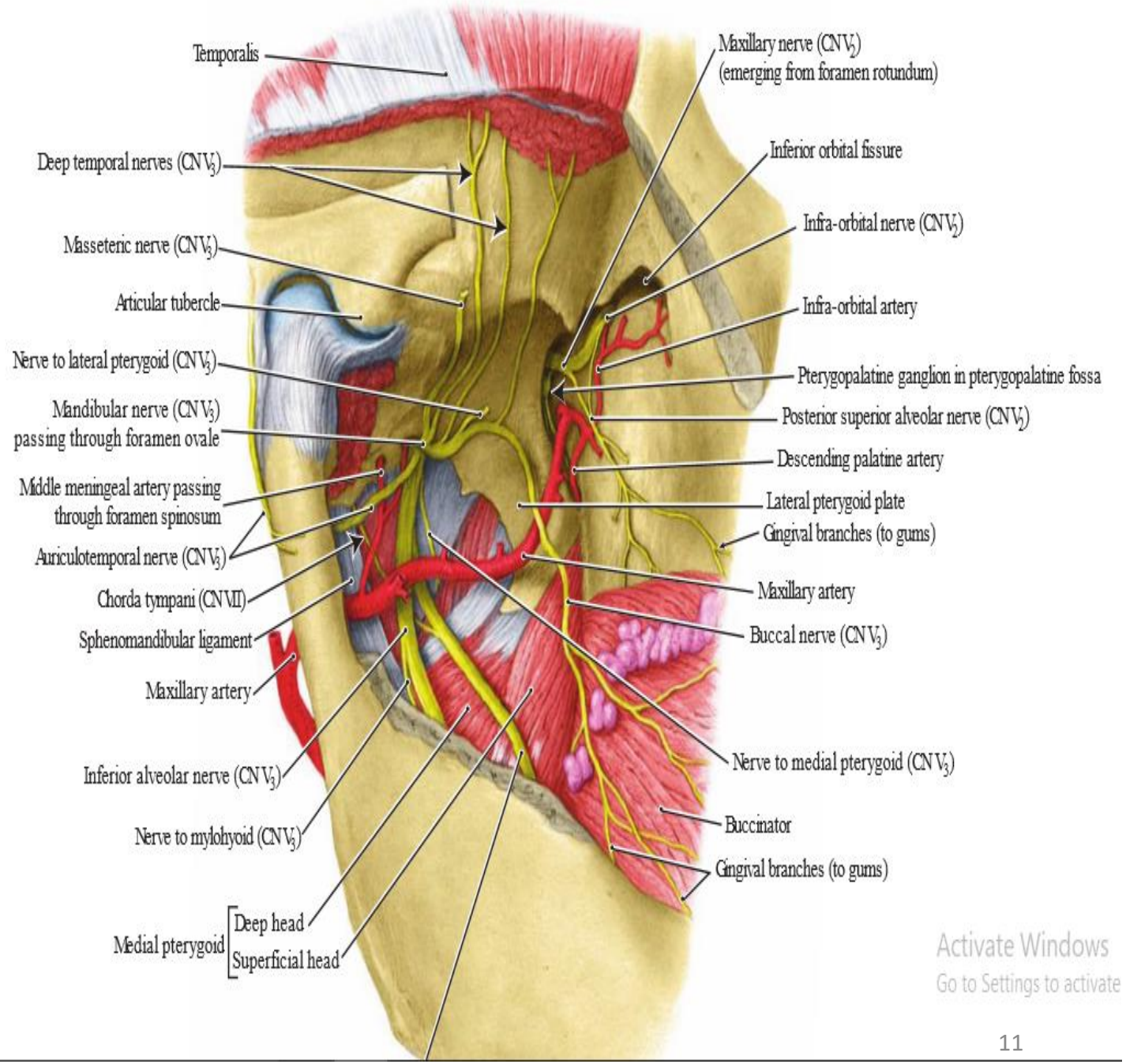
BOUNDARIES

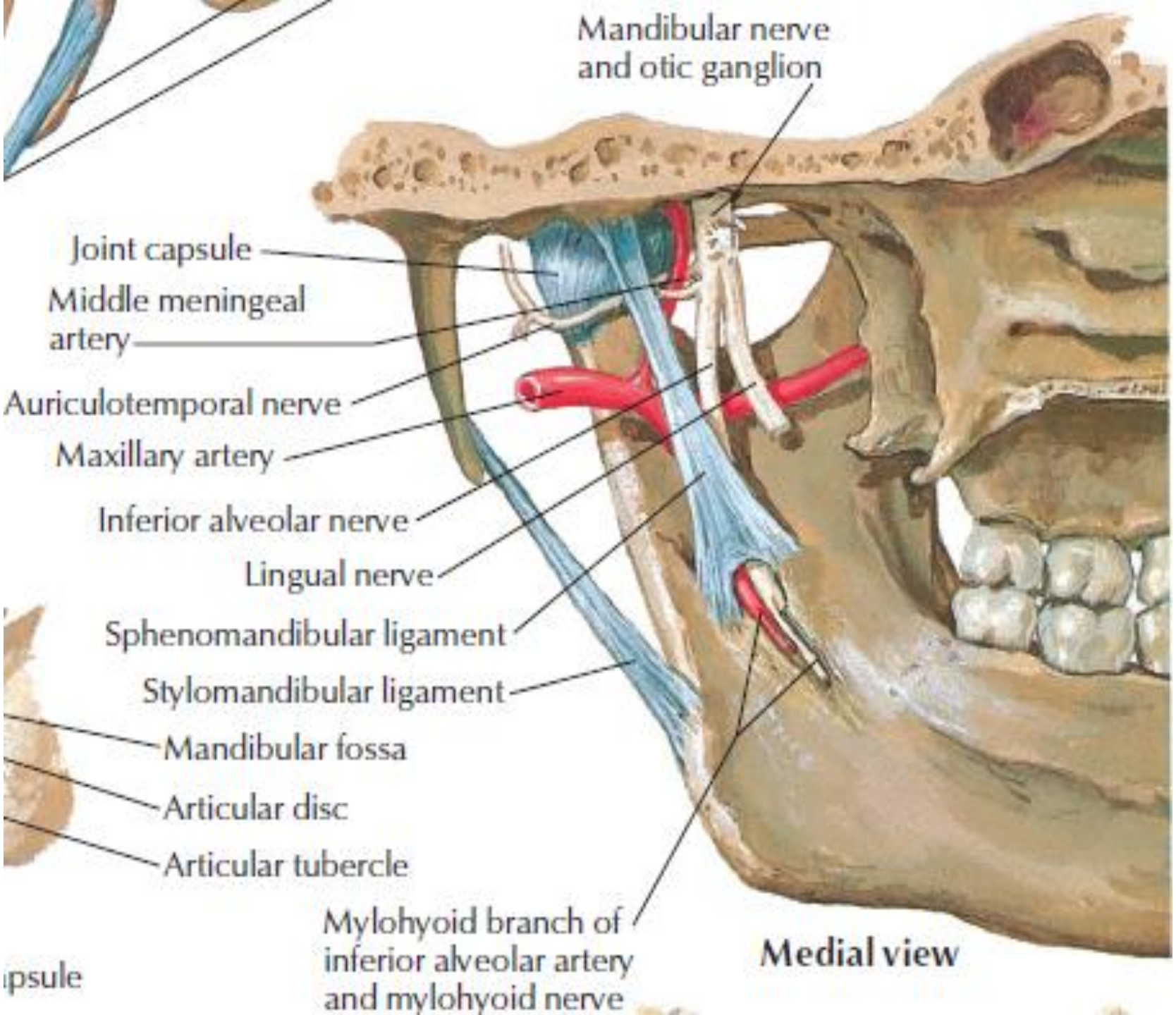
- **Anterior**: Posterior surface of the Body of Maxilla
- **Roof:** Infratemporal surface of Greater Wing Of Sphenoid.
- **Medial**: Lateral pterygoid plate and pyramidal process of palatine bone
- **Lateral**: Ramus of Mandible



Major structures that occupy the infratemporal fossa

1. The lateral & medial pterygoid muscles
2. The mandibular division of the Trigeminal Nerve
3. The Chorda Tympani branch of the Facial Nerve
4. The Otic parasympathetic ganglion
5. The Maxillary artery & its branches
6. The Pterygoid Venous Plexus

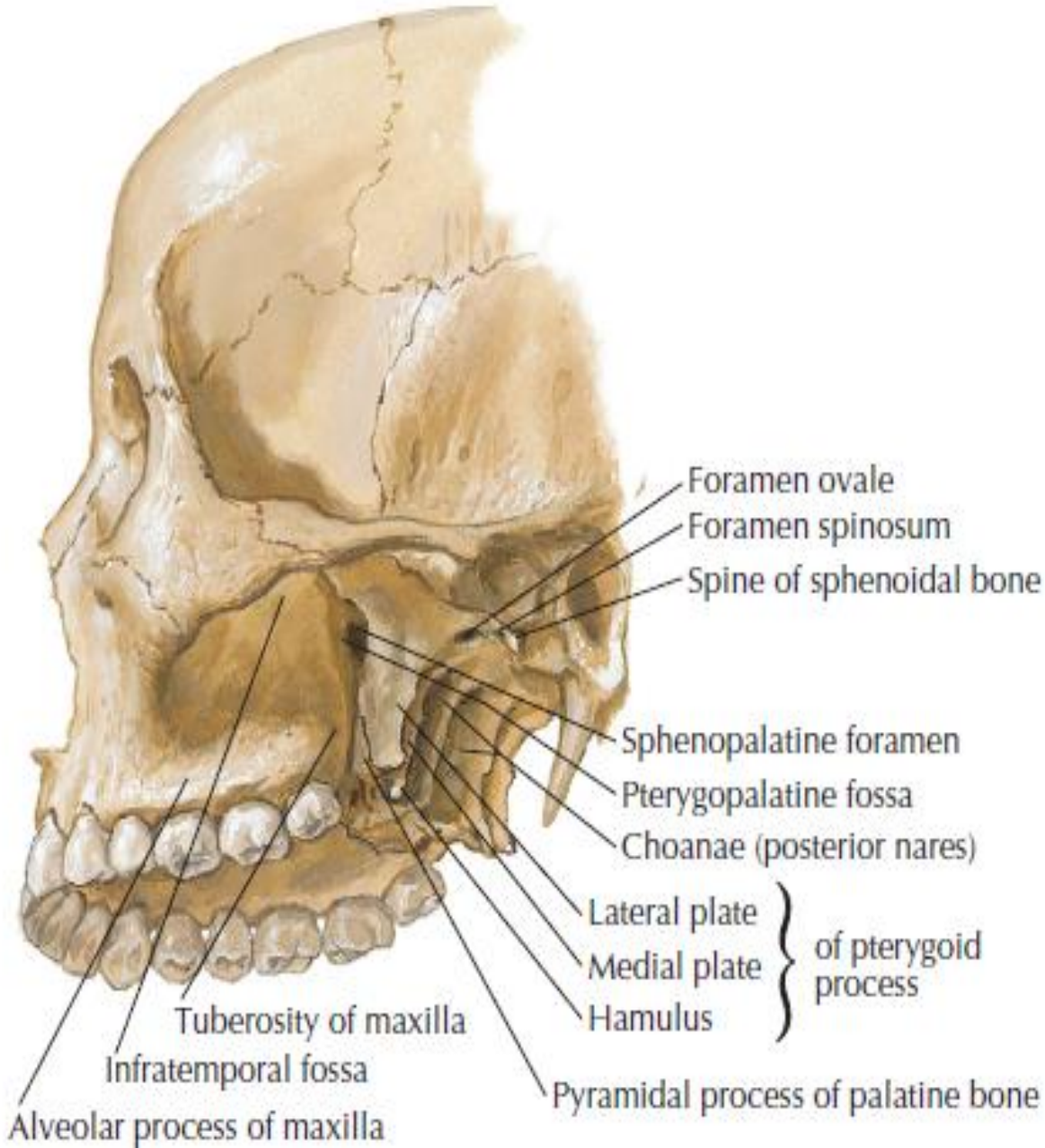


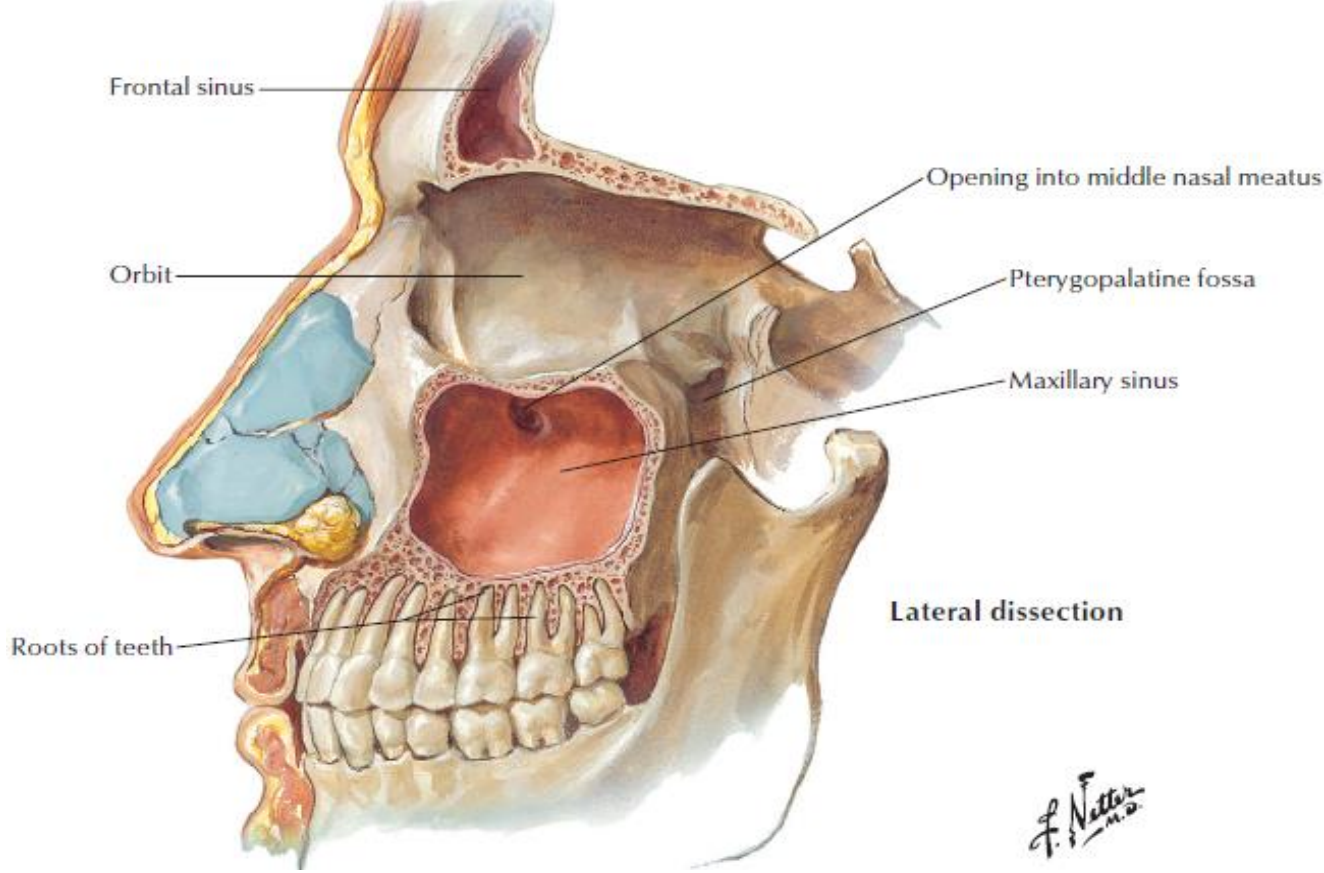

Mandibular nerve
and otic ganglion
Joint capsule
Middle meningeal
artery
Auriculotemporal nerve
Maxillary artery
Inferior alveolar nerve
Lingual nerve
Sphenomandibular ligament
Stylomandibular ligament
Mandibular fossa
Articular disc
Articular tubercle
Mylohyoid branch of
inferior alveolar artery
and mylohyoid nerve
Medial view

Pterygopalatine Fossa(PPF)

- Area bounded by the Maxillary, Palatine & Sphenoid Bone
- **Anterior**: *Superomedial part of posterior surface of Maxilla*
- **Posterior**: *Root of Pterygoid process & anterior surface of greater wing of sphenoid*
- **Medial**: upper part of perpendicular plate of *Palatine bone*
- **Lateral:** opens into *infratemporal fossa via Pterygomaxillary Fissure*
- **Superior**: under surface of *sphenoid bone & orbital process of the palatine bone*
- *Inferior: closed by pyramidal process of palatine bone*

- **Roof:** *sphenoid bone*.





Lateral dissection

Content

1. 3rd part of **Maxillary Artery** & its branches
2. **Maxillary nerve** and its branches; Ganglionic , Zygomtic & Posterior Superior Alveolar
3. Pterygopalatine ganglion & its numerous branches (maxillary nerves mixed with autonomic nerves)

COMMUNICATION

Anteriorly: With the orbit via medial end of the inferior orbital fissure

Posteriorly

1 **Middle cranial fossa** via Foramen Rotundum.

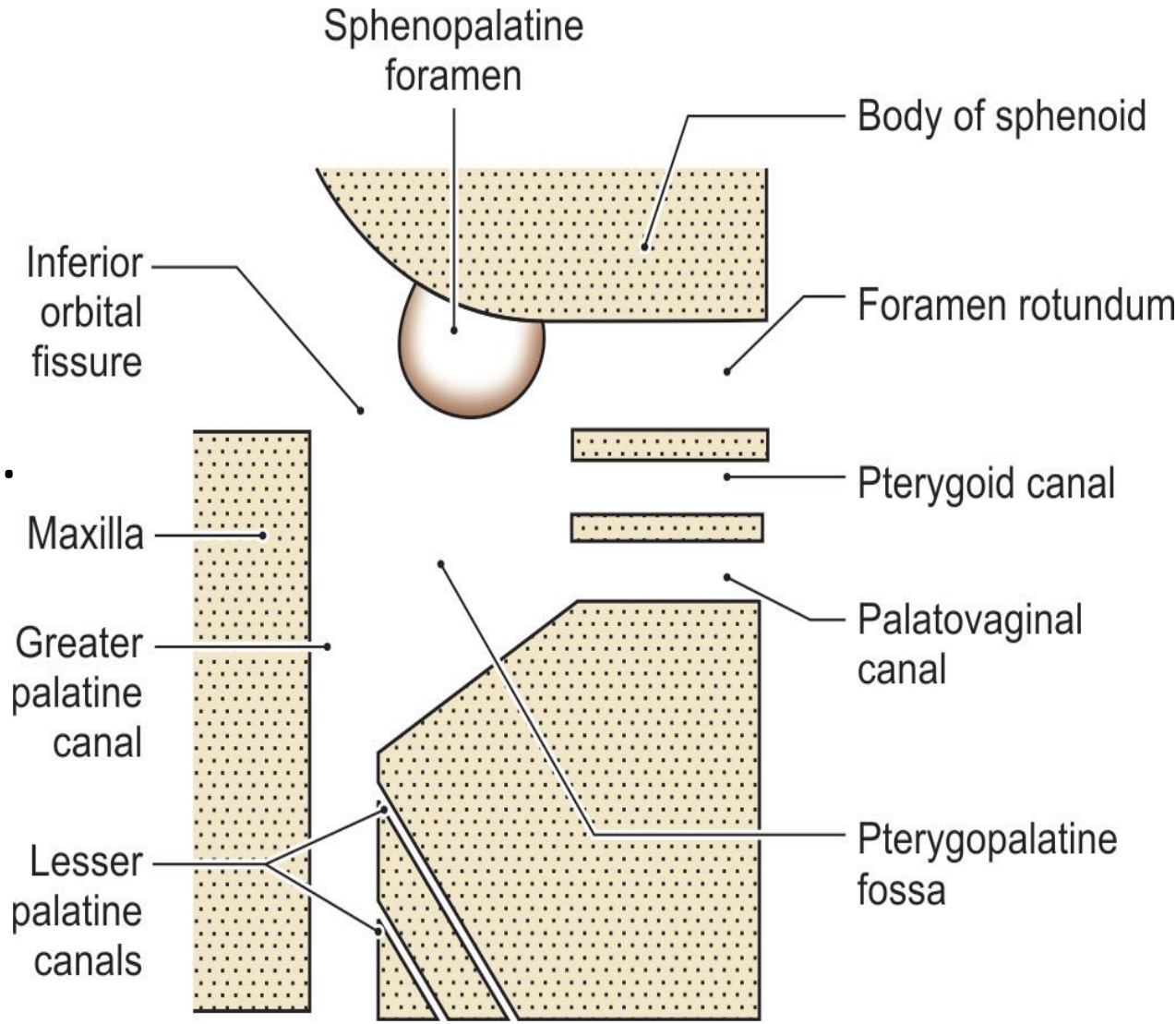
2 **Foramen lacerum** via pterygoid canal.

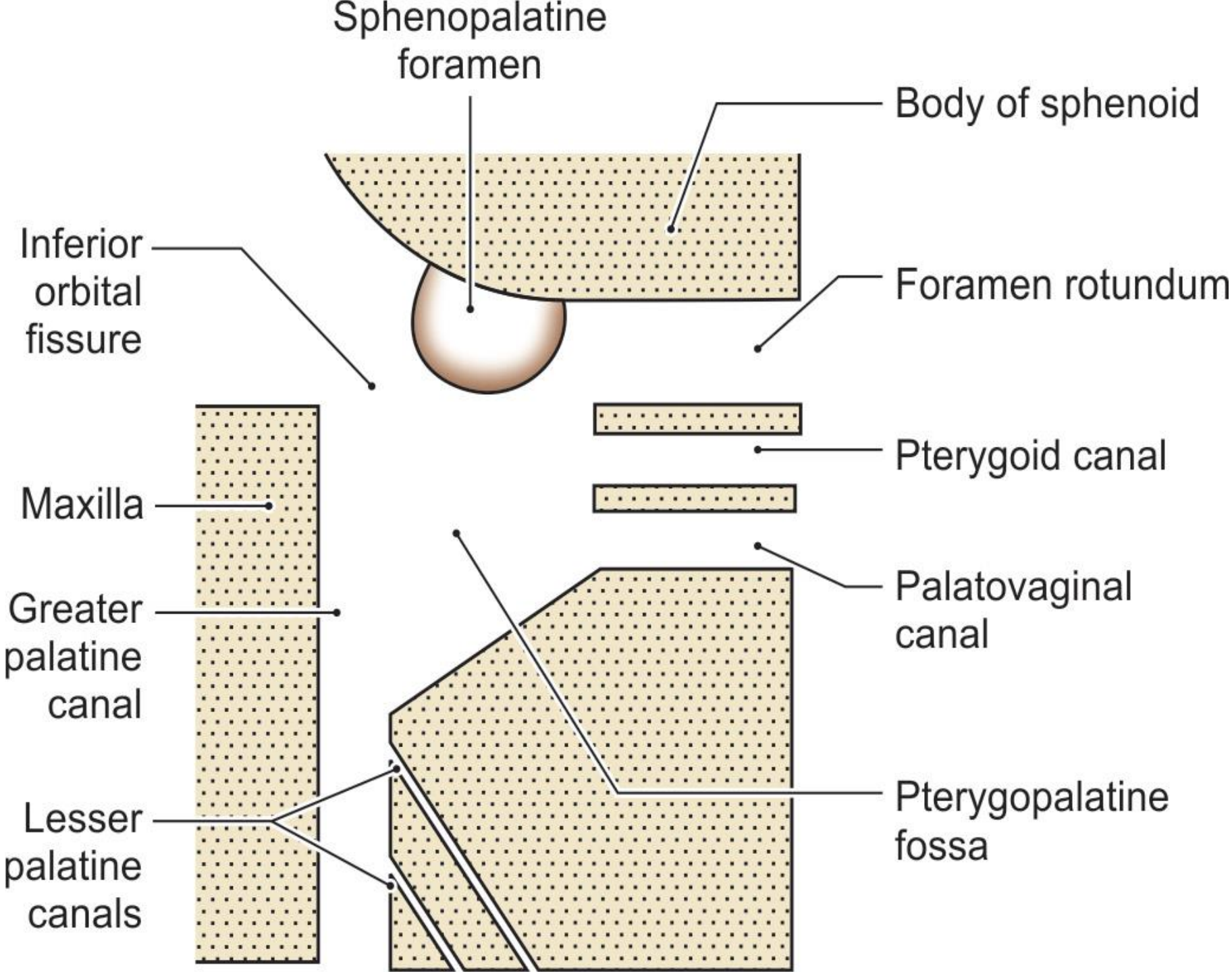
3 **Pharynx** via palatinovaginal canal.

Medially: With the nose via sphenopalatine foramen.

Laterally: With the infratemporal fossa via Pterygomaxillary Fissure.

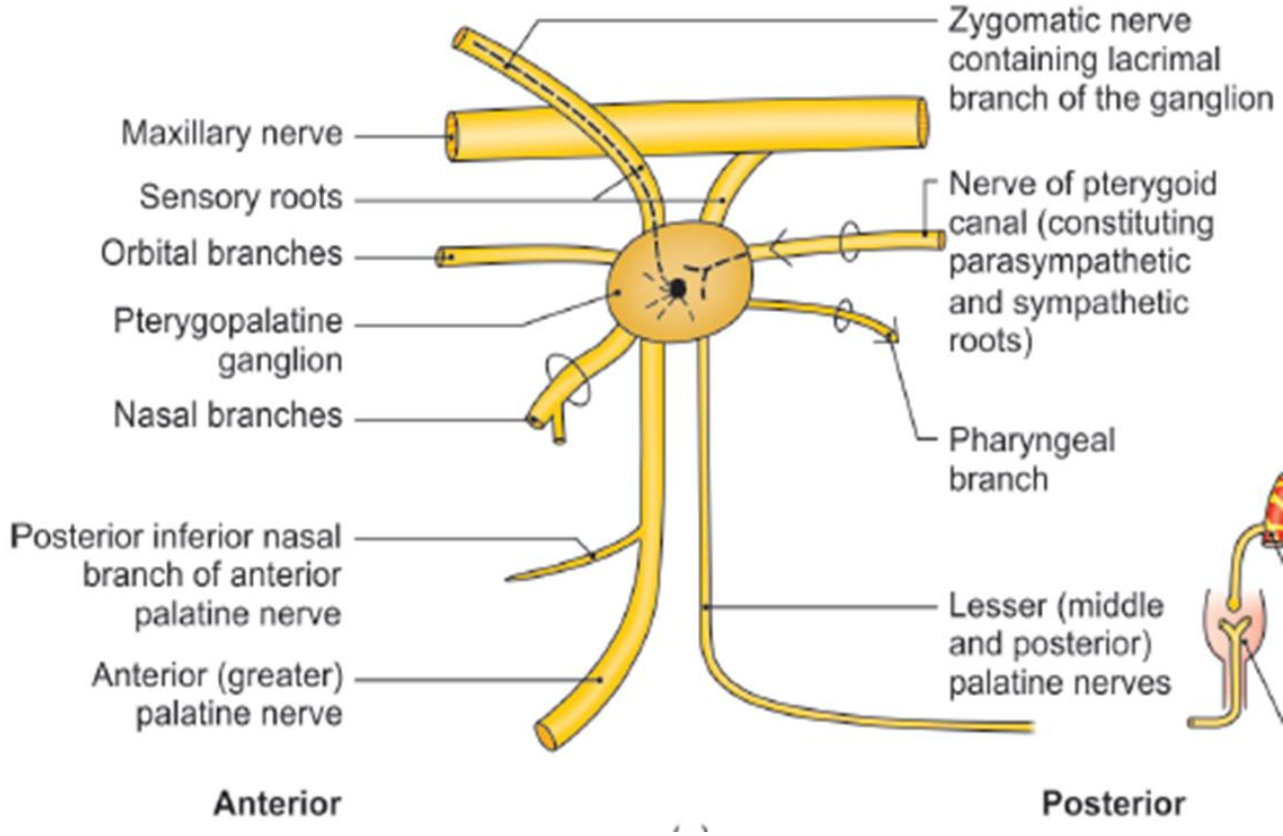
Inferiorly: With the oral cavity via greater & lesser palatine canals




Sphenopalatine foramen
Body of sphenoid
Inferior orbital fissure
Foramen rotundum
Pterygoid canal
Maxilla
Greater palatine canal
Palatovaginal canal
Lesser palatine canals
Pterygopalatine fossa

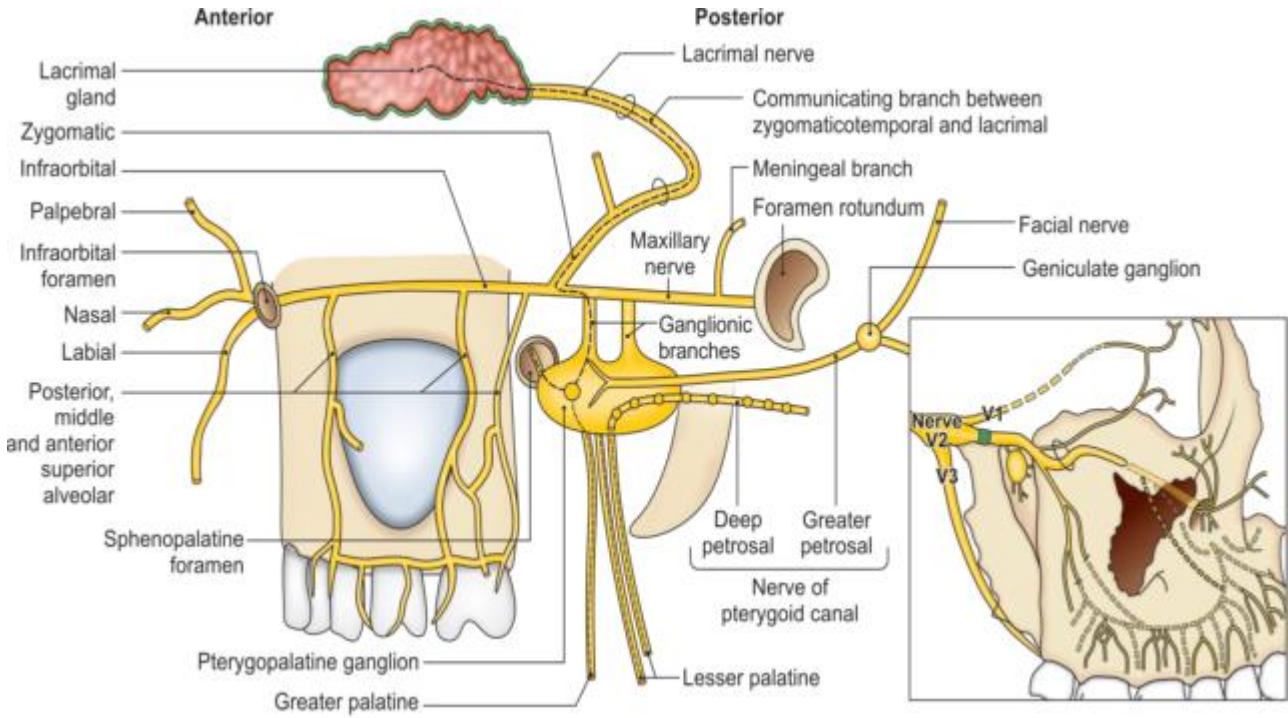
Maxillary Nerve

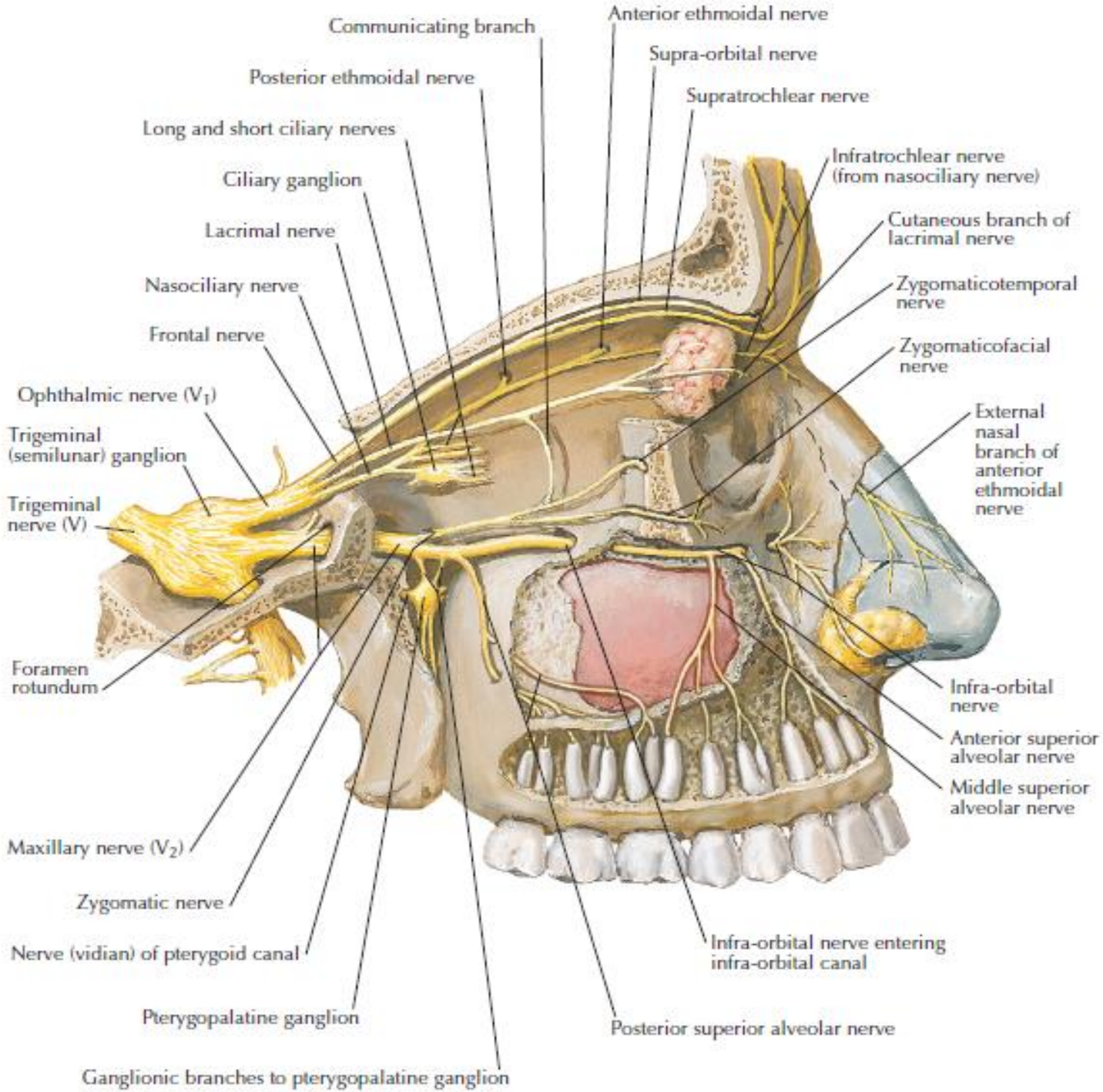
- Arises from Trigeminal ganglion, runs in lateral wall of cavernous sinus below **Ophthalmic Nerve**
- Leaves middle cranial fossa via **Foramen Rotundum**
- Crosses upper part of PPF-continues as ***Infraorbital Nerve.***
- In middle cranial fossa M.N gives off **Meningeal Branch**.
- In PPF, M.N is related to Pterygopalatine ganglion giving off: Ganglionic, Posterior Superior Alveolar And Zygomatic Nerves.

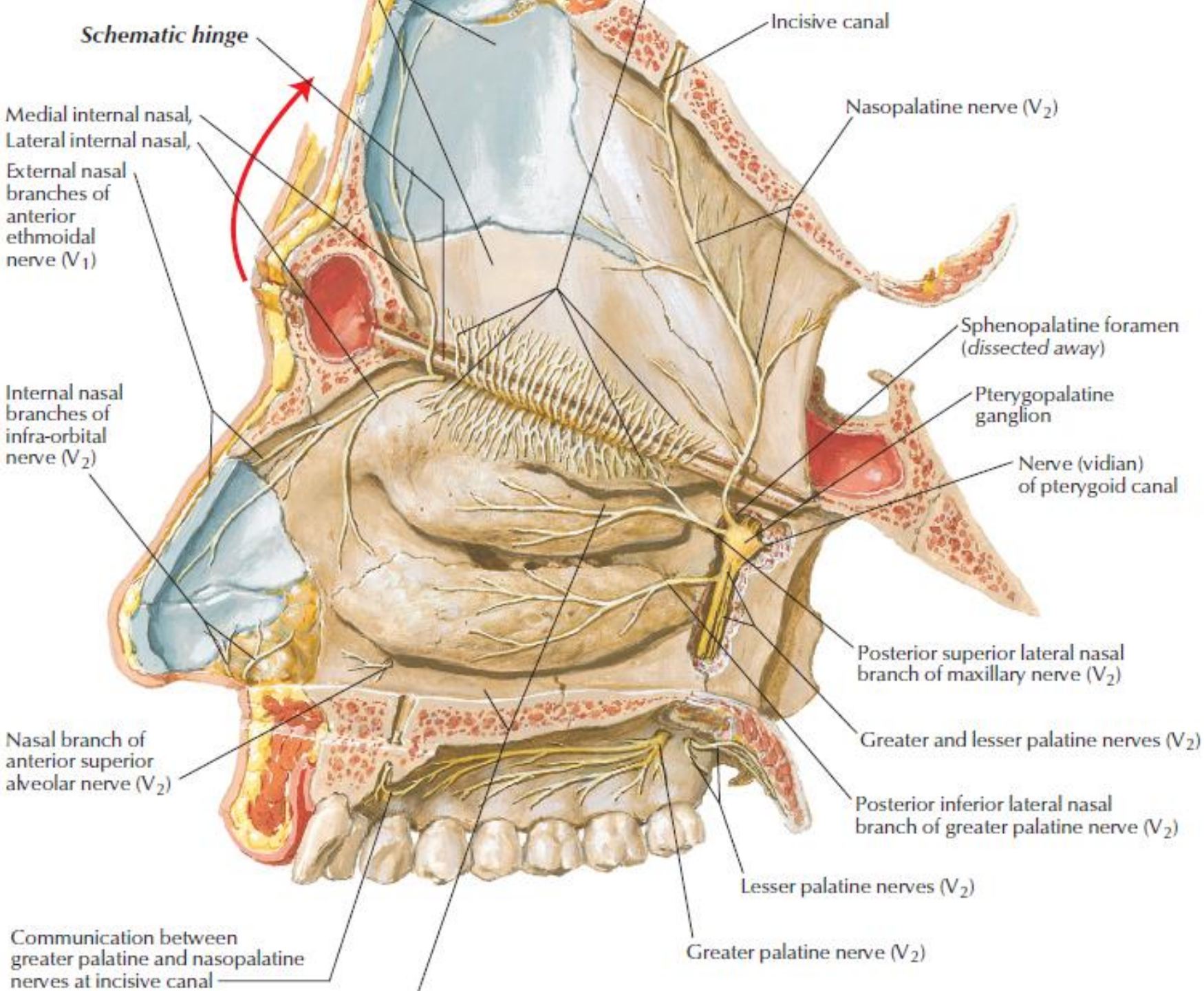


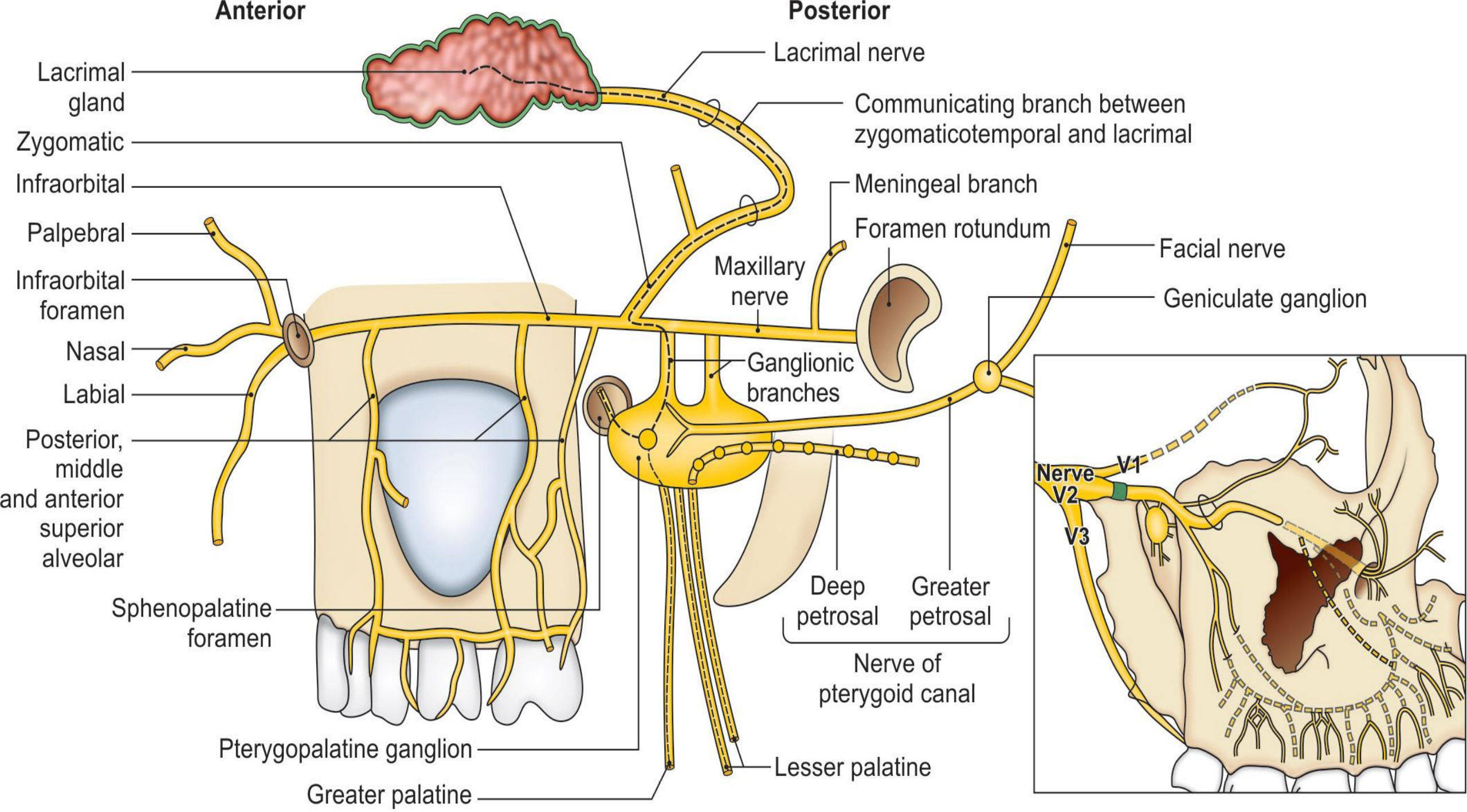
1. **Ganglionic Branches:** The pterygopalatine ganglion is suspended by the ganglionic branches.
2. **Posterior Superior Alveolar Nerve:** enters posterior surface of the body of maxilla; supplies **3 upper molar teeth** & adjoining part of the gum.
3. **Zygomatic Nerve:** branch of the maxillary nerve, given off in PPF.enters orbit through the inferior orbital fissure.

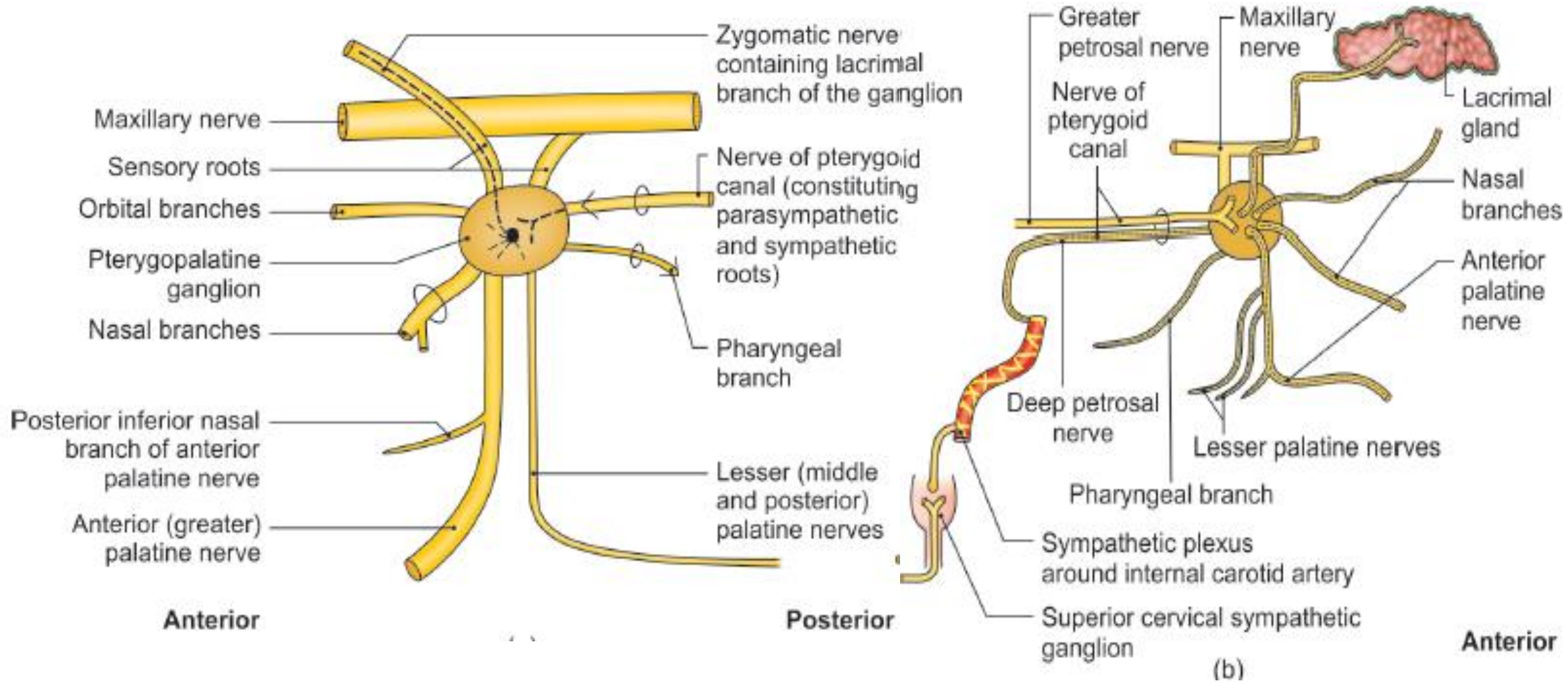
NB: ***Terminates*** as Zygomaticofacial & Zygomaticotemporal Nerves: supply skin of face & anterior part of temple




Communicating branch
Anterior ethmoidal nerve
Supra-orbital nerve
Posterior ethmoidal nerve
Supratrochlear nerve
Long and short ciliary nerves
Infratrochlear nerve (from nasociliary nerve)
Ciliary ganglion
Cutaneous branch of lacrimal nerve
Lacrimal nerve
Zygomaticotemporal nerve
Nasociliary nerve
Zygomaticofacial nerve
Frontal nerve
Ophthalmic nerve (V_1)
External nasal branch of anterior ethmoidal nerve
Trigeminal (semilunar) ganglion
Trigeminal nerve (V)
Foramen rotundum
Infra-orbital nerve
Anterior superior alveolar nerve
Middle superior alveolar nerve
Maxillary nerve (V_2)
Zygomatic nerve
Nerve (vidian) of pterygoid canal
Infra-orbital nerve entering infra-orbital canal
Pterygopalatine ganglion
Posterior superior alveolar nerve
Ganglionic branches to pterygopalatine ganglion


Schematic hinge
Incisive canal
Nasopalatine nerve (V_2)
Medial internal nasal,
Lateral internal nasal,
External nasal branches of anterior ethmoidal nerve (V_1)
Sphenopalatine foramen (*dissected away*)
Pterygopalatine ganglion
Internal nasal branches of infra-orbital nerve (V_2)
Nerve (vidian) of pterygoid canal
Posterior superior lateral nasal branch of maxillary nerve (V_2)
Nasal branch of anterior superior alveolar nerve (V_2)
Greater and lesser palatine nerves (V_2)
Posterior inferior lateral nasal branch of greater palatine nerve (V_2)
Lesser palatine nerves (V_2)
Communication between greater palatine and nasopalatine nerves at incisive canal
Greater palatine nerve (V_2)

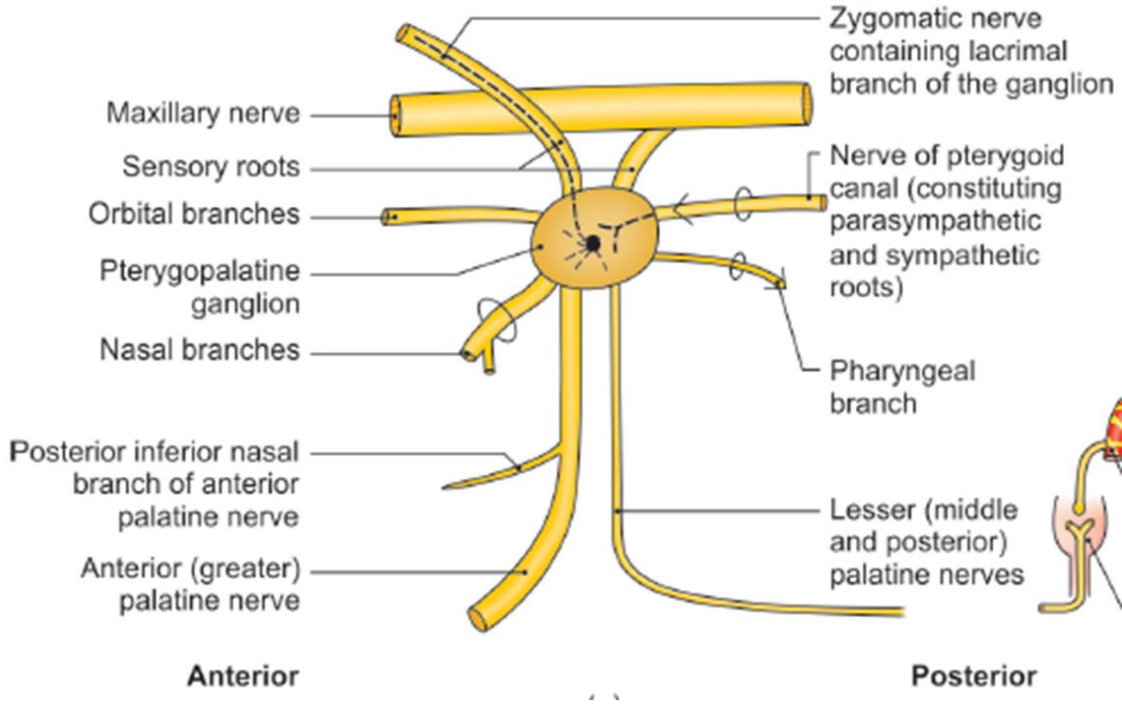

Anterior
Posterior
Lacrimal gland
Zygomatic
Infraorbital
Palpebral
Infraorbital foramen
Nasal
Labial
Posterior, middle and anterior superior alveolar
Sphenopalatine foramen
Pterygopalatine ganglion
Greater palatine
Lacrimal nerve
Communicating branch between zygomaticotemporal and lacrimal
Meningeal branch
Foramen rotundum
Facial nerve
Maxillary nerve
Geniculate ganglion
Ganglionic branches
Deep petrosal
Greater petrosal
Nerve of pterygoid canal
Lesser palatine
Nerve
V1
V2
V3


Zygomatic nerve containing lacrimal branch of the ganglion
Maxillary nerve
Sensory roots
Orbital branches
Pterygopalatine ganglion
Nasal branches
Nerve of pterygoid canal (constituting parasympathetic and sympathetic roots)
Pharyngeal branch
Posterior inferior nasal branch of anterior palatine nerve
Anterior (greater) palatine nerve
Lesser (middle and posterior) palatine nerves
Anterior
Posterior
Greater petrosal nerve
Maxillary nerve
Nerve of pterygoid canal
Lacrimal gland
Nasal branches
Anterior palatine nerve
Deep petrosal nerve
Lesser palatine nerves
Pharyngeal branch
Sympathetic plexus around internal carotid artery
Superior cervical sympathetic ganglion
Anterior
(b)

PTERYGOPALATINE GANGLION/SPHENOPALATINE GANGLION/GANGLION OF HAY FEVER/MECKEL'S GANGLION

Features

- Pterygopalatine is largest parasympathetic peripheral ganglion.
- Serves as a relay station; ***Secretomotor Fibres*** to lacrimal gland & Mucous glands of Nose, Paranasal Sinuses, Palate & Pharynx.
- Topographically its related to ***Maxillary Nerve***-functionally its connected to ***Facial Nerve*** via its greater petrosal branch.
- The flattened ganglion lies in the pterygopalatine fossa just below the maxillary nerve, in front of the pterygoid canal and lateral to *the Sphenopalatine Foramen*



Branches of P.P.G

- Stems from branches of maxillary nerve.
- They also carry *Parasympathetic & Sympathetic Fibres* which pass through the ganglion.

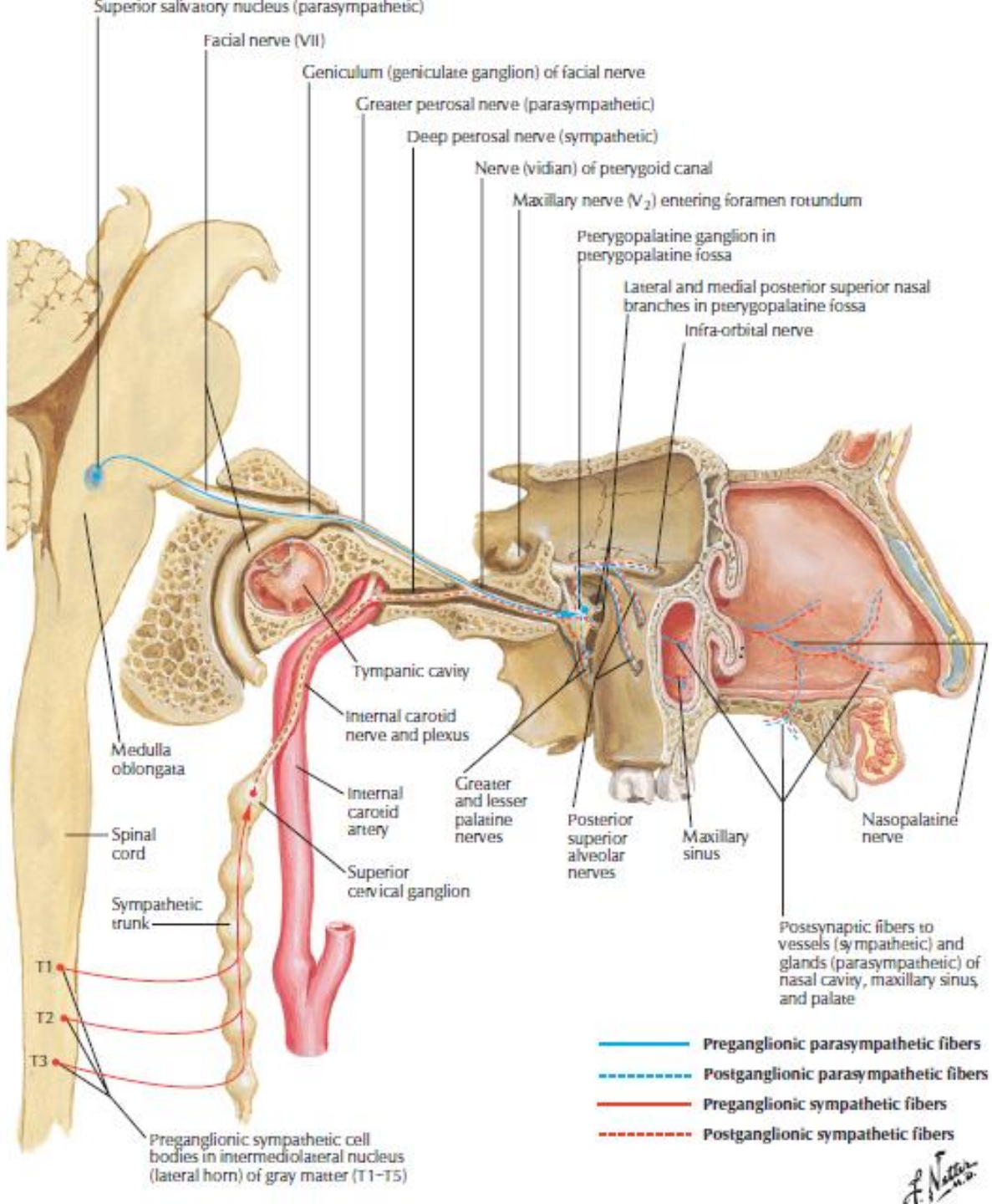
The branches are:

1 Orbital branches: pass through inferior orbital fissure-supply the periosteum of the orbit & orbitalis muscle (*involuntary*)

2 Palatine branches: the *greater/anterior palatine nerve* descends through **greater palatine canal**-supply hard palate & labial aspect of upper gums. *The lesser/middle & posterior palatine nerves* supply the soft palate & tonsil

3 Nasal branches: enter nasal cavity Via sphenopalatine foramen.

- The *lateral posterior superior nasal branches*- (6) in number, supply the posterior parts of the superior & middle conchae
- The *medial posterior superior nasal branches*, (2/3) in number, supply posterior part of roof of nose & nasal septum.
- The largest of these nerves(*Nasopalatine Nerve*) descends up to the anterior part of hard palate via **Incisive Foramen**


Superior salivatory nucleus (parasympathetic)
Facial nerve (VII)
Geniculum (geniculate ganglion) of facial nerve
Greater petrosal nerve (parasympathetic)
Deep petrosal nerve (sympathetic)
Nerve (vidian) of pterygoid canal
Maxillary nerve (V_2) entering foramen rotundum
Pterygopalatine ganglion in pterygopalatine fossa
Lateral and medial posterior superior nasal branches in pterygopalatine fossa
Infra-orbital nerve
Tympanic cavity
Internal carotid nerve and plexus
Medulla oblongata
Internal carotid artery
Greater and lesser palatine nerves
Posterior superior alveolar nerves
Maxillary sinus
Nasopalatine nerve
Spinal cord
Superior cervical ganglion
Sympathetic trunk
T1
T2
T3
Postsynaptic fibers to vessels (sympathetic) and glands (parasympathetic) of nasal cavity, maxillary sinus, and palate
Preganglionic sympathetic cell bodies in intermediolateral nucleus (lateral horn) of gray matter (T1–T5)
Preganglionic parasympathetic fibers
Postganglionic parasympathetic fibers
Preganglionic sympathetic fibers
Postganglionic sympathetic fibers

4. **Pharyngeal branch**: Pass via *Palatinovaginal canal*-supply part of Nasopharynx behind ***Auditory Tube***

5. Lacrimal branch: The postganglionic fibres pass back into maxillary nerve to leave it through *Zygomatic Nerve* & its Zygomaticotemporal branch a communicating branch to lacrimal nerve to supply the **Secretomotor fibres** to **Lacrimal Gland**

SUMMARY OF PTERYGOPALATINE FOSSA

It contains three or multiple of three structures:

Three contents:

- Maxillary nerve
- 3rd part of maxillary artery
- Pterygopalatine ganglion.

Three names of ganglion:

- Sphenopalatine
- Pterygopalatine
- Ganglion of hay fever/Meckel's ganglion.

Three structures traversing in openings in posterior wall:

- Maxillary nerve through foramen rotundum.
- Nerve of pterygoid canal through pterygoid canal.
- Pharyngeal branch through palatinovaginal canal.

Three structures through inferior orbital fissure:

- Infraorbital nerve.
- Zygomatic nerve.
- Orbital branches of the ganglion.

Three structures through inferior orbital fissure:

- Infraorbital nerve.
- Zygomatic nerve.
- Orbital branches of the ganglion.

Three structures through inferior openings:

- One anterior palatine nerve with greater palatine vessels.
- Two posterior palatine nerves including lesser palatine vessels.

Three structures through medial opening:

- Nasopalatine nerve and sphenopalatine vessels.
- Medial posterior superior nasal branches.
- Lateral posterior superior nasal branches.

Three roots of the ganglion: Sensory, sympathetic and secretomotor.

3 × 2 branches of the ganglion: Orbital, pharyngeal, for lacrimal gland, anterior palatine, posterior palatine and nasopalatine branches.

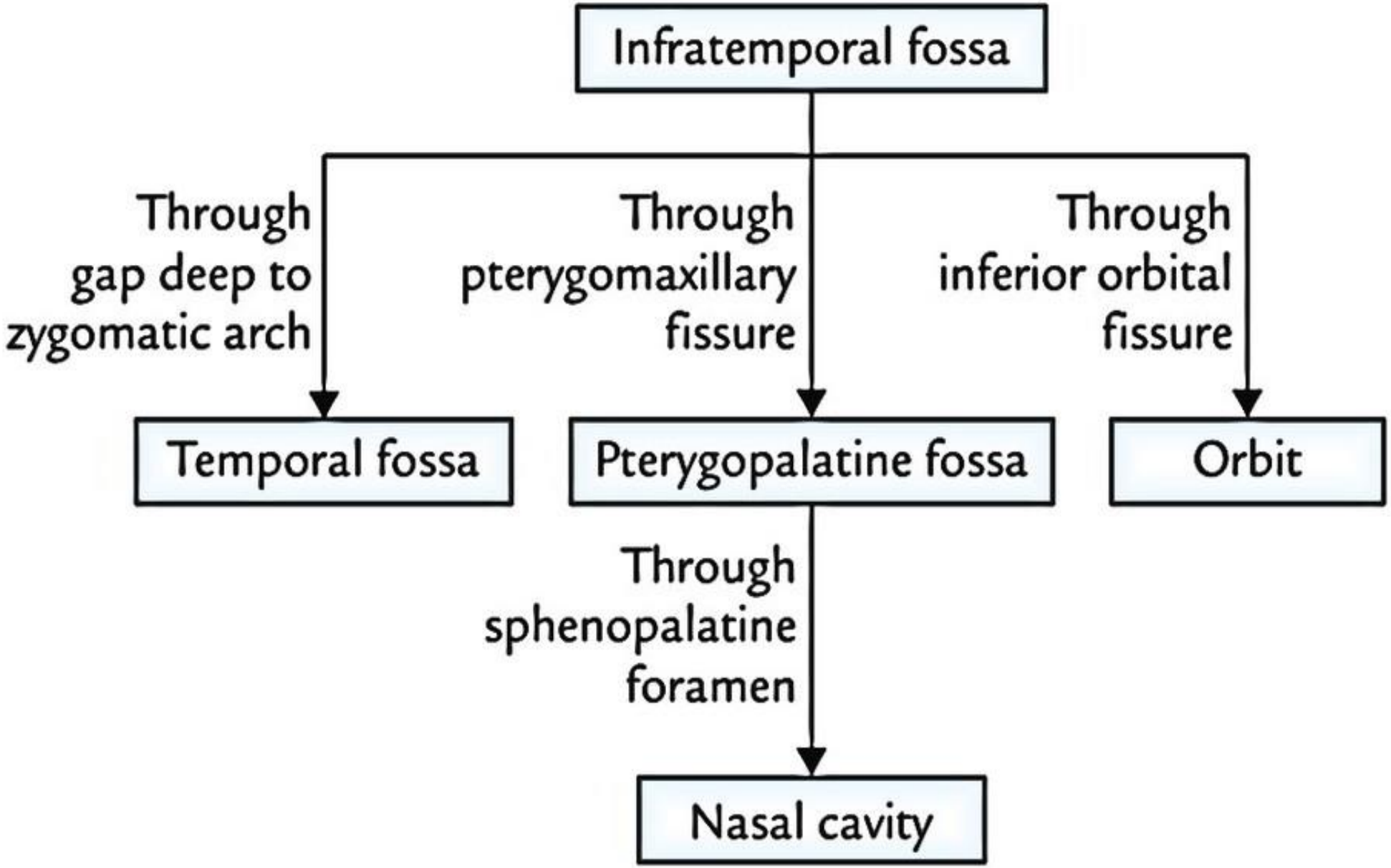
3 × 2 branches of 3rd part of maxillary artery: Posterior superior alveolar, infraorbital, *sphenopalatine*, pharyngeal, artery of pterygoid canal and greater palatine.

CLINICAL ANATOMY

- Trigeminal neuralgia affecting its maxillary branch produces symptoms in the area of its distribution. The nerve can be anaesthetised at the foramen rotundum.
- The pterygopalatine ganglion, if irritated or infected, causes congestion of the glands of palate and nose including the lacrimal gland producing running nose and lacrimation. The condition is called hay fever. The ganglion is called '*ganglion of hay fever*.
- Maxillary nerve carries the afferent limb fibres of the sneeze reflex as it carries general sensation from the nasal mucous membrane.

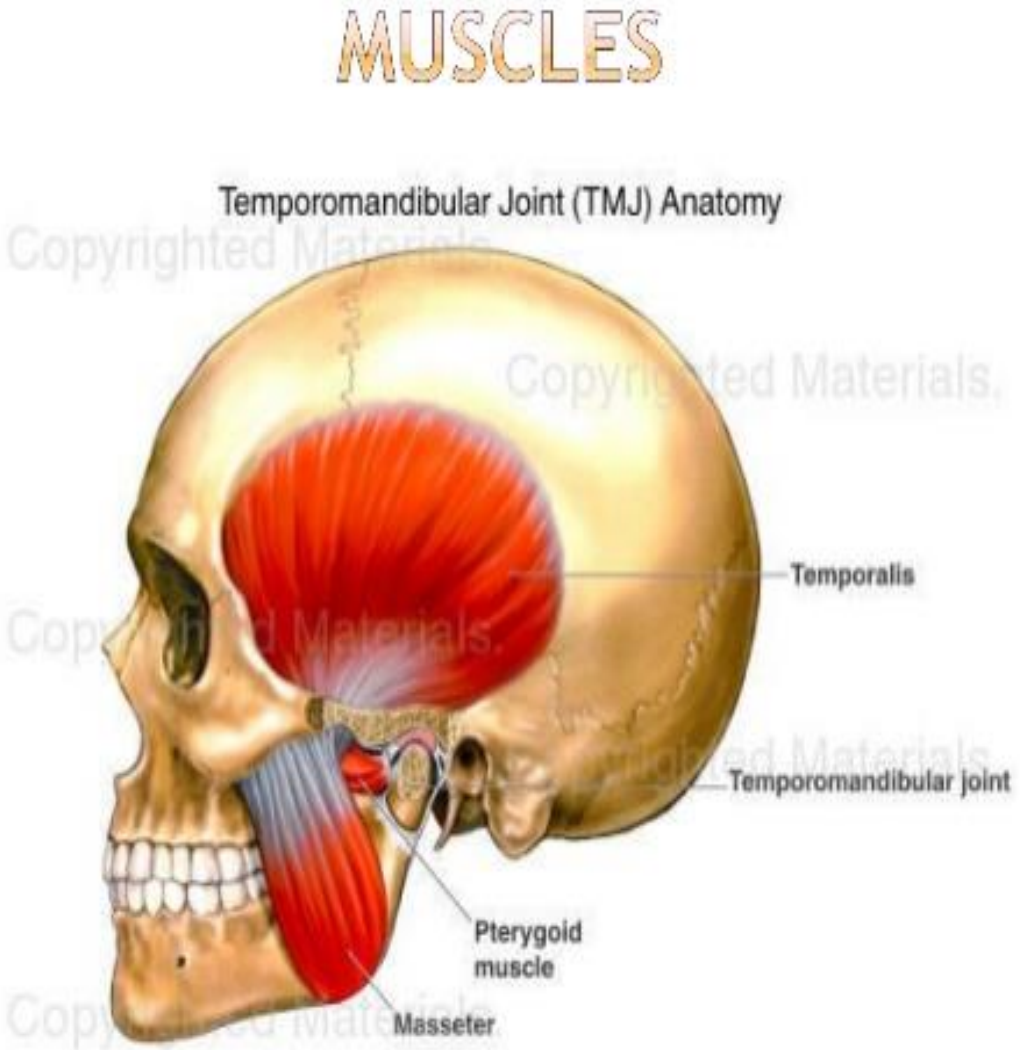
CLINICAL ANATOMY

- Trigeminal neuralgia affecting its maxillary branch produces symptoms in the area of its distribution. The nerve can be anaesthetised at the foramen rotundum.
- The pterygopalatine ganglion, if irritated or infected, causes congestion of the glands of palate and nose including the lacrimal gland producing running nose and lacrimation. The condition is called hay fever. The ganglion is called '*ganglion of hay fever*.
- Maxillary nerve carries the afferent limb fibres of the sneeze reflex as it carries general sensation from the nasal mucous membrane.


Infratemporal fossa
Through gap deep to zygomatic arch
Through pterygomaxillary fissure
Through inferior orbital fissure
Temporal fossa
Pterygopalatine fossa
Orbit
Through sphenopalatine foramen
Nasal cavity

Muscles

1. Tempolaris
2. Masseter
3. Medial pterygoid
4. Lateral pterygoid



Innervation

Sensory

1. Auriculo temporal nerve
2. Messeteric nerve

Motor

1. Mandibular division of trigeminal nerve

Vascularisation

1. Branches of external carotid artery
2. Superficial temporal artery
3. Deep auricular artery
4. Anterior tympanic artery
5. Ascending pharyngeal artery
6. Maxillary artery
7. The blood supply to TMJ is superficial i.e. there is no blood supply inside the capsule
8. TMJ takes it nourishment from the synovial fluid

MOVEMENT

- Rotational movements in first 20-25 mm of mouth opening
- Transitional movement after that the mouth is excessively open.

1. Depression of Mandble

1. Lateral pterygoid
2. Digrastric
3. Geniohyoid

2. Elevation of Mandible

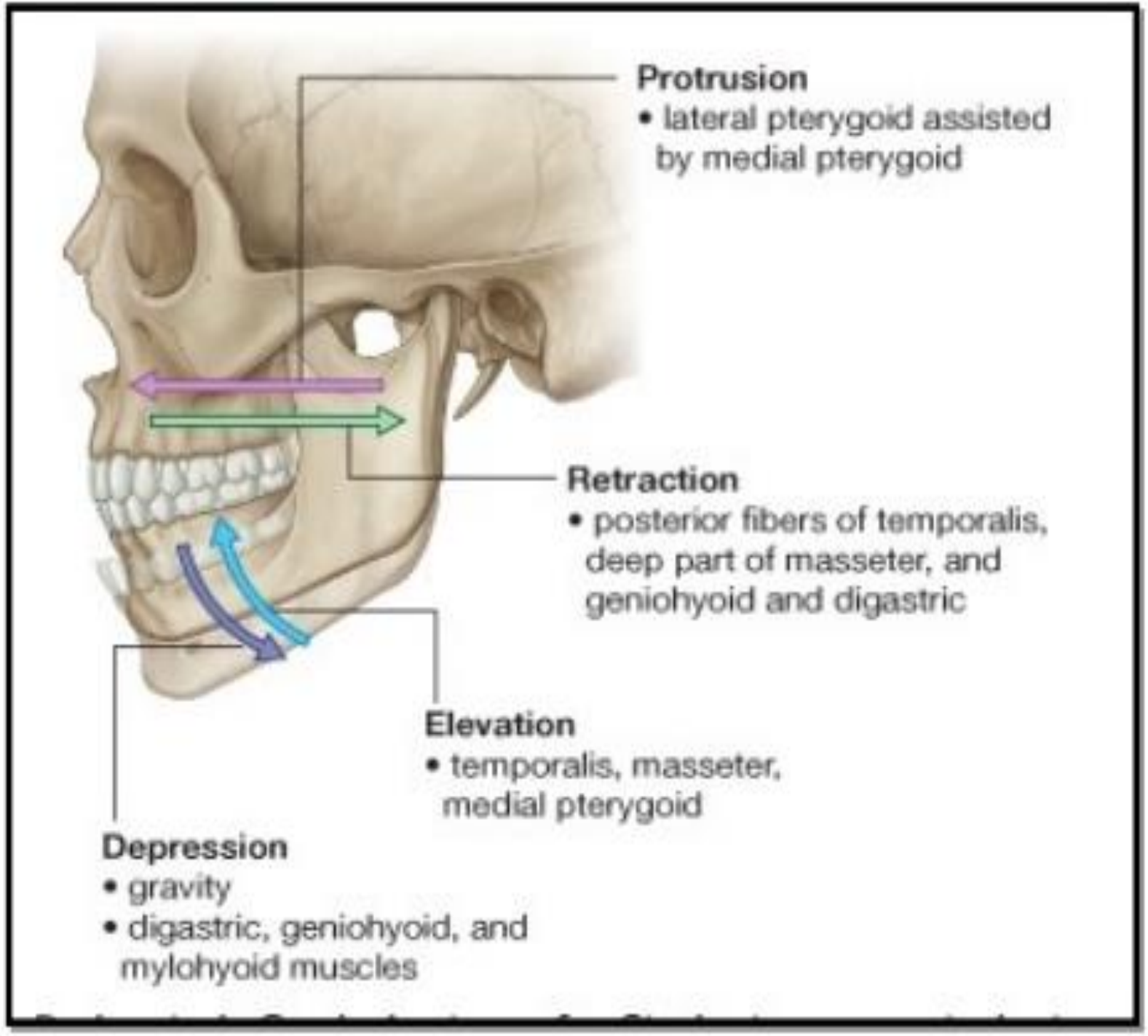
1. Tempolaris
2. Masseter
3. Medial pterygoid

3. Protrusion of Mandible

1. Medial pterygoid
2. Lateral pterygoid

4. Retraction of Mandible

1. Posterior fibres of tempolaris


Protrusion
• lateral pterygoid assisted by medial pterygoid
Retraction
• posterior fibers of temporalis, deep part of masseter, and geniohyoid and digastric
Elevation
• temporalis, masseter, medial pterygoid
Depression
• gravity
• digastric, geniohyoid, and mylohyoid muscles

Muscles of Mastication

Primary Muscles Of Mastication

1. Tempolaris
2. Masseter
3. Medial pterygoid
4. Lateral pterygoid

Secondary Muscles Of Mastication

1. The suprahyoid group of muscles being used as secondary or supplementary muscles they are
2. Digastric
3. Mylohyoid
4. Geniohyoid

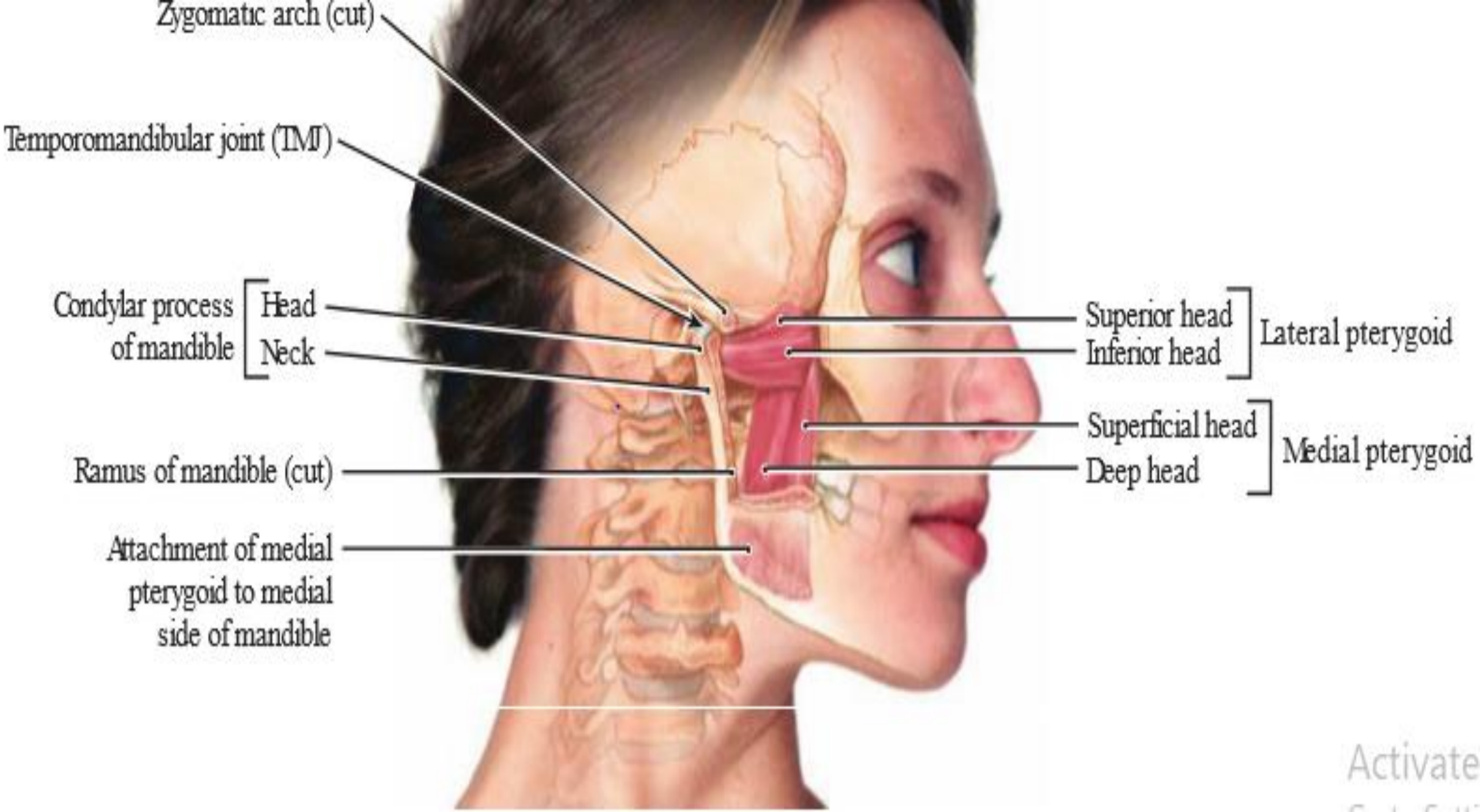
General Features

1. All the muscles arise from cranium and insert in the mandible
2. All the muscles develop from the mesoderm of 1 pharyngeal arch
3. All the muscles are supplied by nerve of 1 pharyngeal arch (Mandibular nerve).
4. All the muscles act against the gravity (anti-gravity) except lateral pterygoid.
5. Buccinator is considered as the accessory muscle of mastication.

Muscles

Lateral pterygoid

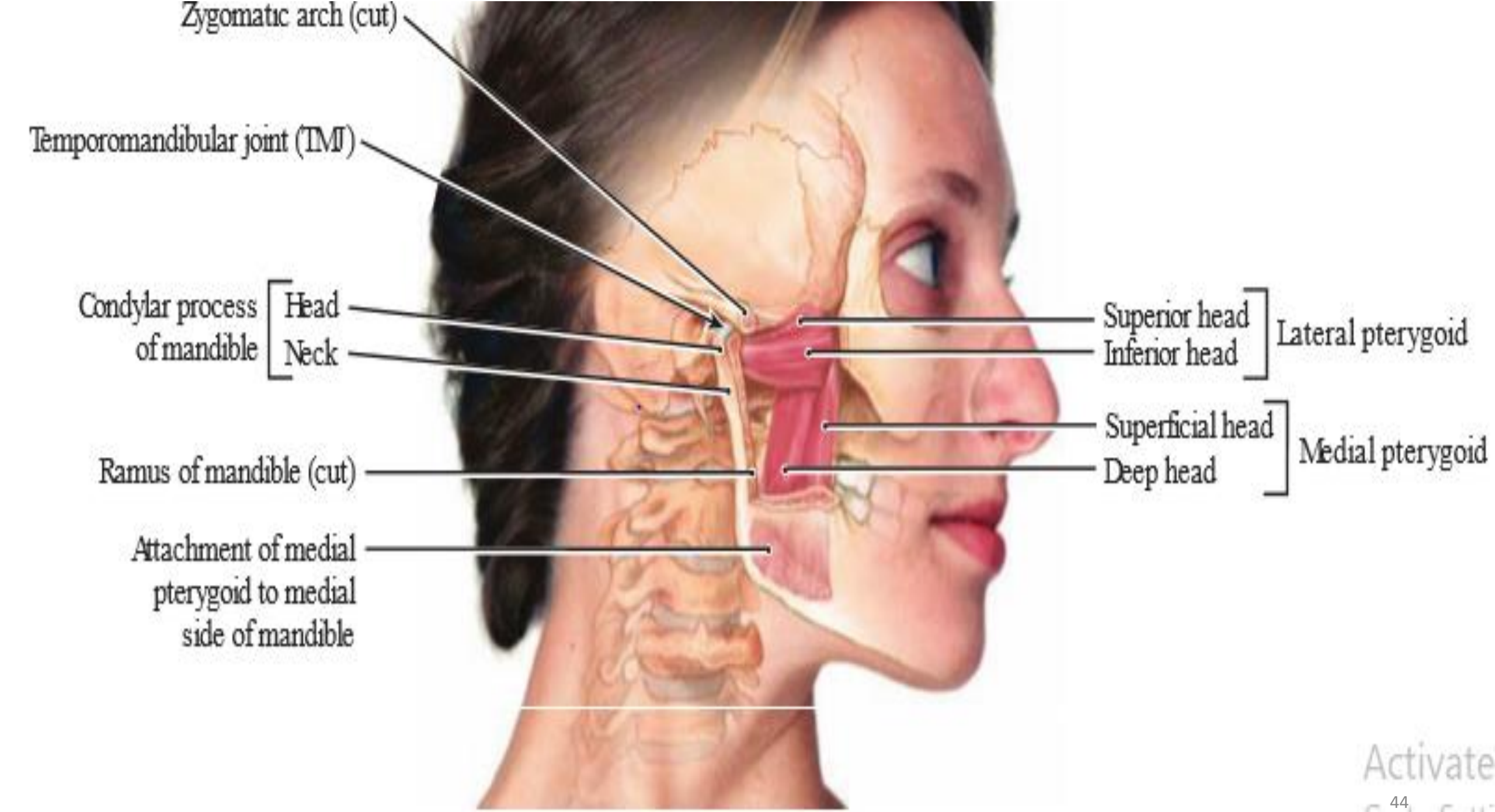
- **Origin** –
  - **Upper head** arises from the infratemporal surface of the **greater wing of the sphenoid**
  - **Lower head** arises from the lateral surface of the **lateral pterygoid plate**
- Insertion - The anterior aspect of the neck of **the mandibular condyle and capsule of the TMJ**
- Innervation - A branch of the mandibular division of the trigeminal nerve
- Function
  - Upper head - involved mainly with chewing, and functions to anteriorly rotate the disc on the condyle during the closing movement
  - Lower head - exerts an anterior, lateral, and inferior pull on the mandible, thereby opening the jaw, protruding the mandible, and deviating the mandible to the opposite side


Zygomatic arch (cut)
Temporomandibular joint (TMJ)
Condylar process of mandible
Head
Neck
Ramus of mandible (cut)
Attachment of medial pterygoid to medial side of mandible
Superior head
Inferior head
Lateral pterygoid
Superficial head
Deep head
Medial pterygoid

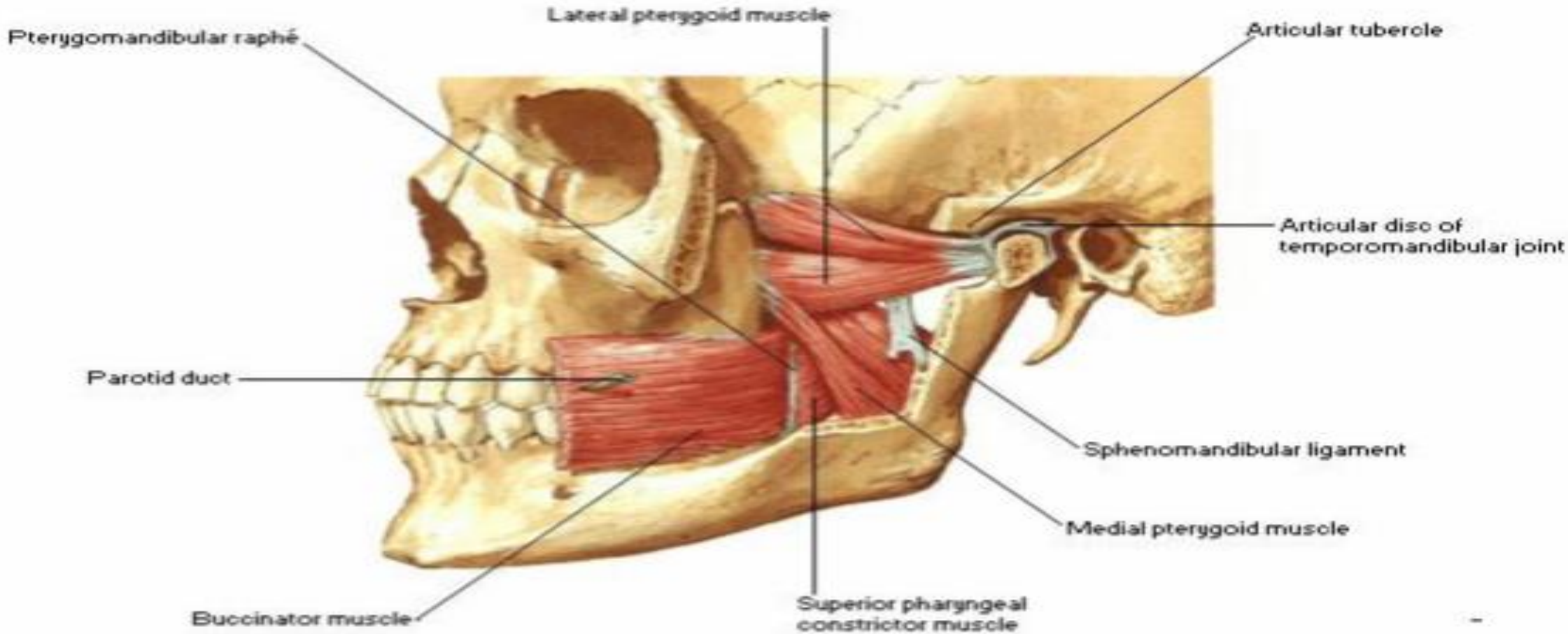
Muscles

Medial pterygoid

- **Origin**
- **Deep head** – lateral plate of the pterygoid process and palatine bone
- **Superficial head –** tubercle of the maxilla and palatine bone
- **Insertion -** The inferior and posterior aspects of the medial subsurface of the **ramus and angle of the mandible**
- **Innervation -** A branch of the mandibular division of the trigeminal nerve
- **Function -** Working bilaterally - assists in mouth closing. Working unilaterally – deviation of the mandible toward the opposite side


Zygomatic arch (cut)
Temporomandibular joint (TMJ)
Condylar process of mandible
Head
Neck
Ramus of mandible (cut)
Attachment of medial pterygoid to medial side of mandible
Superior head
Inferior head
Lateral pterygoid
Superficial head
Deep head
Medial pterygoid

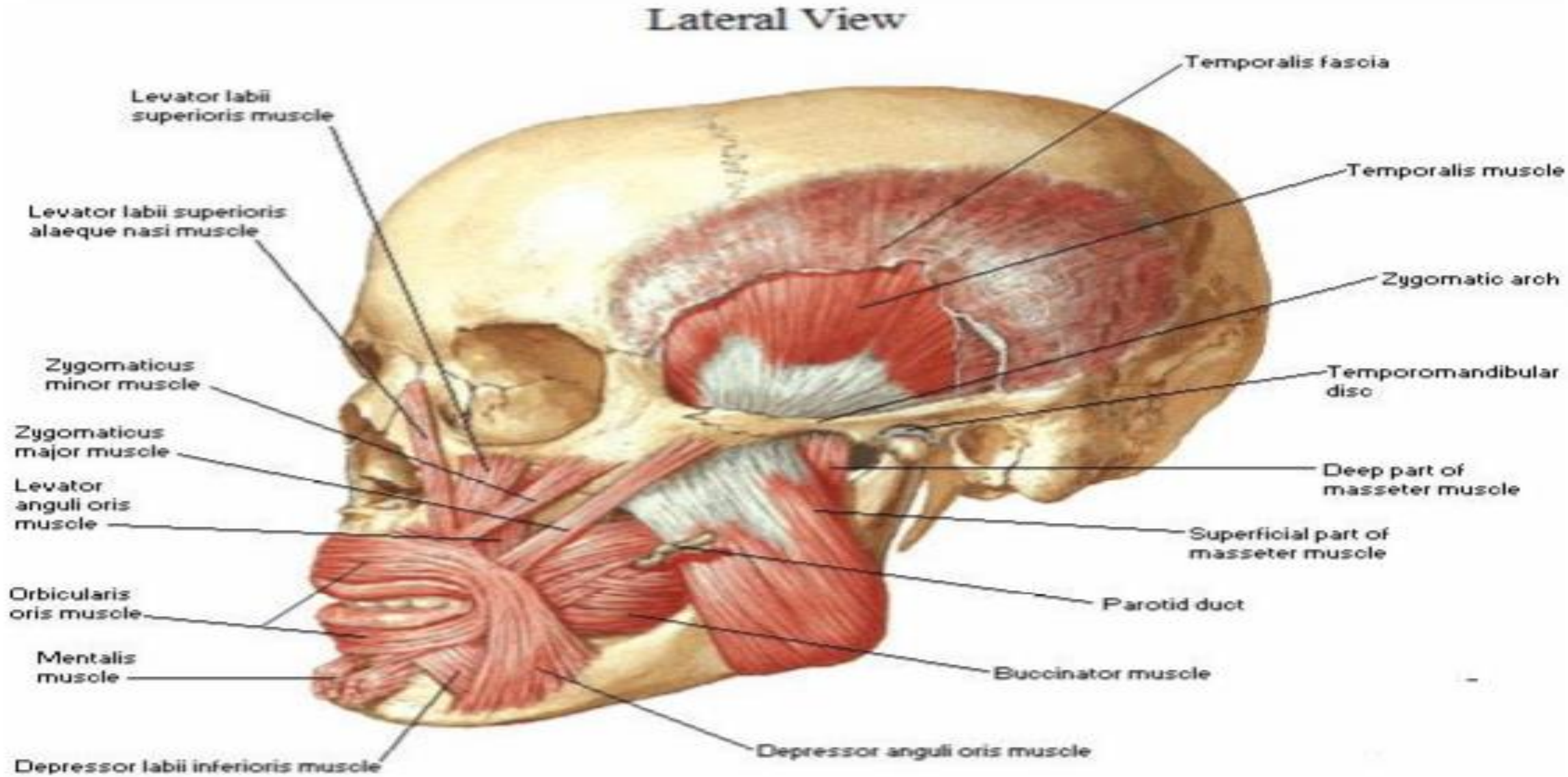
Lateral View



Muscles

Masseter - two-layered quadrilateral shaped muscle.

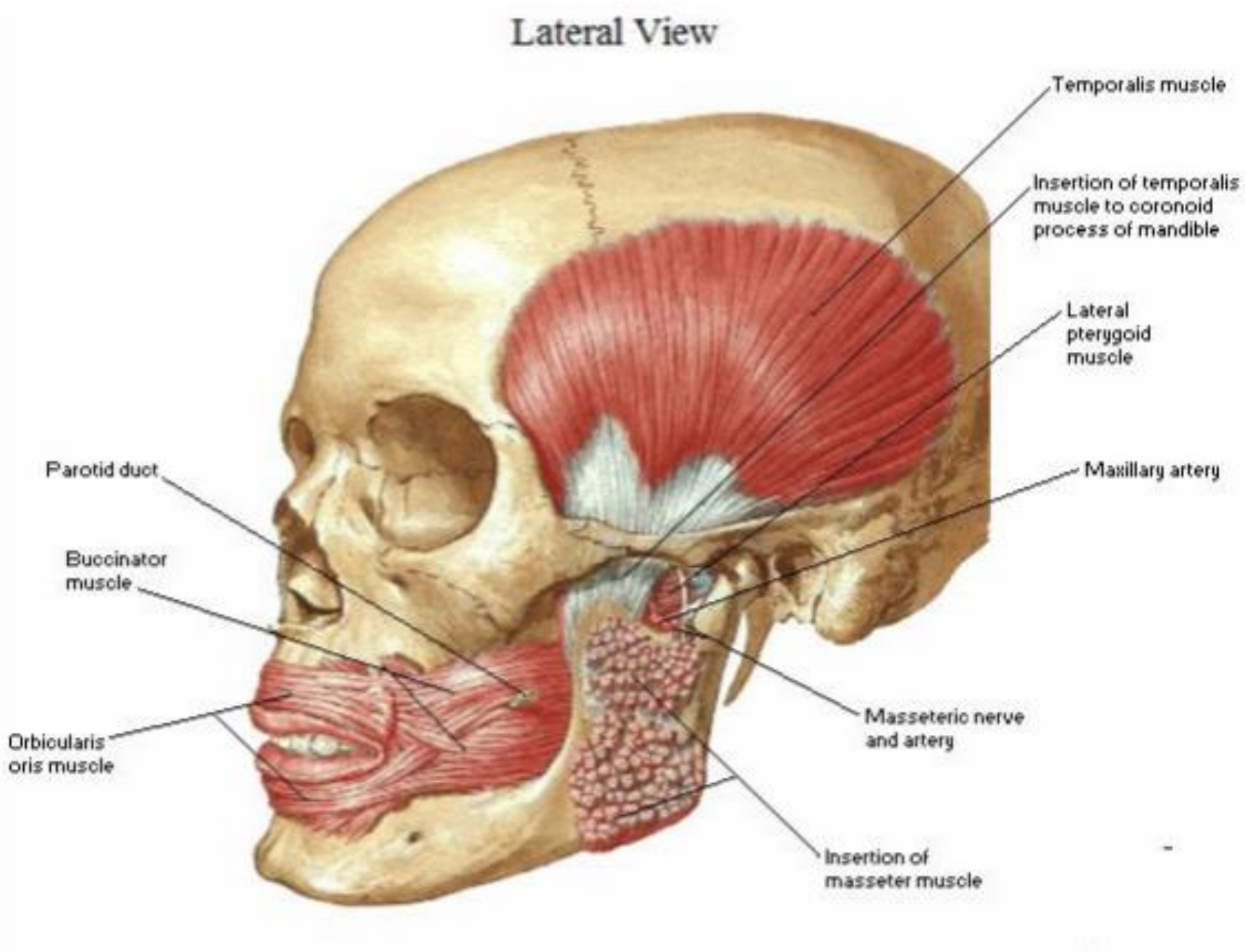
- **Origin**
  - The **superficial portion** arises from the anterior two-thirds of the **lower border of the zygomatic arch**
  - The **deep portion** arises from the **medial surface of the zygomatic arch.**
- **Insertion -** On the lateral surface of the coronoid process of the mandible, upper half of the ramus and angle of the mandible
- **Innervation -** A branch of the mandibular division of the trigeminal nerve
- **Function -** The major function of the masseter is to elevate the mandible, thereby occluding the teeth during mastication.


Lateral View
Temporalis fascia
Levator labii superioris muscle
Temporalis muscle
Levator labii superioris alaeque nasi muscle
Zygomatic arch
Zygomaticus minor muscle
Temporomandibular disc
Zygomaticus major muscle
Deep part of masseter muscle
Levator anguli oris muscle
Superficial part of masseter muscle
Orbicularis oris muscle
Parotid duct
Mentalis muscle
Buccinator muscle
Depressor anguli oris muscle
Depressor labii inferioris muscle

Muscles

Tempororalis

- **Origin -** The **floor** of the **temporal fossa** and **temporal fascia**
- **Insertion -** On the **anterior border** of the **coronoid process** and **anterior border** of the **ramus of the mandible**
- **Innervation -** A branch of the mandibular division of the trigeminal nerve
- **Function -** assists with mouth closing/side-to-side grinding of the teeth. Also provides a good deal of stability to the joint


Lateral View
Temporalis muscle
Insertion of temporalis muscle to coronoid process of mandible
Lateral pterygoid muscle
Maxillary artery
Parotid duct
Buccinator muscle
Masseteric nerve and artery
Orbicularis oris muscle
Insertion of masseter muscle

REFERENCES

1. **Atlas of Human Anatomy**, 6th Edition. Frank H Netter MD. Philadelphia, 2014
2. **Gray`s Anantomy** The Anatomical Basis of Clinical Practice 40th Edition. Susan Standring. 2008
3. **Junqueira`s Basic Histology** Text and Atlas, 40th edition. Athony L Mescher PhD. New York, 2013