

Scalp and cranial nerve anatomy

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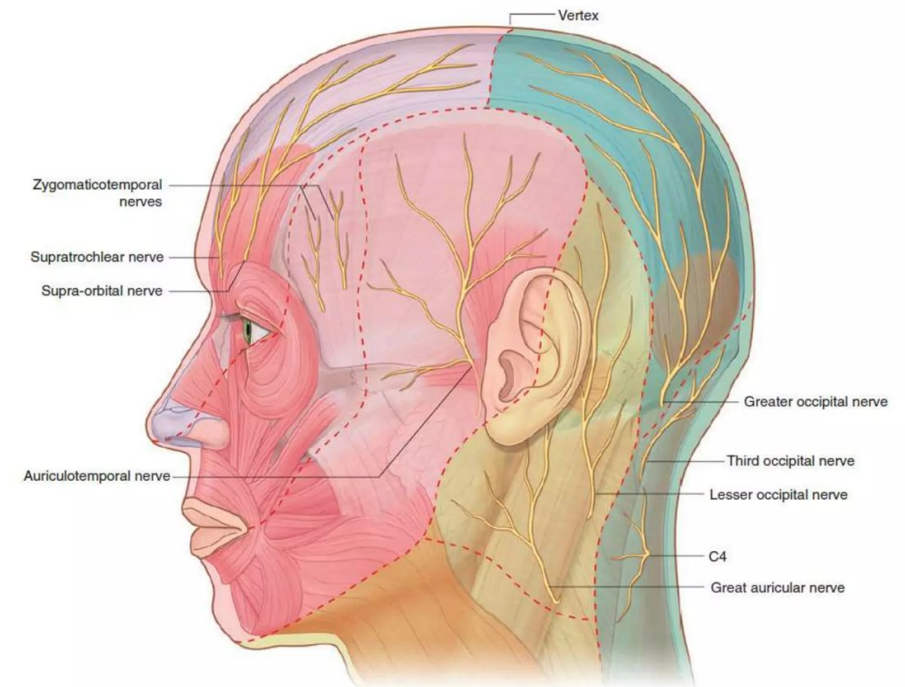
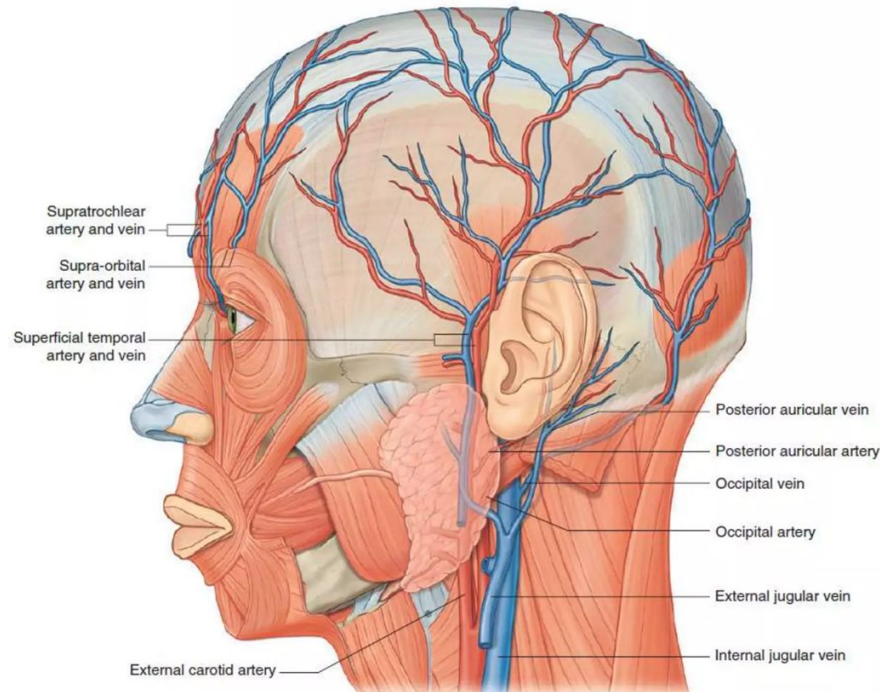
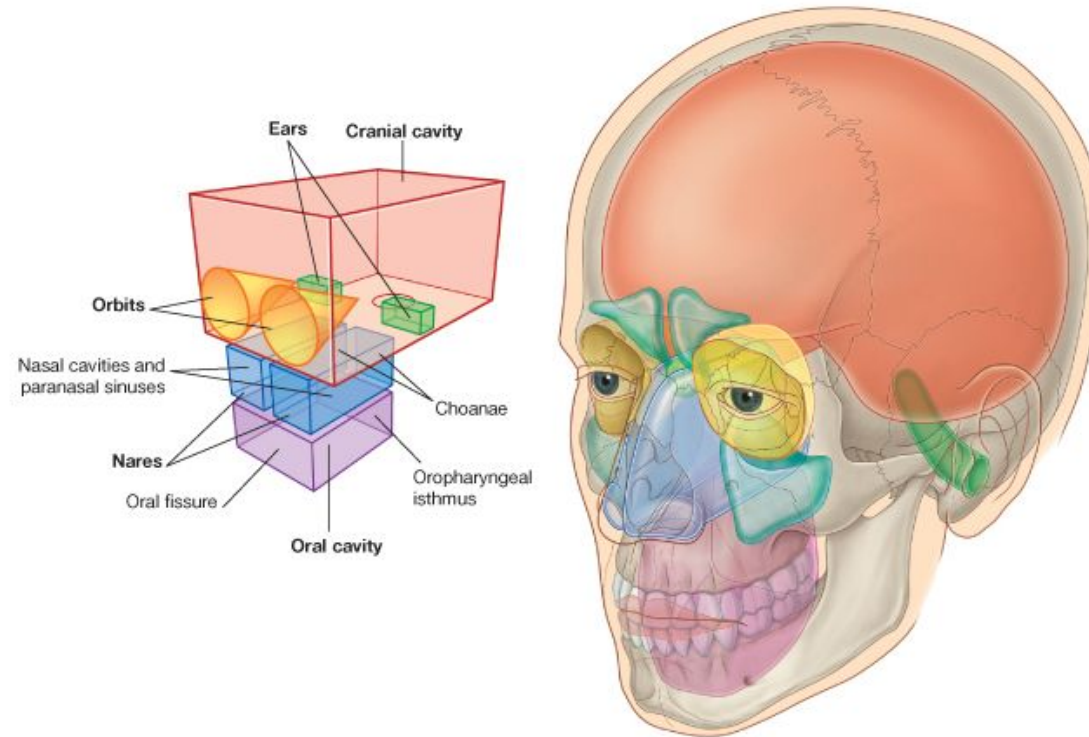


Fig. Innervation of the scalp.

The **cranial cavity** is the largest compartment and contains the brain and associated membranes (meninges).



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Figure 8.1 Major compartments of the head and neck.

Most of the **ear** apparatus on each side is contained within one of the bones forming the floor of the cranial cavity. The external parts of the ears extend laterally from these regions.

The two **orbits** contain the eyes. They are cone-shaped chambers immediately inferior to the anterior aspect of the cranial cavity, and the apex of each cone is directed posteromedially. The walls of the orbits are bone whereas the base of each conical chamber can be opened and closed by the eyelids.

The **nasal cavities** are the upper parts of the respiratory tract and are between the orbits. They have walls, floors, and ceilings, which are predominantly composed of bone and cartilage. The anterior openings to the nasal cavities are **nares (nostrils)**, and the posterior openings are **choanae (posterior nasal apertures)**.

Boundaries & Layers

Description: The **scalp** refers to the **layers of skin** and **subcutaneous tissue** that cover the bones of cranial vault.

Boundaries of the Scalp:

- **Anteriorly:** *superciliary arches of the Frontal Bone*
- **Posteriorly:** *external occipital protuberance and superior nuchal lines of occipital bone.*
- **Laterally:** *inferiorly to the zygomatic arch.*

Layers of the Scalp:

The scalp is a multilayered structure with layers that can be defined by the word itself:

- **S—skin**
- **C—connective tissue (dense)**
- **A—aponeurotic layer**
- **L—loose connective tissue**
- **P—pericranium**

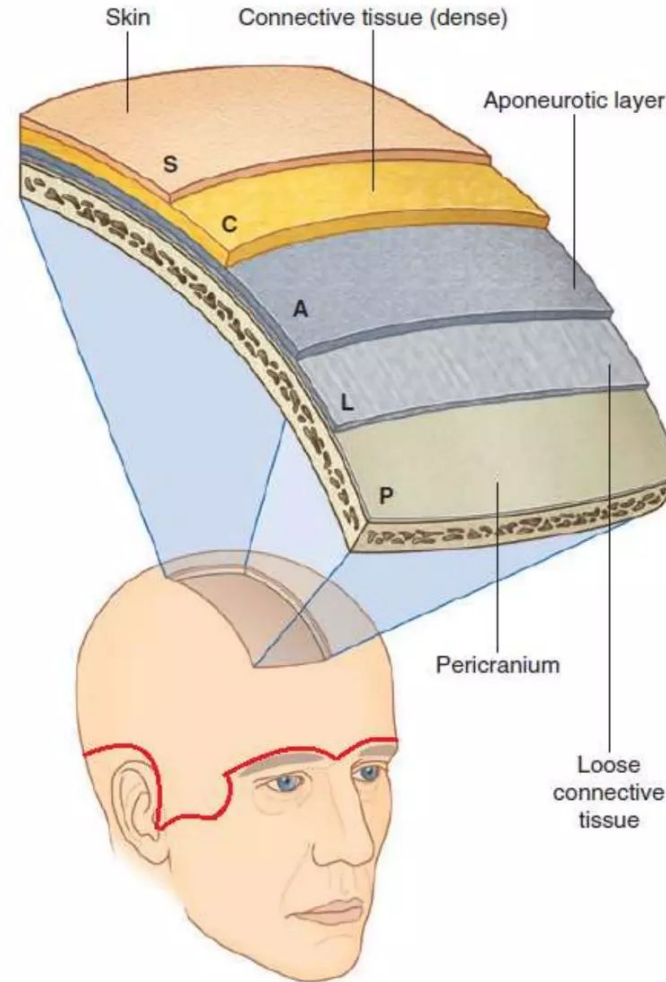


Fig. SCALP.

Layers of the Scalp: 1st & 2nd

The **first 3 layers** are tightly held together, forming a **single unit**. This unit is sometimes referred to as the **scalp proper** and is the tissue torn away during serious “**scalping**” injuries.

❖ **Skin (1st)**

It contains numerous **hair follicles** and **sebaceous glands**

- ❑ **Clinical-** a **common site for sebaceous cysts** due to the abundance of sebaceous glands.

❖ **Dense Connective tissue (2nd)**

It connects the **skin** to the **epicranial aponeurosis**. It is richly vascularised and innervated.

- ❑ **Clinical-** The **blood vessels** within the layer are **highly adherent** to the connective tissue. This renders them **unable to constrict** fully if lacerated causing **profuse bleeding**.
- ❑ **Clinical-** **Inflammation** due to subcutaneous hemorrhage causes much **pain & swelling** due to the **inelastic fibrous tissue**.
- ❑ **Clinical-** Its **rich blood supply** ensures the **vitality of scalp**. Thus, when a large area of scalp (previously separated) is replaced & stitched it will **heal rapidly**.

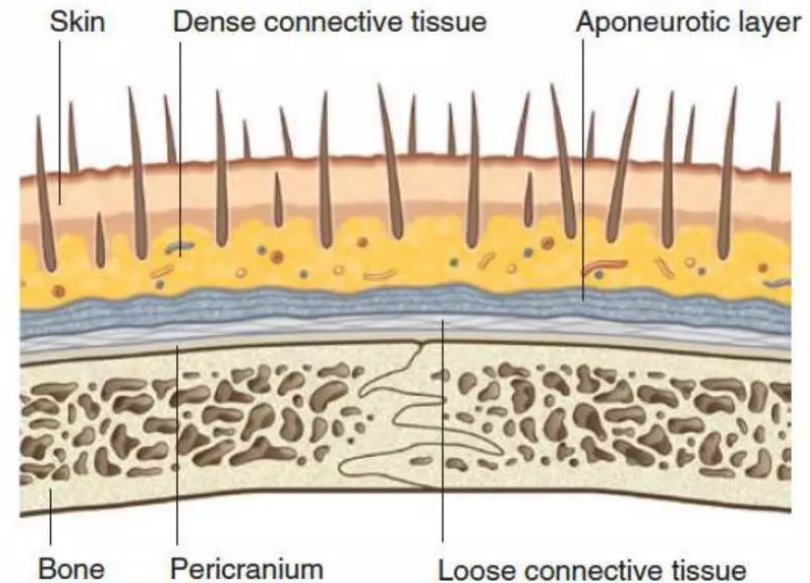


Fig. Layers of the scalp.

Layers of the Scalp: 3rd

❖ Aponeurotic layer (3rd)

The **deepest layer** of the **first 3 layers** is the aponeurotic layer. Firmly **attached** to the **skin** by the **dense connective tissue** of the 2nd layer, this layer consists of the **frontalis muscle** connected to the **occipitalis muscle** via an aponeurosis known as the **galea aponeurotica**. The galea continues into the **temples**, investing the **auricular muscles**, and **terminates** by **attaching to** the **mastoid processes** and the **zygomatic arch**.

Actions of the Occipitofrontalis muscles: *The occipitofrontalis muscles move the scalp, wrinkle the forehead, and raise the eyebrows.*

Innervation of the Occipitofrontalis muscles:

- **Frontal belly-** by **temporal branches of CN VII**
- **Posterior belly-** by **posterior auricular branch**

❑ **Clinical-** *If this aponeurosis is lacerated in the coronal plane the frontalis and occipitalis muscles contract in opposite directions and may result in a large gaping wound.*

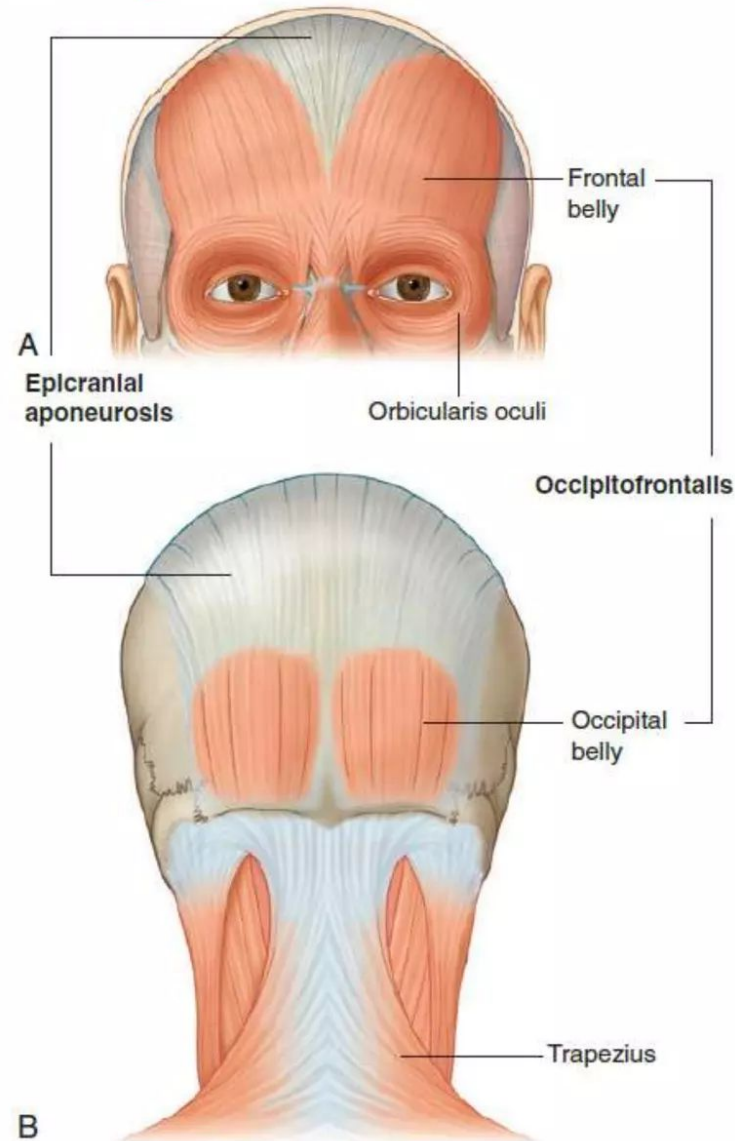


Fig. Occipitofrontalis muscle. A. Frontal belly. B. Occipital belly.

Layers of the Scalp: 4th & 5th

❖ Loose connective tissue (4th)-

A layer of loose connective tissue **separates** the aponeurotic layer from the **pericranium** and **facilitates movement** of the **scalp proper** over the **calvaria**. This layer contains **emissary veins**.

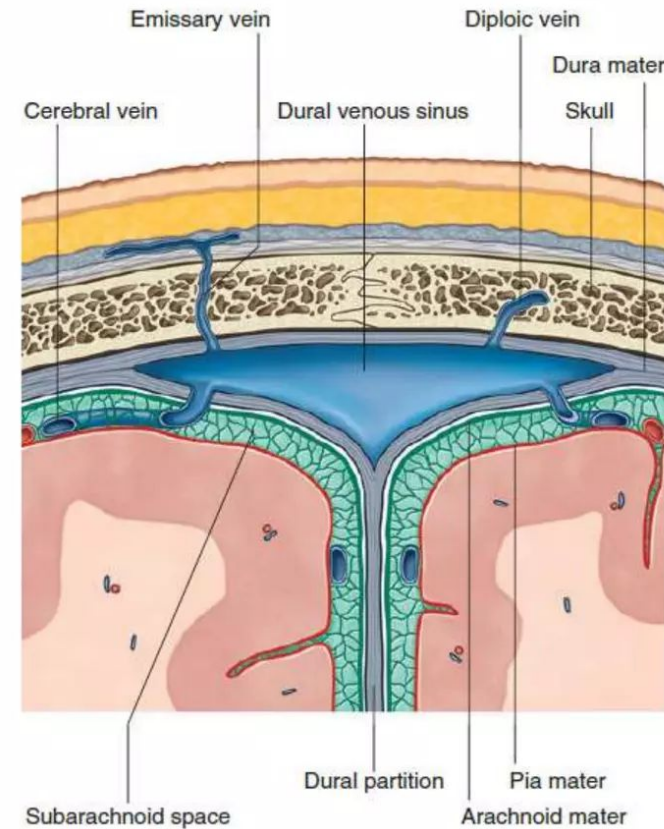
❑ Clinical- DANGER LAYER

- In scalping injuries, this is the layer in which **separation occurs**.
- **Infection** can **easily spread in this layer**. The **emissary veins** are a **conduit** through which infections can enter the **cranial cavity** because they **have no valves**.
- **Blunt trauma** can result in **hemorrhage** in this layer. The **blood** can **spread forward into the face** because **occipitofrontalis** muscle has **no bony attachment anteriorly**; resulting in “**black eyes**”.

- ❑ Clinical- “Caput succedaneum” refers to **swelling, or edema**, of an **infant's scalp** that appears as a lump or bump on their head **shortly after delivery**. This condition is **harmless** and is **due to pressure** put on the infant's head during delivery.

❖ Pericranium (5th)-

Is the **periosteum** over the external surface of the skull; **knits** into the **sutures**.



Scalp: Vasculature

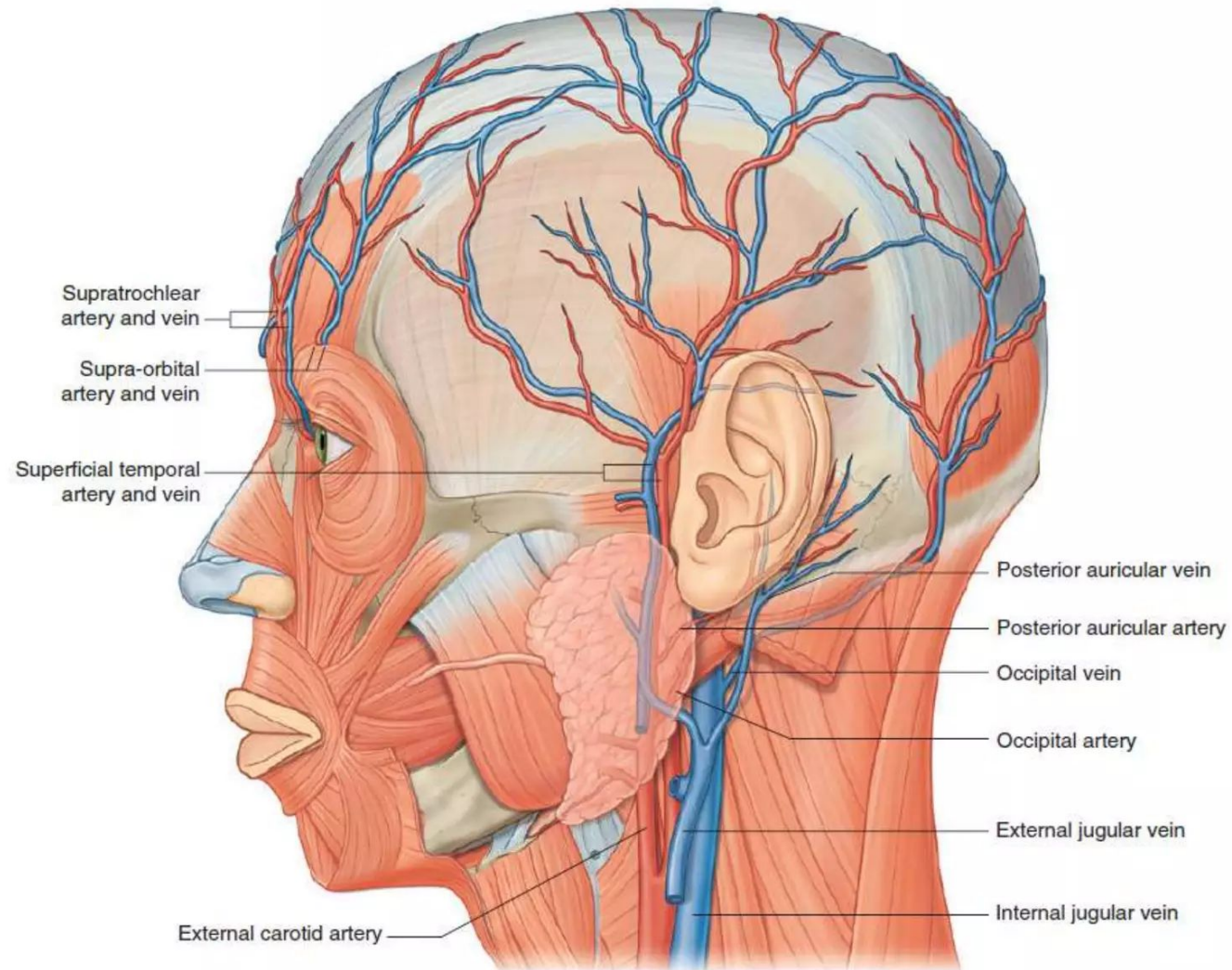


Fig. Vasculature of the scalp.

Scalp Vasculature: Arterial Supply

Branches from the internal carotid artery

2 branches of the internal carotid artery supply the anterior part of scalp

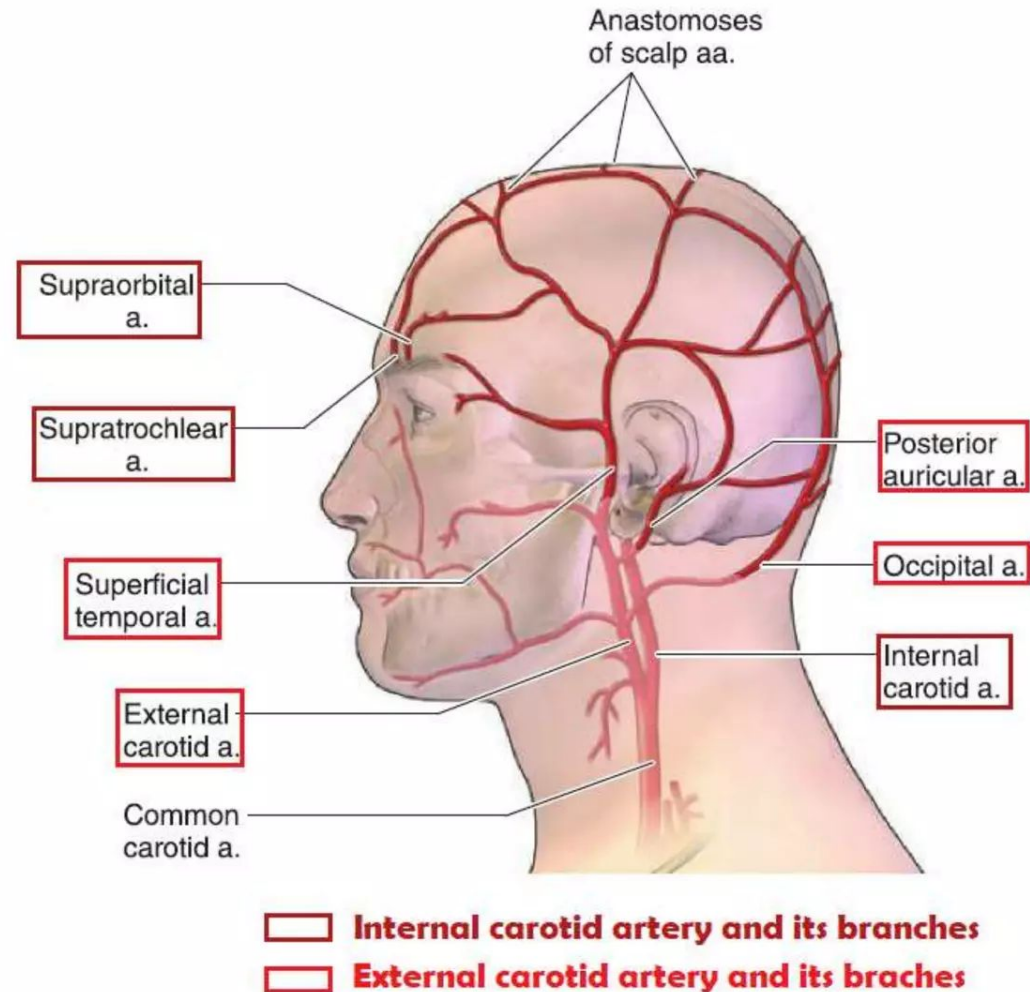
- 1) **Supratrochlear arteries**
- 2) **supra-orbital arteries**

supply the **anterior and superior aspects** of the scalp. They **branch from the ophthalmic artery** while it is in the orbit, continue through the orbit, and exit onto the forehead in association.

Branches from the external carotid artery

3 branches of the external carotid artery supply the largest part of the scalp

- 1) **Posterior auricular artery** - supply an area of the scalp **posterior to the ear**.
- 2) **Occipital artery**- supply a **large part of the posterior aspect** of the scalp.
- 3) **Superficial temporal artery**- supplies almost the **entire lateral aspect** of the scalp.



Scalp Vasculature: Venous Drainage

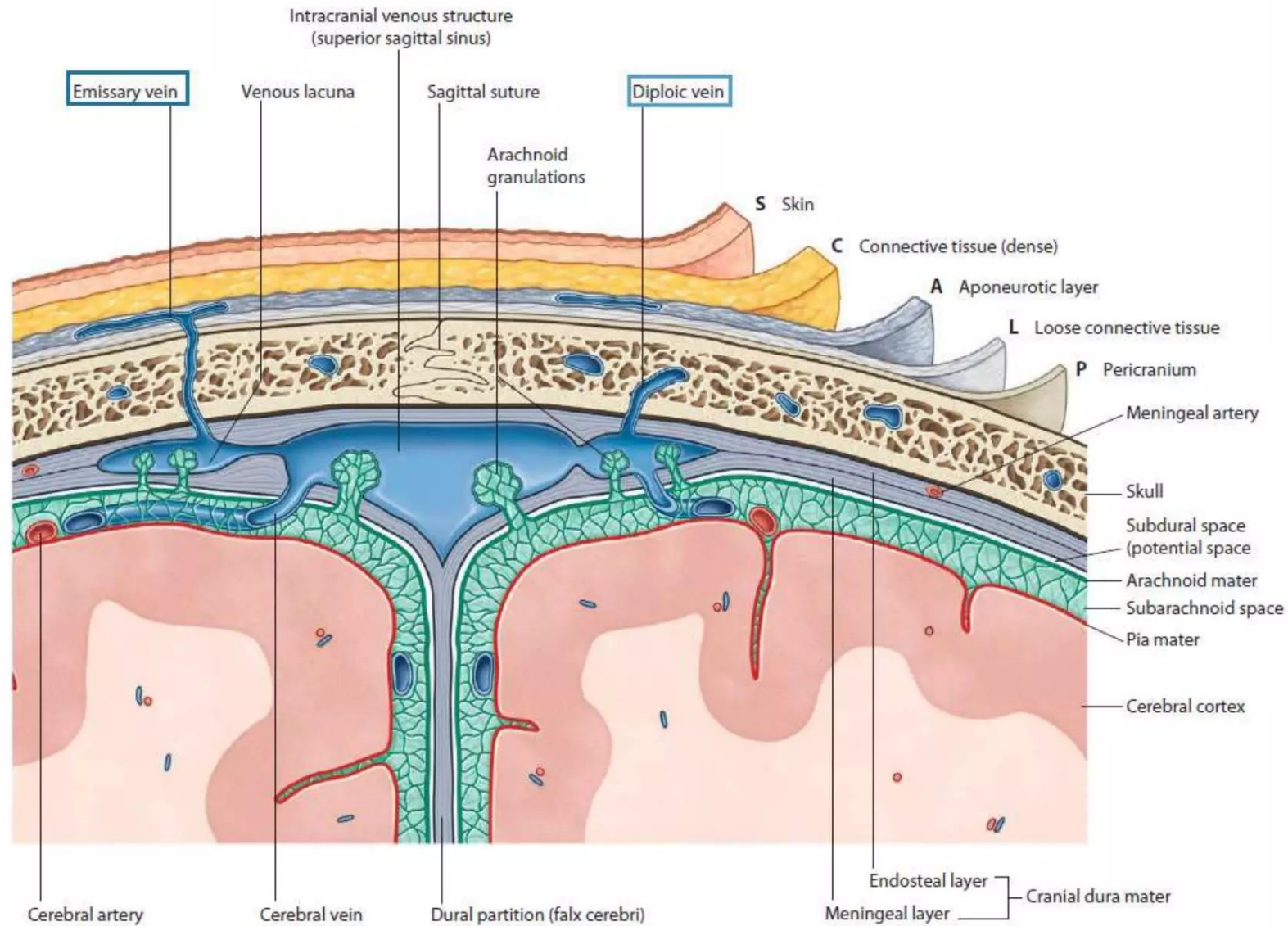
Blood from the scalp drains via the following veins:

- Supraorbital and supratrochlear veins: **Drain** into the **facial vein**.
- Superficial temporal vein: **Joins** with the **maxillary vein to form the retromandibular vein** in the **parotid salivary gland**.
- Posterior auricular vein: **Joins** with the **posterior division of the retromandibular vein to form the external jugular vein**.

Additionally, scalp veins connect with diploic and emissary veins:

- Diploic veins: **Course in the diploe of the cranial bones of the skull and connect with the dural venous sinuses via emissary veins**.
- Emissary veins: **Connect veins of the scalp and skull with the dural venous sinuses**.

Emissary Veins & Diploic Veins



Emissary Veins

Description: Emissary veins are **valveless venous vessels** that connect the extracranial and intracranial venous systems. Their walls **don't have muscular tissues** but are rather **formed by endothelium**.

Some Important Emissary Veins:

1. Mastoid emissary vein: **passes through** the **mastoid foramen** and **connects** the **occipital or posterior auricular veins** with the **sigmoid sinus**.
2. Parietal emissary vein: **passes through** the **parietal foramen**, **connecting** the **veins of the scalp** with the **superior sagittal sinus**.
3. Hypoglossal emissary venous plexus: **traverses** the **hypoglossal canal** and **connects** the **internal jugular vein** with the **sigmoid sinus**.
4. Supracondylar emissary vein: that **passes through** the **posterior condylar canal** and **connects** the **veins of the suboccipital triangle** with the **sigmoid sinus**.
5. Emissary venous plexus of foramen ovale: **connects** the **pterygoid plexus** and the **cavernous sinus**.
6. Emissary veins of foramen lacerum: **connect** the **pharyngeal veins** and **pterygoid plexus** with the **cavernous sinus**.
7. Emissary vein of sphenoidal foramen (of Vesalius): **connect** the **pharyngeal veins** and **pterygoid plexus** with the **cavernous sinus**.
8. Internal carotid venous plexus: acts as an emissary plexus **connecting** the **internal jugular vein** with the **cavernous sinus via the carotid canal**.
9. Petrosquamous sinus: as an emissary vein **connecting** the **retromandibular vein** and **transverse sinus**. (This sinus diminishes in the third trimester of pregnancy)
10. Occipital emissary vein: which **connects** the **occipital vein** with the **confluence of sinuses** via **the occipital protuberance**. Occasionally, it **connects** the **occipital diploic vein** with the **occipital vein**.

Functions:

- Connection of extracranial and intracranial venous systems
- Equalization of intracranial venous pressure
- ❑ **Clinical:** The emissary veins are a **potential pathway for the spread of infections** from the extracranium to the intracranial space which may lead to thrombosis putting life in danger

Scalp: Innervation

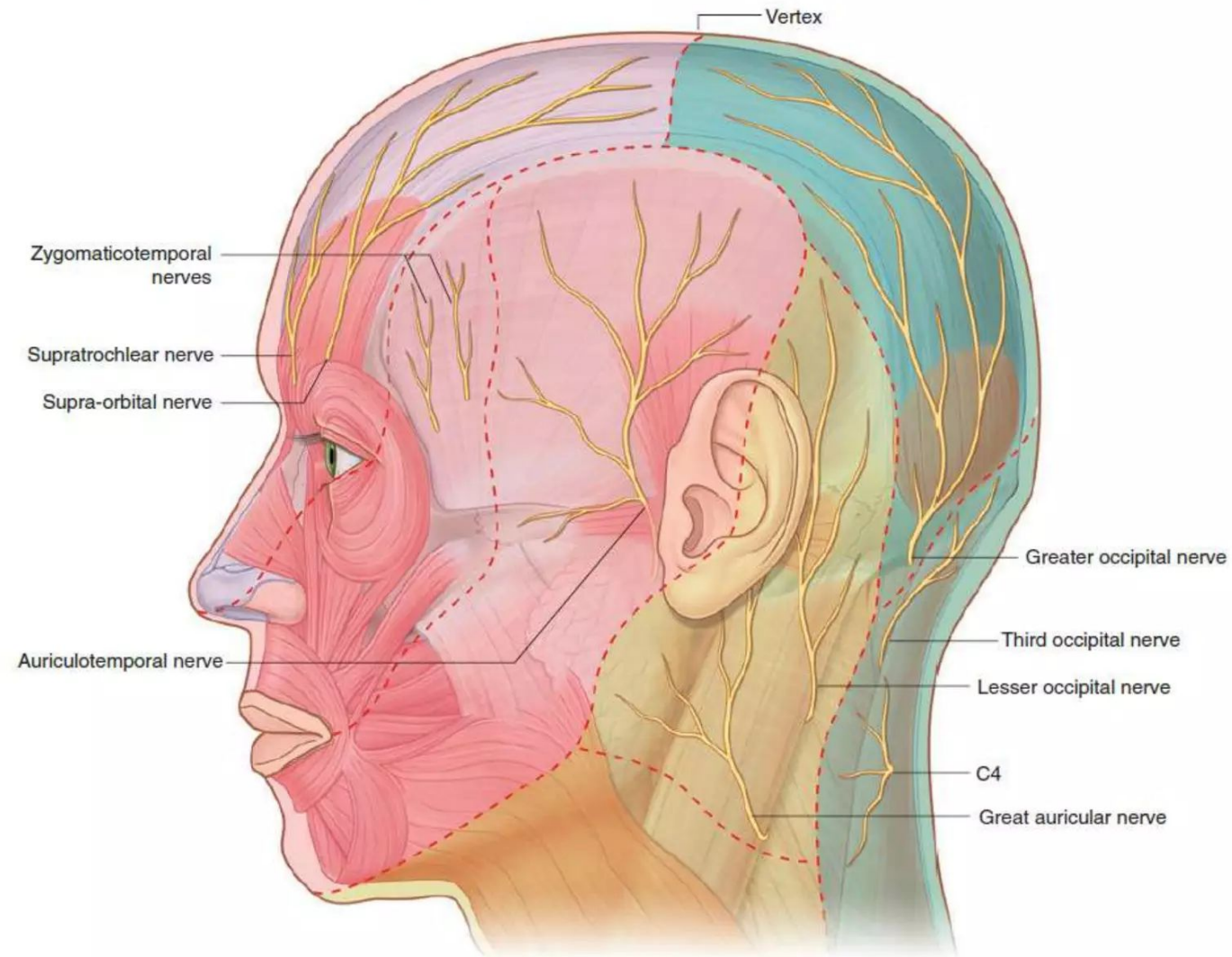
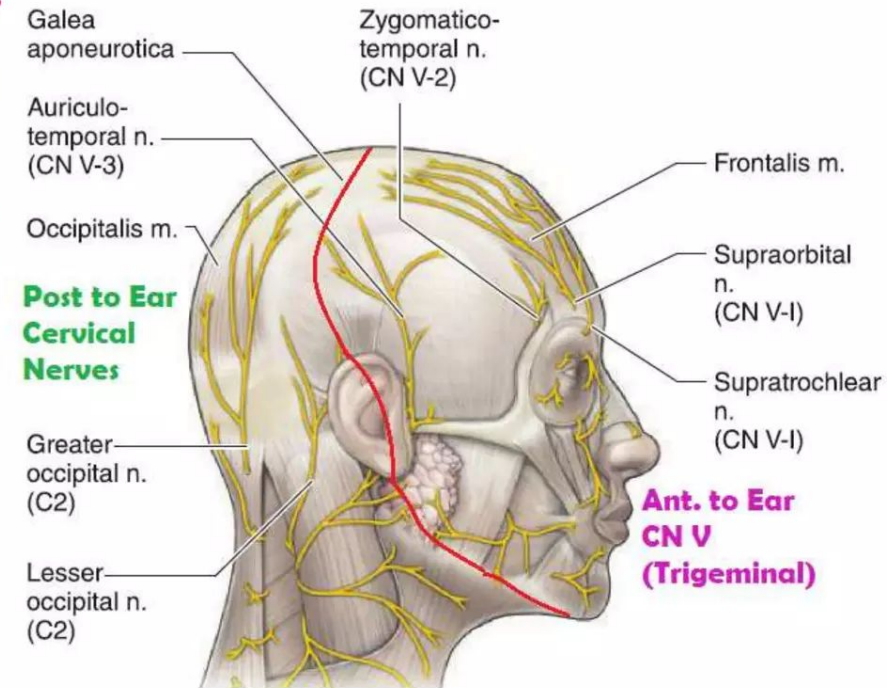


Fig. Innervation of the scalp.

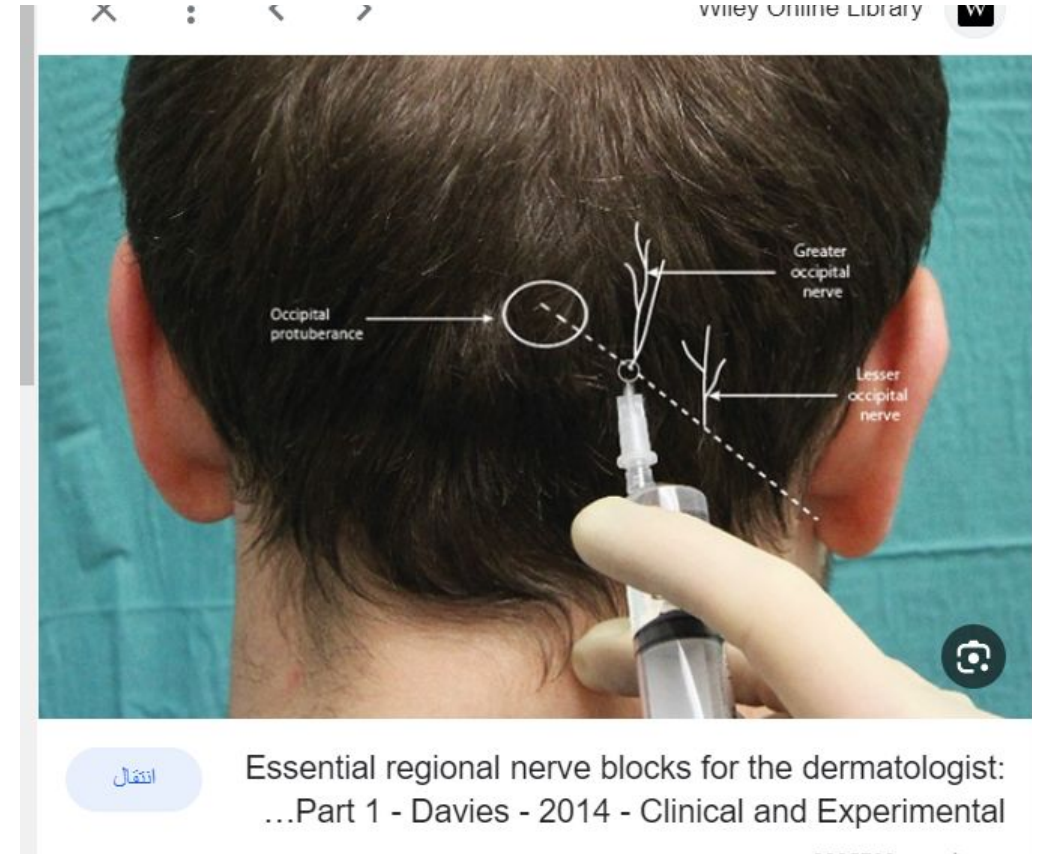
Scalp: Innervation

- **Trigeminal Nerve** - supplies *anterior to the ears and the vertex*
 - **Supratrochlear nerve** – branch of the **ophthalmic nerve [CN V1]**, which supplies the **anteromedial forehead**.
 - **Supraorbital nerve** – branch of the **ophthalmic nerve [CN V1]**, which supplies a large portion of the scalp **between the anterolateral forehead and the vertex**.
 - **Zygomaticotemporal nerve** – branch of the **maxillary nerve [CN V2]**, this supplies **the temple**.
 - **Auriculotemporal nerve** – branch of the **mandibular nerve [CN V3]** which supplies **skin anterosuperior to the auricle**.
- **Cervical Nerves** -supplies *posterior to the ears and the vertex*
 - **Lesser occipital nerve** – derived from the **anterior ramus (division) of C2** and supplies the **skin posterior to the ear**
 - **Greater occipital nerve** – derived from the **posterior ramus (division) of C2** and supplies the **skin of the occipital region**.
 - **Great auricular nerve** – derived from the **anterior rami of C2 and C3** and supplies the **skin posterior to the ear and over the angle of the mandible**.
 - **3rd occipital nerve** – derived from **the posterior ramus of C3** and supplies the **skin of the inferior occipital region**.





Awake craniotomy scalp block



occipital neuralgia

Face boundaries:
Hair line superior

Auricles, lateral

**Mandibular border
and chin, Inferior**



Skeleton of face

Frontal
bone

Maxilla

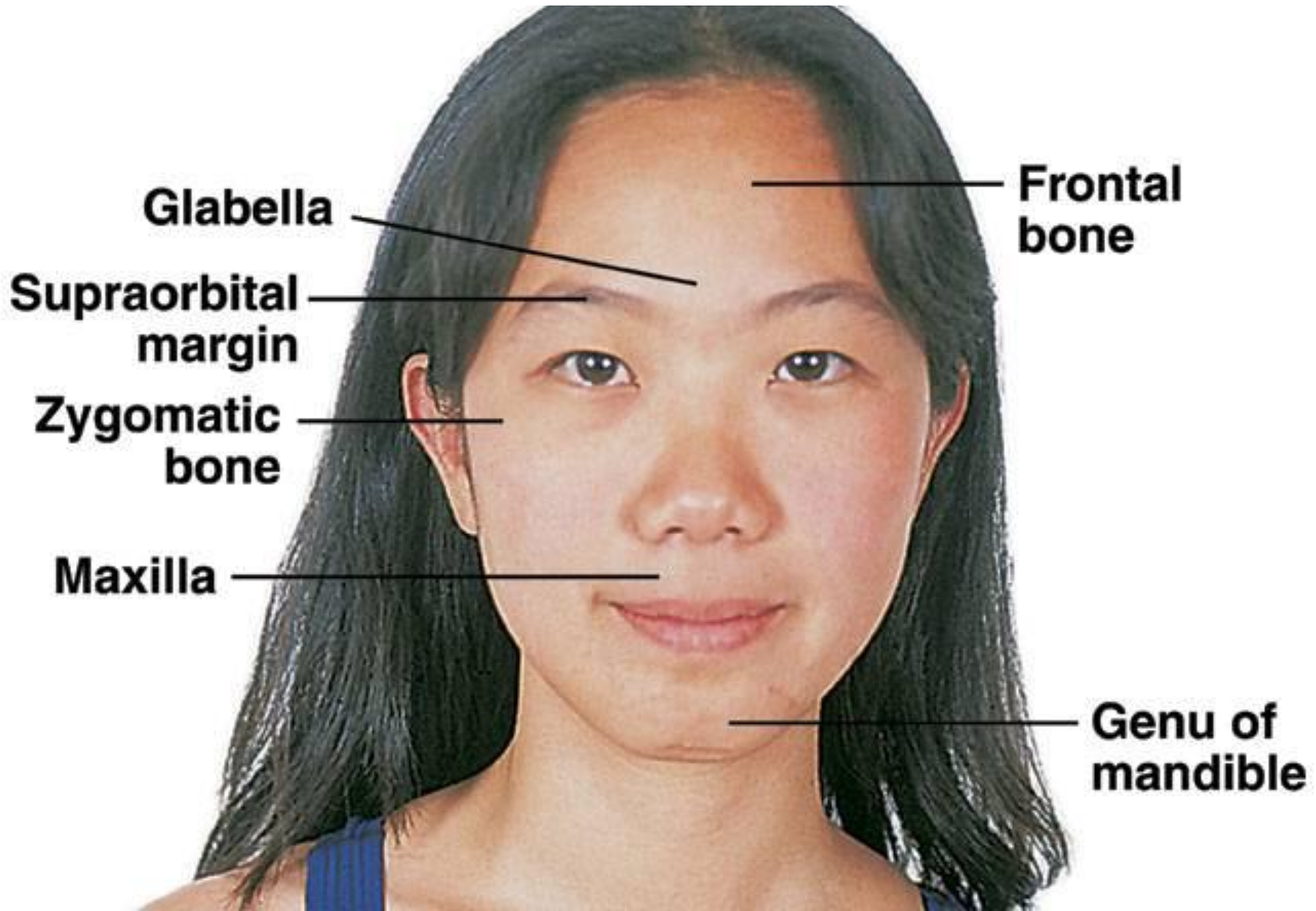
Skull
(cranium)

Zygoma

Mandible

4 bones
of the
face

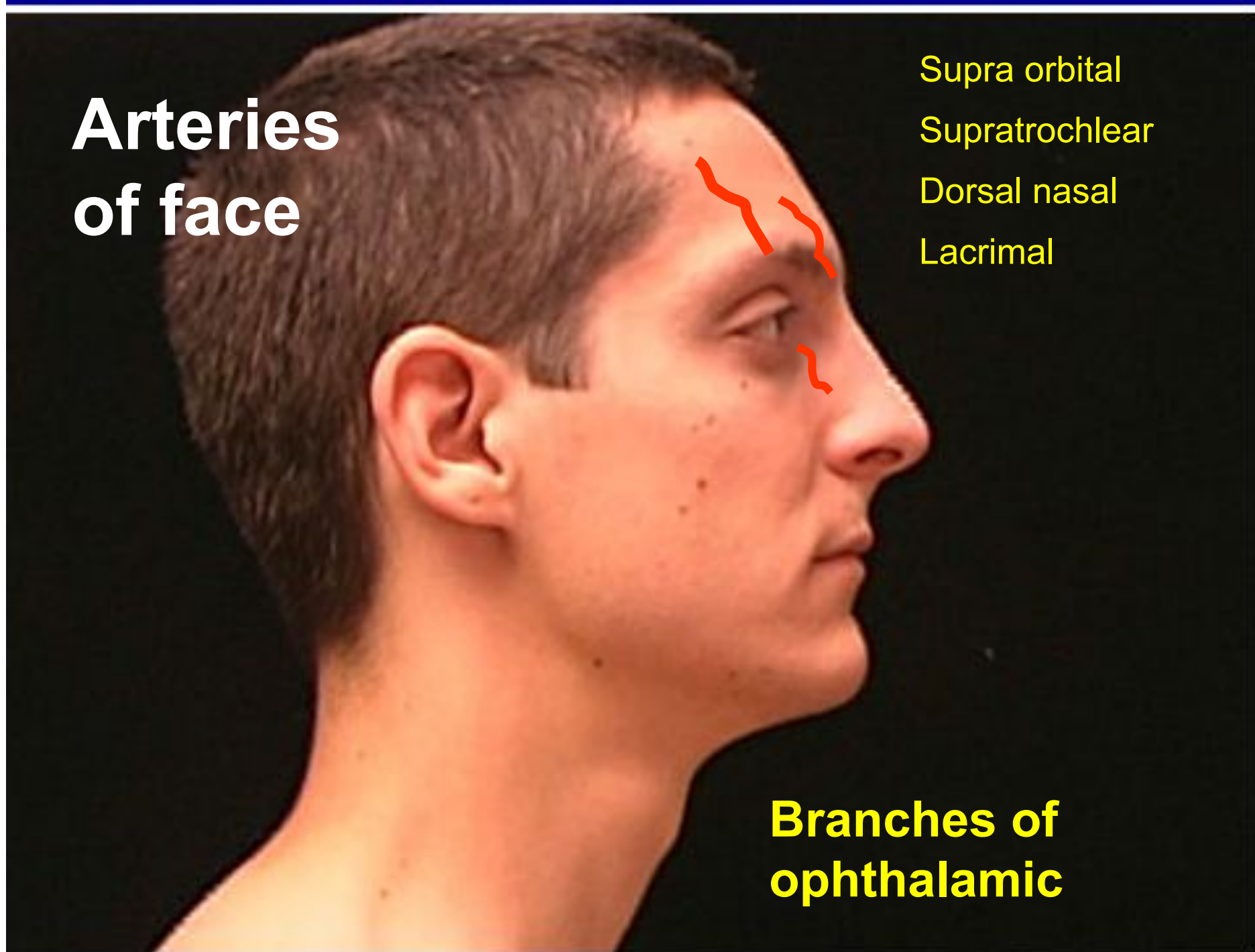
Anterior View of Bony Landmarks on the Face



Arteries of face

Supra orbital
Supratrochlear
Dorsal nasal
Lacrimal

Branches of
ophthalmic



Arteries of face

Angular

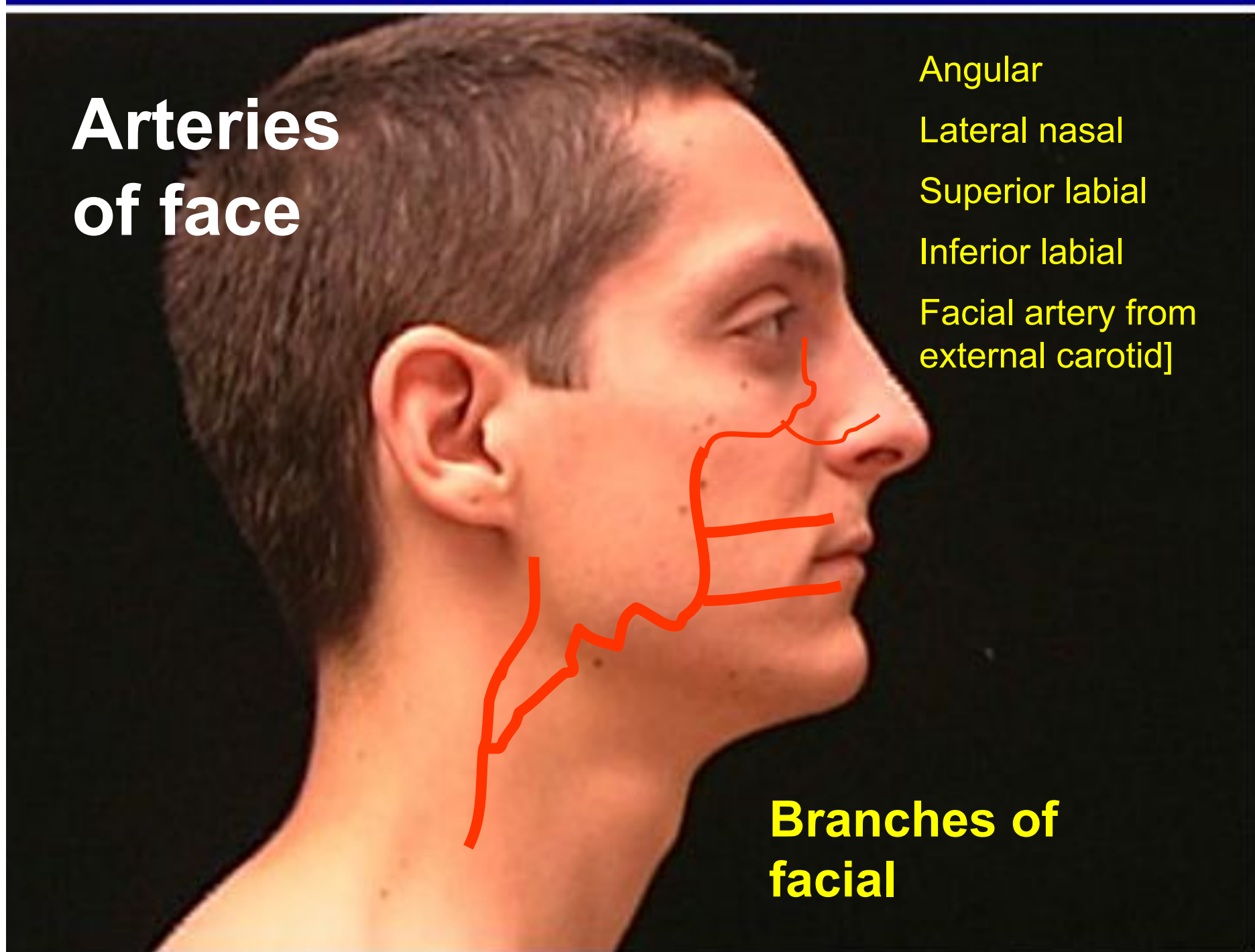
Lateral nasal

Superior labial

Inferior labial

Facial artery from
external carotid]

Branches of
facial



Arteries of face

Supra orbital
Supratrochlear
Dorsal nasal
Lacrimal

Branches of
maxillary



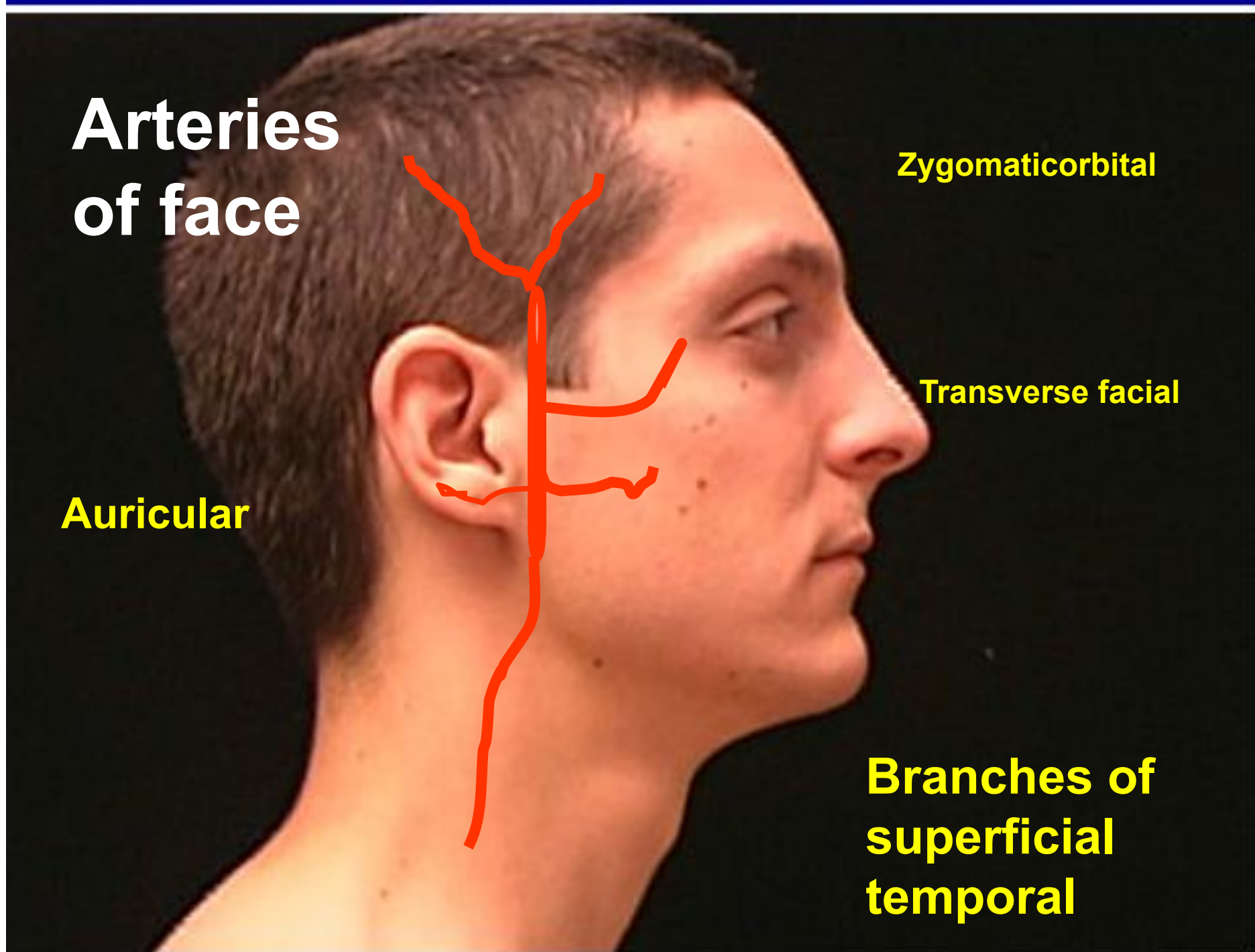
Arteries of face

Zygomaticorbital

Transverse facial

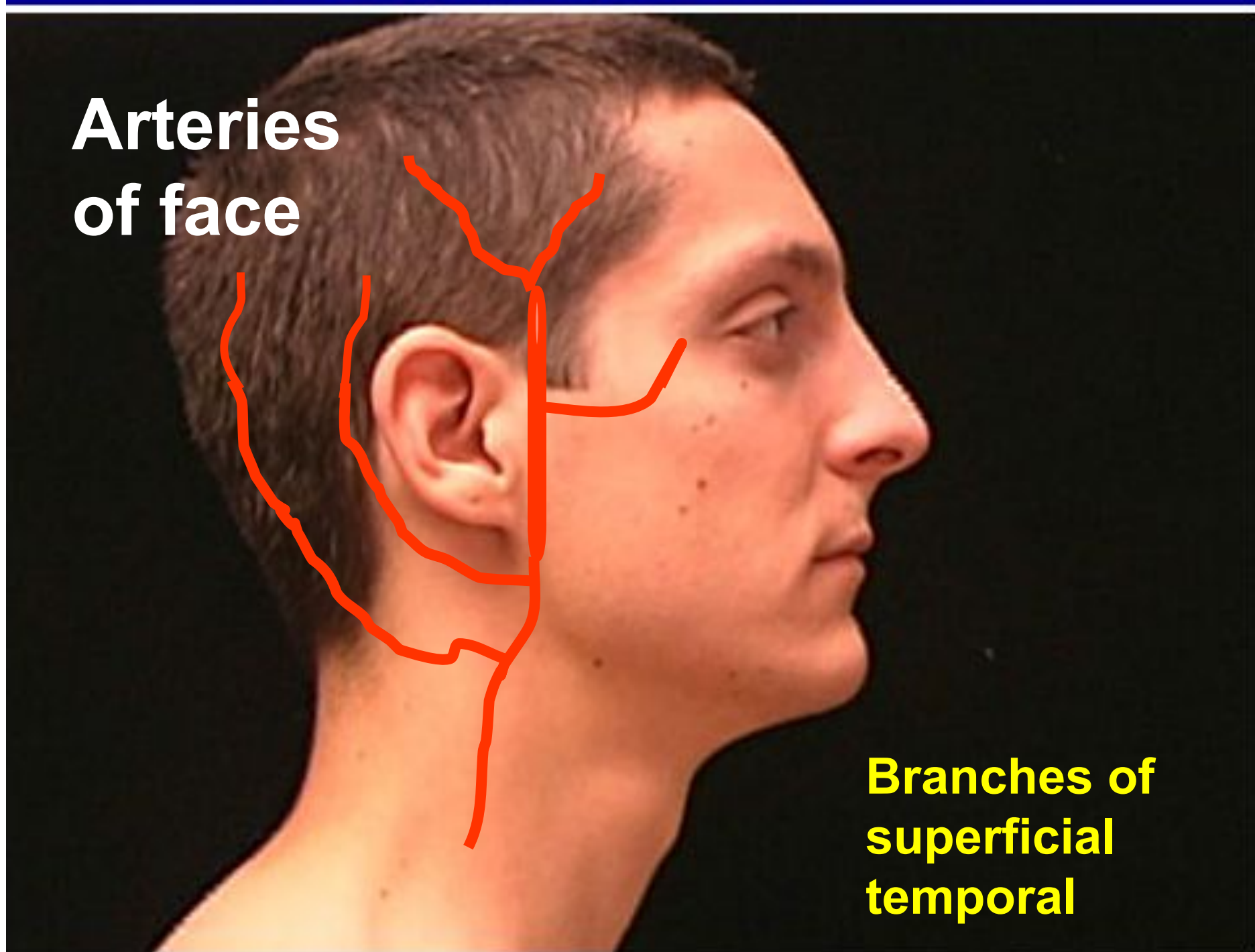
Auricular

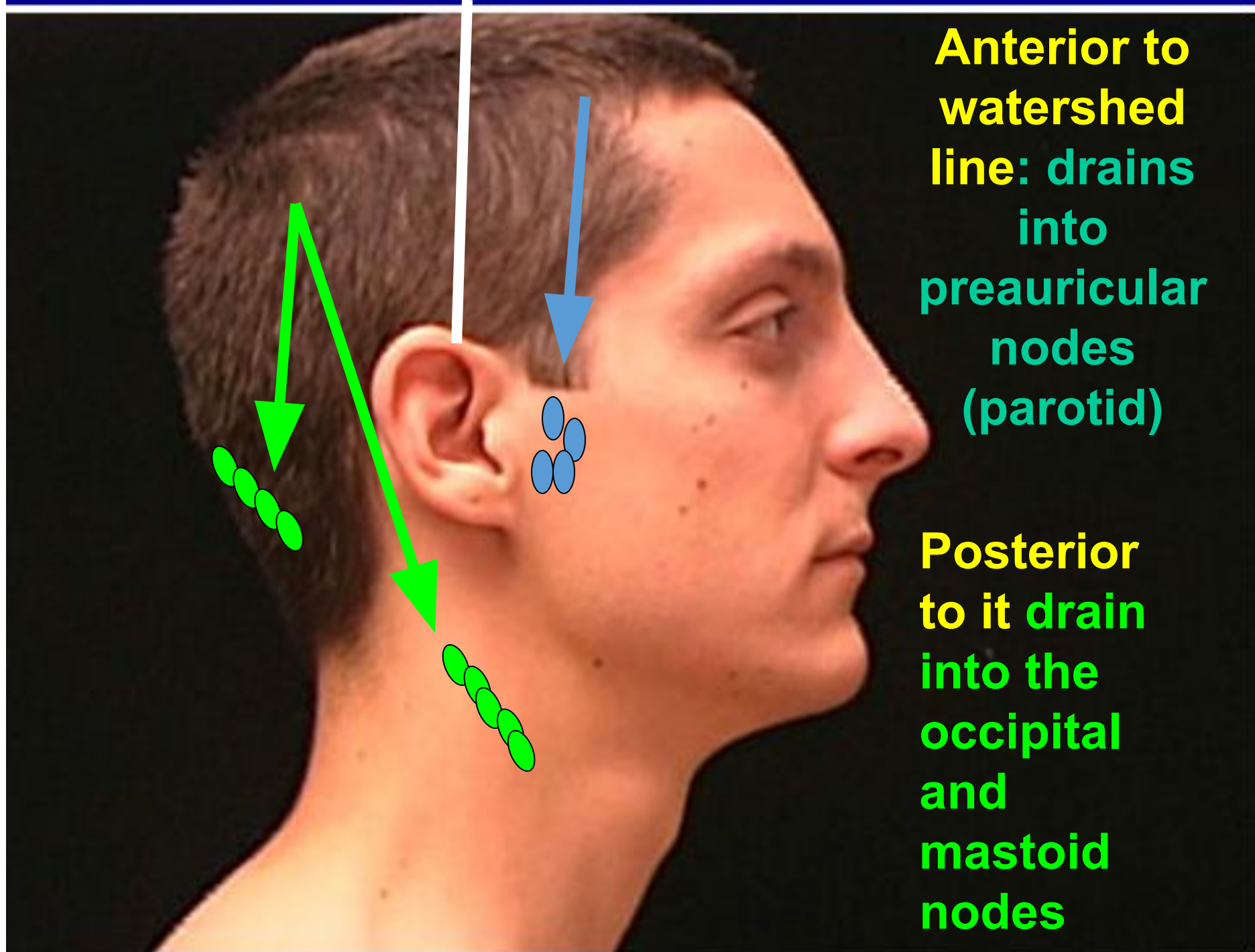
Branches of
superficial
temporal



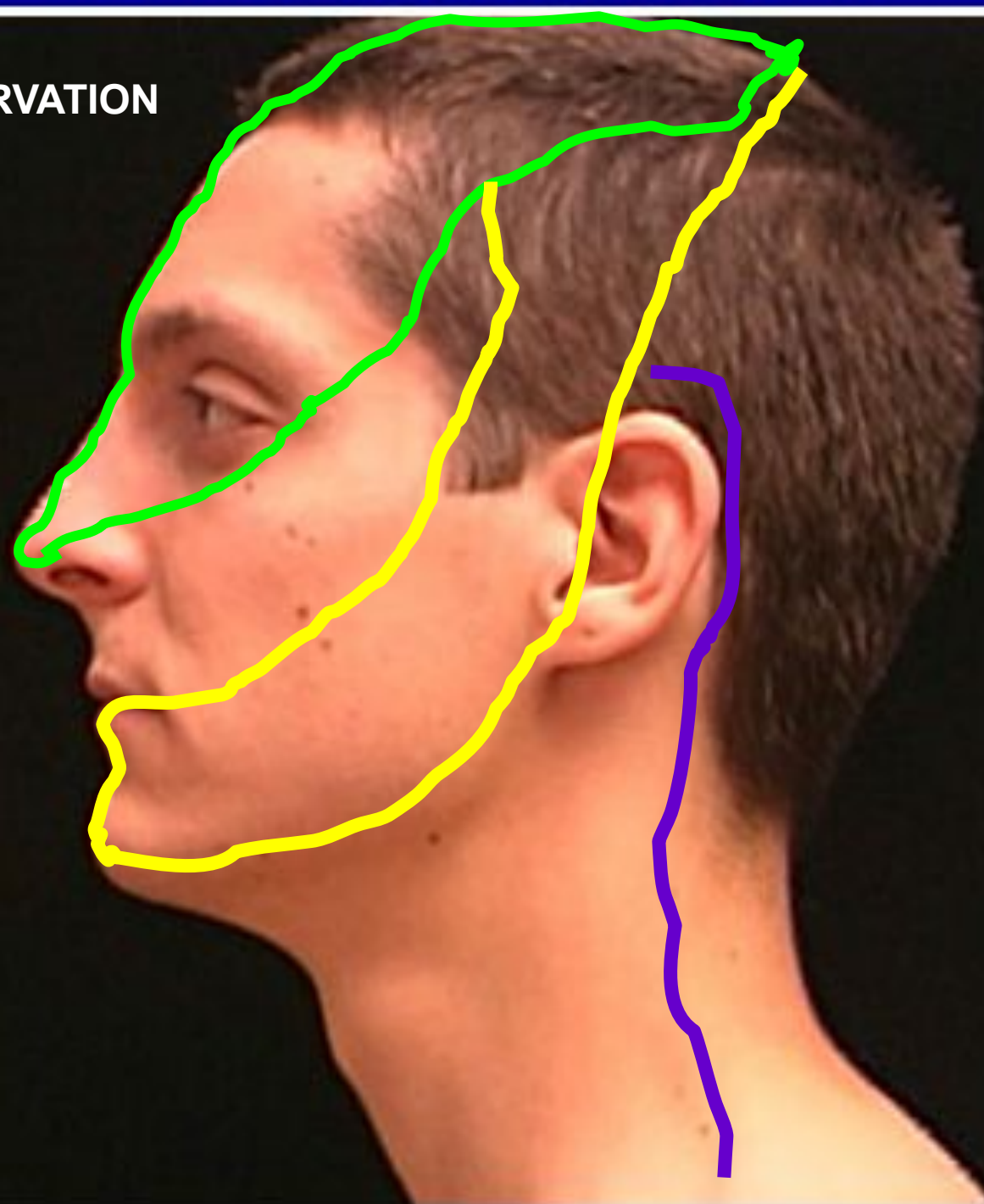
Arteries of face

Branches of
superficial
temporal





SENSORY INNERVATION



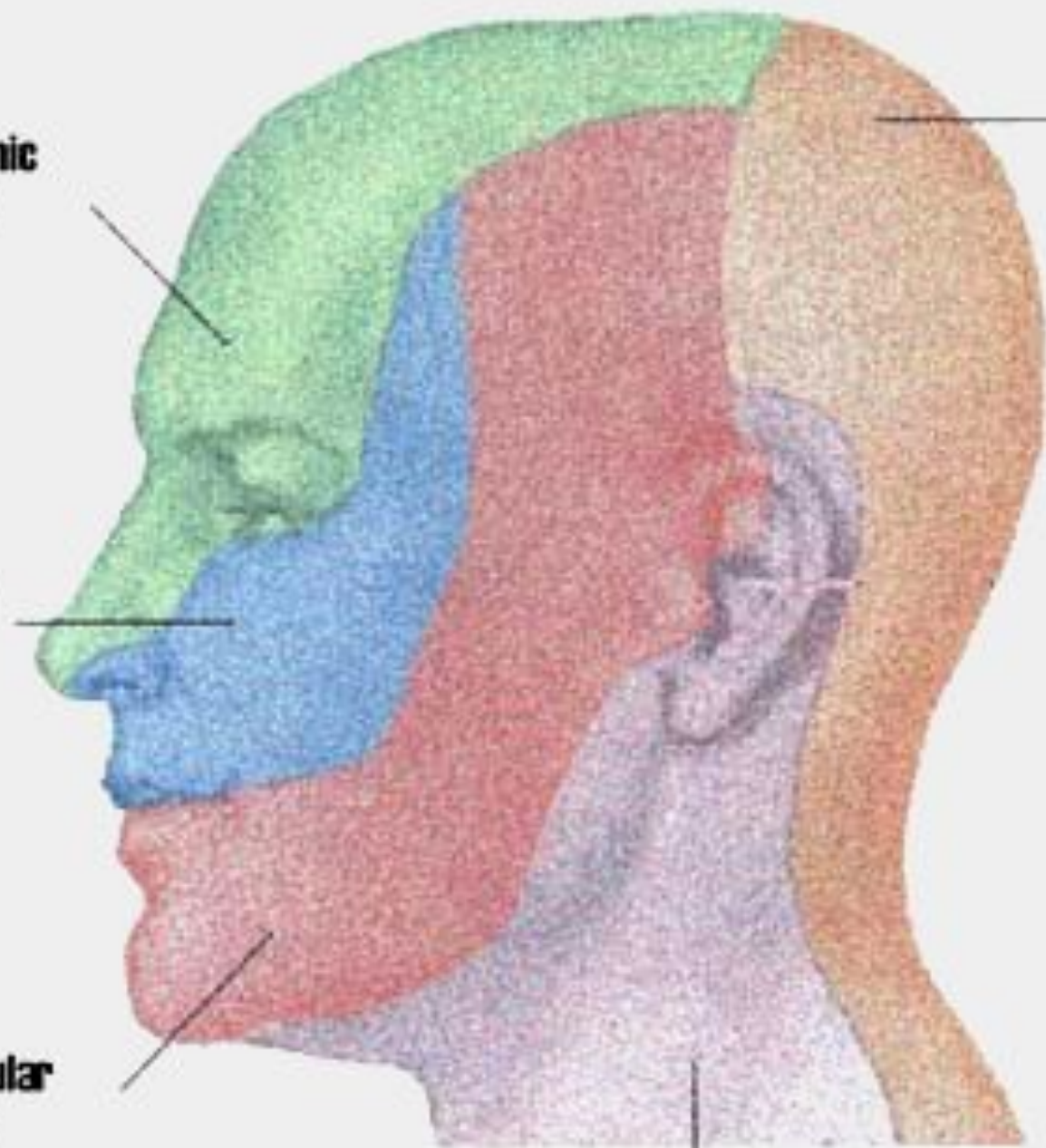
**Ophthalmic
Division**

**Maxillary
Division**

**Mandibular
Division**

**Greater
Occipital
Nerve**

C2,3



MUSCLES OF THE FACE

Sphincters

Dilators

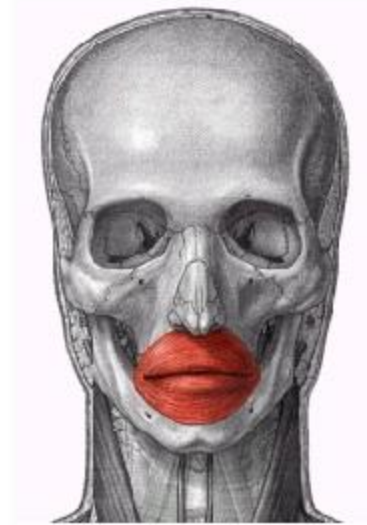
Expressors

MUSCLES OF THE FACE

Sphincters

ORBICULARIS ORIS

Encircling the mouth, it inserts into muscle and skin around the mouth. This muscle closes the mouth and purses the lips - the “kissing muscle”.



ORBICULARIS OCULI

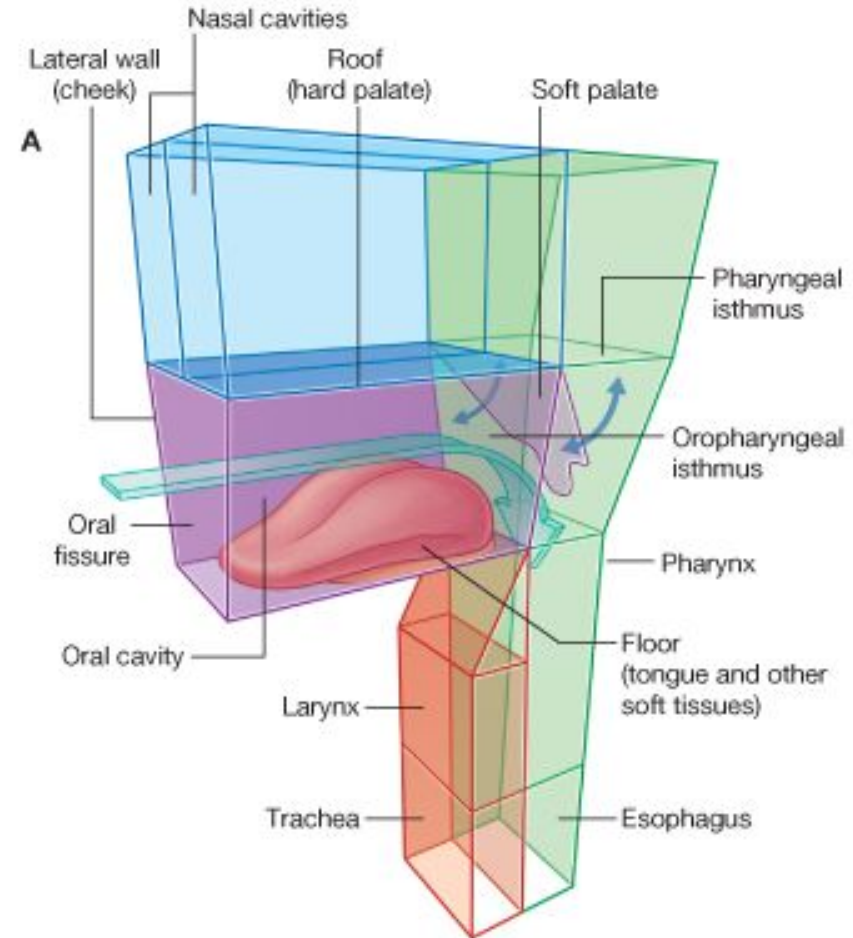
Muscles encircling the orbit of the eye. They close the eyes, produce blinking, squinting and draw the eyebrows downward.



ORAL CAVITY

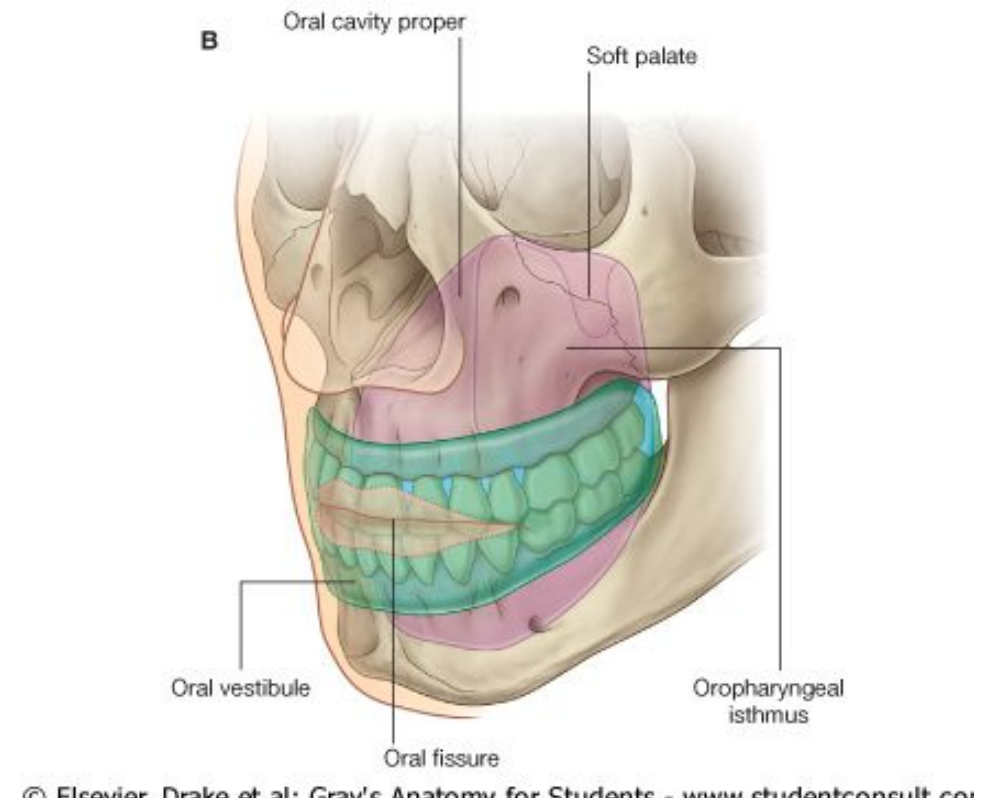
The oral cavity is inferior to the nasal cavities. It has a roof and floor, and lateral walls, opens onto the face through the oral fissure, and is continuous with the cavity of the pharynx at the oropharyngeal isthmus.

The roof of the oral cavity consists of the hard and soft palates. The floor is formed mainly of soft tissues, which include a muscular diaphragm and the tongue. The lateral walls (cheeks) are muscular and merge anteriorly with the lips surrounding the oral fissure (the anterior opening of the oral cavity).



oral cavity is separated into two regions by the upper and lower dental arches consisting of the teeth and alveolar bone that supports them

the outer **oral vestibule**, which is horseshoe shaped, is between the dental arches and the deep surfaces of the cheeks and lips-the oral fissure opens into it and can be opened and closed by muscles of facial expression, and by movements of the lower jaw; the inner **oral cavity proper**, which is enclosed by the dental arches



Multiple nerves innervate the oral cavity

General sensory innervation is carried predominantly by branches of the trigeminal nerve [V]:

the upper parts of the cavity, including the palate and the upper teeth, are innervated by branches of the **maxillary nerve [V2]**;

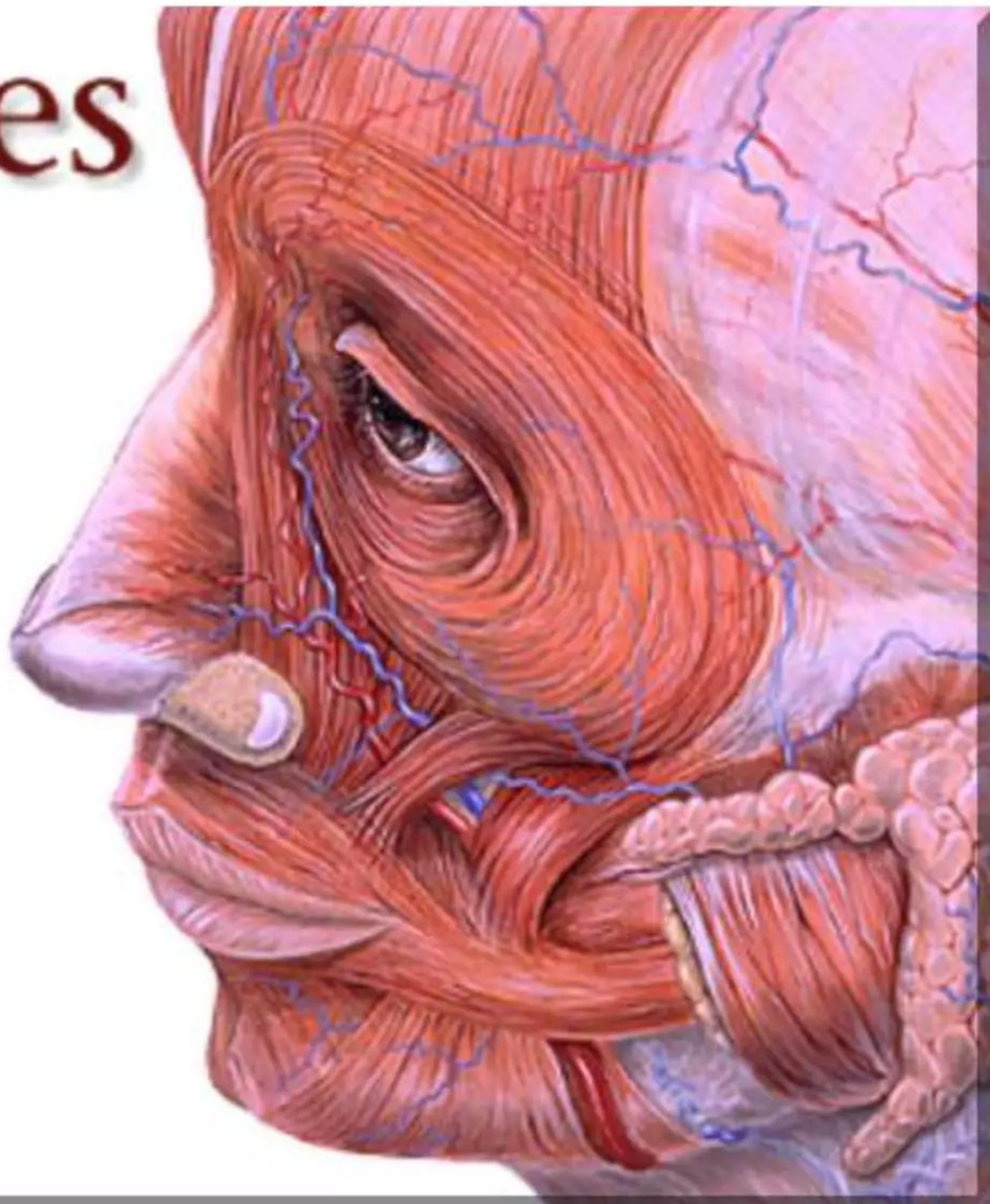
the lower parts, including the teeth and oral part of the tongue, are innervated by branches of the **mandibular nerve [V3]**

taste (special afferent-SA) from the oral part or **anterior two-thirds of the tongue** is carried by branches of the **facial nerve [VII]**, which join and are distributed with branches of the trigeminal nerve [V];

All muscles of the tongue are innervated by the **hypoglossal nerve [XII]**, except the palatoglossus, which is innervated by the vagus nerve [X].

Cranial Nerves

- I Olfactory
- II Optic
- III Oculomotor
- IV Trochlear
- V Trigeminal
- VI Abducens
- VII Facial
- VIII Vestibulocochlear
- IX Glossopharyngeal
- X Vagus
- XI Accessory
- XII Hypoglossal



I. Olfactory Nerve

❖ Component: Sensory

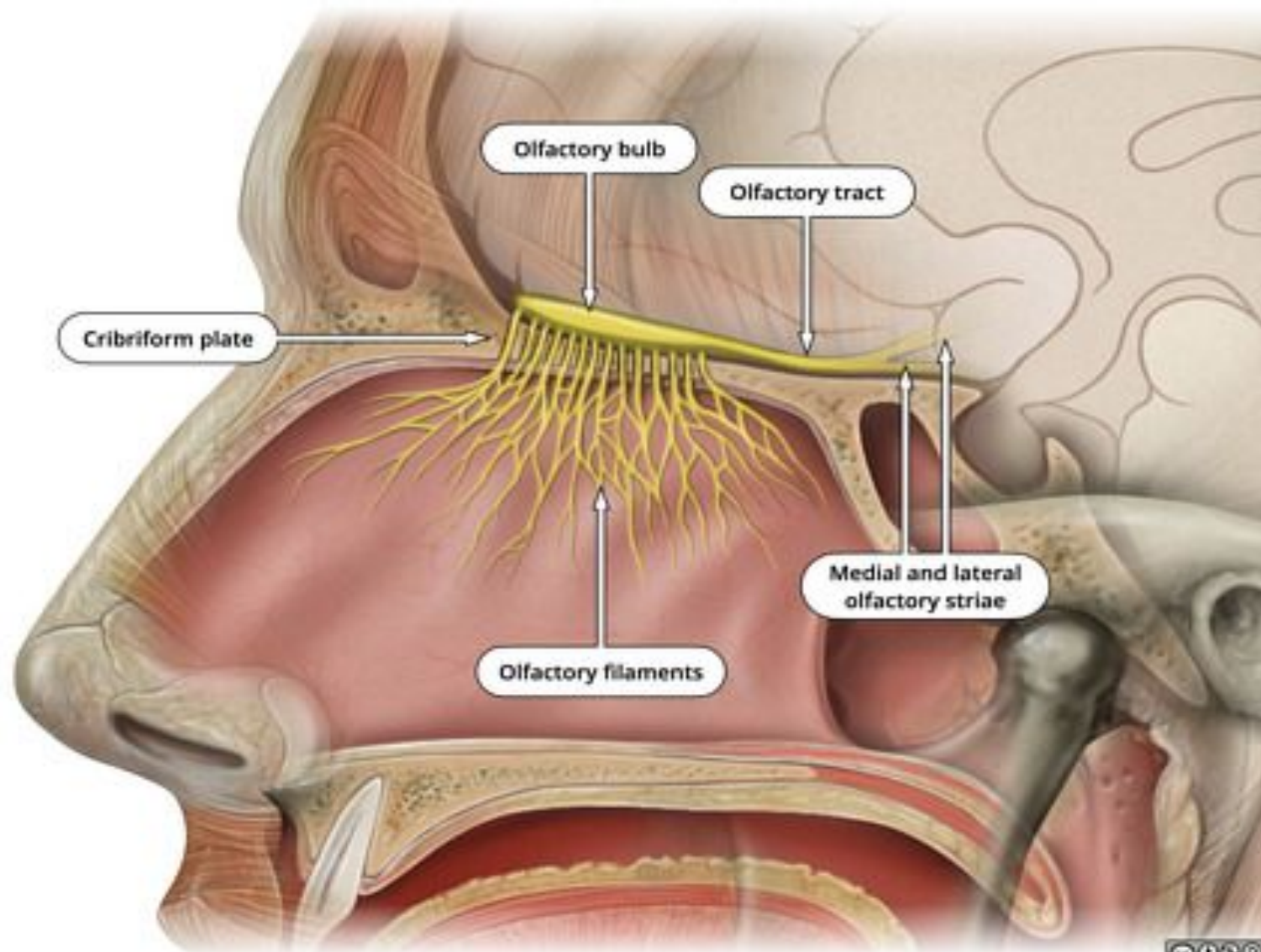
❖ Function: Smell

❖ Origin: Olfactory receptor nerve cells

❖ Opening to the Skull: Openings in cribriform plate of ethmoid



Olfactory nerve



II. Optic Nerve

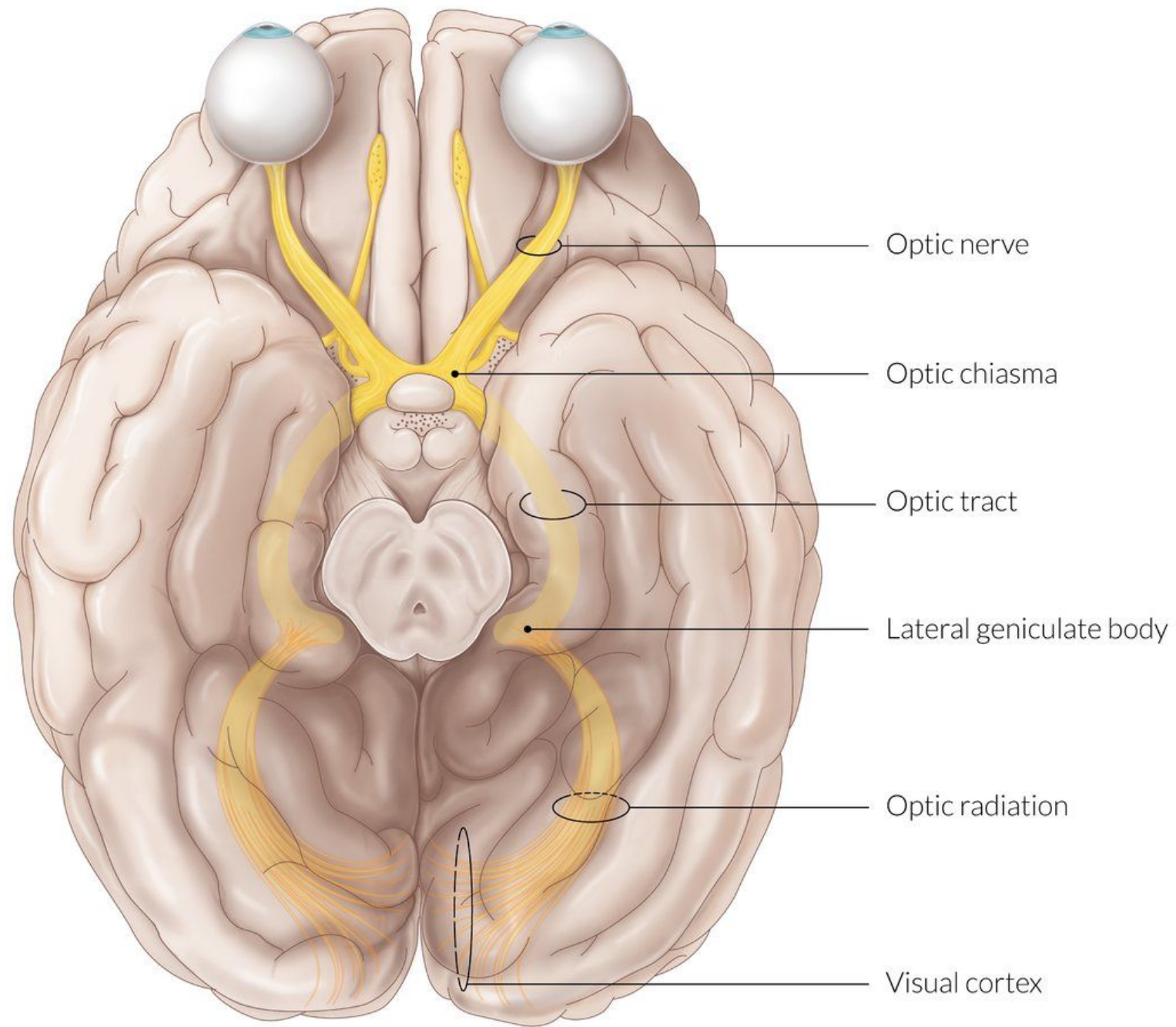
☐ Component: Sensory

☐ Function: Vision

☐ Origin: Back of the eyeball

☐ Opening to the Skull: Optic Canal





III. Oculomotor Nerve

- Component: Motor

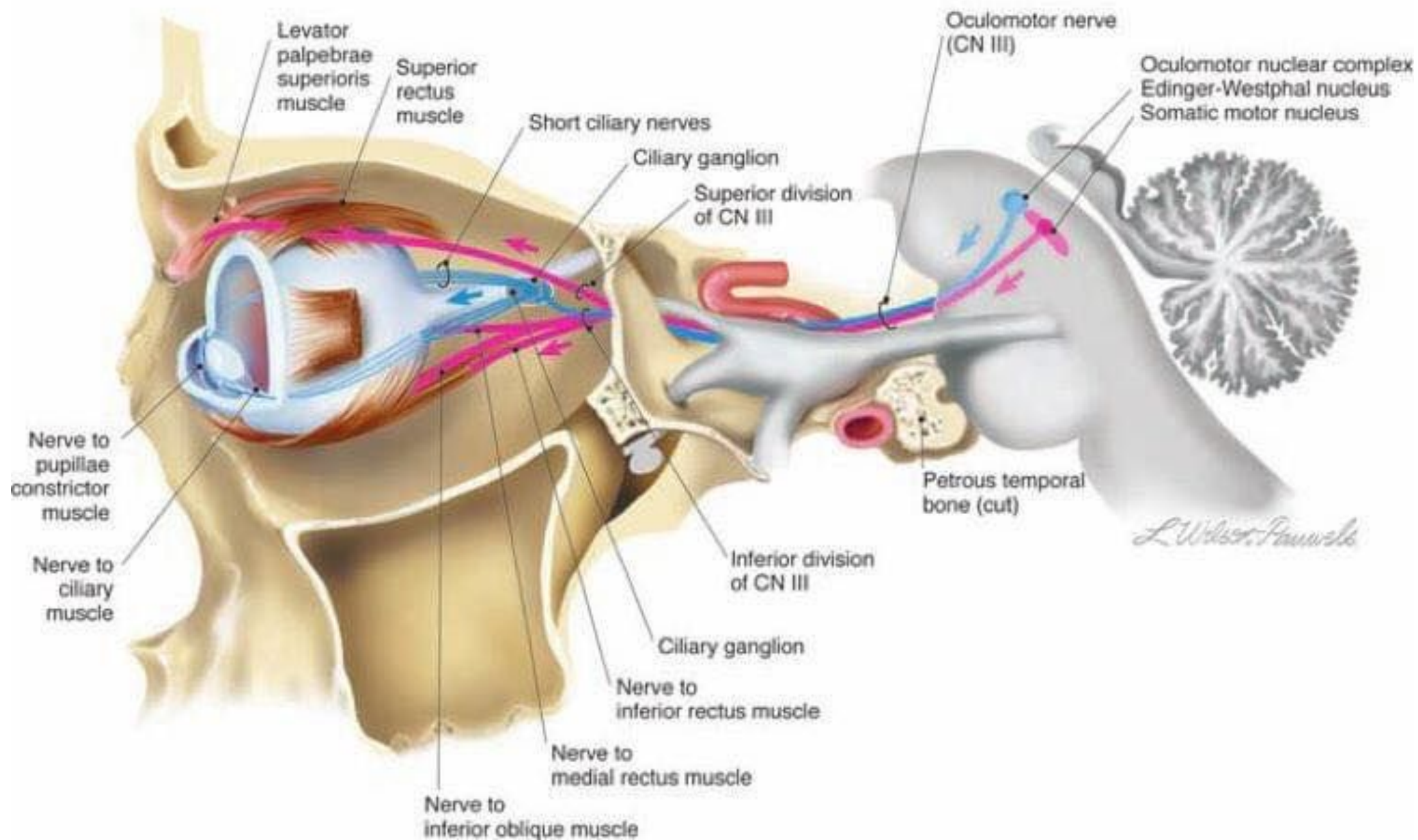
- Function:

- Raises upper eyelid
- Turns eyeball upward, downward and medially
- Constricts pupil
- Accommodates the eye



- Origin: Anterior surface of the midbrain

- Opening to the Skull: Superior orbital fissure



IV. Trochlear Nerve

✓ Component: **Motor**



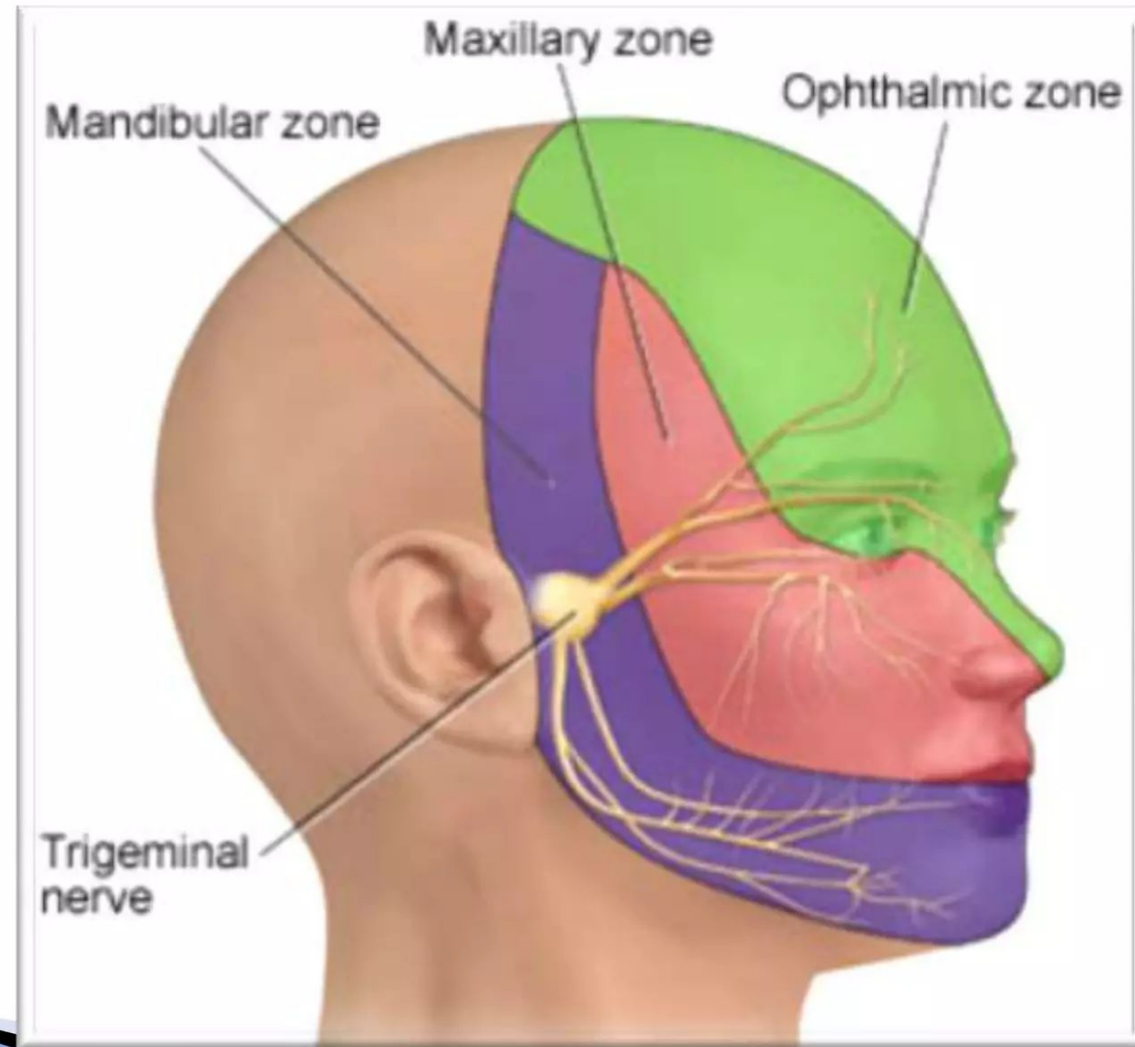
✓ Function: **Assisting in turning eyeball downward and laterally**



✓ Origin: **Posterior surface of the midbrain**

✓ Opening to the Skull: **Superior orbital fissure**

V. Trigeminal Nerve



V1. Ophthalmic Nerve

❖ Component: Sensory

❖ Function:

- ❖ Cornea
- ❖ Skin of forehead
- ❖ Scalp
- ❖ Eyelids and nose
- ❖ Mucous membranes of paranasal sinuses and nasal cavity

❖ Origin: Anterior aspect of the pons

❖ Opening to the Skull: Superior orbital fissure

V2. Maxillary Nerve

- Component: Sensory

- Function:
 - Skin of the face over maxilla
 - Teeth of the upper jaw
 - Mucous membrane of the nose, the maxillary sinus and palate

- Origin: Anterior aspect of the pons

- Opening to the Skull: Foramen ovale

V3. Mandibular Nerve

- Component: a. Motor

- Function:
 - Muscles of mastication
 - Mylohyoid
 - Anterior belly of digastric
 - Tensor veli palatine
 - Tensor tympani

- Origin: Anterior aspect of the pons

- Opening to the Skull: Foramen Rotundum

VI. Abducent Nerve

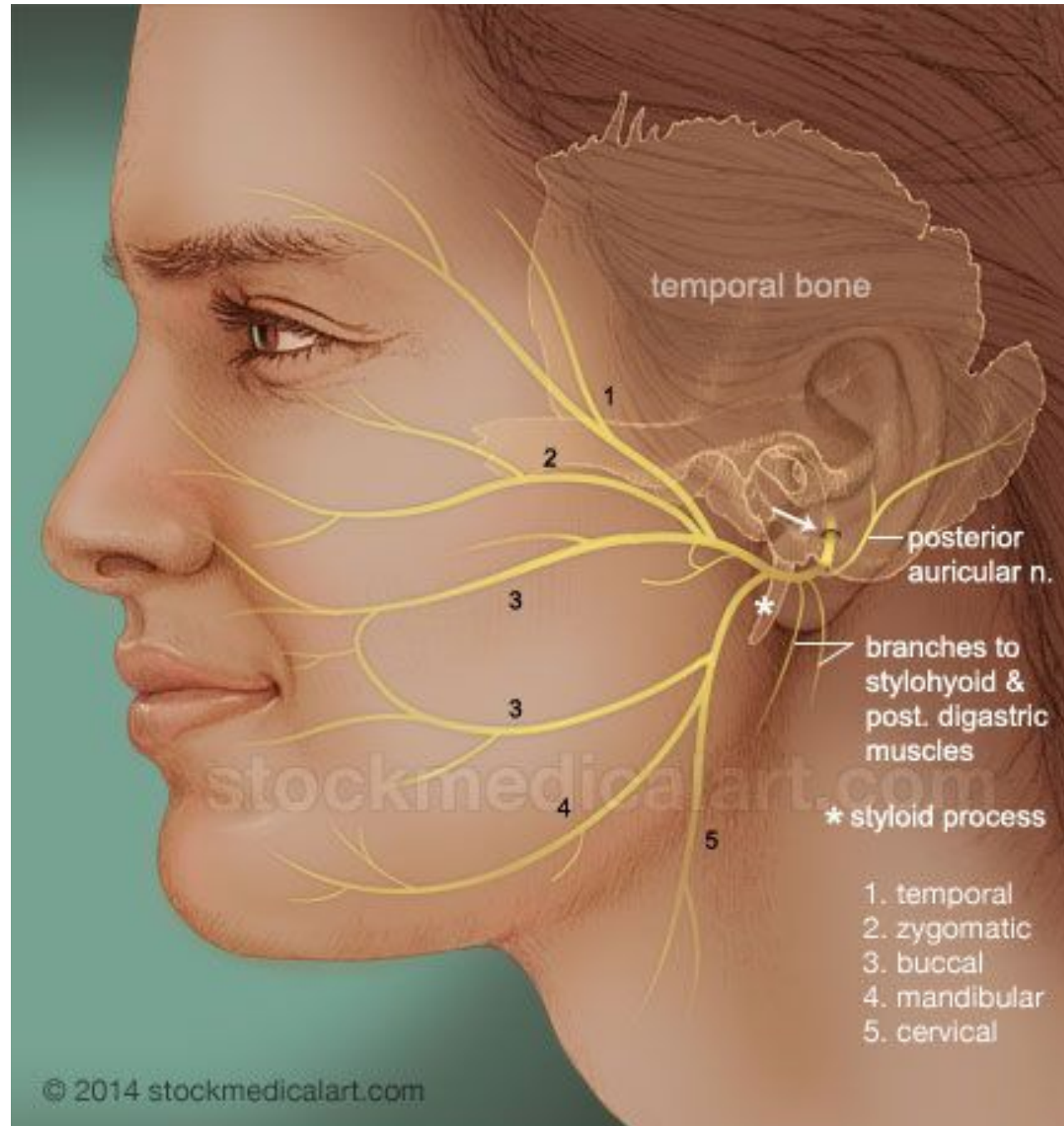


✓ Component: **Motor**

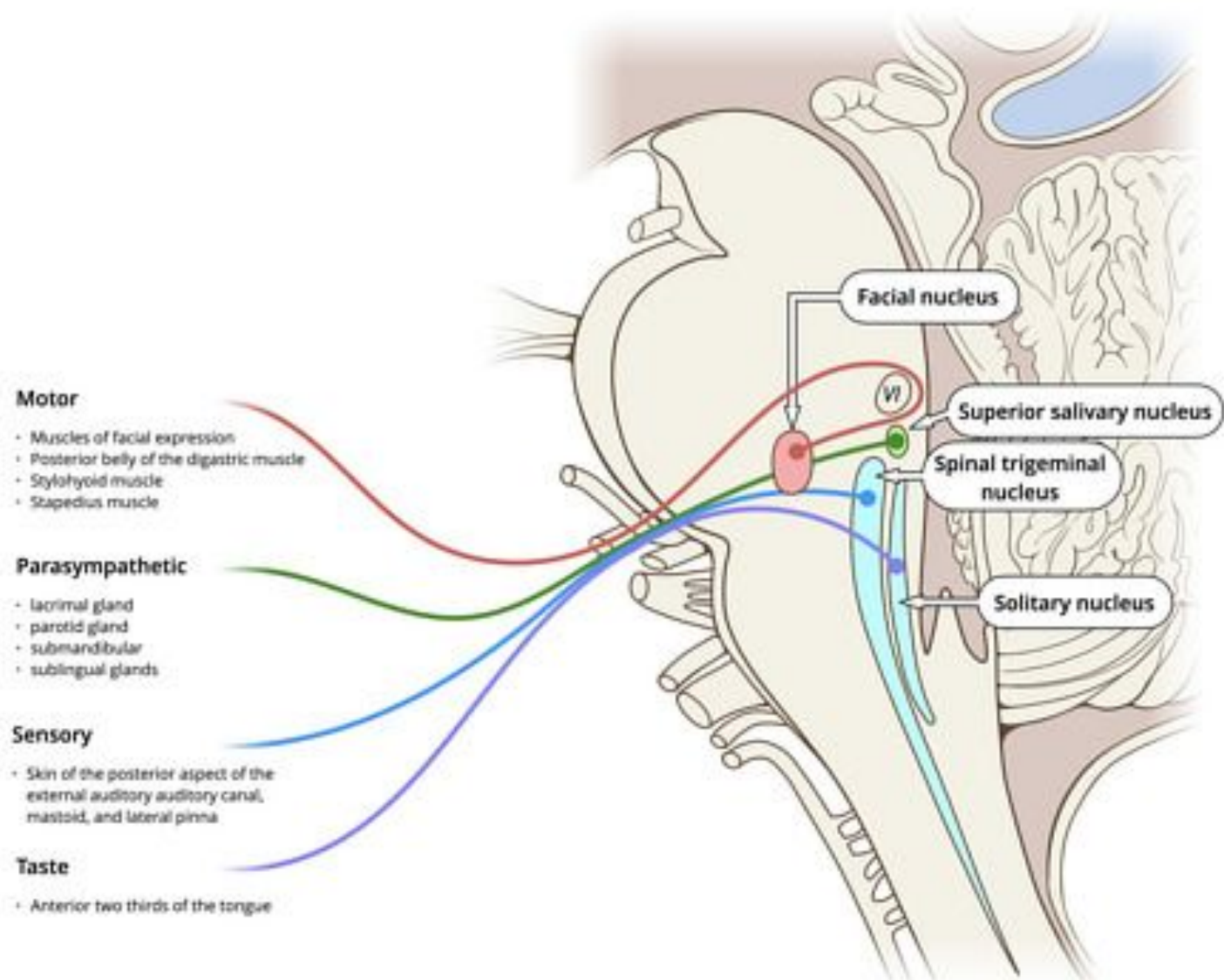
✓ Function: **Lateral rectus muscle turns eyeball laterally**

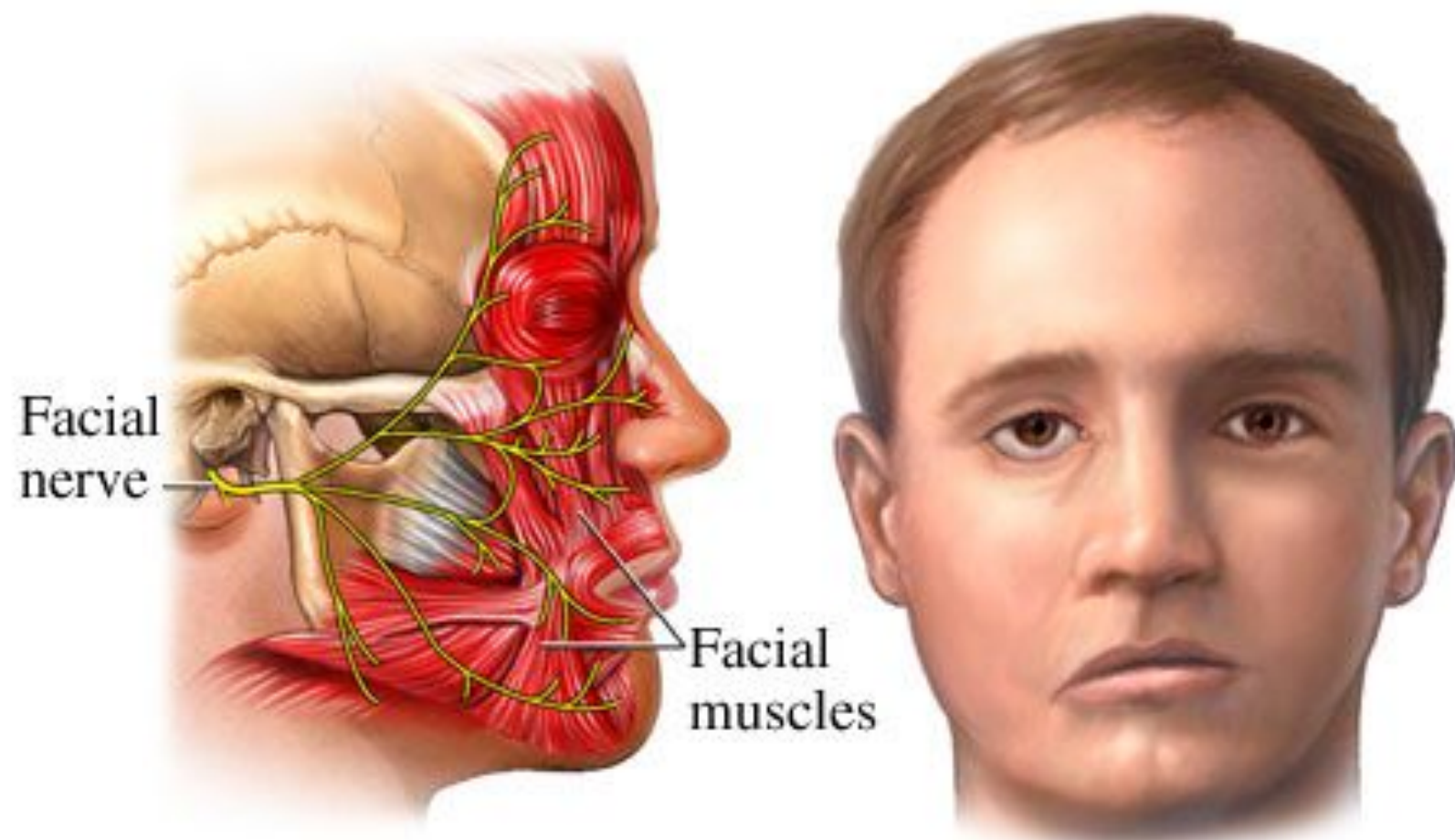
✓ Origin: **Anterior Surface of hindbrain between pons and medulla**

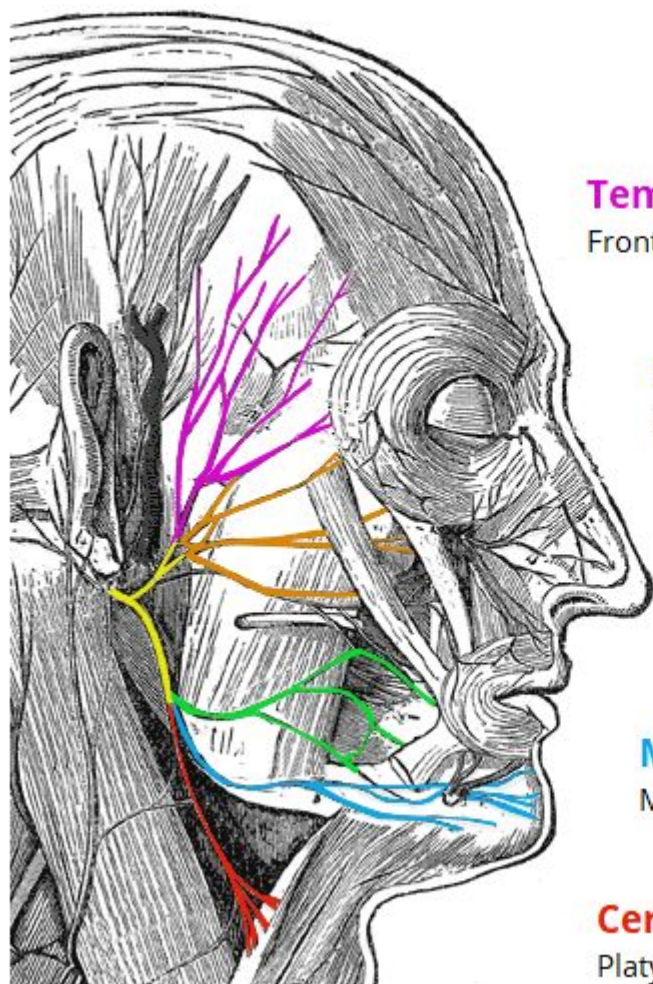
✓ Opening to the Skull: **Superior orbital fissure**



Facial nerve







Temporal branches

Frontalis, orbicularis oculi, corrugator supercilii

Zygomatic branches

Orbicularis oculi

Buccal branches

Orbicularis oris, buccinator, zygomaticus

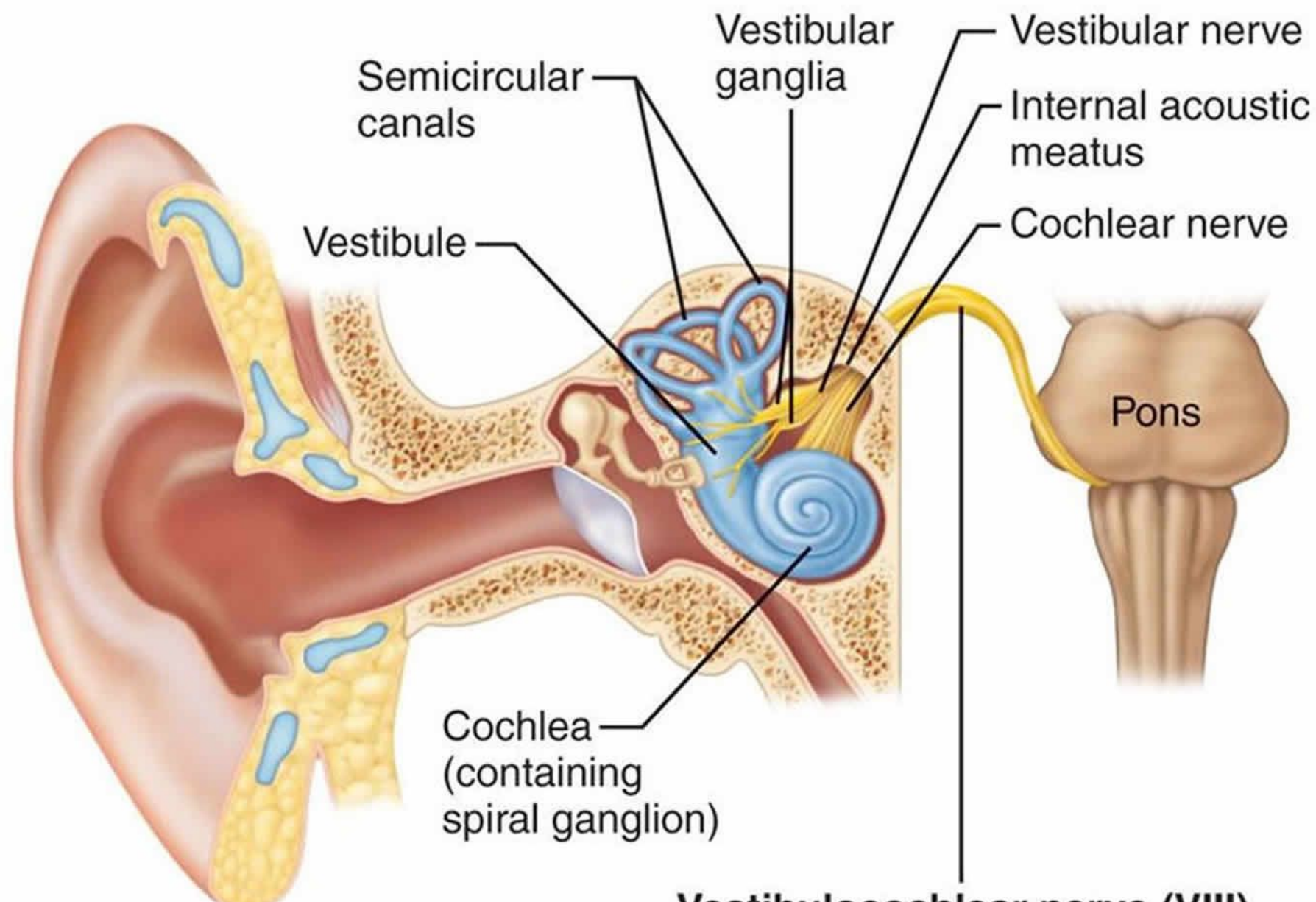
Marginal mandibular branches

Mentalis, depressor labii inferioris, depressor anguli oris

Cervical branches

Platysma

The Vestibulocochlear Nerves - VIII



Glossopharyngeal nerve

Parasympathetic

- Parotid gland

Sensory

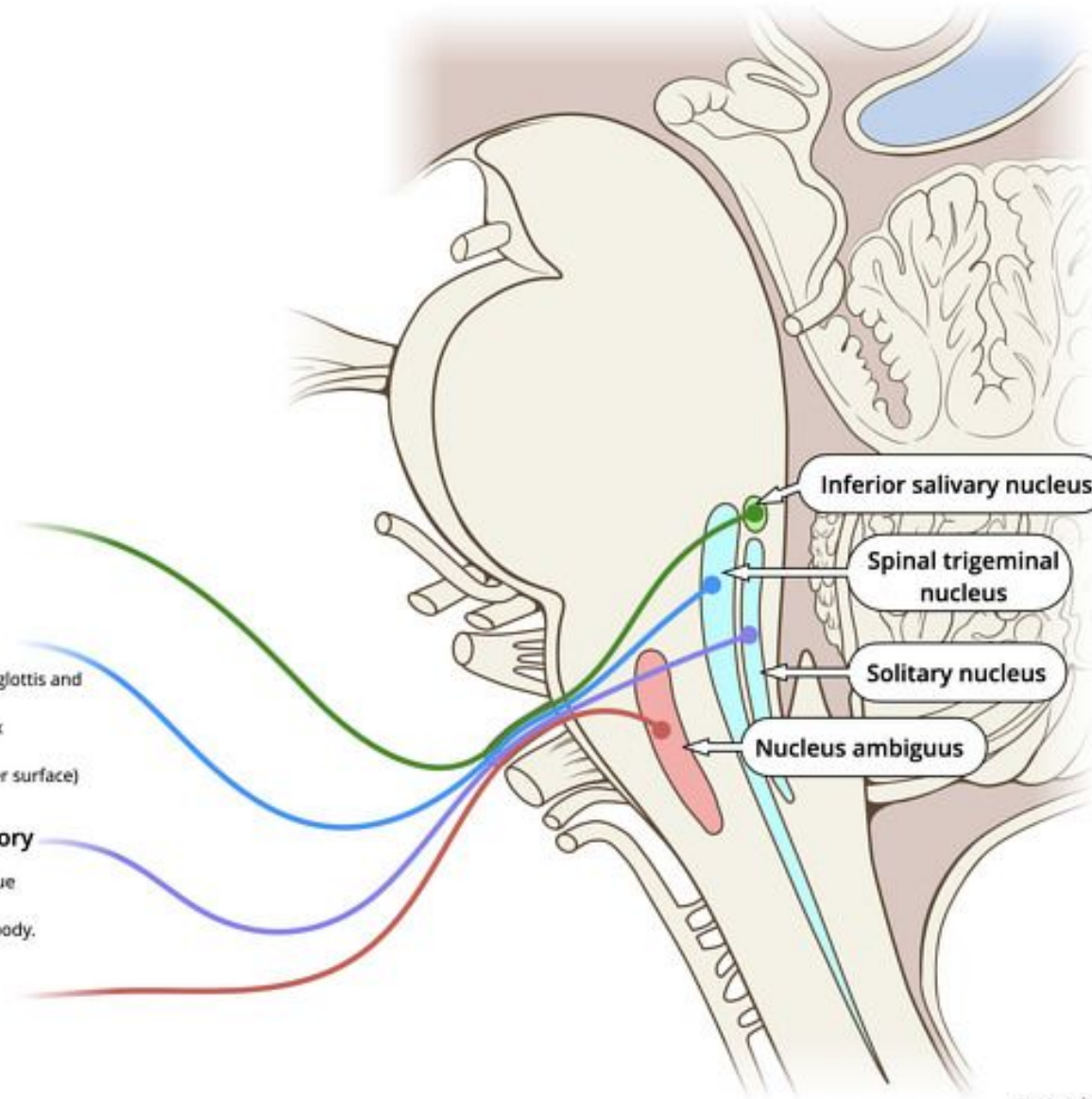
- Anterior surface of the epiglottis and vallecula
- Walls of the upper pharynx
- Skin of the external ear
- Tympanic membrane (inner surface)

Taste & visceral sensory

- Posterior third of the tongue and vallate papillae
- Carotid sinus and carotid body.

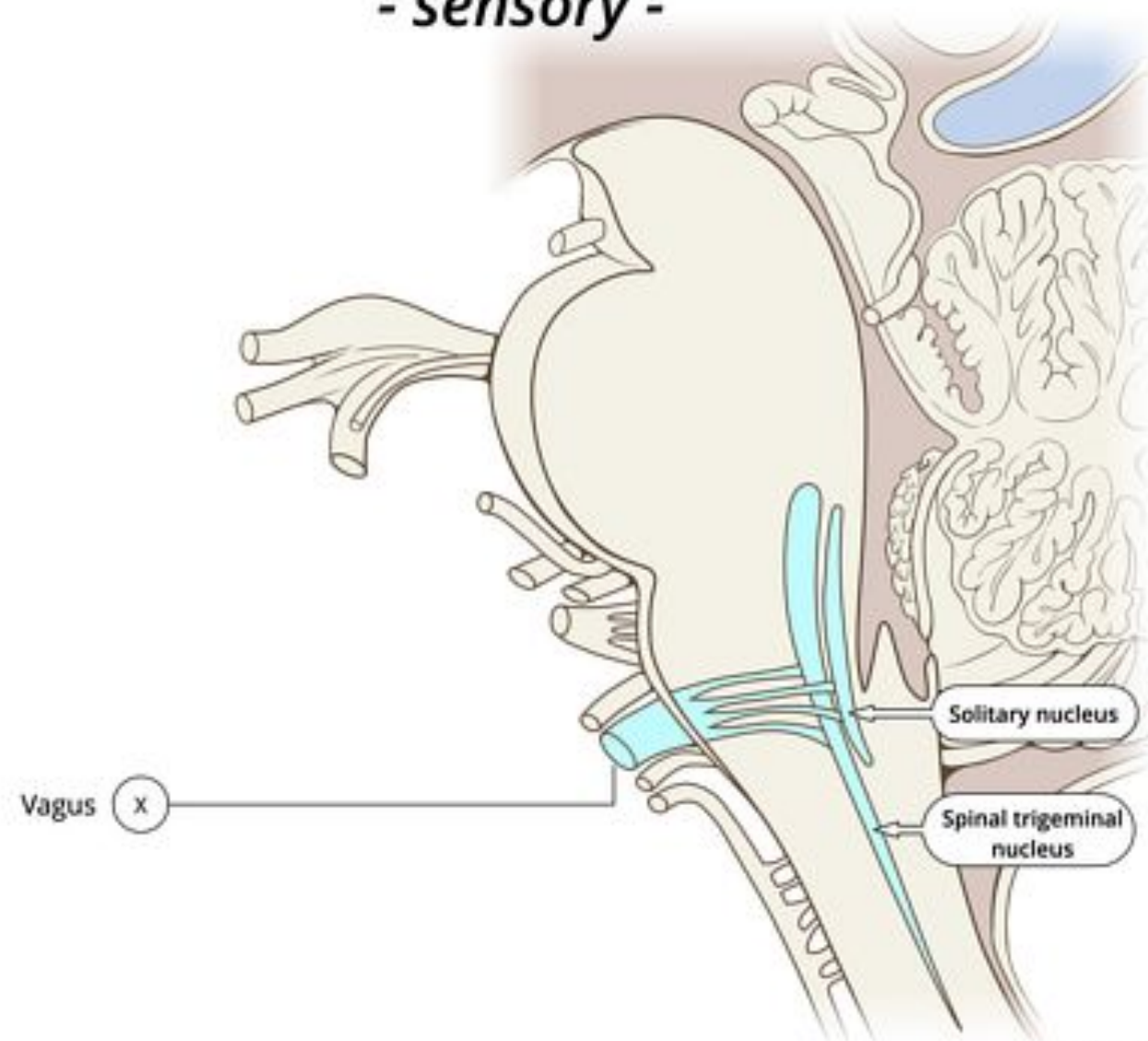
Motor

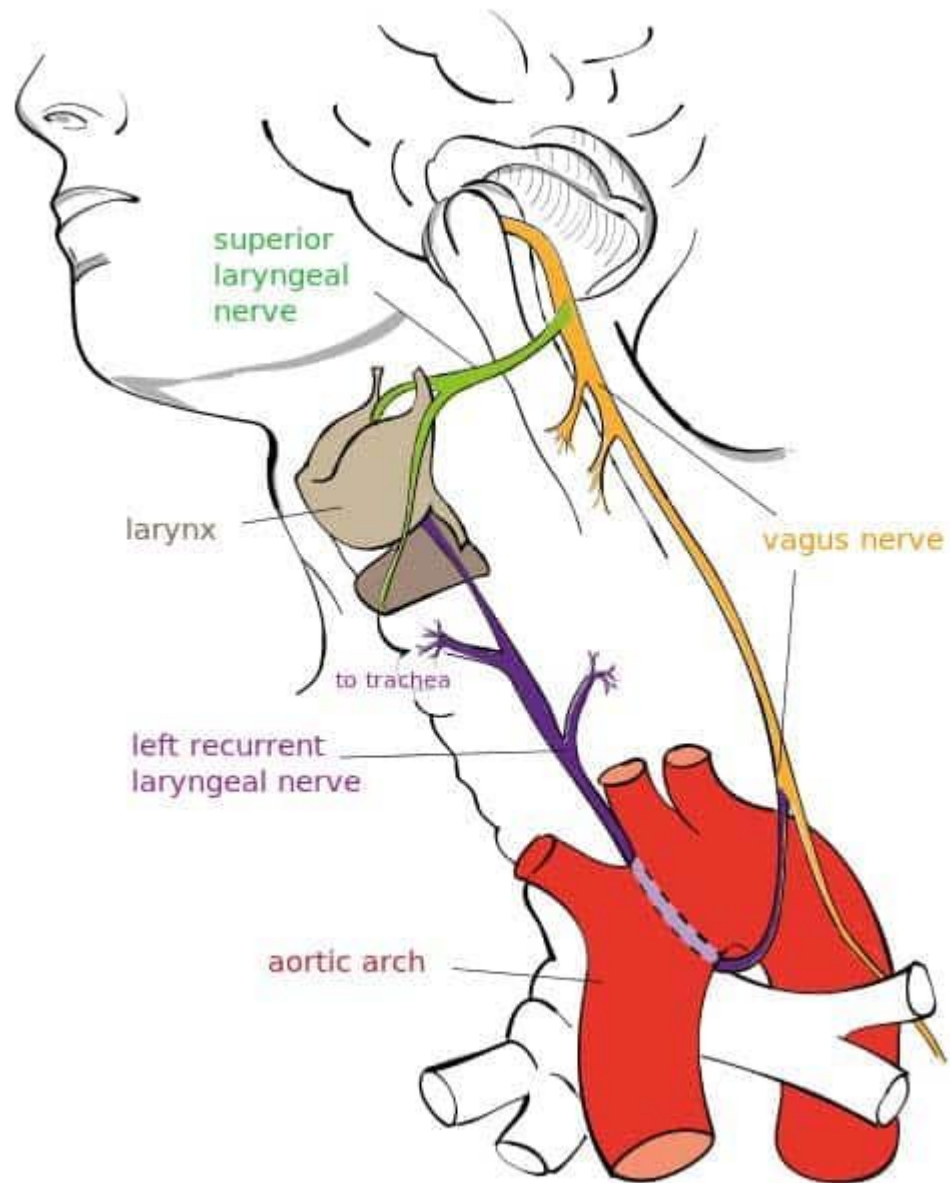
- Stylopharyngeus muscle



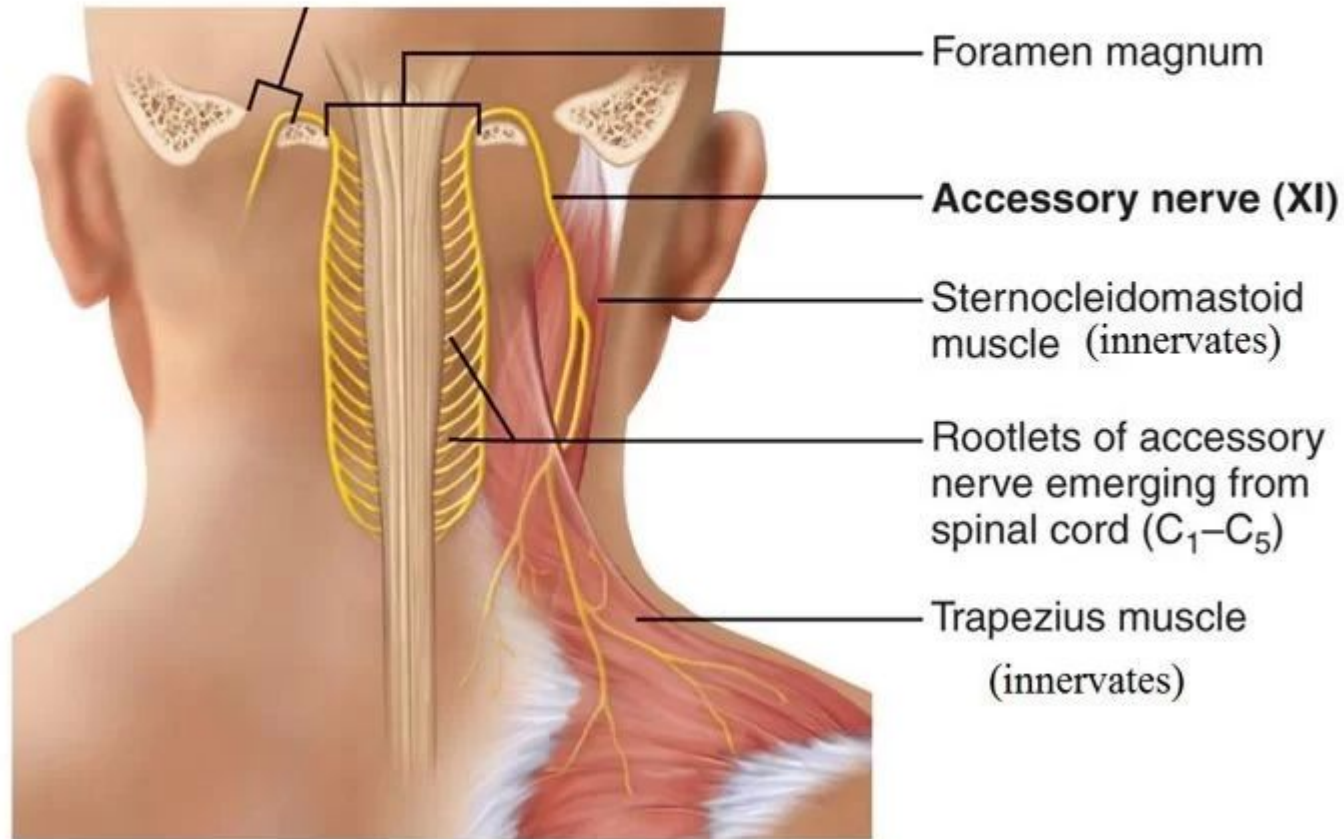
Vagus nerve

- sensory -

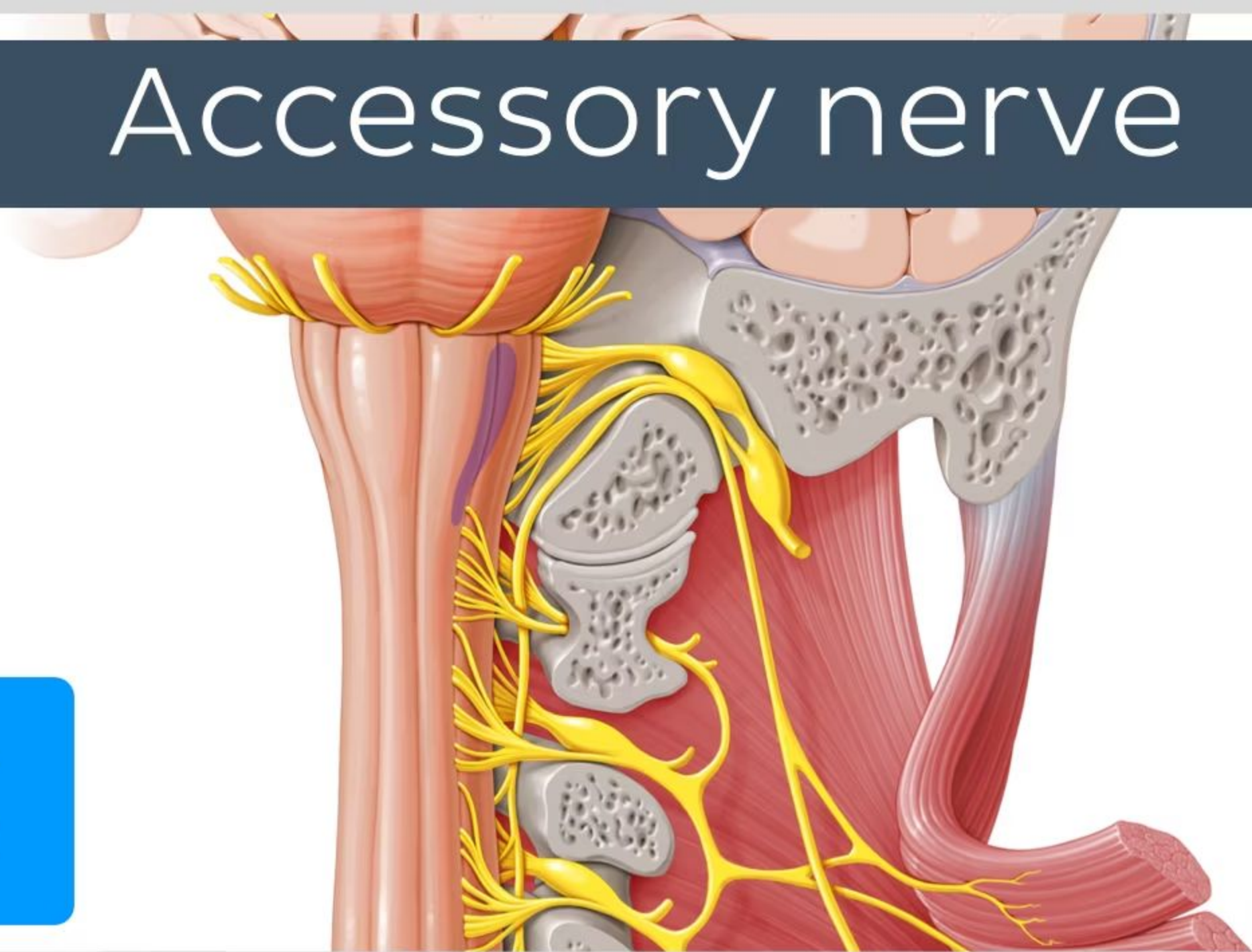




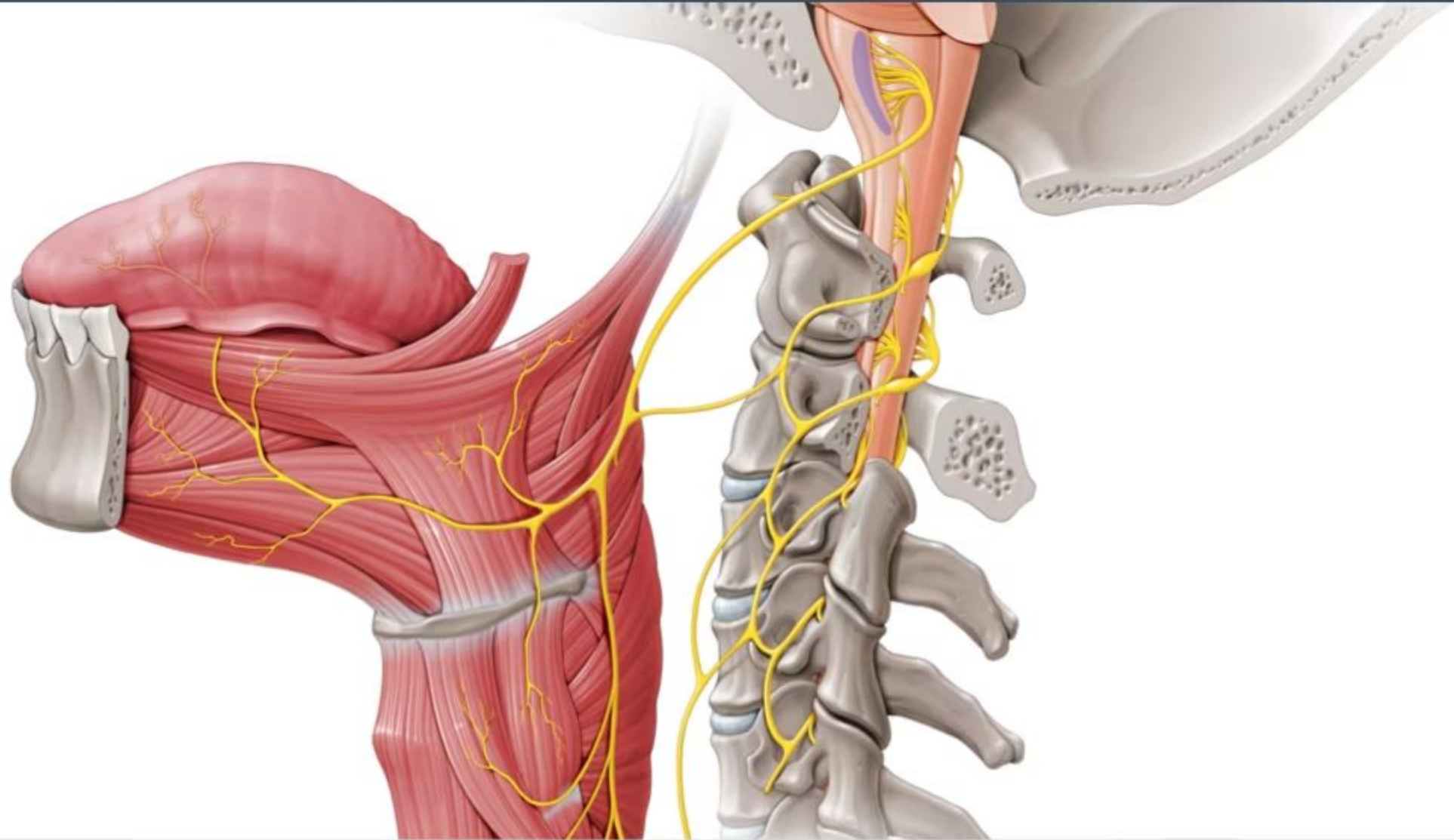
The Accessory Nerves – XI – unique origin from spinal cord



Accessory nerve



Hypoglossal nerve



K

Thanks for your attention

Questions