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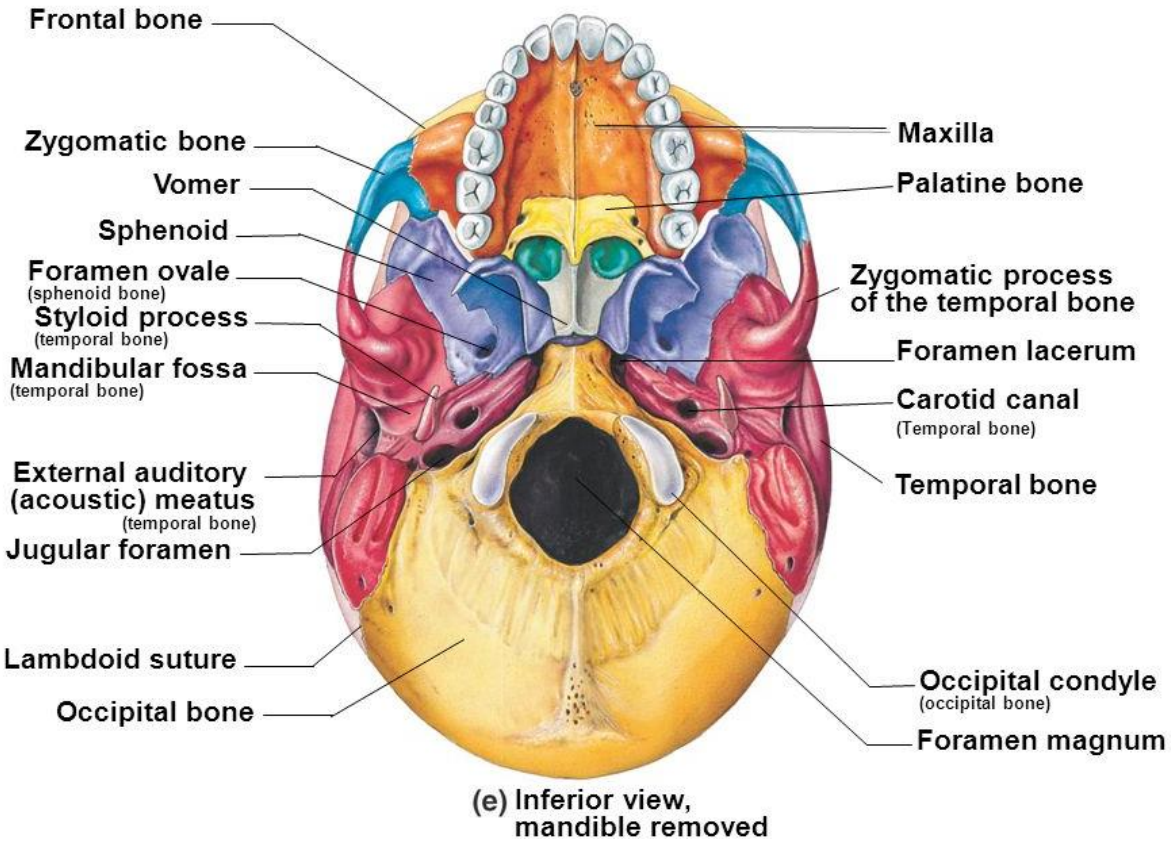
Foramina of the Base of the Skull

Foramen	Location	Contents		
Foramen ovale *"OVALE"*	Sphenoid bone	• Otic ganglion • V_3 (Mandibular nerve: 3rd branch of trigeminal)	• Accessory meningeal artery • Lesser petrosal nerve • Emissary veins	
Foramen spinosum		• Middle meningeal artery • Meningeal branch of the Mandibular nerve		
Foramen rotundum		• Maxillary nerve (V_2)		
Foramen lacerum		• ICA* (passes along its superior surface but does not traverse it) • Nerve of the pterygoid canal (Vidian n.) *(deep petrosal + superficial greater petrosal)* • Artery of the pterygoid canal		
Optic canal		• Optic nerve + 3 layers of dura → infection of meninges is seen as papilledema • Ophthalmic artery **(end artery)** • Sympathetic nerves		
Superior orbital fissure *"Live Free Son To See No Ignorant-Ass Individuals" (nerves: 3, 4, 5_1, 6)*		• Lacrimal branch of ophthalmic (V_1) • Frontal branch of ophthalmic (V_1) • Superior ophthalmic *vein* • Trochlear (IV) • Superior division of oculomotor (III)	• Nasociliary branch of ophthalmic (V_1) • Inferior Division of oculomotor (III) • Abducens (VI) • Inferior ophthalmic *veins*	
Carotid canal *"SIDE"*	Temporal bone	• Sympathetic plexus around arteries • Internal carotid artery	• Deep petrosal nerve • Emissary veins	
Jugular foramen		• **Anterior:** inferior petrosal sinus • **Intermediate:** glossopharyngeal, vagus, and accessory nerves. ***(9, 10, 11)*** • **Posterior:** sigmoid sinus (becoming the internal jugular vein) and some meningeal branches from the occipital and ascending pharyngeal arteries.		
Stylomastoid foramen		• Stylomastoid artery • Facial nerve		
Foramen magnum	Occipital	***Vessels*** • Vertebral arteries • Anterior spinal artery • Posterior spinal artery	***Nerves*** • Spinal root of XI • Lower end of medulla	***Tissues*** • Tectorial membranes • Apical ligament of the dens



(e) Inferior view, mandible removed

Foramen rotundum:
(middle cranial fossa/ pterygopalatine fossa)
• [V2] Maxillary division of [V] (trigeminal nerve)

Foramen ovale:
(middle cranial fossa/ infratemporal fossa)
• [V3] Mandibular division of [V] (trigeminal nerve)

Carotid canal:
(middle cranial fossa/ neck)
• Internal carotid artery

Foramen spinosum:
(middle cranial fossa/ infratemporal fossa)
• Middle meningeal artery

Jugular foramen:
(posterior cranial fossa/ neck)
• [IX] Glossopharyngeal nerve
• [X] Vagus nerve
• [XI] Accessory nerve
• Internal jugular vein

Foramen magnum:
(posterior cranial fossa/ neck)
• Spinal cord
• Vertebral arteries

Roots of accessory nerve [XI] pass from upper region of spinal cord through the foramen magnum into the cranial cavity and then leave the cranial cavity though the jugular foramen

Cribriform plate:
(anterior cranial fossa/ nasal cavity)
• [I] Olfactory nerves

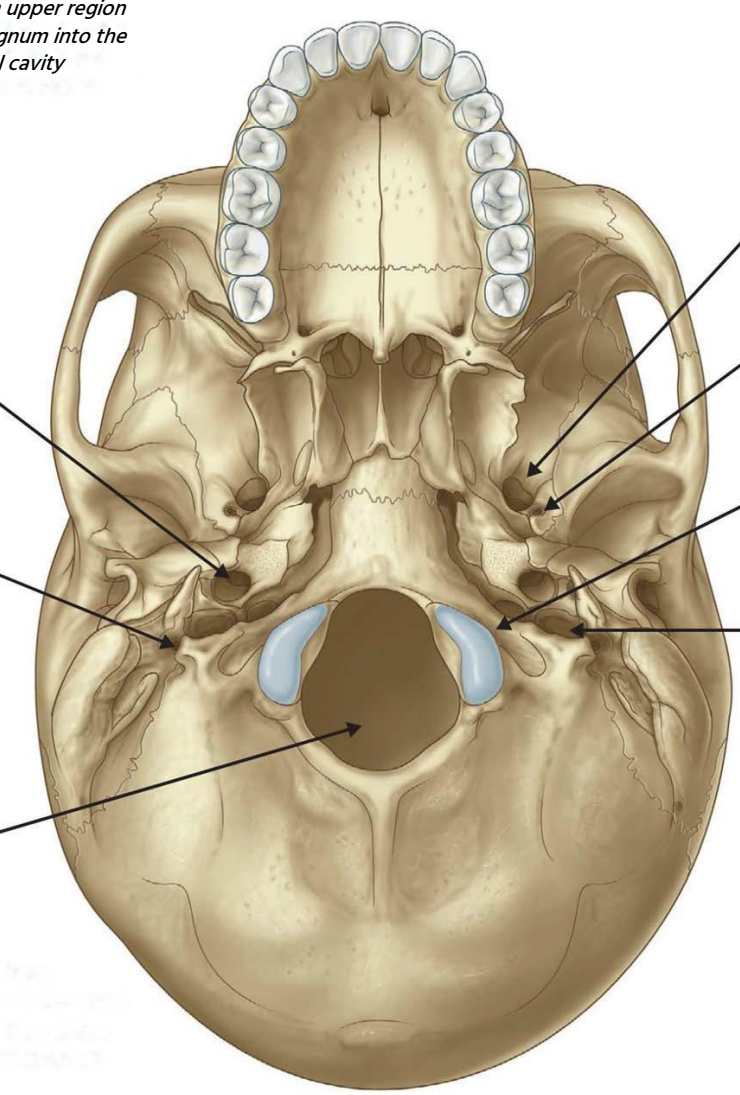
Optic canal:
(middle cranial fossa/ orbit)
• [II] Optic nerve
• Ophthalmic artery

Superior orbital fissure:
(middle cranial fossa/ orbit)
• [V_1] Ophthalmic division of [V] (trigeminal nerve)
• [III] Oculomotor nerve
• [IV] Trochlear nerve
• [VI] Abducent nerve
• Superior ophthalmic vein

Foramen lacerum:
(filled with cartilage in life)

Internal acoustic meatus:
(posterior cranial fossa/ear, and neck via stylomastoid foramen)
• [VII] Facial nerve
• [VIII] Vestibulocochlear nerve
• Labyrinthine artery and vein

Hypoglossal canal:
(posterior cranial fossa/ neck)
• [XII] Hypoglossal nerve



Carotid canal:
• Internal carotid artery

Stylomastoid foramen:
• [VII] Facial nerve

Foramen magnum:
(posterior cranial fossa/ neck)
• Spinal cord
• Vertebral arteries

Foramen ovale:
• [V_3] Mandibular division of [V] (trigeminal nerve)

Foramen spinosum:
• Middle meningeal artery

Hypoglossal canal:
• [XII] Hypoglossal nerve

Jugular foramen:
(posterior cranial fossa/ neck)
• [IX] Glossopharyngeal nerve
• [X] Vagus nerve
• [XI] Accessory nerve
• Internal jugular vein

Visual Field Defects

- Left homonymous hemianopia means visual field defect to the left, i.e. Lesion of right optic tract
- Homonymous quadrantanopias: PITS (Parietal-Inferior, Temporal-Superior)
- Incongruous defects = optic tract lesion; congruous defects = optic radiation lesion or occipital cortex

Homonymous hemianopia

- Incongruous defects: lesion of optic tract
- Congruous defects: lesion of optic radiation or occipital cortex
- Macula sparing: lesion of occipital cortex

Homonymous quadrantanopia

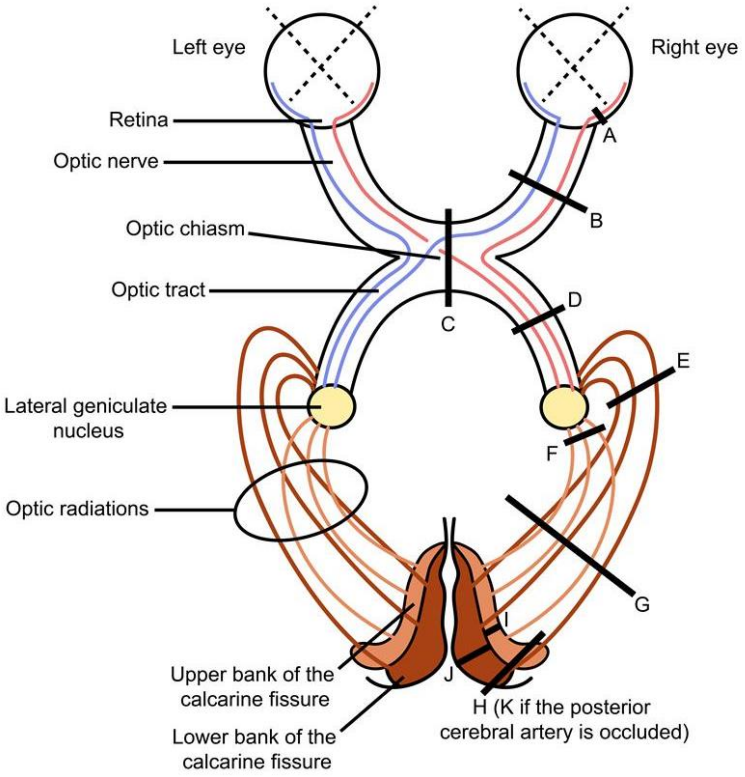
- Superior: lesion of temporal lobe
- Inferior: lesion of parietal lobe
- Mnemonic = ***PITS*** (**P**arietal-**I**nferior, **T**emporal-**S**uperior)

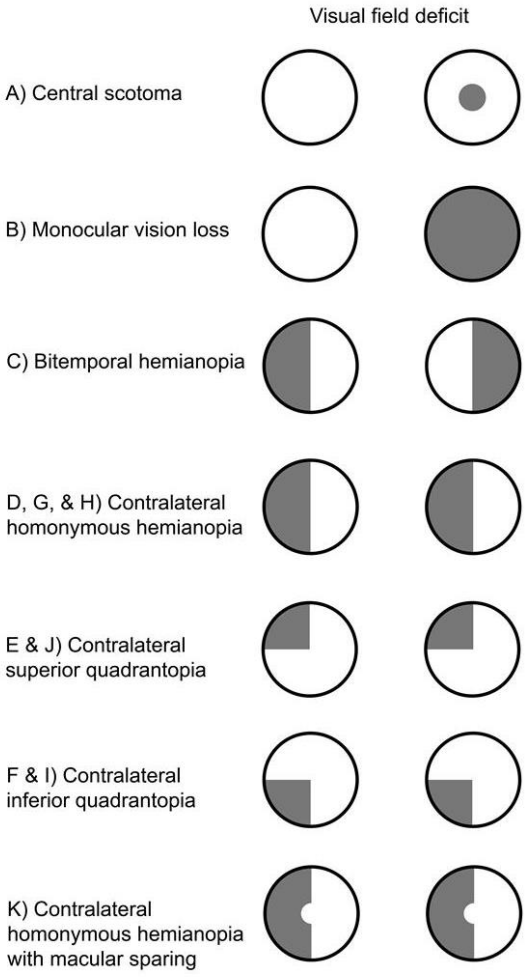
Lesions before optic chiasm:
Monocular vision loss = Optic nerve lesion
Bitemporal hemianopia = Optic chiasm lesion

Lesions after the optic chiasm:
Homonymous hemianopia = Optic tract lesion
Upper quadrantanopia = Temporal lobe lesion
Lower quadrantanopia = Parietal lobe lesion

Bitemporal hemianopia

- Lesion of optic chiasm
- Upper quadrant defect > Lower quadrant defect = inf. chiasmal compression, commonly a pituitary tumour
- Lower quadrant defect > Upper quadrant defect = sup. chiasmal compression, commonly a craniopharyngioma





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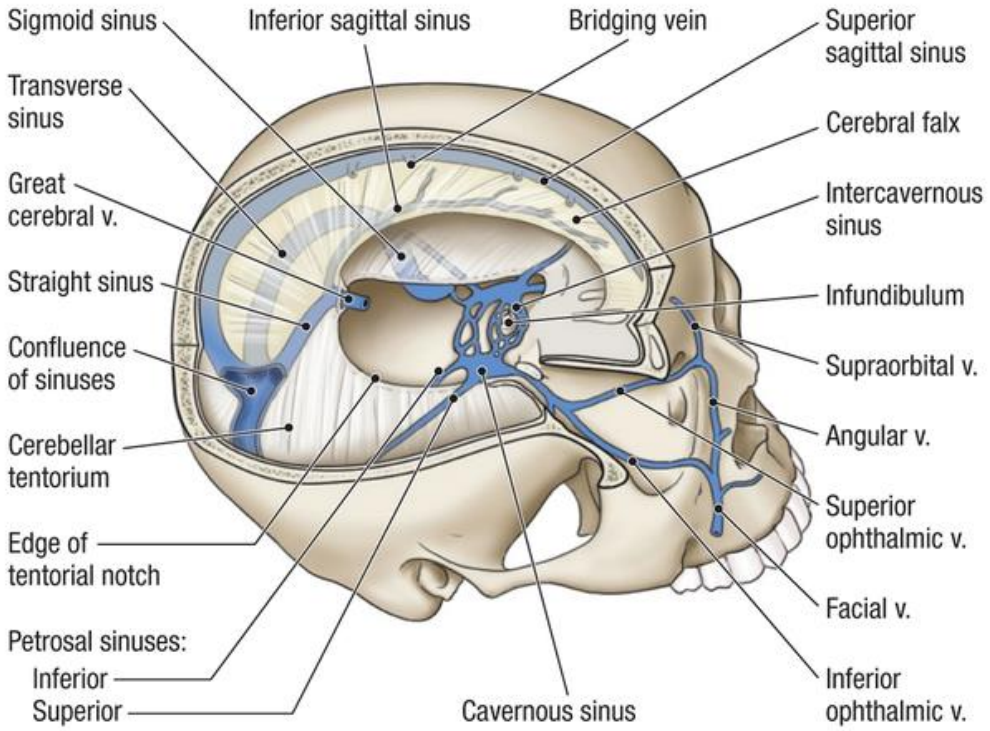
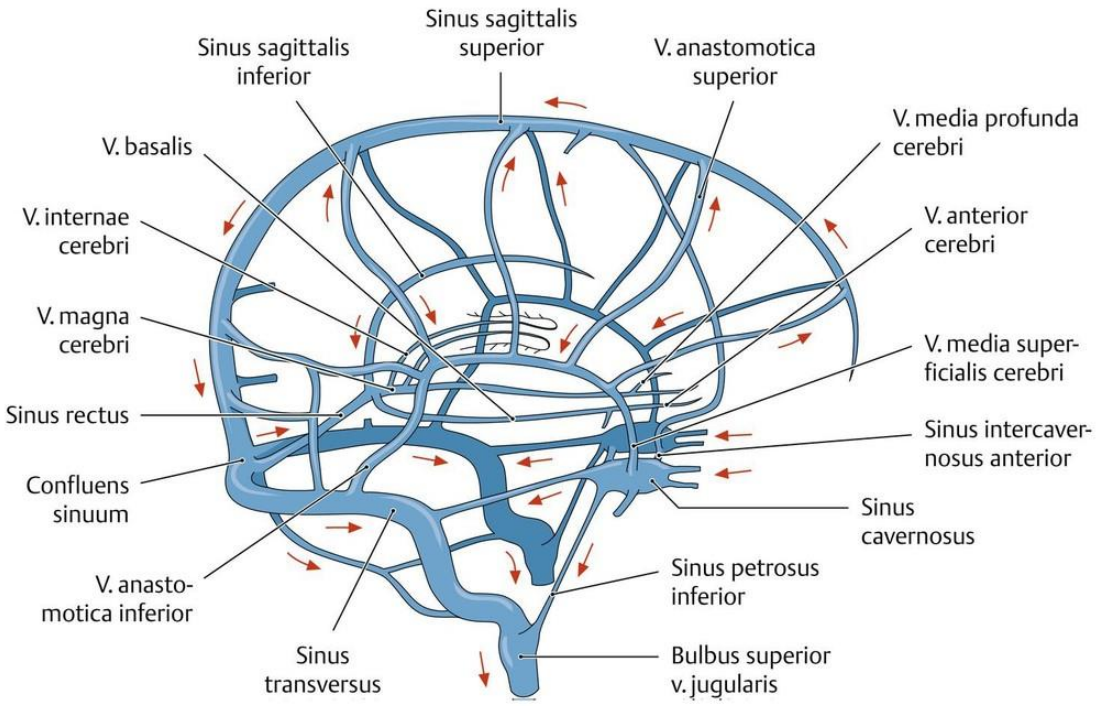
Cranial Venous Sinuses

The cranial venous sinuses are located within the dura mater. They have no valves which is important in the potential for spreading sepsis. They eventually drain into the internal jugular vein. They are:

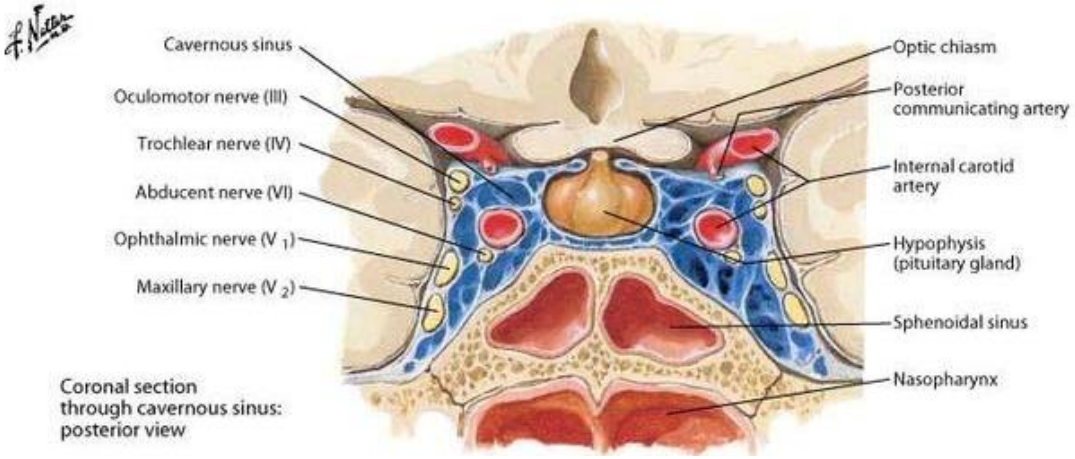
- Superior sagittal sinus
- Inferior sagittal sinus
- Straight sinus
- Transverse sinus
- Sigmoid sinus
- Confluence of sinuses
- Occipital sinus
- Cavernous sinus





Cavernous Sinus

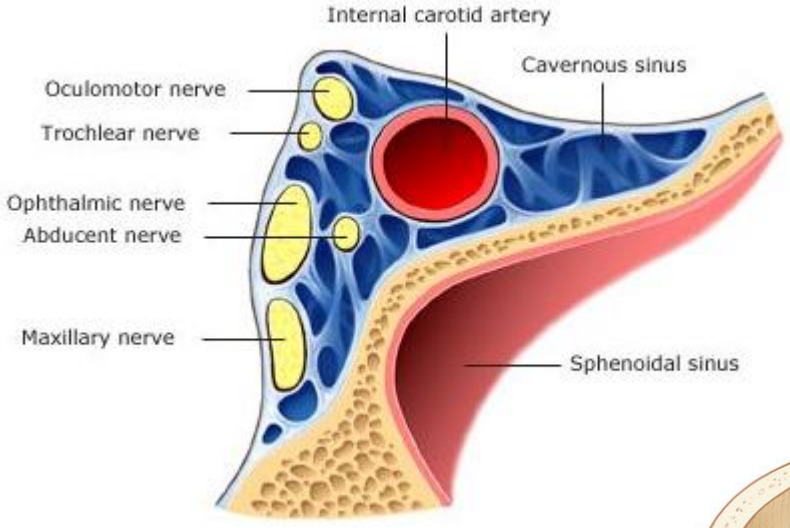
The cavernous sinuses are paired and are situated on the body of the sphenoid bone. It runs from the superior orbital fissure to the petrous temporal bone.



Contents: *"O TOM CAT"*

Lateral wall components	*(from top to bottom:)* **O**culomotor nerve (III) **T**rochlear nerve (IV) **O**phthalmic nerve (V_1) **M**axillary nerve (V_2)
Contents of the sinus	*(from medial to lateral:)* Internal **C**arotid artery (and sympathetic plexus) **A**bducens nerve (VI)

Cavernous sinus syndrome is most commonly caused by cavernous sinus tumours. Diagnosis is based on signs of pain, ophthalmoplegia, proptosis, trigeminal nerve lesion (ophthalmic branch) and Horner's syndrome.

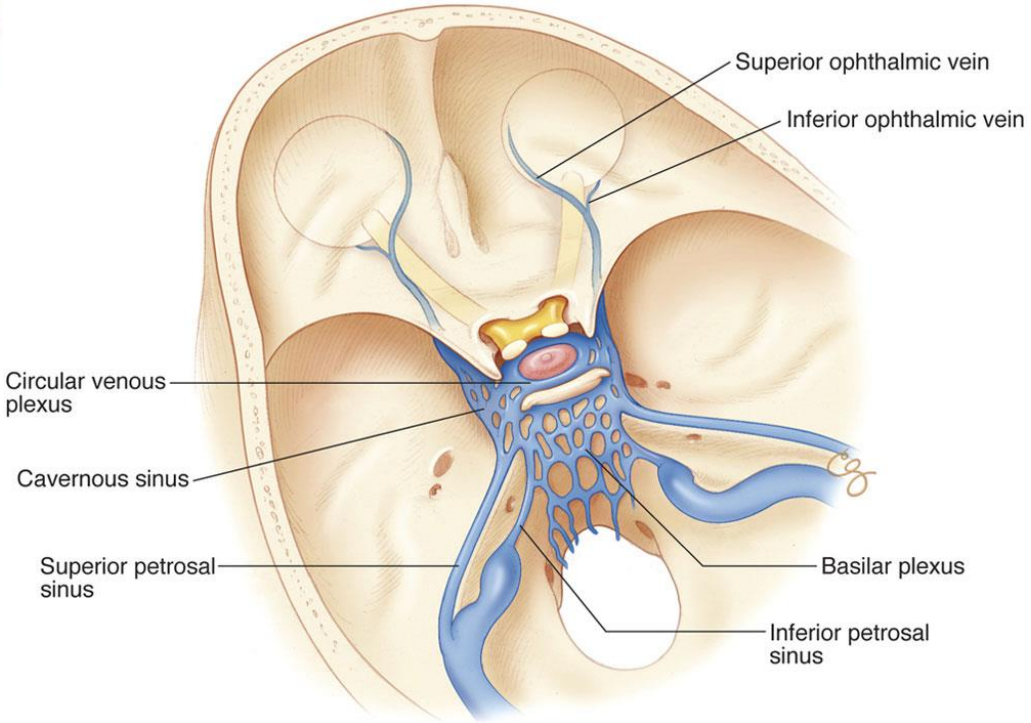


Relations

Medial	Lateral
Pituitary fossa Sphenoid sinus	Temporal lobe

Blood supply

Ophthalmic vein, superficial cortical veins, basilar plexus of veins posteriorly.
Drains into the internal jugular vein via: the superior and inferior petrosal sinuses



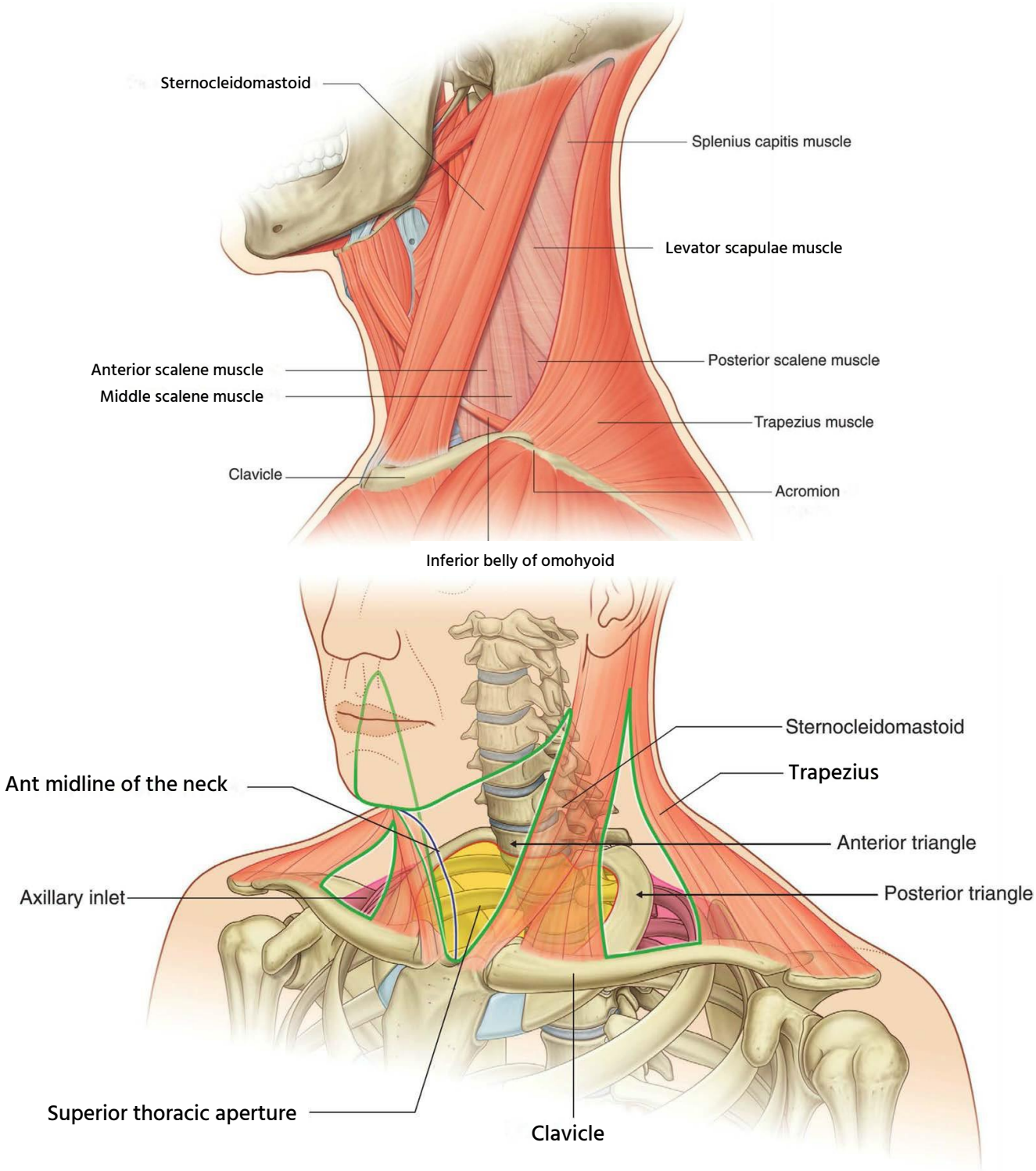
Sternocleidomastoid

Anatomy

Origin	Rounded tendon attached to upper manubrium sterni and muscular head attached to medial third of the clavicle
Insertion	Mastoid process of the temporal bone and lateral area of the superior nuchal line of the occipital bone
Innervation	Spinal part of **accessory nerve** and anterior rami of C2 and C3 (proprioception)*
Action	• Both: extend the head at atlanto-occipital joint and flex the cervical vertebral column. Accessory muscles of inspiration. • Single: lateral flexion of neck, rotates head so face looks upward to the opposite side

**The motor supply to the sternocleidomastoid is from the accessory nerve. The ansa cervicalis supplies sensory information from the muscle.*

Sternocleidomastoid divides the anterior and posterior triangles of the neck.

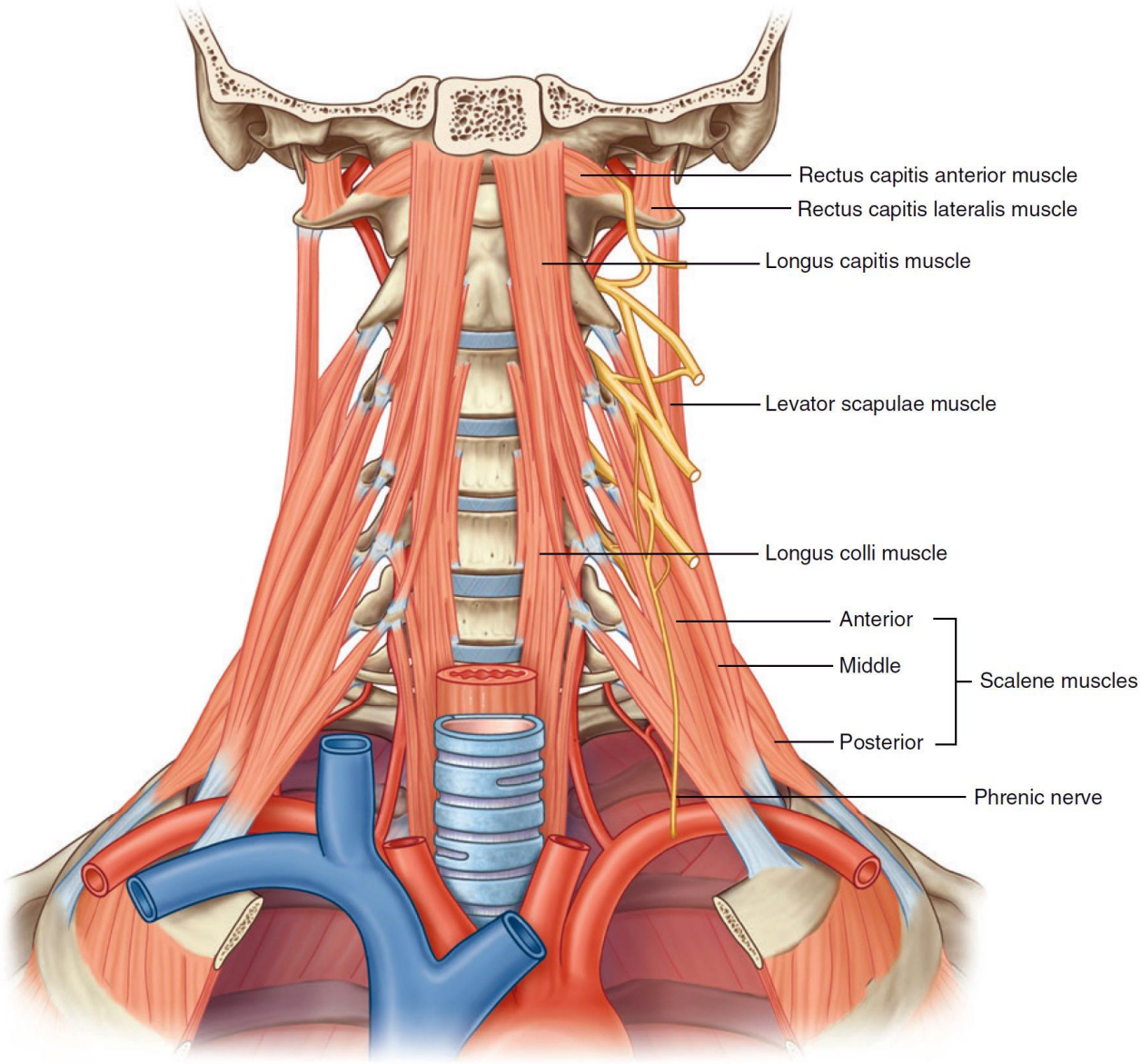


Scalene Muscles

The 3 paired muscles are:

- Scalenus anterior: Elevate 1st rib and laterally flex the neck to same side
- Scalenus medius: Same action as scalenus anterior
- Scalenus posterior: Elevate 2nd rib and tilt neck to opposite side

Innervation	Spinal nerves C4-6
Origin	Transverse processes C2 to C7
Insertion	First and second ribs
Important relations	• The brachial plexus and subclavian artery pass between the anterior and middle scalenes through a space called the scalene hiatus/fissure. • The subclavian vein and phrenic nerve pass anteriorly to the anterior scalene as it crosses over the first rib.



Thoracic outlet syndrome

The scalenes are at risk of adhering to the fascia surrounding the brachial plexus or shortening causing compression of the brachial plexus when it passes between the clavicle and 1st rib causing thoracic outlet syndrome.

Anterior Triangle of the Neck

Boundaries	Posterior	Anterior border of sternocleidomastoid
	Ant	Midline of the neck
	Superior	Lower border of the mandible

Sub triangles (divided by Digastric above and Omohyoid)

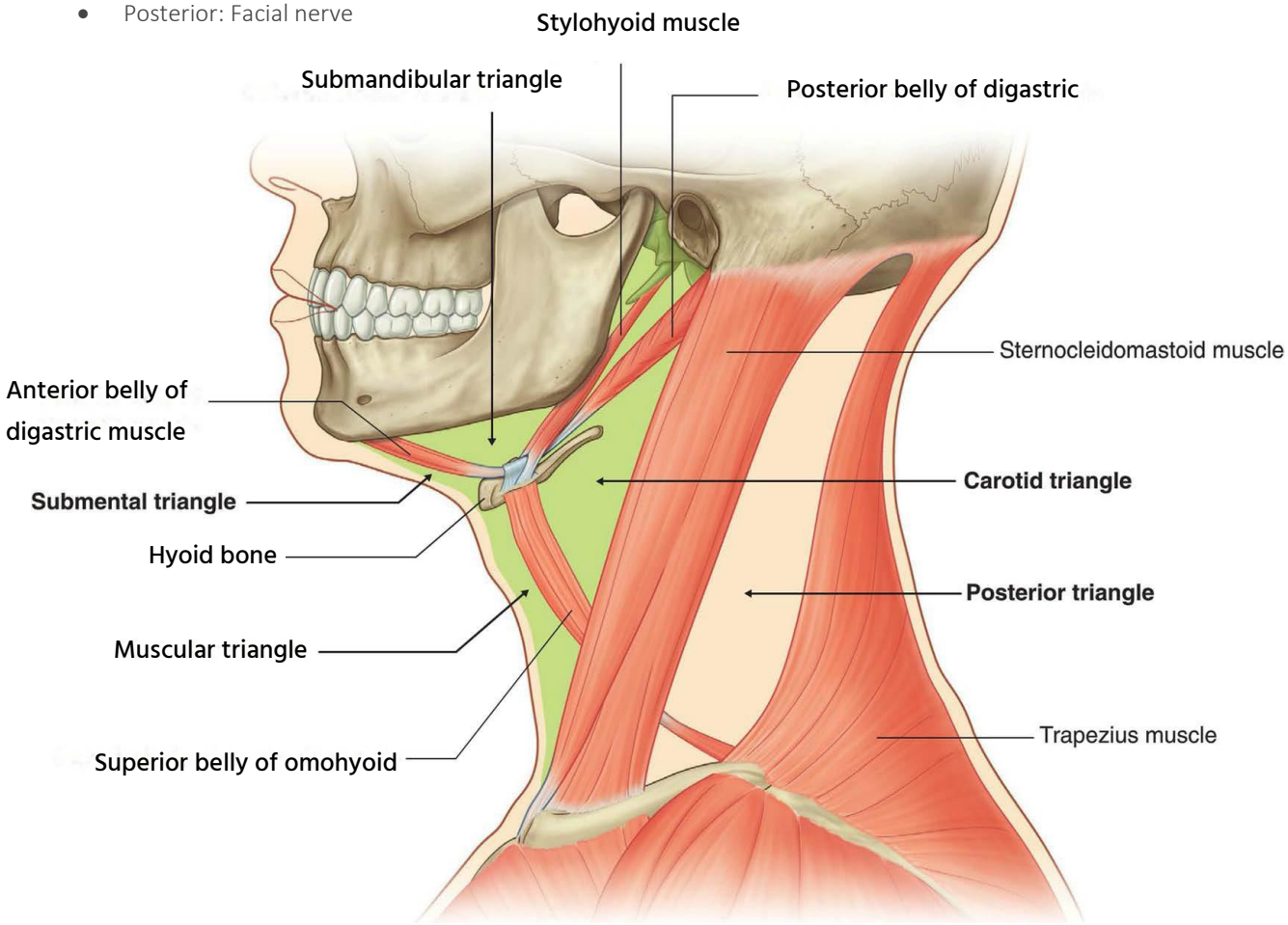
- Submandibular Triangle (Digastric)
- Muscular triangle: Neck strap muscles
- Carotid triangle: Carotid sheath

Contents of the anterior triangle

Digastric triangle (submandibular)	Submandibular gland Submandibular nodes Facial vessels Hypoglossal nerve
Muscular triangle	Strap muscles External jugular vein
Carotid triangle	Carotid sheath (Common carotid, Vagus and IJV) Ansa cervicalis

Nerve supply to digastric muscle

- Anterior: Mylohyoid nerve
- Posterior: Facial nerve

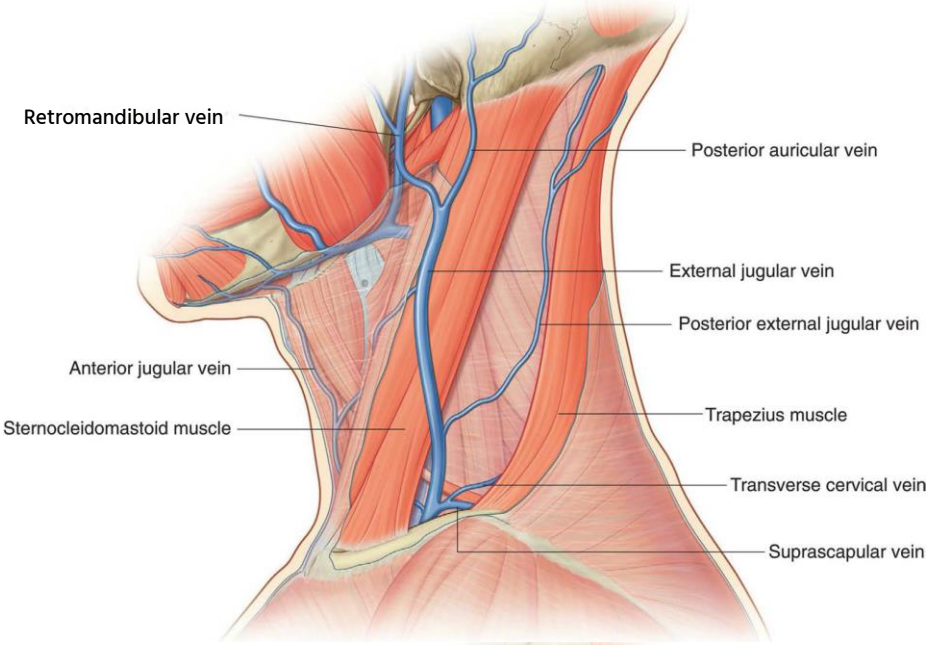


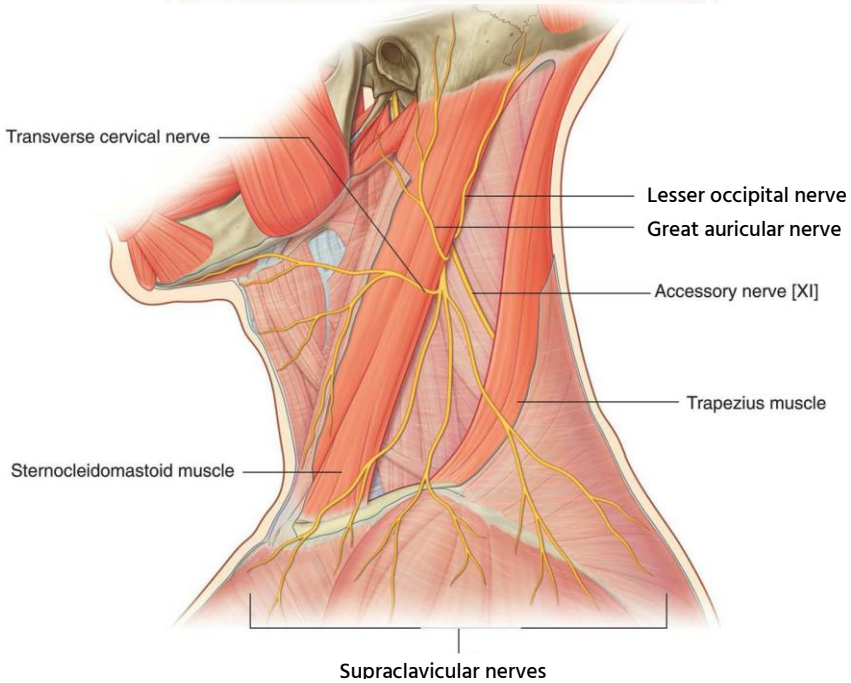
Posterior Triangle of the Neck

Boundaries	**Apex**	Sternocleidomastoid and the Trapezius muscles at the Occipital bone
	Anterior	Posterior border of the Sternocleidomastoid
	Posterior	Anterior border of the Trapezius
	Base	Middle third of the clavicle

Contents	**Nerves**	• Accessory nerve • Phrenic nerve • Three trunks of the brachial plexus • Branches of the cervical plexus: Supraclavicular nerve, transverse cervical nerve, great auricular nerve, lesser occipital nerve
	Vessels	• **External jugular vein** • Subclavian artery **(3rd part)**
	Muscles	• Inferior belly of omohyoid • Scalene
	Lymph nodes	• Supraclavicular • Occipital

The IJV does not lie in the posterior triangle. However, the terminal branches of the external jugular vein do.





Parathyroid Glands - Anatomy

- Four parathyroid glands
- Located posterior to the thyroid gland
- They lie within the pretracheal fascia

Embryology

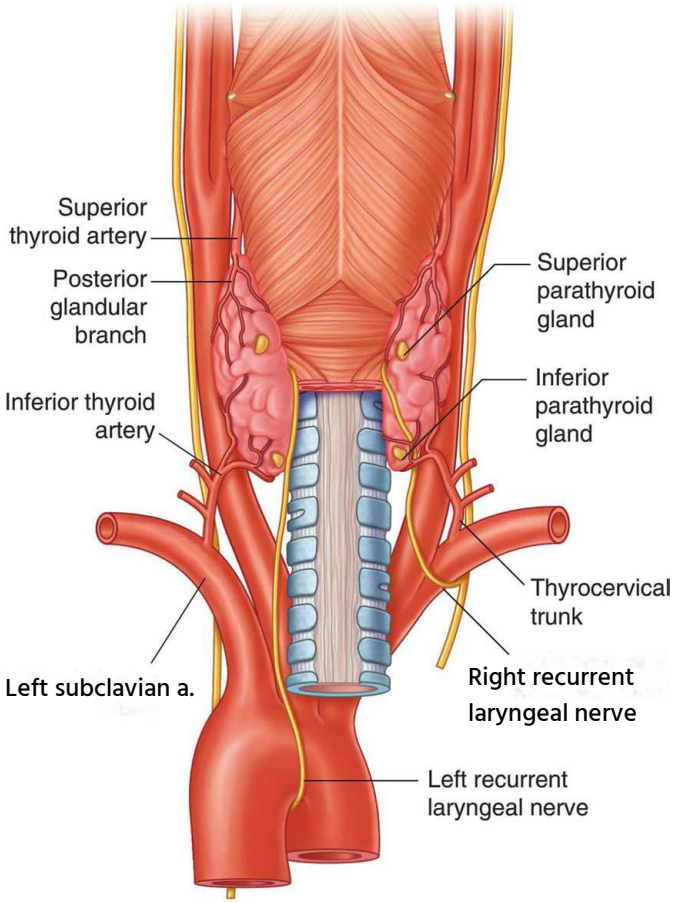
The parathyroids develop from the extremities of the third and fourth pharyngeal pouches. The parathyroids derived from the fourth pharyngeal pouch are located more superiorly and are associated with the thyroid gland. Those derived from the third pharyngeal pouch lie more inferiorly and may become associated with the thymus.

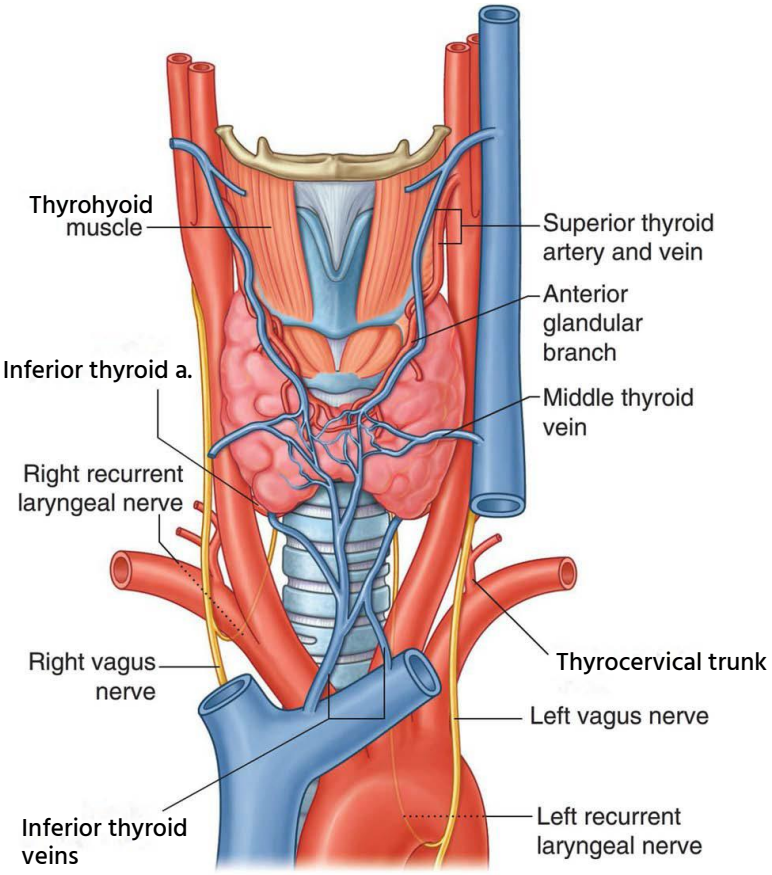
Blood supply

The blood supply to the parathyroid glands is derived from the inferior and superior thyroid arteries *(Thyrocervical trunk and the ECA respectively).* There is a rich anastomosis between the two vessels. Venous drainage is into the thyroid veins.

Relations

Laterally	Common carotid
Medially	Recurrent laryngeal nerve, trachea
Anterior	Thyroid
Posterior	Pretracheal fascia





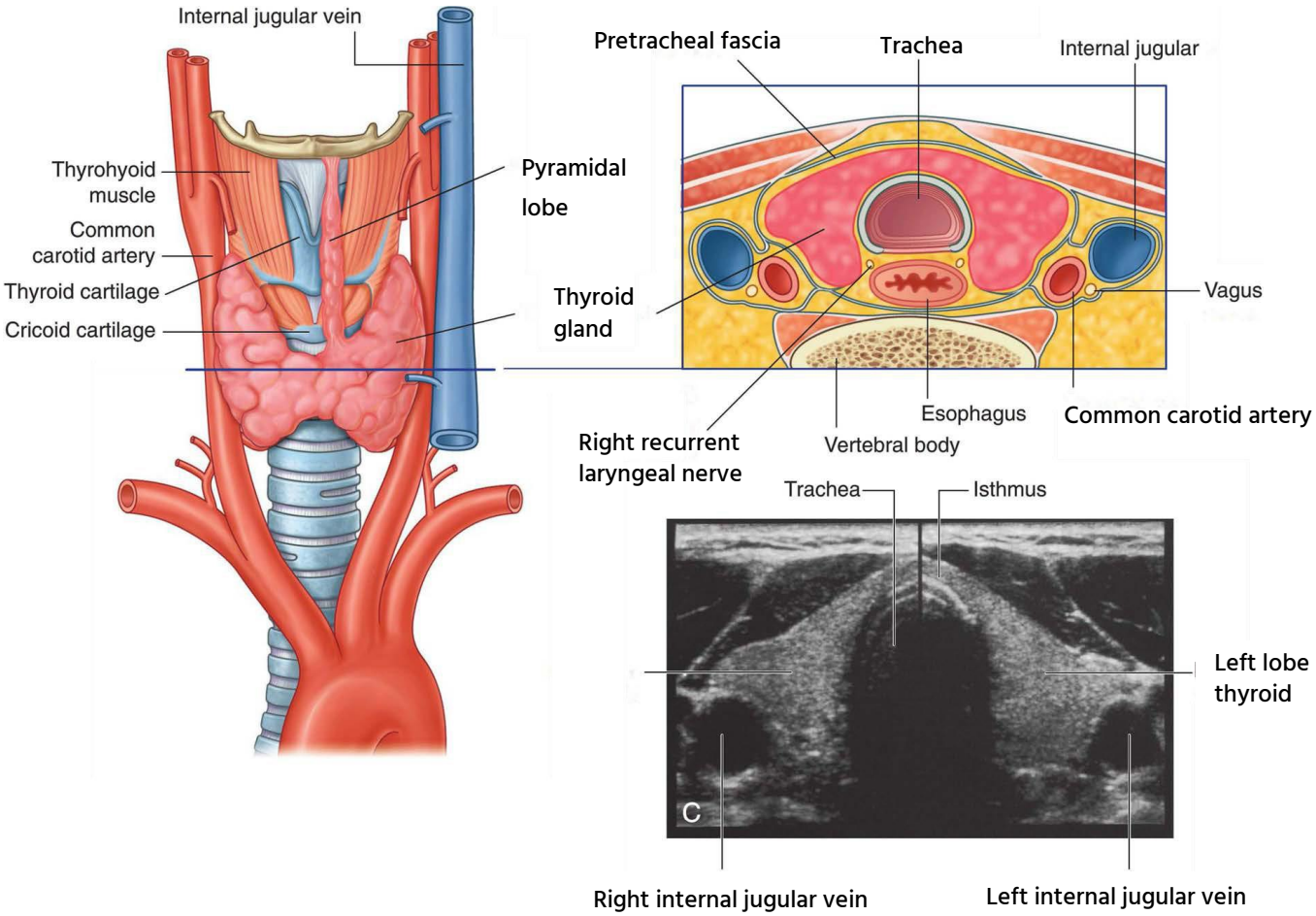
Thyroid Gland

- Right and left lobes connected by isthmus
- Surrounded by sheath from pretracheal layer of deep fascia
- ***Apex:*** Lamina of thyroid cartilage. ***Base:*** 4th-5th tracheal ring
- Pyramidal lobe: from isthmus. Mnemonic *"Rings 2,3,4 make the isthmus floor"*
- May be attached to foramen caecum at the base of the tongue

Relations	**Anteromedially**	• Sternothyroid • Sternohyoid • Superior belly of omohyoid • Anterior aspect of sternocleidomastoid
	Posterolaterally	Carotid sheath *(CCA, IJV, X)*
	Medially	• Larynx • Oesophagus • External laryngeal nerve (near superior thyroid a.) • Trachea • Cricothyroid muscle • Recurrent laryngeal nerve (near inferior thyroid a.) • Pharynx
	Posterior	• Parathyroid glands • Anastomosis of superior and inferior thyroid arteries
	Isthmus	• Anteriorly: Sternothyroid, sternohyoid, anterior jugular veins • Posteriorly: 2nd, 3rd, 4th tracheal rings (attached via Ligament of Berry)

Blood Supply

Arterial	• **Superior thyroid** artery *(1st branch of external carotid)* • **Inferior thyroid** artery *(from thyrocervical trunk from subclavian a. 1st part)* • Thyroidea ima (in 10% of population -from brachiocephalic artery or aorta)
Venous	• Superior and middle thyroid veins - into the IJV • Inferior thyroid vein - into the brachiocephalic veins

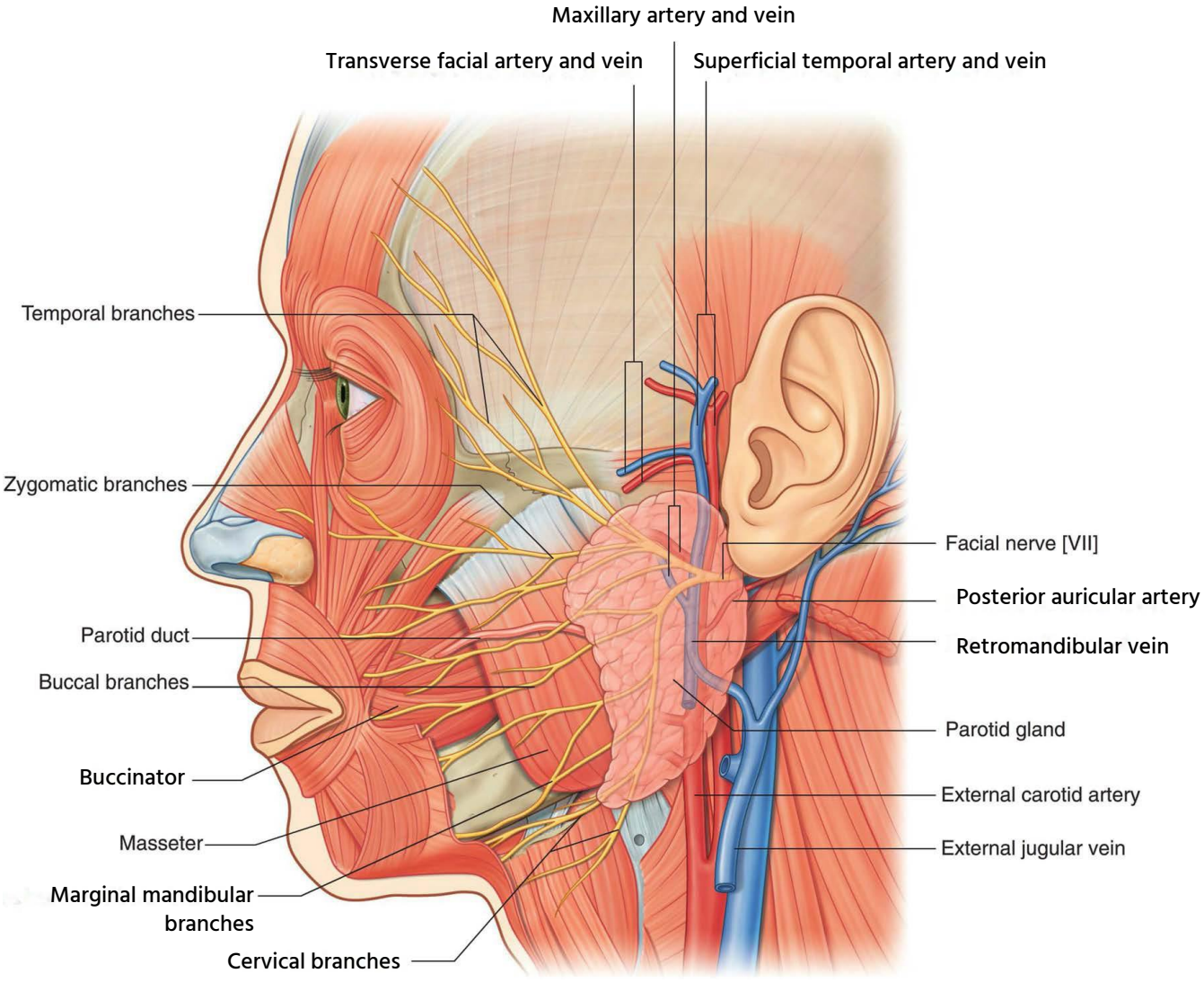


Parotid Gland

Anatomy of the parotid gland

Location	Overlying the mandibular ramus; anterior and inferior to the ear.
Salivary duct	Crosses the masseter, pierces the buccinator and drains adjacent to the 2nd upper molar tooth (Stensen's duct).
Structures passing through the gland	• Facial nerve *(most superficial structure)* *("The Zebra Buggered My Cat" Temporal Zygomatic, Buccal, Mandibular, Cervical)* • External carotid artery • Retromandibular vein • Auriculotemporal nerve *(from post. trunk of V_3)*
Relations	• *Anterior*: masseter, medial pterygoid, superficial temporal and maxillary artery, facial nerve, stylomandibular ligament • *Posterior*: posterior belly digastric muscle, sternocleidomastoid, stylohyoid, internal carotid artery, mastoid process, styloid process
Arterial supply	Branches of external carotid artery
Venous drainage	Retromandibular vein *(union of the superficial temporal and maxillary veins)*
Lymphatic drainage	Deep cervical nodes
Nerve innervation	• *Parasympathetic*: Secretomotor *(from otic ganglion)* • *Sympathetic*: Superior cervical ganglion • *Sensory*: Greater auricular nerve

Parasympathetic stimulation produces a water-rich, serous saliva. Sympathetic stimulation leads to the production of a low volume, enzyme-rich saliva.



The Tongue

Lymphatic Drainage

- The lymphatic drainage of the anterior two thirds of the tongue shows only minimal communication of lymphatics across the midline, so metastasis to the ipsilateral nodes is usual.
- The lymphatic drainage of the **posterior third** of the tongue have communicating networks, as a result early **bilateral nodal metastases** are more common in this area.
- Lymphatics from the **tip** of the tongue usually pass to the **sub mental nodes** and from there to the deep cervical nodes.
- Lymphatics from the **mid portion** of the tongue usually drain to the **submandibular** nodes and then to the deep cervical nodes. Mid tongue tumours that are laterally located will usually drain to the ipsilateral deep cervical nodes, **those from more central regions may have bilateral deep cervical nodal involvement.**

Motor Innervation

All of the motor innervation is provided by **Hypoglossal (XII)** except for the palatoglossus muscle which is provided by Vagus (X).

Sensory and taste Innervation

Area	Sensory Innervation	Gustatory (taste) Innervation
Posterior part of the root of tongue	Vagus (X)	
Posterior 1/3	Glossopharyngeal (IX)*	
Anterior 2/3	Mandibular (V_3) via Lingual	Facial (VII) via Chorda tympani

**Supplies general sensation to the posterior third of the tongue and contributes to the gag reflex.*

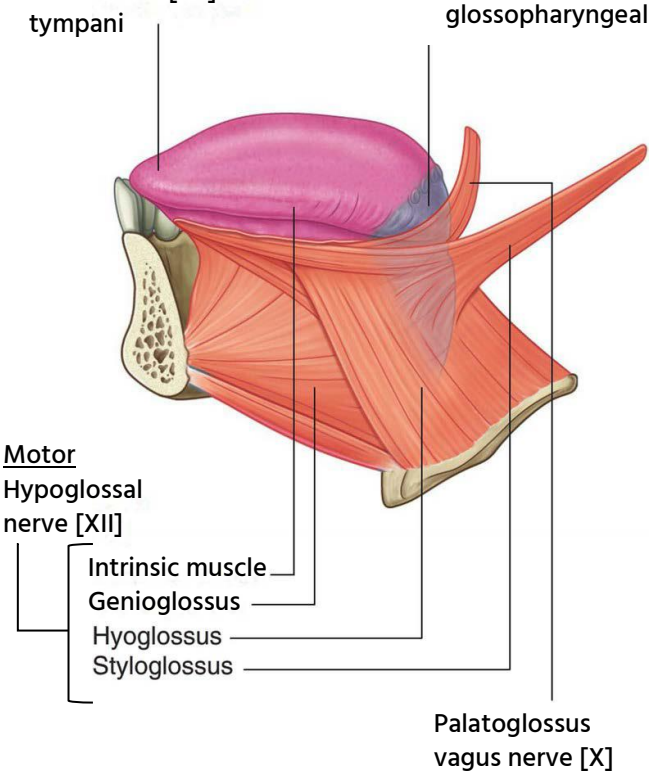
Sensory

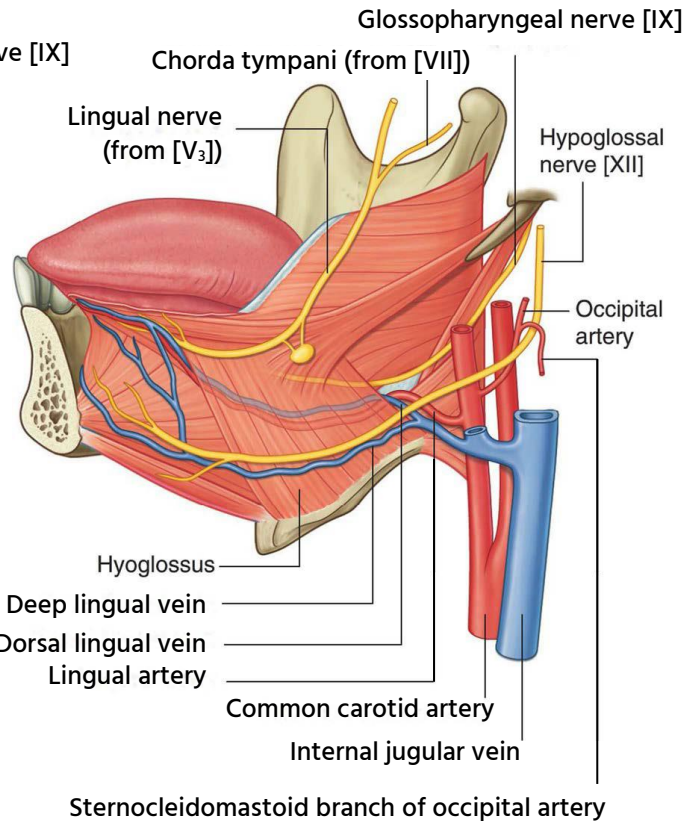
Anterior two-thirds (oral)

- General sensation mandibular nerve [V_3] via lingual nerve
- Special sensation (taste) facial nerve [VII] via chorda tympani

Posterior one-third (pharyngeal)

- General and special (taste) sensation via glossopharyngeal nerve [IX]





Submandibular Gland

Relations of the submandibular gland

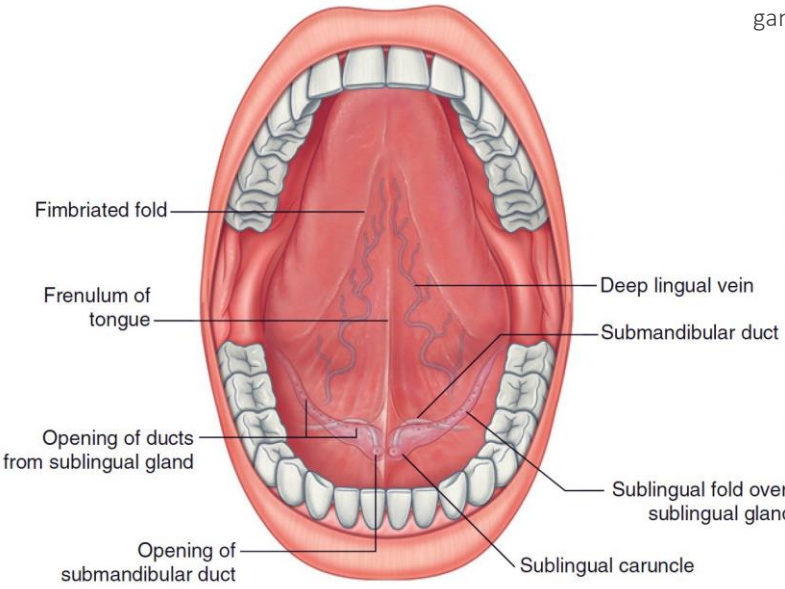
Superficial	Platysma, deep fascia and mandible Submandibular lymph nodes Facial vein (facial artery near mandible) **Marginal mandibular nerve** *(of facial n.)* Cervical branch of the facial nerve
Deep	Facial artery (inferior to the mandible) Mylohyoid muscle Sub mandibular duct **Hyoglossus muscle** **Lingual nerve** Submandibular ganglion Hypoglossal nerve

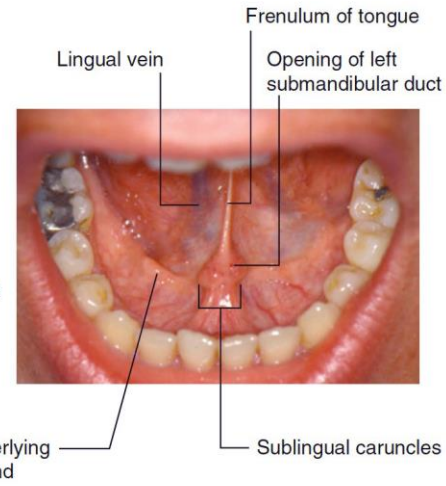
Submandibular duct (Wharton's duct)

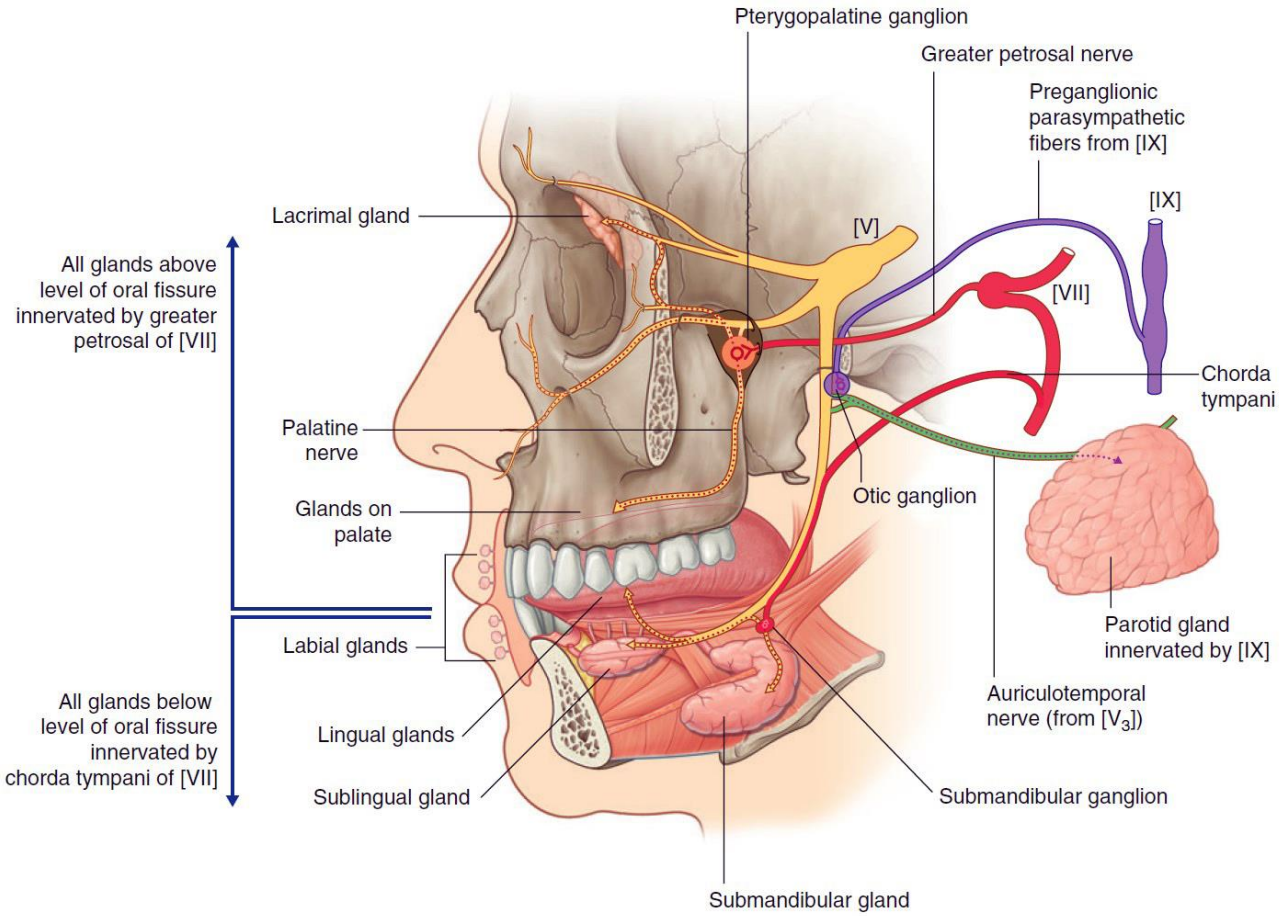
- Opens lateral to the lingual frenulum on the anterior floor of mouth.
- 5 cm length
- Lingual nerve wraps around Wharton's duct. As the duct passes forwards it crosses medial to the nerve to lie above it and then crosses back, lateral to it, to reach a position below the nerve.

Innervation

- Sympathetic innervation- Derived from superior cervical ganglion
- Parasympathetic innervation- Submandibular ganglion via lingual nerve







Arterial supply
Branch of the facial artery. The facial artery passes through the gland to groove its deep surface. It then emerges onto the face by passing between the gland and the mandible.

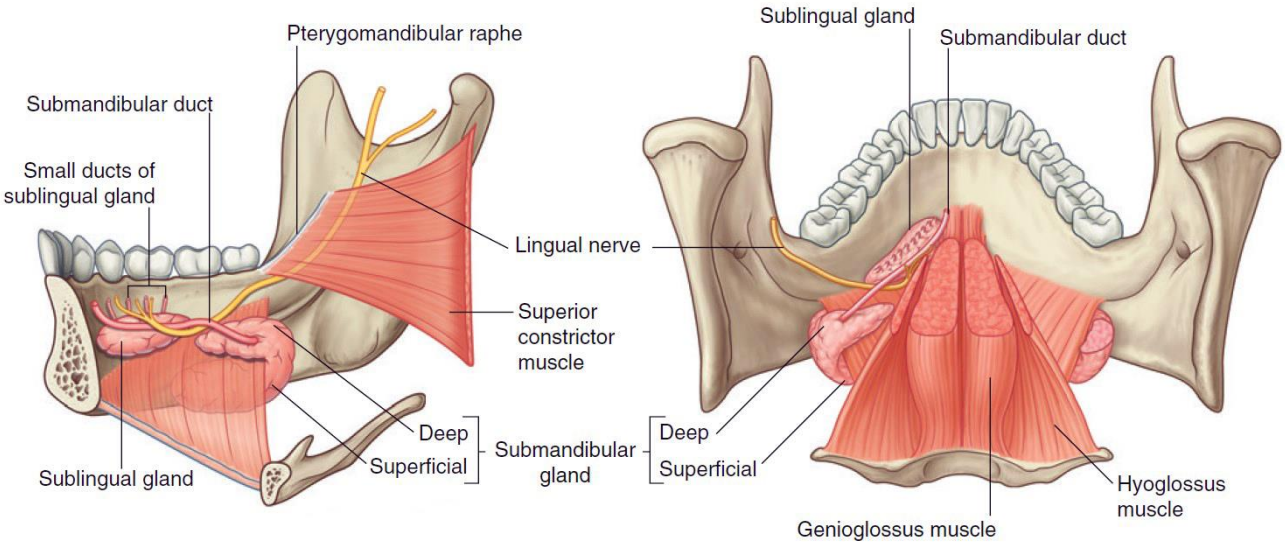
Venous drainage
Anterior facial vein (lies deep to the Marginal Mandibular nerve)

Lymphatic drainage
Deep cervical and jugular chains of nodes

Three cranial nerves may be injured during submandibular gland excision.

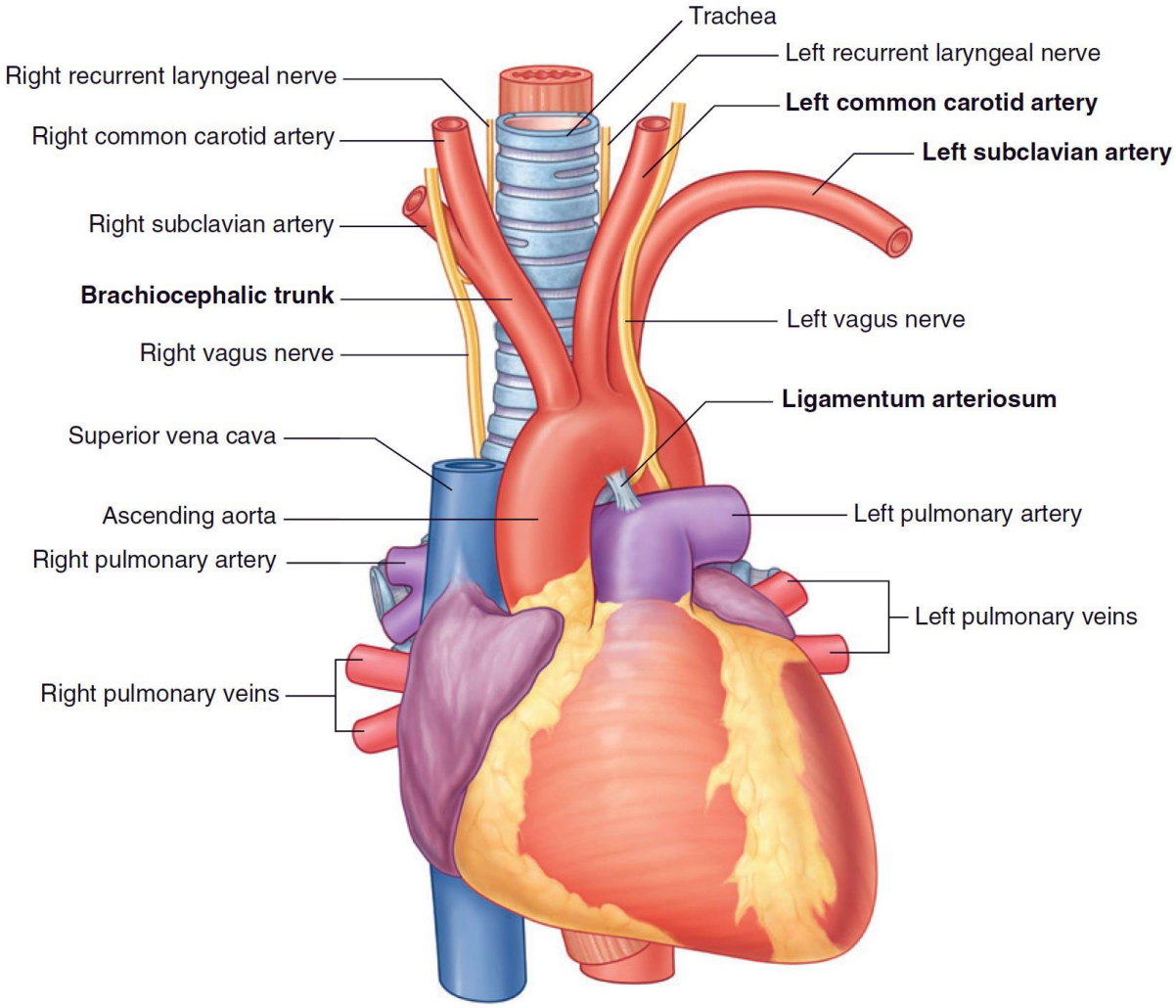
- Marginal mandibular branch of the facial nerve
- Lingual nerve
- Hypoglossal nerve

Hypoglossal nerve damage may result in paralysis of the ipsilateral aspect of the tongue. The nerve itself lies deep to the capsule surrounding the gland and should not be injured during an intracapsular dissection. The lingual nerve is probably at greater risk of injury. However, the effects of lingual nerve injury are sensory rather than motor.



Brachiocephalic Artery

The brachiocephalic artery is the largest branch of the aortic arch. From its aortic origin it ascends superiorly, it initially lies anterior to the trachea and then on its right hand side. It branches into the common carotid and right subclavian arteries at the level of the sternoclavicular joint.



Path

Origin: apex of the midline of the aortic arch
Passes superiorly and posteriorly to the right
Divides into the right subclavian and right common carotid artery

Relations

Anterior	• Sternohyoid • Sternothyroid • Thymic remnants • Left brachiocephalic vein • Right inferior thyroid veins
Posterior	• Trachea • Right pleura
Right lateral	• Right brachiocephalic vein • Superior part of SVC
Left lateral	• Thymic remnants • Origin of left common carotid • Inferior thyroid veins • Trachea (higher level)

Branches

Normally none but may have the thyroidea ima artery

Subclavian Artery

Path

- The left subclavian comes directly off the arch of aorta
- The right subclavian arises from the brachiocephalic artery (trunk) when it bifurcates into the subclavian and the right common carotid artery.
- From its origin, the subclavian artery travels laterally, passing between anterior and middle scalene muscles, deep to scalenus anterior and anterior to scalenus medius. As the subclavian artery crosses the lateral border of the first rib, it becomes the axillary artery. At this point it is superficial and within the subclavian triangle.

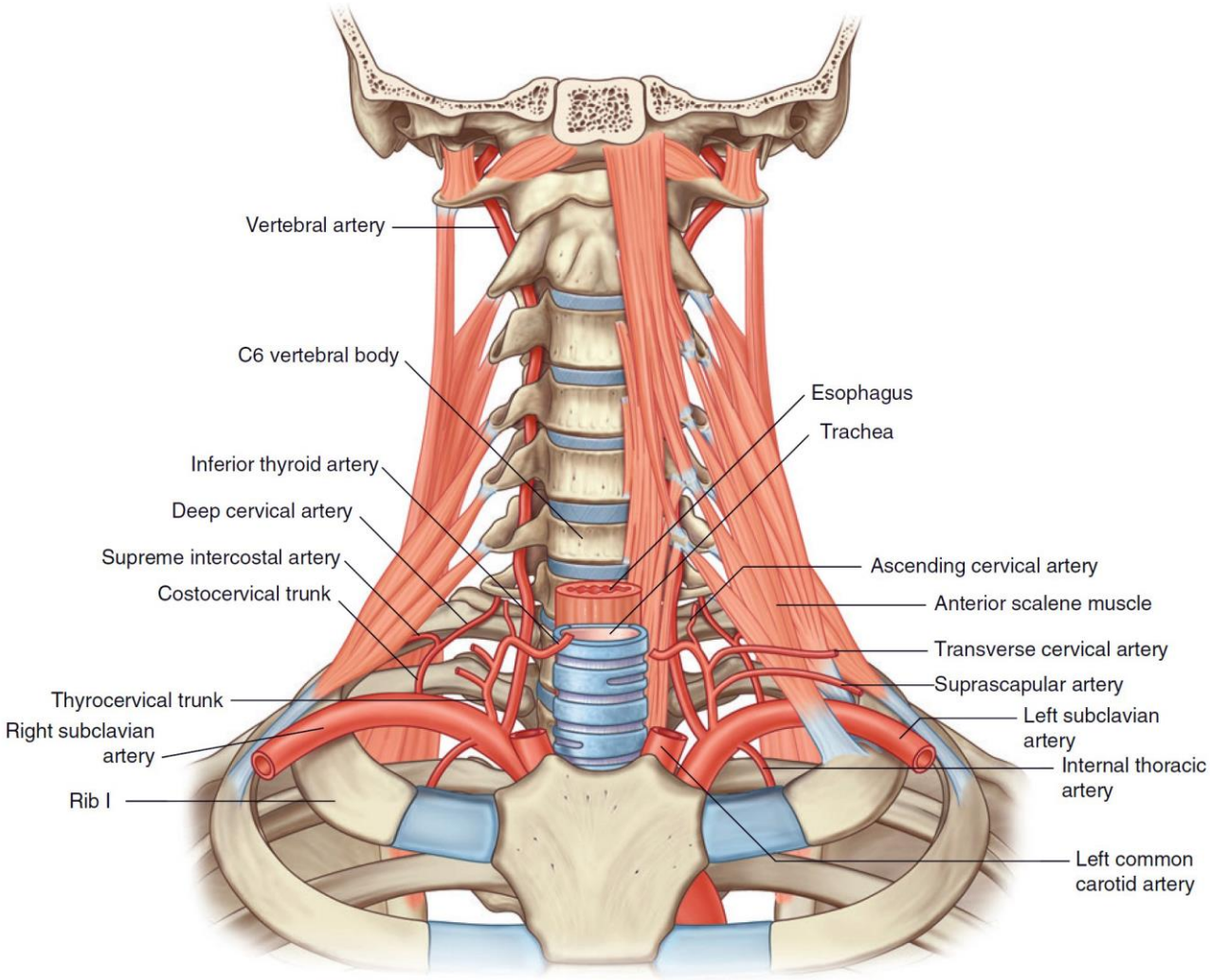
Branches *"VIT C & D"*

- **V**ertebral artery
- **I**nternal thoracic artery
  - *Inf thyroid*
  - *Suprascapular*
  - *Transverse cervical*
  - *Ascending cervical*
- **T**hyrocervical trunk
- **C**ostocervical trunk
- **D**orsal scapular artery

Vertebral Artery

The vertebral artery is the first branch of the subclavian artery. Anatomically it is divisible into 4 regions:

- The first part runs to the foramen in the transverse process of C6. Anterior to this part lies the vertebral and internal jugular veins. On the left side the thoracic duct is also an anterior relation.
- The second part runs superiorly **through the foramina** of the transverse processes of the upper 6 cervical vertebrae. Once it has passed through the transverse process of the axis it then turns superolaterally to the atlas. It is accompanied by a venous plexus and the inferior cervical sympathetic ganglion.
- The third part runs posteromedially on the lateral mass of the atlas. It enters the sub occipital triangle, in the groove of the upper surface of the posterior arch of the atlas. It then passes anterior to the edge of the posterior atlanto-occipital membrane to enter the vertebral canal.
- The fourth part passes through the spinal dura and arachnoid, running superiorly and anteriorly at the lateral aspect of the medulla oblongata. At the lower border of the pons it unites to form the basilar artery.



Common Carotid Artery

The ***right*** common carotid artery arises at the bifurcation of the brachiocephalic trunk. The ***left*** common carotid arises from the arch of the aorta. Both terminate at the level of the upper border of the thyroid cartilage **C4/C3** (the lower border of the third cervical vertebra) by **dividing into the internal and external carotid arteries.**

Left common carotid artery

This vessel arises immediately to the left and slightly behind the origin of the brachiocephalic trunk. Its thoracic portion is 2.5- 3.5 cm in length and runs superolaterally to the sternoclavicular joint.

In the thorax

The vessel is in contact, from below upwards, with the trachea, left recurrent laryngeal nerve, left margin of the oesophagus. Anteriorly the left brachiocephalic vein runs across the artery, and the cardiac branches from the left vagus descend in front of it. These structures together with the thymus and the anterior margins of the left lung and pleura separate the artery from the manubrium.

In the neck

The artery runs superiorly deep to sternocleidomastoid and then enters the anterior triangle. At this point **it lies within the carotid sheath with the vagus nerve and the internal jugular vein**. **Posteriorly the sympathetic trunk lies between the vessel and the prevertebral fascia**. At the level of C7 the vertebral artery and thoracic duct lie behind it. The anterior tubercle of C6 transverse process is prominent and the artery can be compressed against this structure (it corresponds to the level of the cricoid).

Anteriorly at C6 the omohyoid muscle passes superficial to the artery.

Within the carotid sheath the jugular vein lies lateral to the artery.

Right common carotid artery

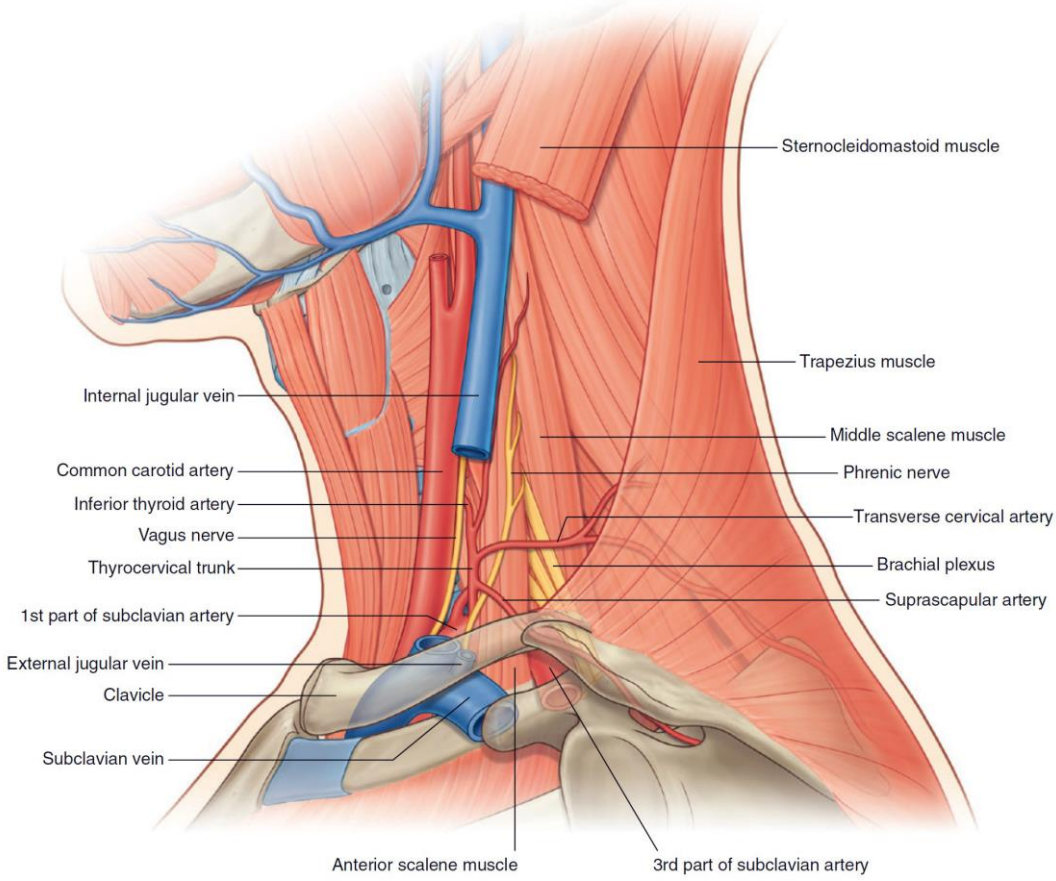
The right common carotid arises from the brachiocephalic artery. The right common carotid artery corresponds with the cervical portion of the left common carotid, except that there is no thoracic duct on the right. The oesophagus is less closely related to the right carotid than the left.

Path

Passes behind the sternoclavicular joint (12% patients above this level) to the upper border of the thyroid cartilage, to divide into the external (ECA) and internal carotid arteries (ICA).

Relations

- Level of 6th cervical vertebra crossed by omohyoid
- Then passes deep to the thyrohyoid, sternohyoid, sternomastoid muscles.
- Passes ant. to the carotid tubercle (transverse process 6th cervical vertebra). NB: compression here stops hge.
- The inferior thyroid artery passes posterior to the common carotid artery. Then:
    - Left common carotid artery crosses the thoracic duct
    - Right common carotid artery crossed by recurrent laryngeal nerve



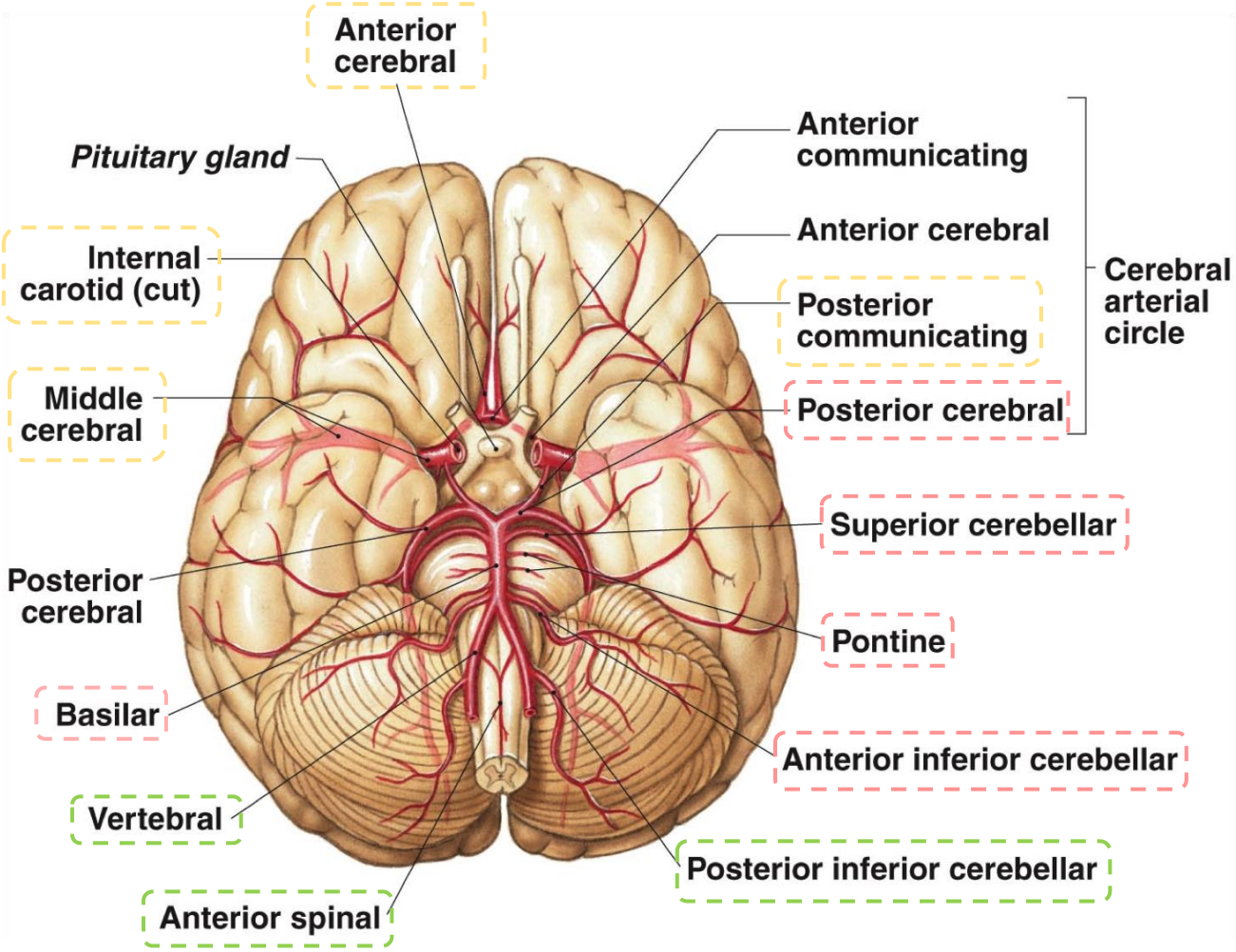
Circle of Willis

The two internal carotid arteries and two vertebral arteries form an anastomosis known as the Circle of Willis on the inferior surface of the brain. Each half of the circle is formed by:

1. Anterior communicating artery
2. Anterior cerebral artery
3. Internal carotid artery
4. Posterior communicating artery
5. Posterior cerebral arteries and the termination of the basilar artery

The circle and its branches supply; the corpus striatum, internal capsule, diencephalon and midbrain.

Vertebral arteries	Basilar artery	Internal carotid arteries
• Enter the cranial cavity via foramen magnum • Lie in the subarachnoid space • Ascend on anterior surface of medulla oblongata • Unite to form the basilar artery at the base of the pons Branches: • Posterior spinal artery • Anterior spinal artery • Posterior inferior cerebellar artery	Branches: • Anterior inferior cerebellar artery • Labyrinthine artery • Pontine arteries • Superior cerebellar artery • Posterior cerebral artery	Branches: • Posterior communicating artery • Anterior cerebral artery • Middle cerebral artery • Anterior choroid artery



Internal Carotid Artery

The internal carotid artery is formed from the common carotid opposite the upper border of the thyroid cartilage. It extends superiorly to enter the skull via the carotid canal. From the carotid canal it then passes through the cavernous sinus, above which it divides into the anterior and middle cerebral arteries.

Relations in the neck	**Posterior**	• Longus capitis • Pre-vertebral fascia • **Sympathetic chain** • Superior laryngeal nerve
	Medially	• External carotid *(near origin)* • Wall of pharynx • Ascending pharyngeal artery
	Laterally	• IJV *(moves posteriorly at entrance to skull)* • Vagus nerve *(most posterolaterally)*
	Anteriorly	• Sternocleidomastoid • Lingual and facial veins • **Hypoglossal nerve**

Mnemonic for branches of the cerebral portion of the internal carotid artery
*'**O**nly **P**ress **C**arotid **A**rteries **M**omentarily'*
- **O**phthalmic
- **P**osterior communicating
- **C**horoidal
- **A**nterior cerebral
- **M**iddle cerebral

Relations in the carotid canal

- Internal carotid plexus
- Cochlea and middle ear cavity
- Trigeminal ganglion (superiorly)
- Leaves canal lies above the foramen lacerum

Path and relations in the cranial cavity

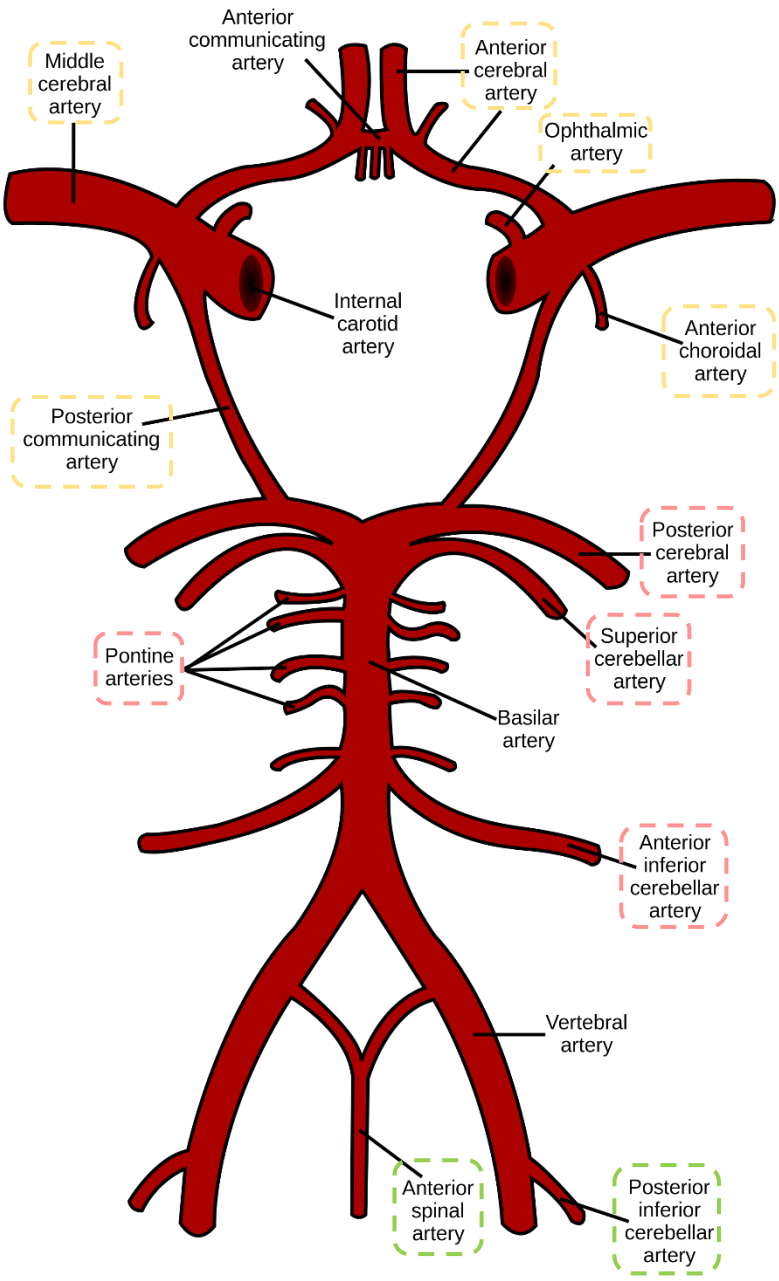
The artery bends sharply forwards in the cavernous sinus, the adducent nerve lies close to its inferolateral aspect. The oculomotor, trochlear, ophthalmic and, usually, the maxillary nerves lie in the lateral wall of the sinus. Near the superior orbital fissure, it turns posteriorly and passes postero-medially to pierce the roof of the cavernous sinus inferior to the optic nerve. It then passes between the optic and oculomotor nerves to terminate below the anterior perforated substance by dividing into the anterior and middle cerebral arteries.

Branches

- Anterior and middle cerebral artery
- Ophthalmic artery
- Posterior communicating artery
- Anterior choroid artery
- Meningeal arteries
- Hypophyseal arteries

The internal carotid **does not** have any branches in the neck.

Nerves at risk during carotid endarterectomy
- Hypoglossal
- Greater auricular
- Superior laryngeal
- Vagus



External Carotid Artery

The external carotid commences immediately lateral to the pharyngeal side wall. It ascends and lies anterior to the internal carotid and posterior to the posterior belly of digastric and stylohyoid. More inferiorly it is covered by sternocleidomastoid, passed by hypoglossal nerves, lingual and facial veins.
It then pierces the fascia of the parotid gland finally dividing into its terminal branches within the gland itself.

Surface marking of the carotid

This is an imaginary line drawn from the bifurcation of the common carotid passing behind the angle of the jaw to a point immediately anterior to the tragus of the ear.

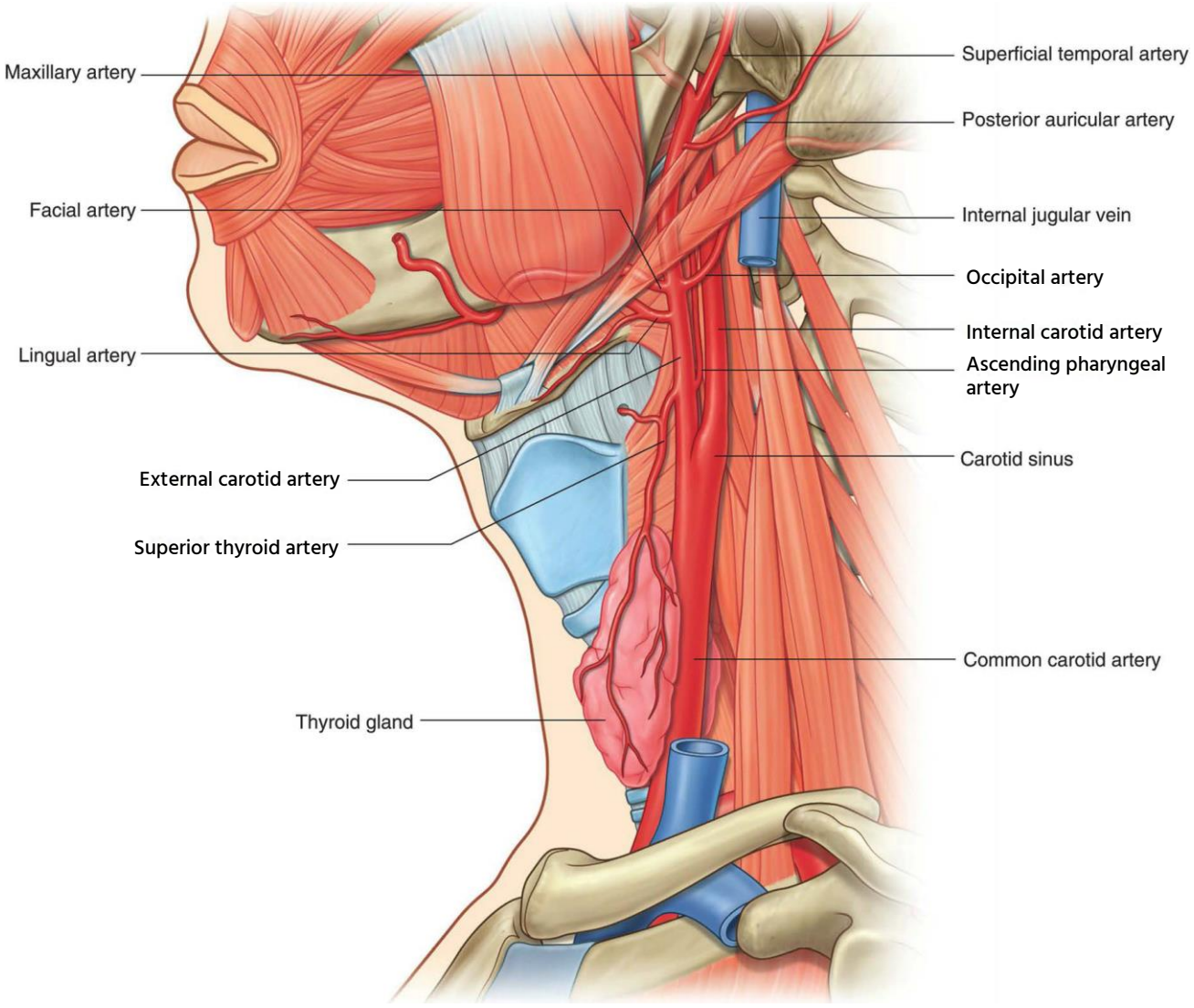
Branches of the external carotid artery

It has six main branches, three in front, two behind and one deep.

Three in front	Superior thyroid Lingual Facial
Two behind	Occipital Posterior auricular
Deep	Ascending pharyngeal

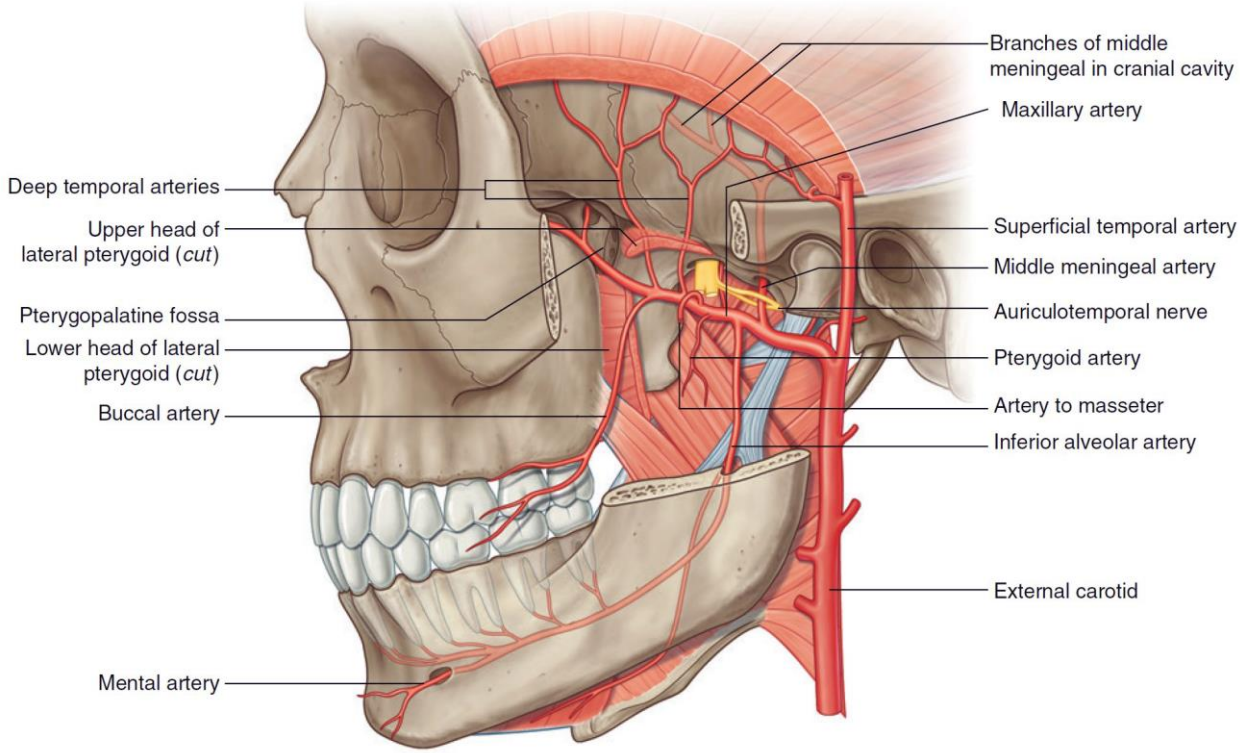
'***S***ome ***A***ngry ***L***ady ***F***igured ***O***ut ***PMS***' *(in order)*
Superior thyroid (superior laryngeal artery branch)
Ascending pharyngeal
Lingual
Facial (tonsillar and labial artery)
Occipital
Posterior auricular
Maxillary (inferior alveolar artery, middle meningeal a.)
Superficial temporal

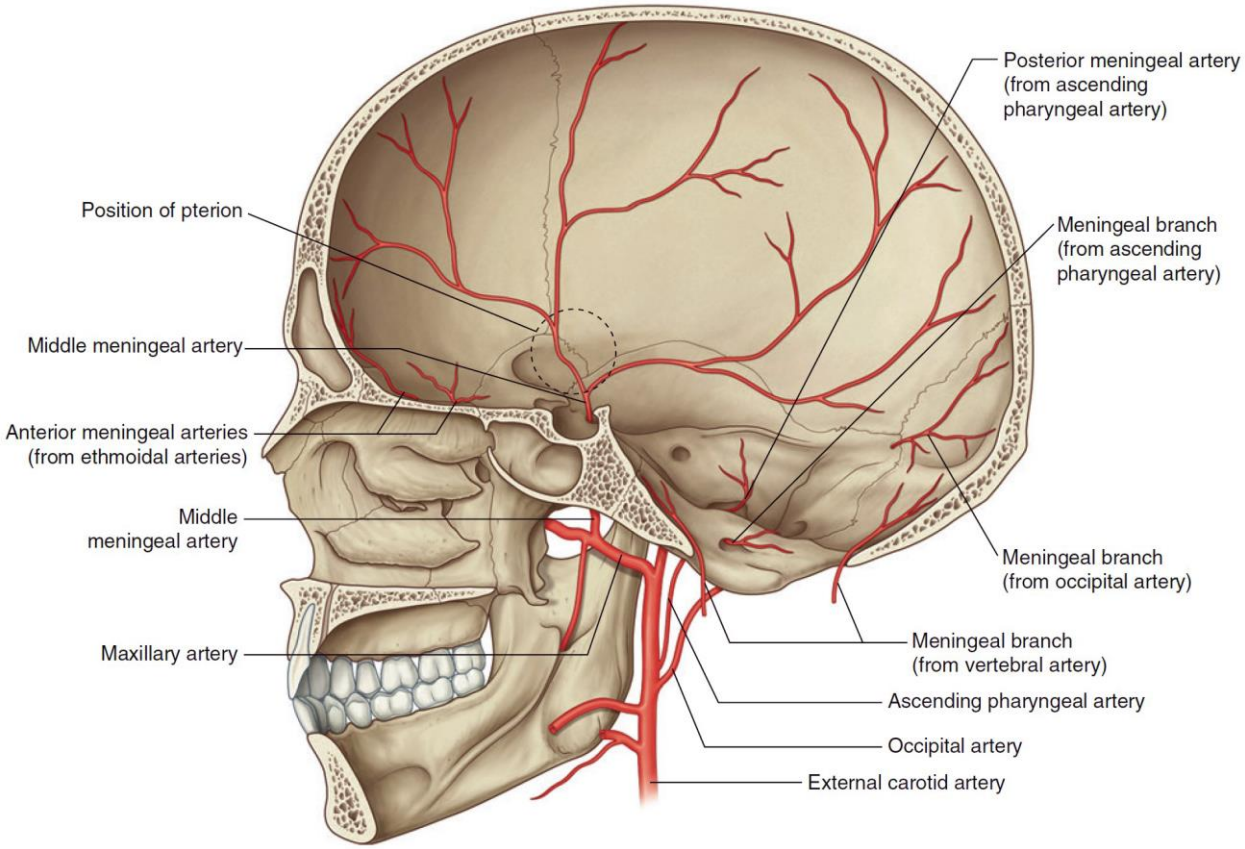
It terminates by dividing into the superficial temporal and maxillary arteries in the parotid gland.



Middle Meningeal Artery

- Middle meningeal artery is typically the third branch of the first part of the maxillary artery, one of the two terminal branches of the external carotid artery. After branching off the maxillary artery in the infratemporal fossa, it runs through the foramen spinosum to supply the dura mater (the outermost meninges).
- The middle meningeal artery is the largest of the three (paired) arteries which supply the meninges, the others being the anterior meningeal artery and the posterior meningeal artery.
- The middle meningeal artery runs beneath the pterion. It is vulnerable to injury at this point, where the skull is thin. Rupture of the artery may give rise to an extra dural hematoma.
- In the dry cranium, the middle meningeal, which runs within the dura mater surrounding the brain, makes a deep indention in the calvarium.
- The middle meningeal artery is intimately associated with the auriculotemporal nerve which wraps around the artery making the two easily identifiable in the dissection of human cadavers and also easily damaged in surgery.





Internal Jugular Vein

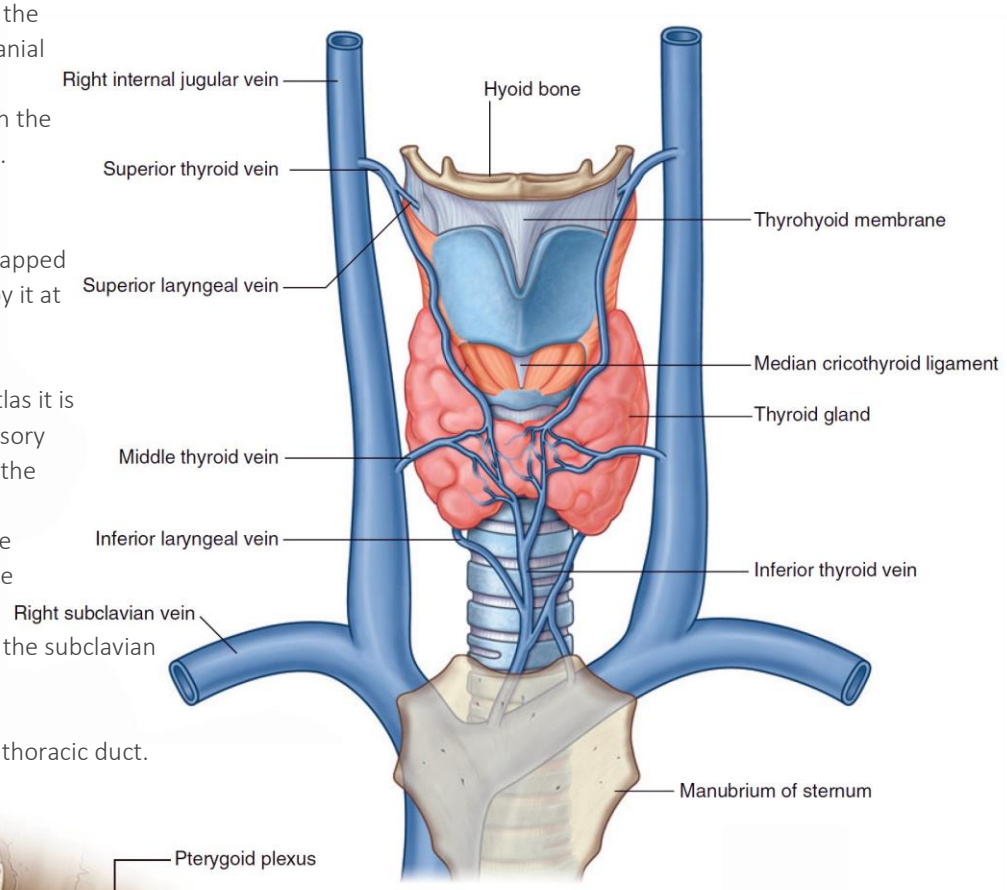
Each jugular vein begins in the jugular foramen, where they are the continuation of the sigmoid sinus. They terminate at the medial end of the clavicle where they unite with the subclavian v.

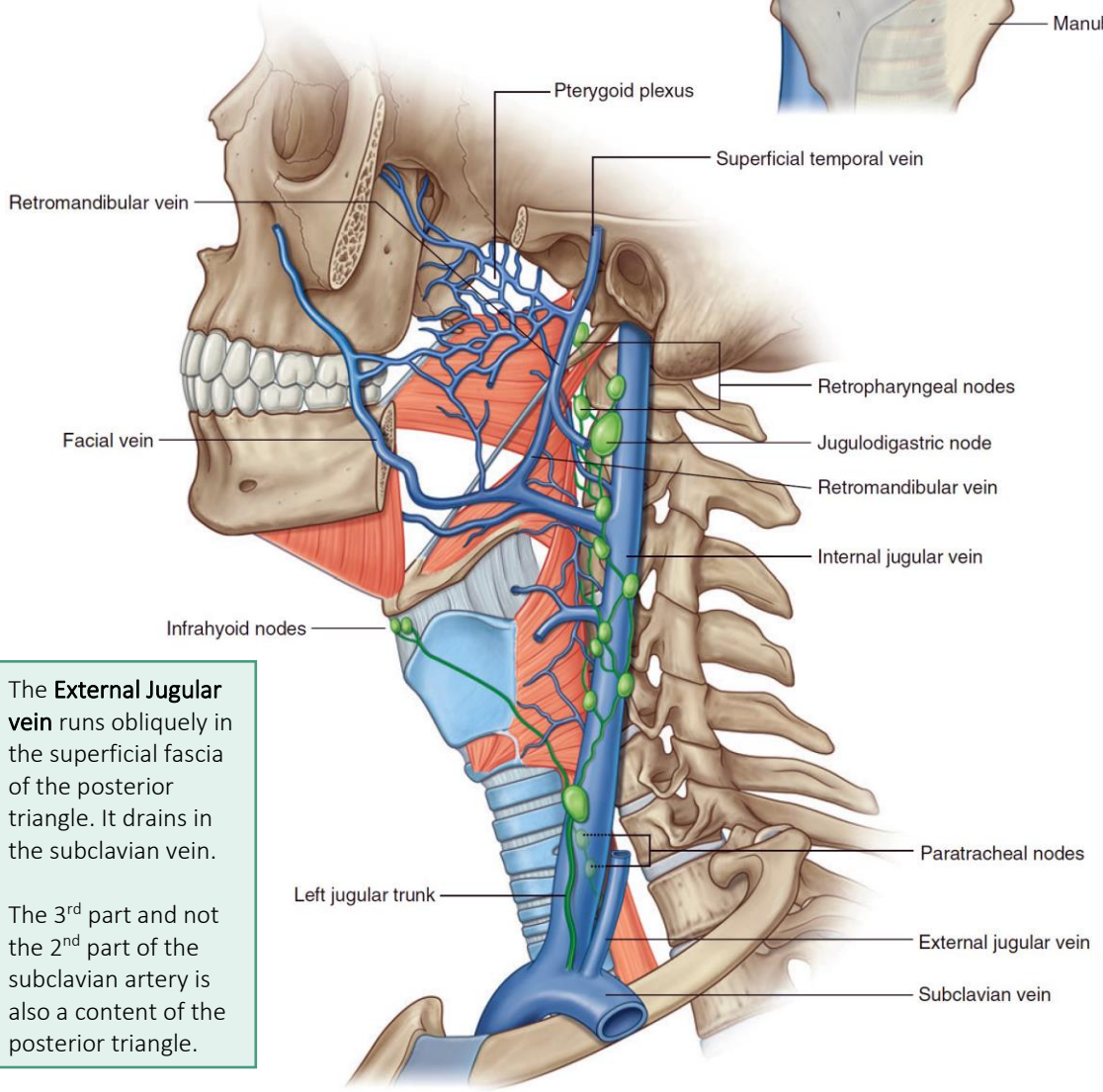
The vein lies within the carotid sheath throughout its course. Below the skull the internal carotid artery and last four cranial nerves are anteromedial to the vein. Thereafter it is in contact medially with the internal (then common) carotid artery. The vagus lies posteromedially.

At its superior aspect, the vein is overlapped by sternocleidomastoid and covered by it at the inferior aspect of the vein.

Below the transverse process of the atlas it is crossed on its lateral side by the accessory nerve. At its mid-point it is crossed by the inferior root of the ansa cervicalis. Posterior to the vein are the transverse processes of the cervical vertebrae, the phenic nerve as it descends on the scalenus anterior, and the first part of the subclavian artery.

On the left side it's also related to the thoracic duct.





The **External Jugular vein** runs obliquely in the superficial fascia of the posterior triangle. It drains in the subclavian vein.

The 3rd part and not the 2nd part of the subclavian artery is also a content of the posterior triangle.

Cranial Nerves

Cranial nerve lesions

Olfactory nerve	May be injured in basal skull fractures or involved in frontal lobe tumour extension. Loss of olfactory nerve function in relation to major CNS pathology is seldom an isolated event and thus it is poor localiser of CNS pathology.
Optic nerve	Problems with visual acuity may result from intra ocular disorders. Problems with the blood supply such as amaurosis fugax may produce temporary visual distortion. More important surgically is the pupillary response to light. The pupillary size may be altered in a number of disorders. Nerves involved in the resizing of the pupil connect to the pretectal nucleus of the high midbrain, bypassing the lateral geniculate nucleus and the primary visual cortex. From the pretectal nucleus neurones pass to the Edinger - Westphal nucleus, motor axons from here pass along with the oculomotor nerve. They synapse with ciliary ganglion neurones; the parasympathetic axons from this then innervate the iris and produce miosis. The miotic pupil is seen in disorders such as Horner's syndrome or opiate overdose. Mydriasis is the dilatation of the pupil in response to disease, trauma, drugs (or the dark!). It is pathological when light fails to induce miosis. The radial muscle is innervated by the sympathetic nervous system. Because the parasympathetic fibres travel with the oculomotor nerve they will be damaged by lesions affecting this nerve (e.g. cranial trauma). The response to light shone in one eye is usually a constriction of both pupils. This indicates intact direct and consensual light reflexes. When the optic nerve has an afferent defect the light shining on the affected eye will produce a diminished pupillary response in both eyes. Whereas light shone on the unaffected eye will produce a normal pupillary response in both eyes. This is referred to as the Marcus Gunn pupil and is seen in conditions such as optic neuritis. In a total CN II lesion shining the light in the affected eye will produce no response.
Oculomotor nerve	The pupillary effects are described above. In addition, it supplies all ocular muscles apart from lateral rectus and superior oblique. Thus the affected eye will be deviated inferolaterally. Levator palpebrae superioris may also be impaired resulting in impaired ability to open the eye.
Trochlear nerve	The eye will not be able to look down.
Trigeminal nerve	Largest cranial nerve. Exits the brainstem at the pons. Branches are ophthalmic, maxillary and mandibular. **Only the mandibular branch has both sensory and motor fibres**. Branches converge to form the trigeminal ganglion (located in Meckels cave). It supplies the muscles of mastication and also tensor veli palatine, mylohyoid, anterior belly of digastric and tensor tympani. Check textbook for detailed descriptions of the various sensory functions. The **corneal reflex** is important and is elicited by applying a small tip of cotton wool to the cornea, a reflex blink should occur if it is intact. It is mediated by: the **naso ciliary** branch of the ophthalmic branch **of the trigeminal (sensory component)** and the **facial nerve producing the motor response**. Lesions of the afferent arc will produce bilateral absent blink and lesions of the efferent arc will result in a unilateral absent blink.
Abducens nerve	The affected eye will have a deficit of abduction. This cranial nerve exits the brainstem between the pons and medulla. It thus has a **relatively long intra cranial course which renders it susceptible to damage in raised intra cranial pressure.**
Facial nerve	Emerges from brainstem between pons and medulla. It controls muscles of facial expression and taste from the anterior 2/3 of the tongue. The nerve passes into the petrous temporal bone and into the internal auditory meatus. It then passes through the facial canal and exits at the stylomastoid foramen. It passes through the parotid gland and divides at this point. It does not innervate the parotid gland. Its divisions are considered in other parts of the website. Its motor fibres innervate orbicularis oculi to produce the efferent arm of the corneal reflex. In surgical practice it may be injured during parotid gland surgery or invaded by malignancies of the gland and a lower motor neurone on the ipsilateral side will result.
Vestibulo-cochlear nerve	Exits from the pons and then passes through the internal auditory meatus. It is implicated in sensorineural hearing loss. Individuals with sensorineural hearing loss will localise the sound in webers test to the normal ear. Rinnes test will be reduced on the affected side but should still work. These two tests will distinguish sensorineural hearing loss from conductive deafness. In the latter condition webers test will localise to the affected ear and Rinnes test will be impaired on the affected side. Surgical lesions affecting this nerve include CNS tumours and basal skull fractures. It may also be damaged by the administration of ototoxic drugs (of which gentamicin is the most commonly used in surgical practice).
Glossopharyngeal nerve	Exits the pons just above the vagus. Receives sensory fibres from posterior 1/3 tongue, tonsils, pharynx and middle ear (otalgia may occur following tonsillectomy). It receives visceral afferents from the carotid bodies. It supplies parasympathetic fibres to the parotid gland via the otic ganglion and motor function to stylopharyngeaus muscle. The sensory function of the nerve is tested using the gag reflex.

Vagus nerve	Leaves the medulla between the olivary nucleus and the inferior cerebellar peduncle. Passes through the jugular foramen and into the carotid sheath. Details of the functions of the vagus nerve are covered in the website under relevant organ sub headings.
Accessory nerve	Exists from the caudal aspect of the brainstem (multiple branches) supplies trapezius and sternocleidomastoid muscles. The distal portion of this nerve is most prone to injury during surgical procedures.
Hypoglossal nerve	Emerges from the medulla at the preolivary sulcus, passes through the hypoglossal canal. It lies on the carotid sheath and passes deep to the posterior belly of digastric to supply muscles of the tongue (except palatoglossus). Its location **near the carotid sheath makes it vulnerable during carotid endarterectomy** surgery and damage will produce ipsilateral defect in muscle function.

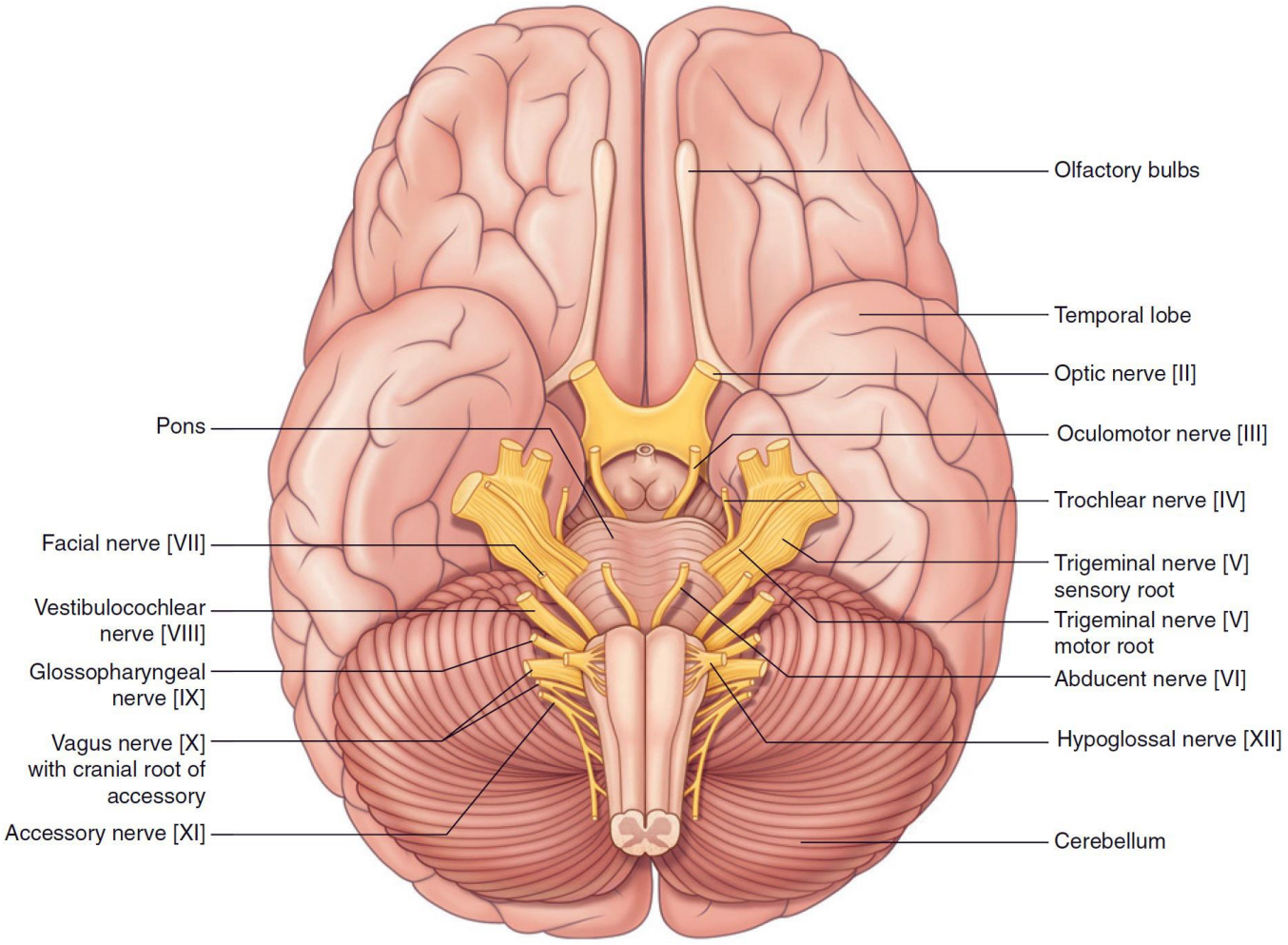
Cranial nerves carrying parasympathetic fibres
X IX VII III **(1973)**

The parasympathetic functions served by the cranial nerves include:

III (oculomotor)	Pupillary constriction and accommodation
VII (facial)	Lacrimal gland, submandibular and sublingual glands
IX (glossopharyngeal)	Parotid
X (vagus)	Heart and abdominal viscera

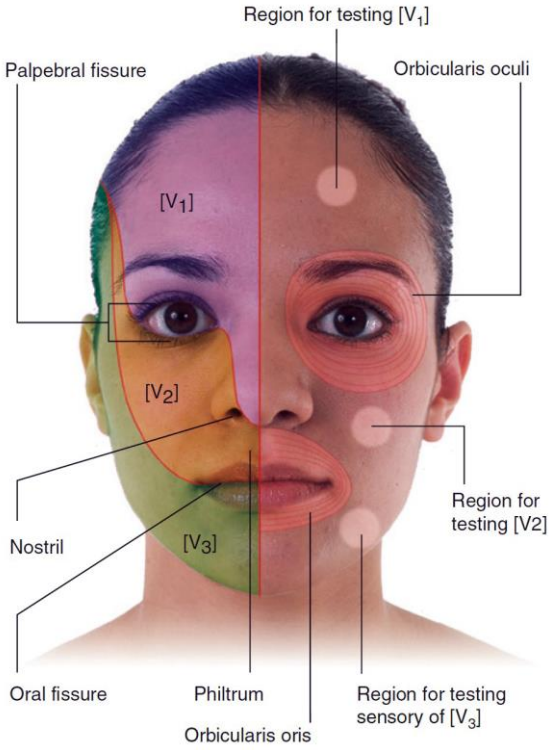
The optic nerve carries no parasympathetic fibres.

The cranial preganglionic parasympathetic nerves arise from specific nuclei in the CNS. These synapse at one of four parasympathetic ganglia; otic, pterygopalatine, ciliary and submandibular. From these ganglia the parasympathetic nerves complete their journey to their target tissues via CN V (trigeminal) branches (ophthalmic nerve CNV branch 1, Maxillary nerve CN V branch2, mandibular nerve CN V branch 3)



Trigeminal Nerve

The trigeminal nerve is the main sensory nerve of the head. In addition to its major sensory role, it also innervates the muscles of mastication.



Distribution of the trigeminal nerve

Sensory	• Scalp • Face • Oral cavity (and teeth) • Nose and sinuses • Dura mater
Motor	• Muscles of mastication • Mylohyoid • Anterior belly of digastric • Tensor tympani • Tensor palati
Autonomic connections (ganglia)	• Ciliary • Sphenopalatine • Otic • Submandibular

Path

- Originates at the pons
- Sensory root forms the large, crescentic trigeminal ganglion within Meckel's cave, and contains the cell bodies of incoming sensory nerve fibres. Here the 3 branches exit.
- The motor root cell bodies are in the pons and the motor fibres are distributed via the mandibular nerve. The motor root is not part of the trigeminal ganglion.

Branches of the trigeminal nerve

Ophthalmic nerve	Sensory only
Maxillary nerve	Sensory only
Mandibular nerve	Sensory and motor

Exit of branches of trigeminal nerve from the skull
*"**S**tanding **R**oom **O**nly"*
V_1 - **S**uperior orbital fissure
V_2 - foramen **R**otundum
V_3 - foramen **O**vale

Sensory

Ophthalmic	Exits skull via the superior orbital fissure Sensation of: scalp and forehead, the upper eyelid, the conjunctiva and cornea of the eye, the nose (*via **anterior ethmoidal** from nasociliary,* including the tip of the nose, except alae nasi), the nasal mucosa, the frontal sinuses, and parts of the meninges (the dura and blood vessels).
Maxillary nerve	Exit skull via the foramen rotundum Sensation: lower eyelid and cheek, the nares and upper lip, the upper teeth and gums, the nasal mucosa, the palate and roof of the pharynx, the maxillary, ethmoid and sphenoid sinuses, and parts of the meninges.
Mandibular nerve	Exit skull via the foramen ovale Sensation: lower lip, the lower teeth and gums, the chin and jaw (except the angle of the jaw), parts of the external ear, and parts of the meninges.

Motor (*Distributed via the mandibular nerve.)*

The following muscles of mastication are innervated:

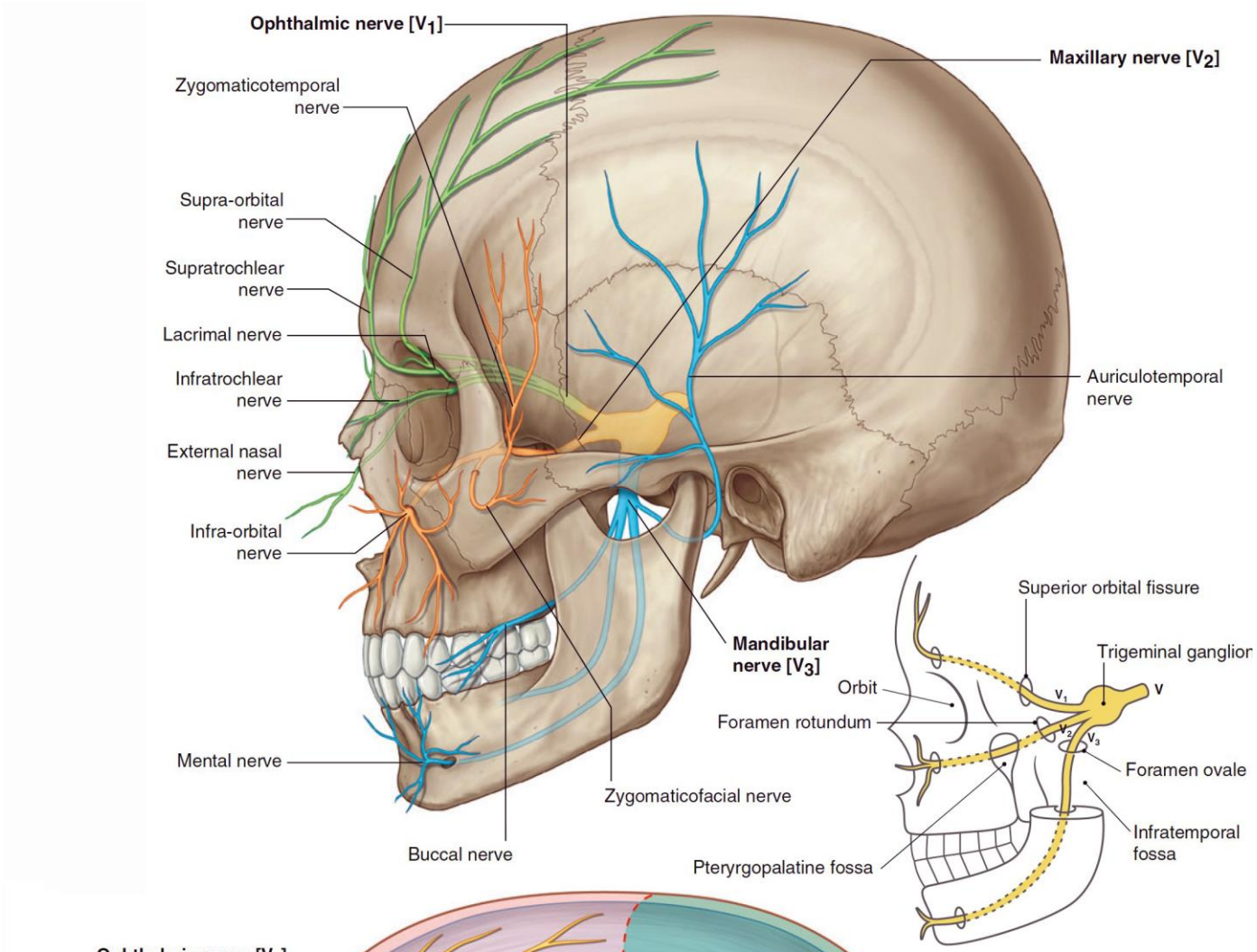
- Masseter
- Temporalis
- Medial pterygoid
- Lateral pterygoid

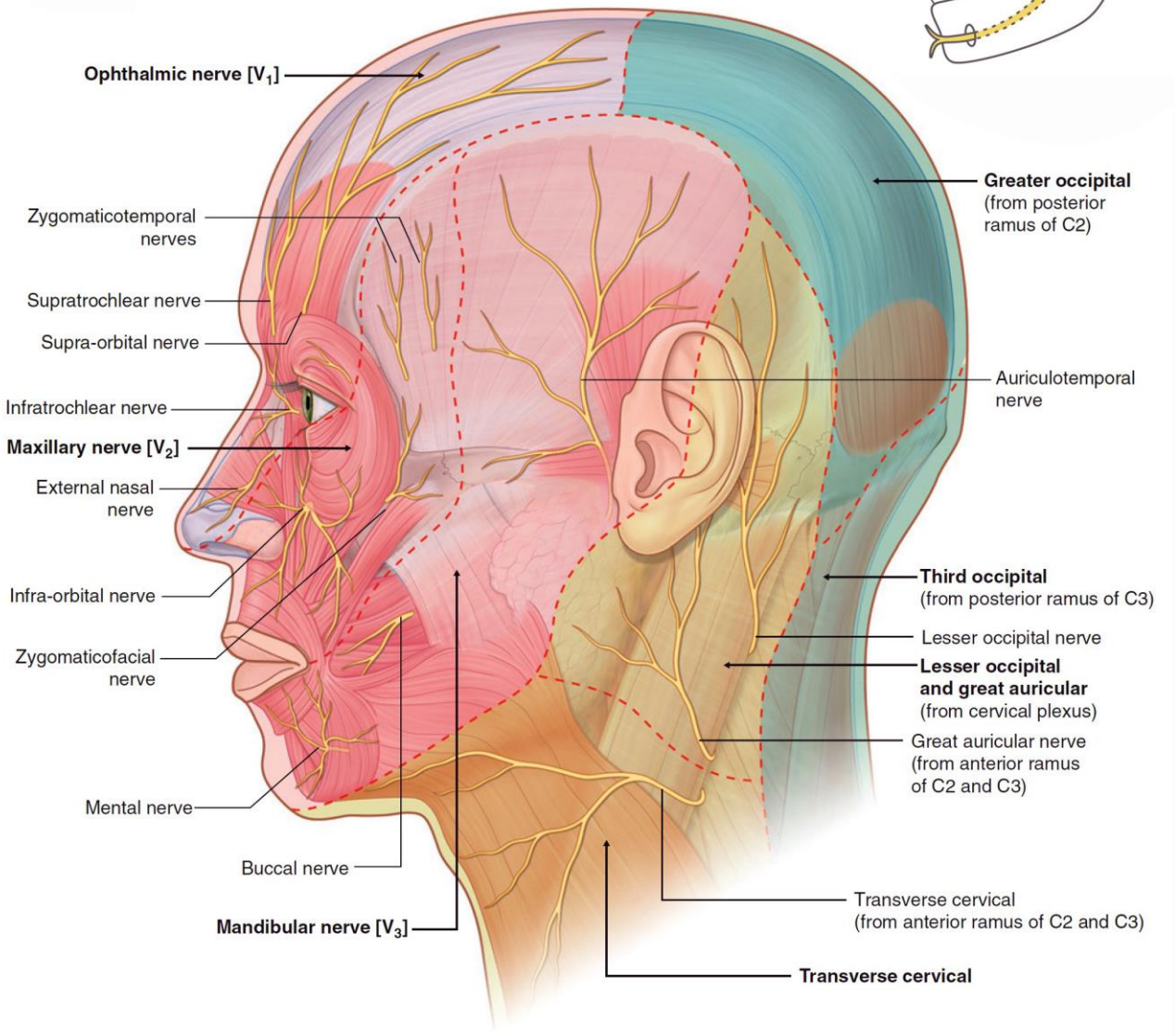
Other muscles innervated include:

- Tensor veli palatini
- Mylohyoid
- Anterior belly of digastric
- Tensor tympani

The trigeminal nerve is the major sensory nerve to the face ***except*** over the angle of the jaw which is supplied by the greater auricular nerve.

The lateral aspect of the external nose is innervated by lateral nasal branches of the anterior ethmoidal nerve. The ethmoidal nerve is a branch of the nasociliary nerve (V_1).


Ophthalmic nerve [V1]
Maxillary nerve [V2]
Zygomaticotemporal nerve
Supra-orbital nerve
Supratrochlear nerve
Lacrimal nerve
Infratrochlear nerve
External nasal nerve
Infra-orbital nerve
Auriculotemporal nerve
Mandibular nerve [V3]
Mental nerve
Zygomaticofacial nerve
Buccal nerve
Superior orbital fissure
Trigeminal ganglion
Orbit
V
V1
Foramen rotundum
V2
V3
Foramen ovale
Infratemporal fossa
Pteryrgopalatine fossa


Ophthalmic nerve [V1]
Greater occipital (from posterior ramus of C2)
Zygomaticotemporal nerves
Supratrochlear nerve
Supra-orbital nerve
Auriculotemporal nerve
Infratrochlear nerve
Maxillary nerve [V2]
External nasal nerve
Infra-orbital nerve
Third occipital (from posterior ramus of C3)
Lesser occipital nerve
Zygomaticofacial nerve
Lesser occipital and great auricular (from cervical plexus)
Great auricular nerve (from anterior ramus of C2 and C3)
Mental nerve
Buccal nerve
Transverse cervical (from anterior ramus of C2 and C3)
Mandibular nerve [V3]
Transverse cervical

Facial Nerve

The facial nerve is the main nerve supplying the structures of the second embryonic branchial arch. It is predominantly an efferent nerve to the muscles of facial expression, digastric muscle and also to many glandular structures. It contains a few afferent fibres which originate in the cells of its genicular ganglion and are concerned with taste.

Supply - 'Face, Ear, Taste, Tear'

- Face: muscles of facial expression
- Ear: nerve to stapedius
- Taste: supplies anterior two-thirds of tongue
- Tear: parasympathetic fibres to lacrimal glands, also salivary glands

Path

Subarachnoid path

- Origin: motor- pons, sensory- nervus intermedius
- Pass through the petrous temporal bone into the internal auditory meatus with the vestibulocochlear nerve. Here they combine to become the facial nerve.

Facial canal path

- The canal passes superior to the vestibule of the inner ear
- At the medial aspect of the middle ear, it becomes wider and contains the **geniculate ganglion.**
  3 branches:
  1. Greater (superficial) petrosal nerve
  2. Nerve to stapedius
  3. Chorda tympani

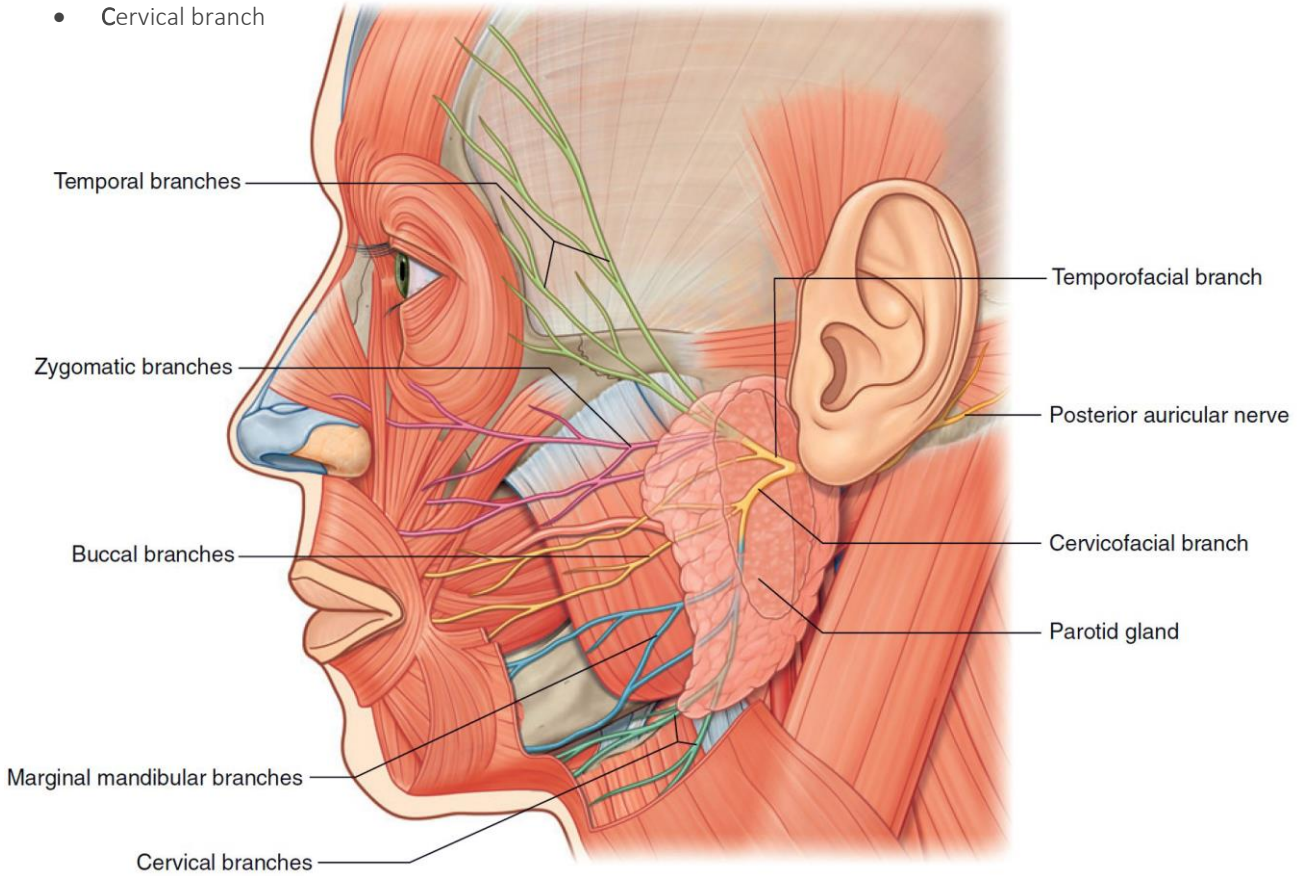
Stylomastoid foramen

- Passes through the stylomastoid foramen (tympanic cavity anterior and mastoid antrum posteriorly)
- Posterior auricular nerve and branch to posterior belly of digastric and stylohyoid muscle

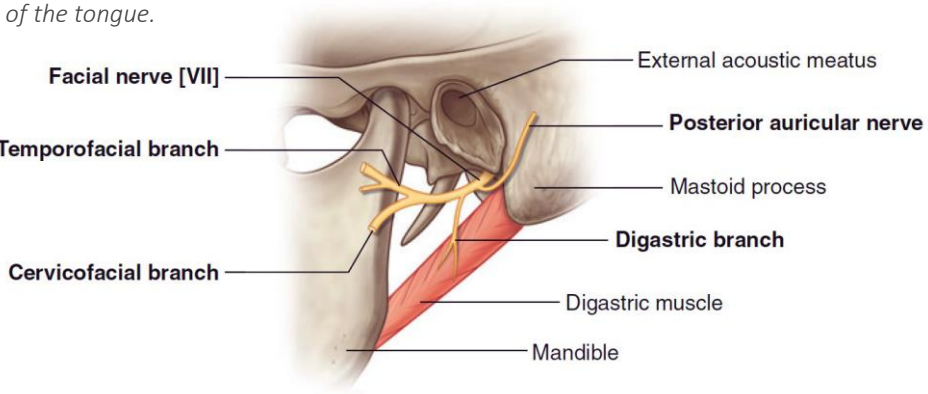
Face

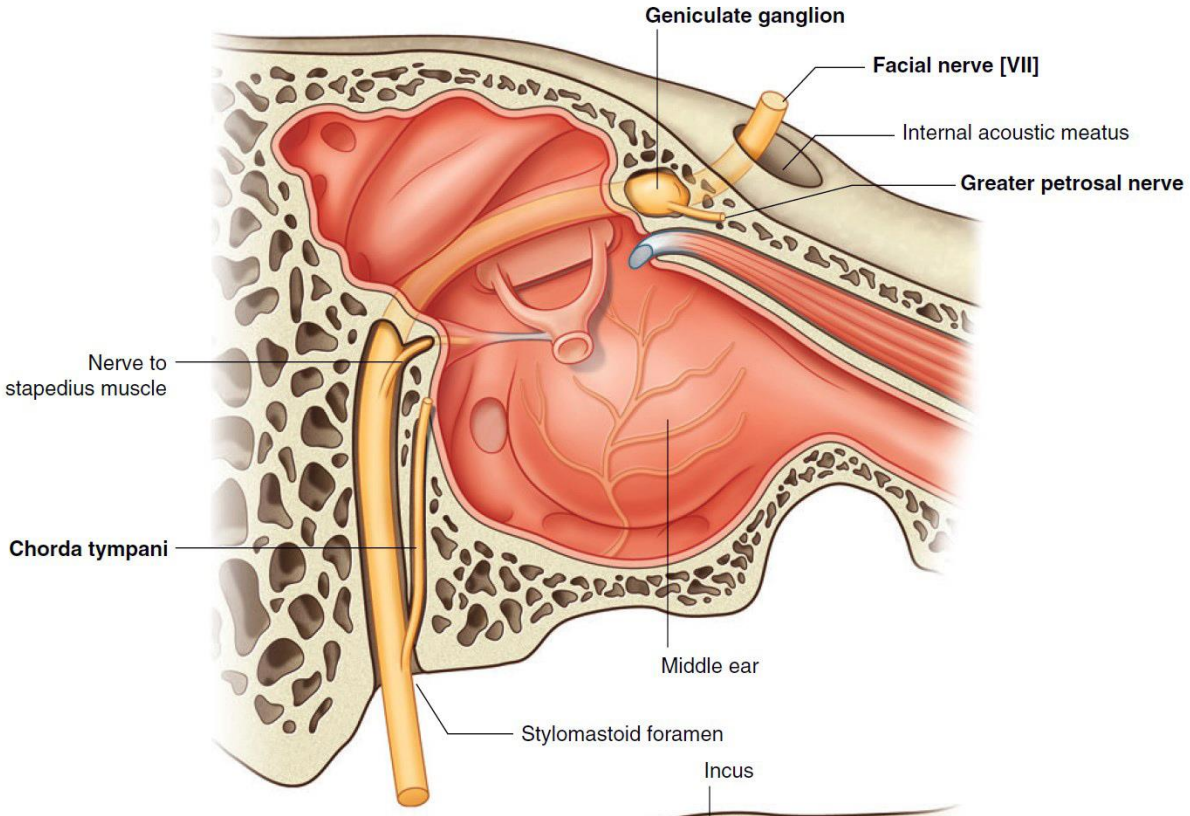
Enters parotid gland and divides into 5 branches: *"The Zebra Buggered My Cat"*

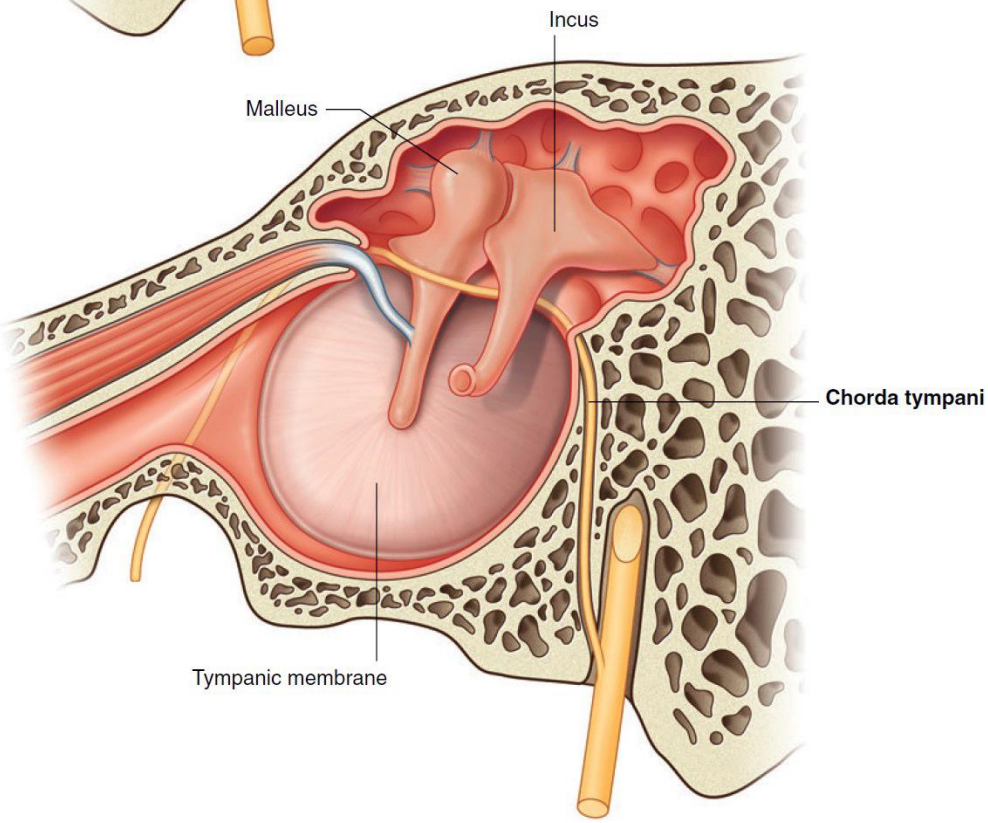
- Temporal branch
- Zygomatic branch
- Buccal branch
- Marginal mandibular branch
- Cervical branch

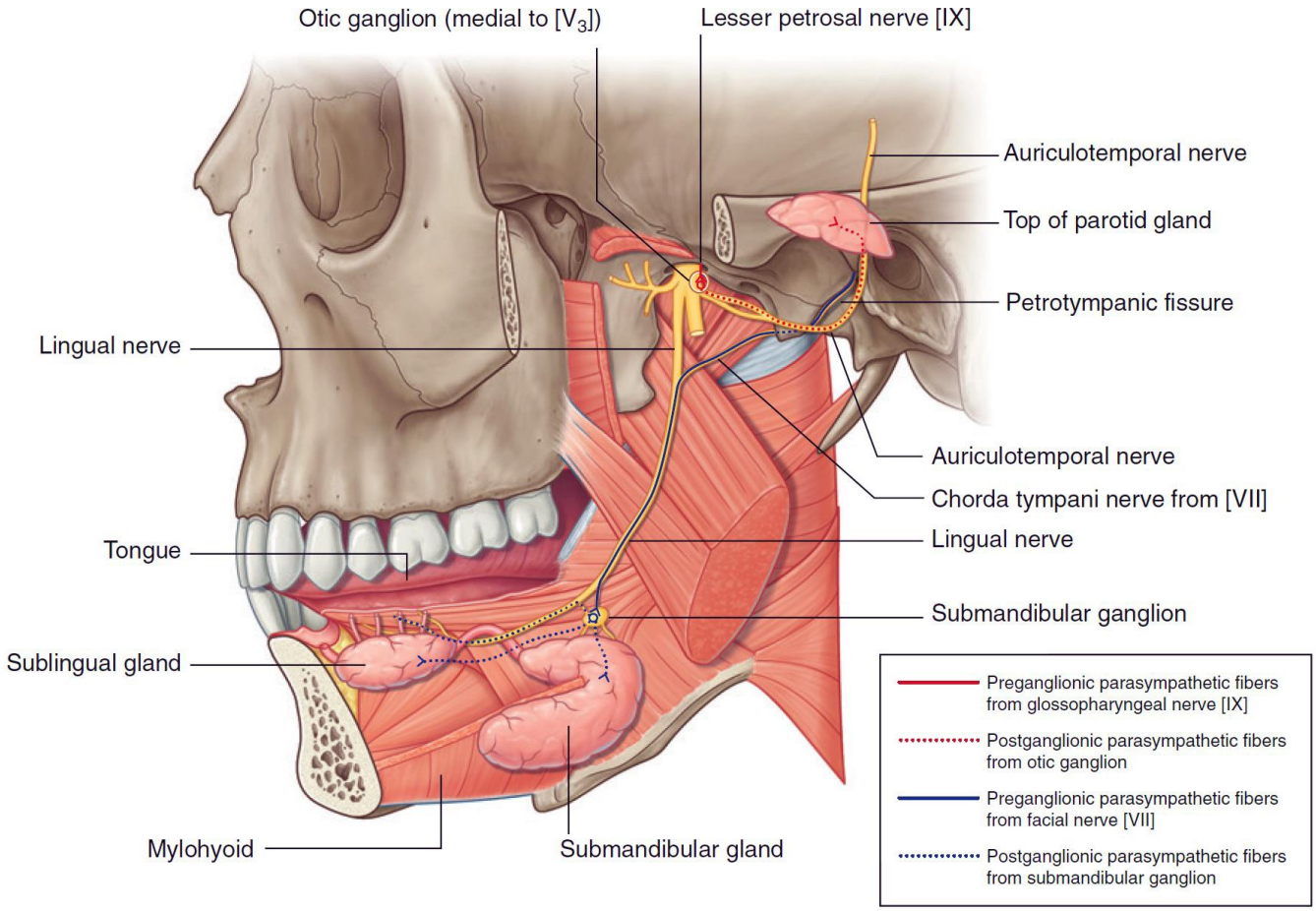


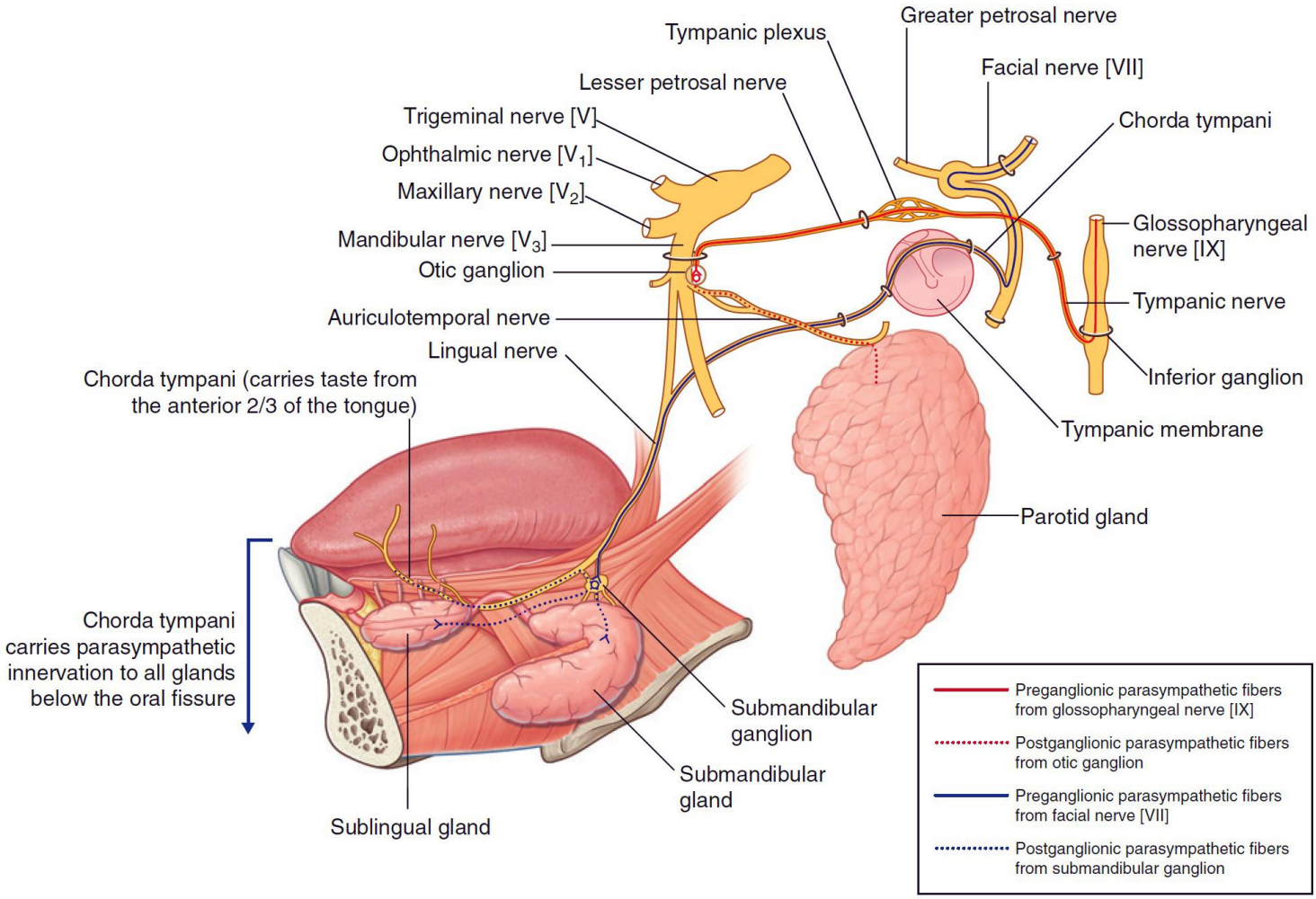
The chorda tympani branch of the facial nerve passes forwards through itrs canaliculus into the middle ear, and crosses the medial aspect of the tympanic membrane. It then passes antero-inferiorly in the infratemporal fossa. It distributes taste fibres to the anterior two thirds of the tongue.








Otic ganglion (medial to [V3])
Lesser petrosal nerve [IX]
Auriculotemporal nerve
Top of parotid gland
Petrotympanic fissure
Lingual nerve
Auriculotemporal nerve
Chorda tympani nerve from [VII]
Lingual nerve
Tongue
Submandibular ganglion
Sublingual gland
Mylohyoid
Submandibular gland
Preganglionic parasympathetic fibers from glossopharyngeal nerve [IX]
Postganglionic parasympathetic fibers from otic ganglion
Preganglionic parasympathetic fibers from facial nerve [VII]
Postganglionic parasympathetic fibers from submandibular ganglion


Tympanic plexus
Greater petrosal nerve
Facial nerve [VII]
Lesser petrosal nerve
Trigeminal nerve [V]
Ophthalmic nerve [V1]
Maxillary nerve [V2]
Chorda tympani
Mandibular nerve [V3]
Otic ganglion
Glossopharyngeal nerve [IX]
Auriculotemporal nerve
Tympanic nerve
Lingual nerve
Inferior ganglion
Chorda tympani (carries taste from the anterior 2/3 of the tongue)
Tympanic membrane
Parotid gland
Chorda tympani carries parasympathetic innervation to all glands below the oral fissure
Submandibular ganglion
Submandibular gland
Sublingual gland
Preganglionic parasympathetic fibers from glossopharyngeal nerve [IX]
Postganglionic parasympathetic fibers from otic ganglion
Preganglionic parasympathetic fibers from facial nerve [VII]
Postganglionic parasympathetic fibers from submandibular ganglion

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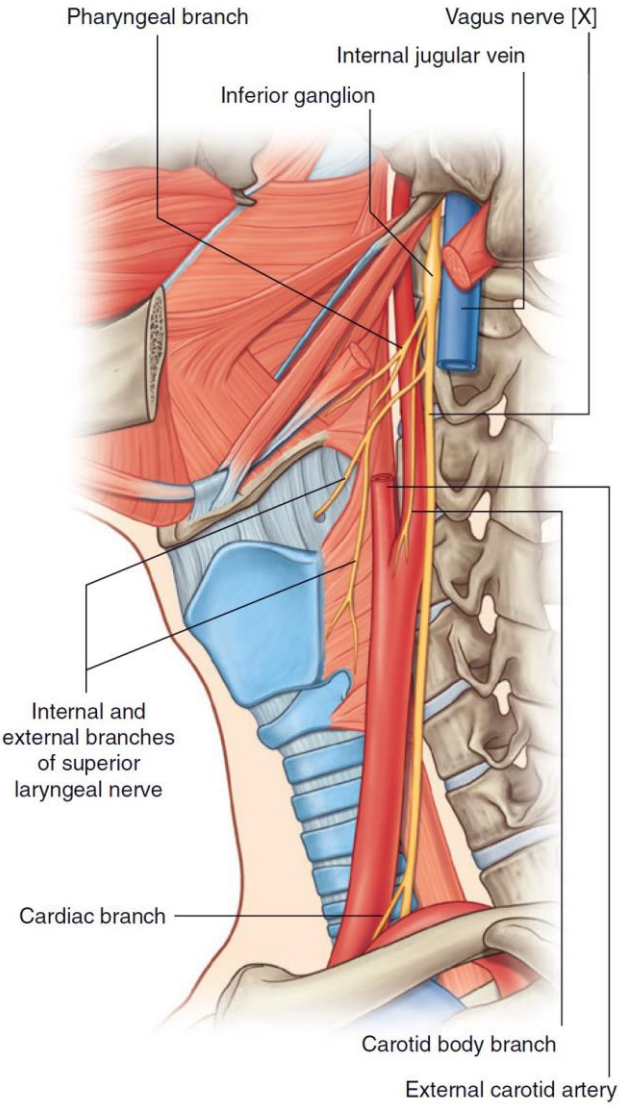
Vagus Nerve

The vagus nerve has mixed functions and supplies the structures from the fourth and sixth pharyngeal arches. It also supplies the fore and midgut sections of the embryonic gut tube. It carries afferent fibres from these areas (viz; pharynx, larynx, oesophagus, stomach, lungs, heart and great vessels). The efferent fibres of the vagus are of two main types. The first are preganglionic parasympathetic fibres distributed to the parasympathetic ganglia that innervate smooth muscle of the innervated organs (such as gut). The second type of efferent fibres have direct skeletal muscle innervation, these are largely to the muscles of the larynx and pharynx.



Origin and course

The vagus arises from the lateral surface of the medulla oblongata by a series of rootlets. It is related to the glossopharyngeal nerve cranially and the accessory nerve caudally. It exits through the jugular foramen and is contained within its own dural sheath alongside the accessory nerve. In the neck it descends vertically in the carotid sheath where it is closely related to the internal and common carotid arteries. It leaves the neck and enters the mediastinum. On the right it passes anterior to the first part of the subclavian artery, on the left it lies in the interval between the common carotid and subclavian arteries. In the mediastinum both nerves pass postero-inferiorly and reach the posterior surface of the corresponding lung root. These then branch into both lungs. At the inferior end of the mediastinum these plexuses reunite to form the formal vagal trunks that pass through the oesophageal hiatus and into the abdomen. The anterior and posterior vagal trunks are formal nerve fibres these then splay out once again sending fibres over the stomach and posteriorly to the coeliac plexus. Branches pass to the liver, spleen and kidney.

Communications and branches

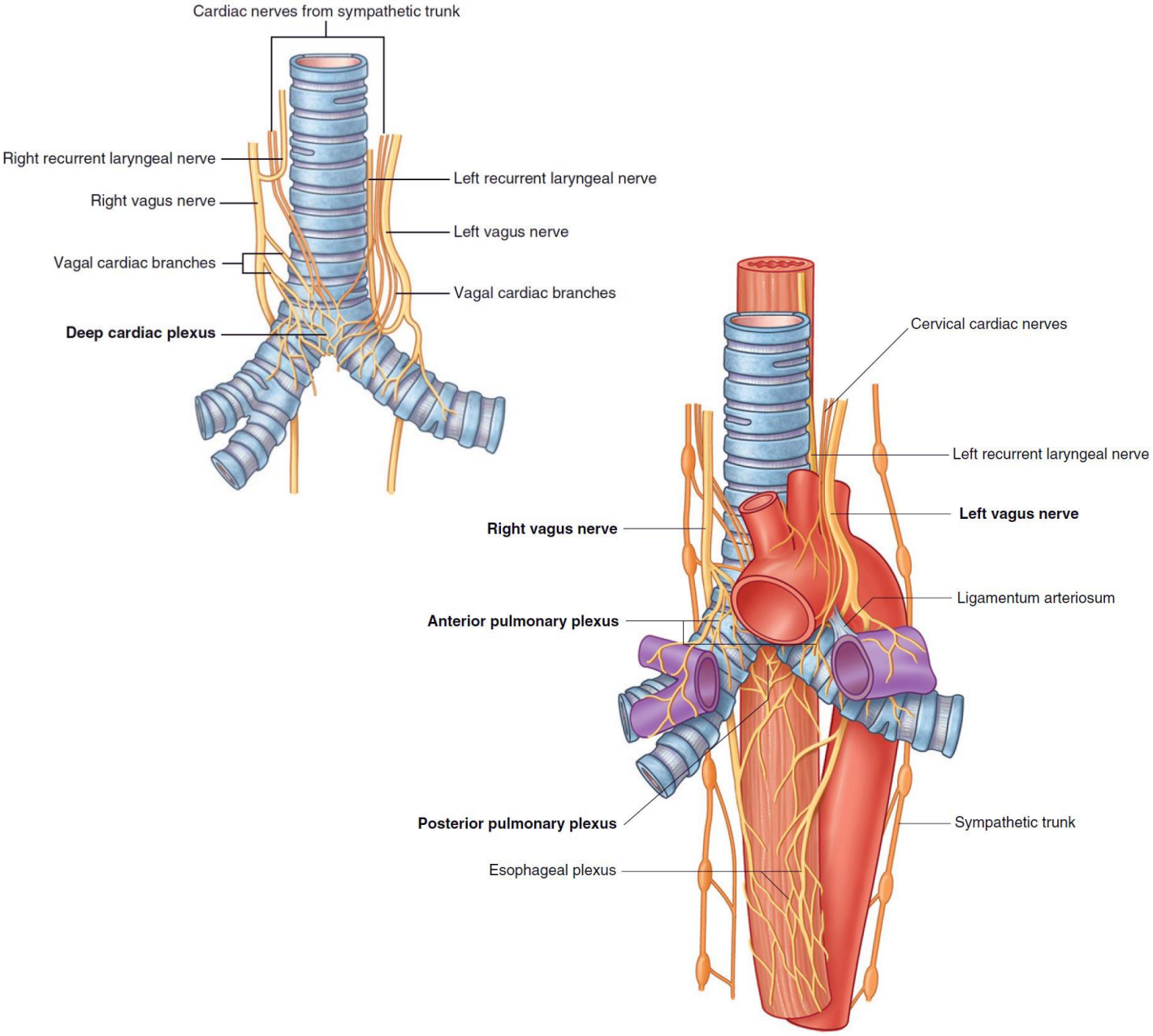
Communication	Details
Superior ganglion	Located in jugular foramen Communicates with the superior cervical sympathetic ganglion, accessory nerve Two branches; meningeal and auricular (the latter may give rise to vagal stimulation following instrumentation of the external auditory meatus)
Inferior ganglion	Communicates with the superior cervical sympathetic ganglion, hypoglossal nerve and loop between first and second cervical ventral rami Two branches; pharyngeal (supplies pharyngeal muscles) and superior laryngeal nerve (inferomedially- deep to both carotid arteries)

Branches in the neck *(see before / parathyroid for pics)*

Branch	Detail
Superior and inferior cervical cardiac branches	Arise at various points and descend into thorax On the right these pass posterior to the subclavian artery On the left the superior branch passes between the arch of the aorta and the trachea to connect with the deep cardiac plexus. The inferior branch descends with the vagus itself.
Right recurrent laryngeal nerve	Arises from vagus anterior to the first part of the subclavian artery, hooks under it, and ascends superomedially. It passes close to the common carotid and finally the inferior thyroid artery to insert into the larynx

Branches in the thorax *(see before for pics)*

Branch	Details
Left recurrent laryngeal nerve	Arises from the vagus on the aortic arch. It hooks around the inferior surface of the arch, posterior to the ligamentum arteriosum and passes upwards through the superior mediastinum and lower part of the neck. It lies in the groove between oesophagus and trachea (supplies both). It passes with the inferior thyroid artery and inserts into the larynx.
Thoracic and cardiac branches	There are extensive branches to both the heart and lung roots. These pass throughout both these viscera. The fibres reunite distally prior to passing into the abdomen.



Abdominal branches

After entry into the abdominal cavity the nerves branch extensively. In previous years the extensive network of the distal branches (nerves of Laterjet) over the surface of the distal stomach were important for the operation of highly selective vagotomy. The use of modern PPI's has reduced the need for such highly selective procedures. Branches pass to the coeliac axis and alongside the vessels to supply the spleen, liver and kidney.

Recurrent Laryngeal Nerve

Branch of the vagus nerve

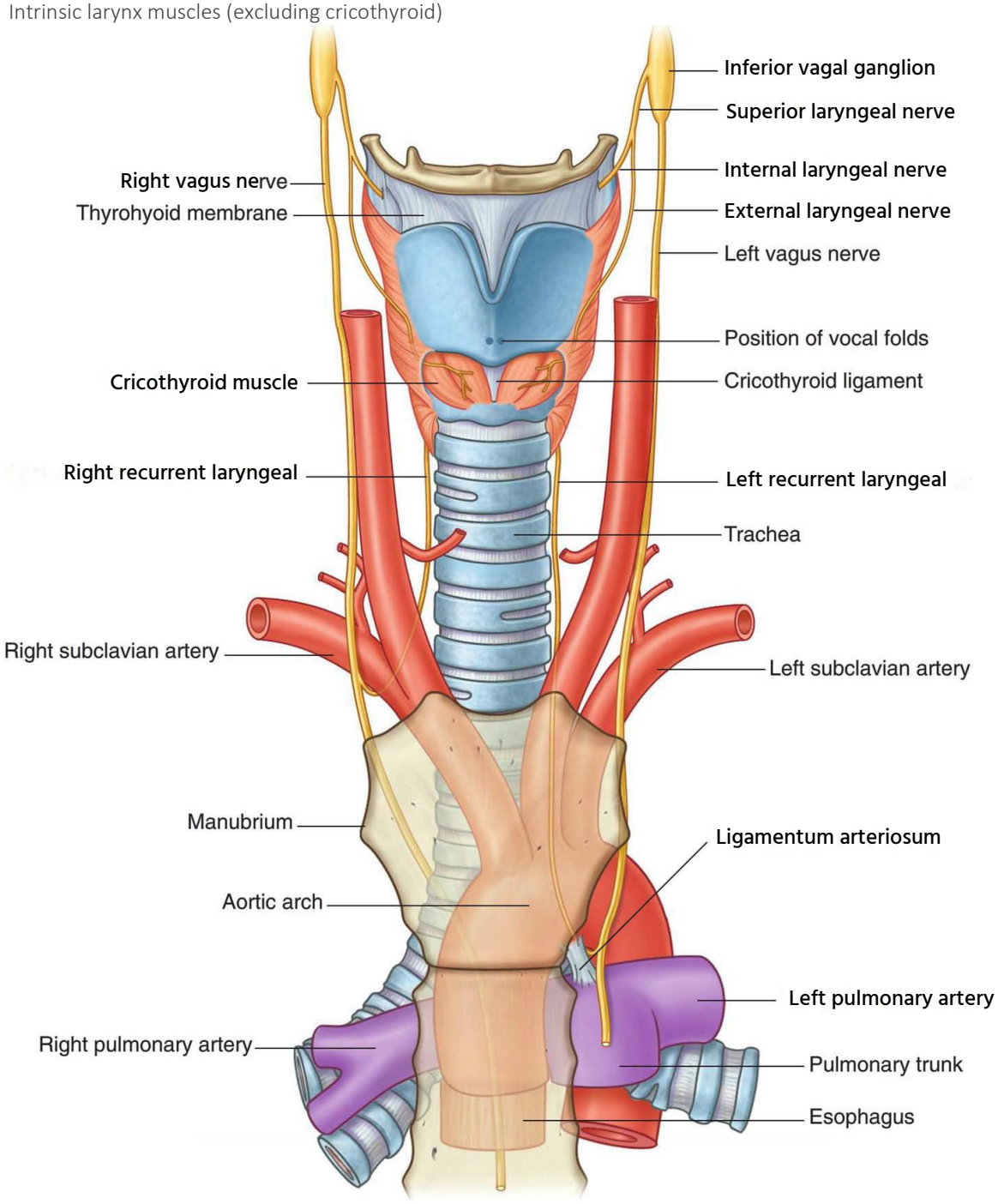
Right	Left
• Arises **anterior to the subclavian artery** and ascends obliquely next to the trachea, behind the common carotid artery • It is either anterior or posterior to the inferior thyroid artery	• Arises **left to the arch of the aorta** • Winds below the aorta • Ascends along the side of the trachea
Then both • Pass in a groove between the trachea and oesophagus • Enters the larynx behind the articulation between the thyroid cartilage and cricoid • Distributed to larynx muscles	

Branches to

- Cardiac plexus
- Mucous membrane and muscular coat of the oesophagus and trachea

Innervates

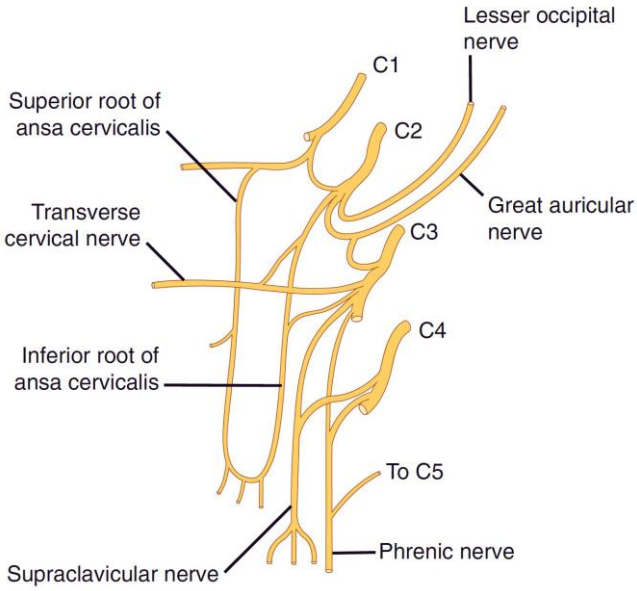
- Intrinsic larynx muscles (excluding cricothyroid)

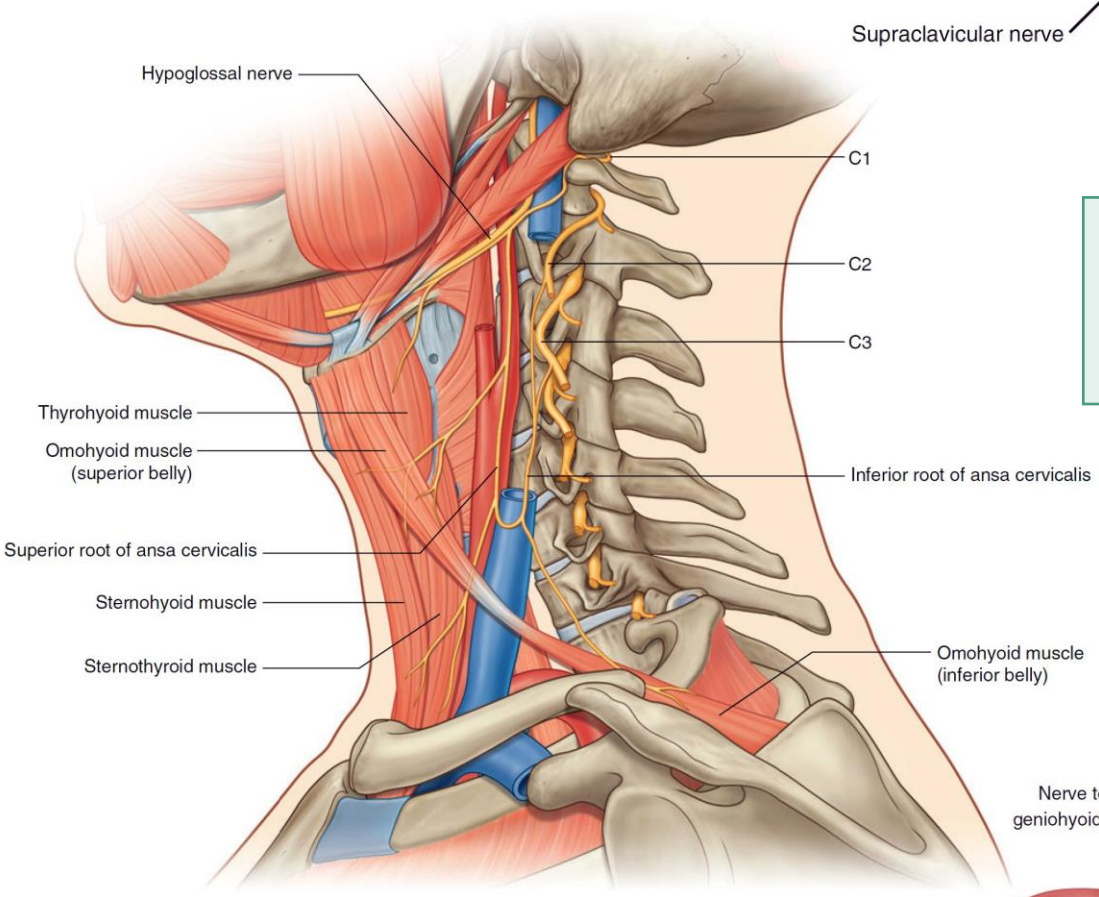


Ansa Cervicalis

Superior root	Branch of C1 anterolateral to carotid sheath
Inferior root	Derived from C2 and C3 roots, passes posterolateral to the internal jugular vein *(may lie either deep or superficial to it)*
Innervation	Sternohyoid Sternothyroid Omohyoid

The ansa cervicalis lies anterior to the carotid sheath in the **anterior Δ**.
The **nerve supply to the inferior strap muscles** enters at their inferior aspect.
Therefore, when dividing these muscles to expose a large goitre, **the muscles should be divided in their upper half**.

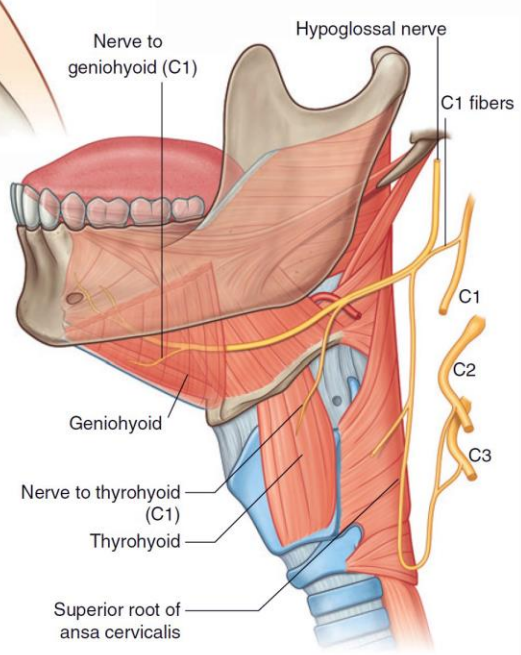




Note: *During a radical neck dissection, division of the **Pretracheal fascia** will expose the Ansa cervicalis.*

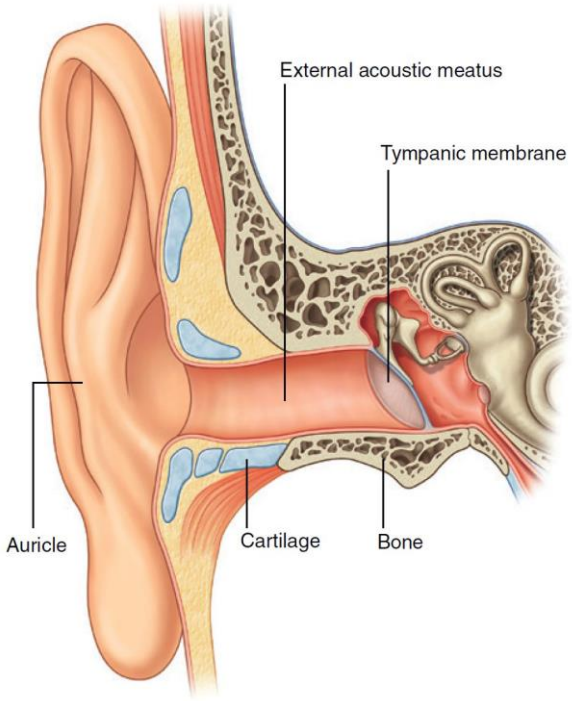
Ansa cervicalis muscles:
*"**GH**ost **TH**ought **SO**meone **ST**upid **SH**ot **I**rene"*

Genio**H**yoid
Thyroid**H**yoid
Superior **O**mohyoid
Sterno**T**hyroid
Sterno**H**yoid
Inferior Omohyoid



Ear Anatomy

The ear is composed of three anatomically distinct regions.



1. External ear

- Auricle is composed of elastic cartilage covered by skin. The lobule has no cartilage and contains fat and fibrous tissue.
- External auditory meatus is approximately 2.5cm long.
- Lateral third of the external auditory meatus is cartilaginous and the medial two thirds is bony.
- The region is innervated by the greater auricular nerve.
- The **auriculotemporal branch of V_3** supplies most the of external auditory meatus and the lateral surface of the auricle.

2. Middle ear

Space between the tympanic membrane and cochlea. The aditus leads to the mastoid air cells is the route through which middle ear infections may cause mastoiditis. Anteriorly the eustacian tube connects the middle ear to the naso pharynx.

The tympanic membrane consists of:

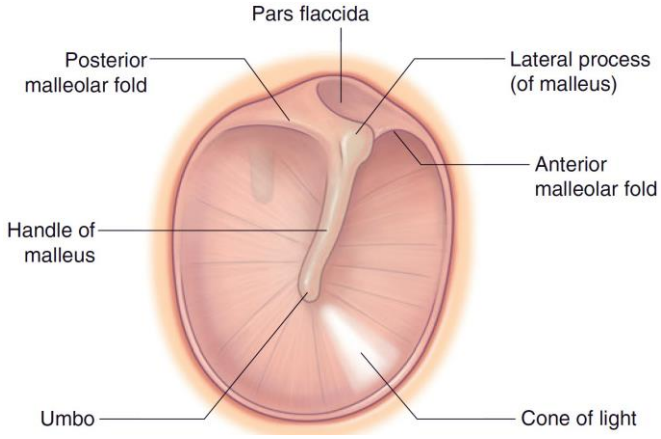
- Outer layer of stratified squamous epithelium.
- Middle layer of fibrous tissue.
- Inner layer of mucous membrane continuous with the middle ear.

The tympanic membrane is approximately 1cm in diameter.

The chorda tympani nerve passes on the **medial side of the pars flaccida**.

The middle ear is innervated by the glossopharyngeal nerve and pain may radiate to the middle ear following tonsillectomy.

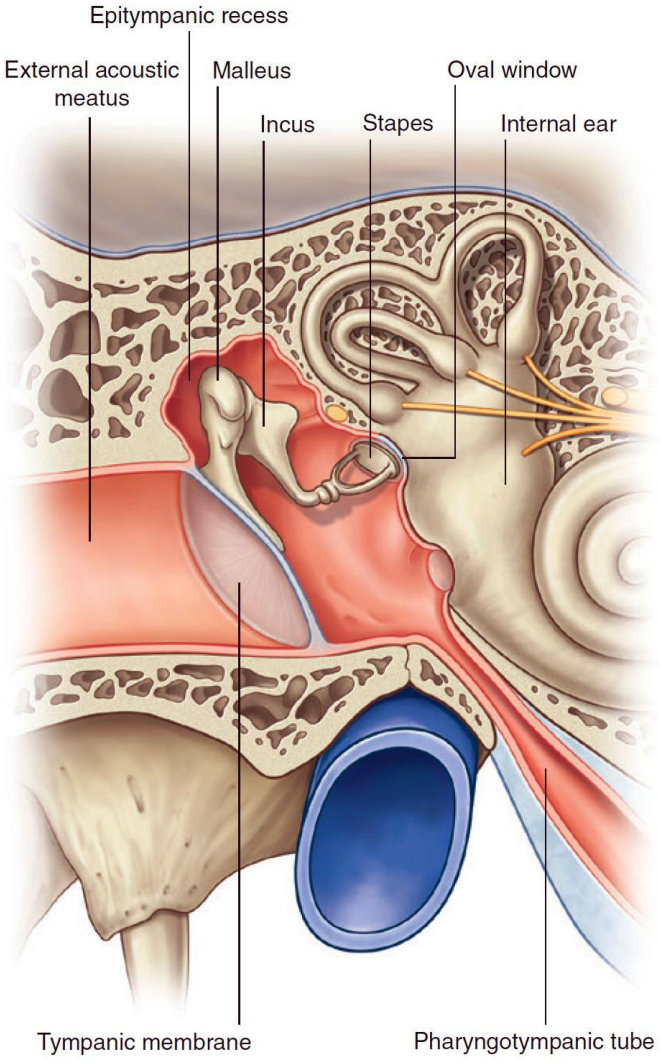
Ossicles



Malleus attaches to the tympanic membrane (the Umbo).

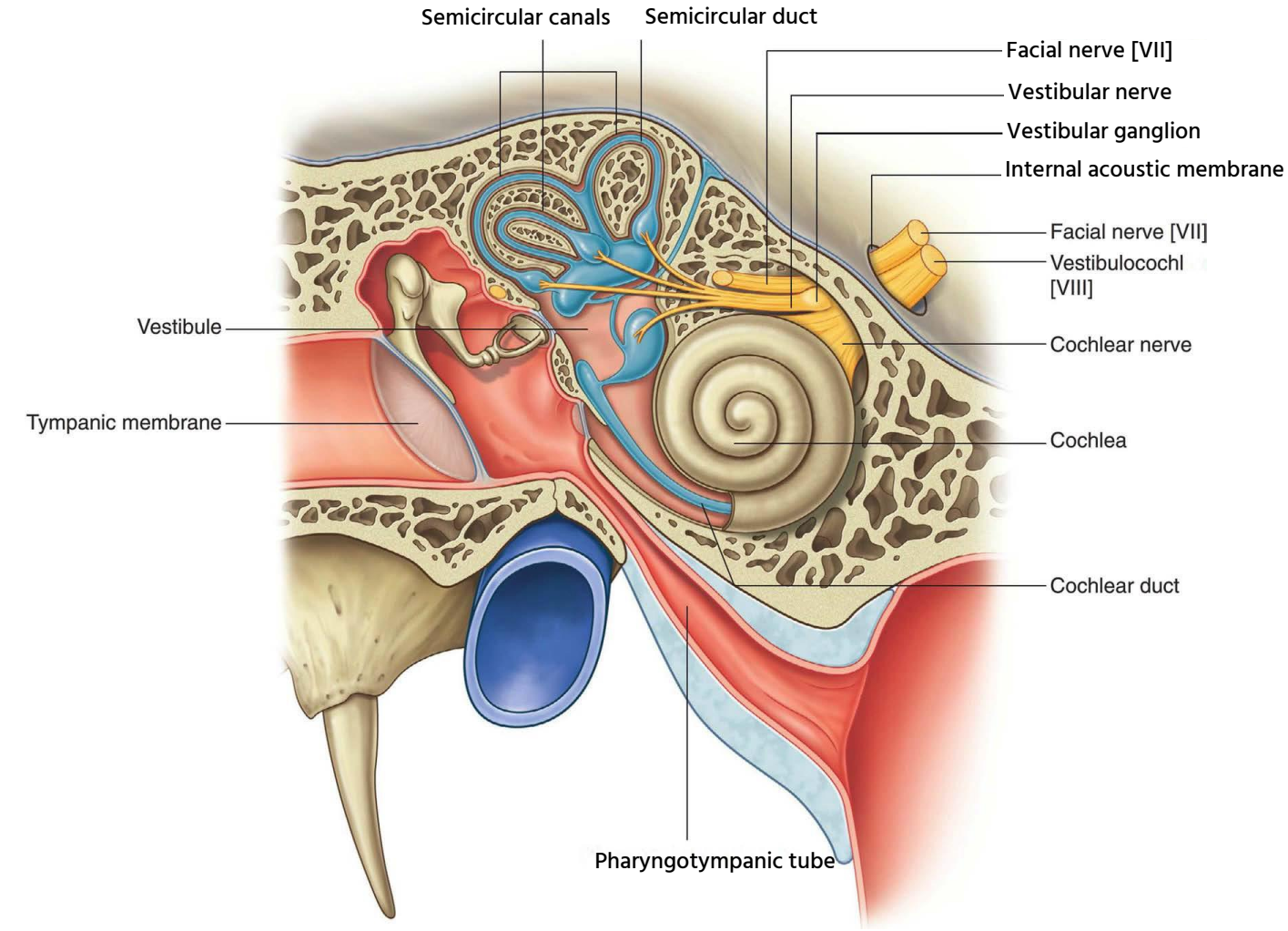
Malleus articulates with the incus (synovial joint).

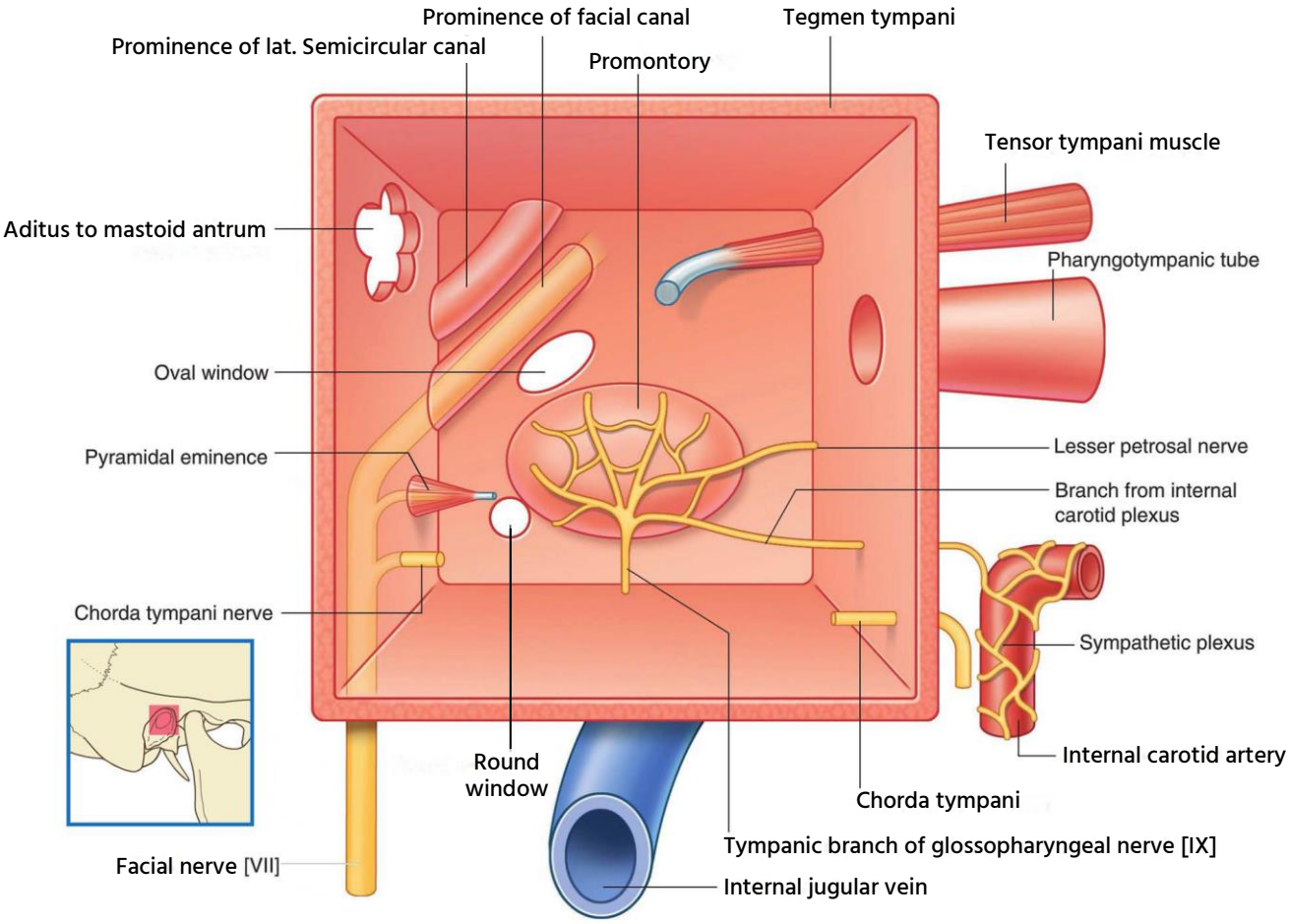
Incus attaches to stapes (another synovial joint).



3. Internal ear

- Cochlea, semicircular canals and vestibule
- Organ of corti is the sense organ of hearing and is located on the inside of the cochlear duct on the basilar membrane.
- Vestibule accommodates the utricule and the saccule. These structures contain endolymph and are surrounded by perilymph within the vestibule.
- The semicircular canals lie at various angles to the petrous temporal bone. All share a common opening into the vestibule.

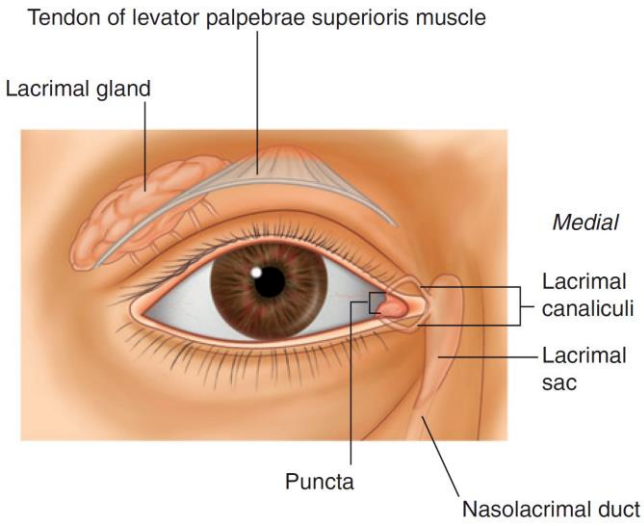

Semicircular canals
Semicircular duct
Facial nerve [VII]
Vestibular nerve
Vestibular ganglion
Internal acoustic membrane
Facial nerve [VII]
Vestibulocochl [VIII]
Vestibule
Cochlear nerve
Tympanic membrane
Cochlea
Cochlear duct
Pharyngotympanic tube


Prominence of facial canal
Prominence of lat. Semicircular canal
Promontory
Tegmen tympani
Tensor tympani muscle
Aditus to mastoid antrum
Pharyngotympanic tube
Oval window
Pyramidal eminence
Lesser petrosal nerve
Branch from internal carotid plexus
Chorda tympani nerve
Sympathetic plexus
Round window
Internal carotid artery
Chorda tympani
Tympanic branch of glossopharyngeal nerve [IX]
Facial nerve [VII]
Internal jugular vein

Lacrimal System

Lacrimal gland

Consists of an orbital part and a palpebral part. They are continuous posterolaterally around the concave lateral edge of the levator palpebrae superioris muscle.
The ducts of the lacrimal gland open into the superior fornix. Those from the orbital part penetrate the aponeurosis of levator palpebrae superioris to join those from the palpebral part. Therefore, excision of the palpebral part is functionally similar to excision of the entire gland.

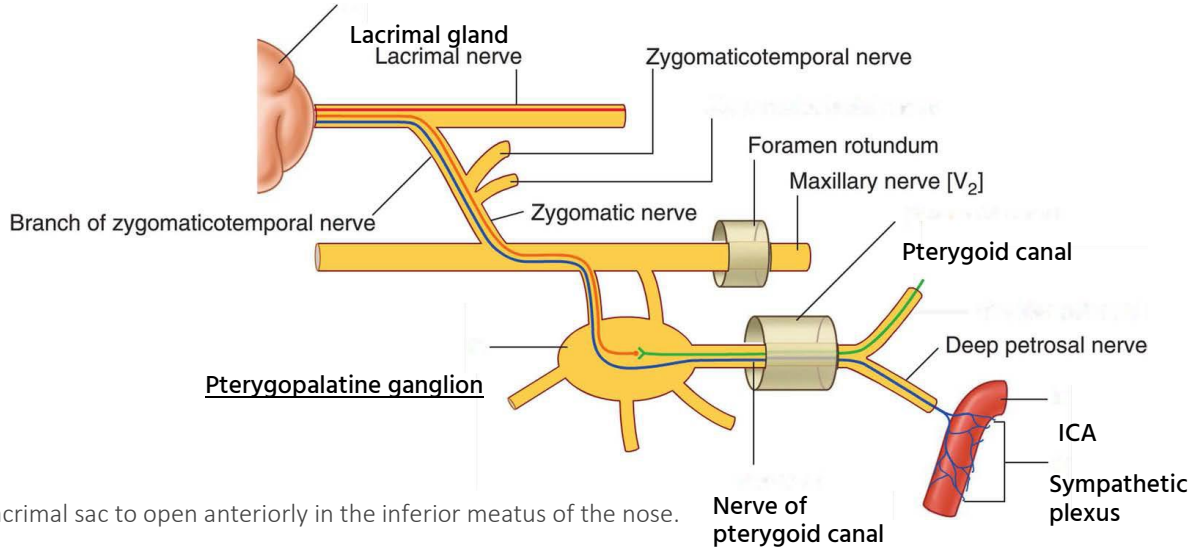


Blood supply

Lacrimal branch of the **ophthalmic artery** *(from ICA)*.
Venous drainage is to the superior **ophthalmic vein**.

Innervation

The gland is innervated by the secretomotor parasympathetic fibres from the **pterygopalatine ganglion** which in turn may reach the gland via the zygomatic or lacrimal branches of the maxillary nerve or pass directly to the gland. The preganglionic fibres travel to the ganglion in the greater petrosal nerve (a branch of the facial nerve at the geniculate ganglion).

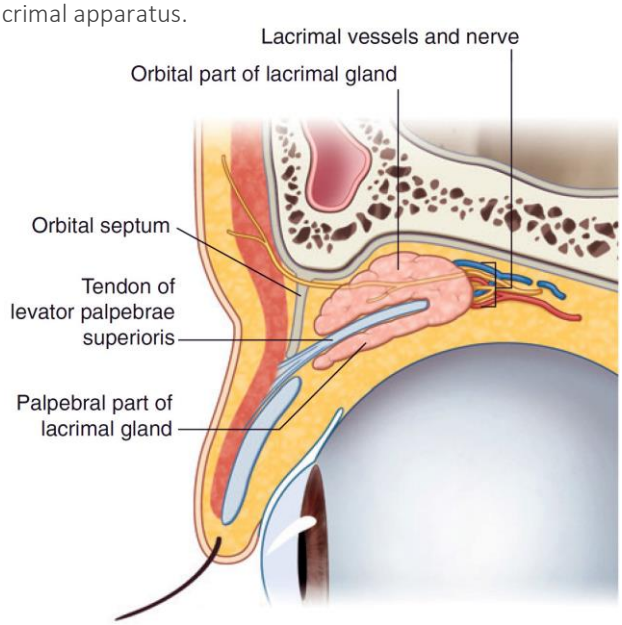


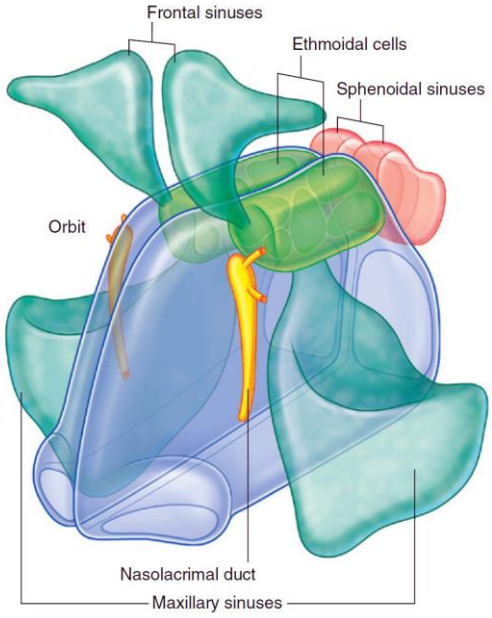
Nasolacrimal duct

Descends from the lacrimal sac to open anteriorly in the inferior meatus of the nose.

Lacrimation reflex

Occurs in response to conjunctival irritation (or emotional events). The conjunctiva will send signals via the ophthalmic nerve. These then pass to the superior salivary centre. The efferent signals pass via the **greater petrosal nerve** (parasympathetic preganglionic fibres) and the deep petrosal nerve which carries the post ganglionic sympathetic fibres. The parasympathetic fibres will relay in the **pterygopalatine ganglion**, the sympathetic fibres do not synapse. They in turn will relay to the lacrimal apparatus.





Tonsil

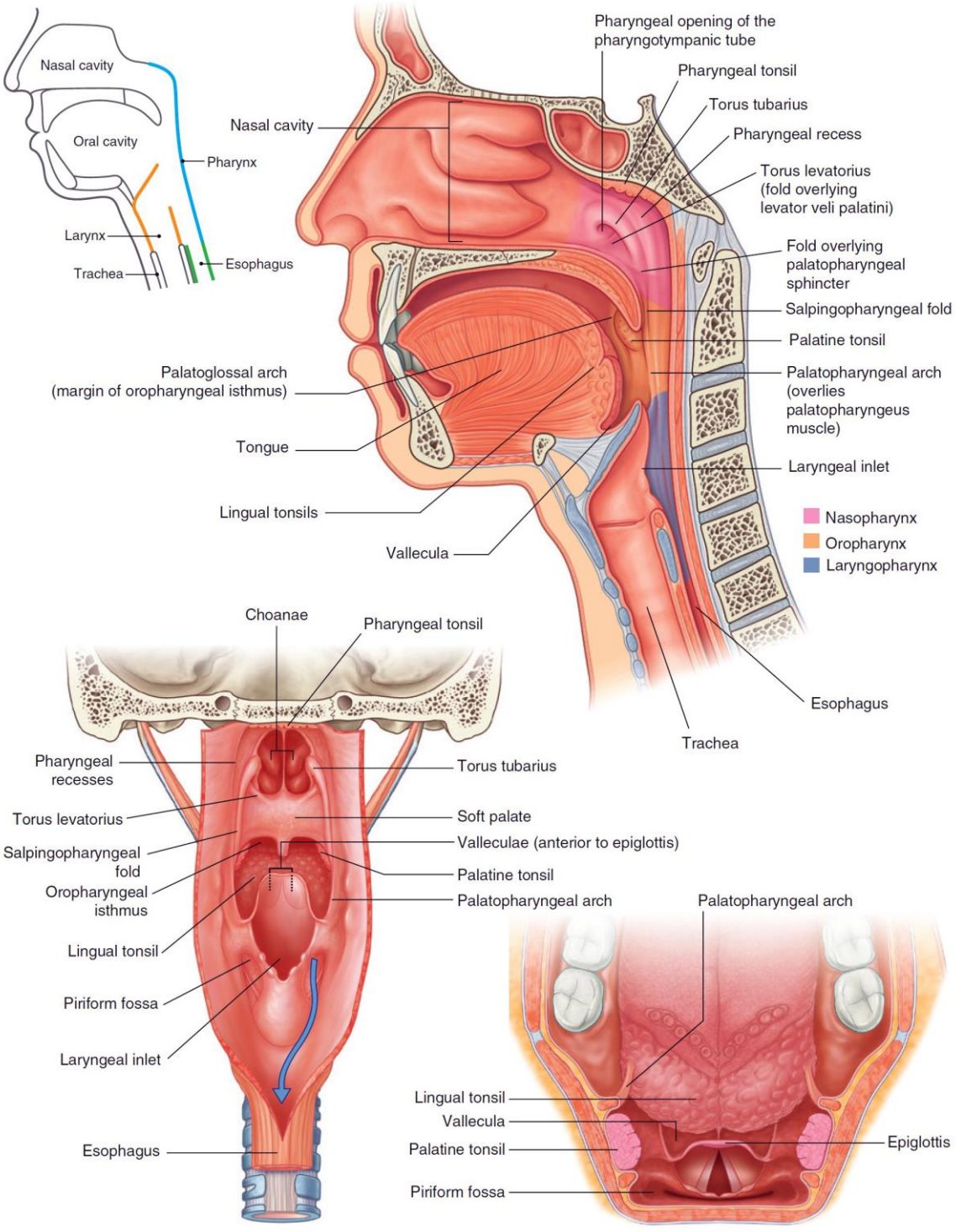
Anatomy

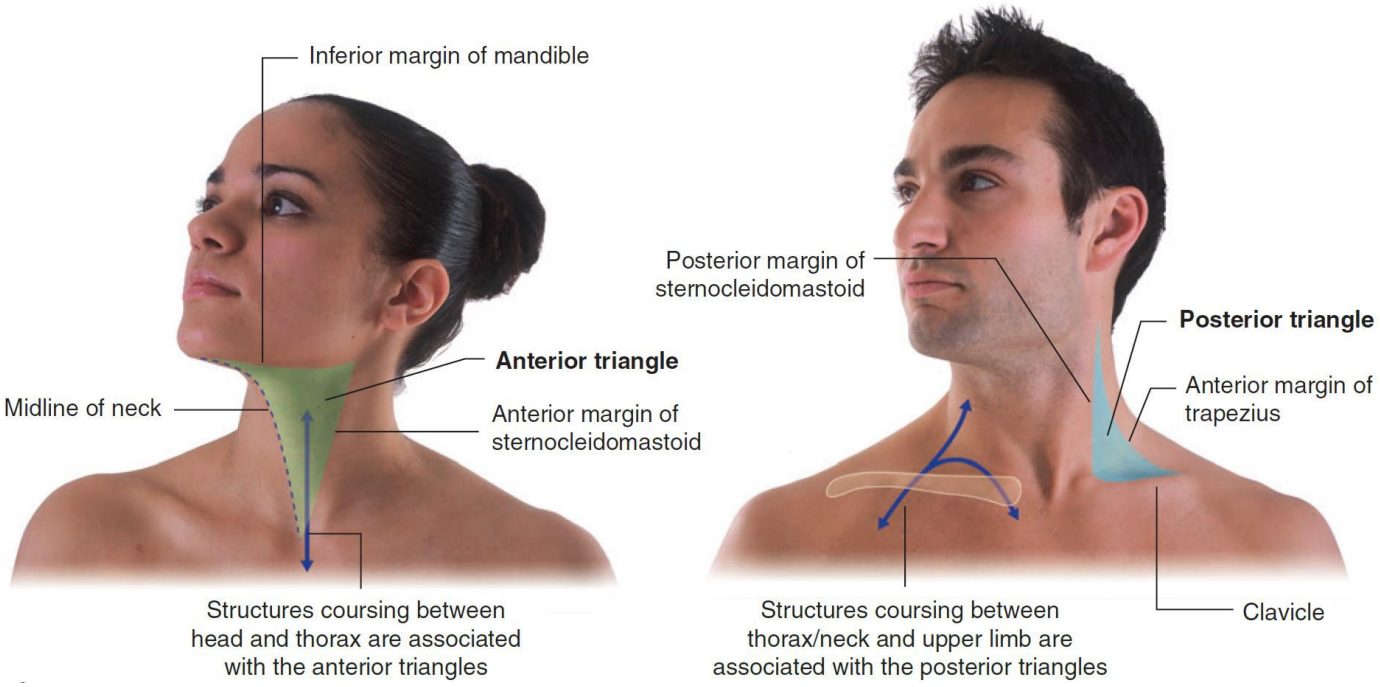
- Each palatine tonsil has two surfaces, a medial surface which projects into the pharynx and a lateral surface that is embedded in the wall of the pharynx.
- They are usually 25mm tall by 15mm wide, although this varies according to age and may be almost completely atrophied in the elderly.
- Their arterial supply is from the **tonsillar artery**, a branch of the facial artery.
- Its veins pierce the constrictor muscle to join the **external palatine** or facial veins. The external palatine vein is immediately lateral to the tonsil, which **may result in haemorrhage during tonsillectomy**.
- Lymphatic drainage is the jugulodigastric node and the deep cervical nodes.

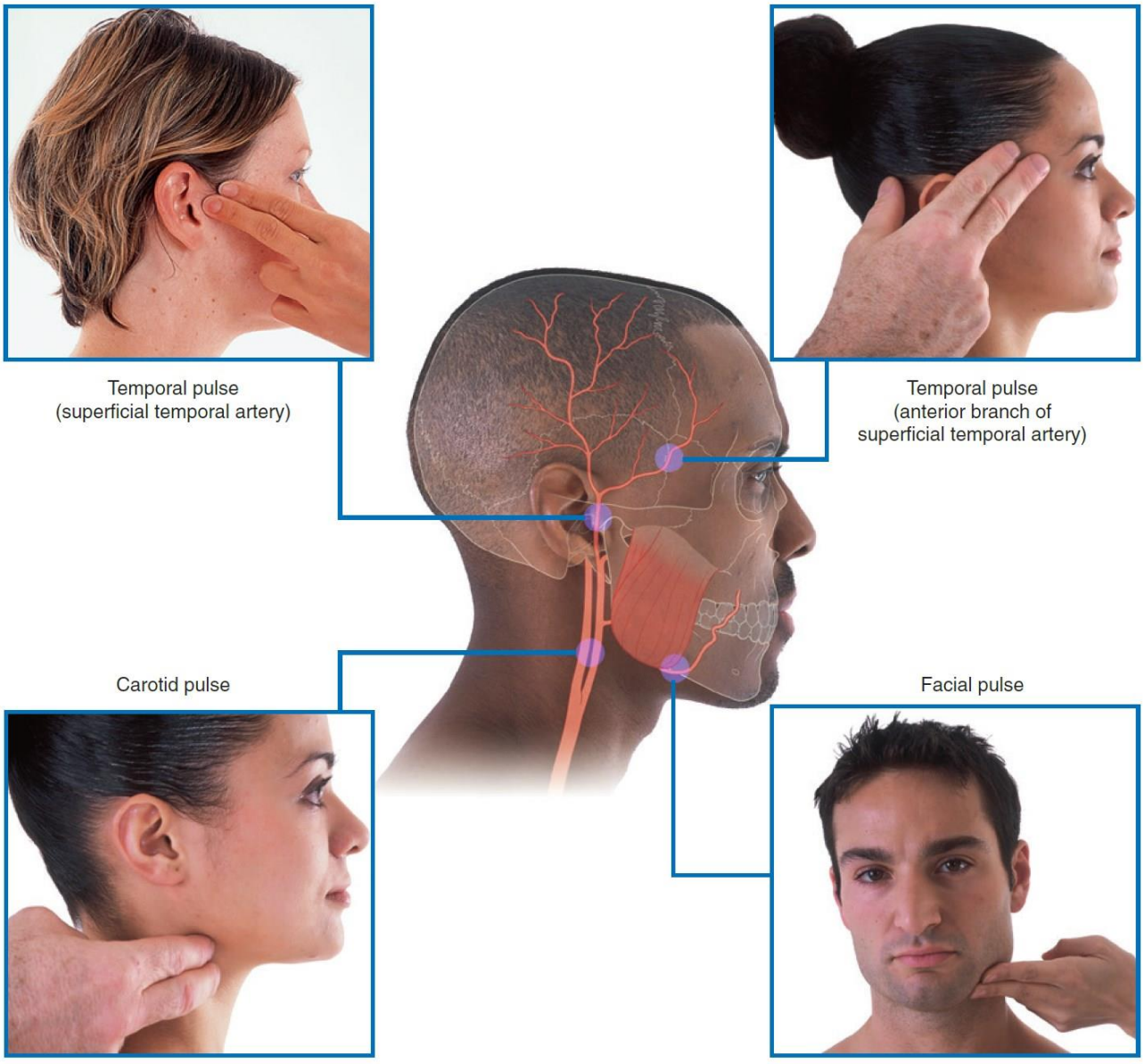
Tonsillitis

- Usually bacterial (50%) - group A *Streptococcus*. Remainder viral.
- May be complicated by development of abscess (quinsy). This may distort the uvula.

• *Indications for tonsillectomy include recurrent acute tonsillitis, suspected mlg, enlargement causing sleep apnoea.*
• *Dissection tonsillectomy is the preferred technique with haemorrhage being the commonest complication. Delayed otalgia may occur owing to irritation of the glossopharyngeal nerve.*




Inferior margin of mandible
Anterior triangle
Midline of neck
Anterior margin of sternocleidomastoid
Structures coursing between head and thorax are associated with the anterior triangles
Posterior margin of sternocleidomastoid
Posterior triangle
Anterior margin of trapezius
Structures coursing between thorax/neck and upper limb are associated with the posterior triangles
Clavicle


Temporal pulse (superficial temporal artery)
Temporal pulse (anterior branch of superficial temporal artery)
Carotid pulse
Facial pulse