NEW YORK INSTITUTE OF TECHNOLOGY
College of Osteopathic Medicine

Anatomy:

Introduction to the Head & Neck

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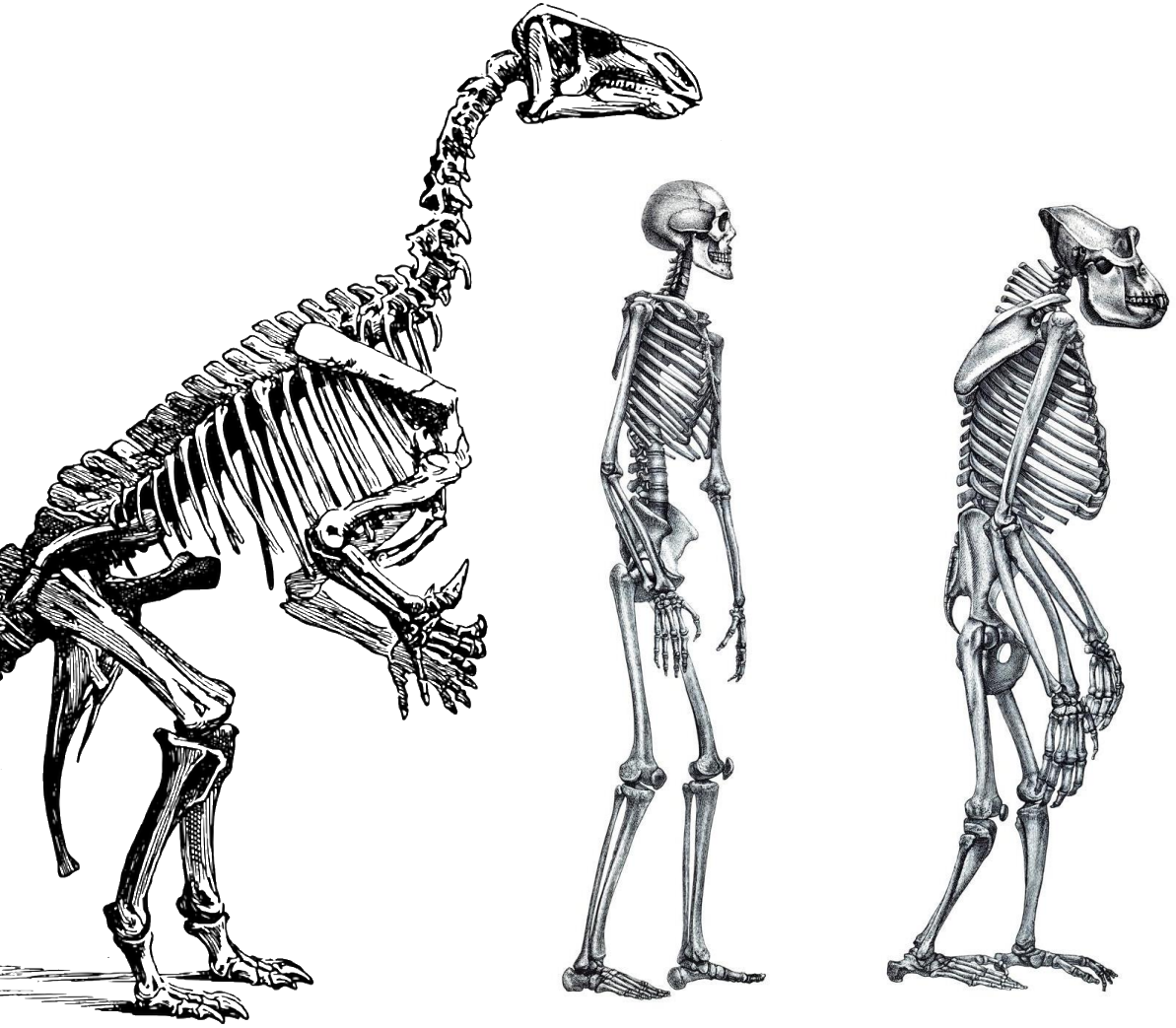
Associate Professor of Anatomy

The Head (and neck that supports it) is a Special Region

Full of Unique Features



Doctor-Patient Interface

Source: *Photo by A. Yahya*; Huxley 1863; Dollo

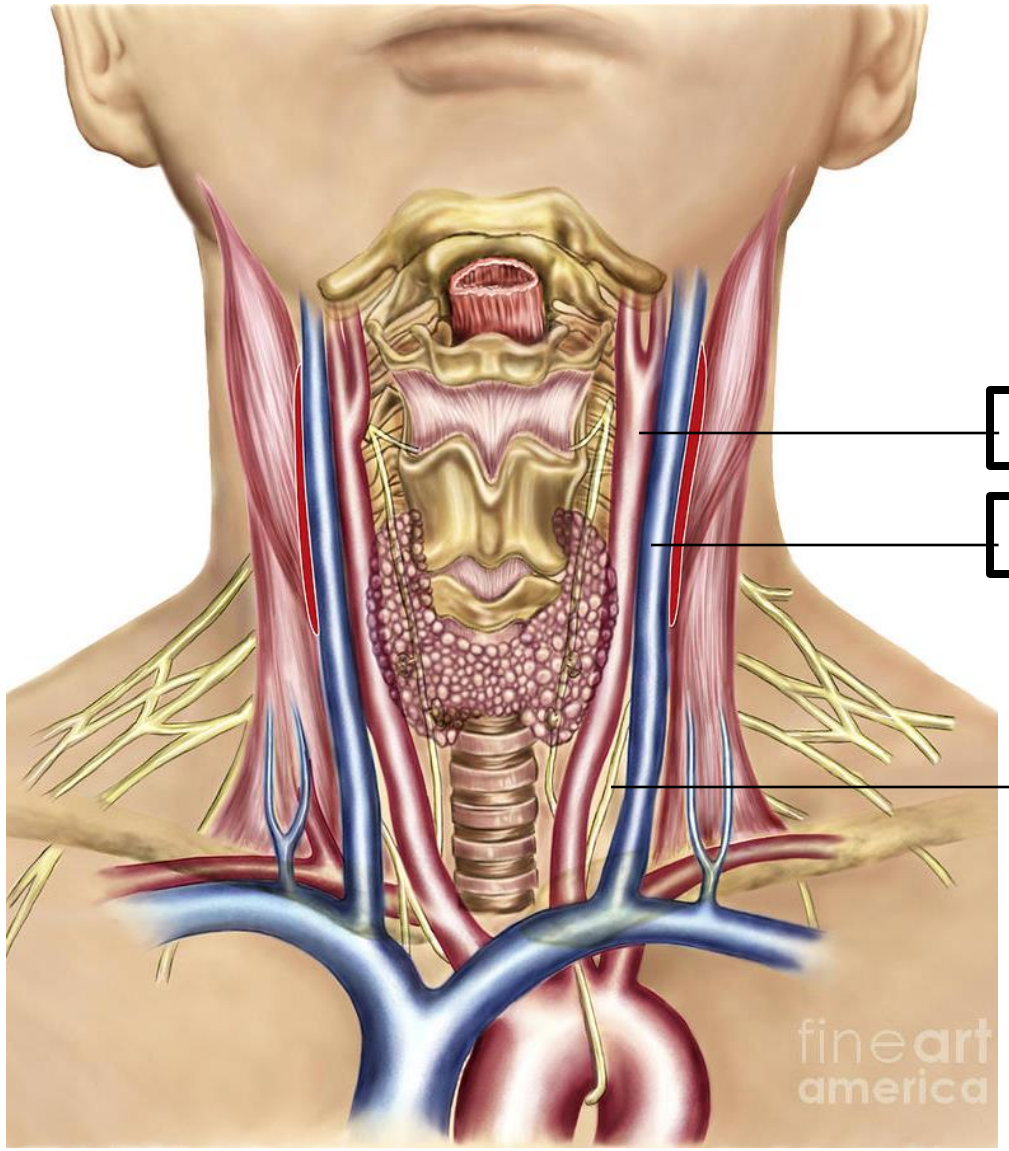
Lecture Outline

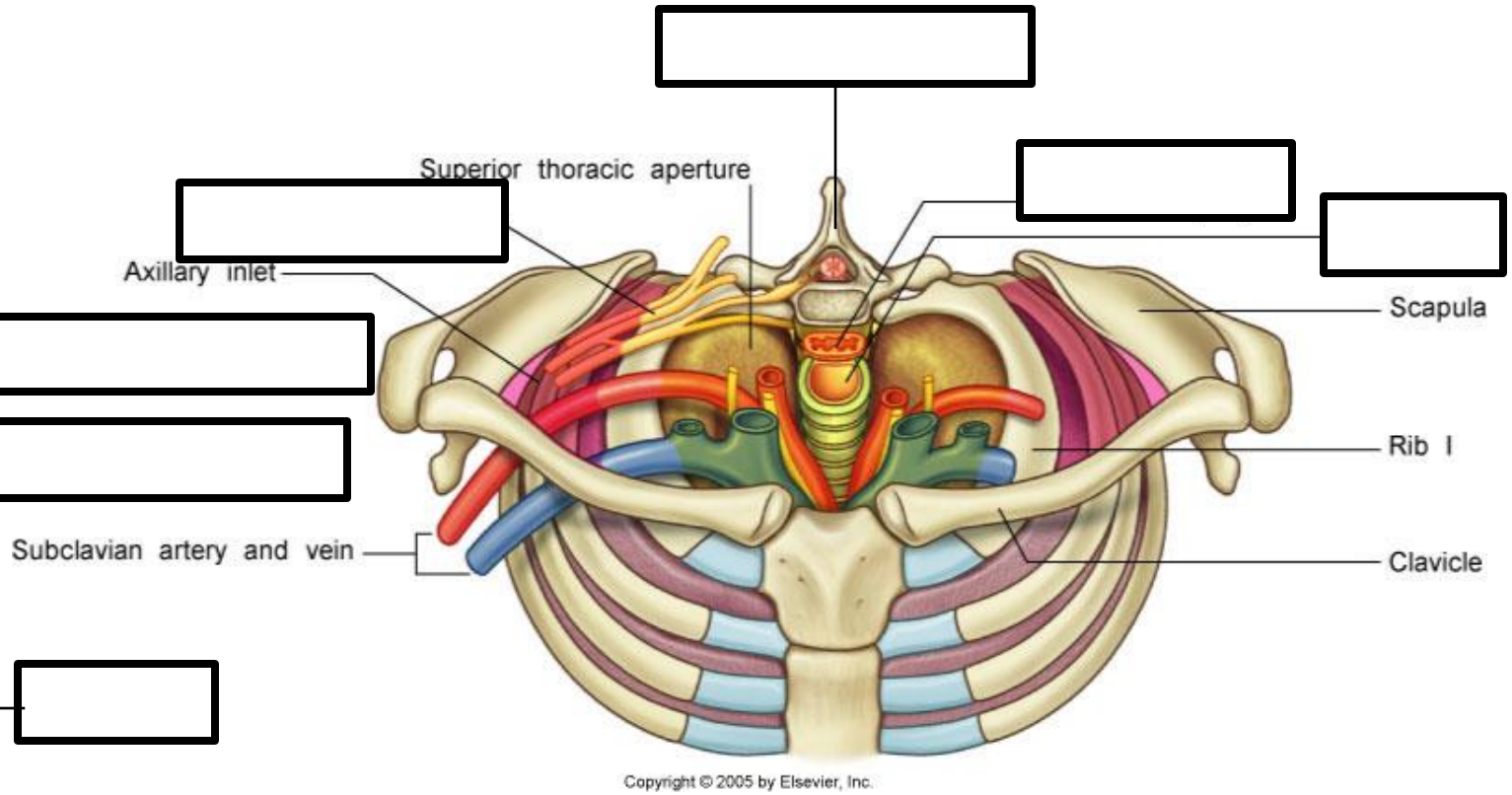
1. Head & Neck Architecture
2. “Special” Senses and Organs
3. Overview of Cranial Nerves

Lecture Content Guide

- Red text on slides = know for exams.
- Anatomical structures labeled in red or red highlight = know for exams. Note: other structures may still be tested on anatomy exam (consult the lab checklist).
- ⚕ Clinical Correlates ⚕ = know for exams.
- Go over Learning Objectives in the CPG

Which Structures Pass To or From the Neck?





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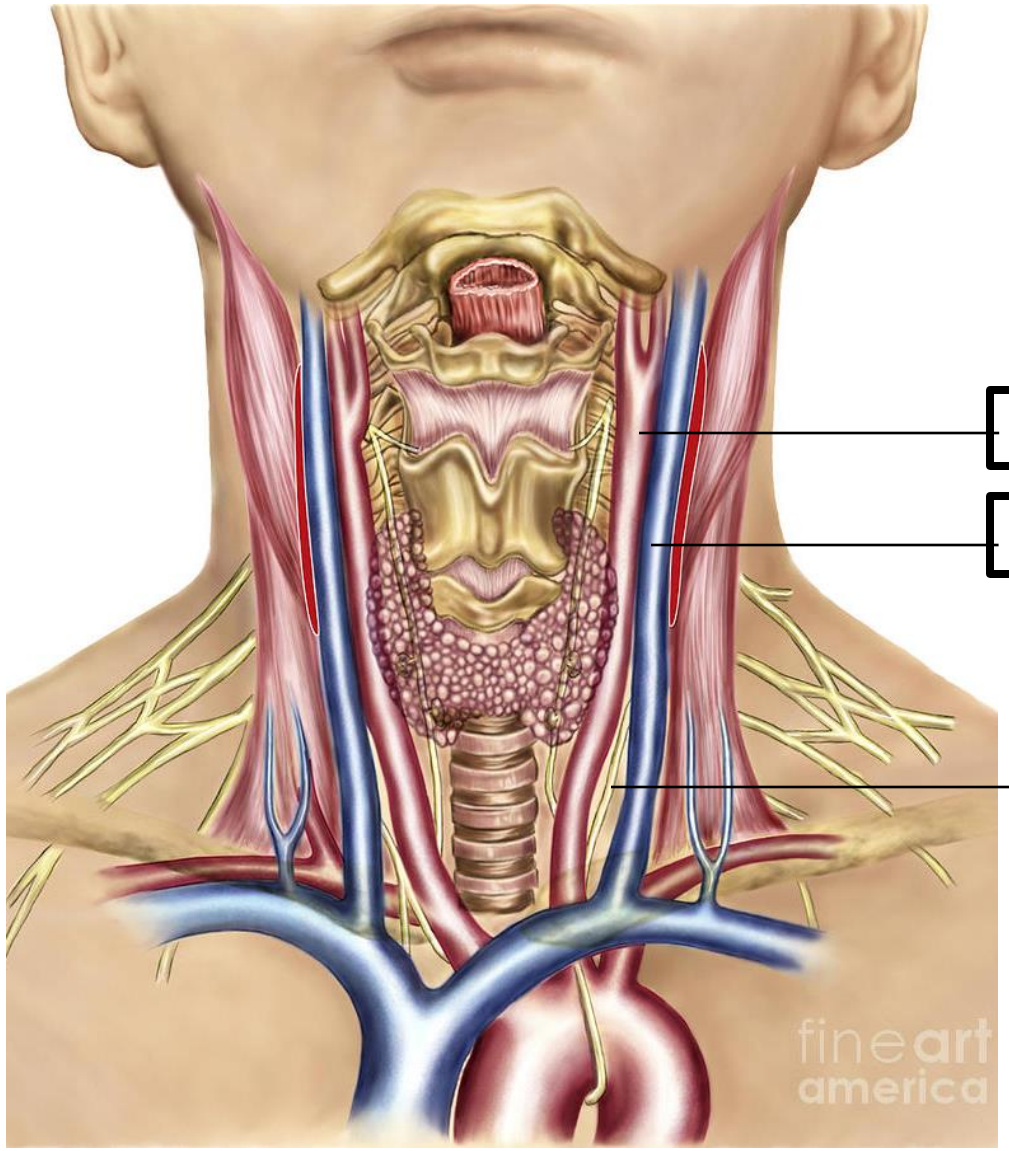
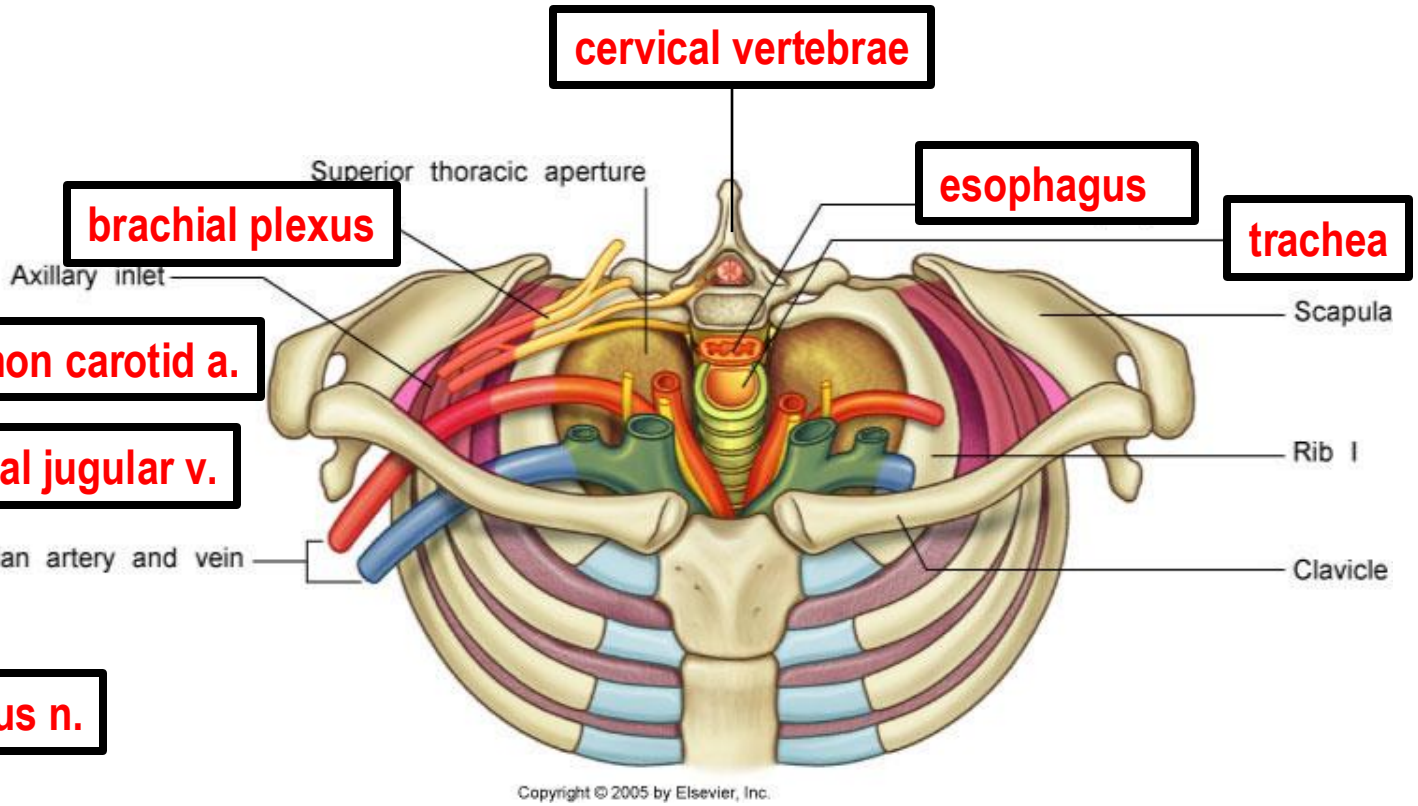
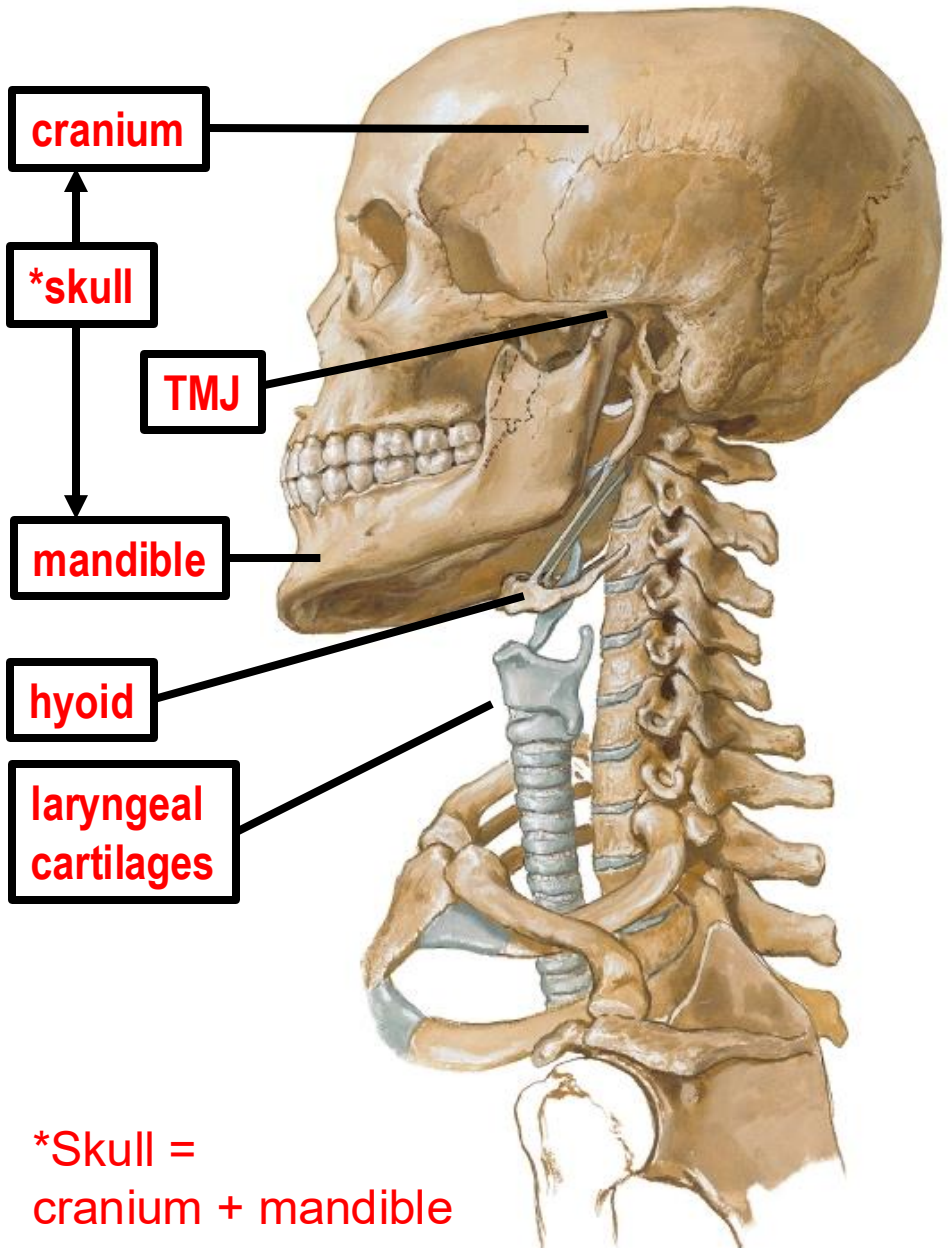




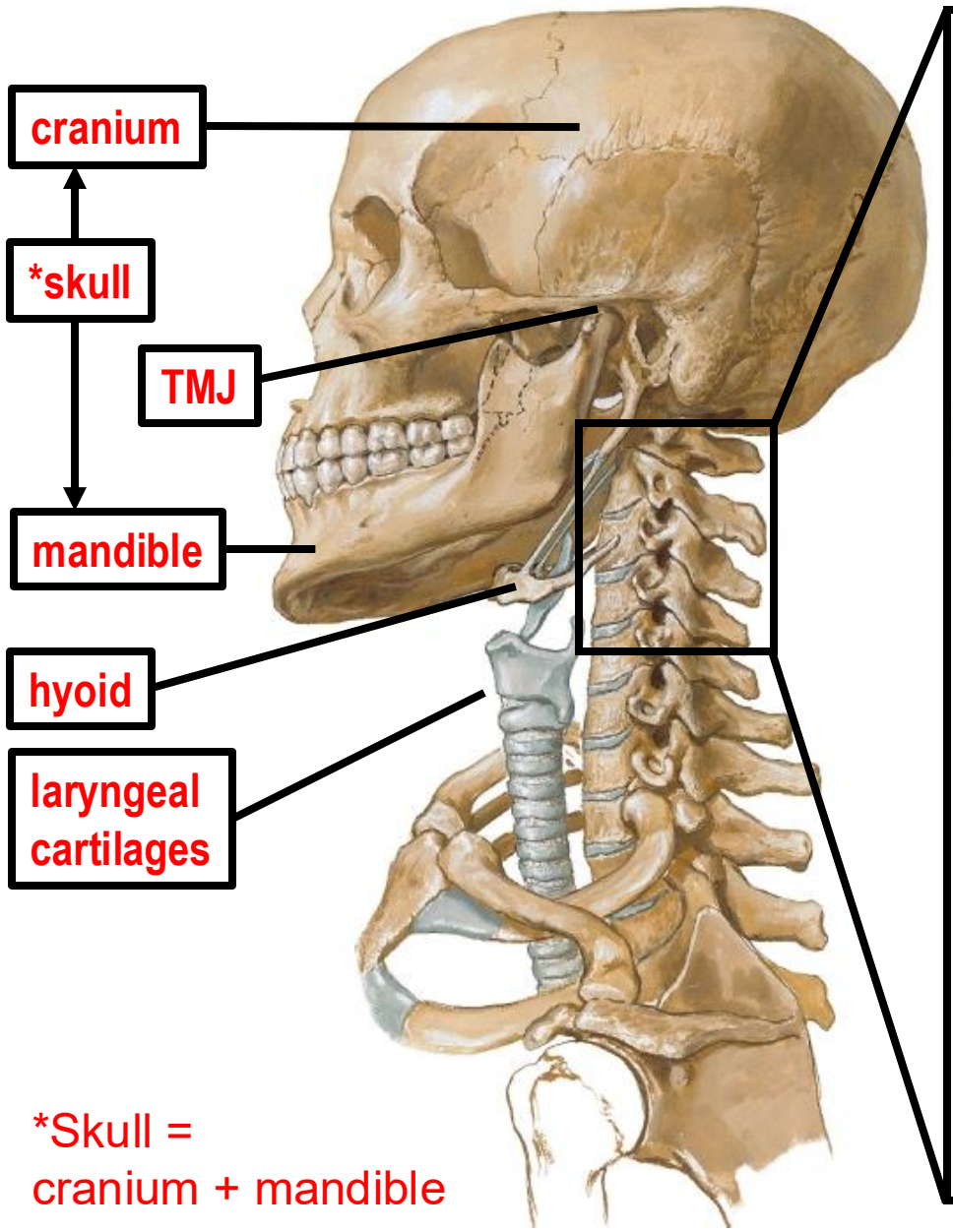
Skeletal System



*Skull =
cranium + mandible

Source: *Netter's Anatomy Atlas*

Skeletal System



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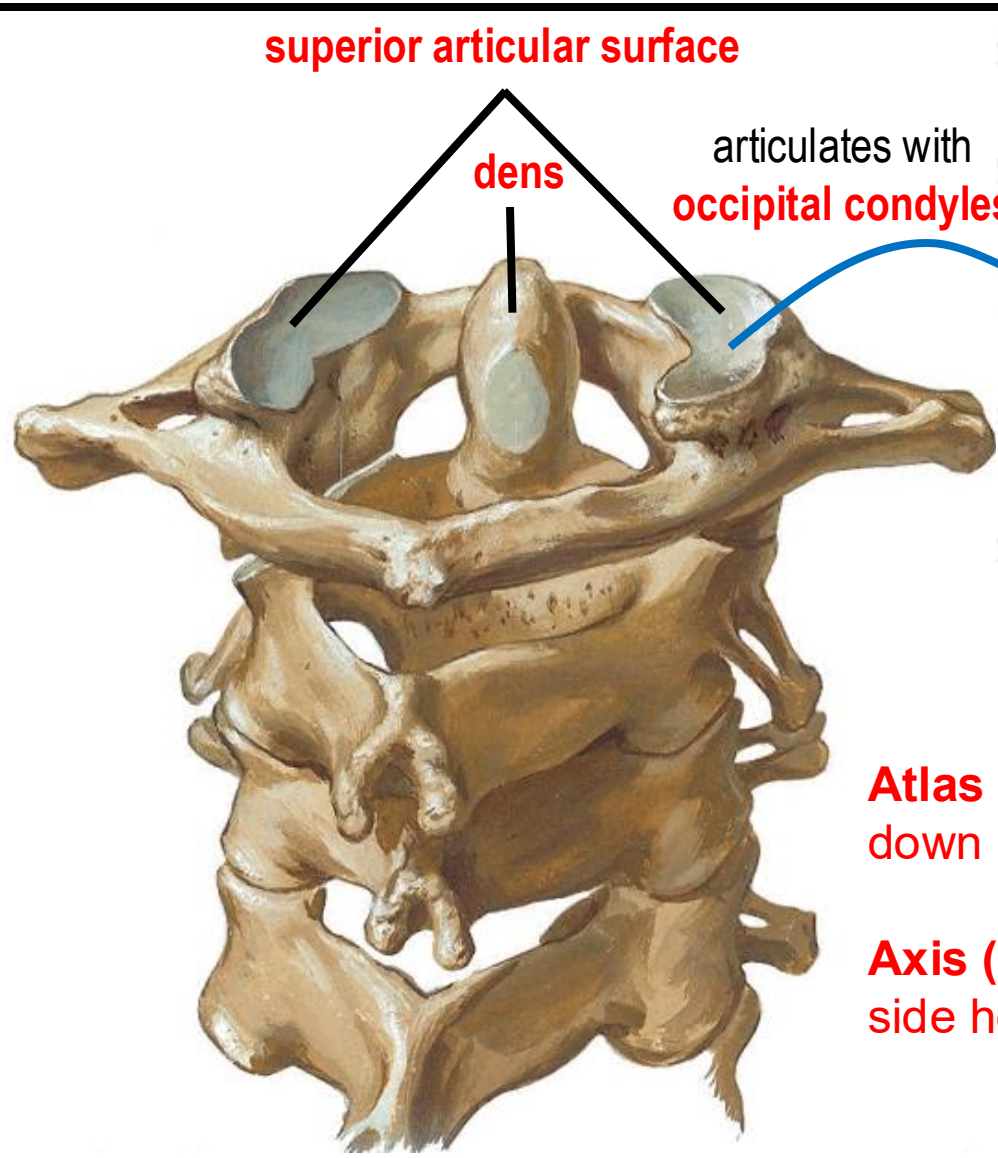
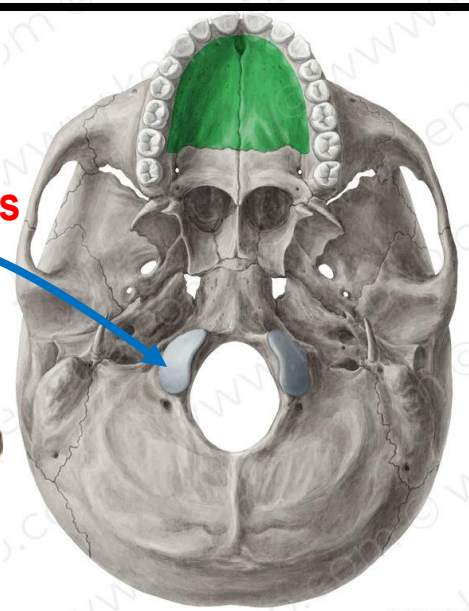


C1– 4 posterior view

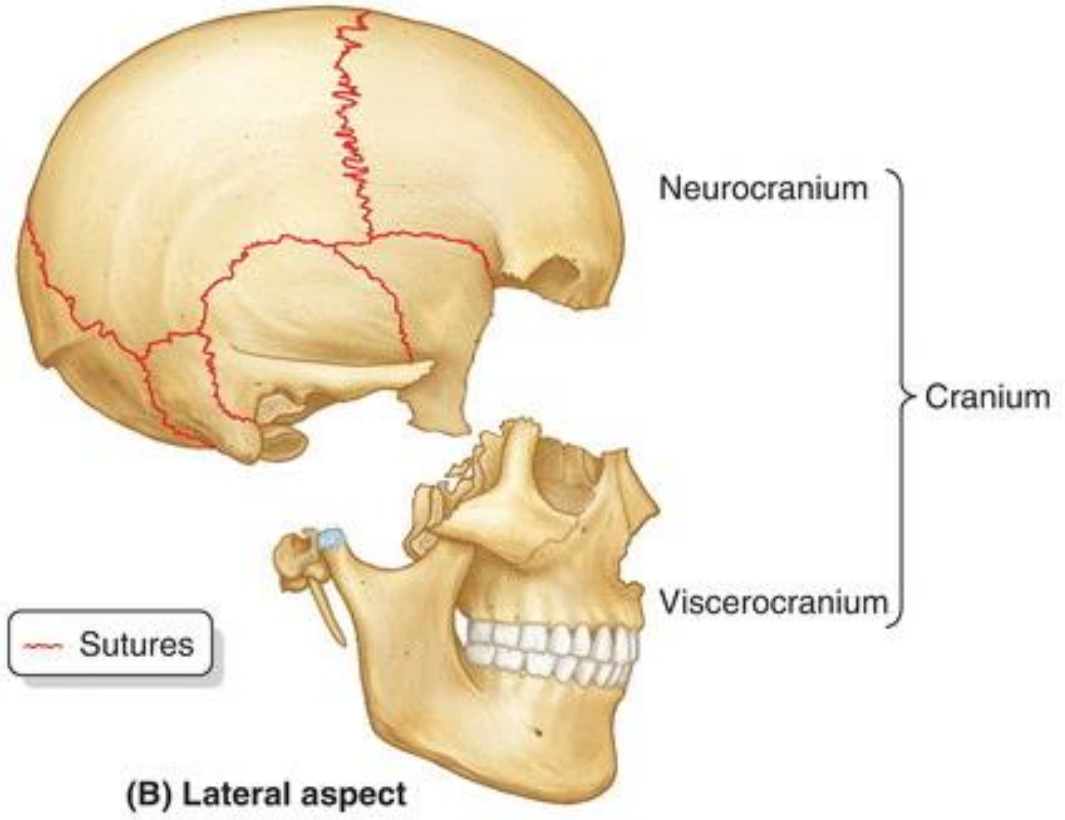


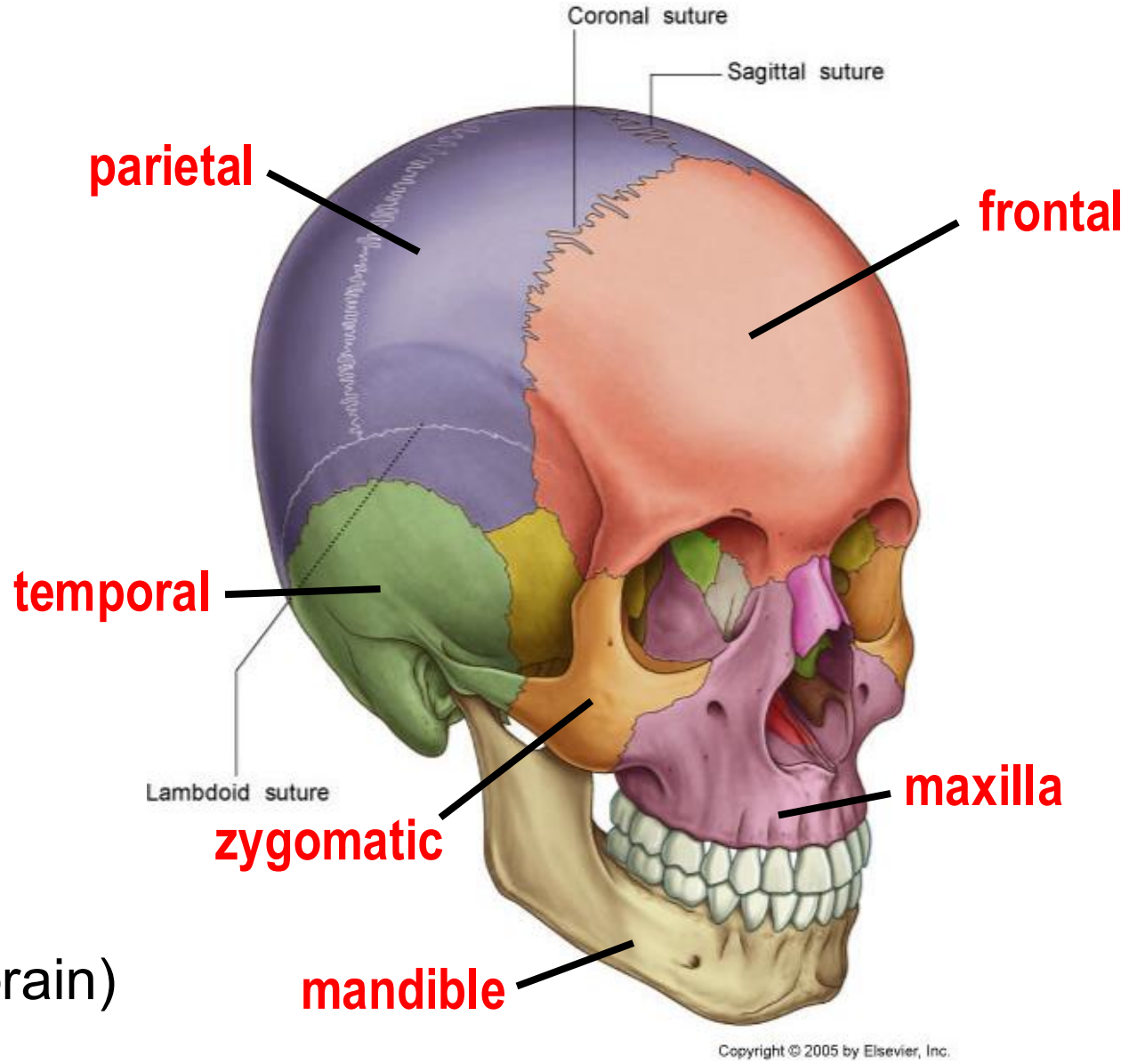
Atlas (C1): allows up and down head motion

Axis (C2): allows side-to-side head motion (swivel)

Source: *Netter's Anatomy Atlas*

Skeletal System

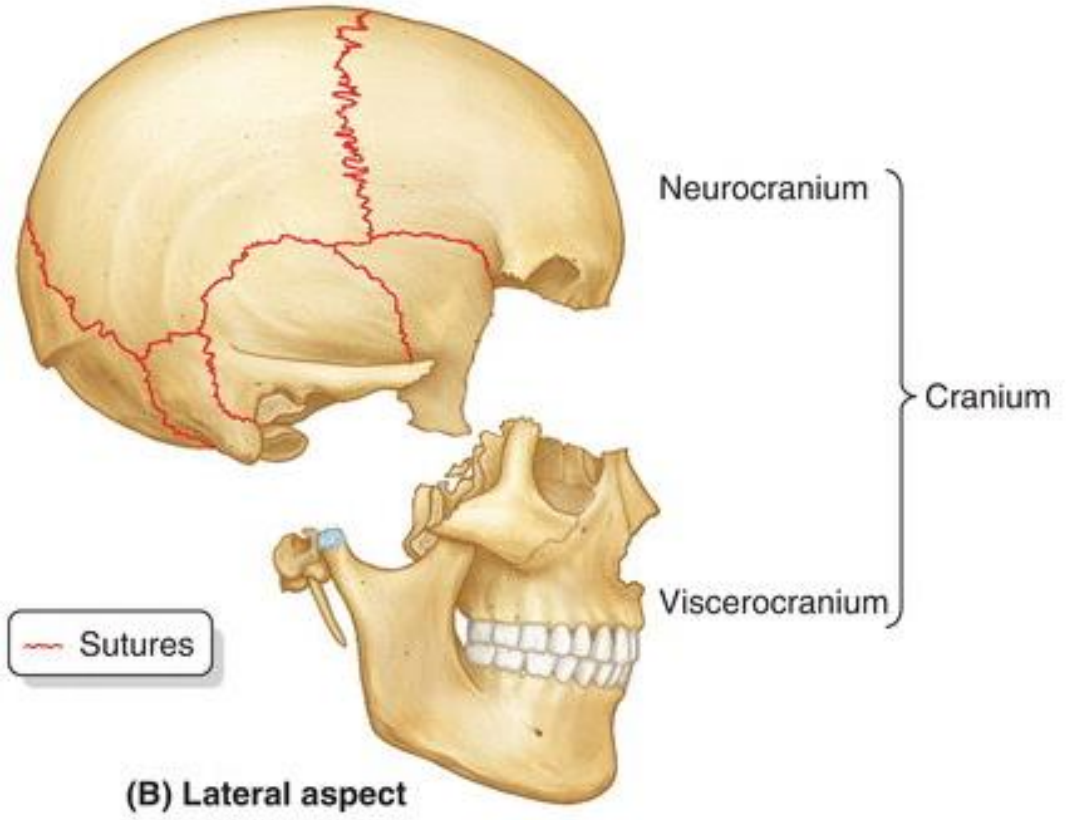


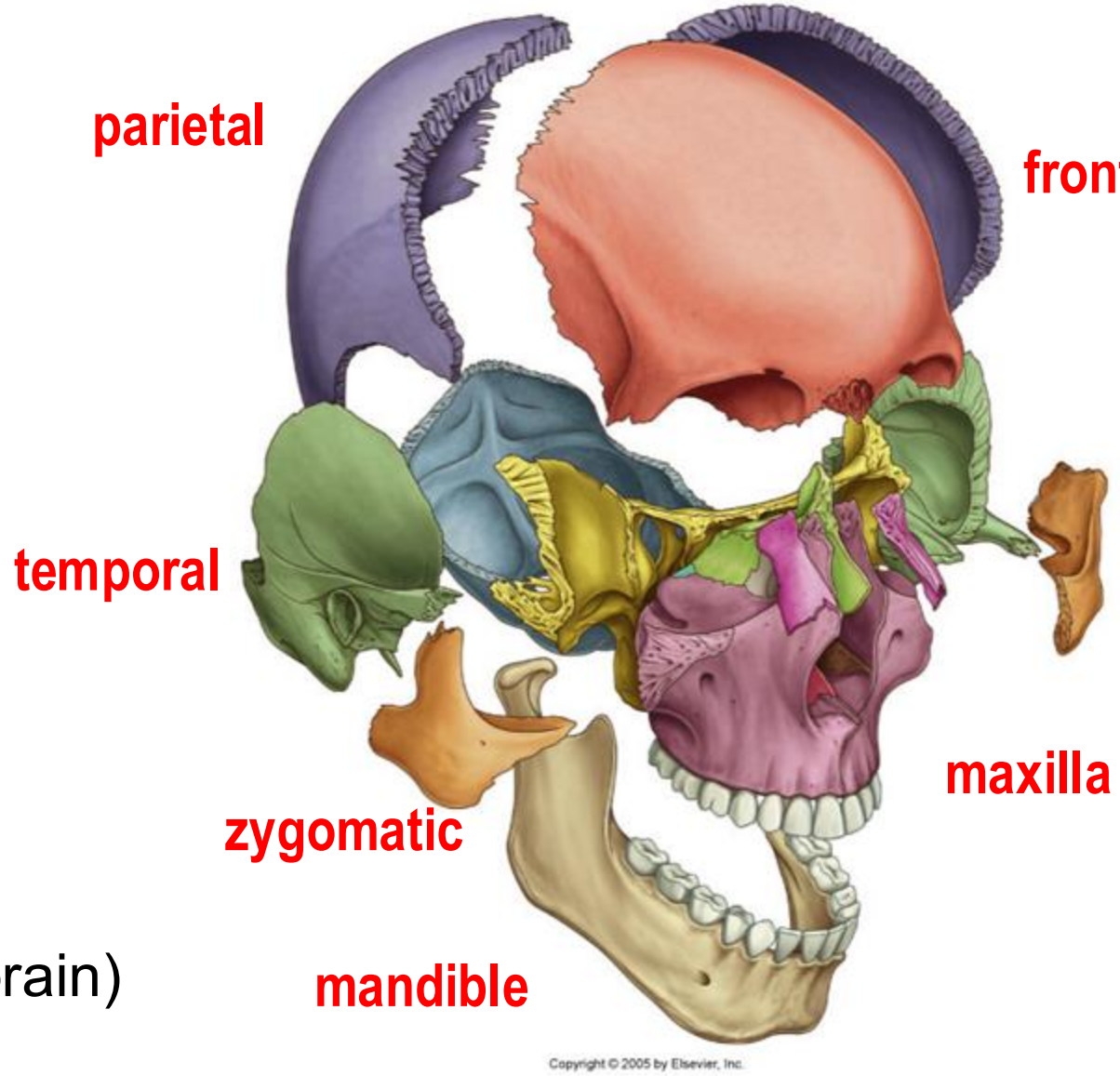


- cranial bones are joined by sutures
- Skull: 22 bones + middle ear ossicles
- **Neurocranium** = braincase (houses the brain)
- **Viscerocranium** = face

Source: *Clinically Oriented Anatomy* 9e

Skeletal System





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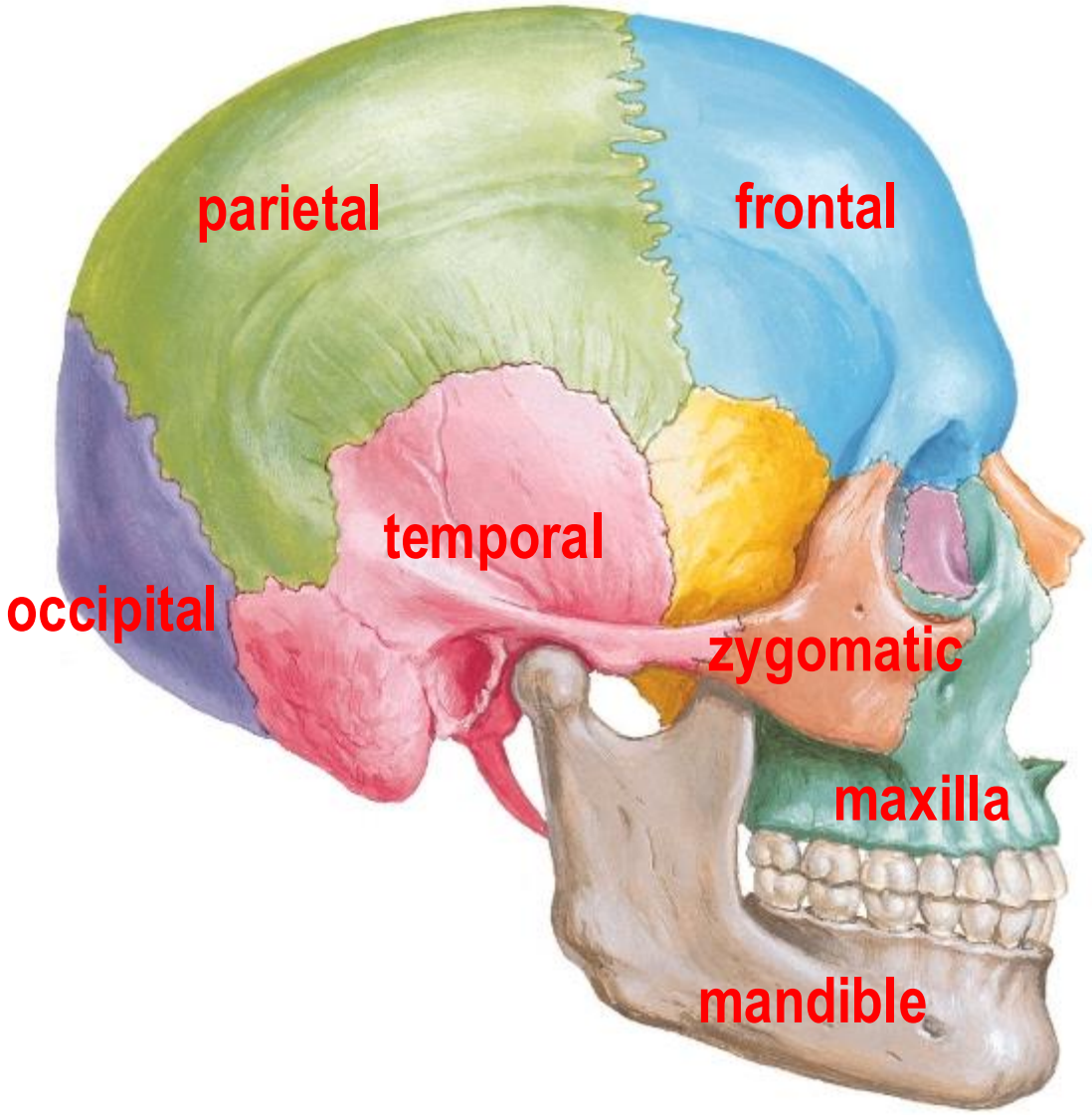
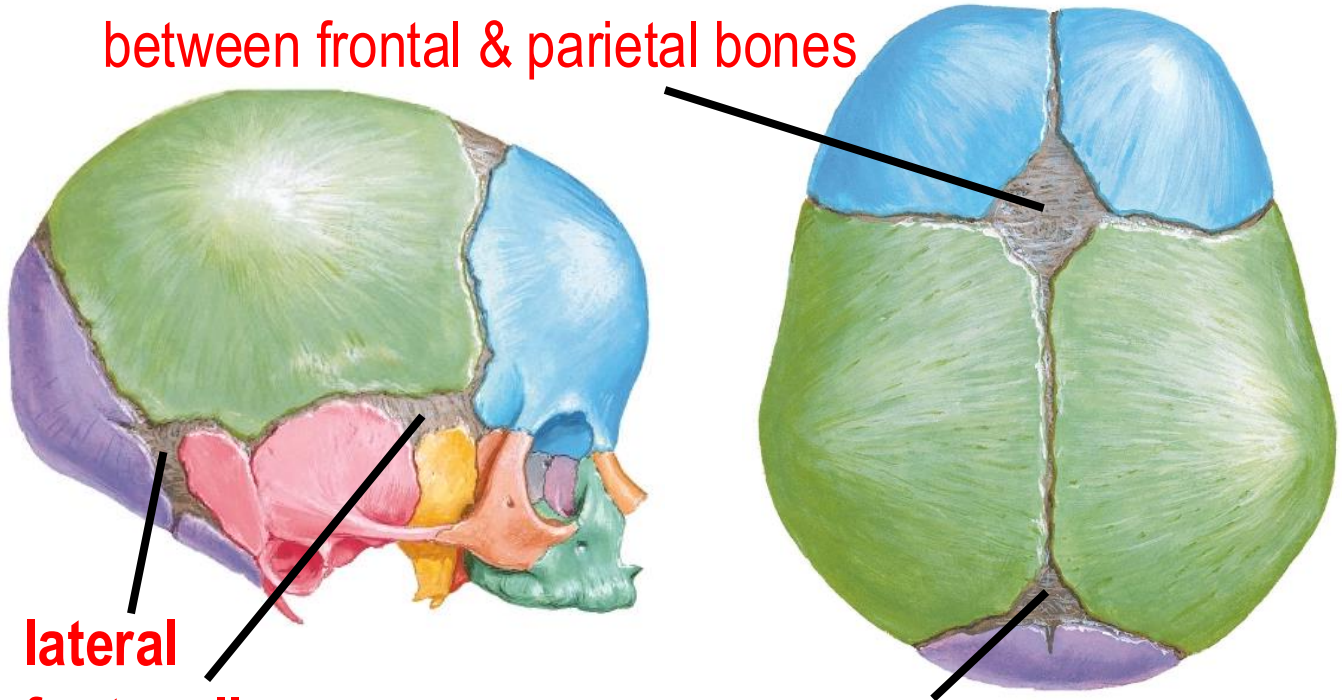


fontanelles: fibrous “soft spots” between cranial bones in infants

anterior fontanelle
between frontal & parietal bones



posterior fontanelle
between parietal & occipital bones

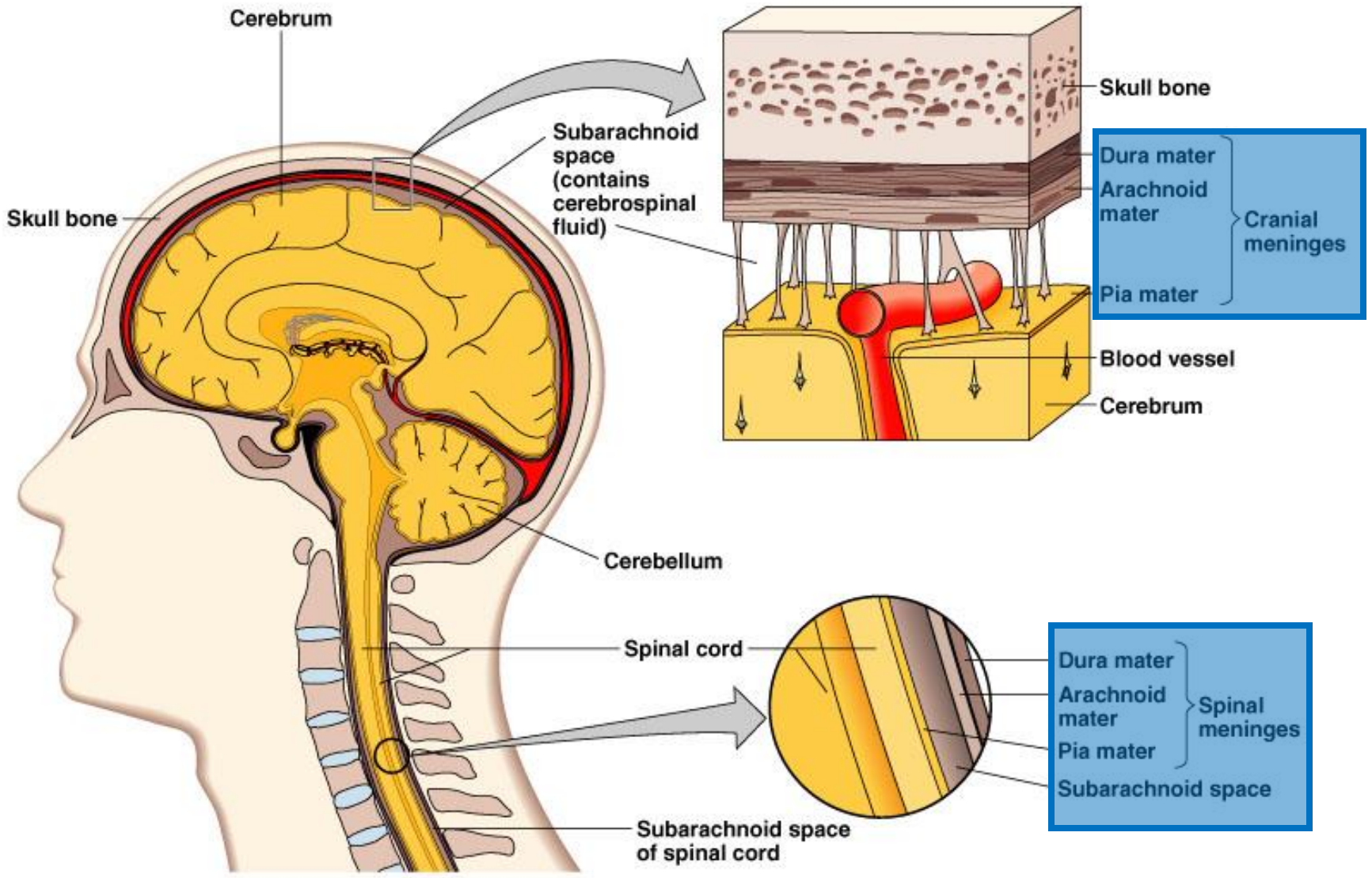
Source: *Netter’s Anatomy Atlas*

Skeletal System

The skull morphology changes through life

Source: Osta International

Nervous System: Brain & Spinal Cord

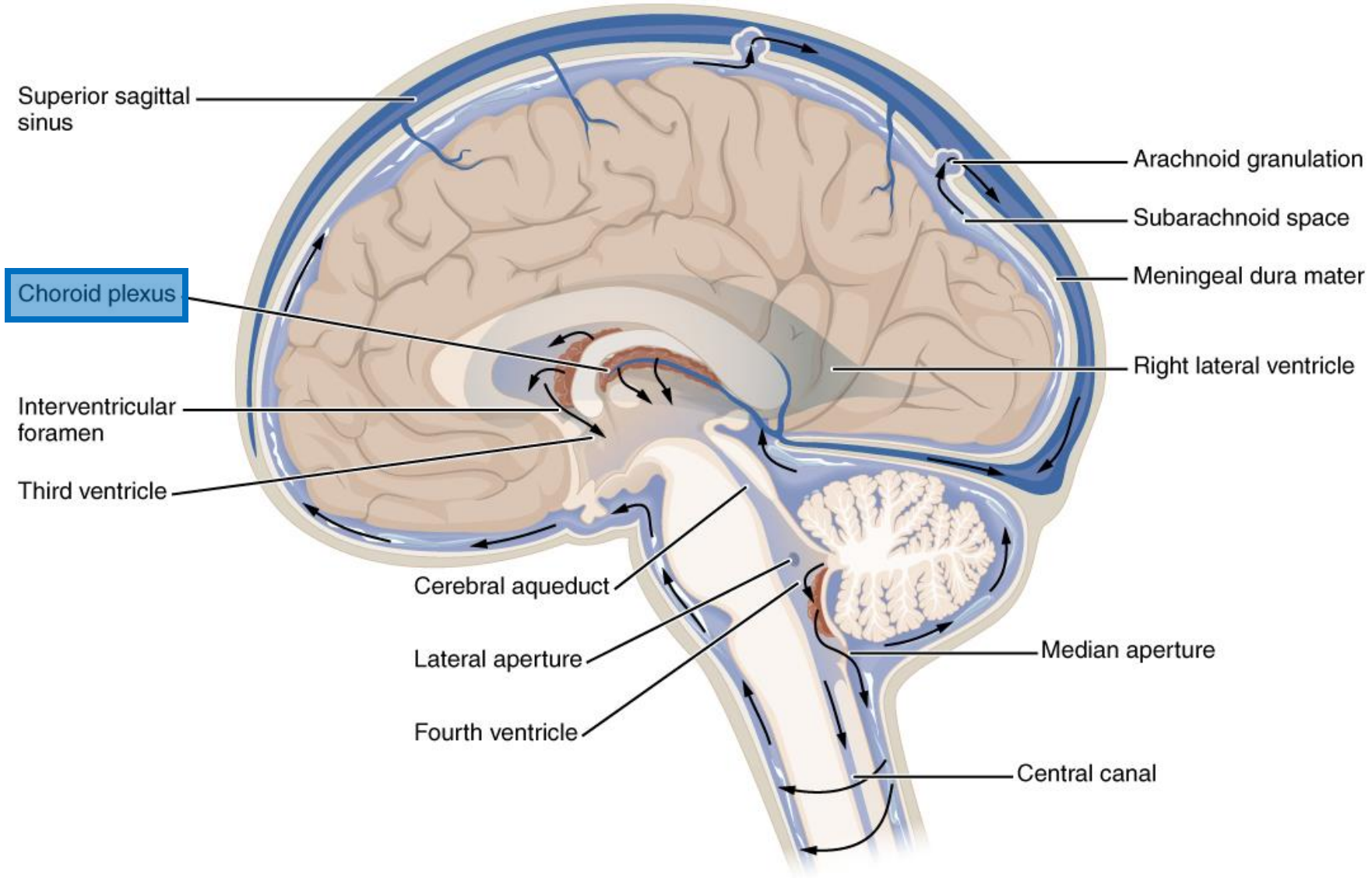


Note: Brain anatomy will be covered in detail in Neuroanatomy next semester.

Meninges (dura, arachnoid, and pia mater) around the brain are continuous with those surrounding the spinal cord.

Source: examnotes.com; *OpenStax Anatomy and Physiology*

Nervous System: Brain & Spinal Cord

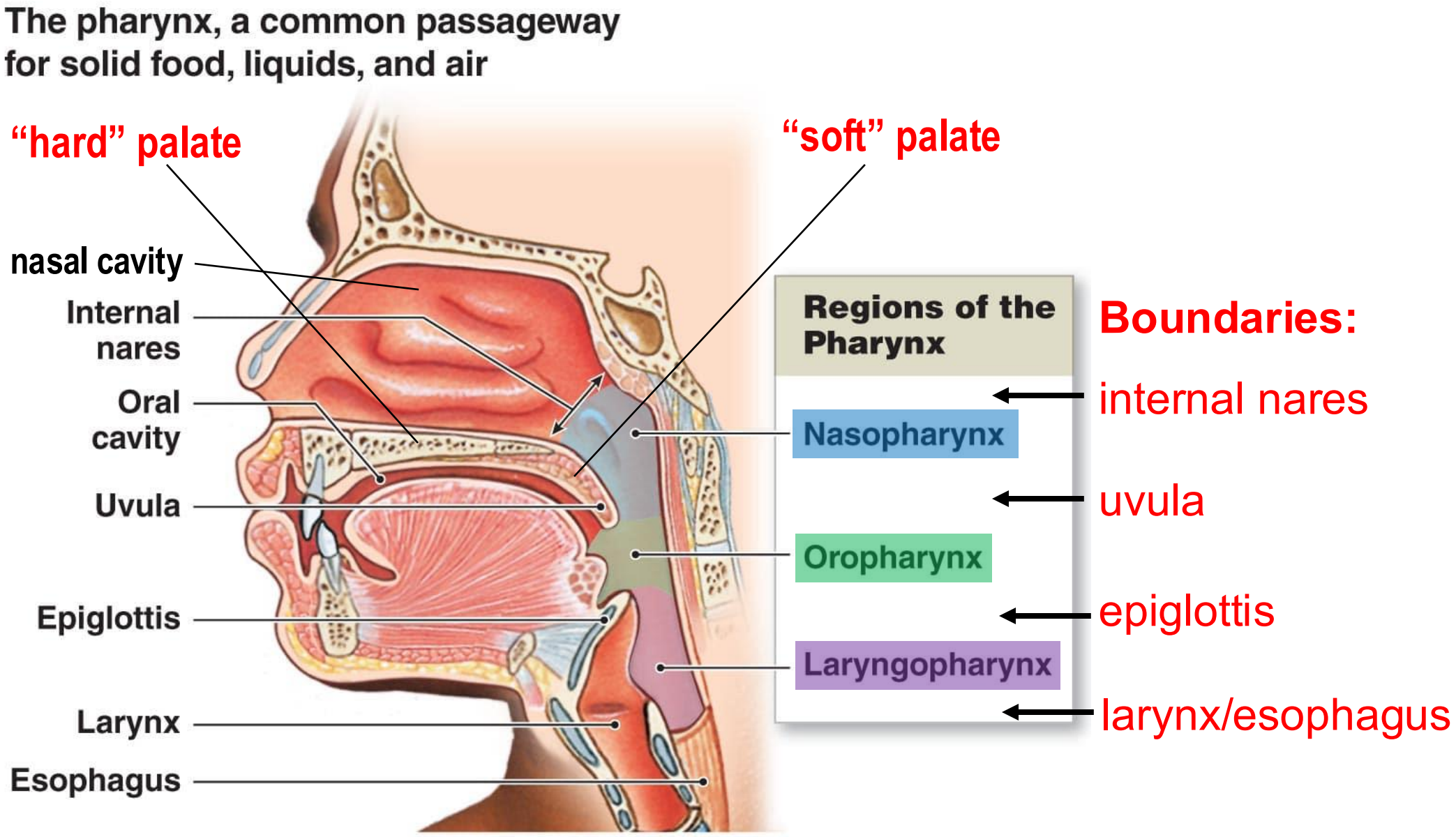


Note: Brain anatomy will be covered in detail in Neuroanatomy next semester.

CSF produced by choroid plexus flows through brain ventricles (spaces within the brain) and subarachnoid space.

Source: examnotes.com; *OpenStax Anatomy and Physiology*

Ingestion & Respiration



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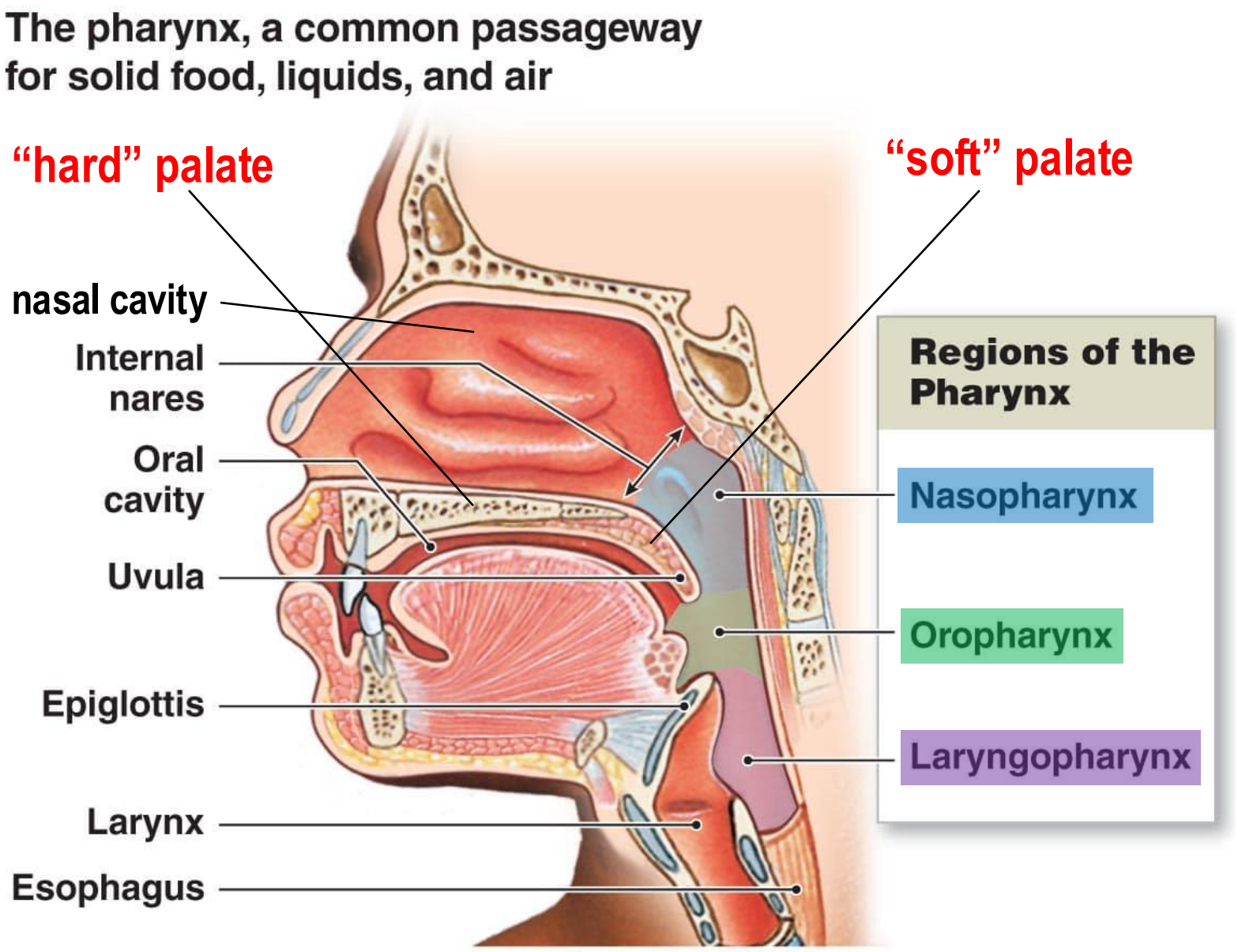
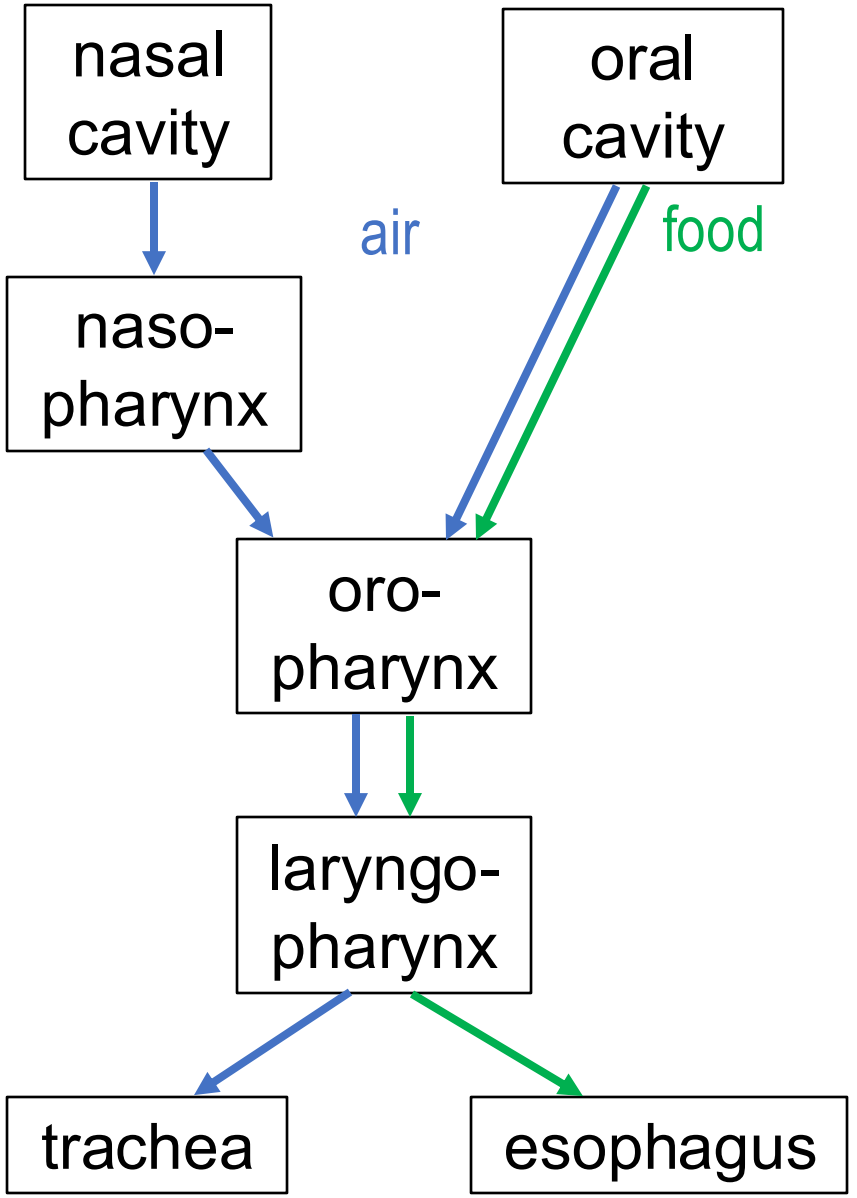
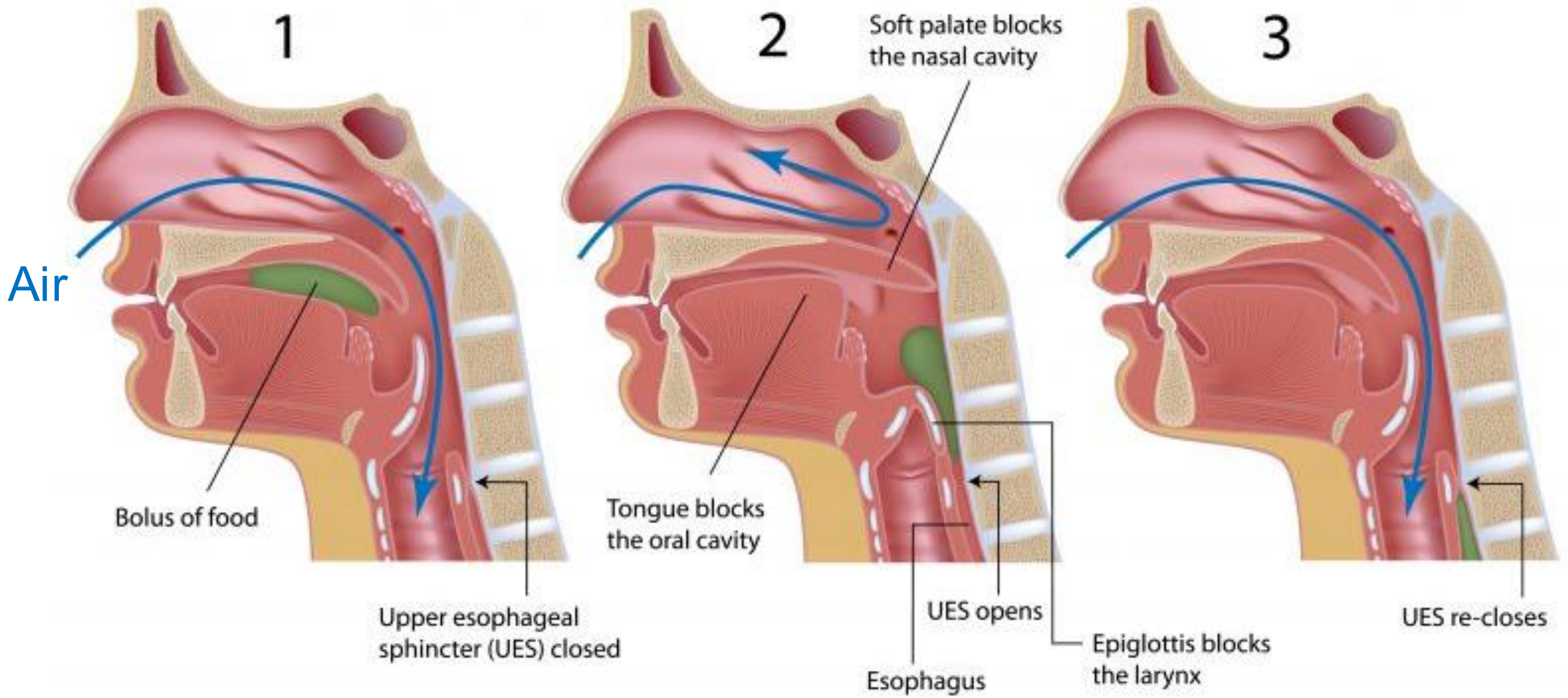




Ingestion & Respiration

Mechanics of Ingestion



1. Food is pushed back by elevating the tongue.

2. Soft palate and uvula elevates to close path into nasopharynx

3. Sequential contraction of pharyngeal constrictor muscles moves food down

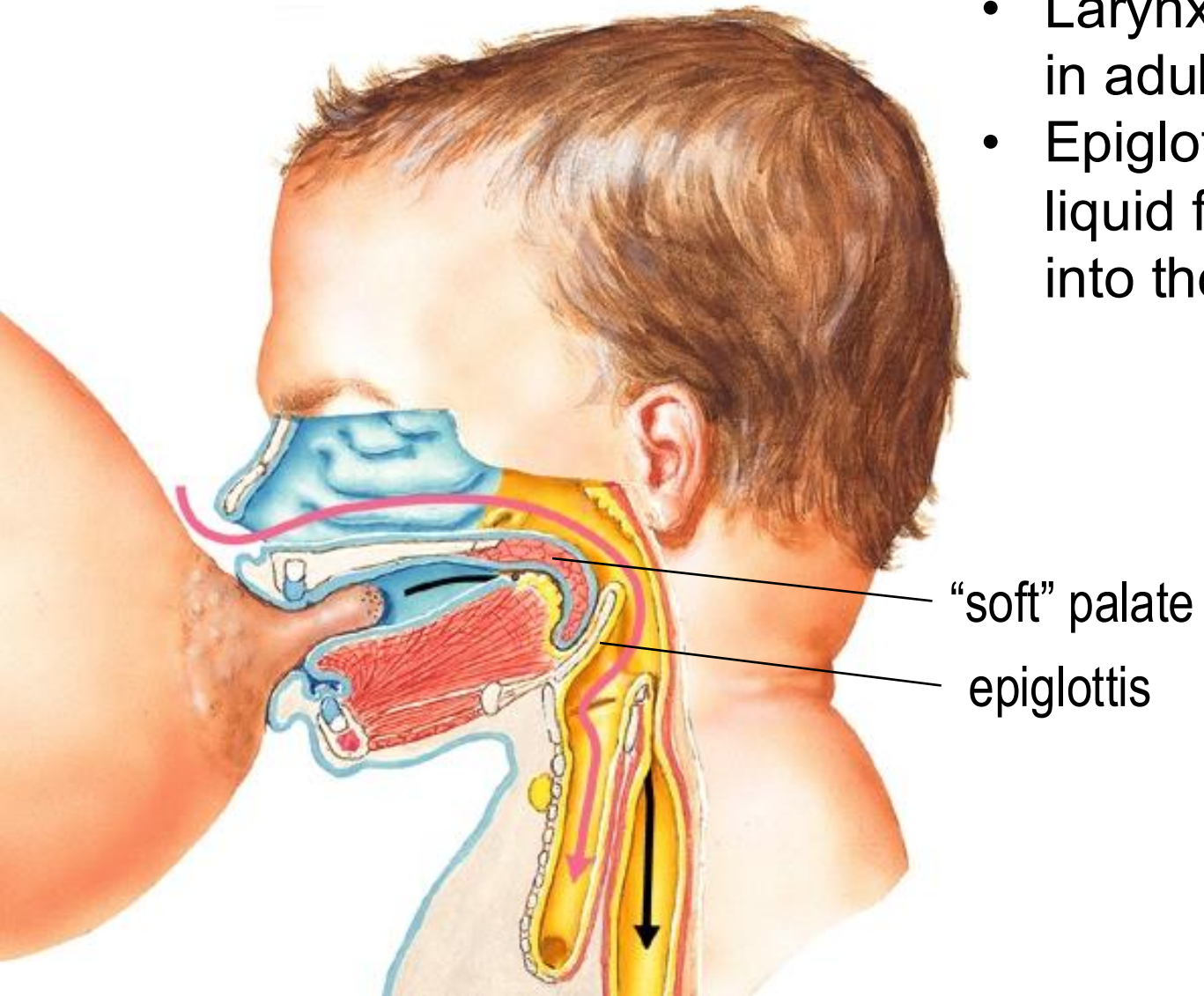
Source: everydayhealth.com

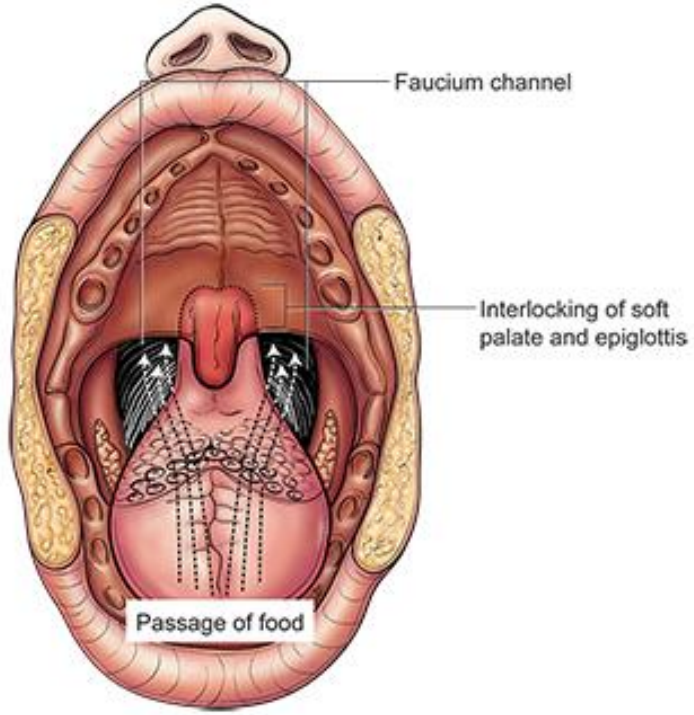
Ingestion & Respiration

Mechanics of Ingestion

Infants can ingest and breathe at the same time.

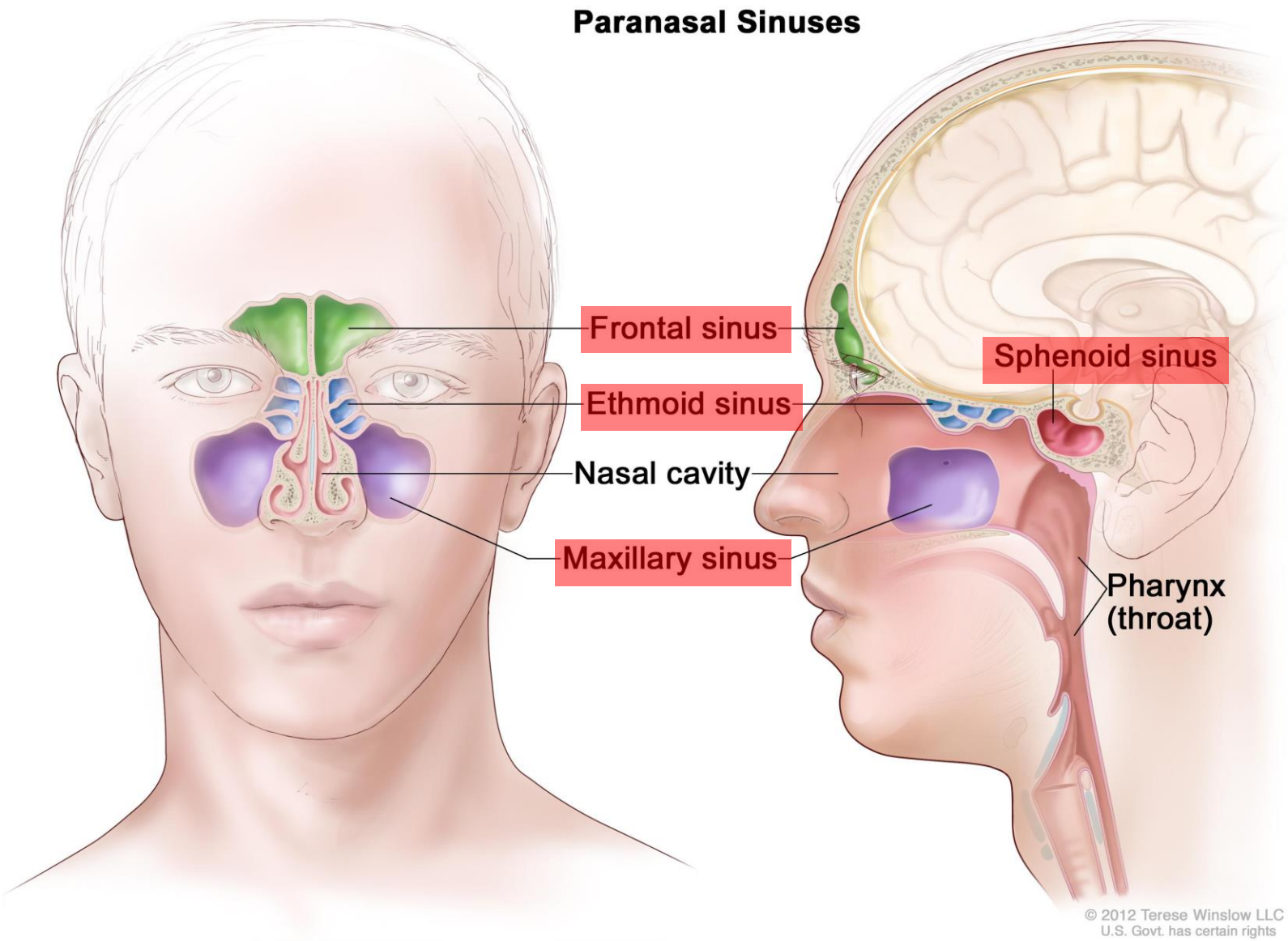
- Larynx and epiglottis sit more superiorly than in adults.
- Epiglottis and soft palate interlock allowing liquid food to pass laterally and bypass entry into the larynx & trachea.





Source: *Netter's Anatomy Atlas*

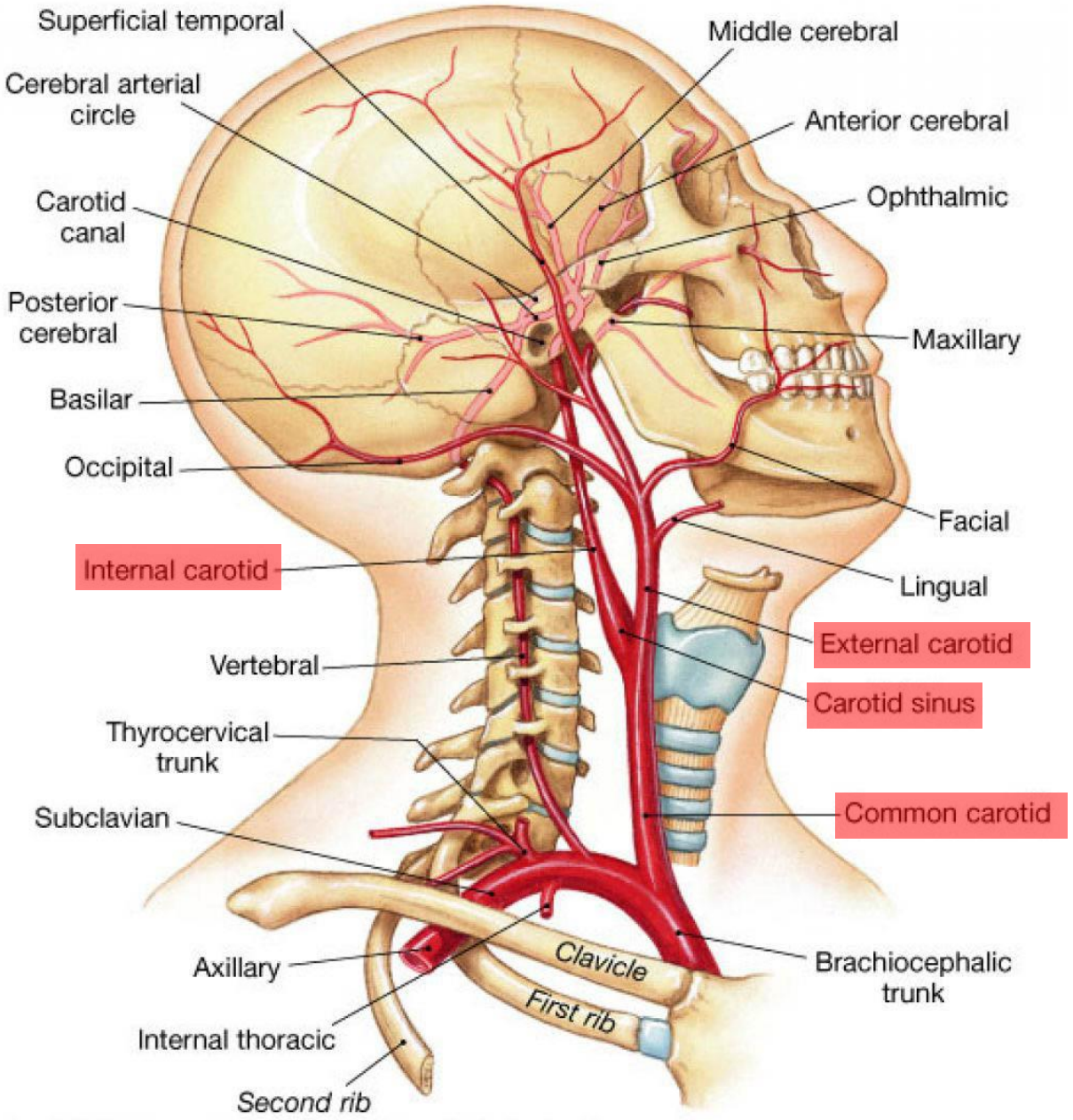
Paranasal Sinuses



4 Paranasal Sinuses:

- paired
- connected to nasal cavity via foramina (ostia)
- Functions:
  - lighten skull weight
  - humidify & heat inhaled air
  - Increase resonance for hearing
- Ostia often become blocked by allergic inflammation or swelling of nasal lining from common cold. This prevents drainage of mucus that leads to facial pain.

Vascular System: Arteries

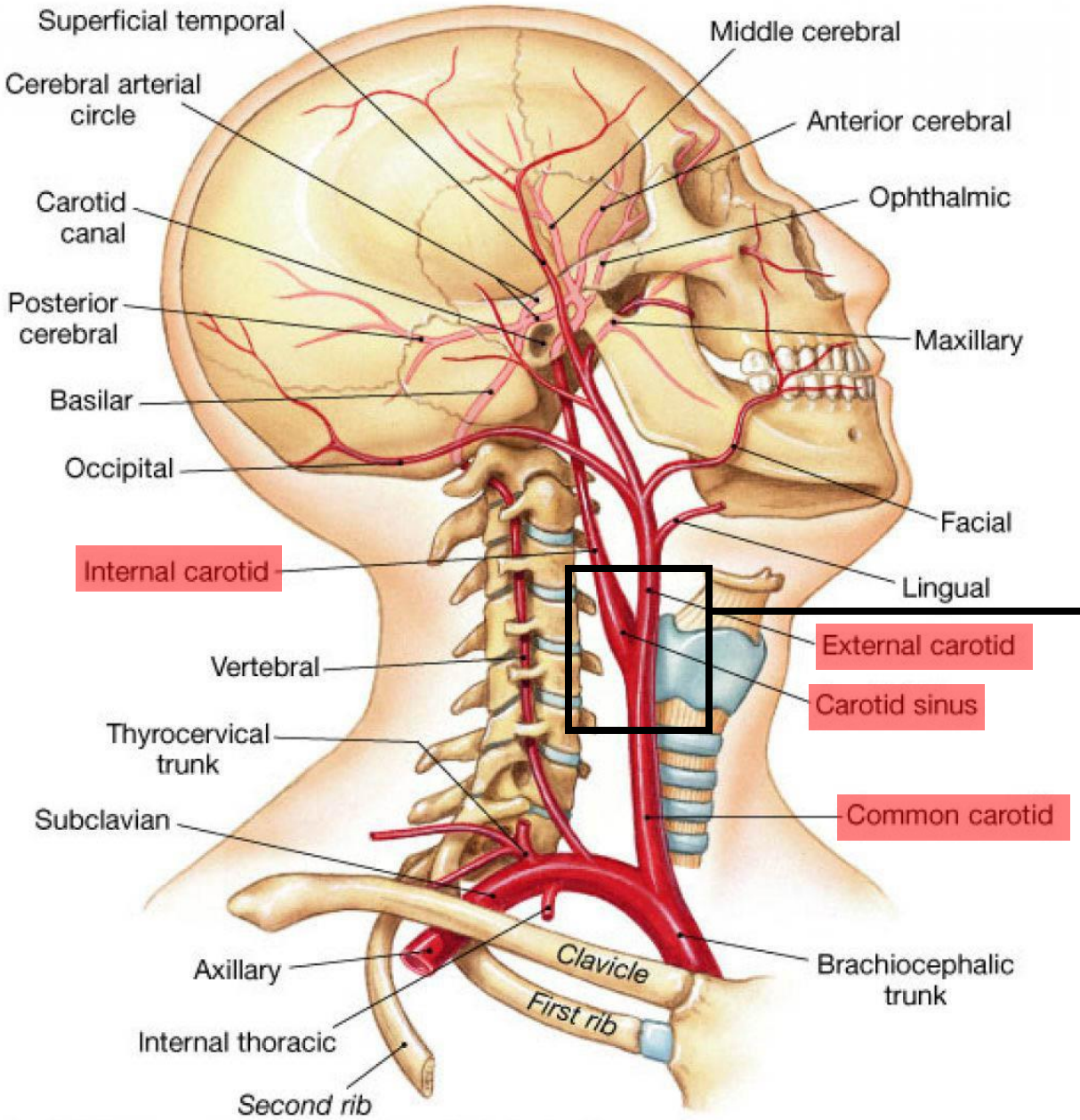


External Carotid: supplies outside skull

Internal Carotid: supplies inside skull

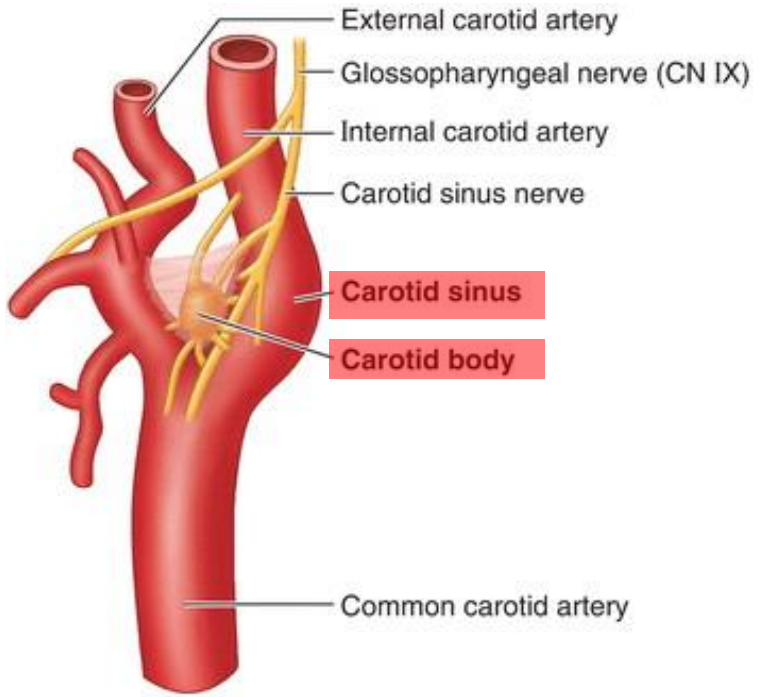
Source: Anatomy-Medicine; Moore's

Vascular System: Arteries



External Carotid: supplies outside skull
Internal Carotid: supplies inside skull

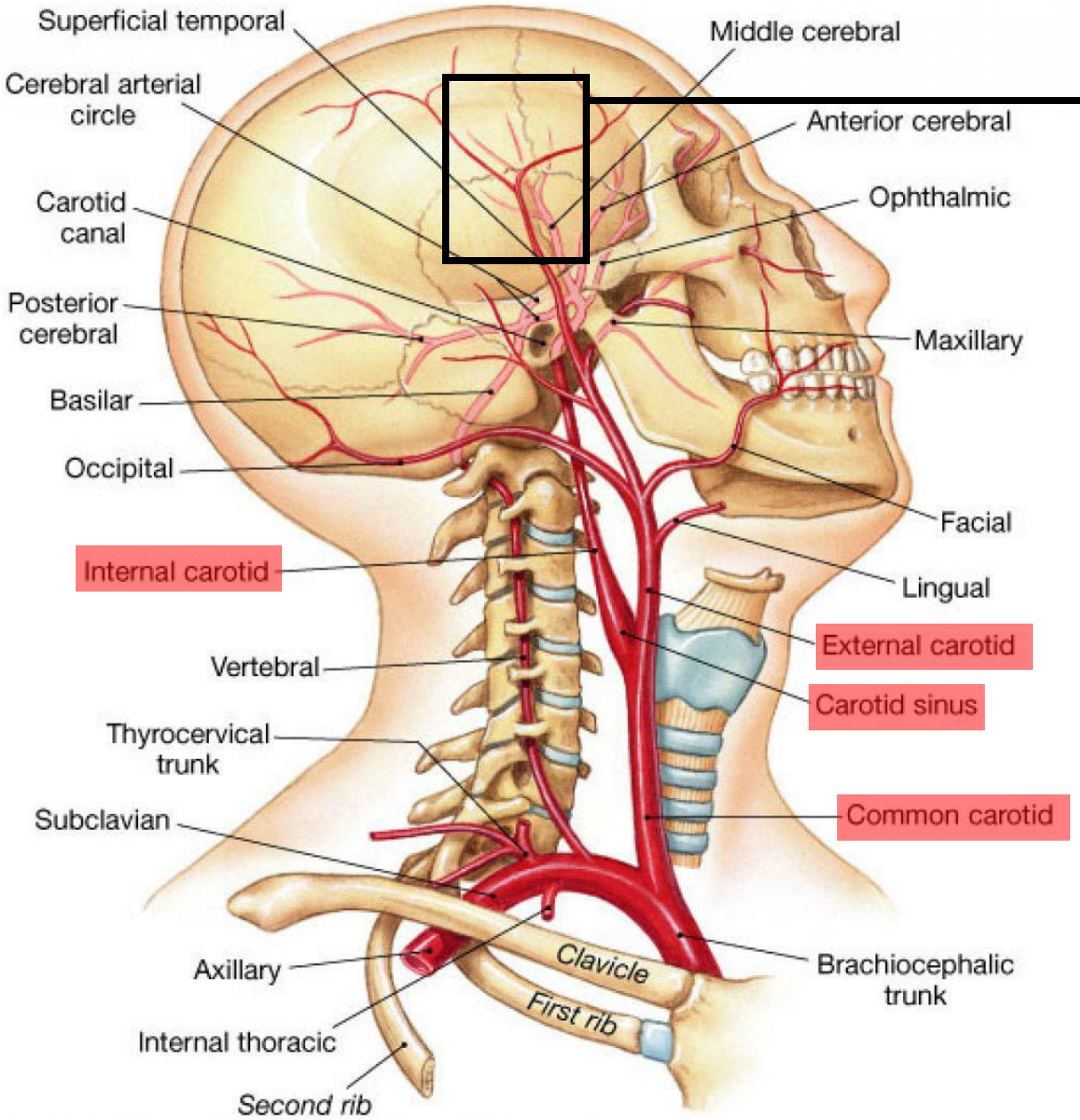
Carotid Body: detector for O_2 and CO_2
Innervated by glossopharyngeal n. (CN IX)



Medial view of right carotid artery

Source: Anatomy-Medicine; Moore's

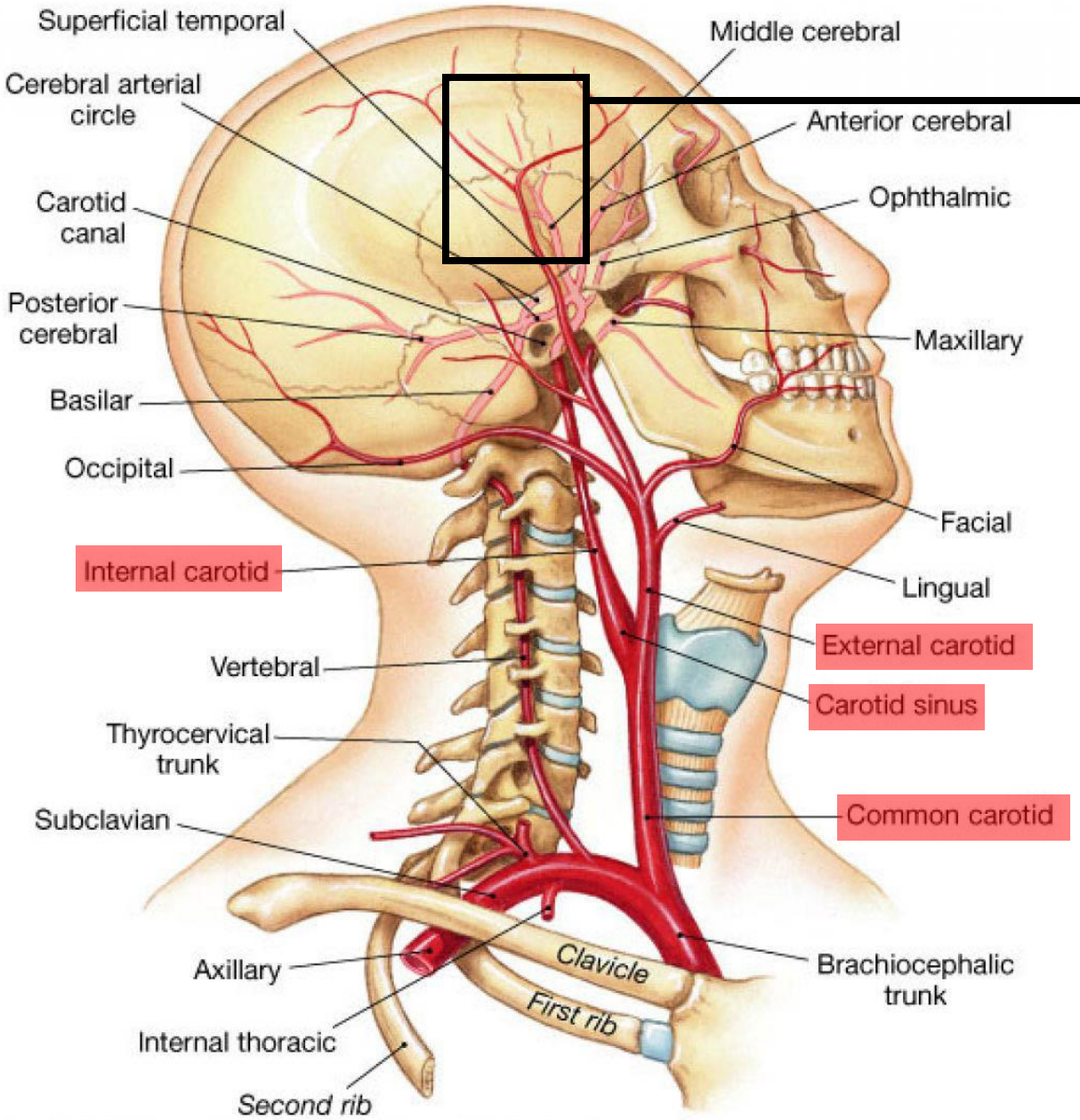
⚕ Clinical Correlate ⚕ "Danger Zone" #1 (of 3)



Pterion: junction of frontal, parietal, temporal, sphenoid bones; thin area overlying **middle meningeal a.**

Source: Anatomy-Medicine

⚕ Clinical Correlate ⚕ "Danger Zone" #1 (of 3)



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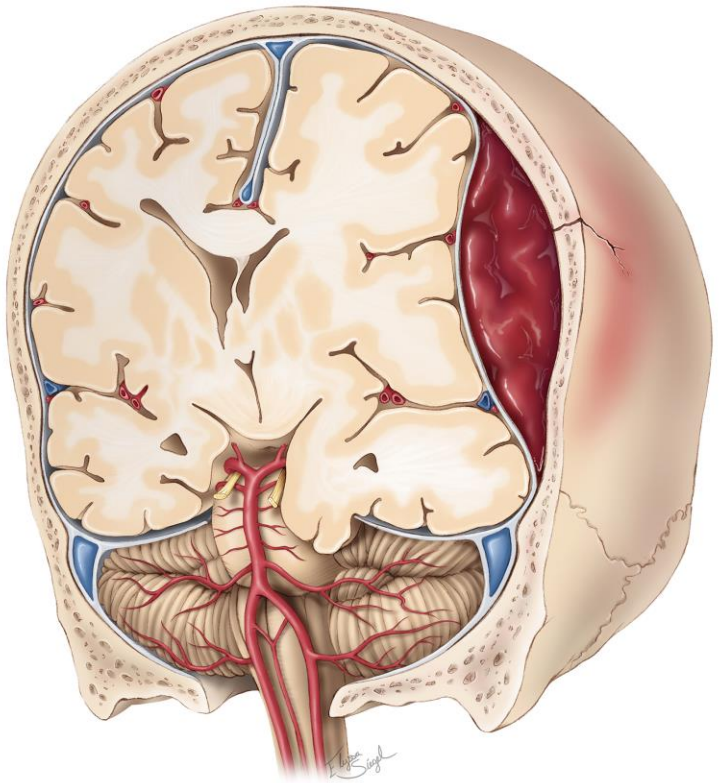
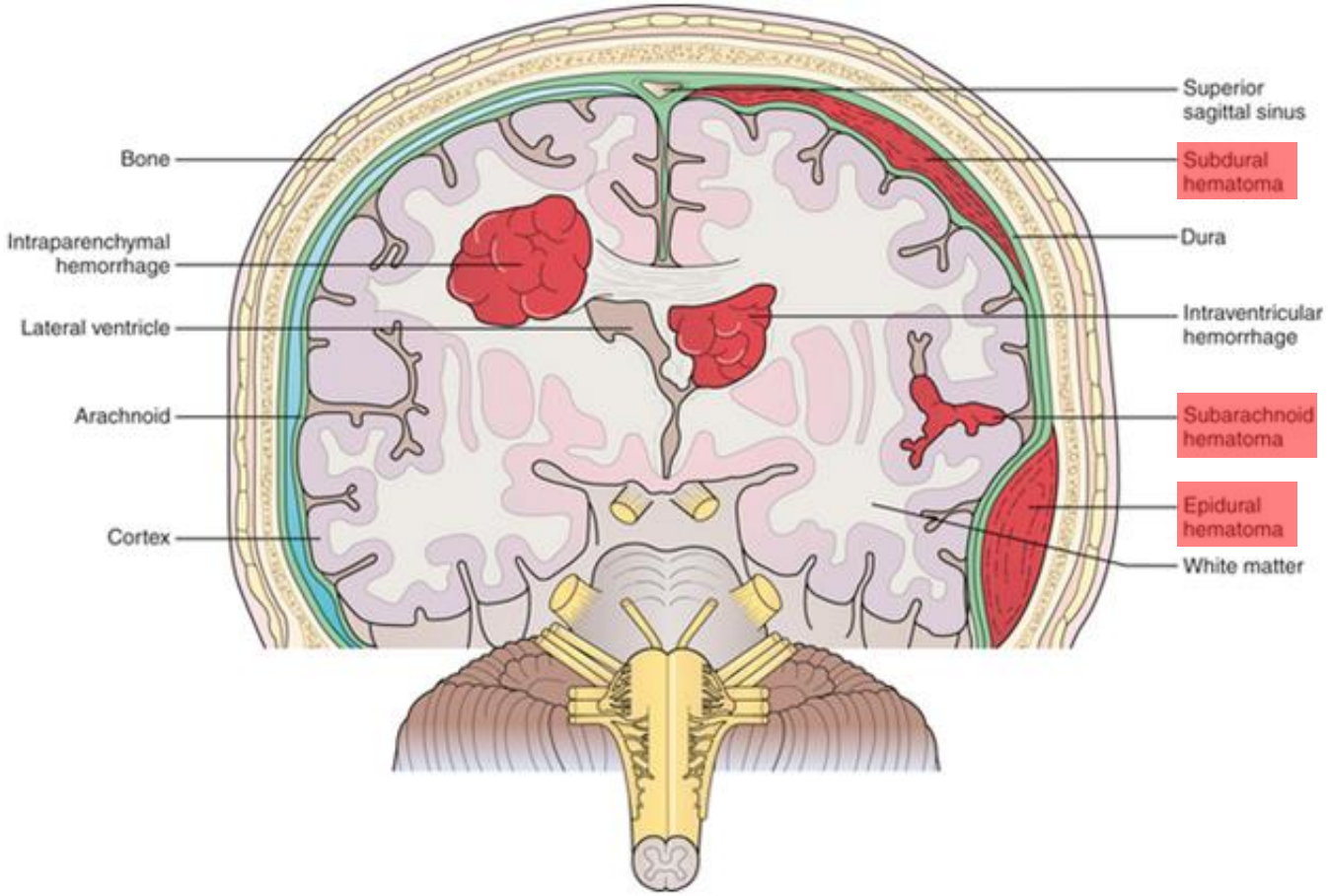


Hard blow to side of the head may fracture thin bones forming the pterion, rupturing the middle meningeal a. which sits between the skull and dura mater.

Source: Anatomy-Medicine; Neurosurgical Atlas

⚕ Clinical Correlate ⚕ "Danger Zone" #1 (of 3)

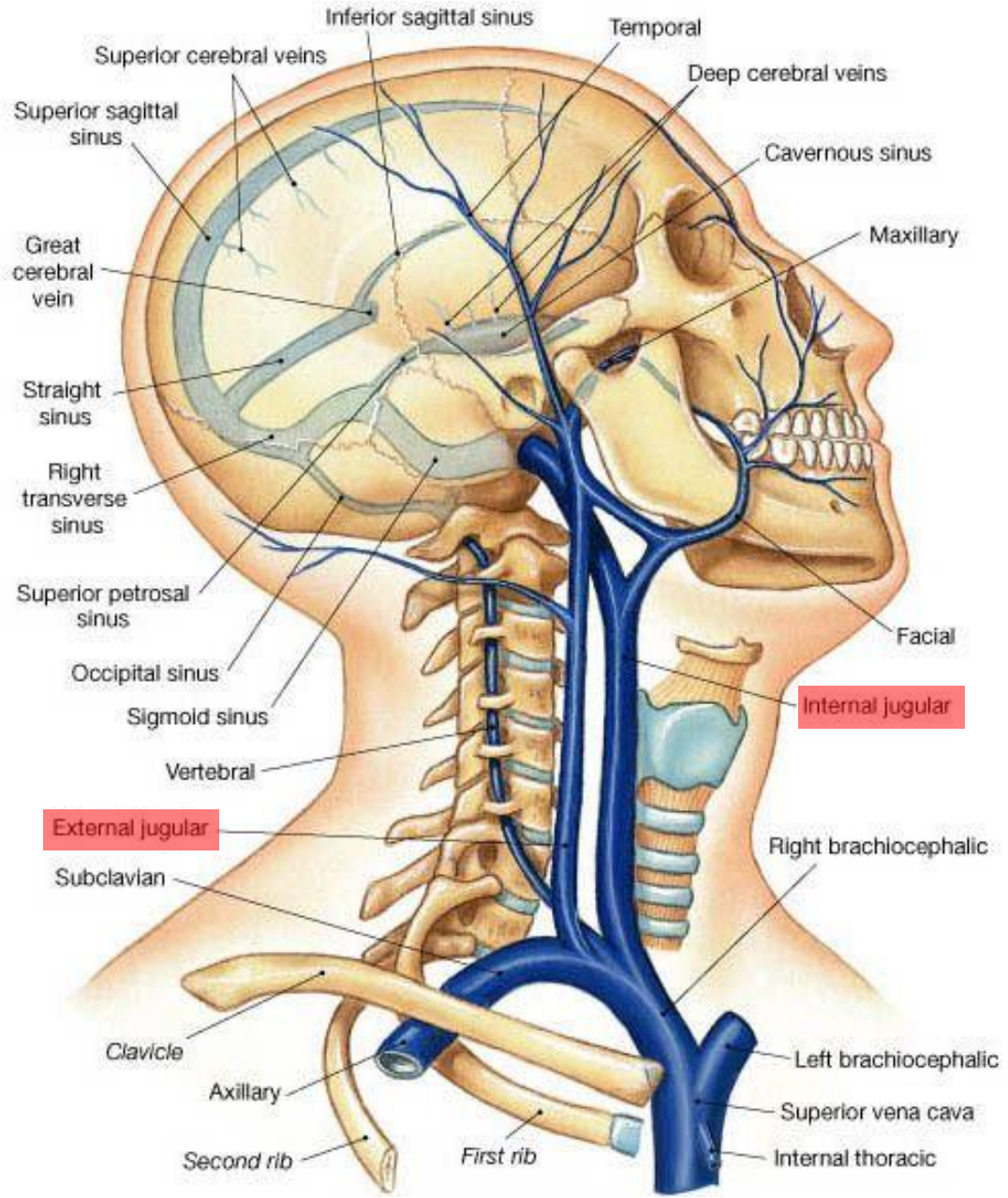
Types of Intracranial Hemorrhage/Hematoma



Intracranial hemorrhage/hematoma: Blood accumulation in the endocranial (brain) cavity, resulting in life threatening compression of the brain.

1. **Epidural hematoma:** between skull and dura mater.
2. **Subdural hematoma:** between dura mater and arachnoid mater. Common when bridging veins and sagittal sinus is torn.
3. **Subarachnoid hemorrhage:** between arachnoid mater and pia mater. Common when cerebral arteries rupture.

Vascular System: Veins

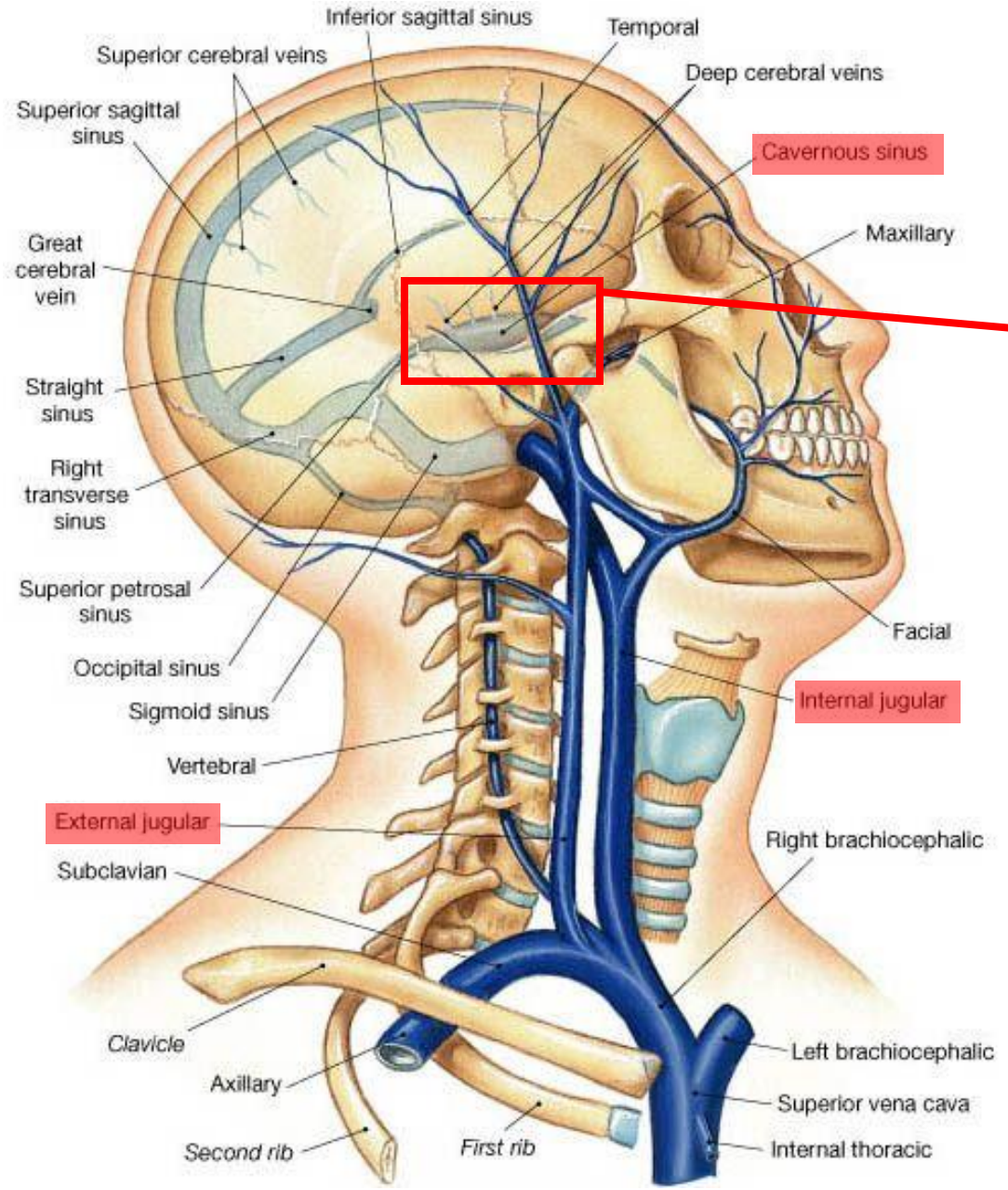


External Jugular: drains temporal (& occipital) regions

Internal Jugular: drains face and inside skull

Source: Anatomy-Medicine; *Moore Clinically Oriented Anatomy* 8e

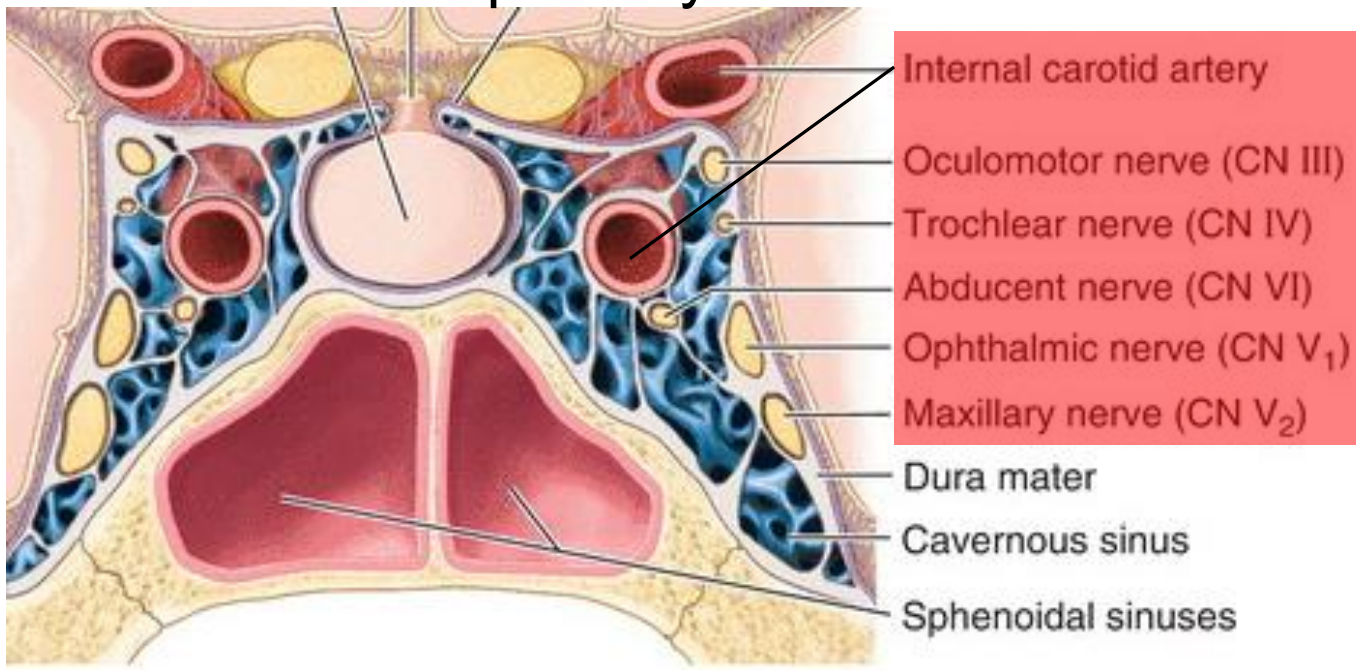
Vascular System: Veins



External Jugular: drains temporal & occipital regions

Internal Jugular: drains face and inside skull

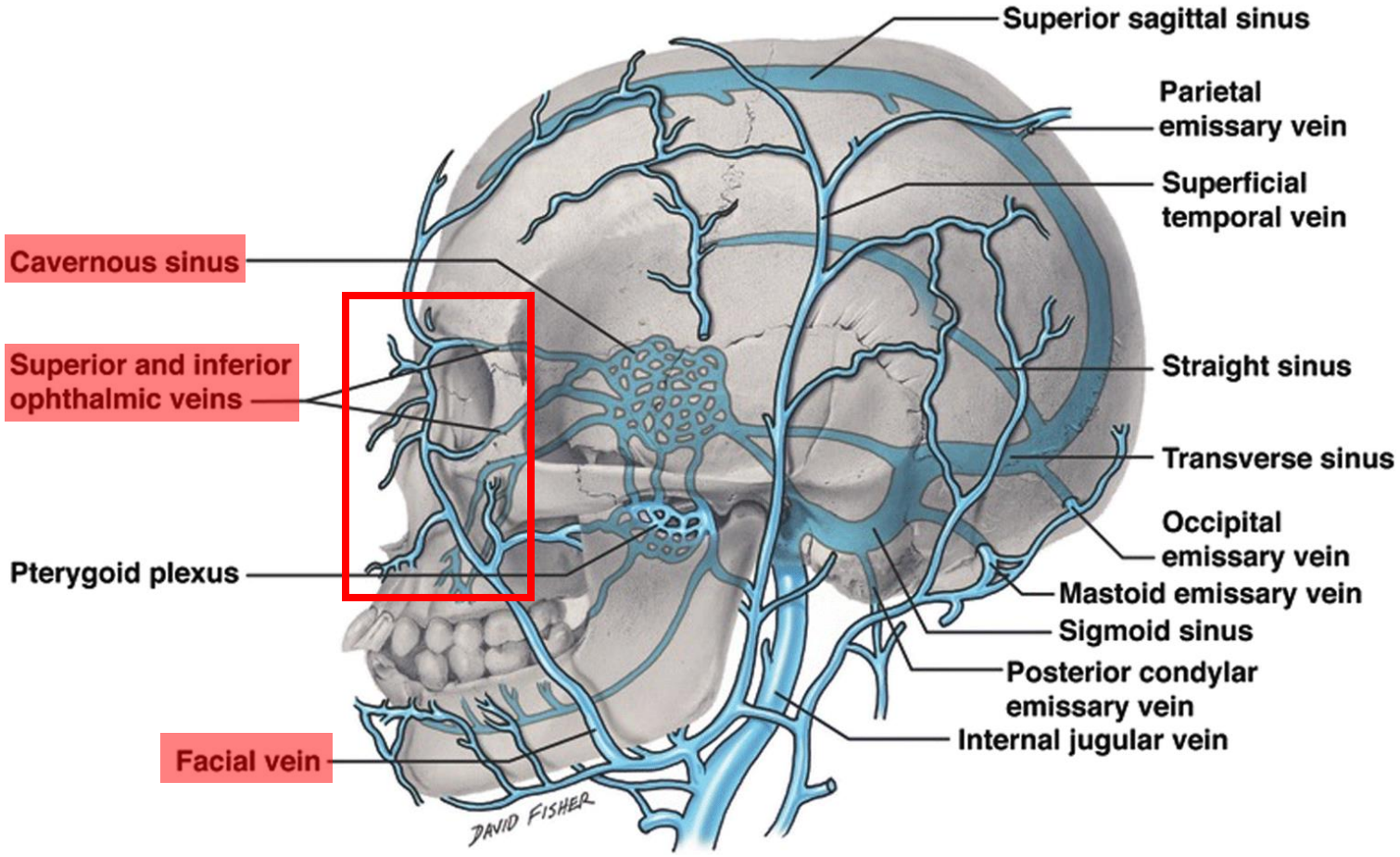
Cavernous Sinus: split dural venous sinus, located lateral to pituitary fossa



(C) Posterior view of coronal section of cavernous sinus

Source: Anatomy-Medicine; *Moore Clinically Oriented Anatomy* 8e

⚕ Clinical Correlate ⚕ "Danger Zone" #2 (of 3)

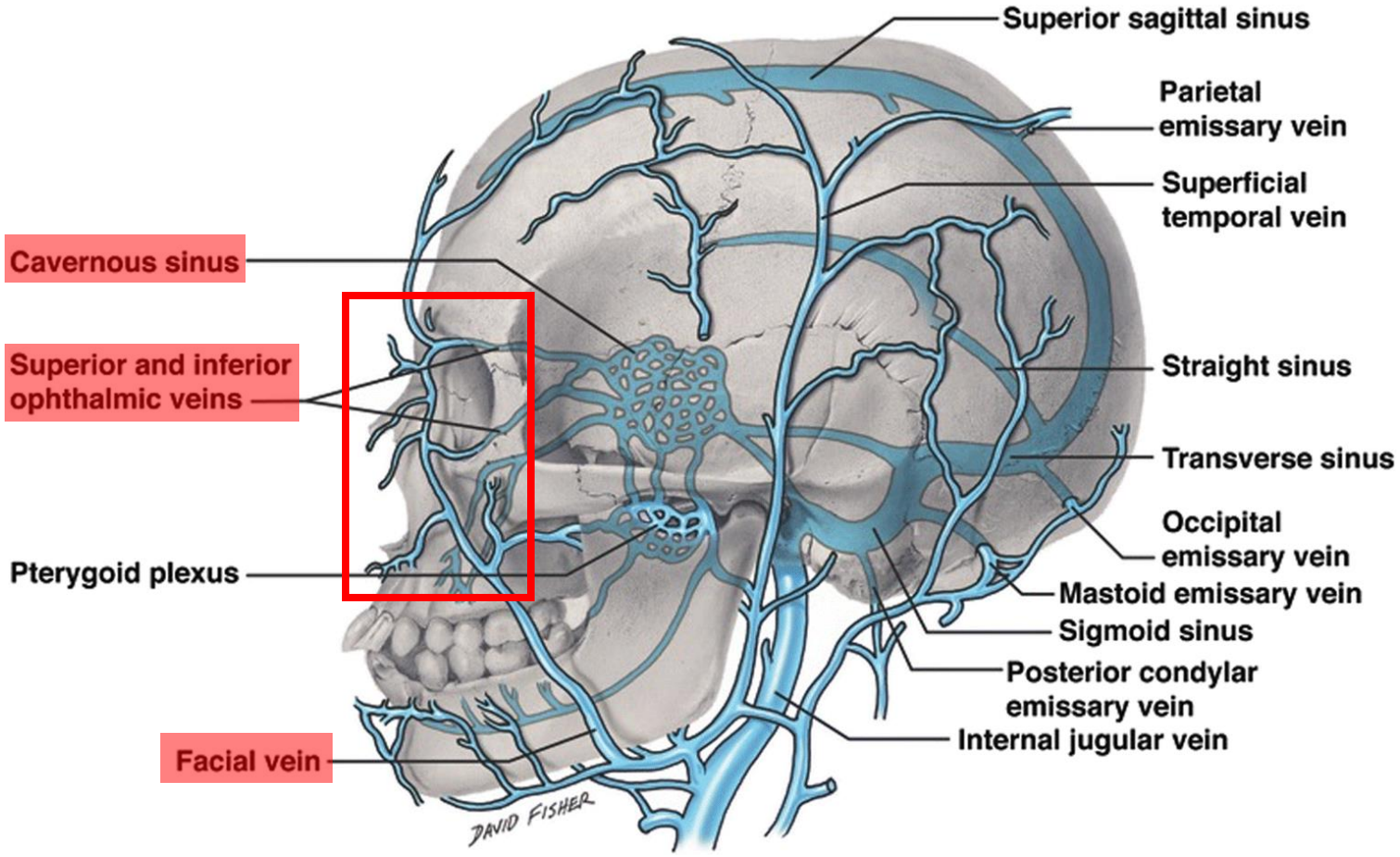


Facial vein has no valves, so blood may drain superiorly into superior & inferior ophthalmic veins and enter the cavernous sinus.

Infection around the nose (e.g., pimples, boils) can spread into cavernous sinus where important arteries and nerves are located.

Source: Lachkar et al. 2019

⚕ Clinical Correlate ⚕ "Danger Zone" #2 (of 3)

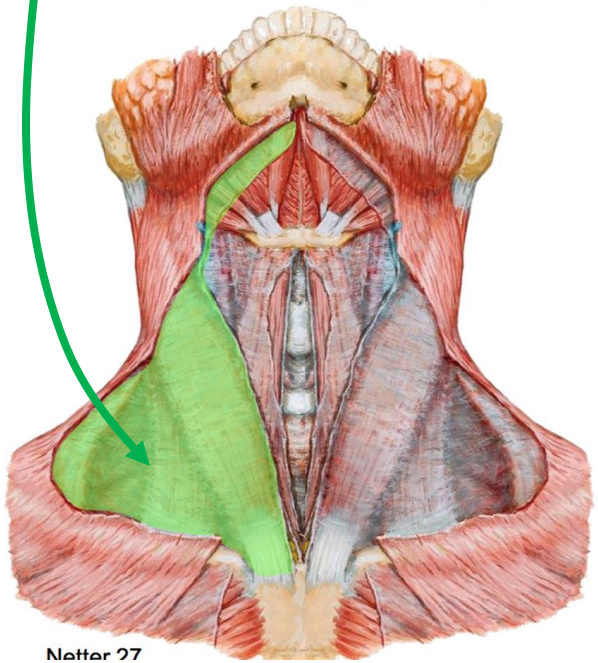


Source: Lachkar et al. 2019

Cervical Fascia

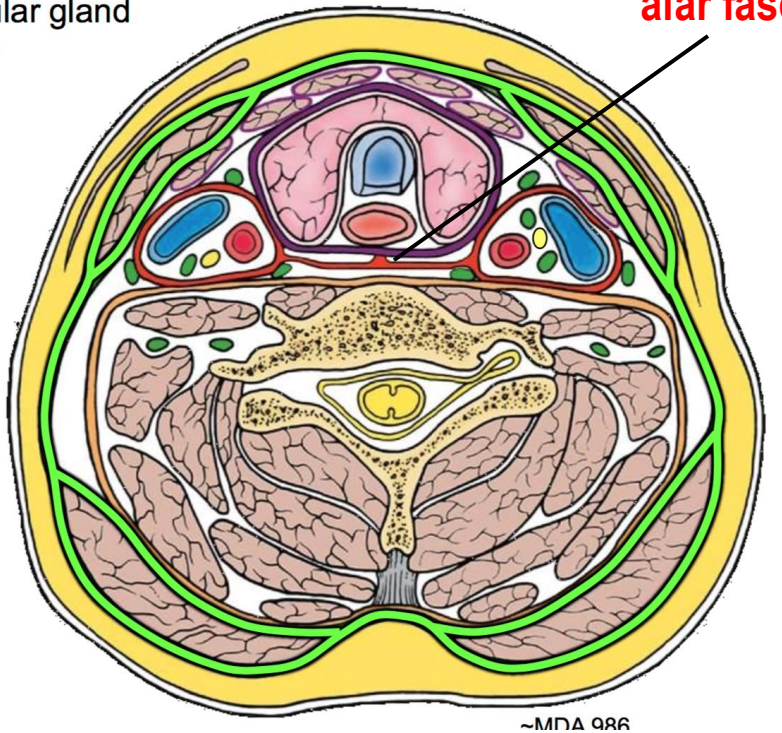
Investing Fascia

Encircles neck
Invests Trapezius and SCM, submandibular gland
Continuous with capsule of parotid gland



investing fascia
pretracheal fascia
carotid sheath
prevertebral fascia

alar fascia: connects carotid sheaths

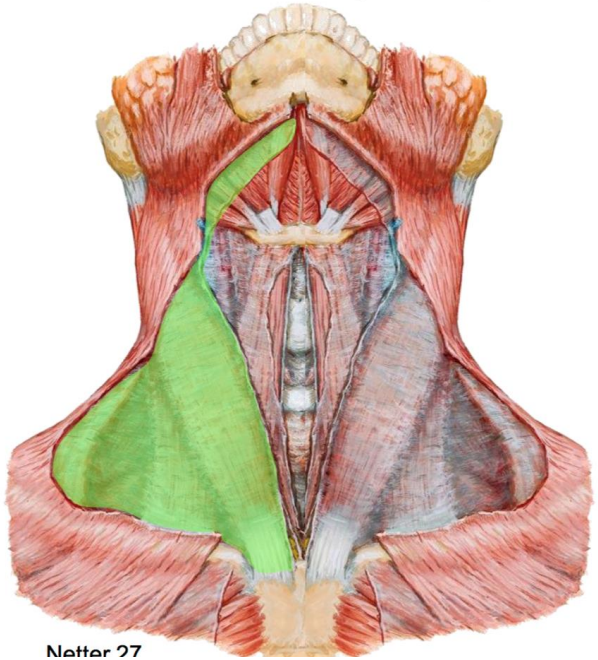


Source: *Netter's Anatomy Atlas*

⚕ Clinical Correlate ⚕ "Danger Space" #3 (of 3)

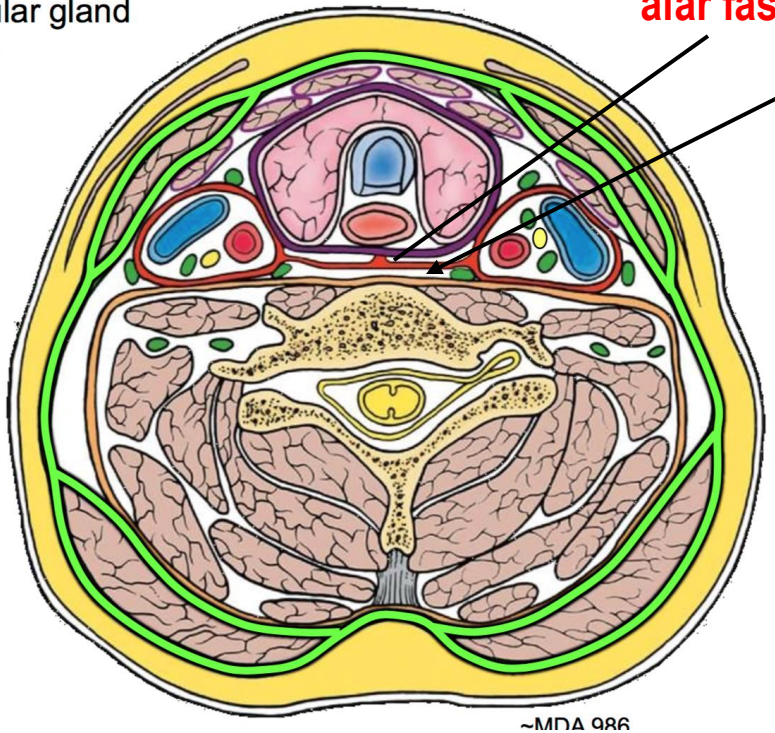
Investing Fascia

Encircles neck
Invests Trapezius and SCM, submandibular gland
Continuous with capsule of parotid gland

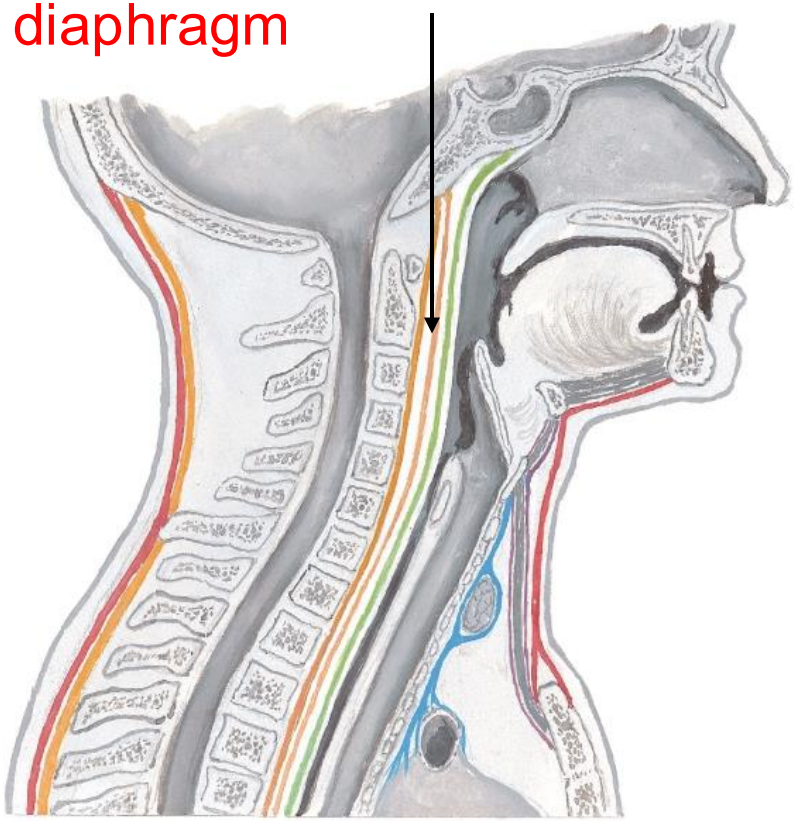


investing fascia
pretracheal fascia
carotid sheath
prevertebral fascia

alar fascia



Danger Zone: space between alar fascia and prevertebral fascia. Infections can travel down through mediastinum to diaphragm

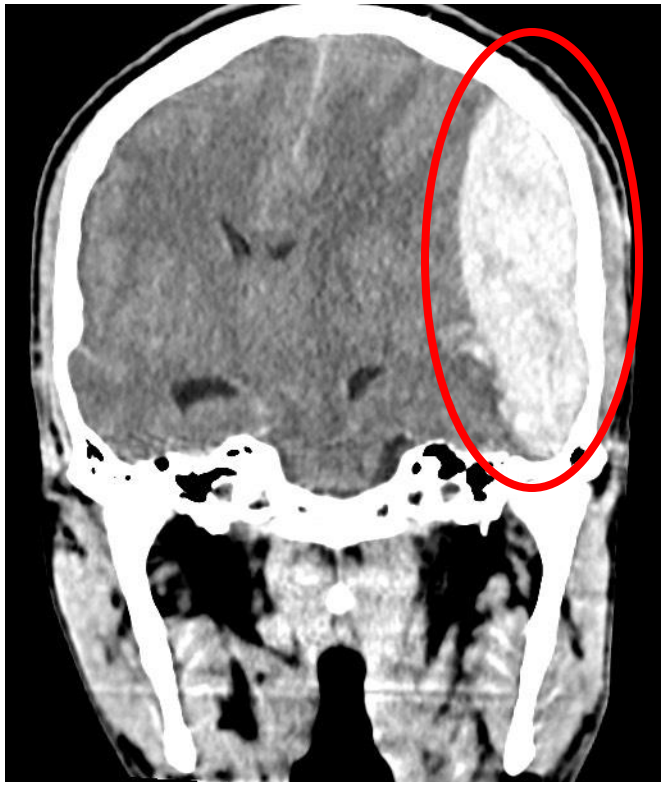


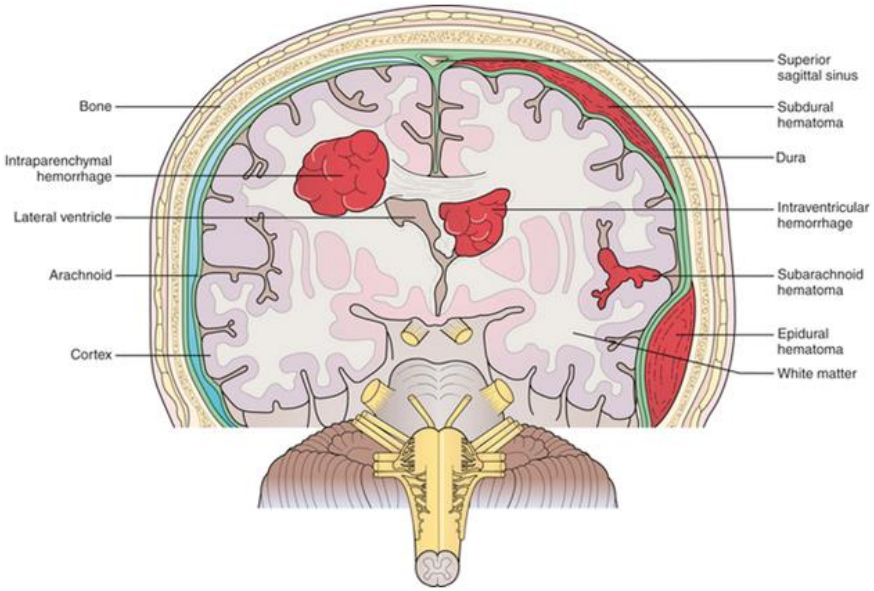
Source: *Netter's Anatomical Atlas*

Example Question

A 30-year-old patient is admitted to a hospital with a traumatic injury to the head. CT scan reveals that the left middle meningeal artery between the skull and dura mater has ruptured. Which type of intracranial hematoma/hemorrhage describes the injury?

a. subdural
b. intraparenchymal
c. intraventricular
d. subarachnoid
e. epidural





Source: VIR Clinic

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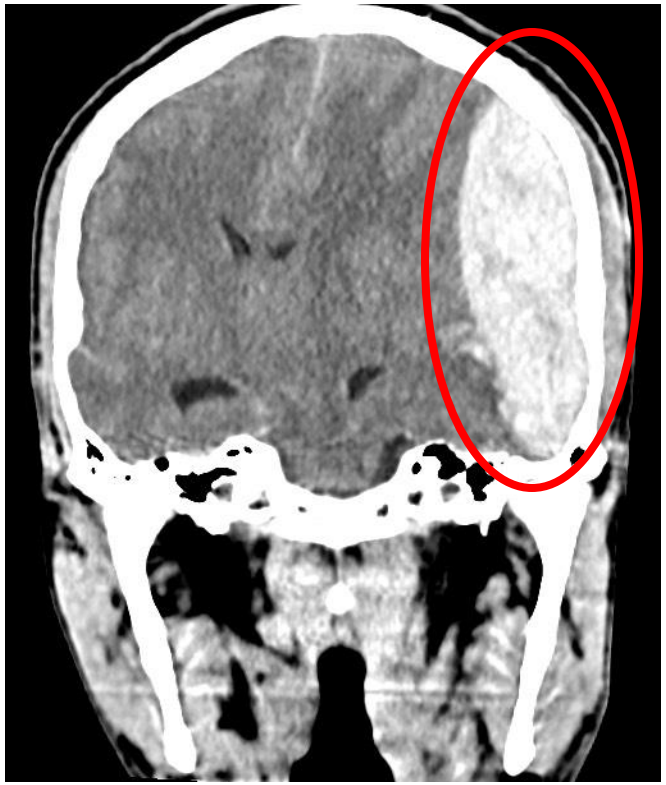

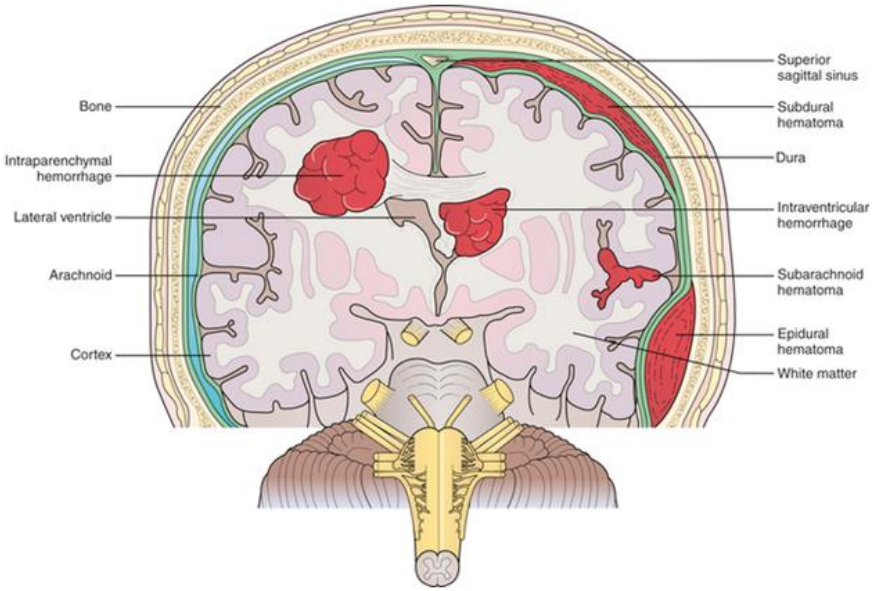

Source: VIR Clinic

Lecture Outline

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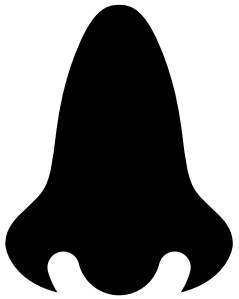
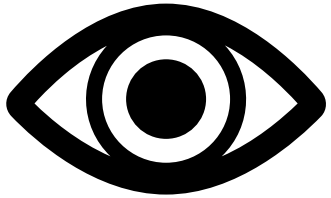
2. “Special” Senses and Organs

3. Overview of Cranial Nerves

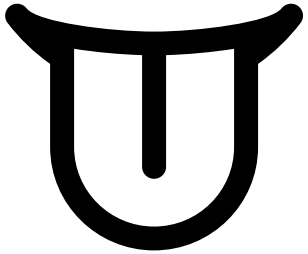
Special Senses



olfaction



vision



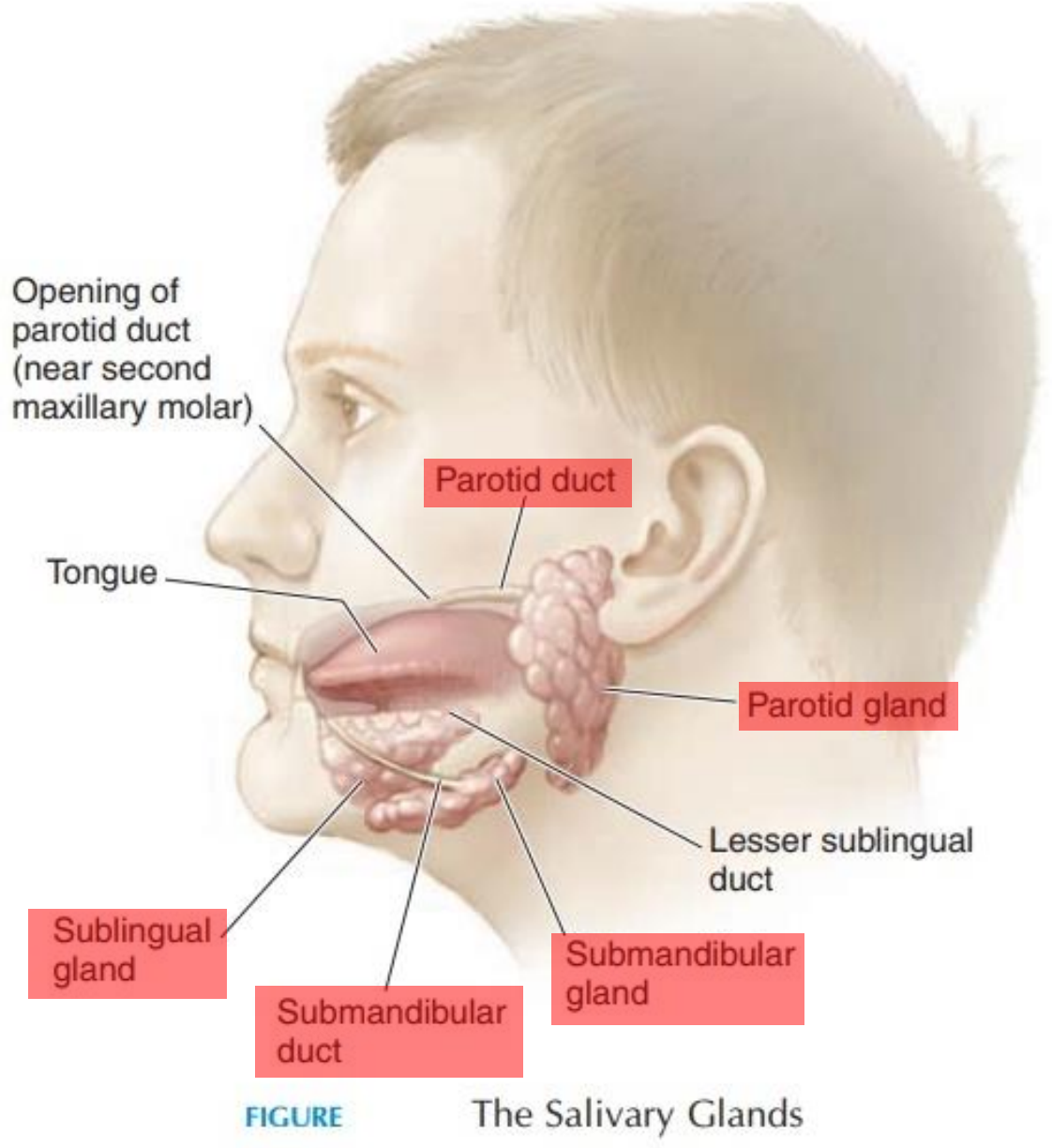
taste (gustation)

hearing

balance

Note: You will learn more about these special senses in later lectures.

Salivary Glands



Salivary glands secrete directly into the oral cavity.

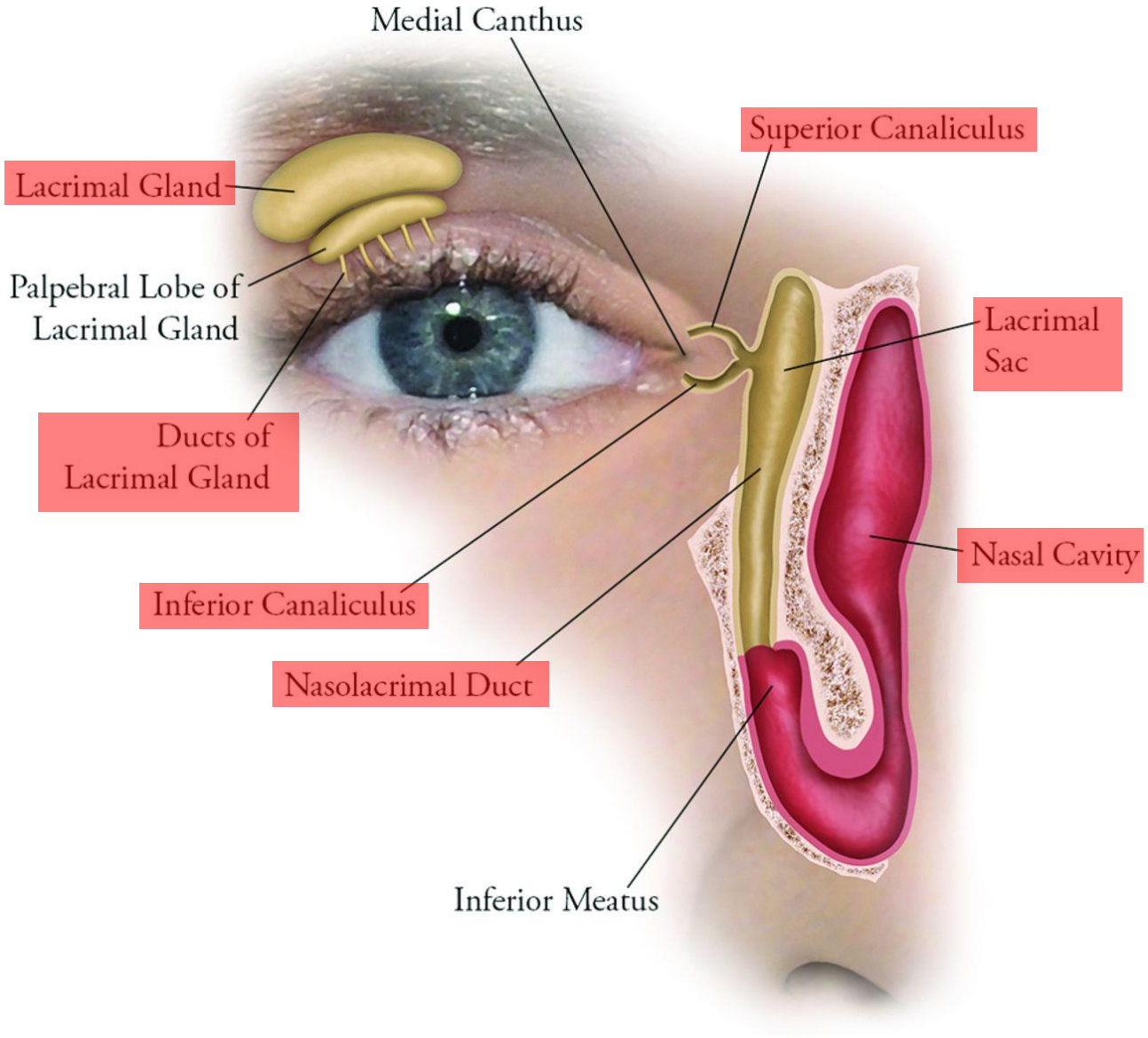
Parotid gland: located anterior to the ears in posterior cheek region. Secretes copious watery saliva (parasympathetic); small amount of viscous saliva (sympathetic).

Submandibular gland: located below the mandible. Secretions travel through submandibular duct.

Sublingual gland: located in the floor of the mouth. Secretions travels superiorly through numerous small ducts.

Source: brainkart.com

Lacrimal Apparatus



Lacrimal gland: located superior-lateral to the eye. Secretes tears through lacrimal ducts.

Lacrimal canaliculi: drain tears from lacrimal punctum (where two canaliculi meet) into the lacrimal sac.

Lacrimal sac: drains tears into the nasolacrimal duct which opens inferiorly into the nasal cavity.

Drainage can be blocked by injury or infection, which can lead to irritated eye.

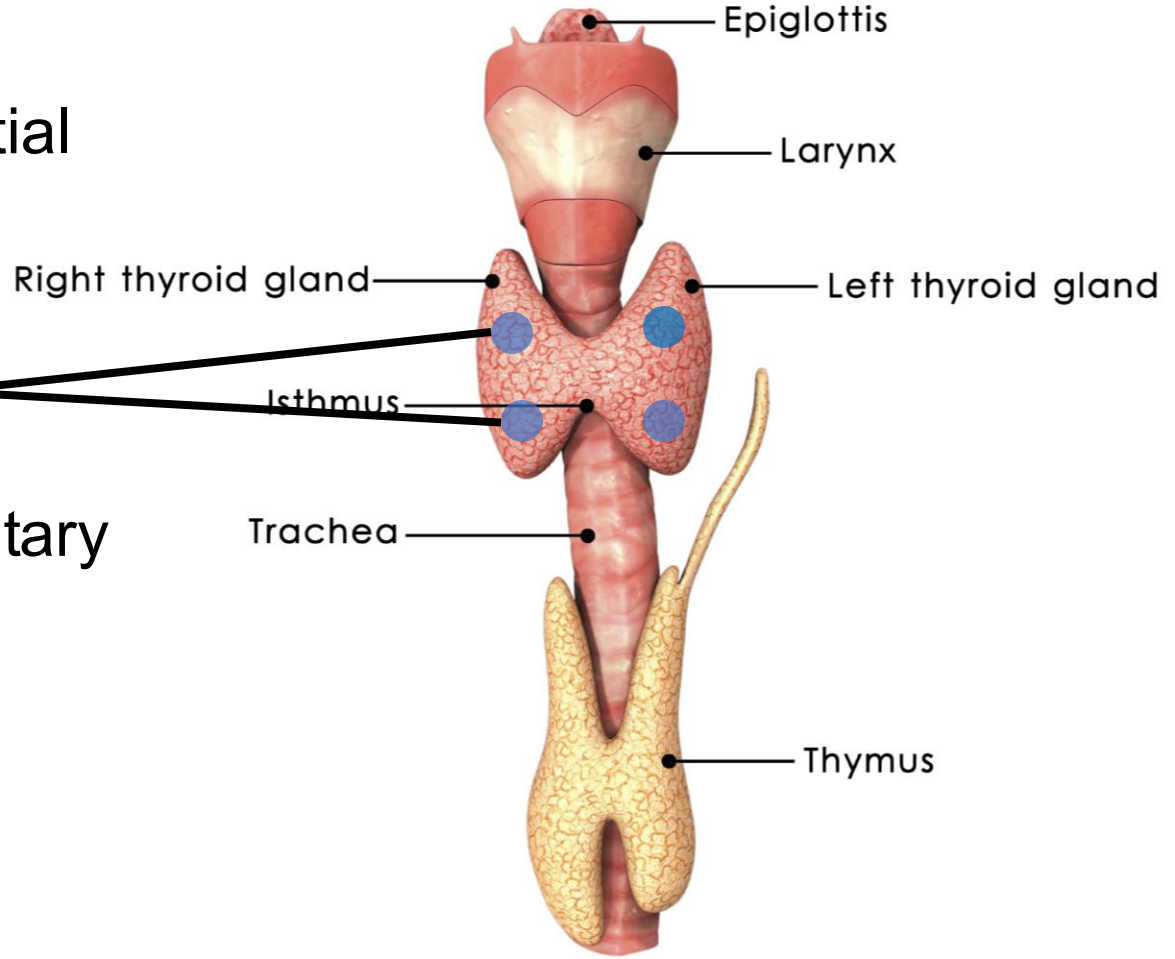
Source: quora.com

Glands in the Deep Neck

Thyroid: takes up iodine from food to produce thyroxine (T4) and triiodothyronine (T3) (essential for growth). Productions controlled by thyroid-stimulating hormone from the pituitary gland.

Parathyroid glands: produces parathyroid hormone (PTH) for regulating calcium and phosphorus metabolism. Controlled by the pituitary and hypothalamus.

Thymus: produces thymosin that promotes differentiation and maturation in T-lymphocyte precursors transported from the bone marrow.



⚕ Clinical Correlate ⚕ Thyroid Gland Diseases

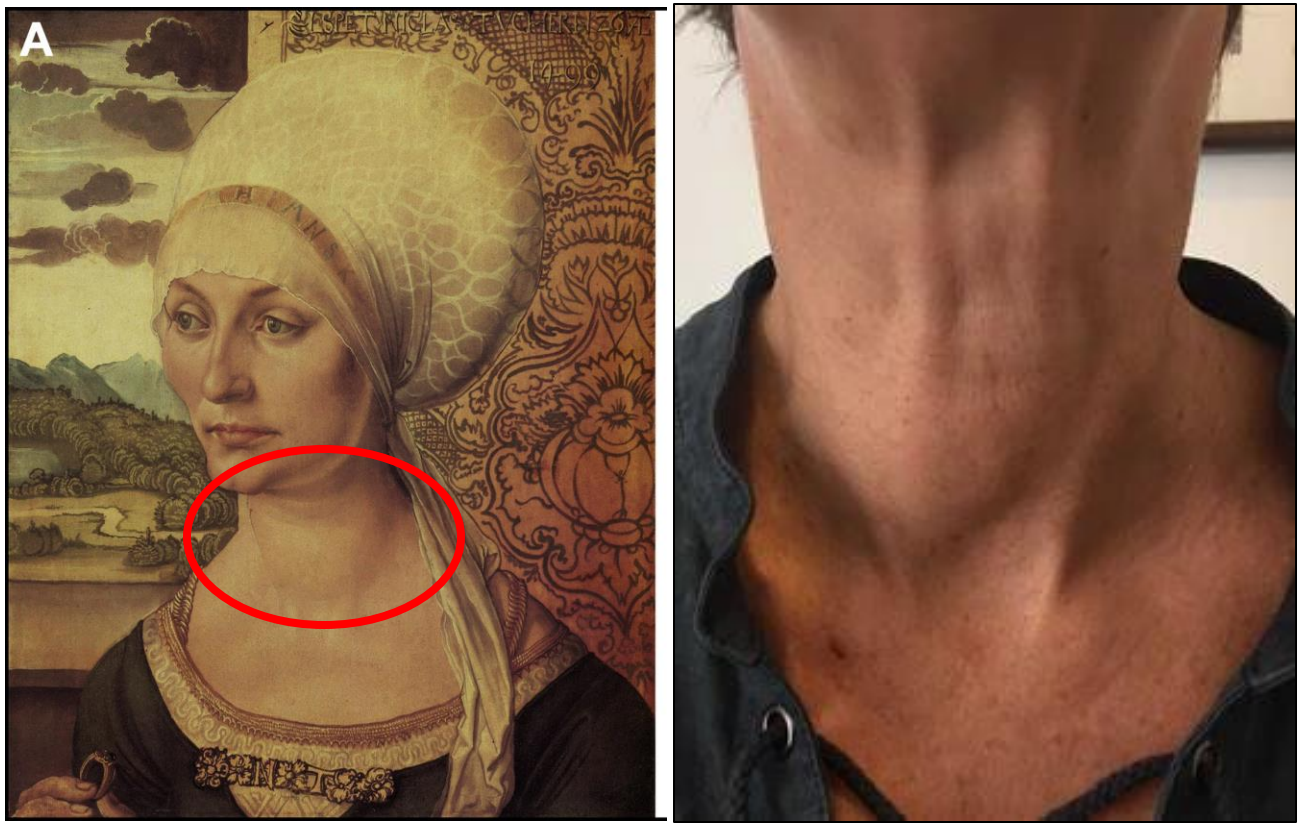
Goiter: enlargement of the thyroid gland, presented as lump on anterior aspect of the neck. Often due to iodine deficiency. Could be associated with:

Hyperthyroidism: overproduction of thyroid hormones.

Hypothyroidism: underproduction of thyroid hormones. Glands swell to try to produce more hormones.

Could cause breathing/swallowing difficulties or speech loss due to compression of the trachea, larynx, esophagus, recurrent laryngeal nerve.

Goiter depicted in Renaissance paintings!



Source: Sterpetti et al. 2016; thyroidsurgery.com

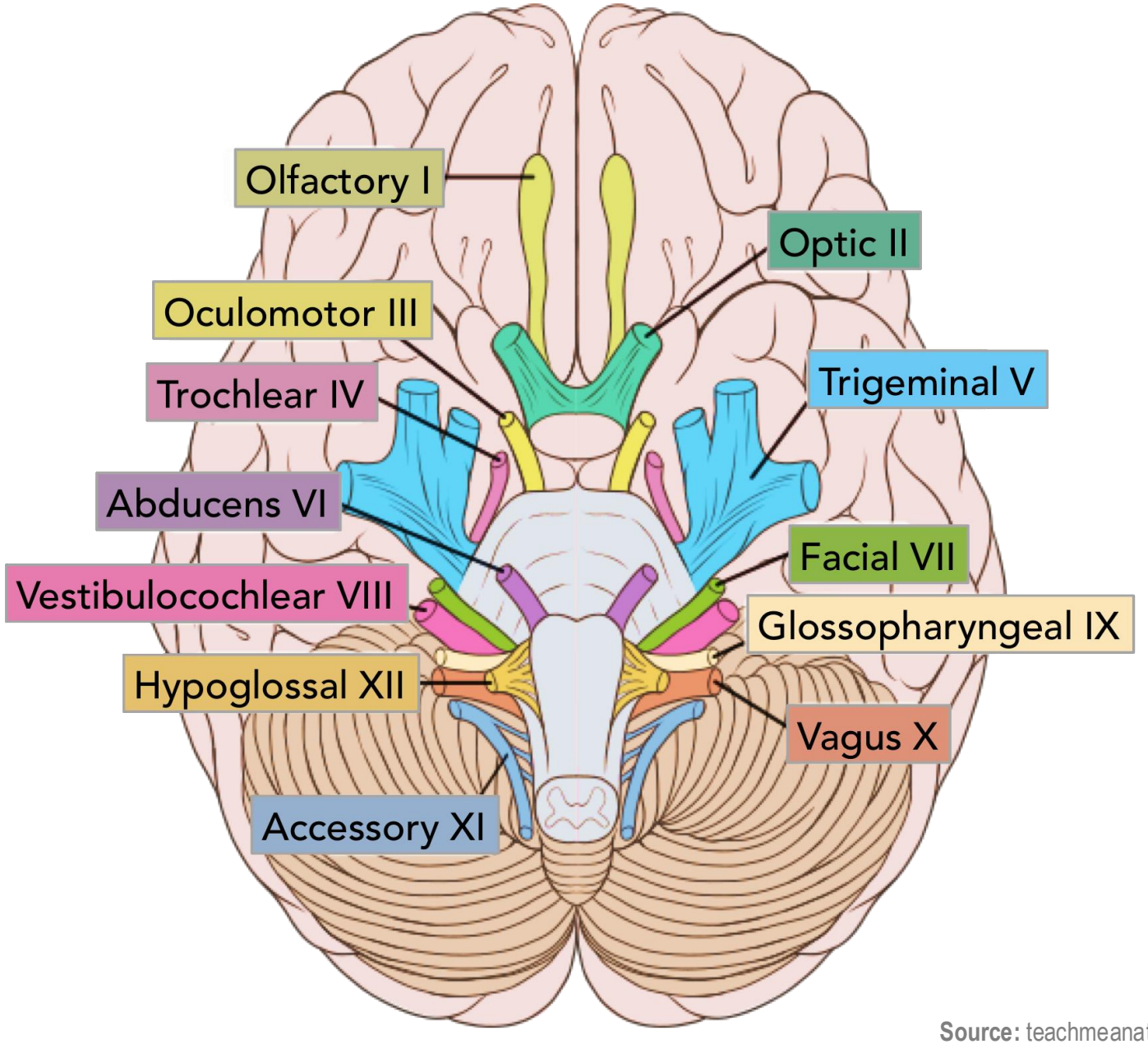
Lecture Outline

1. Head & Neck Architecture

2. “Special” Senses and Organs

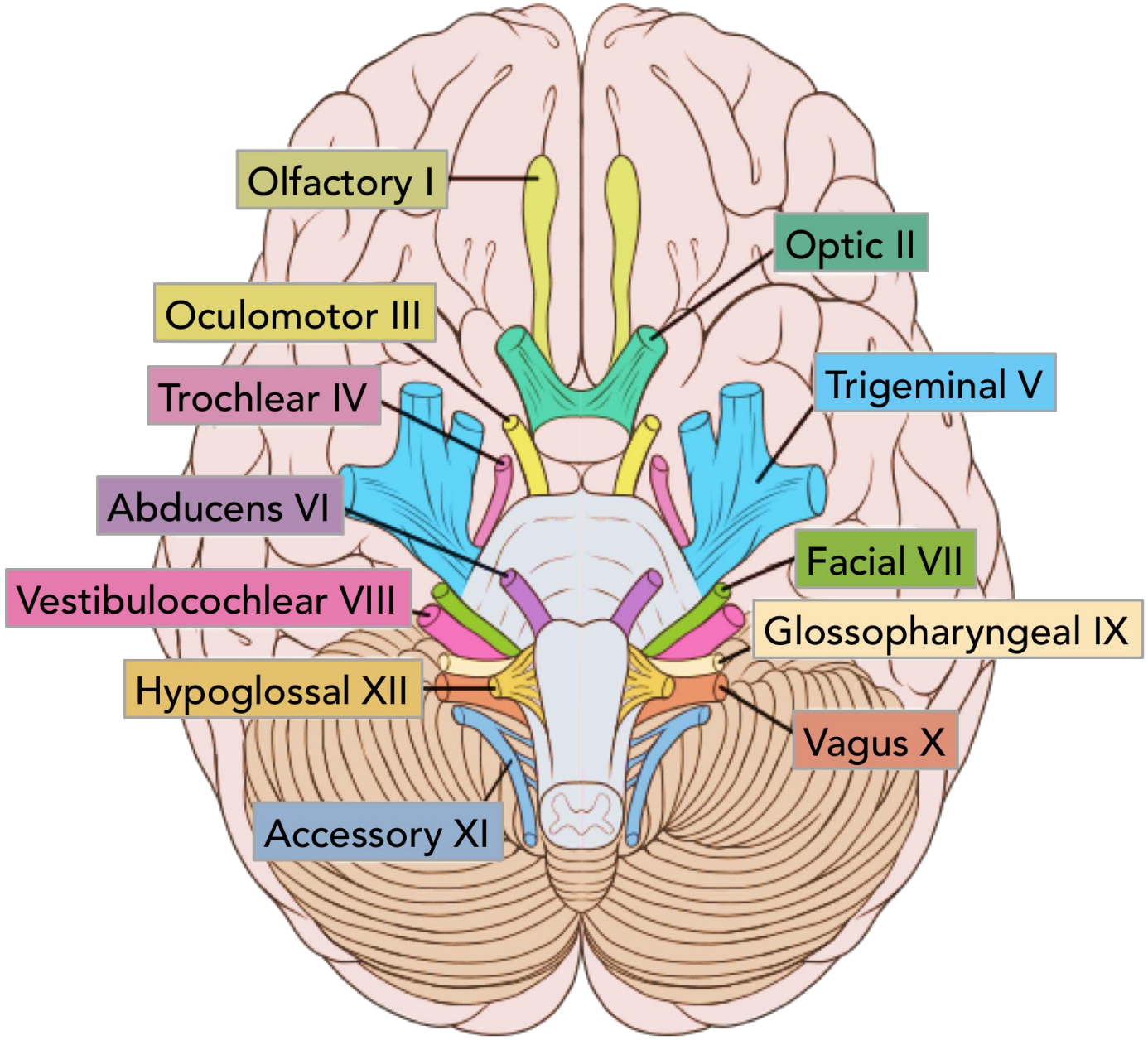
3. Overview of Cranial Nerves

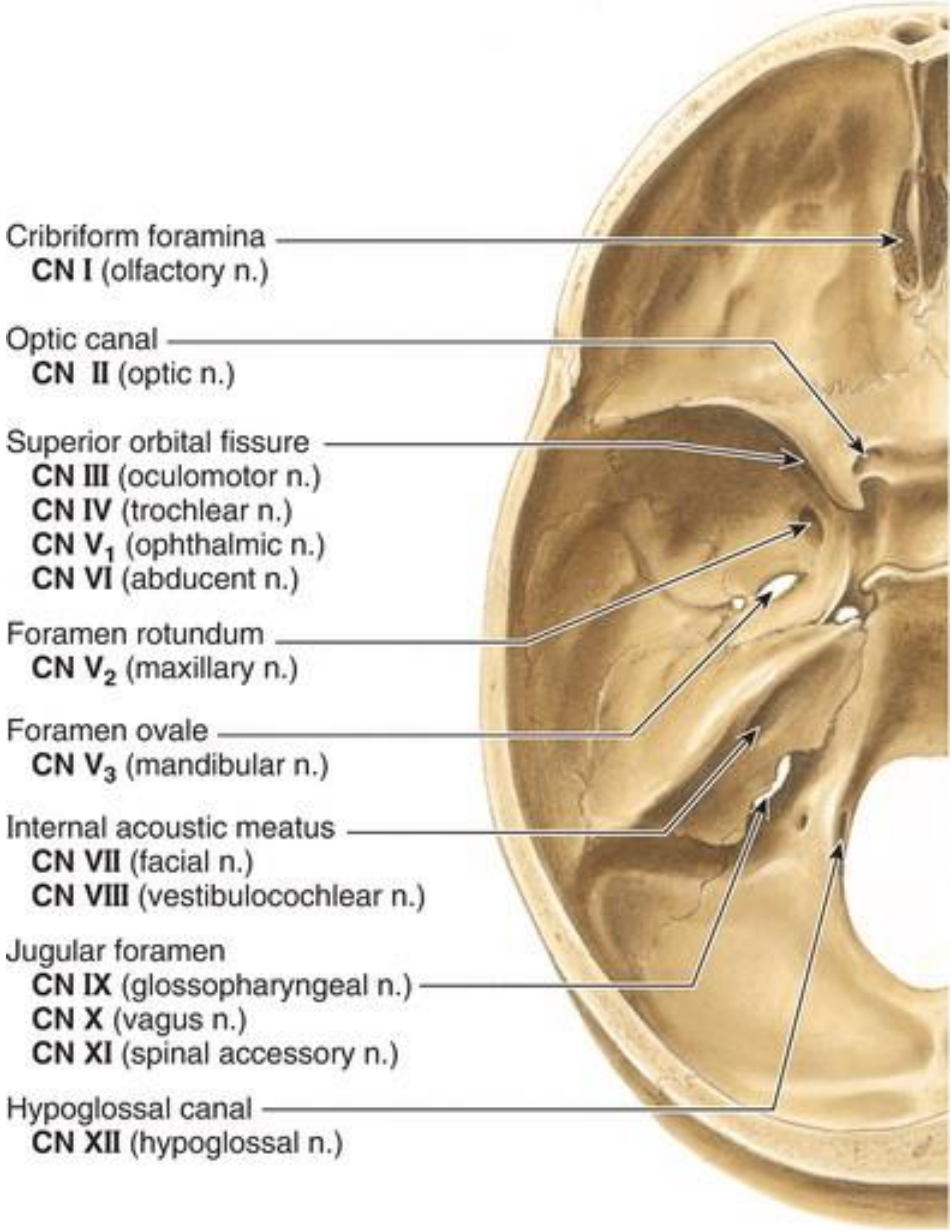
Cranial Nerve Overview



Source: teachmeanatomy.info; *Moore Clinically Oriented Anatomy* 9e

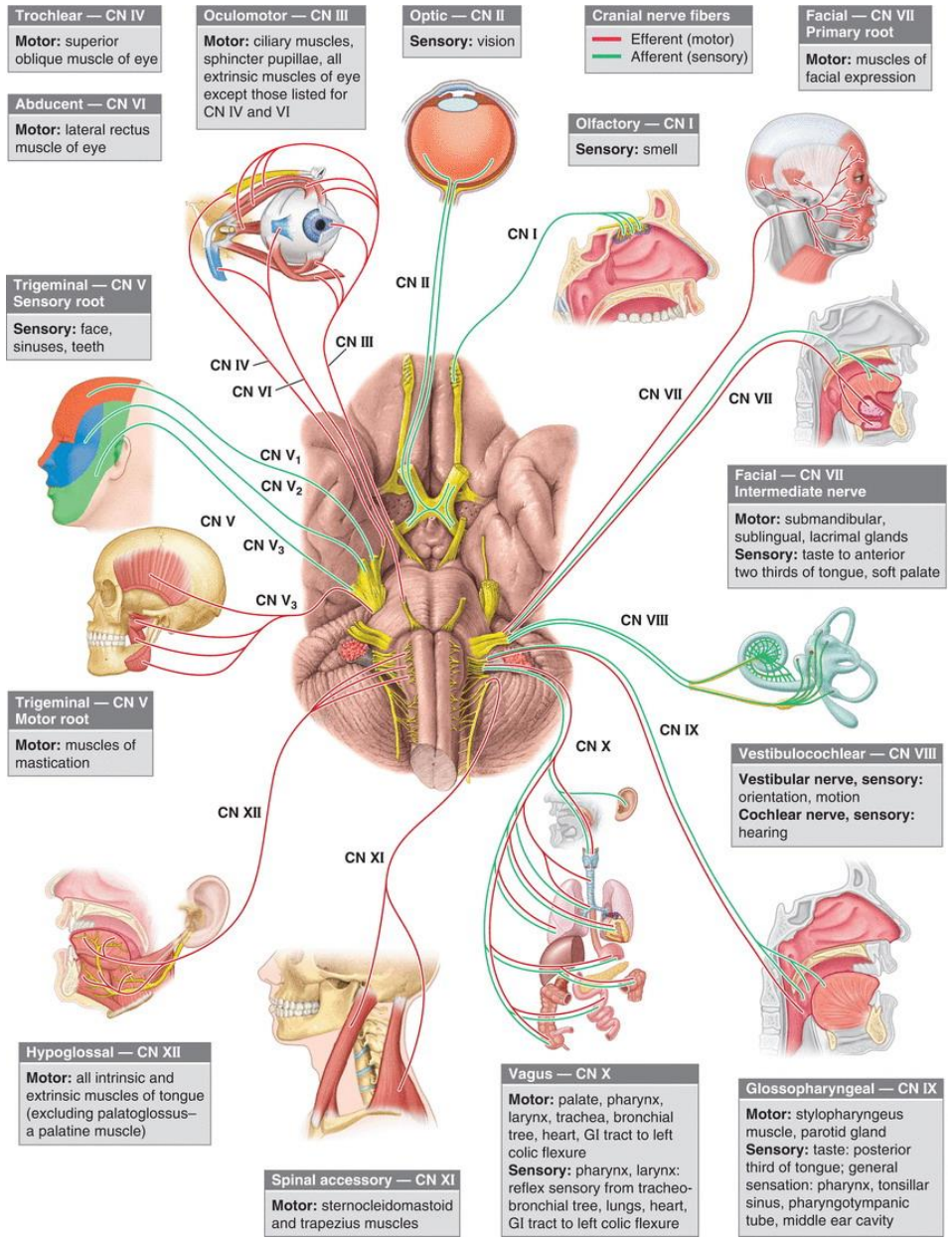
Cranial Nerve Overview





Source: teachmeanatomy.info; *Moore Clinically Oriented Anatomy* 9e

Cranial Nerve Overview



Moore Clinically Oriented Anatomy 9e
Fig. 10.4

Recommended Resource

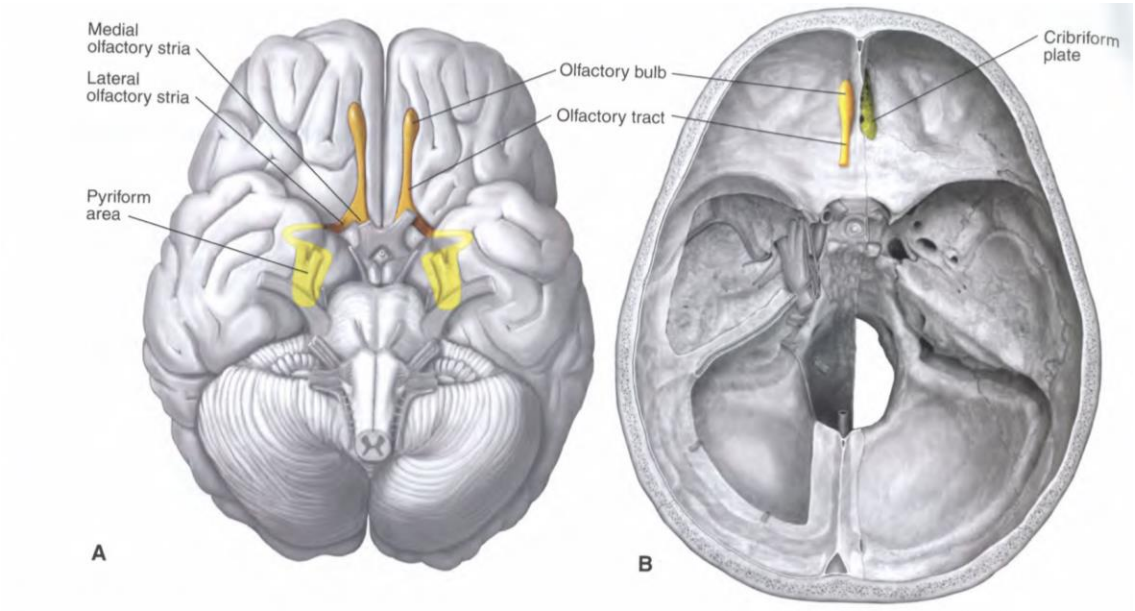
Note: This section will be an introductory overview of all 12 cranial nerves. For this week, learn the names and one function of each cranial nerve. Subsequent lectures will cover these cranial nerves in detail. You will be responsible for learning all functions and fiber types for all 12 nerves for the comprehensive exam.

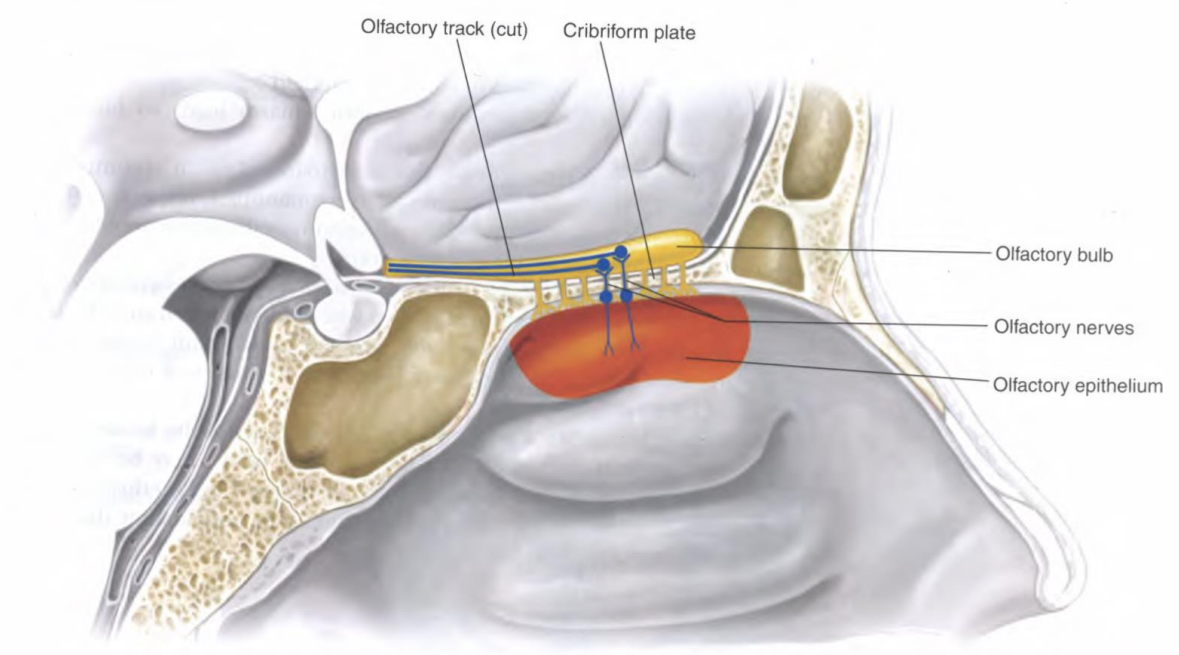
Cranial Nerve Marathon

Create a Table:

Cranial Nerve	Cranial Exit	Fiber Type(s)	Functions
I: olfactory			
II: optic			
III: oculomotor			
IV: trochlear			
V: trigeminal			
VI: abducens			
VII: facial			
VIII: vestibulocochlear			
IX: glossopharyngeal			
X: vagus			
XI: spinal accessory			
XII: hypoglossal			

CN I: Olfactory Nerve & Tract



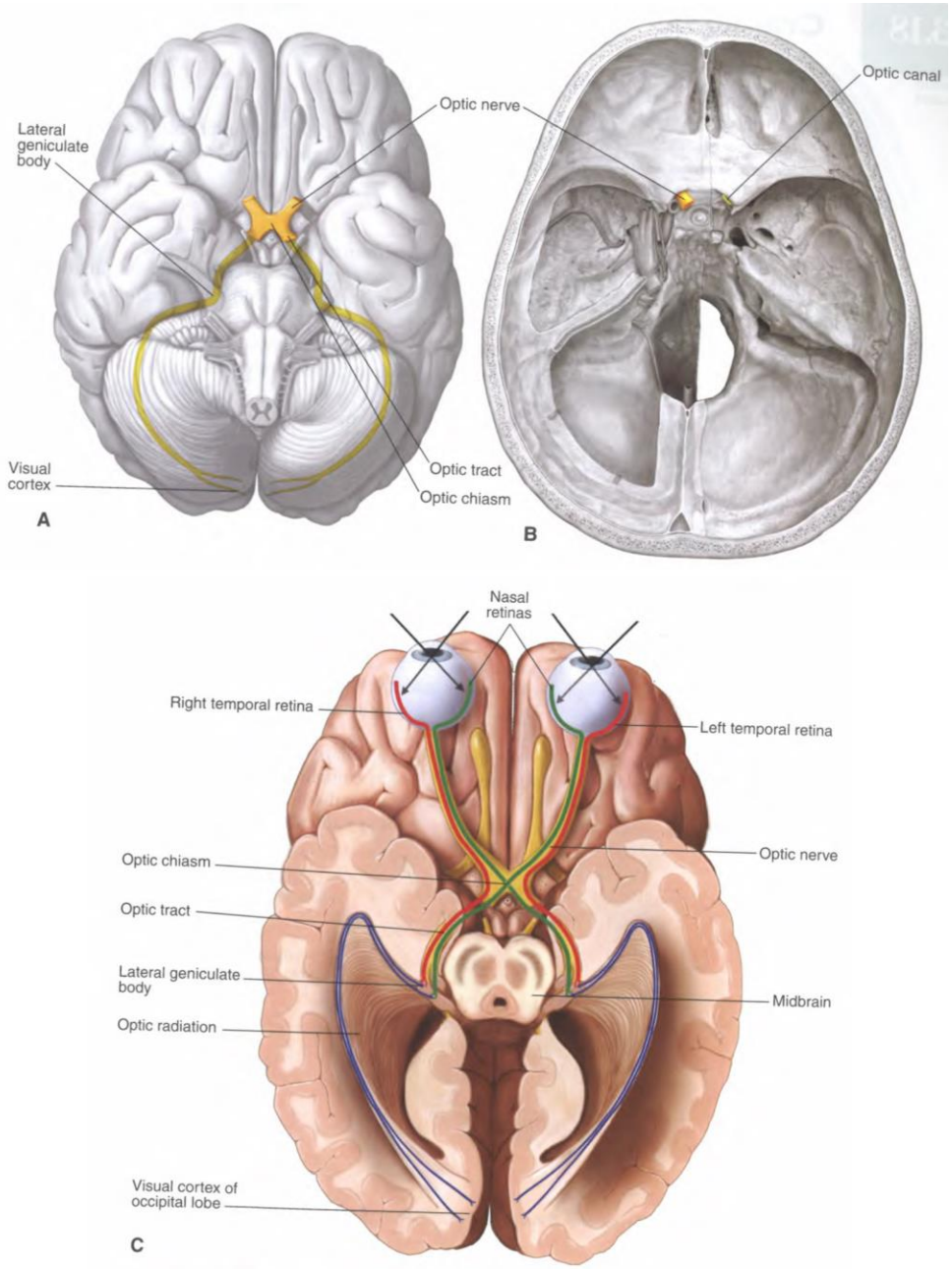


Fiber Type: special sensory

Function: olfaction

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN II: Optic Nerve

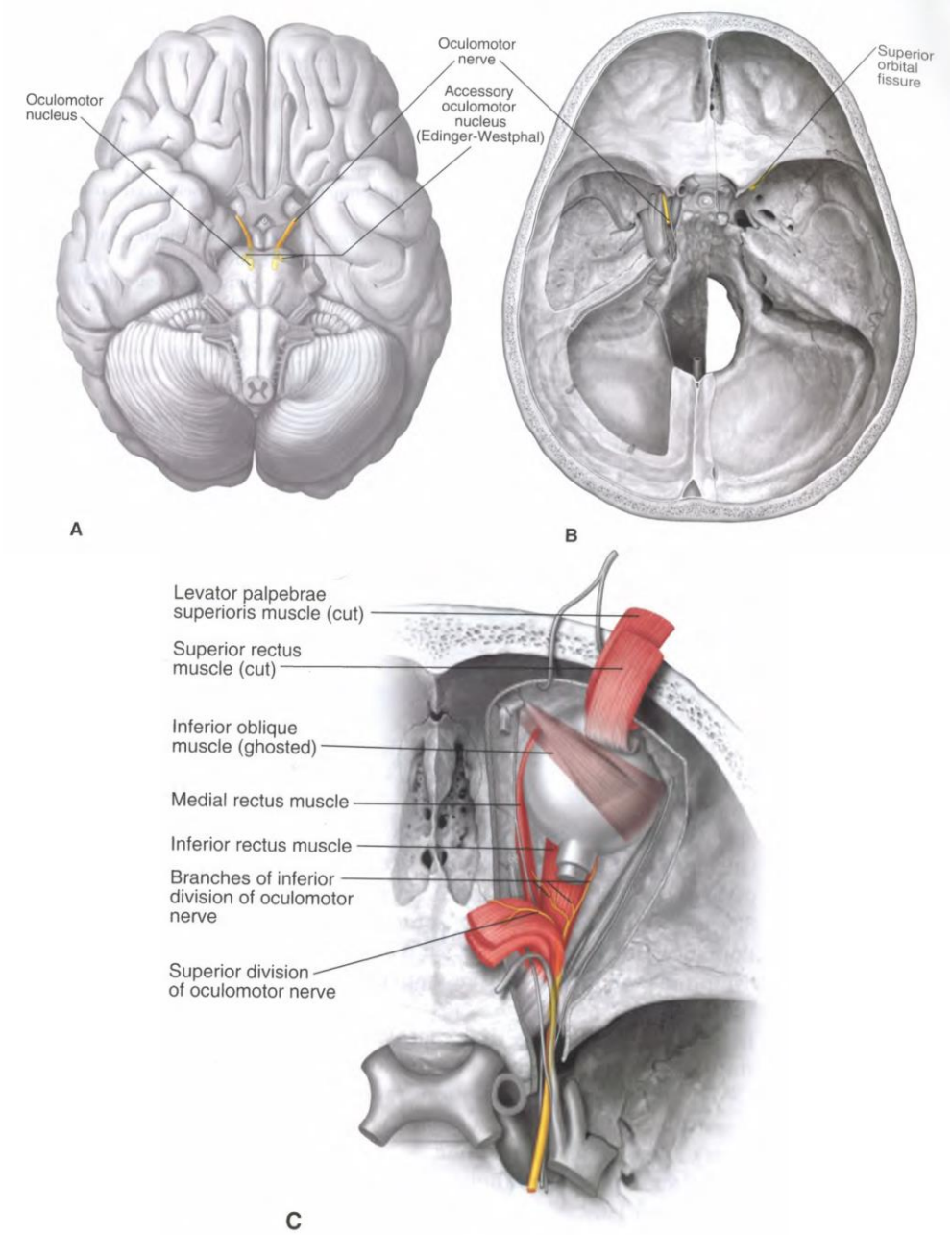


Fiber Type: special sensory

Function: vision

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN III: Oculomotor



Fiber Type: somatic motor

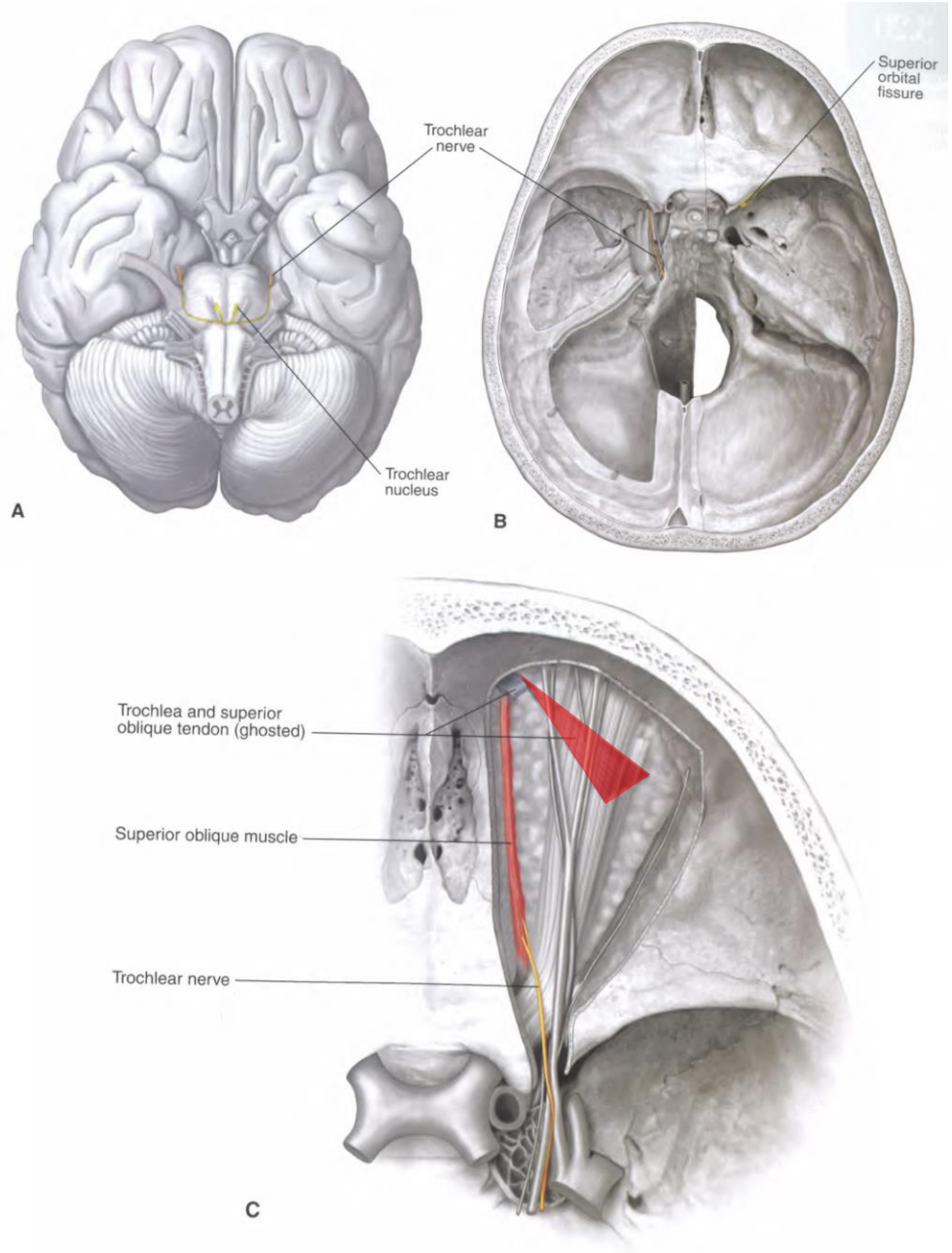
Function: eye movement (superior, inferior, and medial recti, inferior oblique, and levator palpebrae superioris m.)

Additional functions to know for other lectures and for the comp exam.

Visceral motor: constriction of pupil (sphincter pupillae m.) and accommodation (ciliary m.)

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN IV: Trochlear

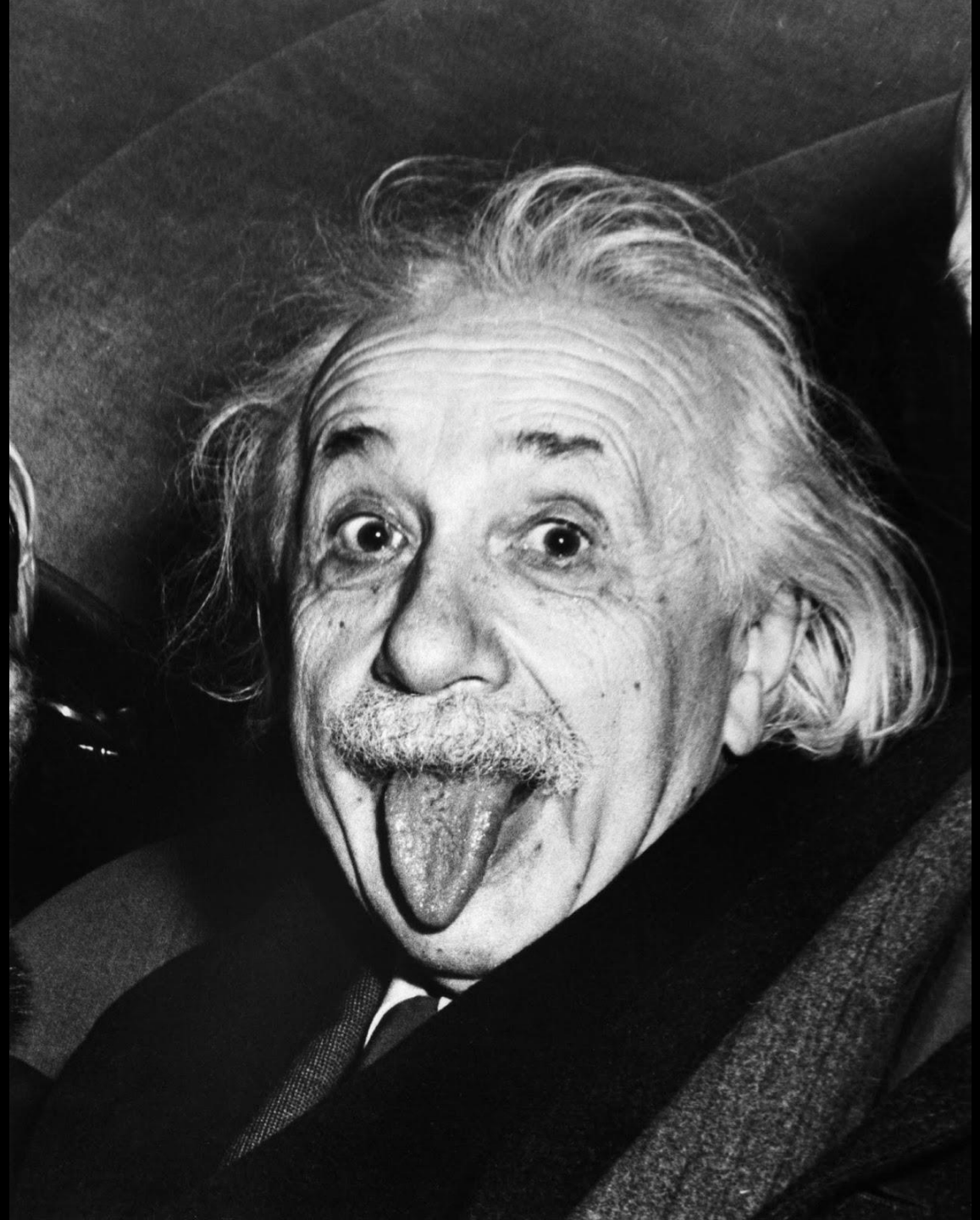


Fiber Type: somatic motor

Function: eye movement (superior oblique m.)

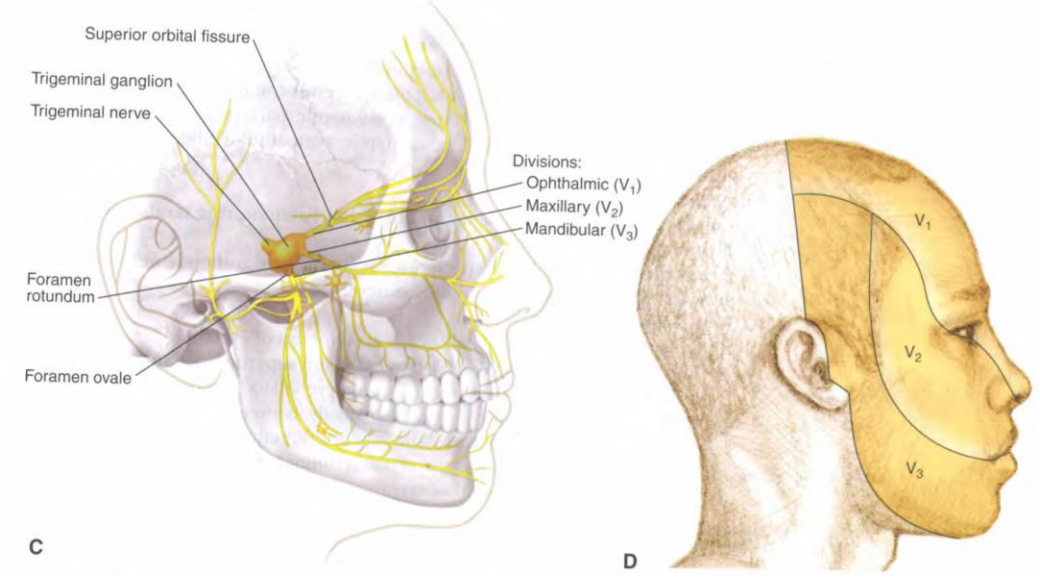
"Trochlea" (Gr.): pulley

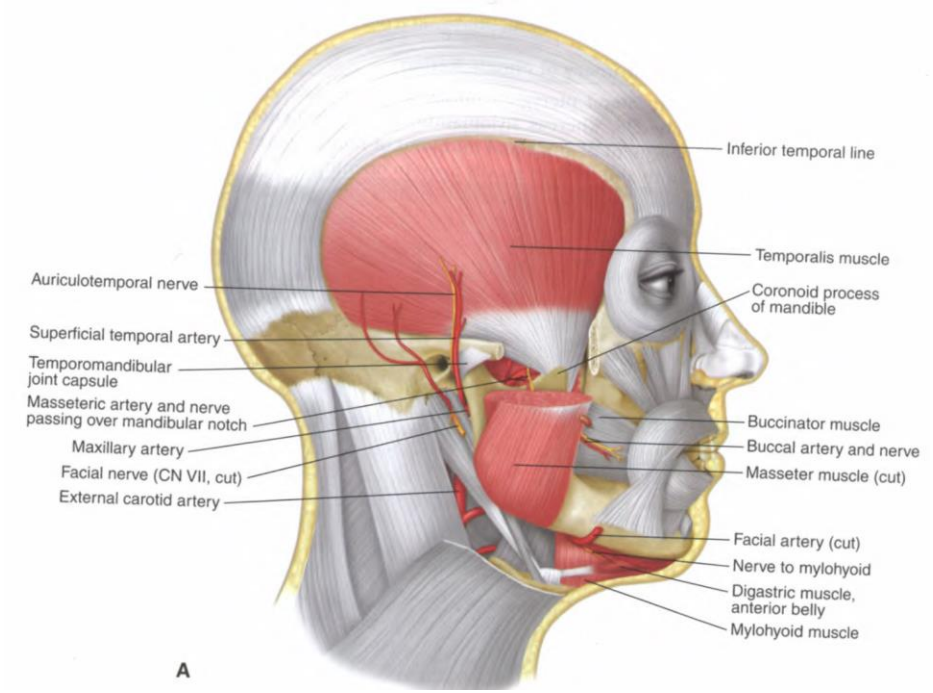
Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*



Source: *Wikipedia*

CN V: Trigeminal





Fiber Type: somatic sensory

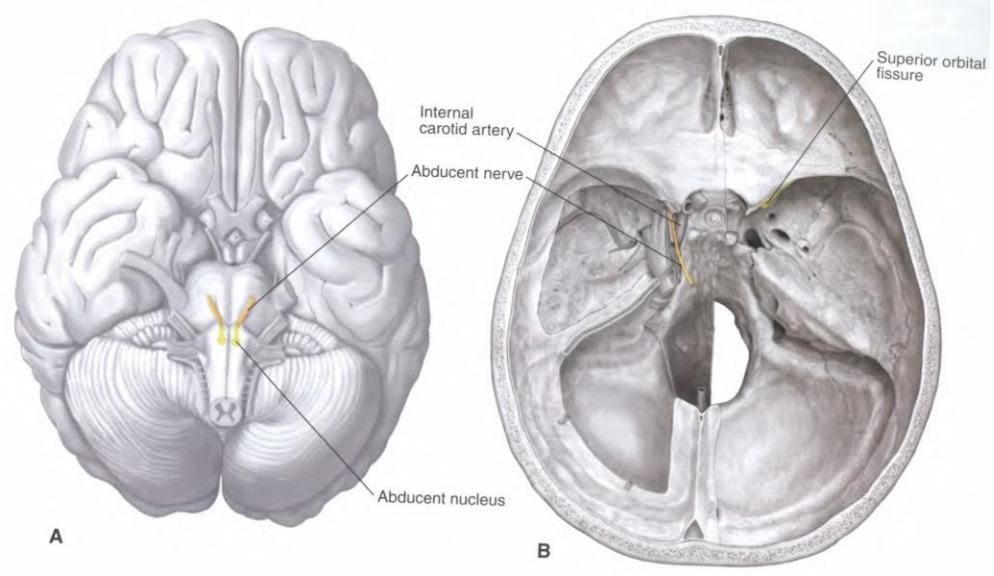
Function: sensation of most of head and teeth.

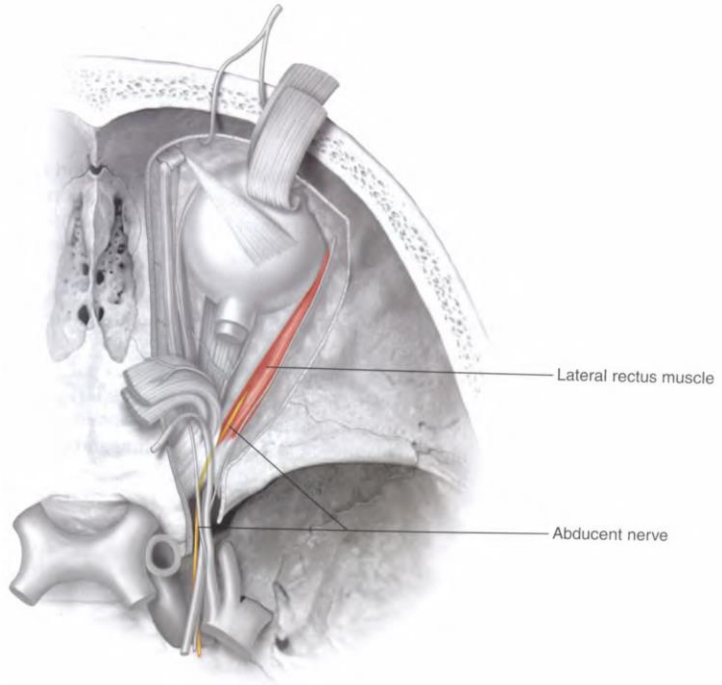
Somatic sensory: touch for anterior 2/3 of tongue

Somatic motor: temporalis, masseter, medial and lateral pterygoids, anterior belly of digastric, tensor veli palatini, tensor tympani

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN VI: Abducens



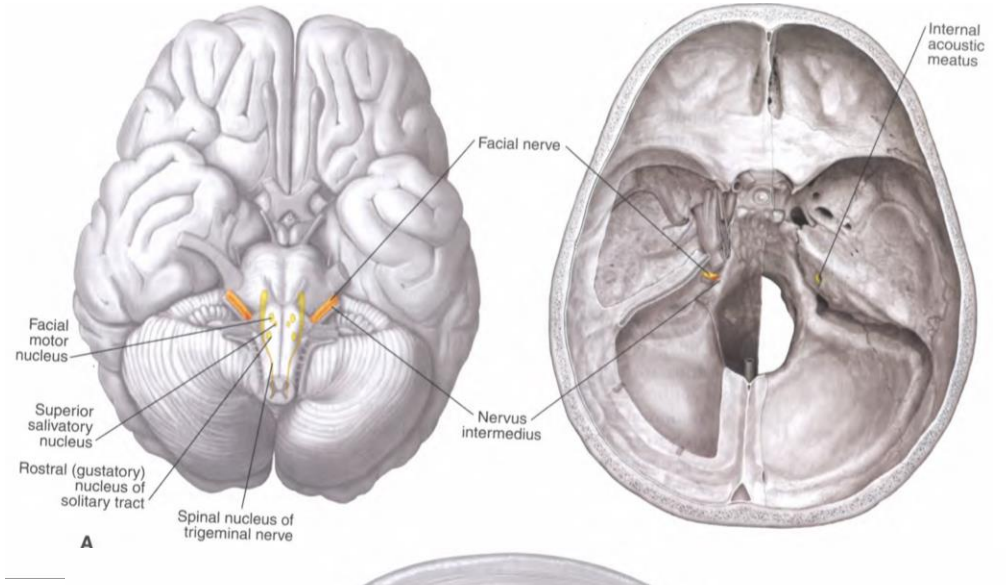


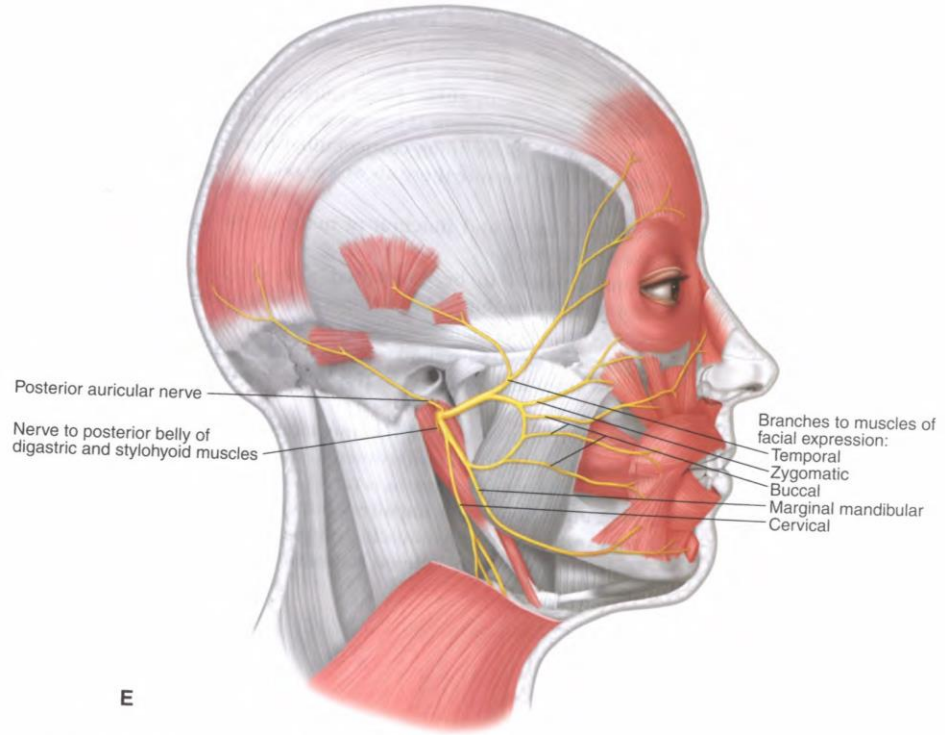
Fiber Type: somatic motor

Function: **abduc**ts eye (lateral rectus m.)

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN VII: Facial





Fiber Type: somatic motor

Function: muscles of facial expression

Somatic motor: posterior belly of digastric, stylohyoid, stapedius mm.

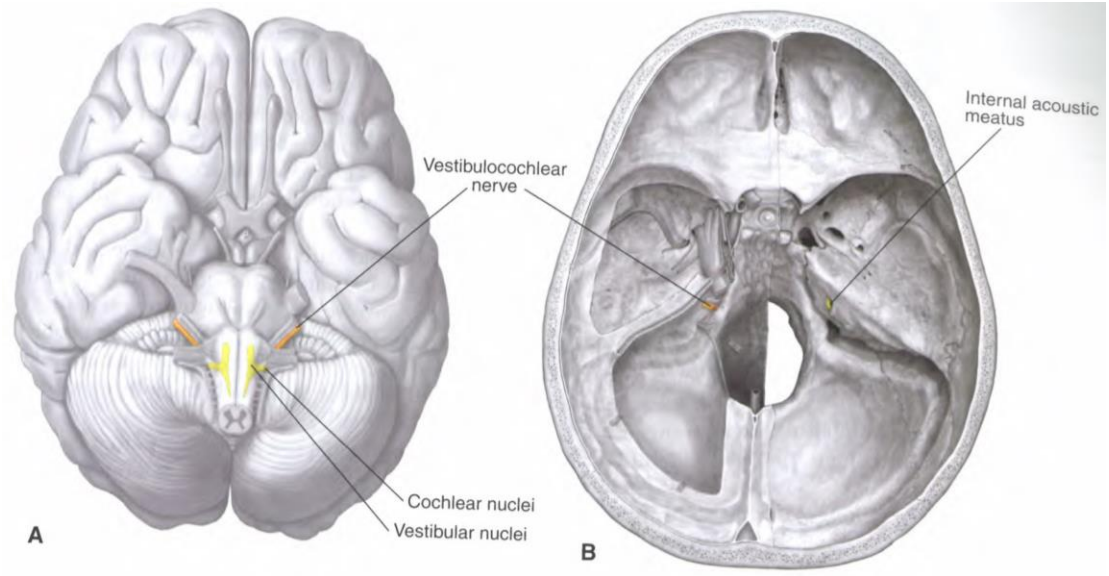
Visceral motor: lacrimal, salivary secretion

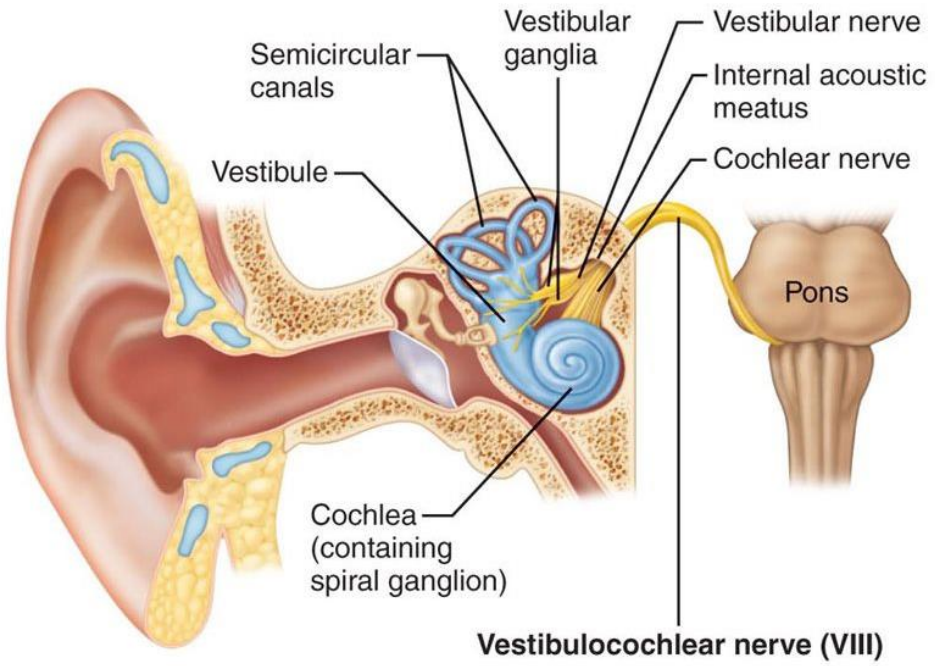
Somatic sensory: auricle, external acoustic meatus

Special sensory: taste for anterior 2/3 tongue

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN VIII: Vestibulocochlear



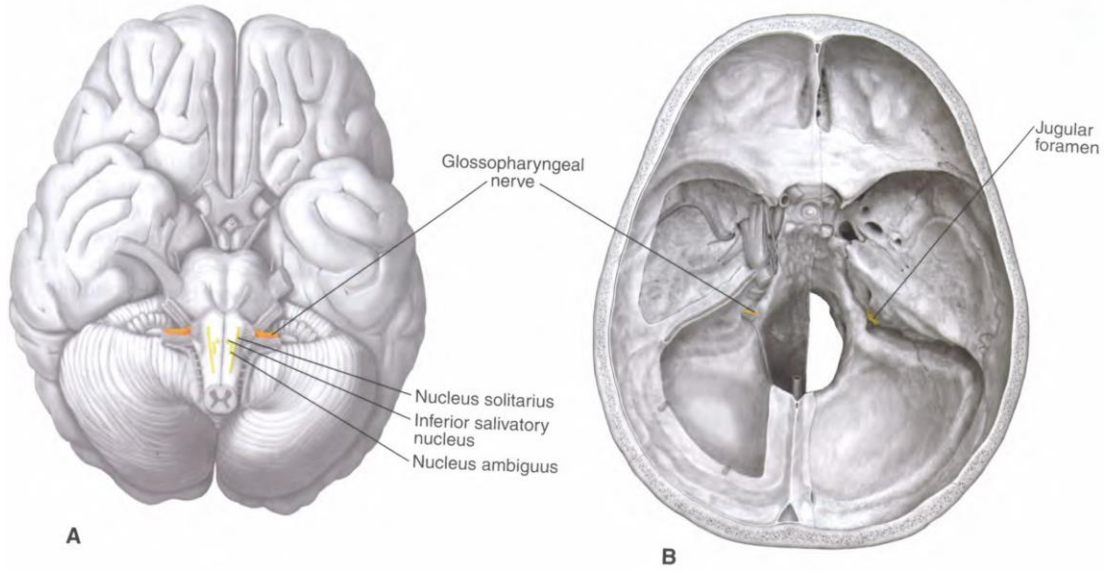


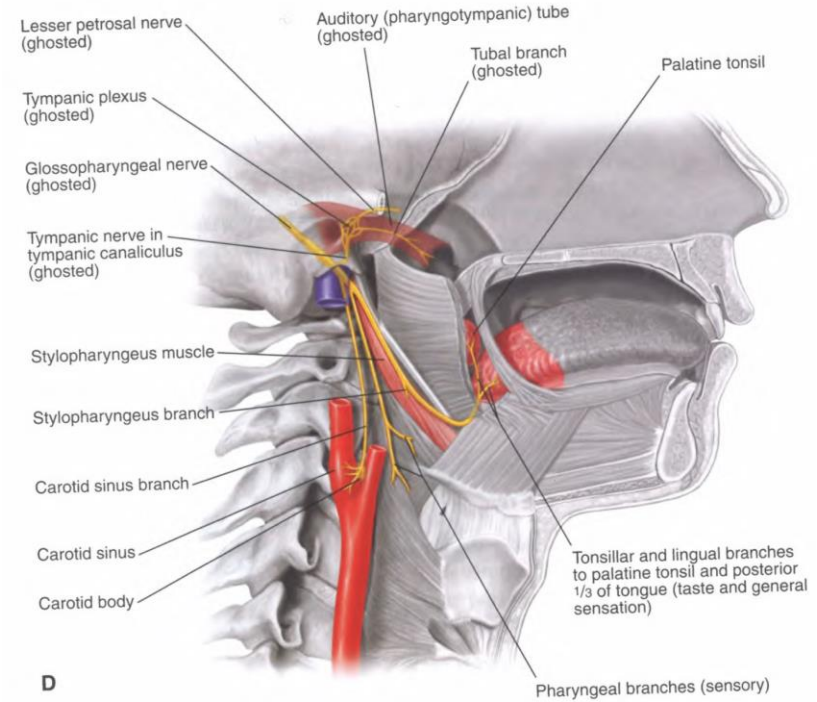
Fiber Type: special sensory

Function: hearing, balance

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN IX: Glossopharyngeal





Fiber Type: special sensory

Function: taste from posterior 1/3 tongue

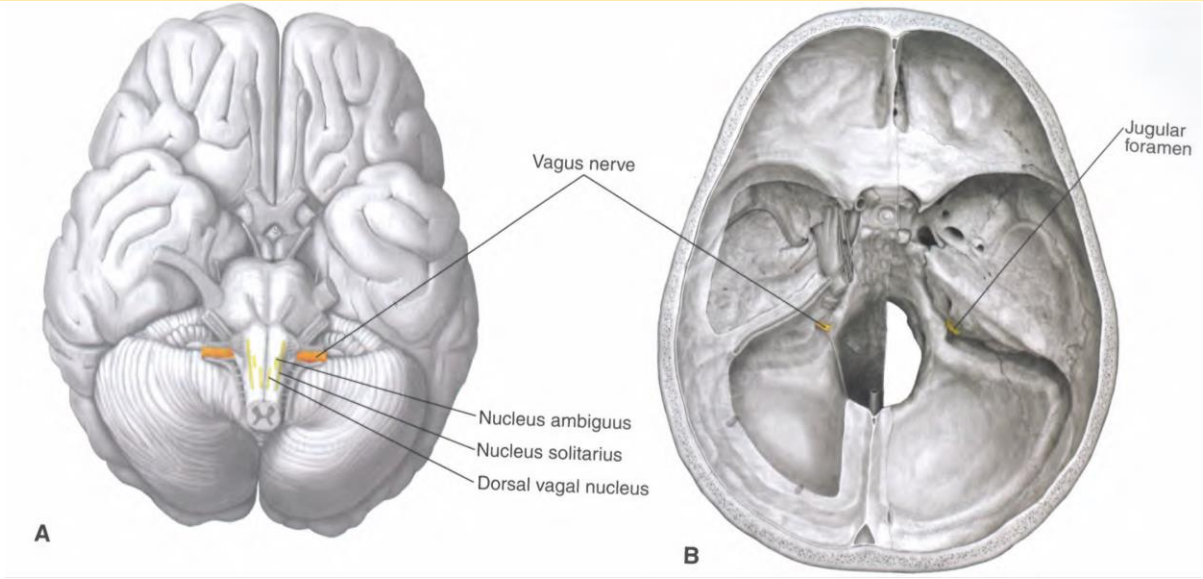
Somatic motor: stylopharyngeus m.

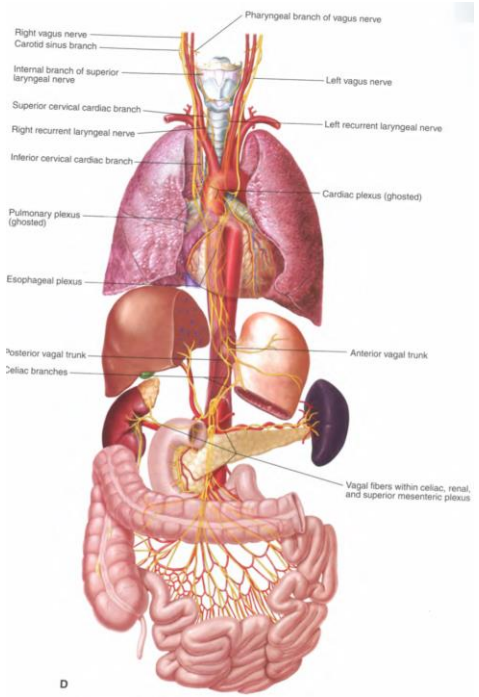
Visceral motor: parotid gland (saliva secretion)

Visceral sensory: carotid sinus & body

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN X: Vagus





Fiber Type: visceral motor

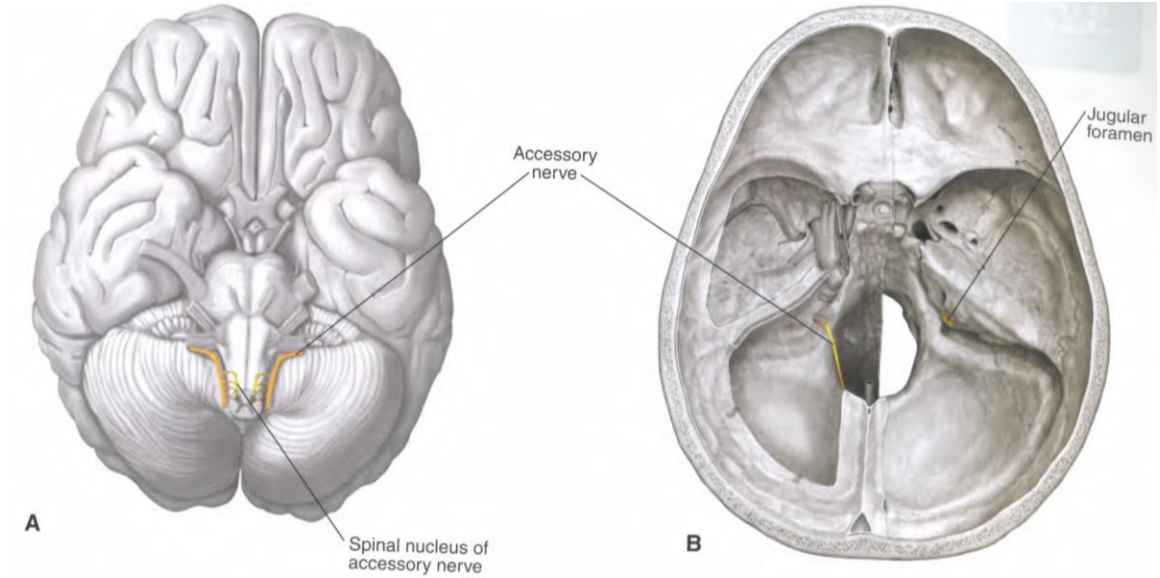
Function: smooth muscles & glands in thoracic & abdominal visceral organs

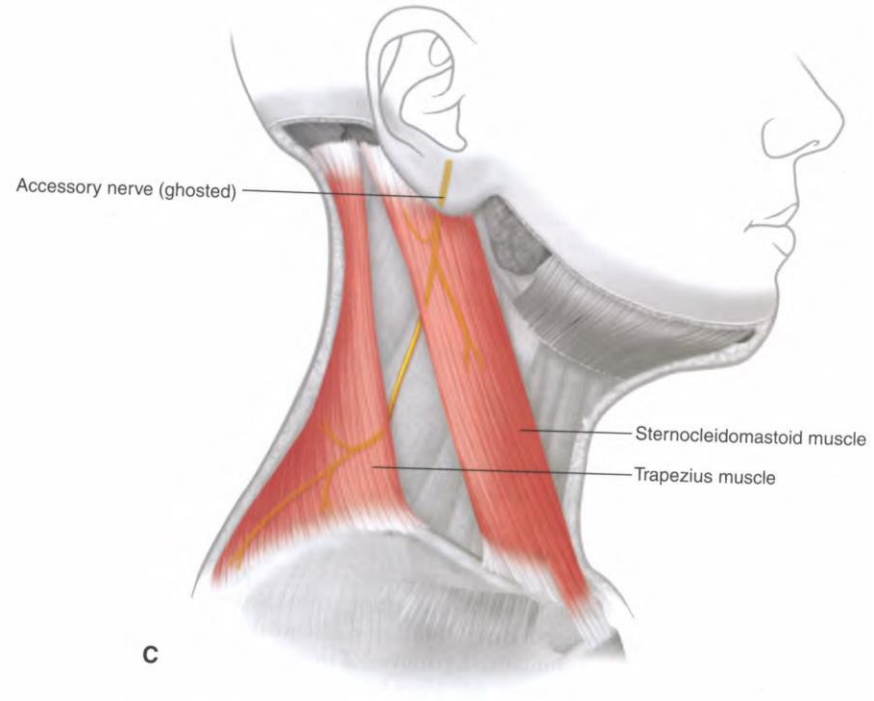
Vagus (Latin): “wander”

Somatic motor: pharynx, larynx, palate mm.
Somatic sensory: sensation in lower pharynx, larynx, trachea
Special sensory: taste on epiglottis
Somatic sensory: auricle, external acoustic meatus

Source: *Lippincott’s Concise Illustrative Anatomy: Head & Neck*

CN XI: Spinal Accessory



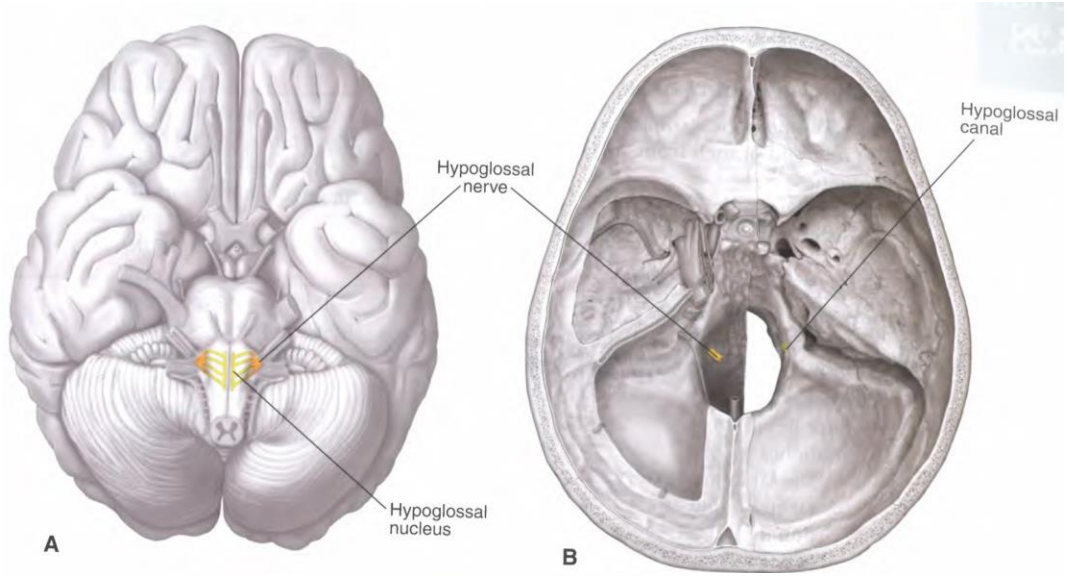


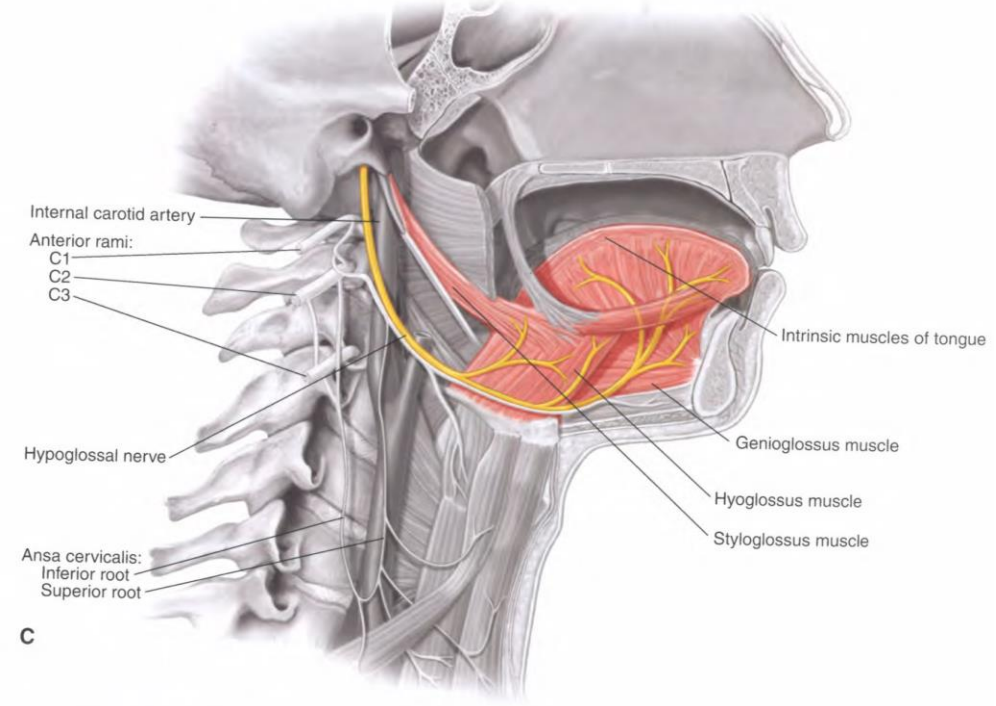
Fiber Type: somatic motor

Function: motor innervation to sternocleidomastoid & trapezius mm.

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

CN XII: Hypoglossal





Fiber Type: somatic motor

Function: tongue movement

Source: *Lippincott's Concise Illustrative Anatomy: Head & Neck*

3 Groupings of Cranial Nerves

ONLY Special Sensory Fibers

- CN I: olfactory
- CN II: optic
- CN VIII: vestibulocochlear

ONLY Somatic Motor Fibers

- CN III: oculomotor
- CN IV: trochlear
- CN VI: abducens
- CN XI: accessory
- CN XII: hypoglossal

Branchiomeric Nerves: derived from pharyngeal arches (see "Head & Neck Embryology" lecture)

- CN V: trigeminal
- CN VII: facial
- CN IX: glossopharyngeal
- CN X: vagus

**Note: branchiomeric nerves have more complex functions.

Example Question

A NYITCOM student is about to get her wisdom teeth pulled. Which of the following cranial nerves should be targeted for local anesthesia?

a. trochlear nerve (CN IV)
b. trigeminal nerve (CN V)
c. facial nerve (CN VII)
d. glossopharyngeal nerve (CN IX)
e. vagus nerve (CN X)

“High-Yield” Topics

- Anatomical organization of the skeletal, nervous, vascular, digestive, and respiratory systems in the head and neck; and how these change from newborns to adult.
- The three “Danger Zones” in the head and neck and how they’re dangerous.
- Locations and functions of organs that only exist in the head and neck, such as glands.
- Names, fiber types, and functions of each cranial nerve.
- Clinical correlates.

Study Tips

- Head and neck is difficult (but don’t panic)!
- Go through CPG “Learning Objectives”
- Cranial nerves, cranial nerves, cranial nerves!
  - Week 1: learn the names of cranial nerves and their numbers.
  - Week 2: learn at least one function of each cranial nerve.
  - Week 3+: keep learning all function of each cranial nerve.

Lecture Feedback

Lecture Feedback:

Click HERE

Questions:

awatanab@nyit.edu