Trigeminal nerve

- Largest cranial nerve
- Sensory supply to: Face
  greater part of scalp
  teeth
  Oral and nasal cavities
  dura mater
- Motor supply to: Muscles of mastication
  anterior belly of diagastric
  mylohyoid

Origin

- Principal sensory nucleus
- Spinal trigeminal nucleus
- Motor nucleus

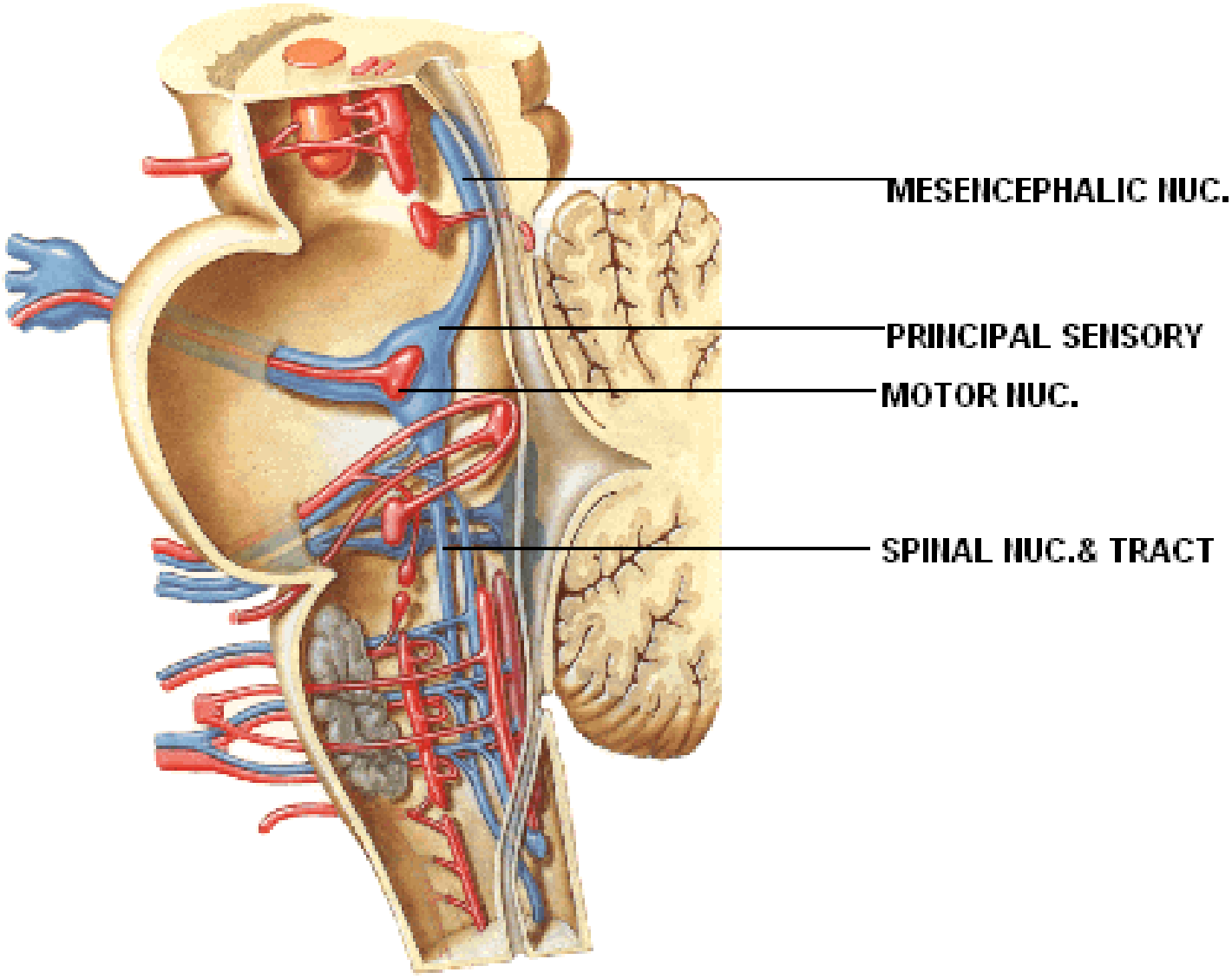
Ventral surface of pons by two roots- motor & sensory

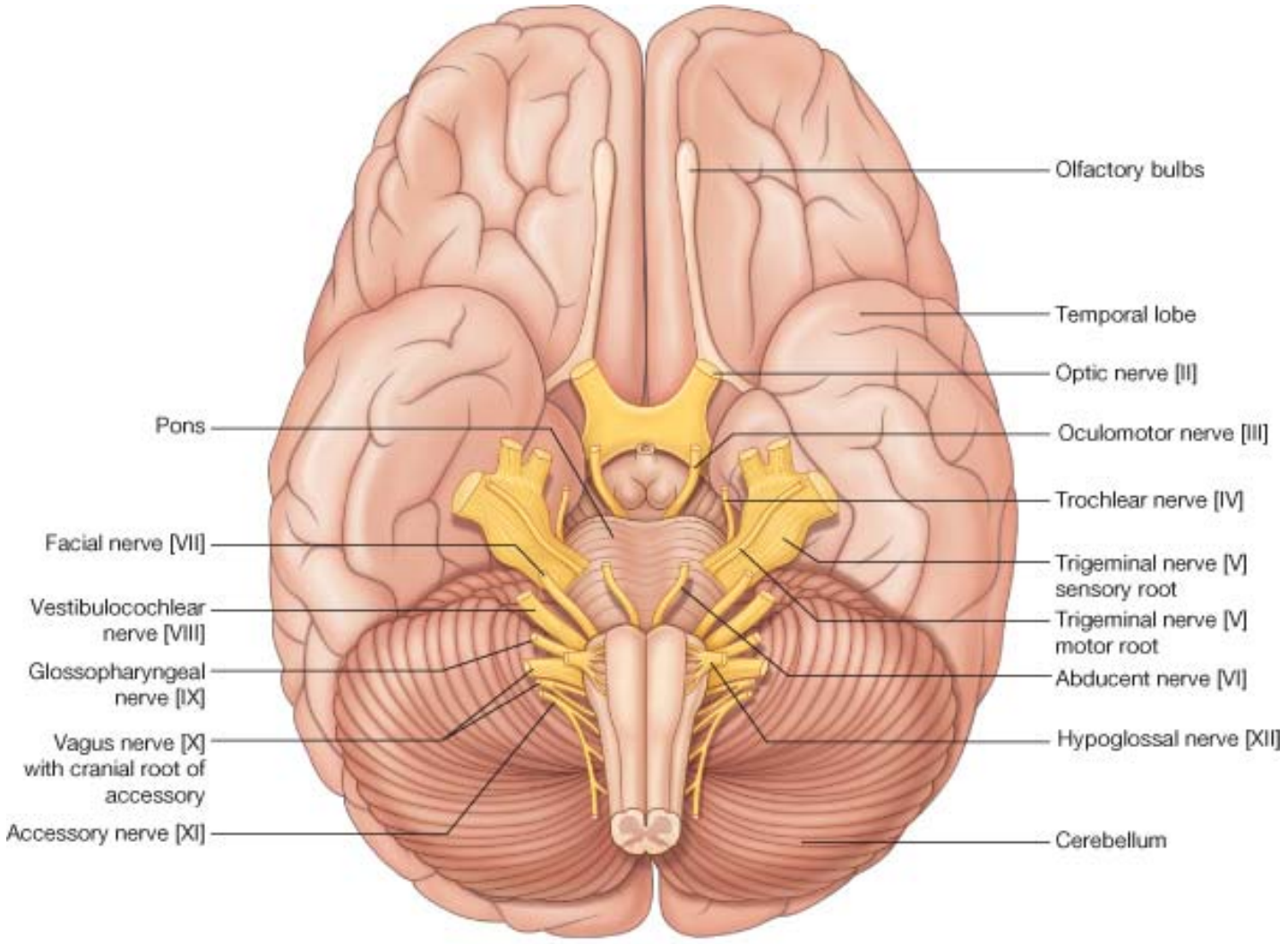
Trigeminal ganglion

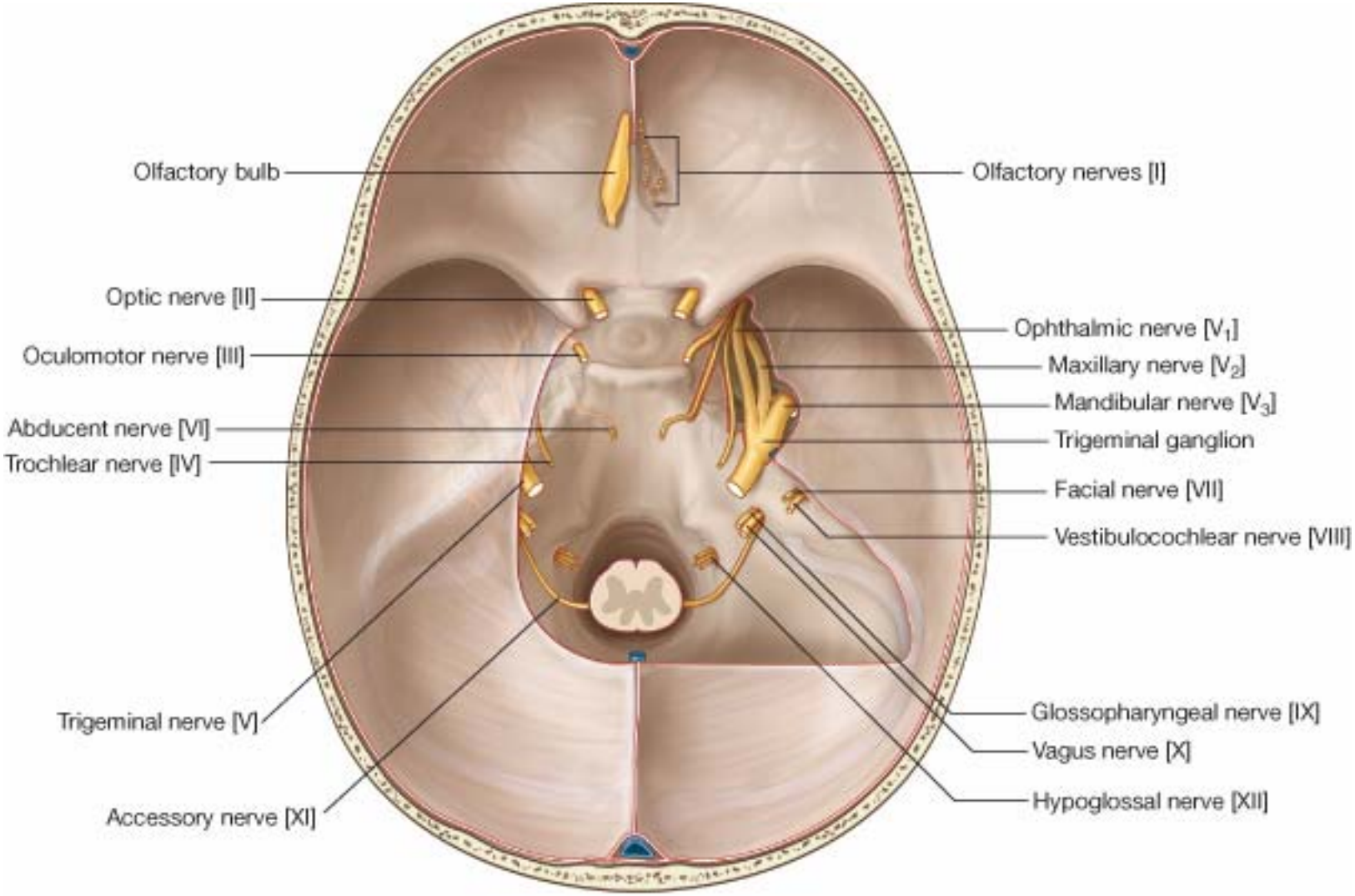
Three divisions: ophthalmic

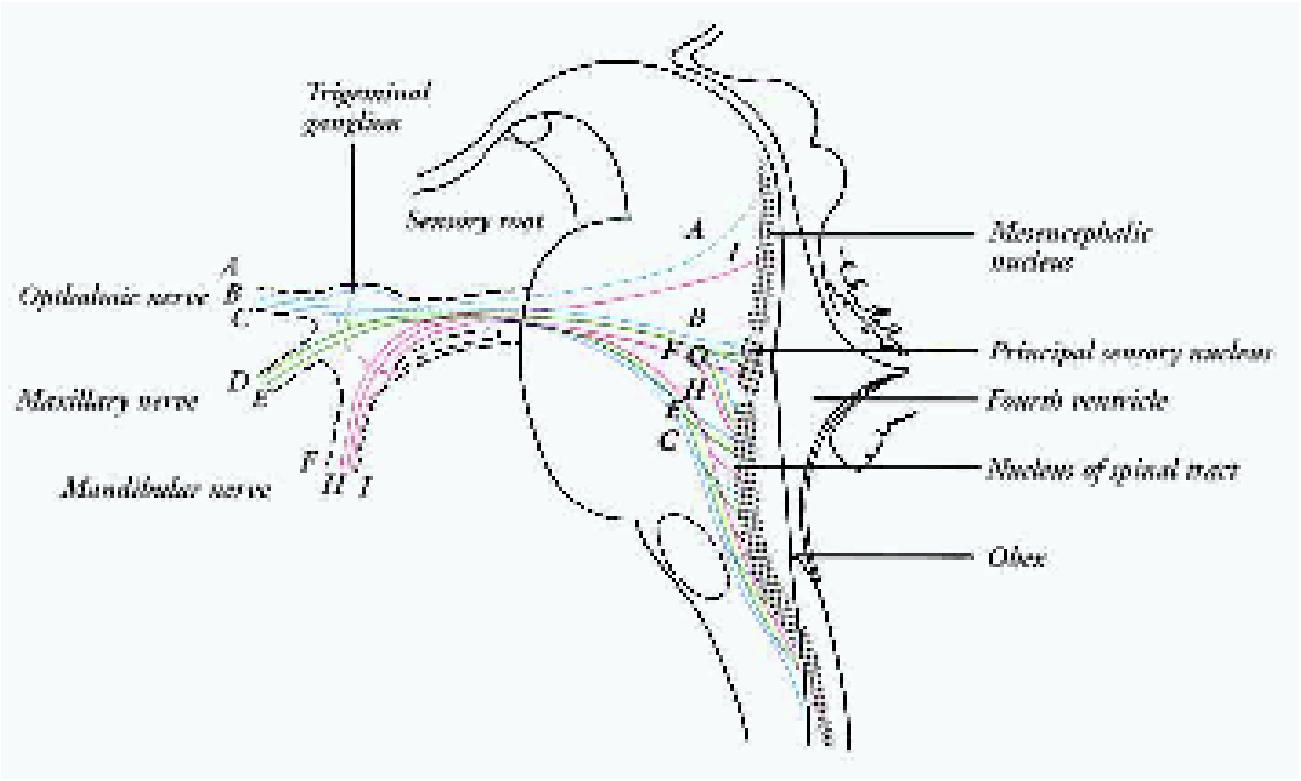
maxillary

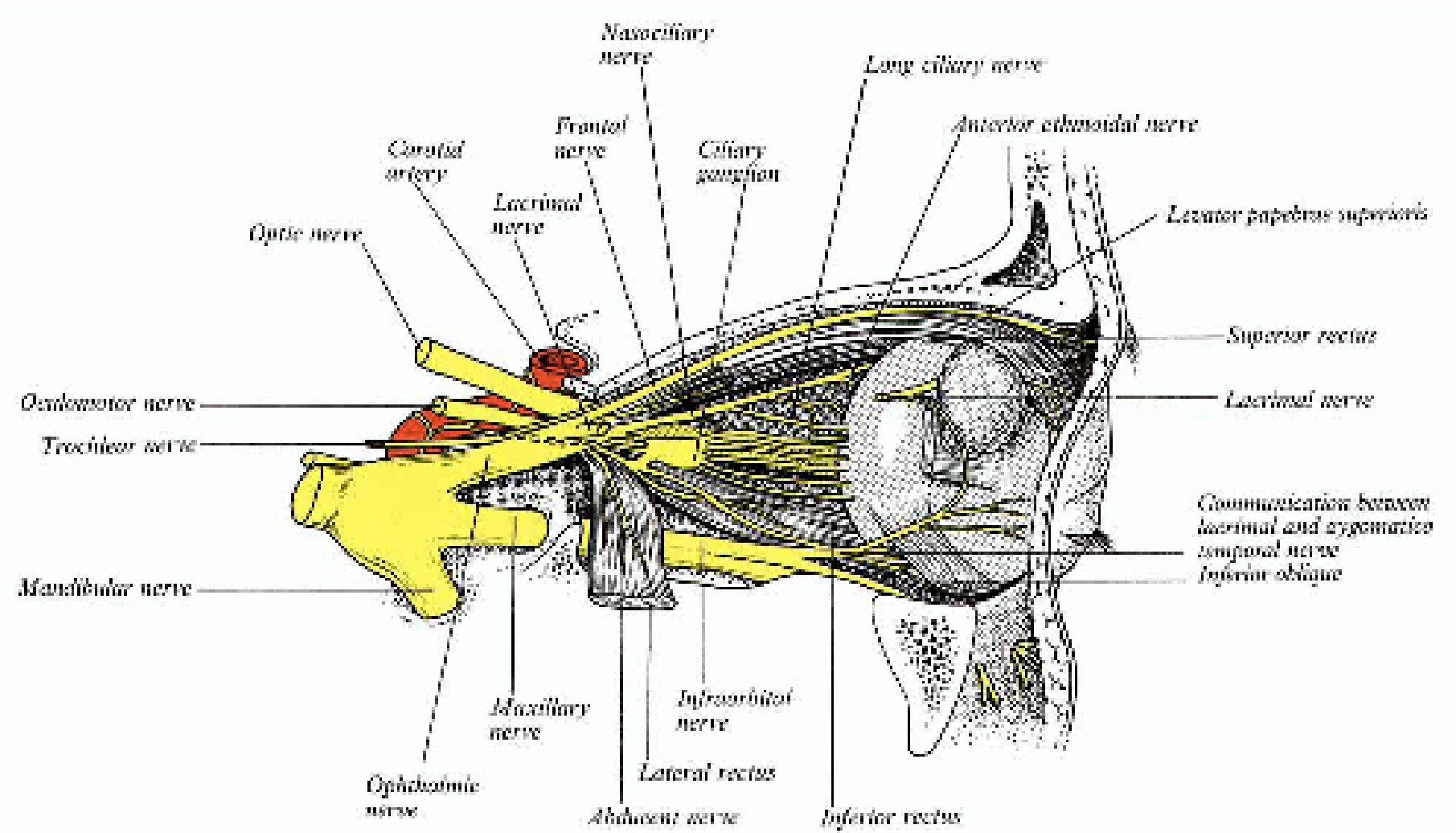
mandibular

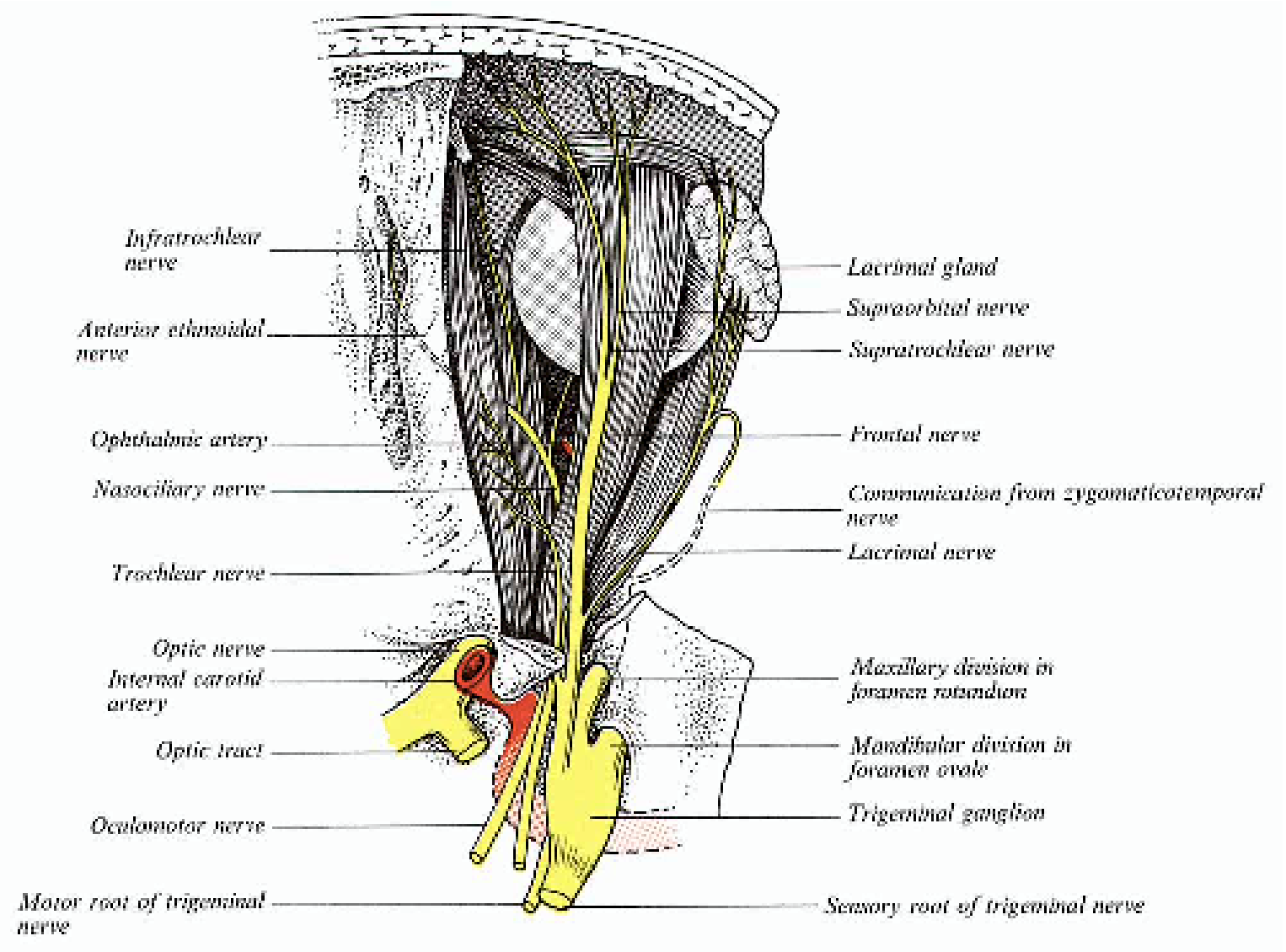

MESENCEPHALIC NUC.
PRINCIPAL SENSORY
MOTOR NUC.
SPINAL NUC.& TRACT


Olfactory bulbs
Temporal lobe
Optic nerve [II]
Pons
Oculomotor nerve [III]
Trochlear nerve [IV]
Facial nerve [VII]
Trigeminal nerve [V] sensory root
Vestibulocochlear nerve [VIII]
Trigeminal nerve [V] motor root
Glossopharyngeal nerve [IX]
Abducent nerve [VI]
Vagus nerve [X] with cranial root of accessory
Hypoglossal nerve [XII]
Accessory nerve [XI]
Cerebellum


Olfactory bulb
Olfactory nerves [I]
Optic nerve [II]
Oculomotor nerve [III]
Abducent nerve [VI]
Trochlear nerve [IV]
Ophthalmic nerve [V1]
Maxillary nerve [V2]
Mandibular nerve [V3]
Trigeminal ganglion
Facial nerve [VII]
Vestibulocochlear nerve [VIII]
Trigeminal nerve [V]
Accessory nerve [XI]
Glossopharyngeal nerve [IX]
Vagus nerve [X]
Hypoglossal nerve [XII]

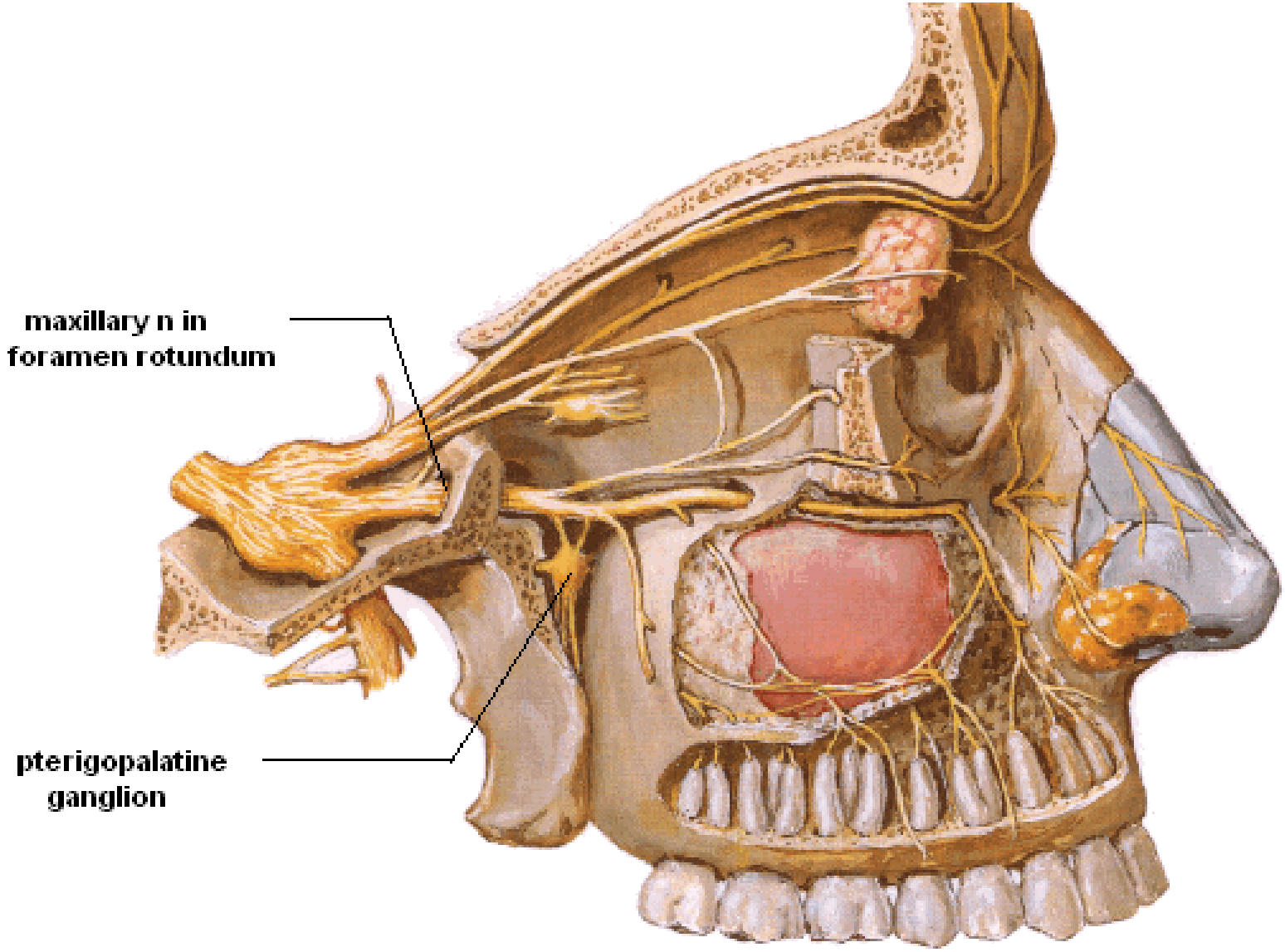

Trigeminal ganglion
Sensory root
Mesencephalic nucleus
Principal sensory nucleus
Fourth ventricle
Nucleus of spinal tract
Obex
Ophtalmic nerve
Maxillary nerve
Mandibular nerve
A
B
C
D
E
F
G
H
I

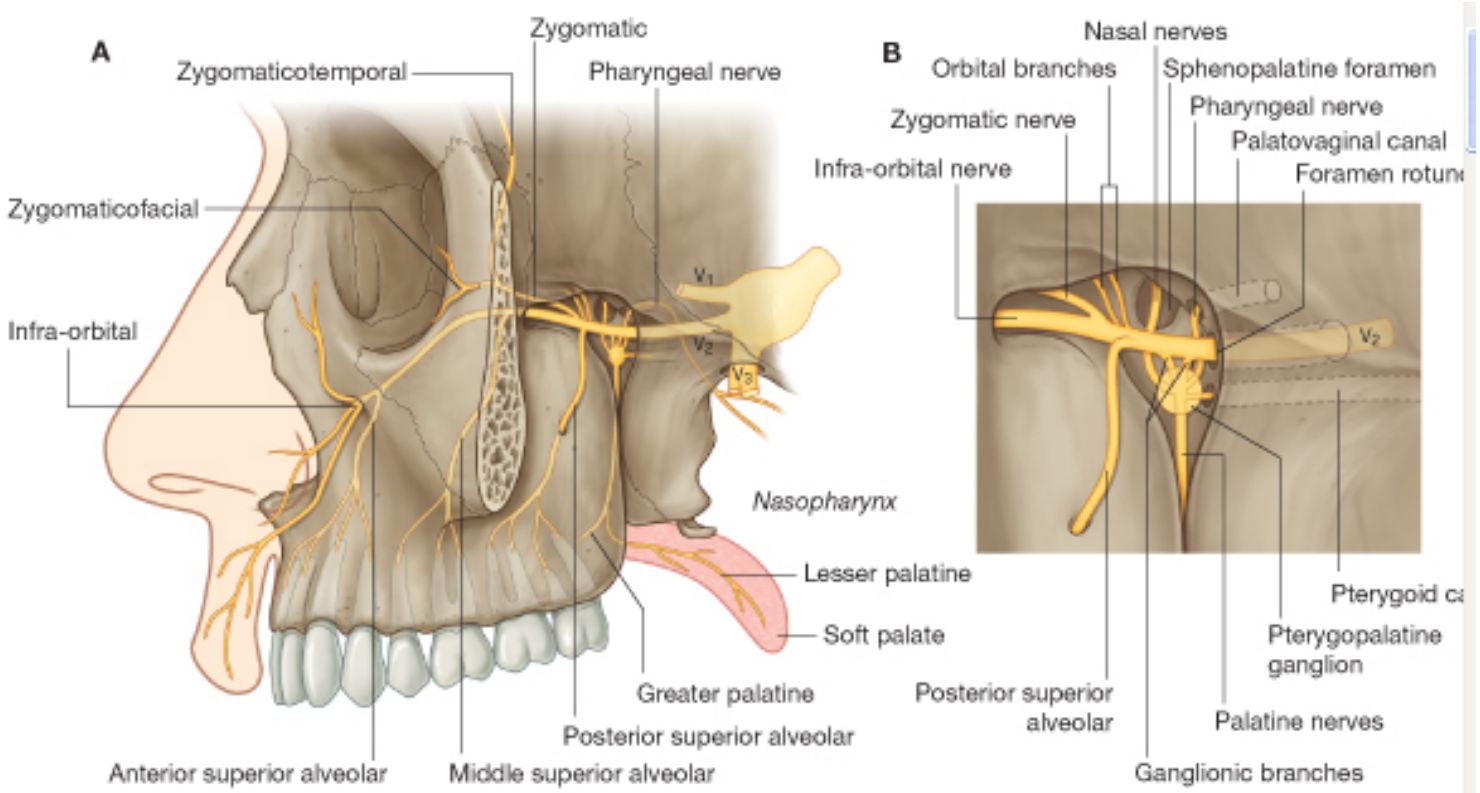

Nasociliary nerve
Long ciliary nerve
Frontal nerve
Anterior ethmoidal nerve
Ciliary ganglion
Carotid artery
Lacrimal nerve
Optic nerve
Levator palpebræ superioris
Superior rectus
Oculomotor nerve
Lacrimal nerve
Trochlear nerve
Communication between lacrimal and zygomatico temporal nerve
Inferior oblique
Mandibular nerve
Infraorbital nerve
Maxillary nerve
Lateral rectus
Ophthalmic nerve
Abducent nerve
Inferior rectus

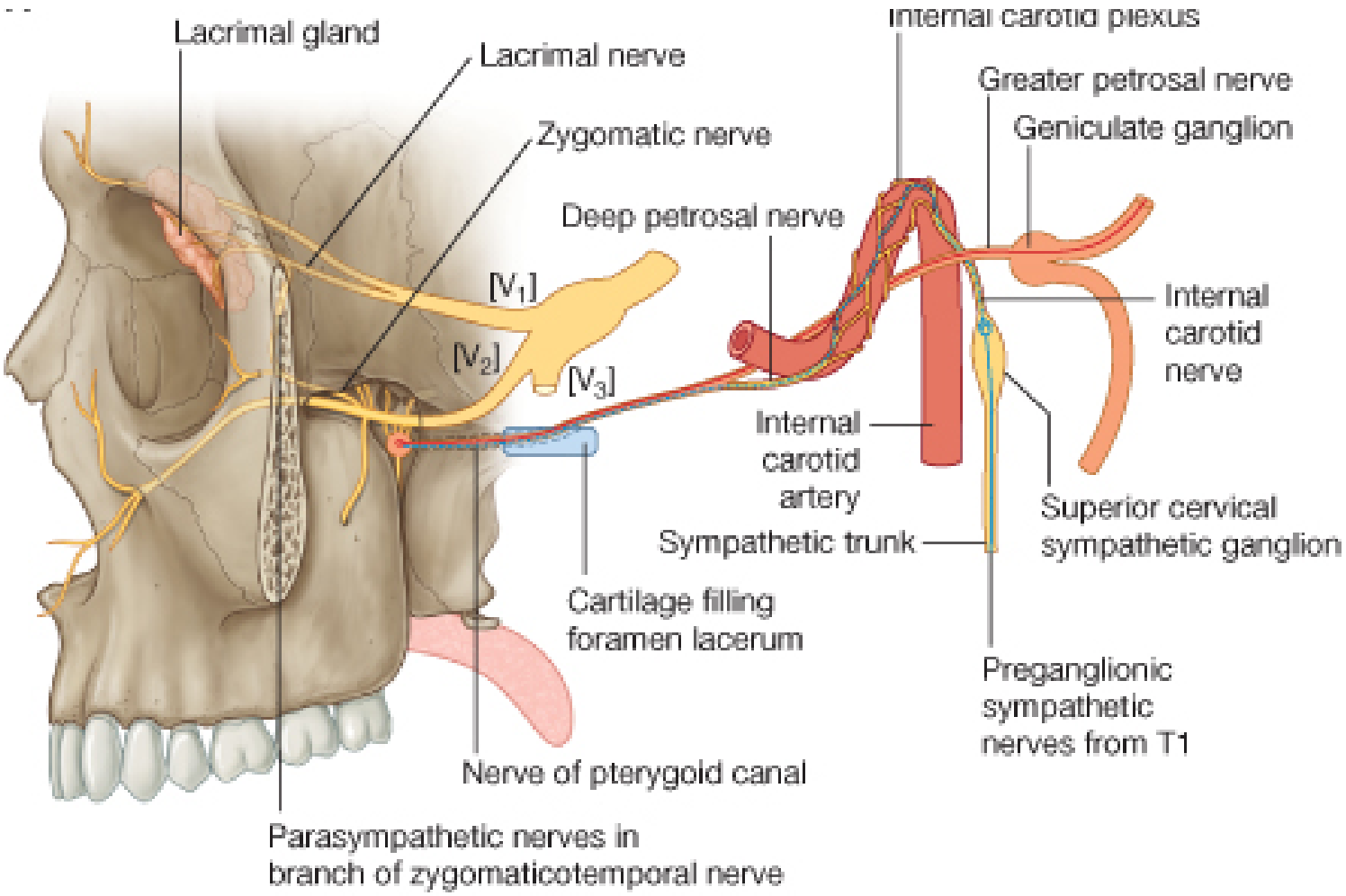

Infratrochlear nerve
Anterior ethmoidal nerve
Ophthalmic artery
Nasociliary nerve
Trochlear nerve
Optic nerve
Internal carotid artery
Optic tract
Oculomotor nerve
Motor root of trigeminal nerve
Lacrimal gland
Supraorbital nerve
Supratrochlear nerve
Frontal nerve
Communication from zygomaticotemporal nerve
Lacrimal nerve
Maxillary division in foramen rotundum
Mandibular division in foramen ovale
Trigeminal ganglion
Sensory root of trigeminal nerve

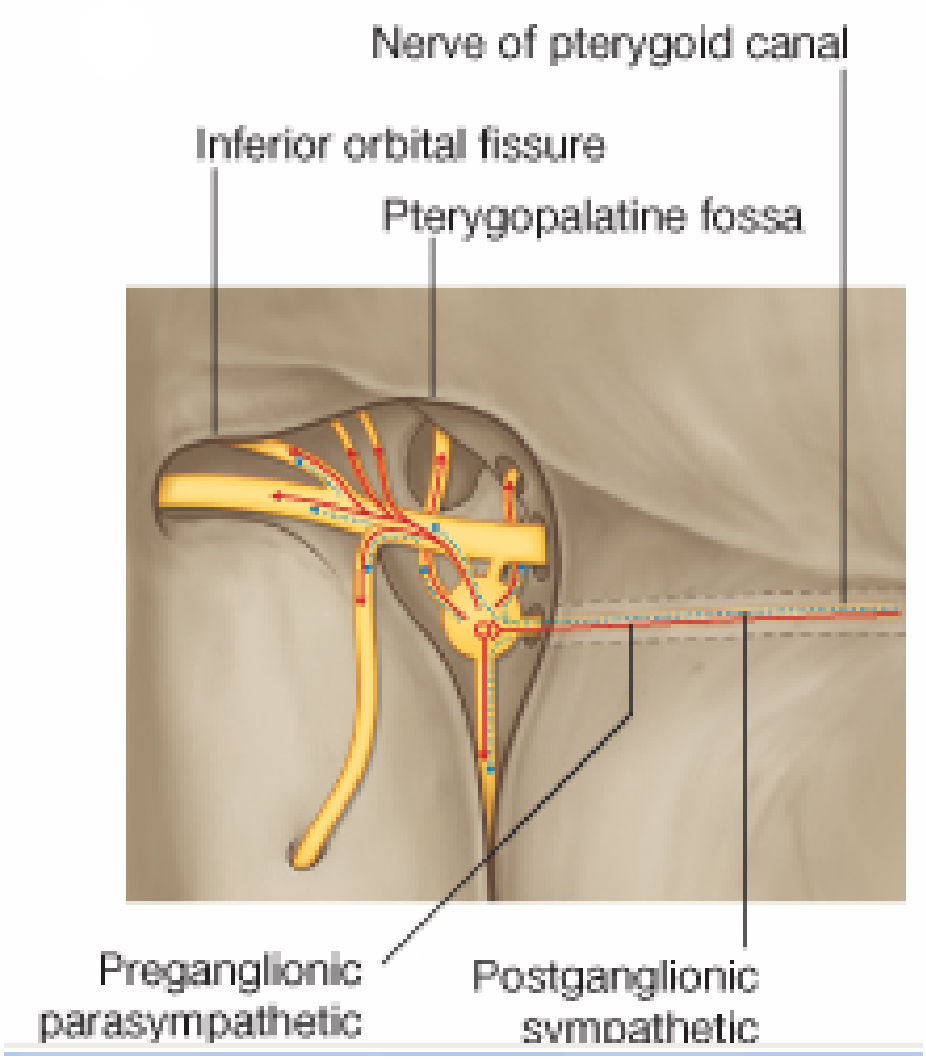
Maxillary nerve

- Wholly sensory
- Course: Traverse foramen rotundum
  post. wall of pterygopalatine fossa
  enters the inferior orbital fissure
  enter infra orbital canal
  emerges on face as infraorbital nerve


maxillary n in
foramen rotundum
pterigopalatine
ganglion


A
Zygomatic
Zygomaticotemporal
Pharyngeal nerve
Zygomaticofacial
Infra-orbital
V1
V2
V3
Nasopharynx
Lesser palatine
Soft palate
Greater palatine
Posterior superior alveolar
Anterior superior alveolar
Middle superior alveolar
B
Nasal nerves
Orbital branches
Sphenopalatine foramen
Pharyngeal nerve
Zygomatic nerve
Palatovaginal canal
Infra-orbital nerve
Foramen rotun
V2
Pterygoid ca
Pterygopalatine ganglion
Posterior superior alveolar
Palatine nerves
Ganglionic branches


Lacrimal gland
Lacrimal nerve
Zygomatic nerve
Deep petrosal nerve
[V1]
[V2]
[V3]
Internal carotid plexus
Greater petrosal nerve
Geniculate ganglion
Internal carotid nerve
Internal carotid artery
Sympathetic trunk
Superior cervical sympathetic ganglion
Cartilage filling foramen lacerum
Preganglionic sympathetic nerves from T1
Nerve of pterygoid canal
Parasympathetic nerves in branch of zygomaticotemporal nerve


Nerve of pterygoid canal
Inferior orbital fissure
Pterygopalatine fossa
Preganglionic parasympathetic
Postganglionic sympathetic

Maxillary nerve-Branches

In the **cranial cavity**:

- Meningeal (to dura mater)

In **pterygopalatine fossa**:

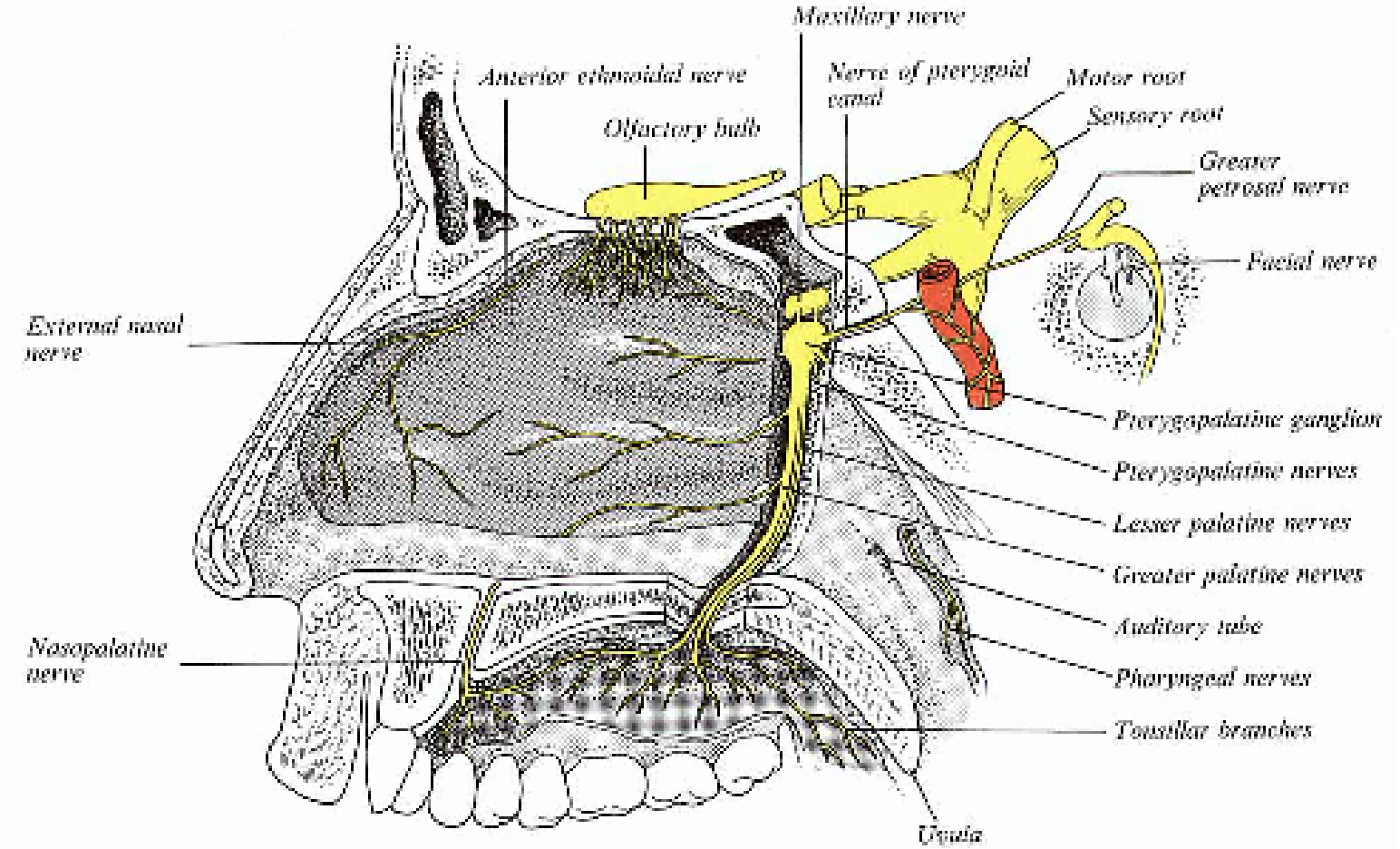
- Ganglionic- connected to PP ganglion; contain lacrimal secretomotor & sensory fibres from orbital periosteum and mucosa of nose, palate and pharynx.
- Zygomatic- enters orbit; divides in to zygomaticotemporal and zygomaticofacial branches.
- Superior alveolar nerves- Posterior

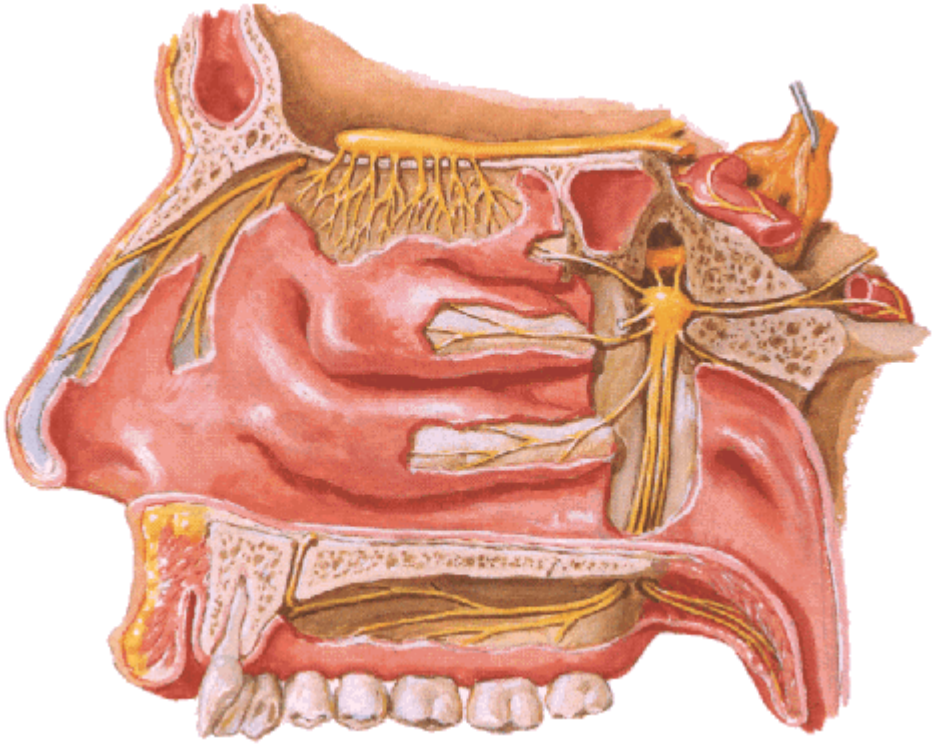
In the infraorbital canal:

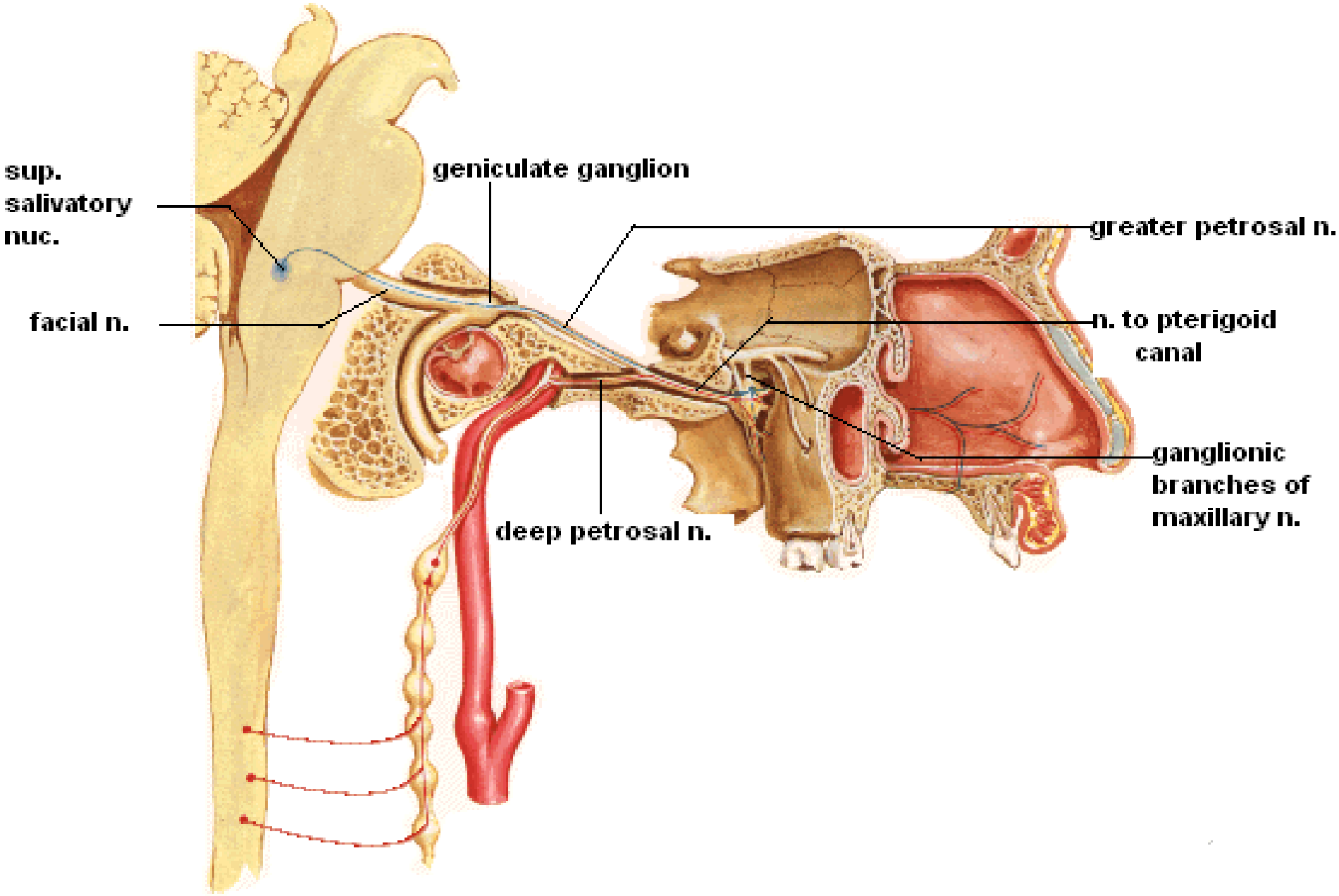
- Middle
- Anterior

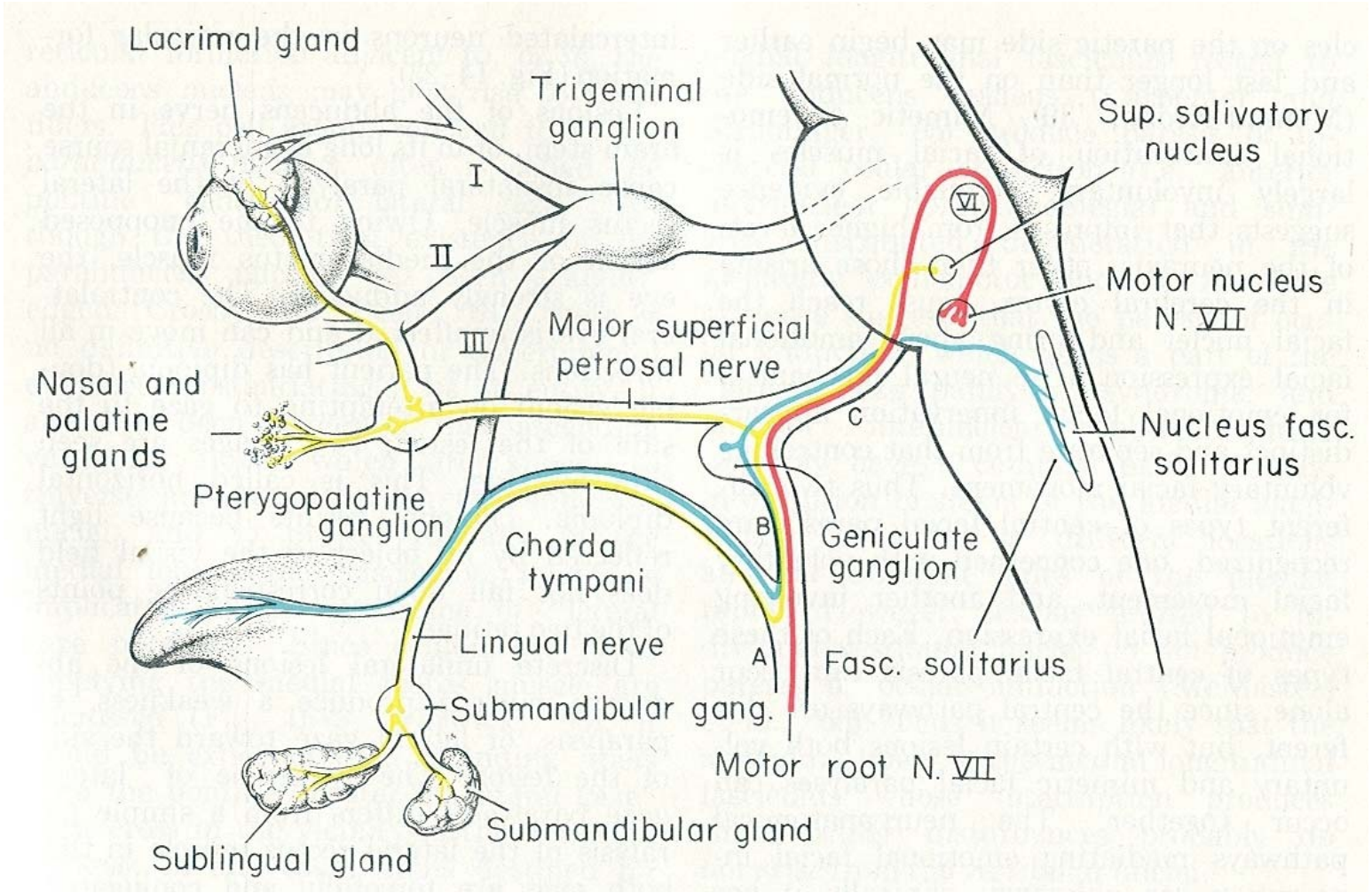
On face:

- palpebral
- nasal
- superior labial


Maxillary nerve
Anterior ethmoidal nerve
Nerve of pterygoid canal
Motor root
Sensory root
Olfactory bulb
Greater petrosal nerve
Facial nerve
External nasal nerve
Pterygopalatine ganglion
Pterygopalatine nerves
Lesser palatine nerves
Greater palatine nerves
Auditory tube
Nasopalatine nerve
Pharyngeal nerves
Tonsillar branches
Uvula




sup.
salivatory
nuc.
facial n.
geniculate ganglion
greater petrosal n.
n. to pterigoid
canal
ganglionic
branches of
maxillary n.
deep petrosal n.


Lacrimal gland
Trigeminal ganglion
I
II
III
Sup. salivatory nucleus
VI
Motor nucleus N. VII
Major superficial petrosal nerve
Nasal and palatine glands
Nucleus fasc. solitarius
C
Pterygopalatine ganglion
Chorda tympani
B
Geniculate ganglion
Lingual nerve
A
Fasc. solitarius
Submandibular gang.
Motor root N. VII
Submandibular gland
Sublingual gland

Pterygopalatine ganglion

- In the Pterygopalatine fossa
- Motor: Preganglionic fibres are from:

Nerve of pterygoid canal

Special lacrimatory nucleus– sensory root of facial nerve– greater petrosal nerve+ deep petrosal nerve – synapse in PP ganglion—(postganglionic fibres)—join maxillary nerve–Zygomatic nerve—lacrimal nerve.

In addition: secretomotor fibres to palatine/pharyngeal/nasal glands via palatine/nasal branches.

- Sympathetic: same as motor root
- Branches:

  Orbital: to orbital periosteum; orbitalis;sphenoid and ethmoid sinuses.

  Palatine: **greater**-runs in greater palatine canal to hard palate; supplies gums, mucosa and glands.

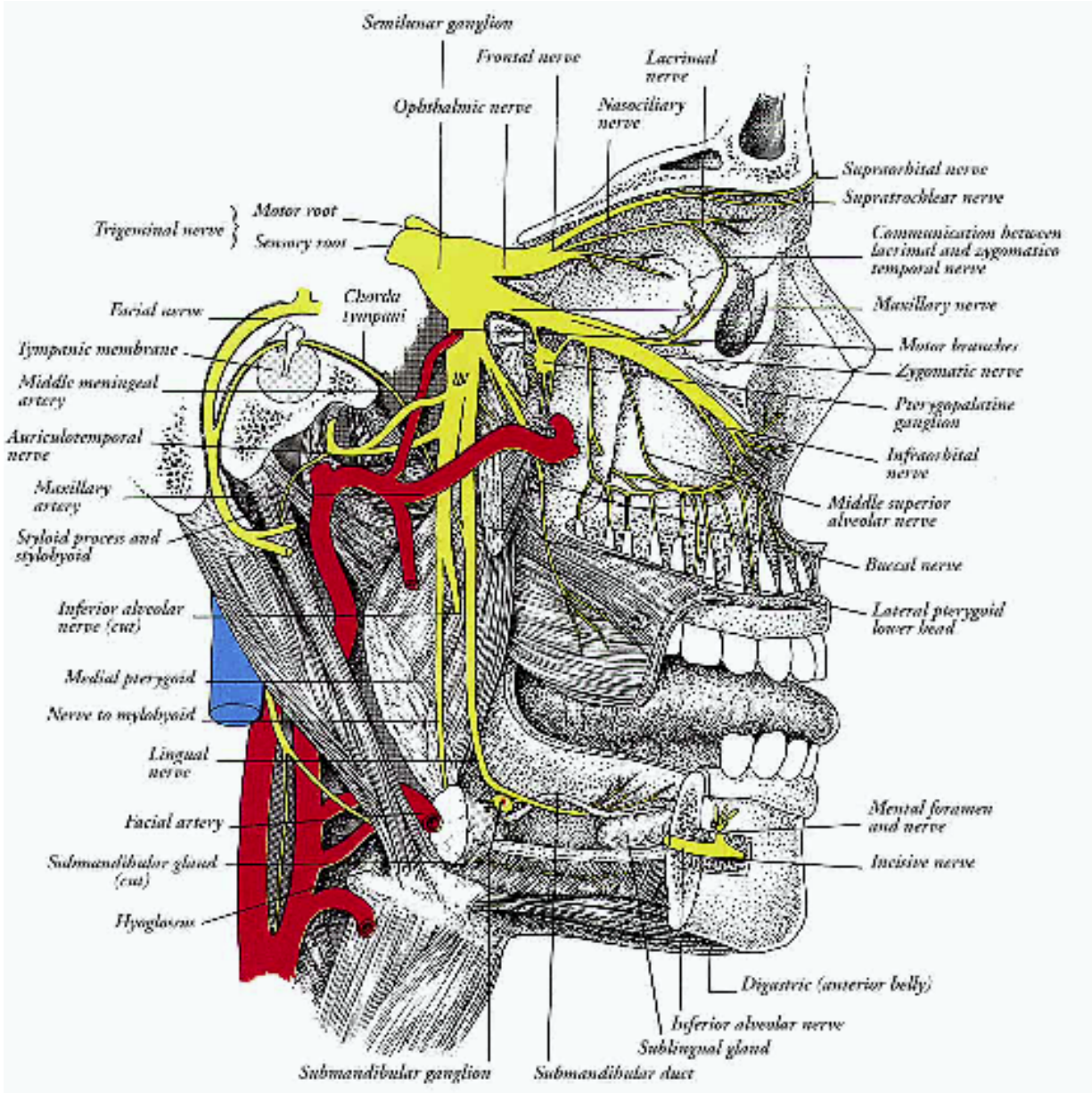
  lesser palatine- runs in greater palatine canal to hard palate; supplies uvula, tonsil, soft palate

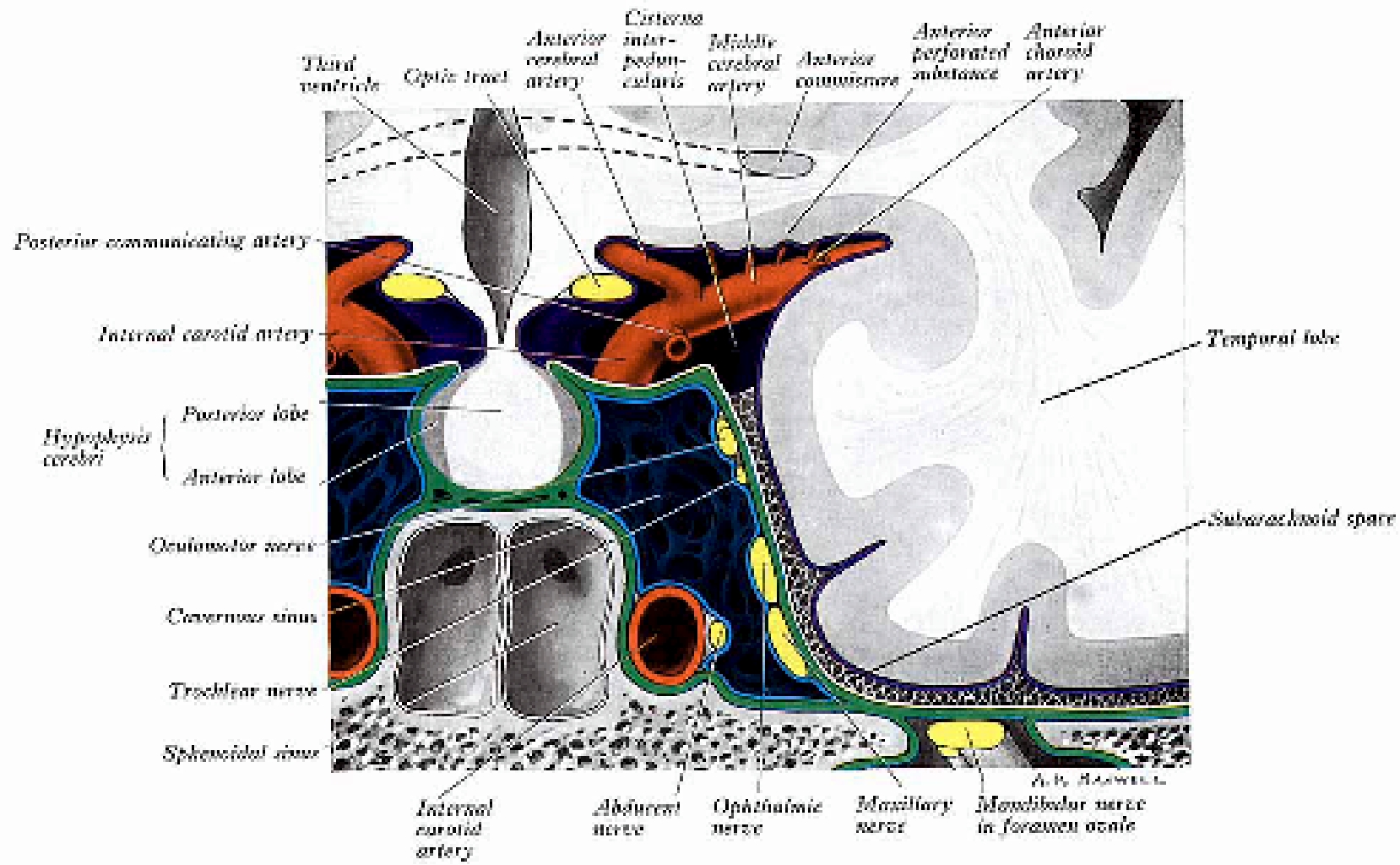
  Nasal: **Lateral post. Sup. nasal branches(6)**

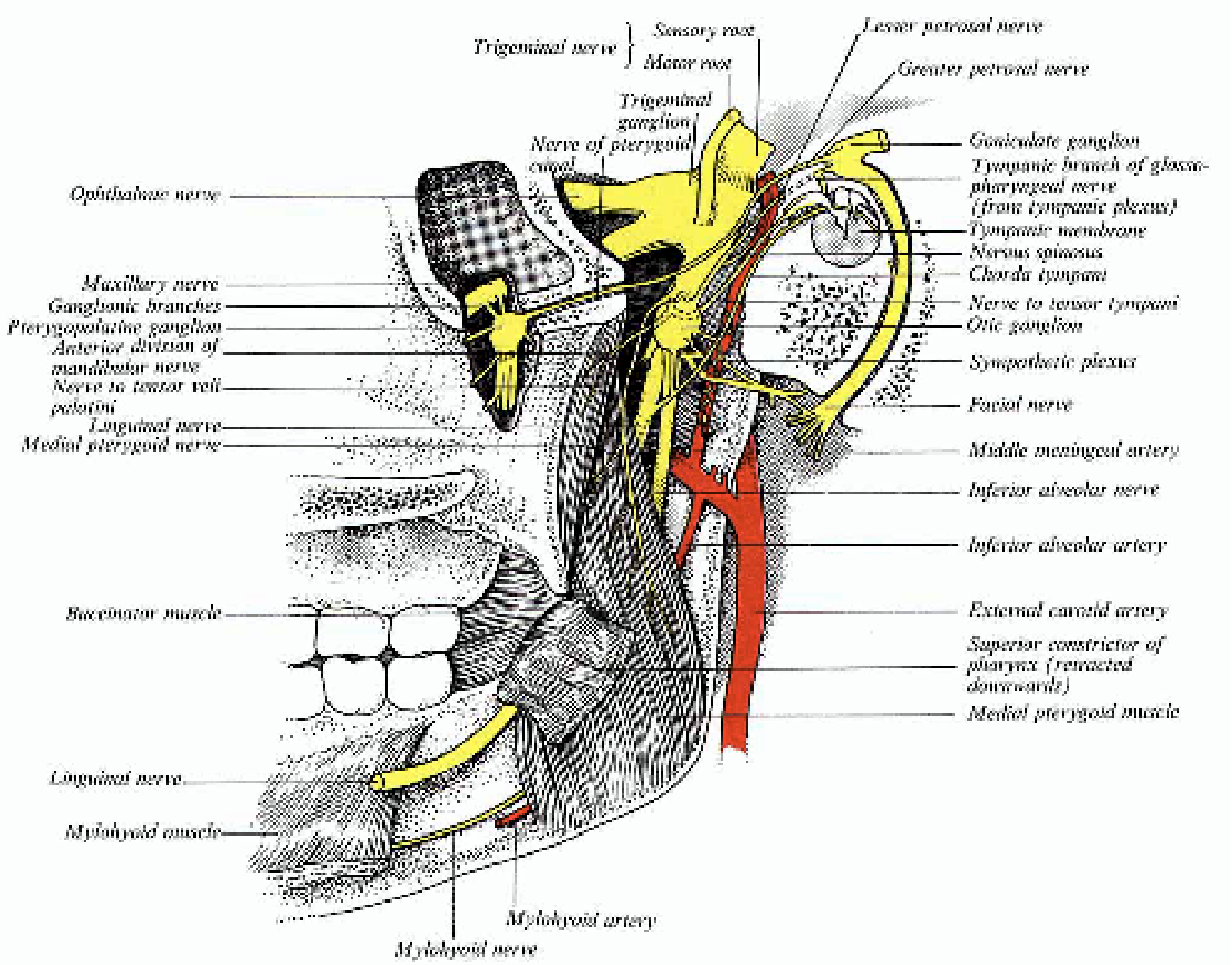
  supply post. Parts of sup. & middle nasal concha, post. Ethmoidal sinuses.

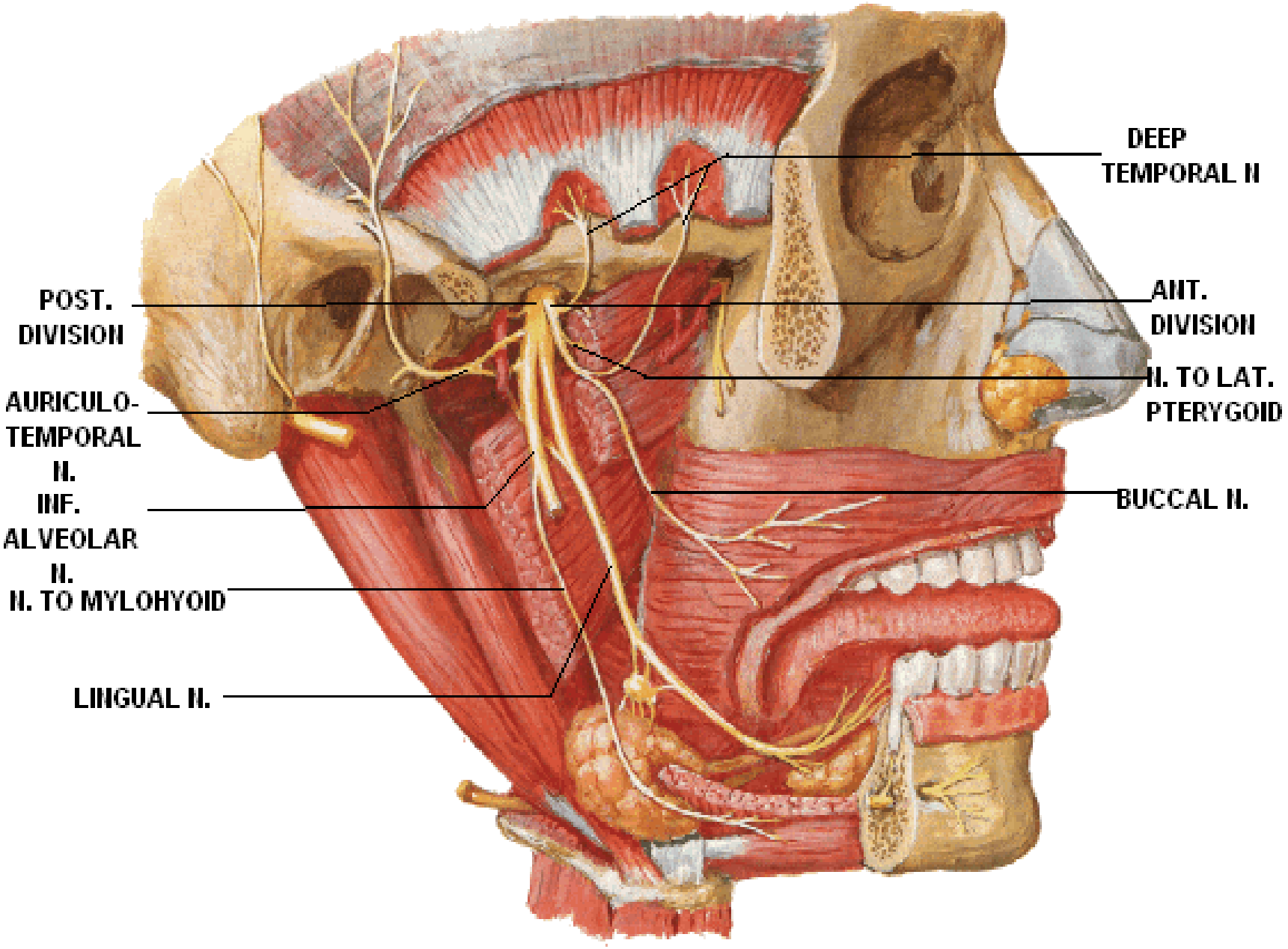
  Medial post. Sup. nasal branches(2-3)-nasopalatine; supply nasal septum and hard palate.

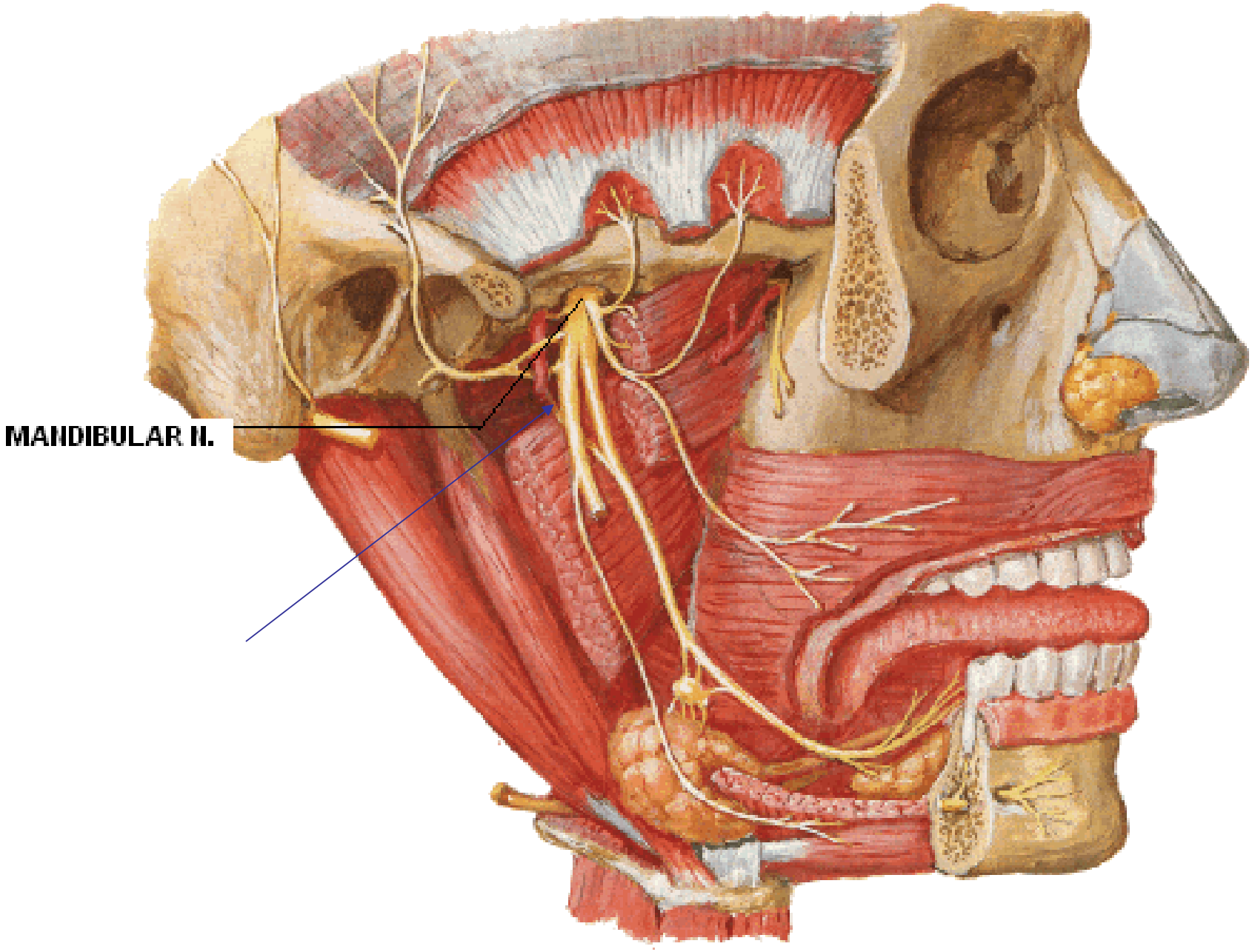
  Pharyngeal: supply mucosa of nasopharynx.

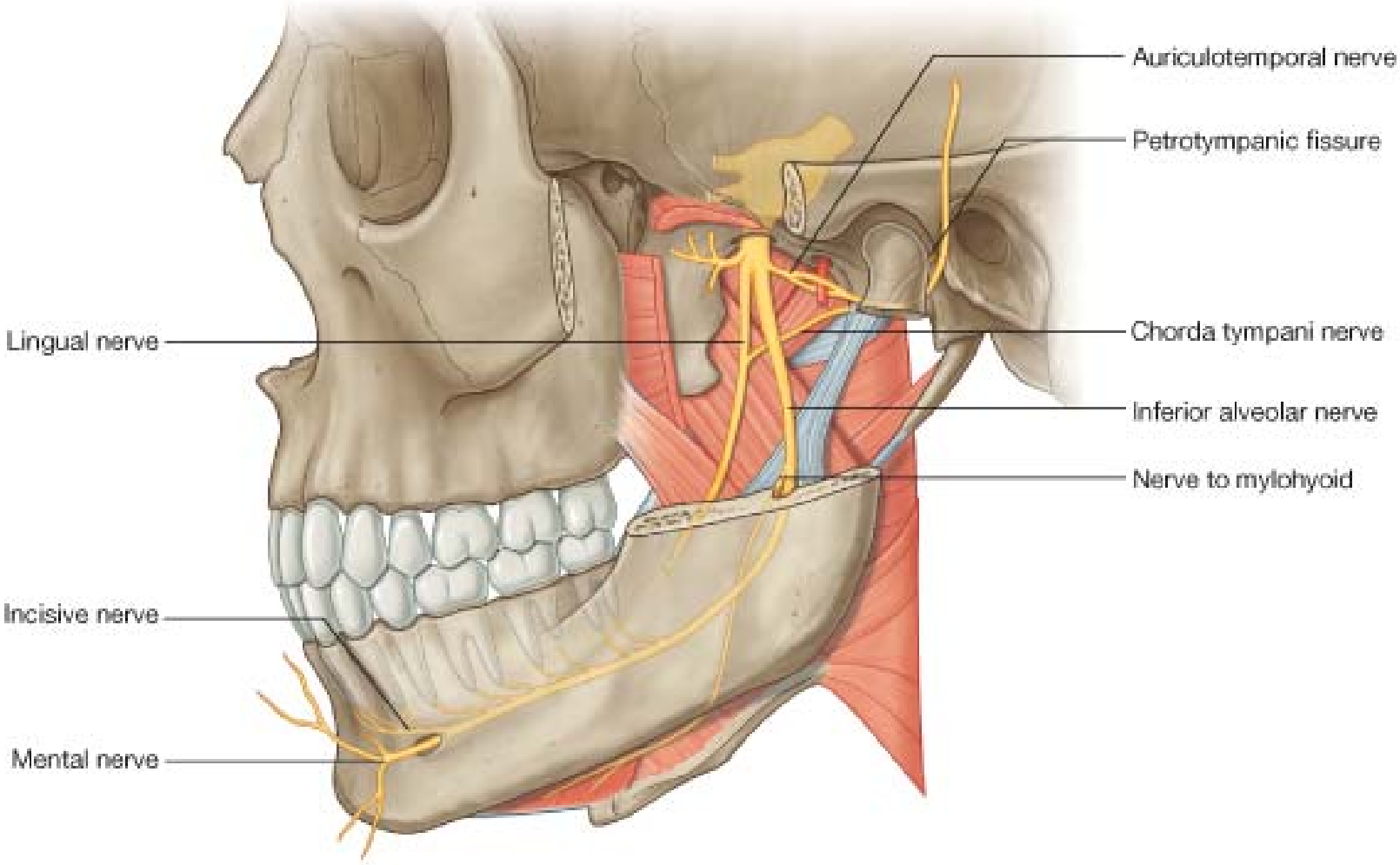

Semilunar ganglion
Frontal nerve
Lacrimal nerve
Ophthalmic nerve
Nasociliary nerve
Supraorbital nerve
Supratrochlear nerve
Trigeminal nerve
Motor root
Sensory root
Communication between lacrimal and zygomatico temporal nerve
Facial nerve
Chorda tympani
Maxillary nerve
Tympanic membrane
Motor branches
Middle meningeal artery
Zygomatic nerve
Pterygopalatine ganglion
Auriculotemporal nerve
Infraorbital nerve
Maxillary artery
Middle superior alveolar nerve
Styloid process and stylohyoid
Buccal nerve
Inferior alveolar nerve (cut)
Lateral pterygoid lower head
Medial pterygoid
Nerve to mylohyoid
Lingual nerve
Mental foramen and nerve
Facial artery
Incisive nerve
Submandibular gland (cut)
Hyoglossus
Digastric (anterior belly)
Inferior alveolar nerve
Sublingual gland
Submandibular ganglion
Submandibular duct

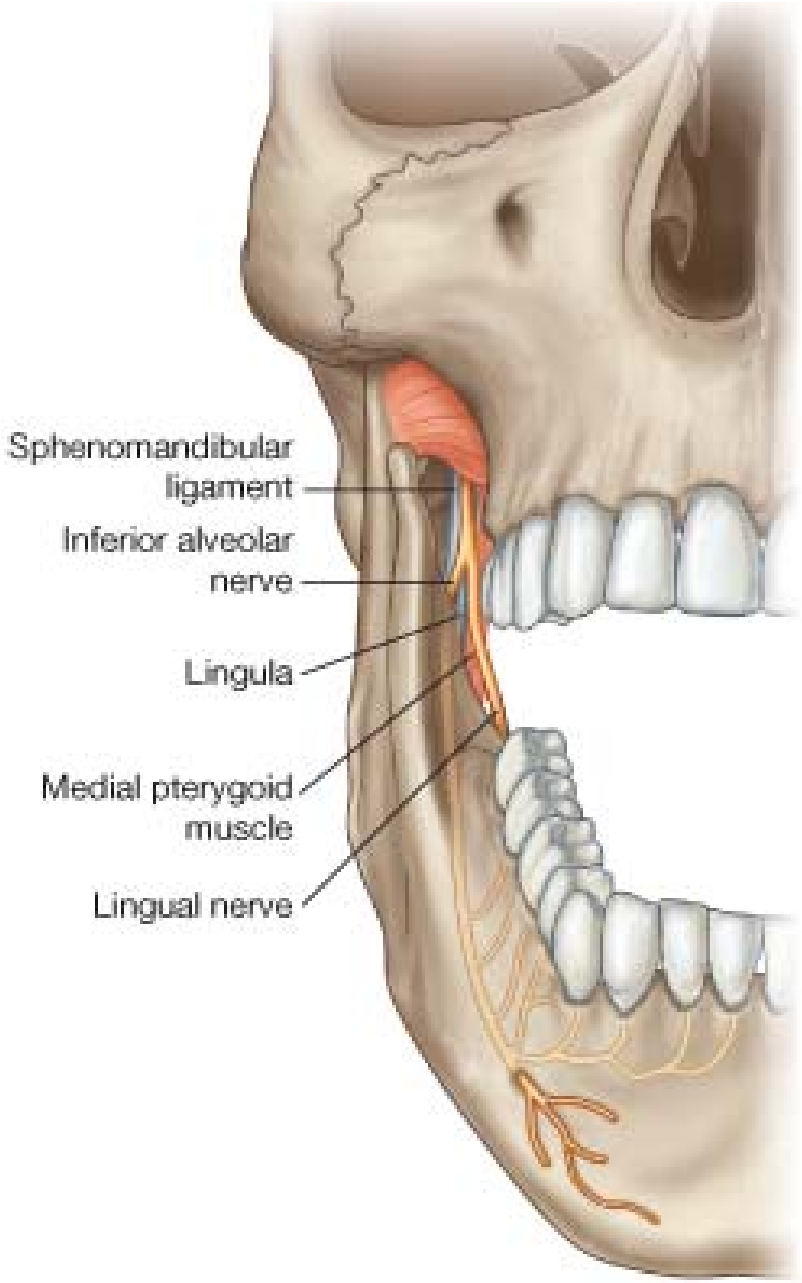

Third ventricle
Optic tract
Anterior cerebral artery
Cisterna inter-pedun-cularis
Middle cerebral artery
Anterior commissure
Anterior perforated substance
Anterior choroid artery
Posterior communicating artery
Internal carotid artery
Temporal lobe
Hypophysis cerebri
Posterior lobe
Anterior lobe
Subarachnoid space
Oculomotor nerve
Cavernous sinus
Trochlear nerve
Sphenoidal sinus
Internal carotid artery
Abducent nerve
Ophthalmic nerve
Maxillary nerve
Mandibular nerve in foramen ovale

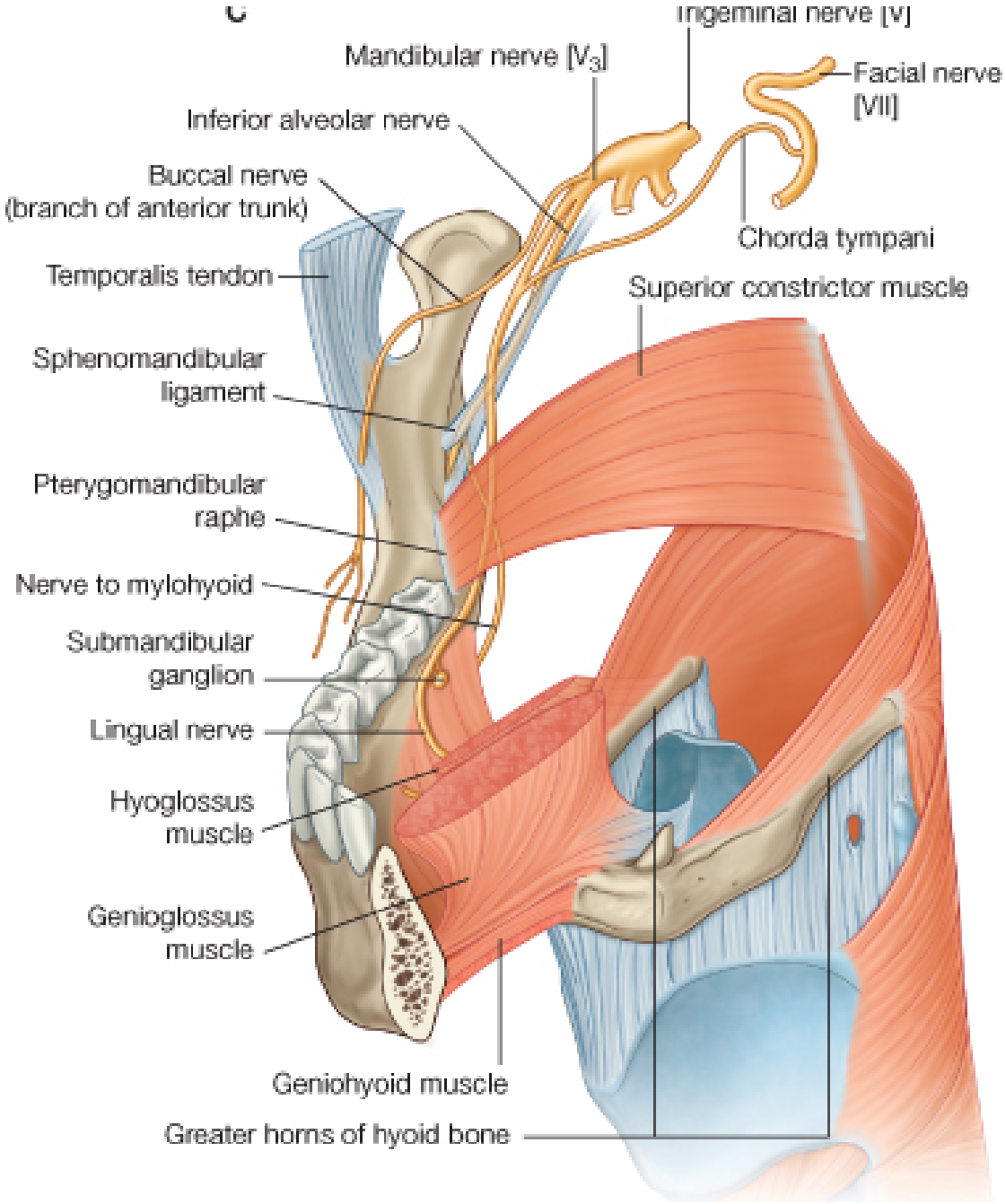

Trigeminal nerve
Sensory root
Motor root
Trigeminal ganglion
Nerve of pterygoid canal
Ophthalmic nerve
Maxillary nerve
Ganglionic branches
Pterygopalatine ganglion
Anterior division of mandibular nerve
Nerve to tensor veli palatini
Lingual nerve
Medial pterygoid nerve
Buccinator muscle
Lingual nerve
Mylohyoid muscle
Mylohyoid artery
Mylohyoid nerve
Lesser petrosal nerve
Greater petrosal nerve
Geniculate ganglion
Tympanic branch of glossopharyngeal nerve (from tympanic plexus)
Tympanic membrane
Nervus spinosus
Chorda tympani
Nerve to tensor tympani
Otic ganglion
Sympathetic plexus
Facial nerve
Middle meningeal artery
Inferior alveolar nerve
Inferior alveolar artery
External carotid artery
Superior constrictor of pharynx (retracted downwards)
Medial pterygoid muscle

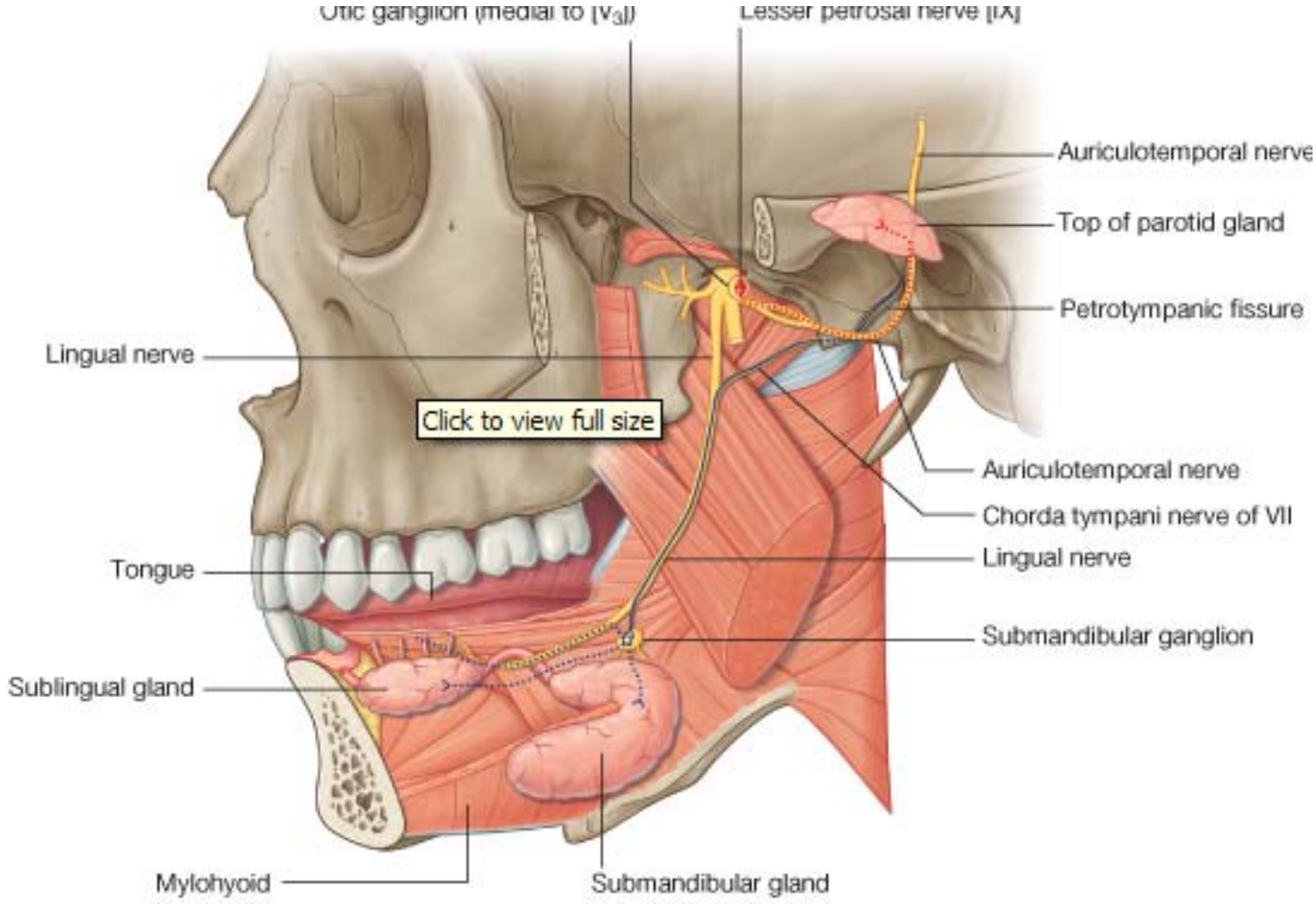

DEEP TEMPORAL N
POST. DIVISION
ANT. DIVISION
N. TO LAT. PTERYGOID
AURICULO-TEMPORAL N.
INF. ALVEOLAR N.
BUCCAL N.
N. TO MYLOHYOID
LINGUAL N.


MANDIBULAR N.


Auriculotemporal nerve
Petrotympanic fissure
Lingual nerve
Chorda tympani nerve
Inferior alveolar nerve
Nerve to mylohyoid
Incisive nerve
Mental nerve


Sphenomandibular ligament
Inferior alveolar nerve
Lingula
Medial pterygoid muscle
Lingual nerve


Trigeminal nerve [V]
Mandibular nerve [V3]
Facial nerve [VII]
Inferior alveolar nerve
Buccal nerve (branch of anterior trunk)
Chorda tympani
Temporalis tendon
Superior constrictor muscle
Sphenomandibular ligament
Pterygomandibular raphe
Nerve to mylohyoid
Submandibular ganglion
Lingual nerve
Hyoglossus muscle
Genioglossus muscle
Geniohyoid muscle
Greater horns of hyoid bone


Otic ganglion (medial to [V3])
Lesser petrosal nerve [IX]
Auriculotemporal nerve
Top of parotid gland
Petrotympanic fissure
Lingual nerve
Click to view full size
Auriculotemporal nerve
Chorda tympani nerve of VII
Lingual nerve
Tongue
Submandibular ganglion
Sublingual gland
Mylohyoid
Submandibular gland

Mandibular nerve

- Supplies: Teeth and gums; skin in temporal region; part of auricle; external auditory meatus; tympanic membrane; lower lip, part of face; muscle of mastication; mucosa of ant.2/3 of tongue;

  mucosa of floor of oral cavity.
- Large sensory root
- Small motor root

Mandibular nerve (contd.)

- Emerges from foramen ovale
- Gives two branches before dividing
  meningeal
  nerve to medial pterygoid
- Divides in to- small anterior
  large posterior
- Branches:

1. Meningeal (nervus spinosus): reenters cranium thru' foramen spinosum; supply dura mater in the middle cranial fossa.
2. N. to medial pterygoid: supplies medial pterygoid; 1 or 2 filaments pass through otic ganglion and supply tensor tympani and tensor palati.

Mandibular nerve (contd.)

- Anterior Trunk:

1. Buccal
2. Masseteric
3. Deep temporal
4. Nerve to lateral pterygoid

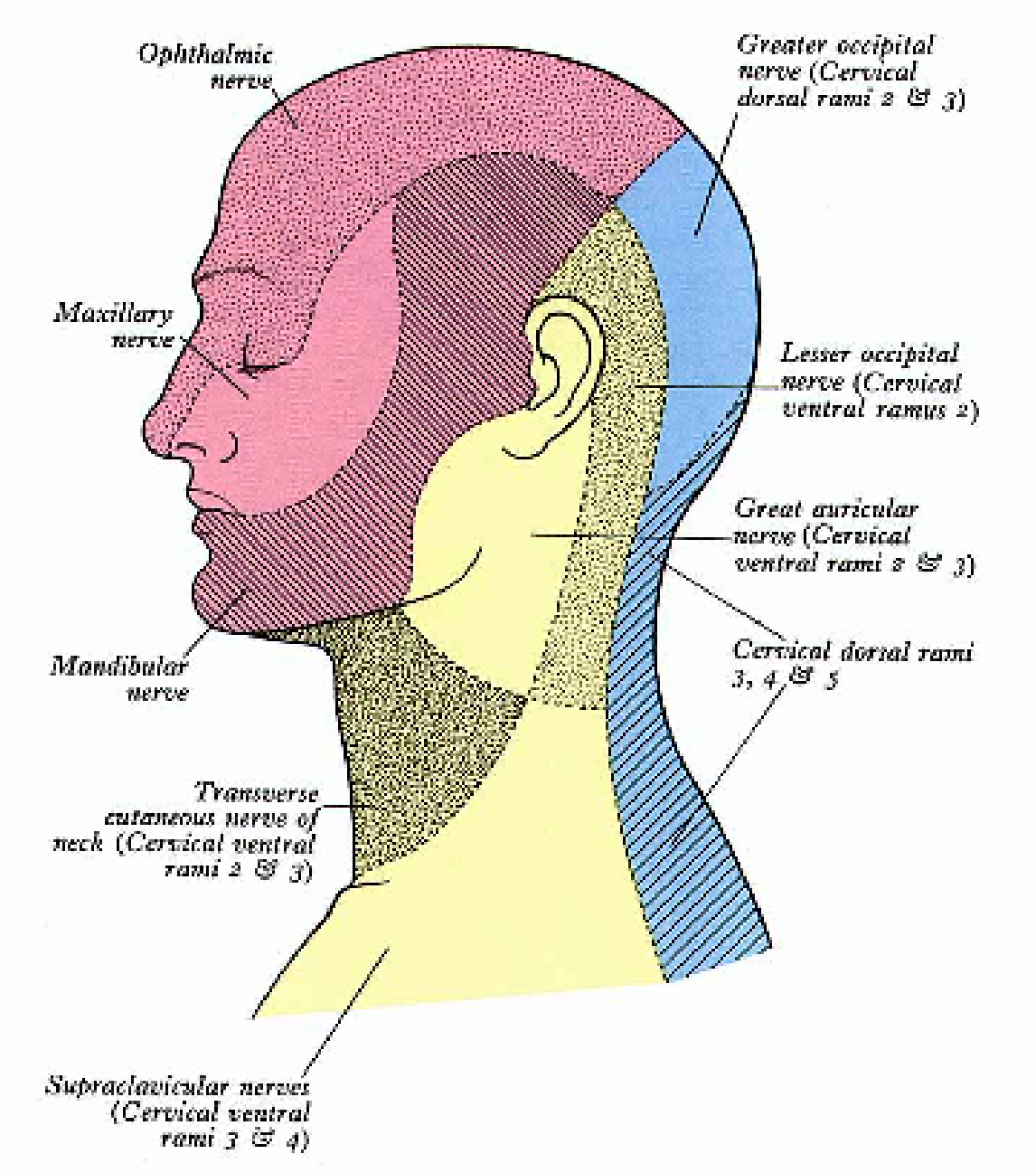
- Posterior Trunk:

1. Auriculotemporal

   Communicates with otic ganglion and facial nerve.

   i) Auricular, ii) Articular, iii) Parotid,

   iv) Temporal & v) to External auditory meatus


Ophthalmic nerve
Greater occipital nerve (Cervical dorsal rami 2 & 3)
Maxillary nerve
Lesser occipital nerve (Cervical ventral ramus 2)
Great auricular nerve (Cervical ventral rami 2 & 3)
Cervical dorsal rami 3, 4 & 5
Mandibular nerve
Transverse cutaneous nerve of neck (Cervical ventral rami 2 & 3)
Supraclavicular nerves (Cervical ventral rami 3 & 4)

Mandibular nerve (contd.)

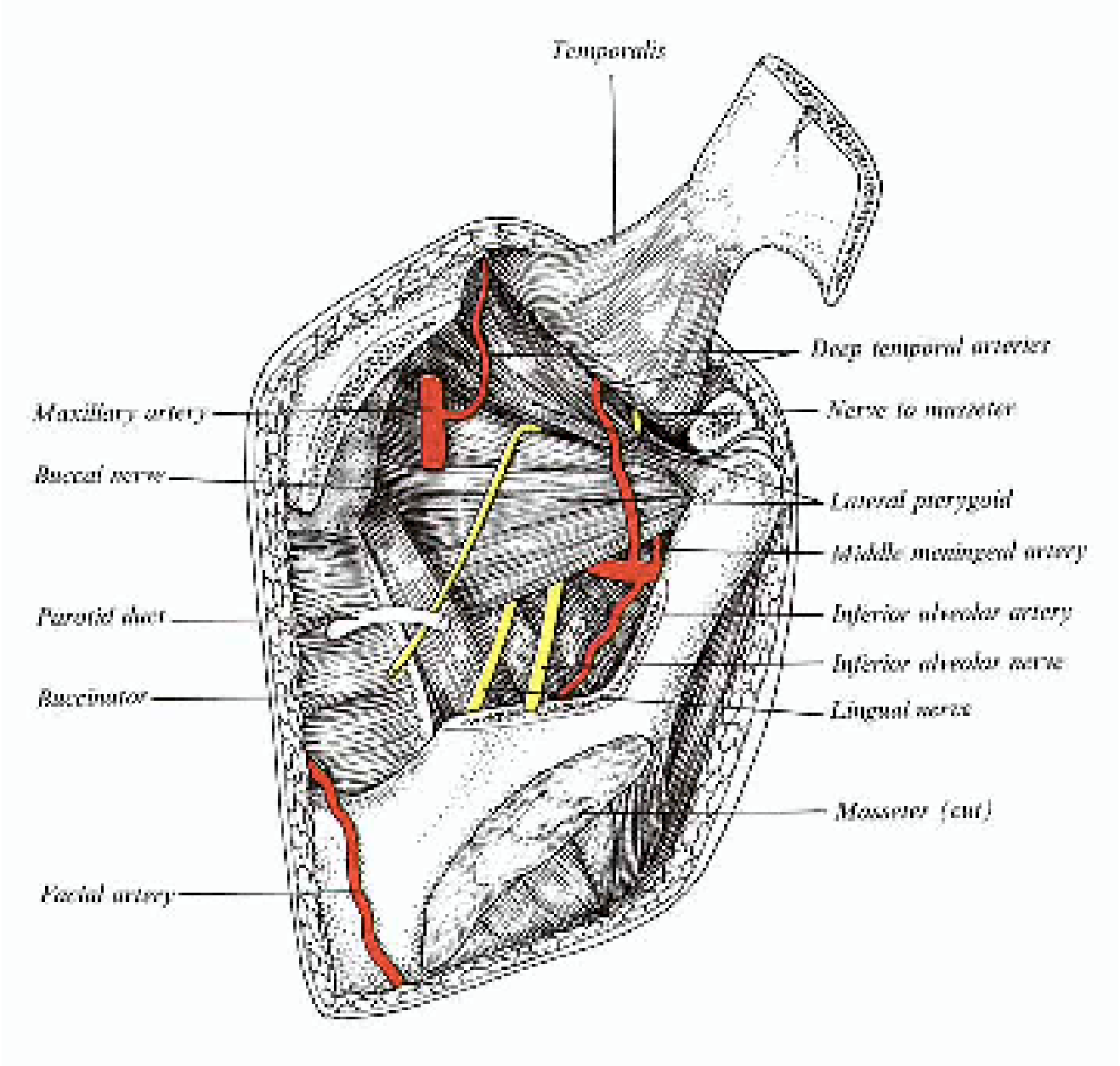
2. Lingual:

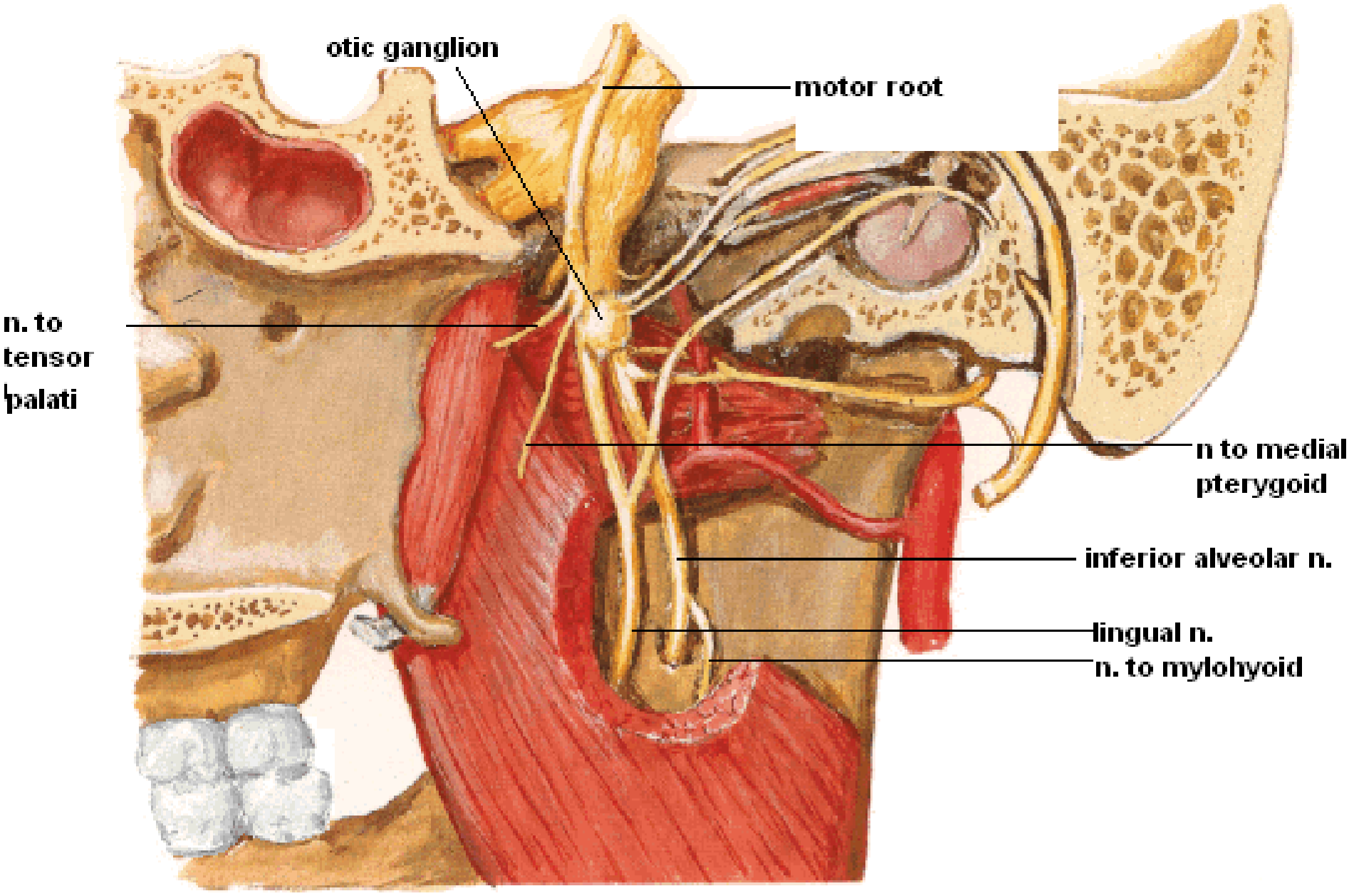
   Joined by chorda tympani.

   Sensory to mucosa of anterior 2/3rd of tongue, floor of mouth and gums.

3. Inferior alveolar:

   Nerve to mylohyoid; Branches to lower teeth and Mental branch.


Temporalis
Deep temporal arteries
Maxillary artery
Nerve to masseter
Buccal nerve
Lateral pterygoid
Middle meningeal artery
Parotid duct
Inferior alveolar artery
Inferior alveolar nerve
Buccinator
Lingual nerve
Masseter (cut)
Facial artery

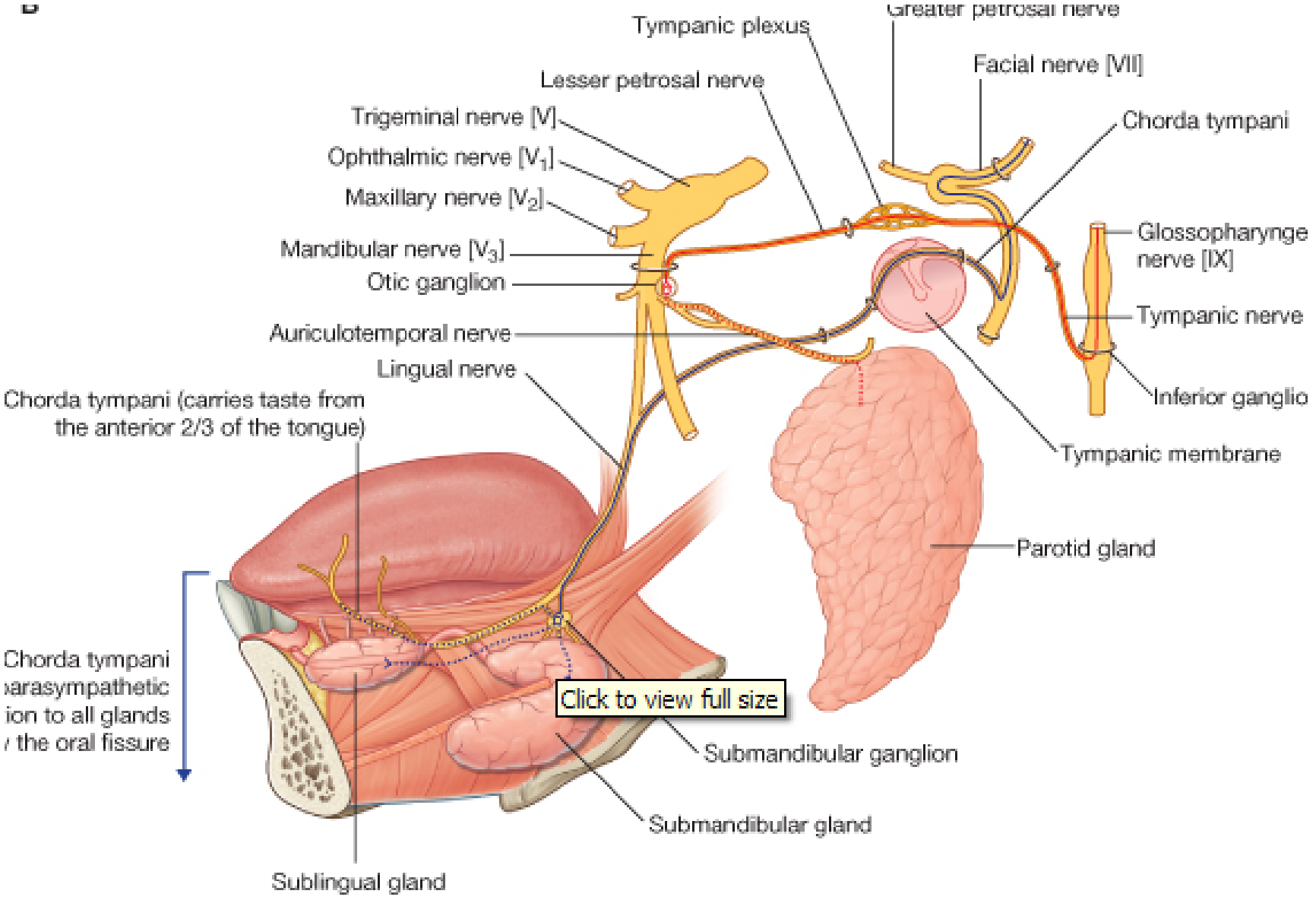

otic ganglion
motor root
n. to tensor palati
n to medial pterygoid
inferior alveolar n.
lingual n.
n. to mylohyoid

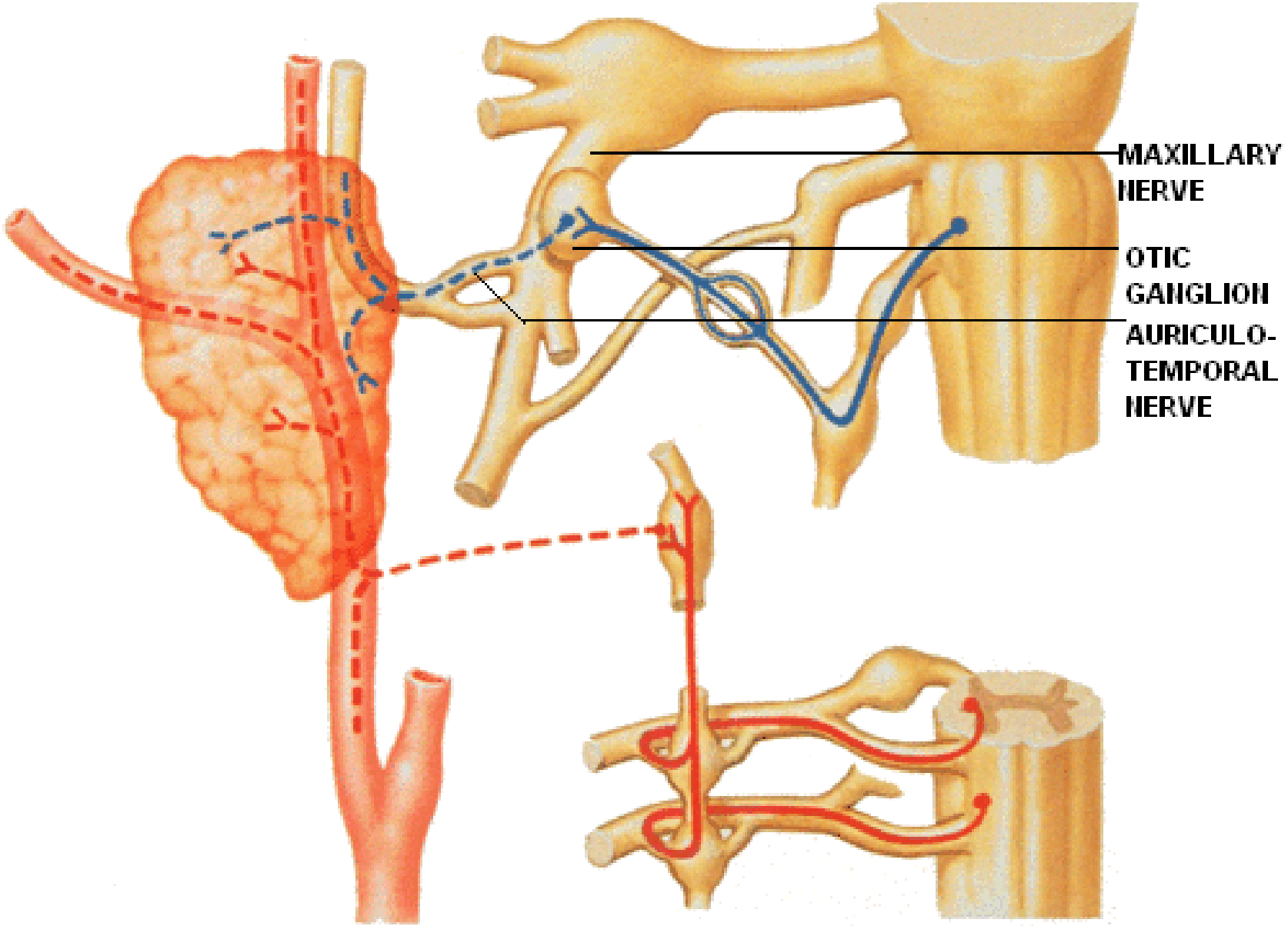
Submandibular ganglion

- Small, fusiform, on upper part of hyoglossus
- Superficial to deep part of submand. Gland
- Connected functionally to facial nerve
- **Motor root**: sup. salivatory N.– facial nerve– chorda tympani– lingual nerve– synapse in ganglion– postgang. Secretomotor fibres to salivary glands.
- **Sympathetic root**: from plexus around facial artery– do not synapse—vasomotor to blood vessels.
- **Sensory root**: from lingual nerve- do not synapse.
- **Branches**: to submandibular and sublingual glands.

Otic ganglion

- Small, fusiform, between mandibular nerve and tensor tympani.
- Peripheral parasympathetic ganglion
- Connected functionally with glossopharyngeal nerve
- **Motor root**: Inf. salivatory N.– IX nerve– Lesser petrosal– synapse in ganglion– postgang. Secretomotor fibres to parotid gland via auriculotemporal nerve.
- **Sympathetic root**: from plexus around Middle men. artery– do not synapse—vasomotor to blood vessels.
- **Sensory root**: from auriculotemporal nerve-- do not synapse.
- **Branches**: communicating branch to auriculotemporal nerve for parotid gland
  communicating branch to chorda tympani
  communicating branch to nerve of pterygoid canal
  Motor branch to tensor tympani and tensor palati


Greater petrosal nerve
Tympanic plexus
Facial nerve [VII]
Lesser petrosal nerve
Trigeminal nerve [V]
Chorda tympani
Ophthalmic nerve [V1]
Maxillary nerve [V2]
Glossopharynge
nerve [IX]
Mandibular nerve [V3]
Otic ganglion
Tympanic nerve
Auriculotemporal nerve
Lingual nerve
Inferior ganglio
Chorda tympani (carries taste from
the anterior 2/3 of the tongue)
Tympanic membrane
Parotid gland
Chorda tympani
arasympathetic
ion to all glands
the oral fissure
Click to view full size
Submandibular ganglion
Submandibular gland
Sublingual gland


MAXILLARY NERVE
OTIC GANGLION
AURICULO-TEMPORAL NERVE

Applied anatomy

- Trauma, tumors, aneurysms or meningeal infections will cause:

  Paralysis of muscles of mastication with deviation of mandible towards the site of lesion.

  Loss of soft tactile, thermal or painful sensations on the face

  Loss of corneal reflex and sneezing reflex
- Trigeminal neuralgia: excruciating pain in the area of distribution; females more affected.
- Referred pain
- Mandibular nerve block
- Dental anesthesia (Inf. Alveolar nerve block)
- Lingual nerve injury