

DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

**Discuss Face, Embryology Cranial
Nerves with Practice Questions**

DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

Discuss Meninges (including Hematomas), Orbit (including Palsy III, IV, VI)

MENINGES

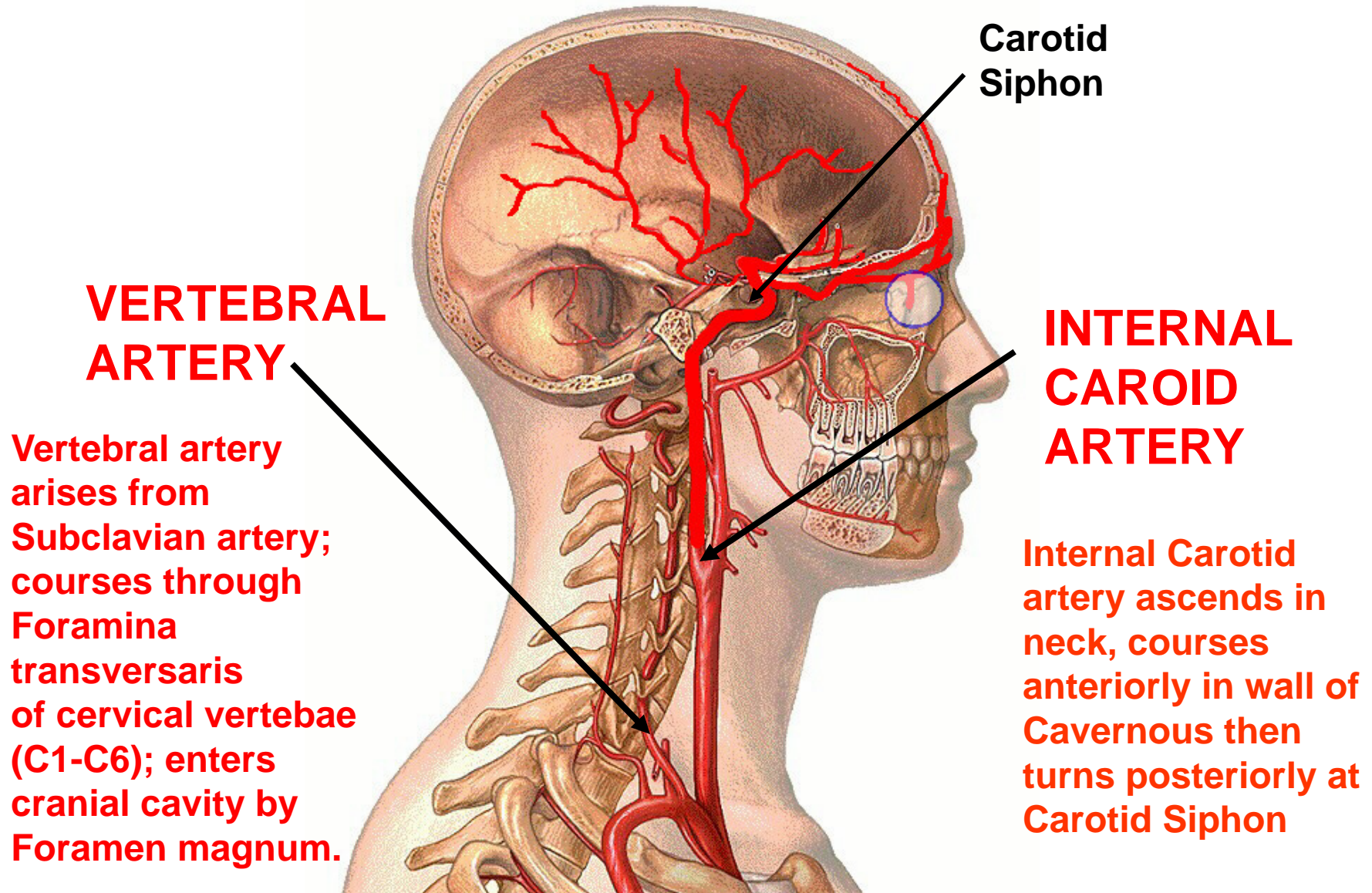
Pattern of venous drainage sinuses

CSF reabsorption

Epidural hematoma

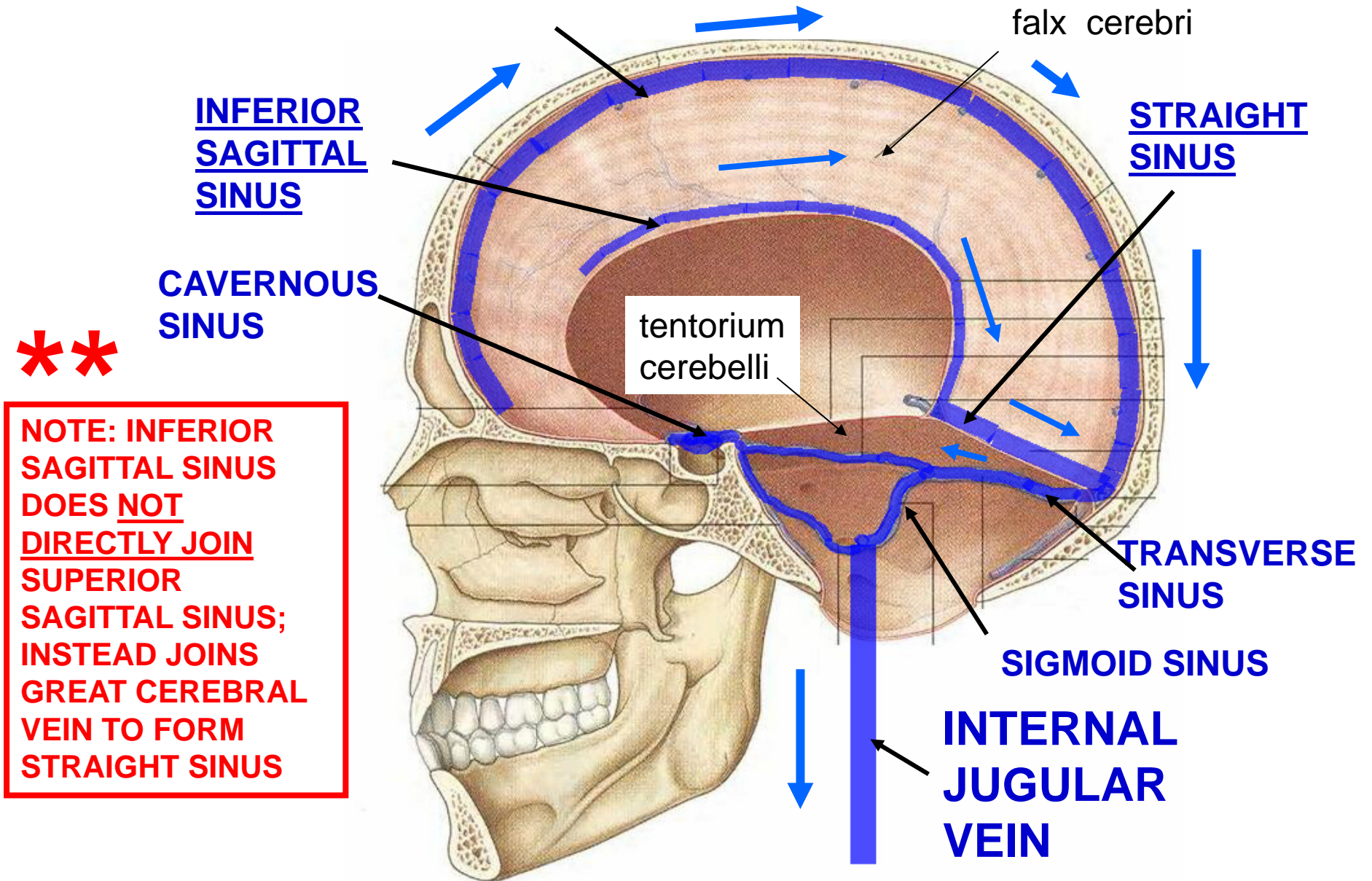
Subdural hematoma

BLOOD SUPPLY TO BRAIN



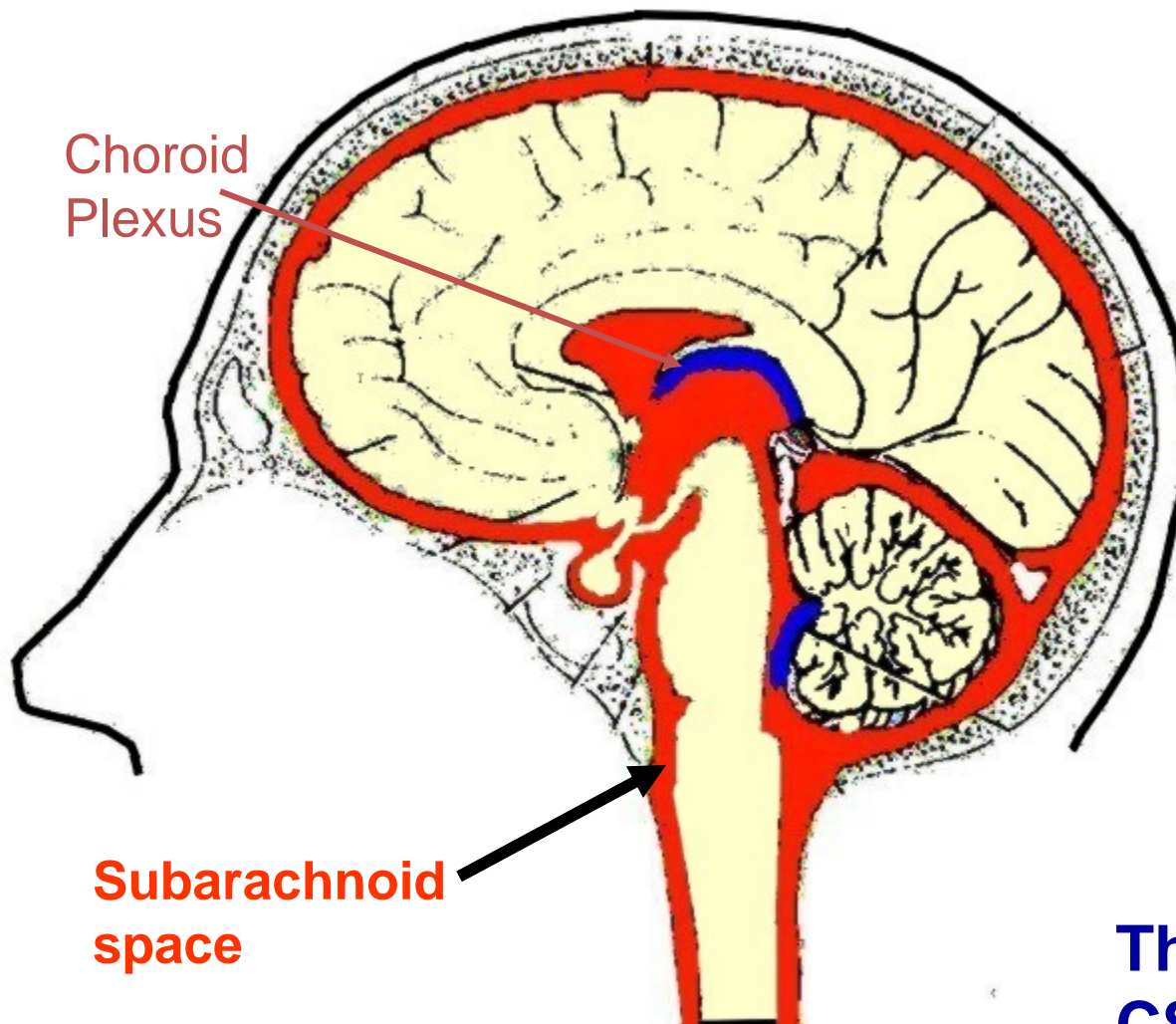
VENOUS DRAINAGE OF BRAIN – MOST THROUGH VENOUS SINUSES

SUPERIOR SAGITTAL SINUS



NOTE: INFERIOR SAGITTAL SINUS DOES NOT DIRECTLY JOIN SUPERIOR SAGITTAL SINUS; INSTEAD JOINS GREAT CEREBRAL VEIN TO FORM STRAIGHT SINUS

CEREBRO-SPINAL FLUID (CSF)



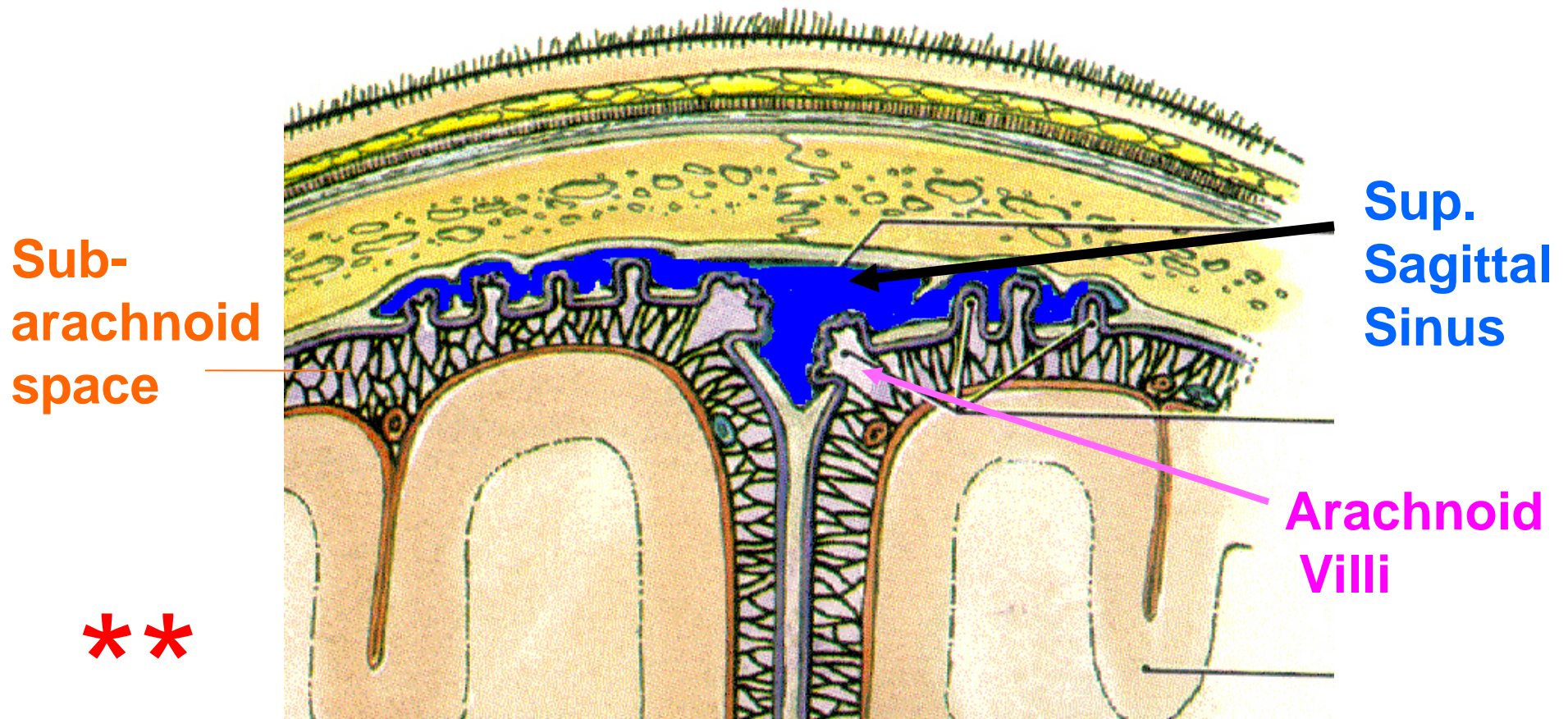
Choroid
Plexus

Subarachnoid
space

made inside
brain in Choroid
Plexus; flows
out of brain to
Subarachnoid
Space

The brain floats in
CSF - Shock
Absorber

CSF REABSORBED INTO VENOUS SINUSES



CSF reabsorbed into venous sinuses (ex. Sup. Sagittal sinus) at Arachnoid Villi; - In elderly arachnoid villi can become calcified- Arachnoid Granulations; Reduced Re-Absorption can produce Communicating Hydrocephalus

CSF REABSORBED INTO VENOUS SINUSES

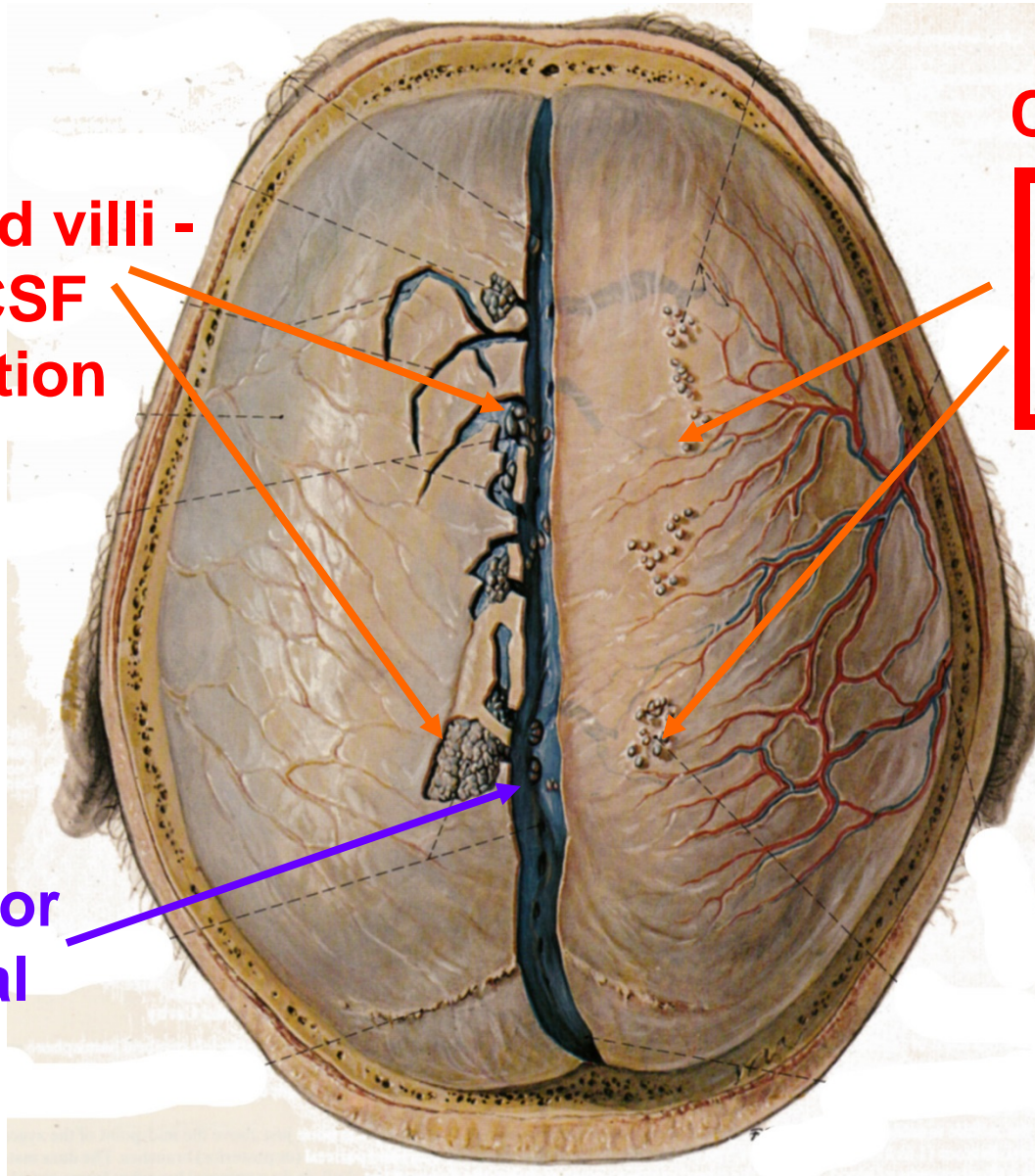
Arachnoid villi -
sites of CSF
reabsorption

CLINICAL **

Arachnoid villi -
sites of CSF
reabsorption

Superior
Sagittal
Sinus

Calcification of
Arachnoid Villi is
common in
elderly; can cause
hydrocephalus
due to decreased
reabsorption of
CSF



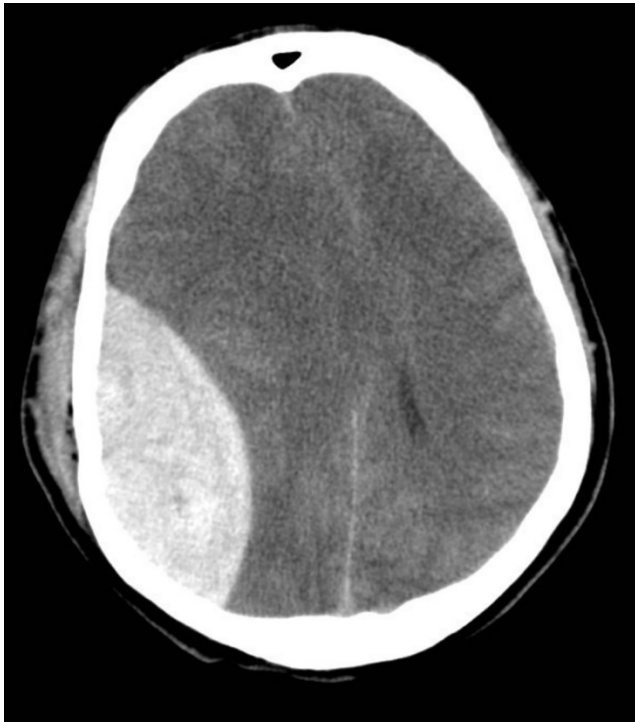
BLEEDING INSIDE SKULL

1- EPIDURAL HEMATOMA

2- SUBDURAL HEMATOMA

3- SUBARACHNOID BLEEDS

PRACTICE QUESTION CLINICAL VIGNETTE

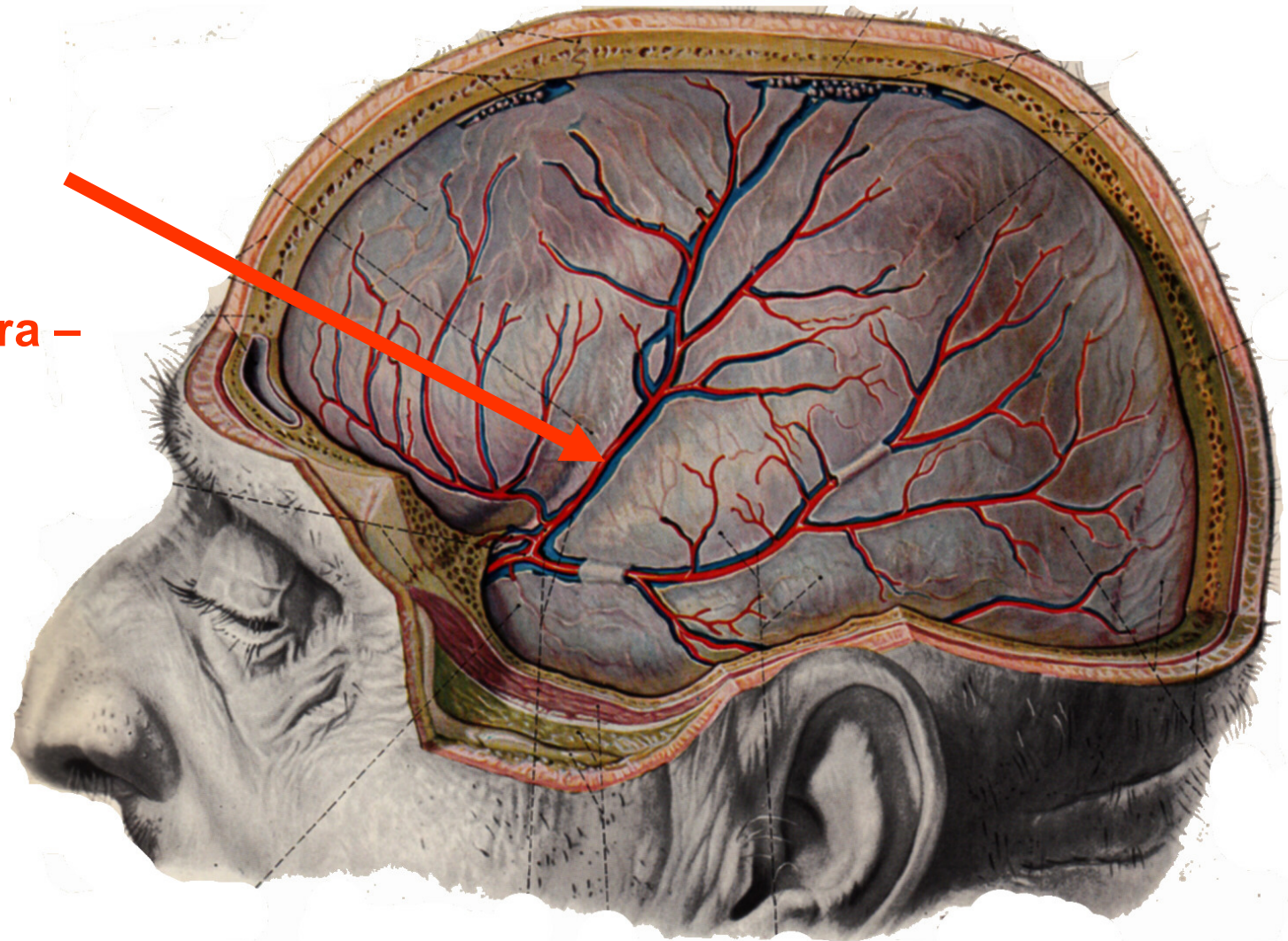


A person is in an automobile accident and gets struck on the side of the head. The patient refuses to be taken to the hospital and instead demands to simply go home and lie down for a while. **Within hours, the person is rushed to the hospital after losing consciousness.** The image is a CT scan section at the level of the cranial cavity. The physician suspects that this is a hematoma that has resulted from tear of a vascular structure. Which of the following describes the type of hematoma and the vascular structure that was damaged?

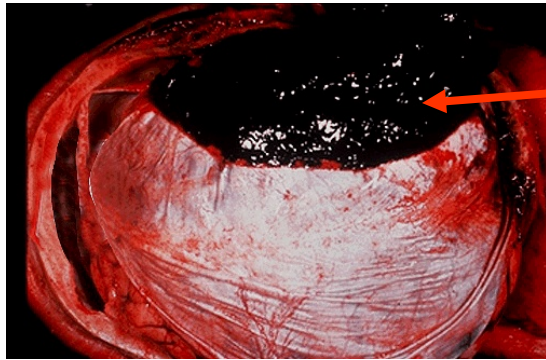
- A. Subdural hematoma, Ophthalmic artery
- B. Subdural hematoma, Middle Meningeal artery
- C. Epidural hematoma, Ophthalmic artery
- D. Epidural hematoma, Middle Meningeal artery
- E. Epidural hematoma, Deep Temporal artery

HEMATOMAS - INTERNAL BLEEDS

**Middle
Meningeal
Artery –
courses
outside dura –
supplies
calvarium**



EPIDURAL HEMATOMA - bleeding between dura and bone



EPIDURAL HEMATOMA

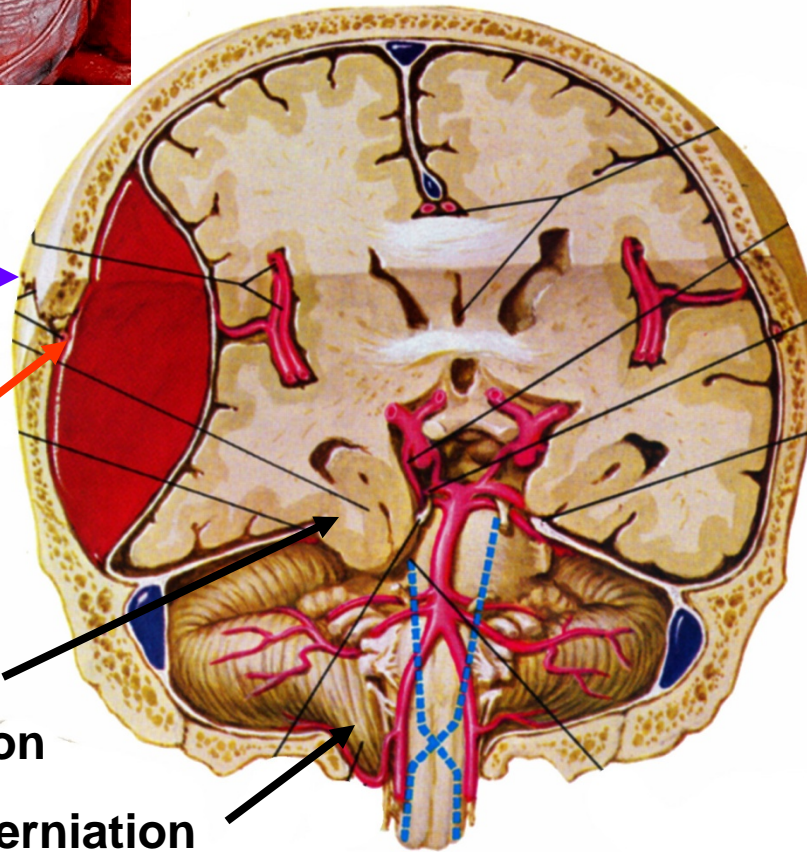
- 1) Skull fracture near Pterion
- 2) Tear Middle Meningeal Artery
- 3) Blood 'peels' dura from bone
- 4) Lens shaped (biconvex) mass on CT

Skull Fracture Near Pterion

Tear Middle Meningeal Artery

Uncal herniation

Tonsillar herniation

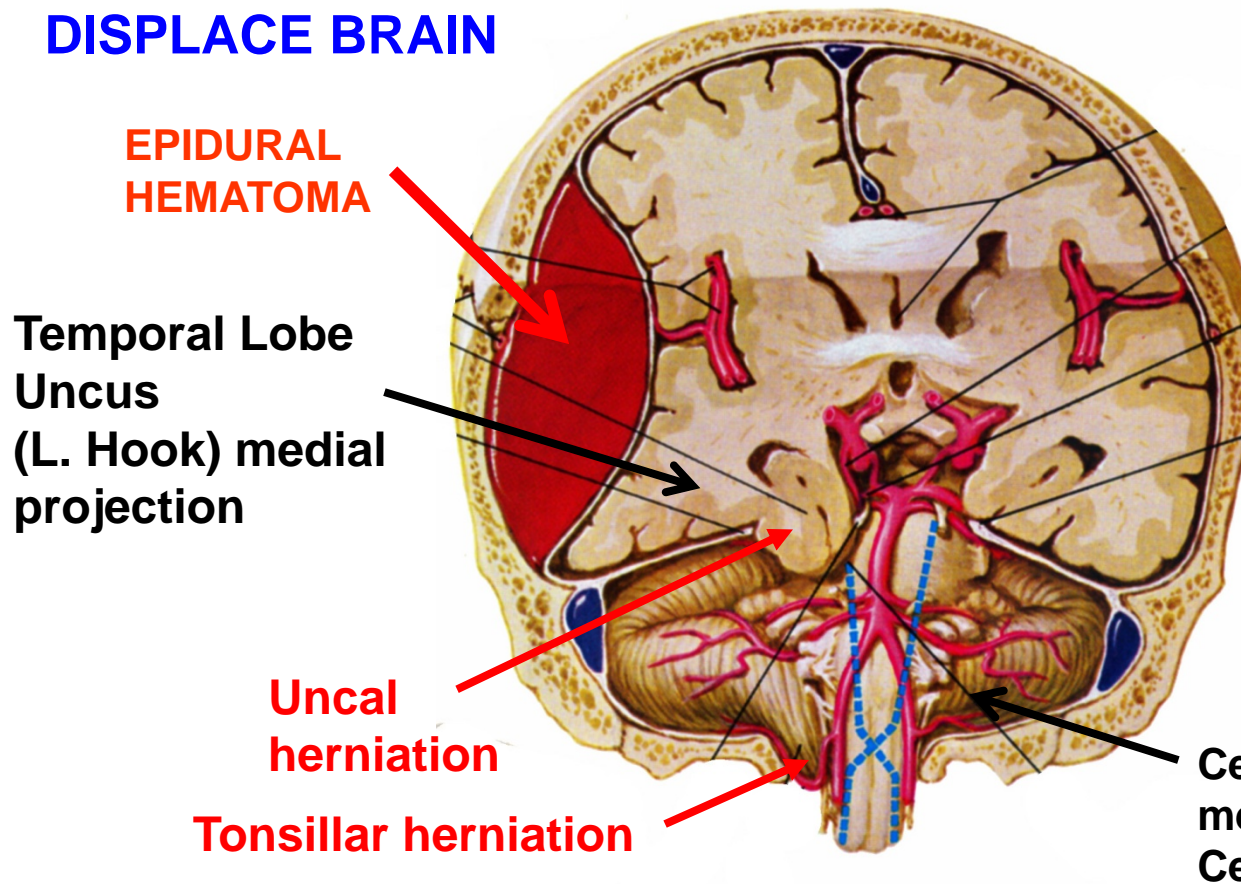


Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident); patient lucid at first; can be fatal within hours if herniation occurs

EPIDURAL HEMATOMA – **
1) **ARTERIAL – often MIDDLE MENINGEAL ARTERY**
2) **'LENS' SHAPED MASS**
3) **RAPID**

EPIDURAL HEMATOMA

MASS OF BLOOD CAN
DISPLACE BRAIN



6) Herniation -

i. Uncal herniation -
push Temporal lobe
(uncus) through
Tentorial Notch

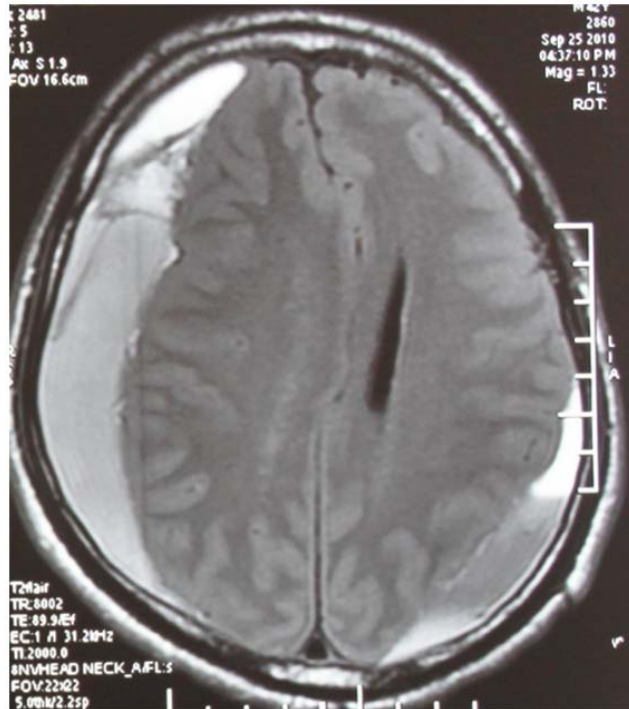
ii. Tonsillar
herniation -
push Cerebellum
(tonsil) through
Foramen Magnum

Cerebellar Tonsil -
medial projection of
Cerebellum

Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident);
patient lucid at first; can be fatal within hours if herniation occurs



PRACTICE QUESTION CLINICAL VIGNETTE

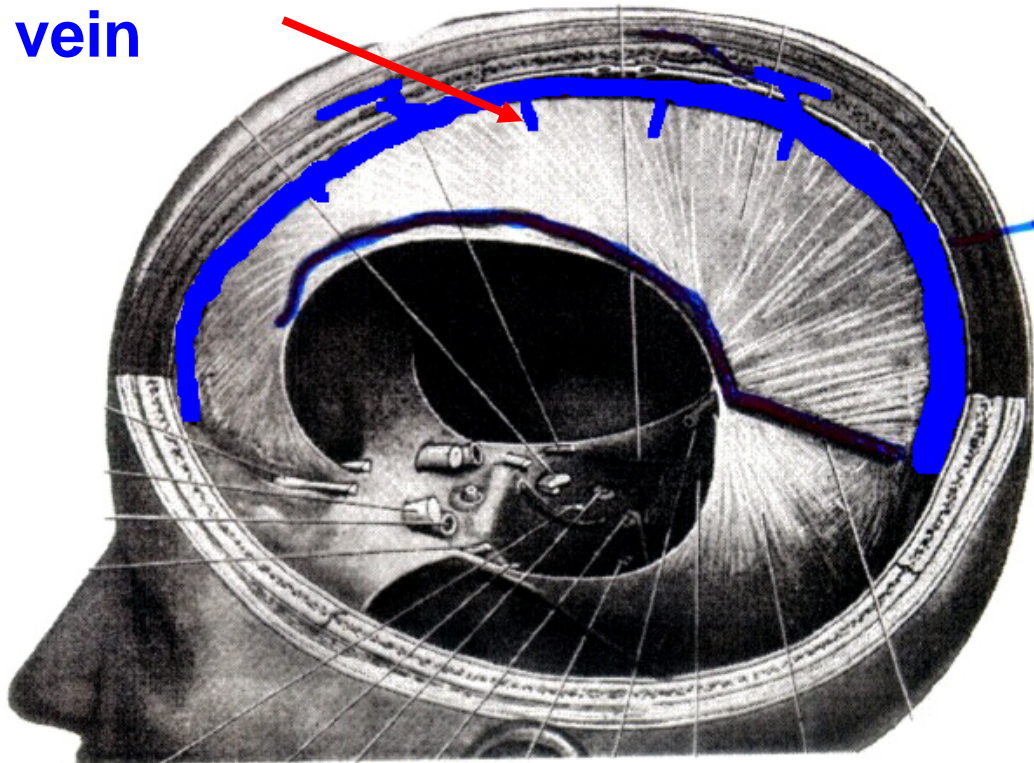


A 63-year-old aging rock musician fell off the stage during a concert tour and his head struck a large speaker in front of the stage. While he felt fine but bruised on the day of the fall, **within the next week he developed a bad headache** and was more verbally incoherent than usual. X rays taken at the hospital showed no fractures of the skull but there was evidence of papilledema. The image above is an MRI image from a series that was subsequently ordered. Damage to which of the following vessels is most likely to account for the symptoms?

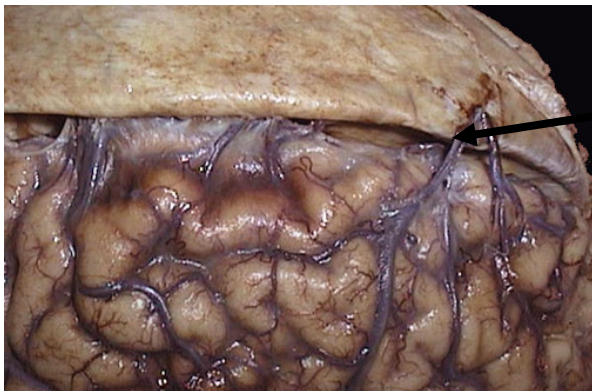
- A. Internal Carotid Artery
- B. Internal Jugular Vein
- C. Vertebral Artery
- D. Superficial Temporal Artery
- E. 'Bridging' Vein or Venous Sinus

SUBDURAL HEMATOMA

'Bridging'
vein



- bleed into potential space between Dura and Arachnoid
- from **tear 'Bridging' vein or sinus ****
- bleeding often **slow**
- chronic subdural hematomas can remain undetected



'Bridging'
vein

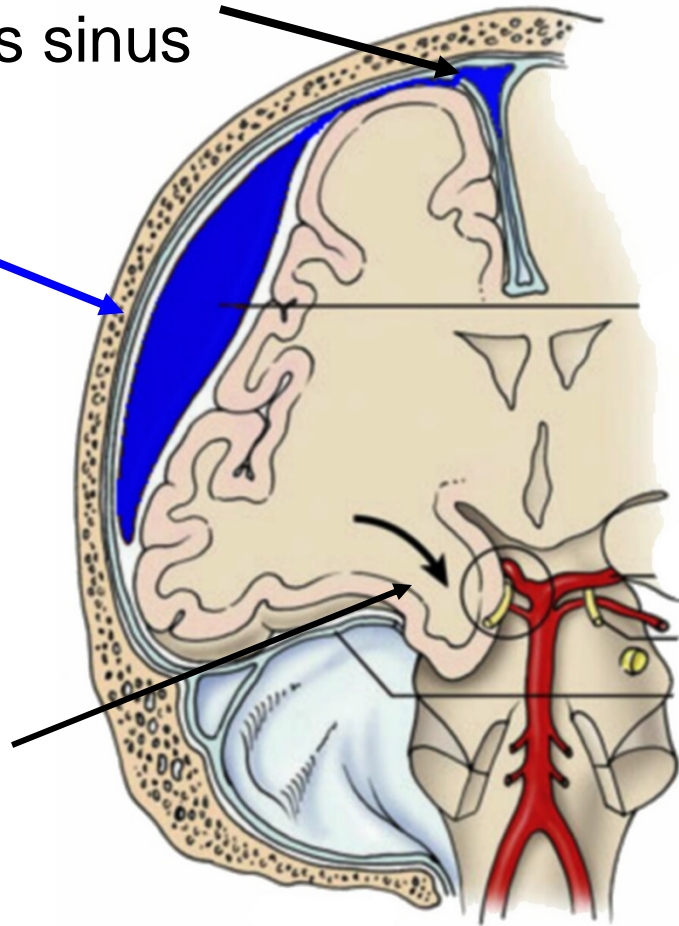
Photo from lecture of Dr. Nancy Norton

SUBDURAL HEMATOMA

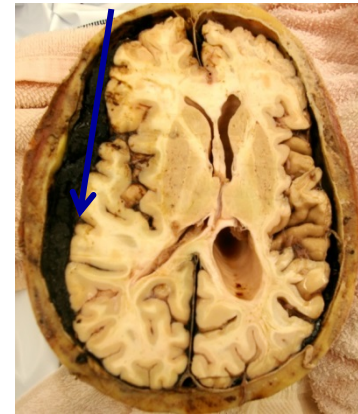
Tear 'bridging' vein
or venous sinus

Crescent
shaped
hematoma
on CT/MRI

Herniation
of uncus (L.
hook) of
temporal
lobe
through
Tentorial
notch



SUBDURAL HEMATOMA
BLOOD

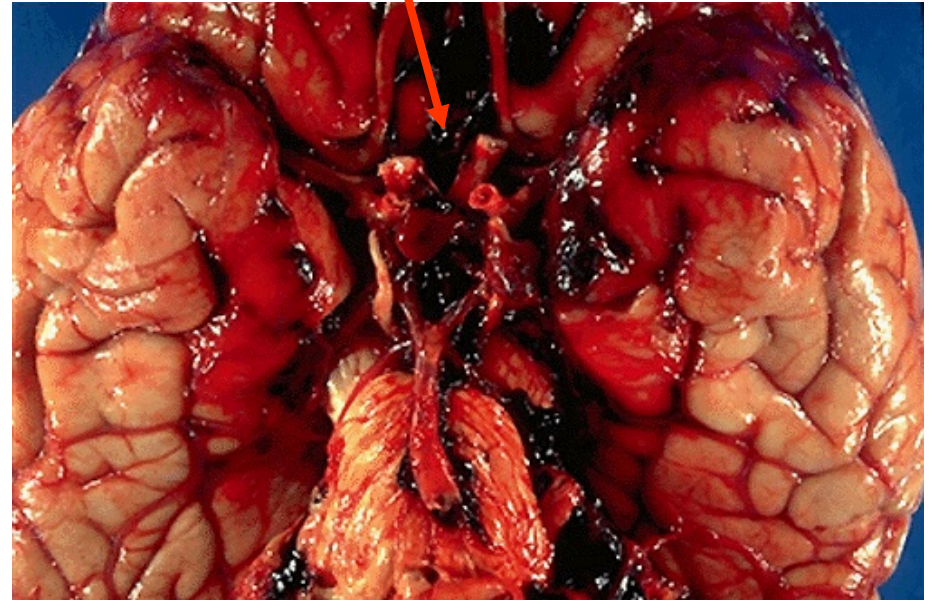
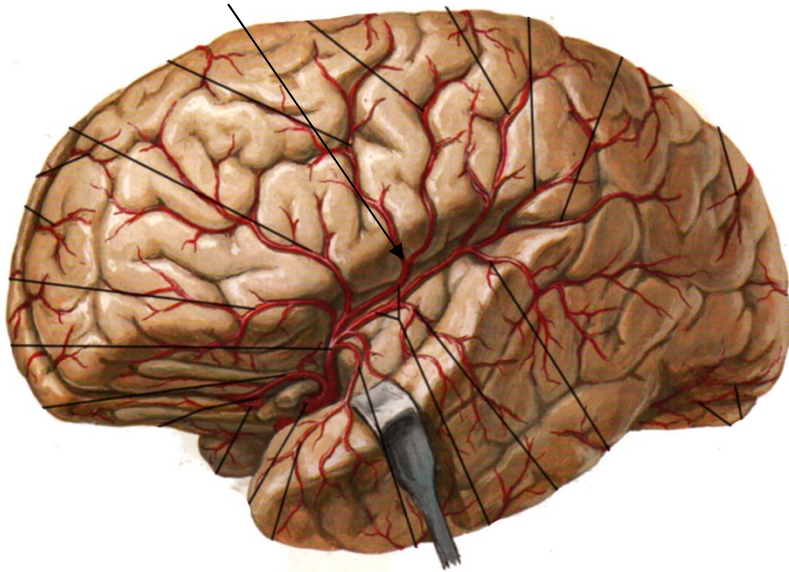


SUBDURAL **
HEMATOMA –
1) VENOUS – often
BRIDGING VEIN
2) CRESCENT
SHAPED MASS
3) SLOW

Clinical: bleeding slow (venous); Chronic Subdural Hematomas can remain undetected; can result in herniation if untreated

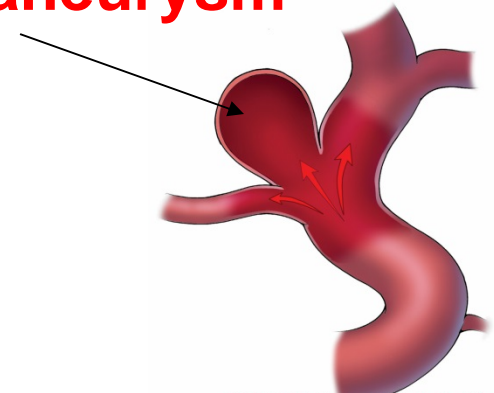
C. SUBARACHNOID HEMATOMA

Cerebral artery



Tearing cerebral artery or aneurysm (ex, berry aneurysma = swelling of vessel wall) or cerebral vein; If arterial can be rapid and fatal

Berry aneurysm



ORBIT

Structure of Eyelids and Gland obstruction

Lacrimal Gland and Innervation

Action of Ciliary Muscles

Eye movement diagram and actions of eye muscles

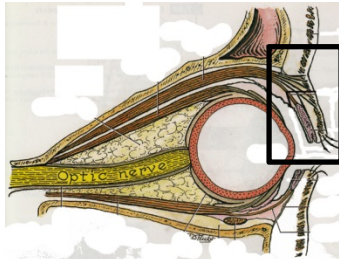
Nerve Damage III, IV, VI

Autonomic Innervation of Eye

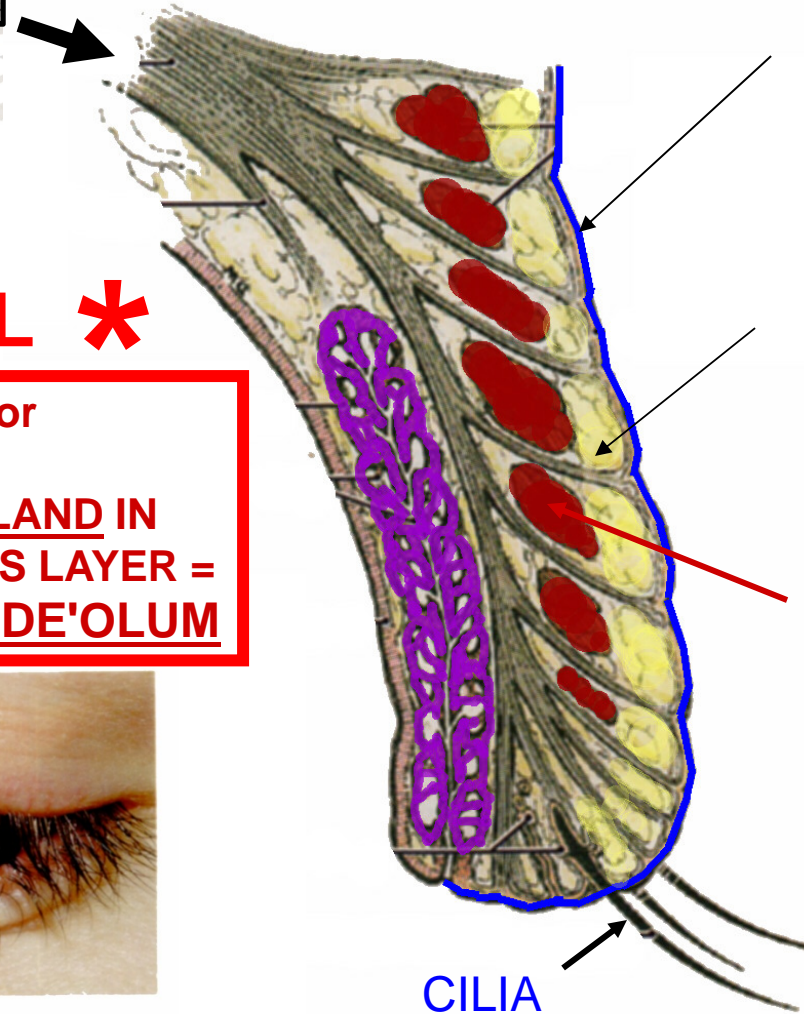


EYELIDS = PALPEBRAE - LAYERED

EYELIDS PROTECT EYE, MOVEABLE, KEEP CORNEA MOIST



ORIENT - EYELID
PARASAGITTAL
SECTION



1. SKIN - CONTAINS EYELASHES (CILIA) AND OPENINGS OF SEBACEOUS, SWEAT GLANDS;

2. SUBCUTANEOUS LAYER - CONNECTIVE TISSUE CONTAINS SEBACEOUS GLANDS; OBSTRUCTION = STYE OR HORDE'OLUM

3. ORBICULARIS OCULI (PALPEBRAL PART) - SKELETAL MUSCLE CLOSES EYE, INNERVATED BY VII - PARALYZE ORBICULARIS OCULI - CAN DAMAGE CORNEA

CLINICAL *

OBSTRUCTION or INFECTION OF SEBACEOUS GLAND IN SUBCUTANEOUS LAYER = STYE OR HORDE'OLUM



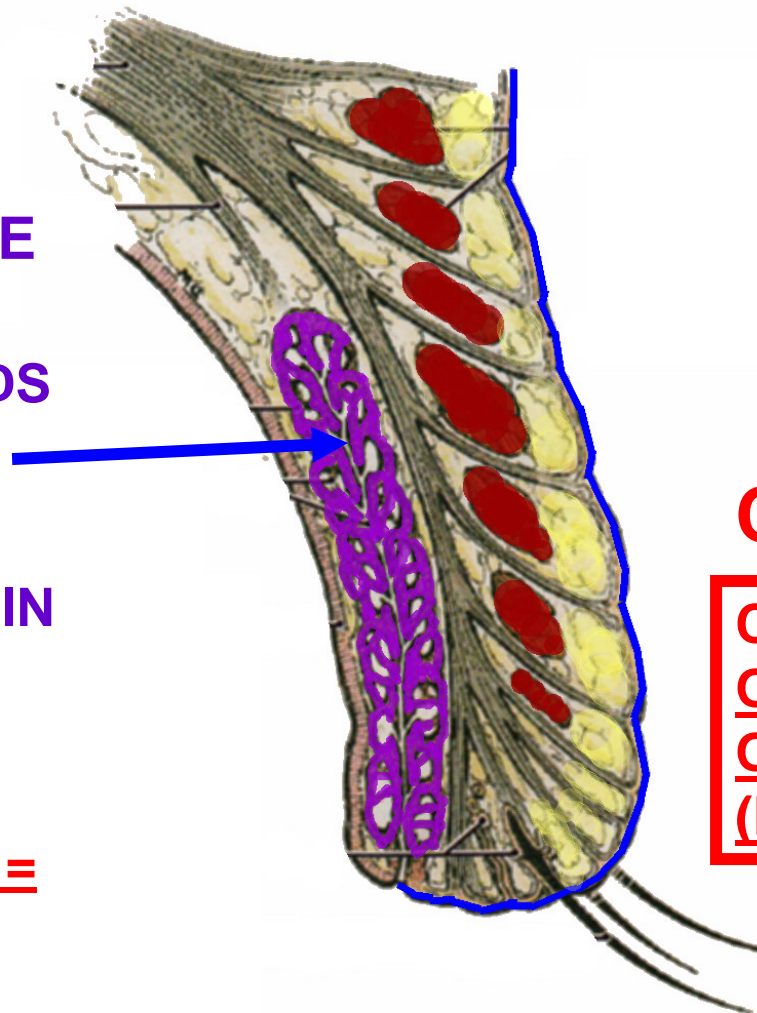
FIGURE 10-10
Acute hordeolum of upper eyelid.
From Palay, Krachmer, 1997.

EYELIDS - LAYERS

TARSAL PLATE - FIBROUS CT 'SKELETON' OF EYELID, DEEP TO ORBITAL SEPTUM

TARSAL PLATE
- CONTAINS
TARSAL GLANDS
(Meibomian glands)

- KEEP TEARS IN EYE, PREVENT EVAPORATION OF TEARS -
OBSTRUCTION = CHALAZION



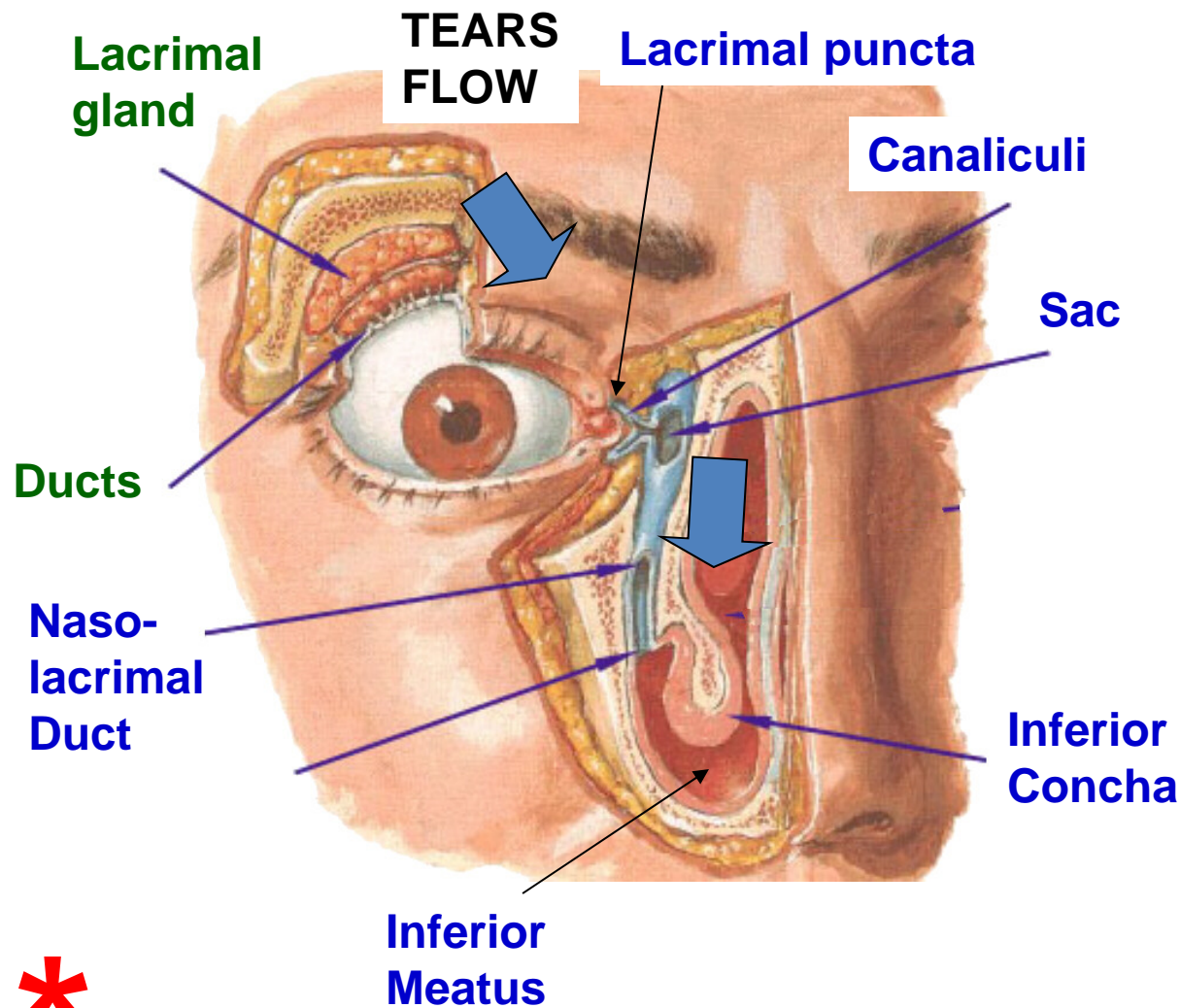
CHALAZION



CLINICAL *

CHALAZION:
OBSTRUCTION
OF TARSAL
(MEIBOMIAN) GLAND

LACRIMAL GLAND



- TEARS FLOW ACROSS EYE TO LACRIMAL PUNCTA ON MEDIAL END OF EYELIDS (eyelids meet at MEDIAL CANTHUS);
- TEARS THEN PASS THROUGH LACRIMAL CANALICULI TO LACRIMAL SAC;
- SAC CONNECTS TO NASOLACRIMAL DUCT WHICH DRAINS TO INFERIOR MEATUS OF NASAL CAVITY

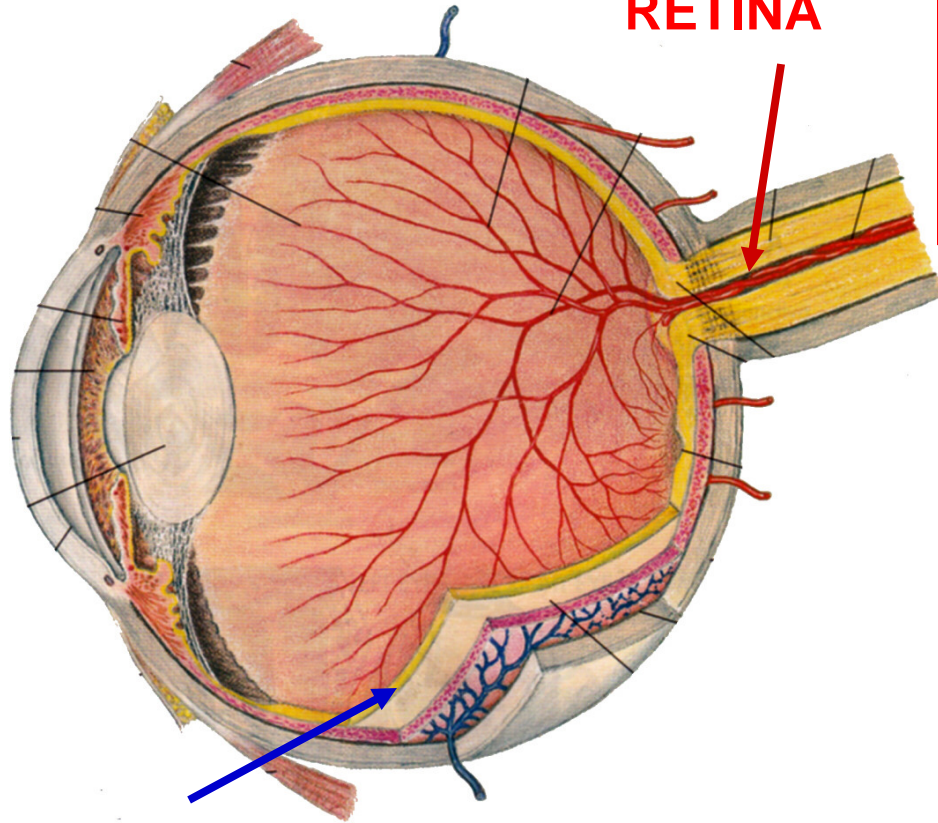


LACRIMAL GLAND IS INNERVATED BY VII - FACIAL NERVE;
BLOCK VII - DECREASE TEARS; PRESSURE/IRRITATION VII - EXCESSIVE TEARS

ARTERIAL SUPPLY – CENTRAL ARTERY OF RETINA

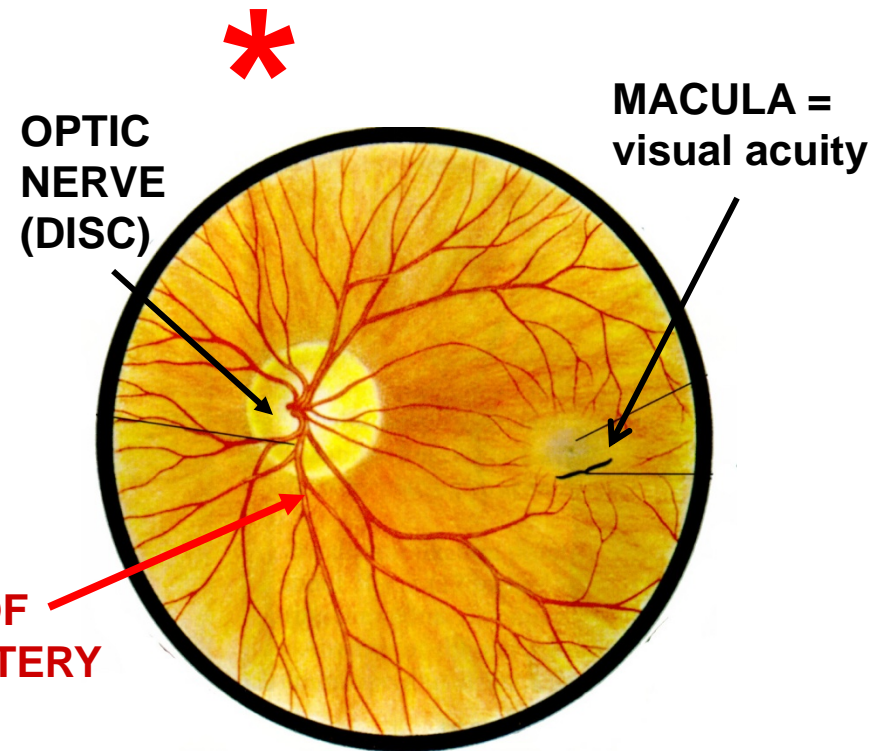
**CENTRAL
ARTERY OF
RETINA**

**CONTAINS RODS AND CONES
(PHOTOSENSITIVE)**
CENTRAL ARTERY OF RETINA-
BRANCH OF OPHTHALMIC ART.
NO (OR LIMITED) ANASTOMOSES;
OCCCLUSION RESULTS IN BLINDNESS
**(EXCEPT WHEN SUPPLY FROM CILIO-
RETINAL ARTERIES)**



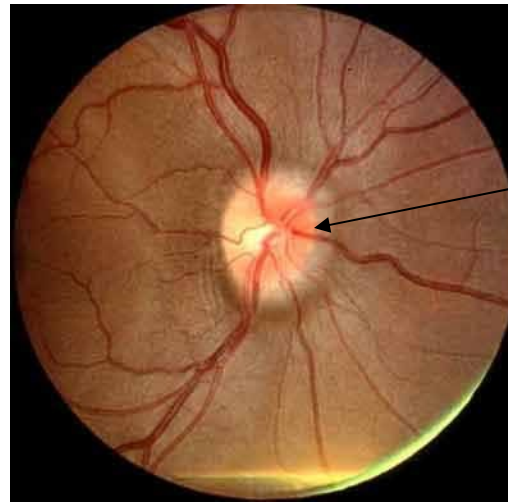
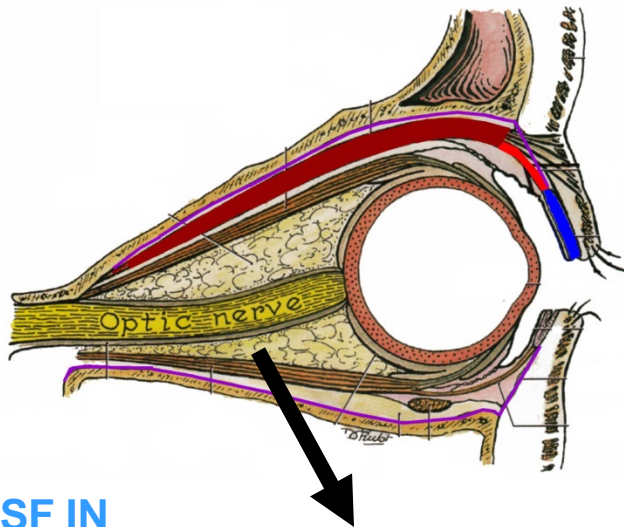
RETINA

**BRANCHES OF
CENTRAL ARTERY
AND VEIN OF
RETINA**



OPHTHALMOSCOPE VIEW

DIAGNOSE CHANGES IN CSF IN OPHTHALMOSCOPE VIEW

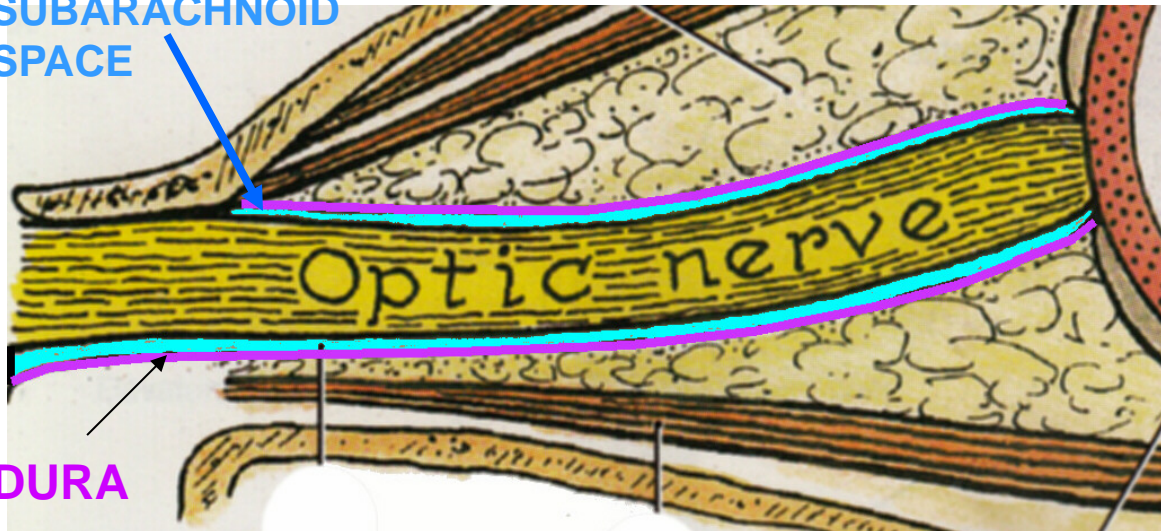


HYDROCEPHALUS

PAPILLEDEMA

- engorgement of retinal veins (correspond to branches of central artery)

CSF IN SUBARACHNOID SPACE



CLINICAL



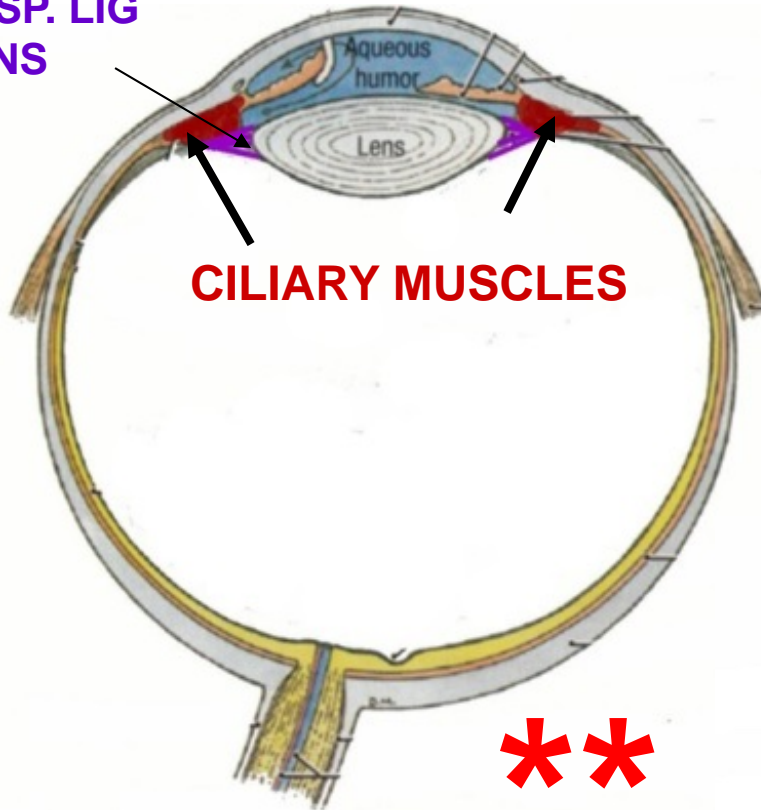
DURA AND SUBARACHNOID SPACE (CSF) EXTEND AROUND OPTIC NERVE; INCREASE IN CSF (PRESSURE) CAN AFFECT VISION

PAPILLEDEMA = swelling of optic disc

Clinical - slow onset; headaches

EYE- STRUCTURE OF EYEBALL- VASCULAR LAYER

SUSP. LIG
LENS

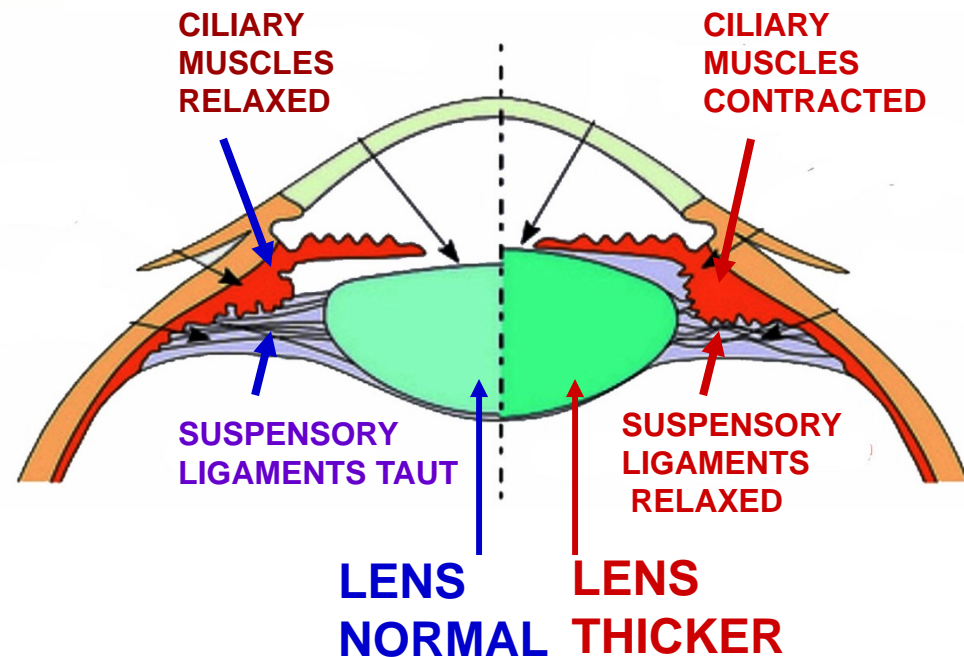


CILIARY MUSCLES

B. CILIARY BODY- CILIARY MUSCLES- SMOOTH MUSCLES AT ATTACHMENTS OF SUSPENSORY LIGAMENTS OF LENS CONTROL THICKNESS OF LENS

NORMAL VISION

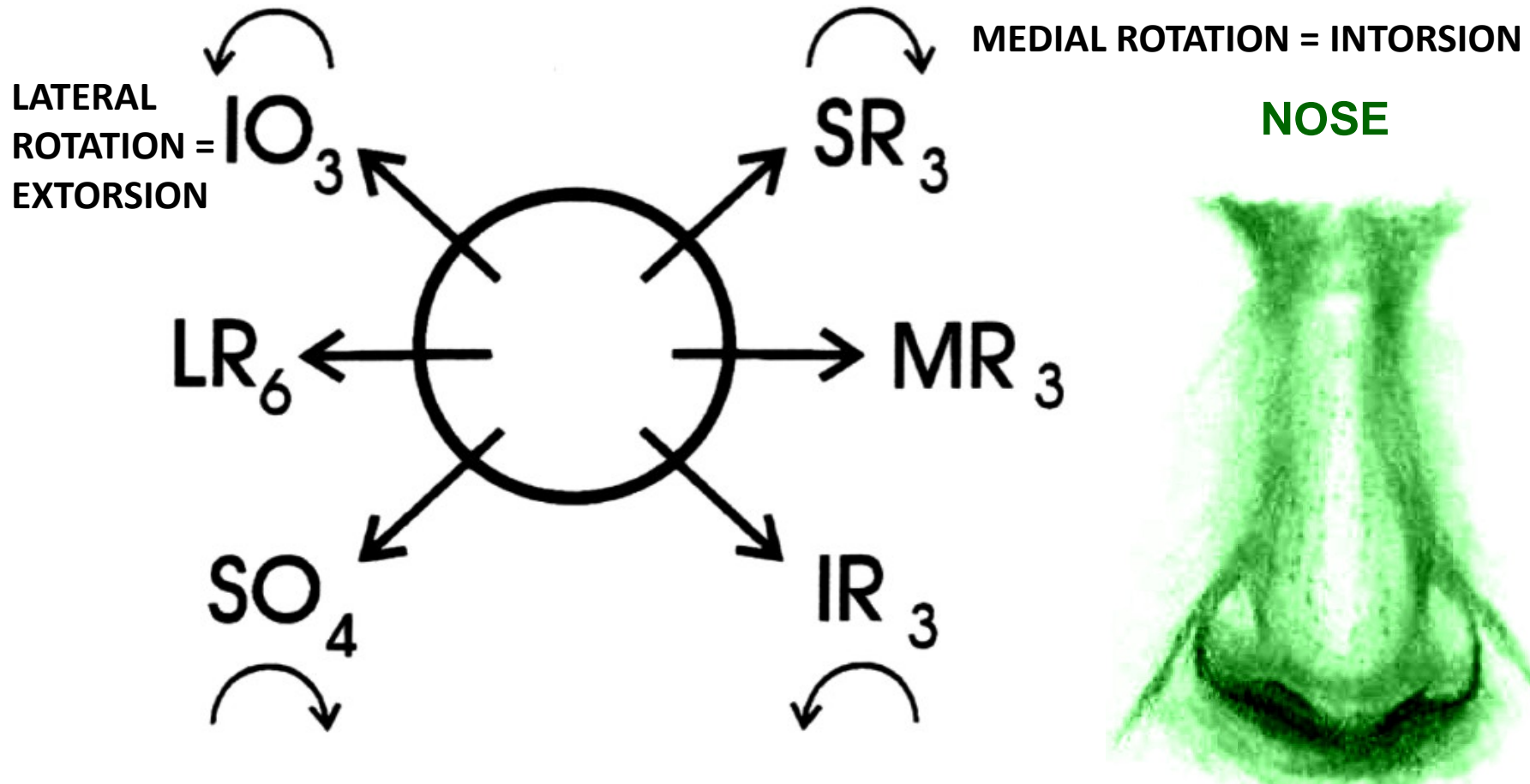
NEAR VISION



ACCOMMODATION - THICKEN LENS FOR NEAR VISION (VIEWING OBJECTS CLOSE UP)
PARASYMPATHETIC CONTROL- III (Short ciliary nerves)

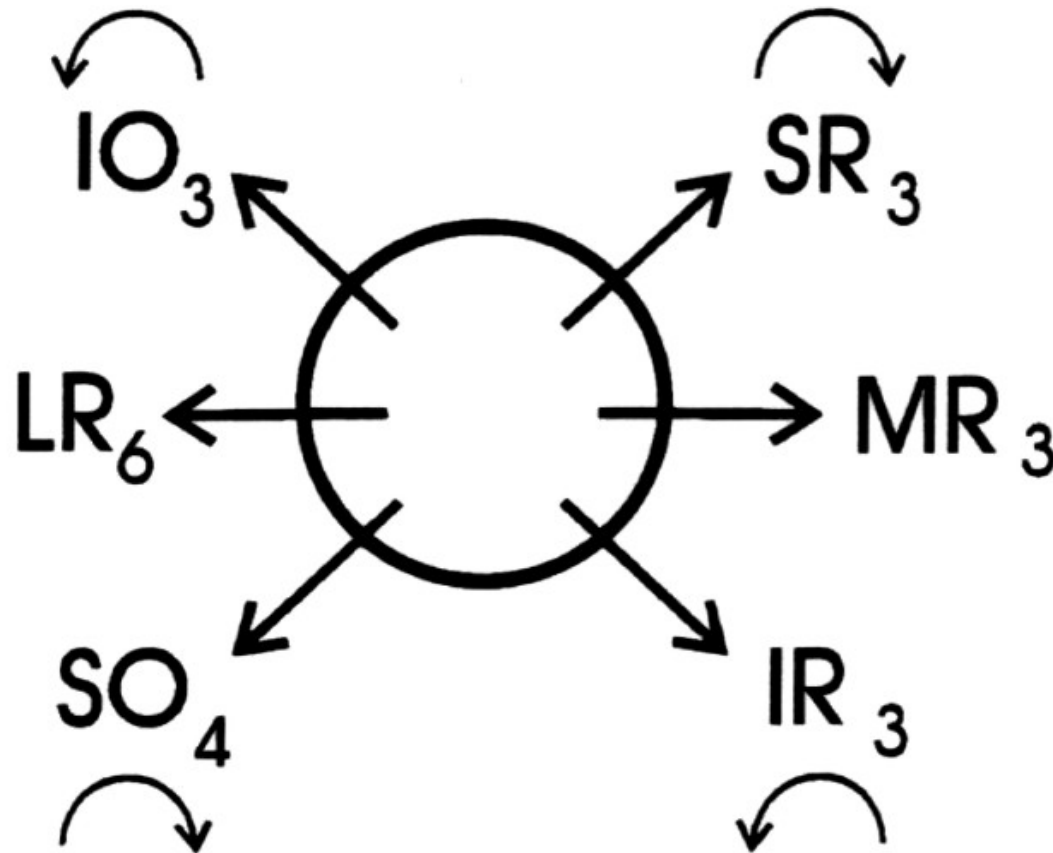
CILIARY MUSCLES CONTRACT - LENS THICKER

EYE MOVEMENTS DIAGRAM



- 1- Resting position of eye depends upon tonic activities in muscles.
- 2- Damage to any one muscle does not entirely eliminate abduction, adduction, elevation or depression; only get weakness.

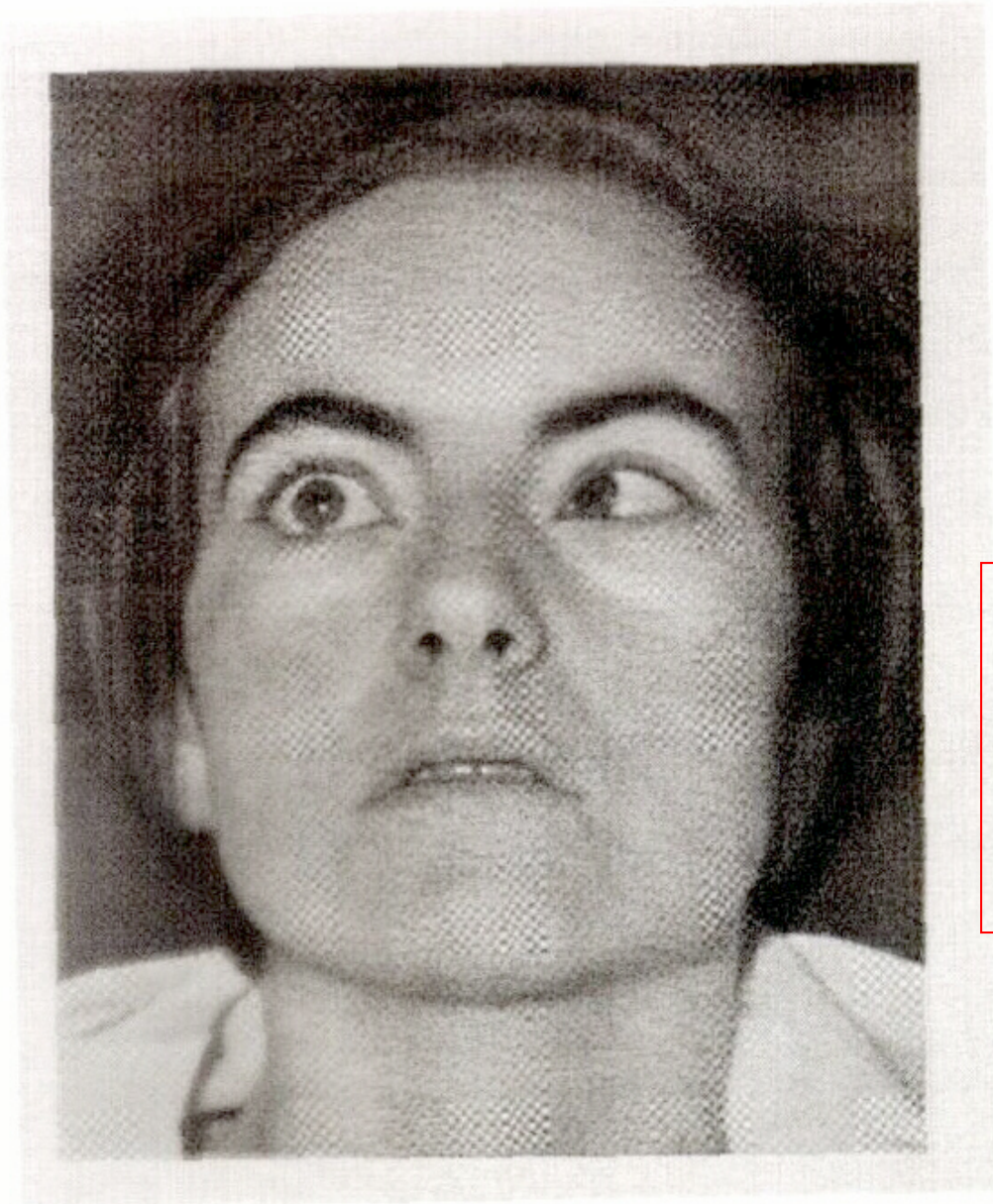
EYE MOVEMENTS DIAGRAM



NOSE



- SAMPLE QUESTIONS: 1- WHAT ARE ACTIONS OF INFERIOR OBLIQUE?**
2- WHAT ARE ACTIONS OF SUPERIOR OBLIQUE?
3. WHICH MUSCLES ROTATE EYE MEDIALY?
2- WHAT IS SYMPTOM OF DAMAGE TO ABDUCENS NERVE?



ABDUCENS (VI) NERVE DAMAGE



ABDUCENS (VI): AT REST 1)
MEDIAL STRABISMUS
(CROSS-EYED) DUE TO
DAMAGE/PARALYZE
LATERAL RECTUS

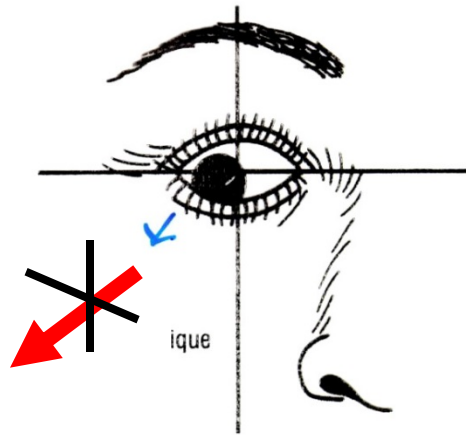
PRACTICE QUESTION CLINICAL VIGNETTE



A 64 year-old female is in the back seat of car that suddenly decelerates in an accident. She shows no acute injury but in the following days **she begins having double vision. Examination of the patient shows that she is holding her head tilted** (see photo above). Cranial nerve examination finds that she has difficulty moving her right eye downward, particularly from an adducted position. A head MRI is ordered to specifically image which the following cranial nerves?

- A. right cranial nerve III
- B. left cranial nerve IV
- C. right cranial nerve IV
- D. left cranial nerve III
- E. right cranial nerve VI

TROCHLEAR (IV) NERVE DAMAGE: INABILITY TO TURN EYE DOWN AND OUT; ALSO HEAD TILT

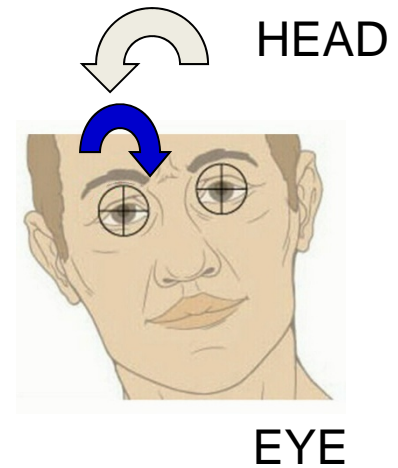
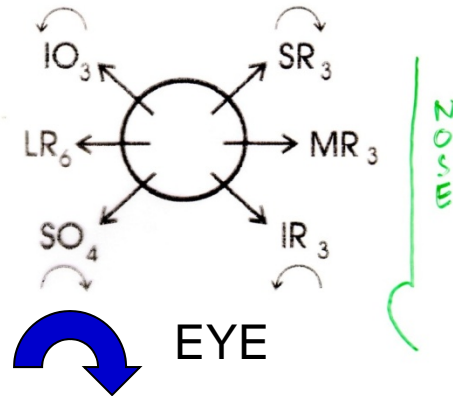


PATIENT CANNOT LOOK DOWN AND OUT

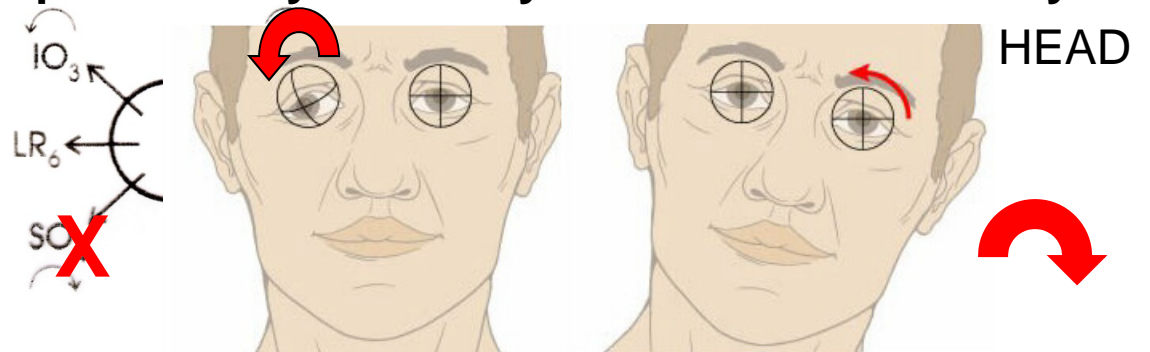
Symptoms - Difficulty walking down stairs; HEAD TILTED

AFTER IV DAMAGE - eye rotated laterally; PATIENT TILTS HEAD TO OPPOSITE SIDE so both eyes rotated

NORMAL



NORMAL Rotation - occurs when tilt head; rotate ipsilateral eye medially when tilt head laterally



PRACTICE QUESTION CLINICAL VIGNETTE



A patient sees a physician because the eyelid of her left eye is drooping and she is having double vision. Examination of the patient (photo above) shows **ptosis of the left eyelid and deviation of the left eye when the patient is told to look straight ahead. Further examination demonstrates that pupil is dilated in the left eye.**

PRACTICE QUESTION CLINICAL VIGNETTE

Which of the following nerves is likely to have been damaged?

- A. Trochlear
- B. Abducens
- C. Oculomotor
- D. Facial
- E. Ophthalmic division of the Trigeminal (V1).



The ptosis is likely to be due to partial paralysis of which of the following muscles?

- A. Superior oblique
- B. Levator Palpebrae Superioris
- C. Frontalis
- D. Superior Rectus
- E. Orbicularis Oculi

The pupil is dilated because the action of the dilator pupillae muscle is unopposed. Which of the following is the innervation of the dilator pupillae muscle?

- A. Sympathetic fibers
- B. Facial nerve
- C. Infraorbital nerve (V2)
- D. Trochlear nerve
- E. Optic nerve

OCULOMOTOR (III) NERVE DAMAGE



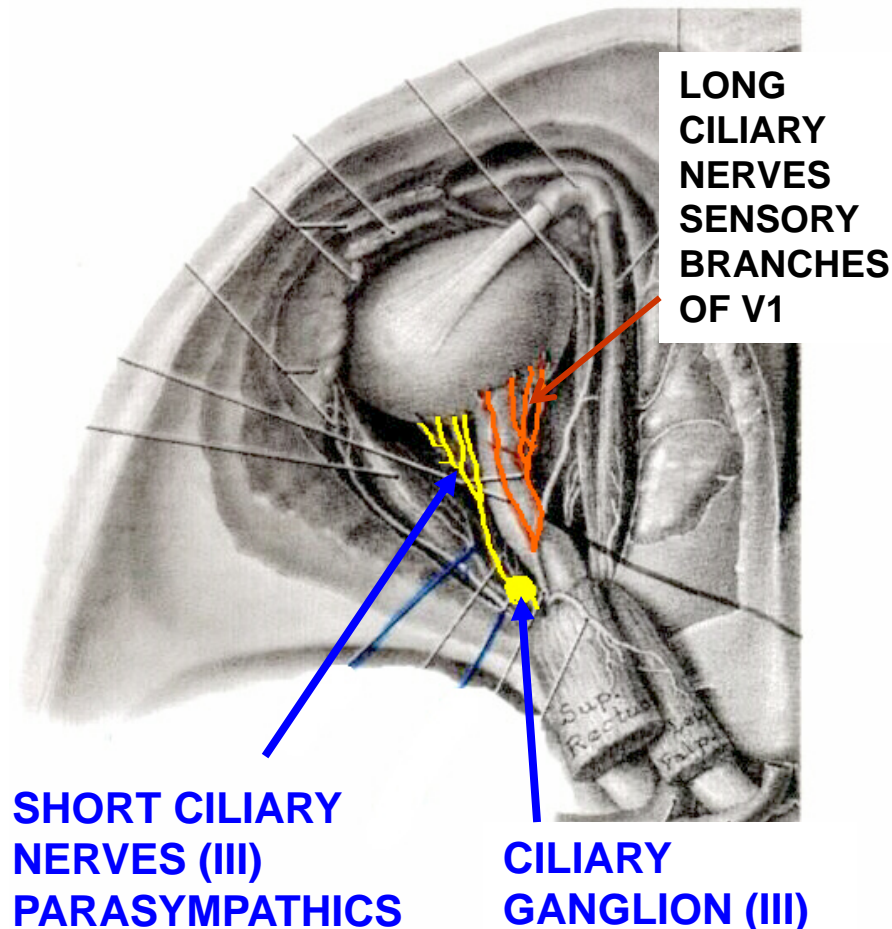
AT REST

1) LATERAL STRABISMUS (WALL-EYED) DUE TO PARALYZE MEDIAL RECTUS

2) PTOSIS - DROOPING EYELID PARALYZE LEV. PALPEBRAE SUPERIORIS

3) DILATED PUPIL - (MYDRIASIS) PARALYZE PUPILLARY CONSTRICTOR

CILIARY GANGLION - PARASYMPATHETIC



CILIARY GANGLION-
PARASYMPATHETICS OF
OCULOMOTOR N (III); TRAVEL IN
SHORT CILIARY NERVES - (FOUND
LATERAL AND DORSAL TO OPTIC
NERVE)

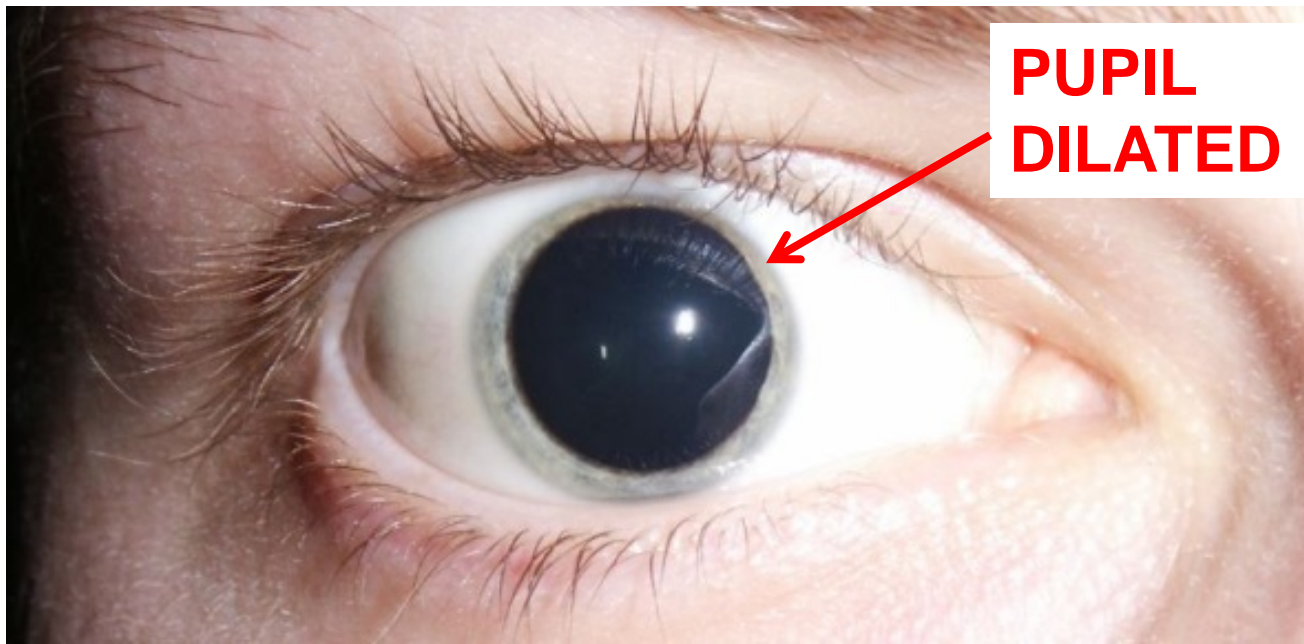
INNERVATE: 1) CILIARY MUSCLES
2) SPHINCTER (CONSTRICTOR)
PUPILLAE

NOTE: LONG CILIARY NERVES
BRANCHES OF V1 (OPHTHALMIC) -
SENSORY TO CORNEA - (FOUND
MEDIAL AND DORSAL TO OPTIC
NERVE)

CLINICAL **

**DAMAGE SHORT CILIARY NERVES (ONLY) - MAIN
SYMPTOM: PUPIL IS DILATED = MYDRIASIS**

'BLOWN PUPIL' = MYDRIASIS (muh-dry'-a-sis)



'BLOWN PUPIL' = MYDRIASIS - PUPIL DILATED, UNABLE TO CONSTRICT IN RESPONSE TO LIGHT - INDICATES CATASTROPHE - STROKE, HERNIATION, ETC.

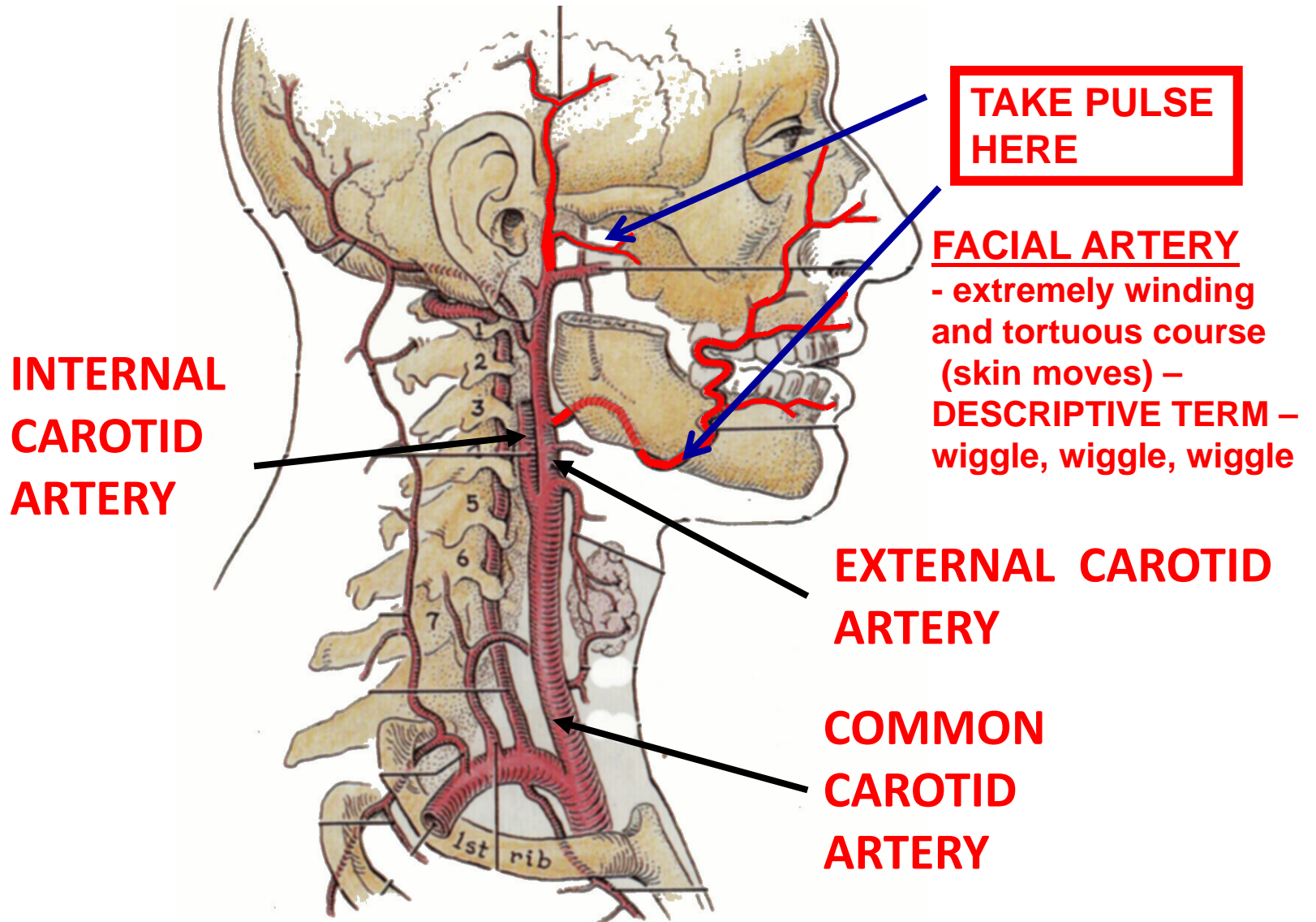
Note; Anisocoria – pupils of unequal size (normal or abnormal)

FACE

- **Arteries, Pulses**
- **Venous Drainage – Spread of Infection**
- **Bell's Palsy – Facial nerve paralysis, clinical tests, practice question**
- **Embryology - Cleft Lip. Nasolacrimal duct; practice question**

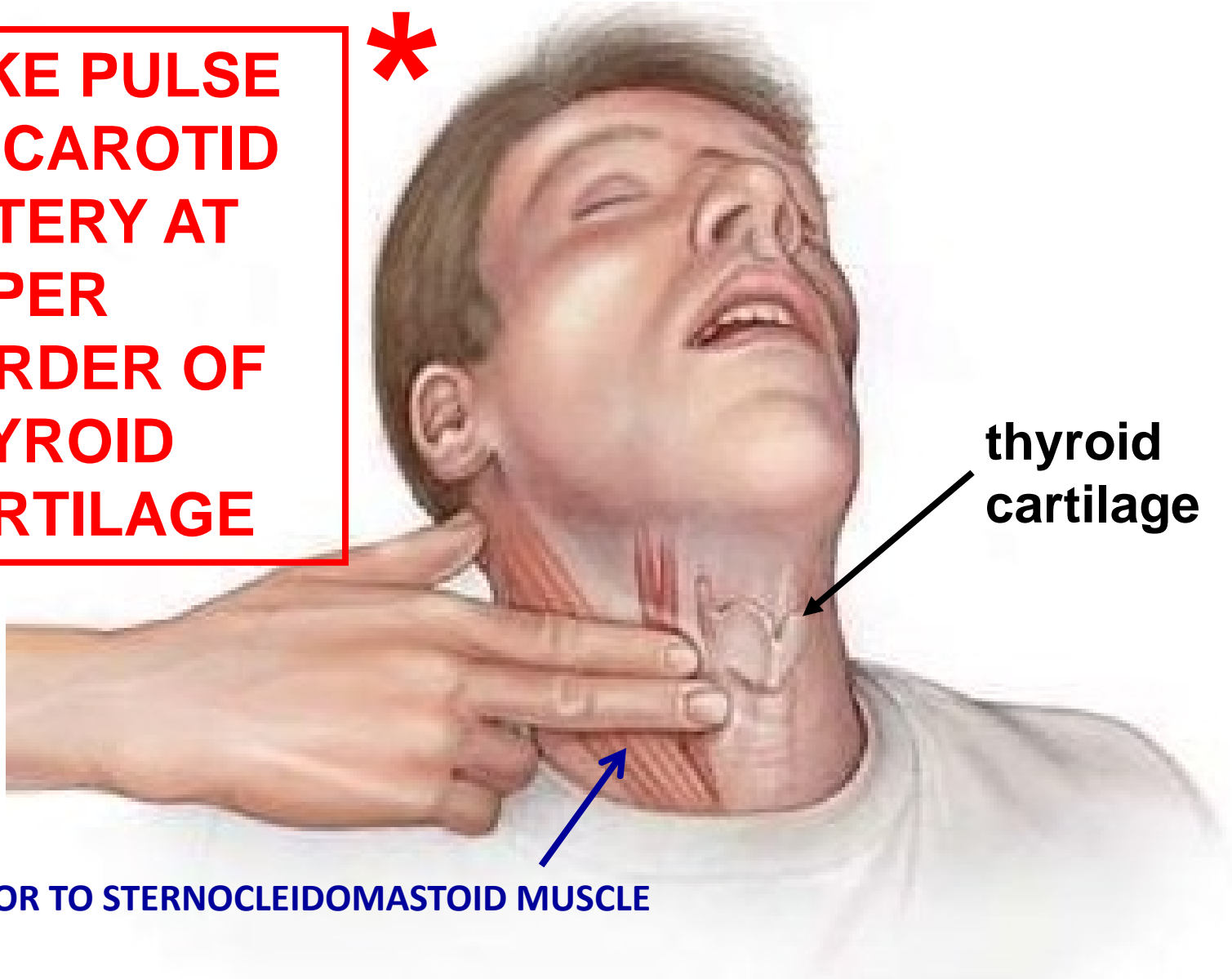
ARTERIAL SUPPLY TO FACE: CAROTID ARTERY

SUPERFICIAL TEMPORAL ARTERY



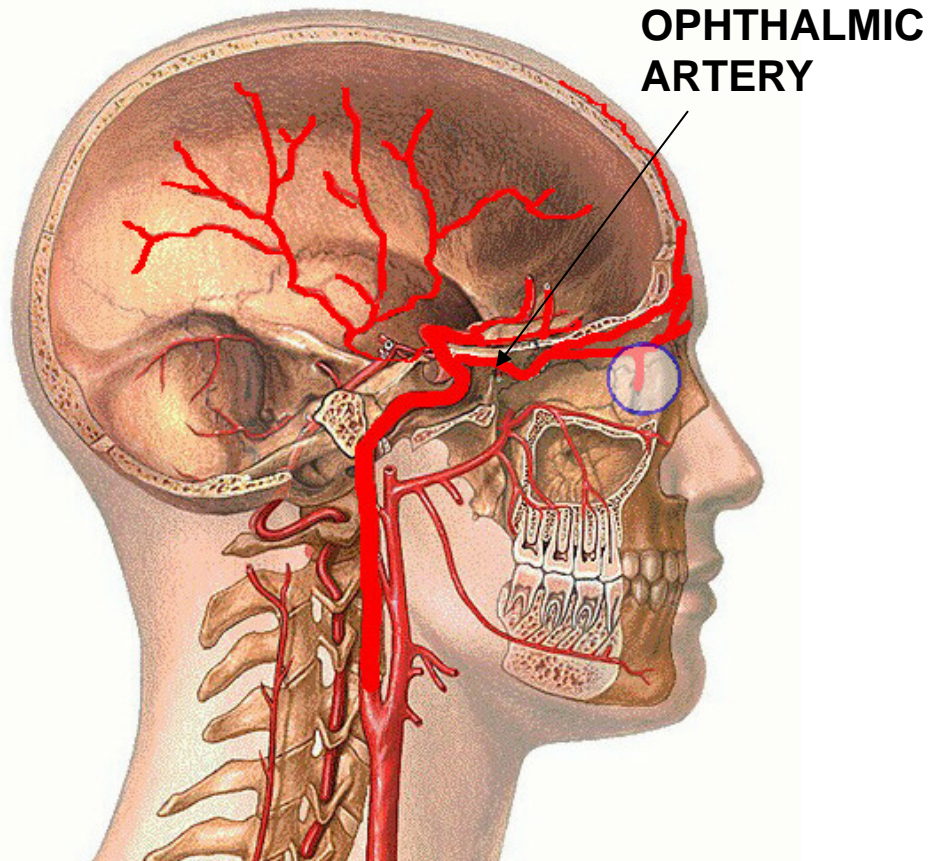
PALPATE CAROTID BIFURCATION AT UPPER BORDER OF THYROID CARTILAGE

TAKE PULSE OF CAROTID ARTERY AT UPPER BORDER OF THYROID CARTILAGE



ANTERIOR TO STERNOCLEIDOMASTOID MUSCLE

INTERNAL CAROTID ARTERY



Note: Carotid = Karatikos
in Greek = stupor;
Named by Galen;
Compression causes
black out

**Enters skull without
Branching**

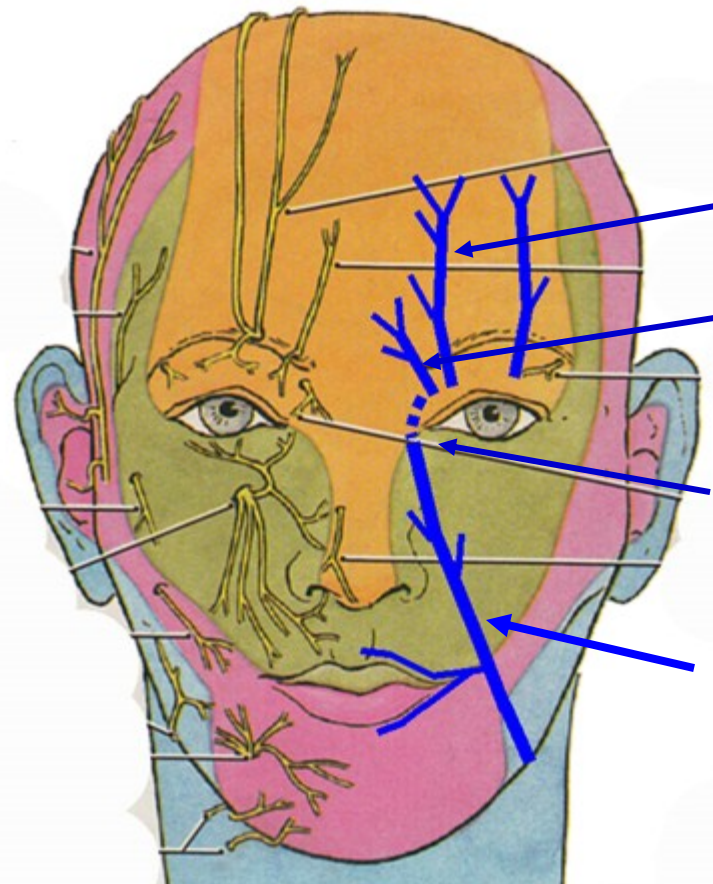
Branches to:

A. Brain

**B. Ophthalmic Artery-
Major blood supply
To eye (orbit)**

**Note: Branches of Ophthalmic artery leave orbit to supply
Face, Forehead, Nasal cavity**

VENOUS DRAINAGE - branches follow arteries



to Ophthalmic veins -

1) Supraorbital Vein

2) Supratrochlear Vein

1) Facial Vein -
straight course

ANASTOMOSE WITH
OPHTHALMIC VEINS



- NOTE: Veins of Face have no (OR FEW AND VARIABLE) valves; drain to neck and into skull;
Extensive anastomoses between branches of Facial
AND Ophthalmic Veins

PRACTICE QUESTION CLINICAL VIGNETTE

A teenager patient develops a pimple on the face lateral to the nose and scratches the sore. In time, the sore becomes infected but remains untreated. The patient then develops neurological symptoms and has the major complaint of 'blurred vision' which is diagnosed as Diplopia.

The physician suspects that the infection has spread to a structure inside the cranial cavity.

What is likely to be the structure and the route by which the infection has spread?

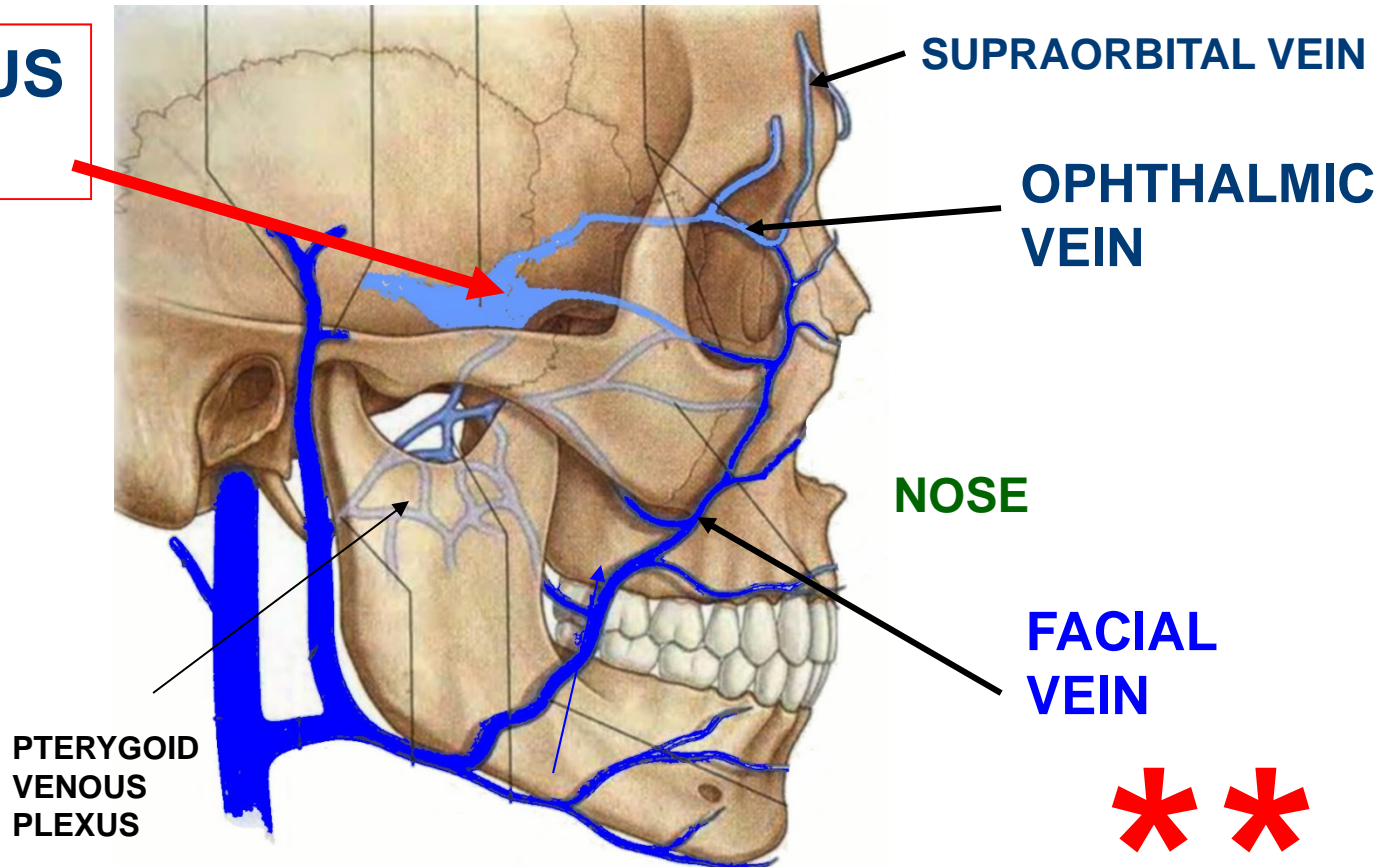
What is a likely cause of the blurred vision?

SPREAD OF INFECTION FROM FACE TO BRAIN

CAVERNOUS SINUS

Anastomoses of Facial and Ophthalmic Veins

- Ophthalmic veins drain to cavernous sinus (venous sinus inside skull)

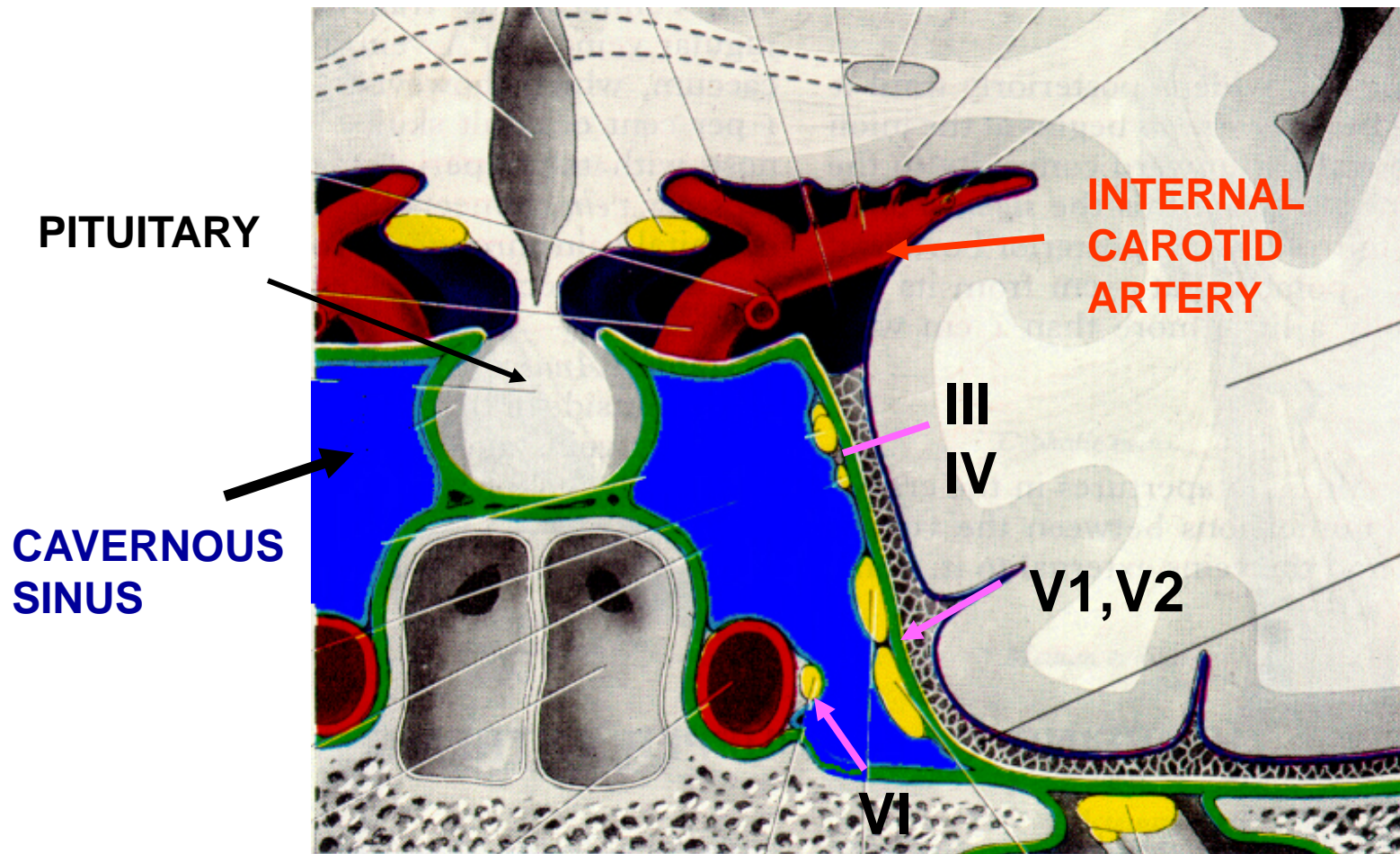


- **Prolonged infections** spread via veins (pressure low, no valves)
- Pass through orbit to Cavernous Sinus - **CAVERNOUS SINUS THROMBOSIS**; infections lateral to nose particularly dangerous
- **Clinical sign: 'Blurred' vision (actually DIPLOPIA) (cranial nerves to eye muscles pass through Cavernous sinus)**

NERVES TO EYE MUSCLES PASS IN WALL OF CAVERNOUS SINUS

STRUCTURES PASSING THROUGH WALL OF CAVERNOUS SINUS - Int. Carotid A., Cranial N.'s III, IV, V1, V2, VI;

Clinical sign of Infection in Sinus – **'BLURRED' VISION (Diplopia)**



CN III, IV, VI – EYE MOVEMENTS

PRACTICE QUESTION CLINICAL VIGNETTE



PHOTO FROM: FIRST AID FOR
THE USMLE STEP 1 - 2021

A 54 year-old patient awakes to find her face feels like it is 'sagging' on her left side. The image at left was taken when she tried to smile and raise her eye brows. She also complains that she **cannot close her left eye and it feels like it is 'drying out'**. She tries to eat breakfast but has difficulty chewing and **food leaks from the corner of her mouth.**

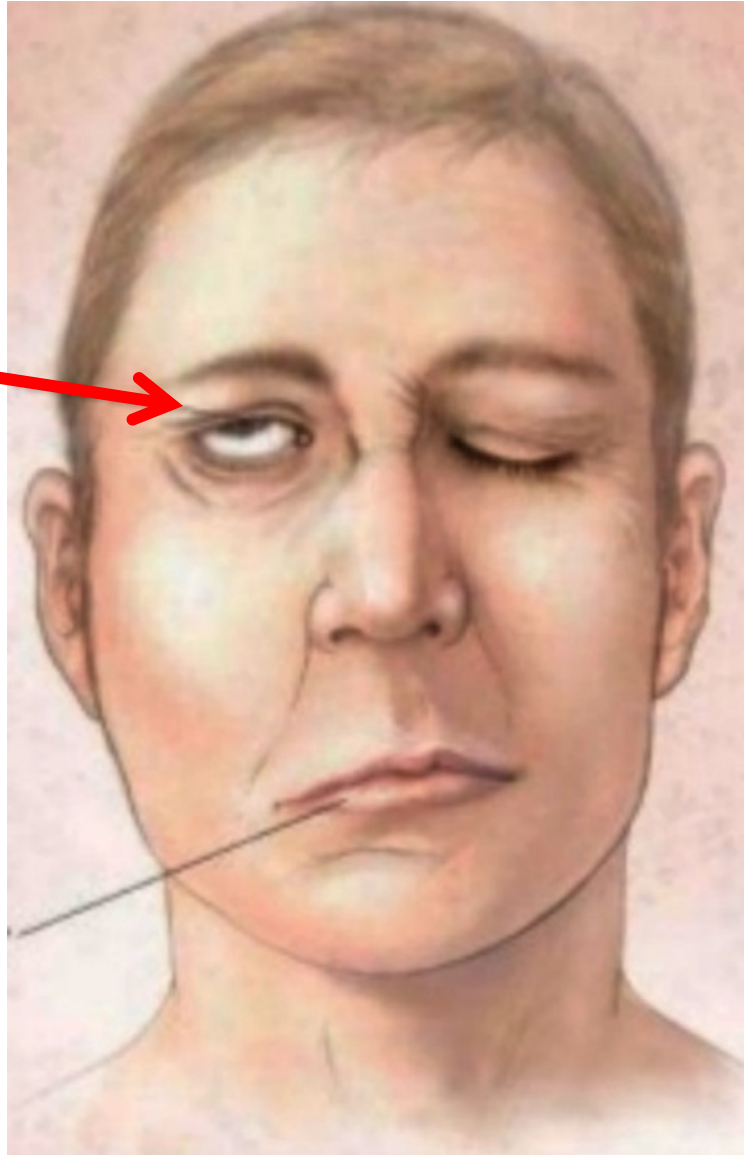
1) WHAT IS THE PHYSICIAN' S
DIAGNOSIS?

2) WHY IS SHE UNABLE TO CLOSE
HER LEFT EYE AND WHY IS IT
'DRYING OUT'

3) WHY DOES SHE HAVE DIFFICULTY
WITH KEEPING FOOD IN HER
MOUTH?

BELL'S PALSY

UNABLE TO
CLOSE EYE
DUE TO
PARALYSIS
OF
ORBICULARIS
OCULI
MUSCLE



* *

FACIAL PARALYSIS

(as in Bell's Palsy)

can paralyze

ORBICULARIS

OCULI MUSCLE

- patient is unable to
close eye

- can damage cornea
of eye

- in newborns, can
sew eyelid shut to
prevent corneal
damage

NOTE:

1) CLOSE
EYELIDS

= CRANIAL
NERVE VII
(FACIAL N.)

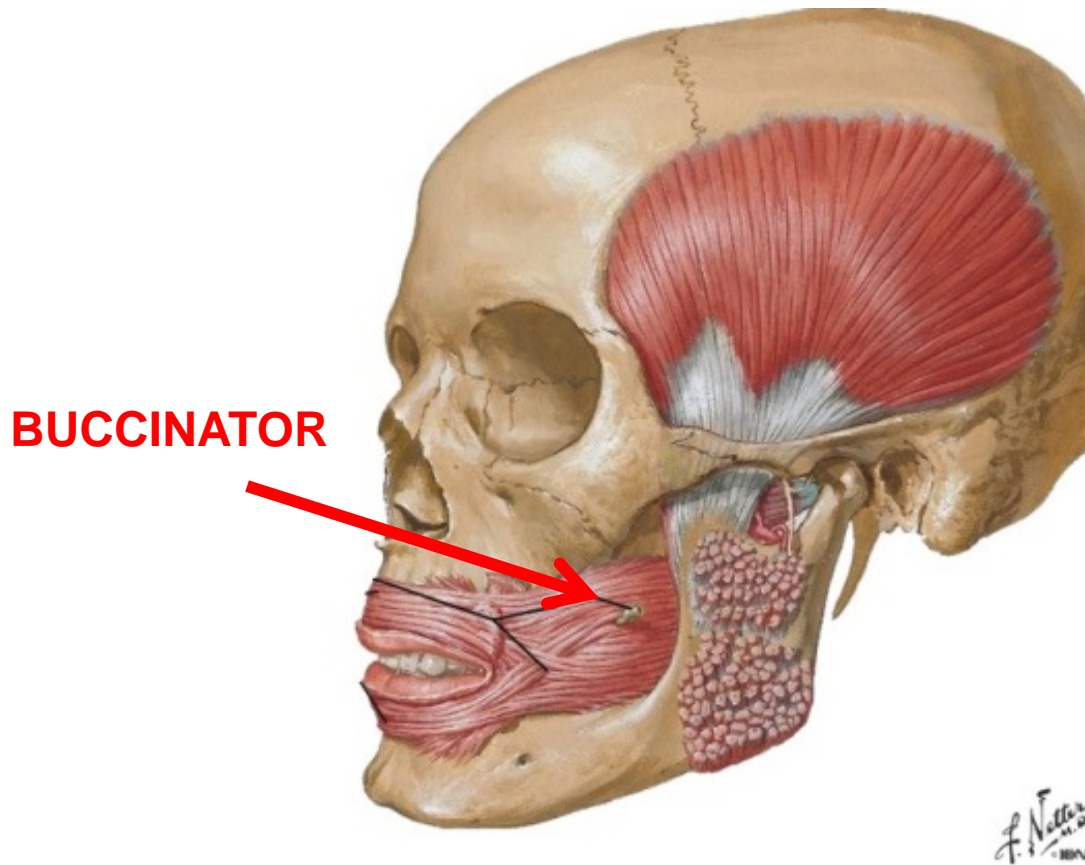
2) OPEN EYELIDS

- CRANIAL
NERVE III
(OCULOMOTOR)

+
SYMPATHETICS

PARALYSIS OF BUCCINATOR MUSCLE

CLINICAL * *



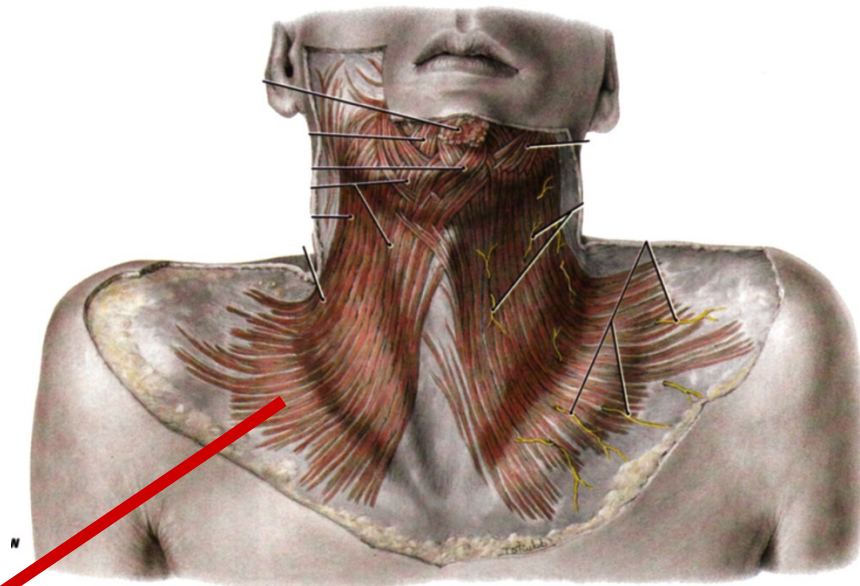
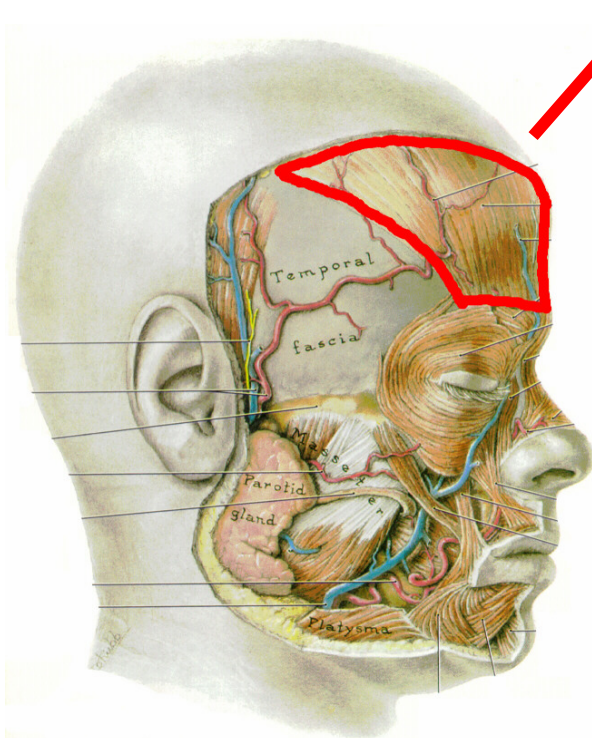
**FACIAL PARALYSIS
can paralyze
BUCCINATOR**

**- patient is unable to
hold food between
teeth**

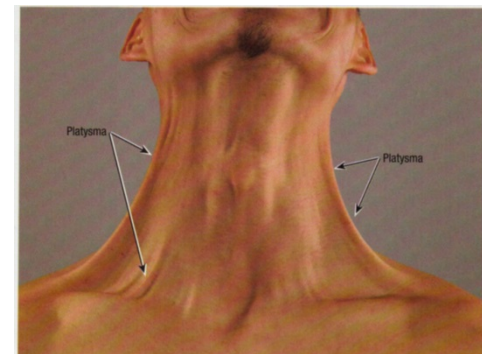
**- DIFFICULTY IN
CHEWING FOOD**

**BUCCINATOR FORMS WALL OF
MOUTH - PARALYZE UNABLE TO
HOLD FOOD BETWEEN TEETH**

FRONTALIS - muscle in scalp attached to **Epicranial Aponeurosis**; **raises eyebrows** (used in clinical test of Facial nerve)



PLATYSMA - extends from mandible to fascia over Pectoralis Major; tenses, moves skin of neck



PRACTICE QUESTION: EMBRYOLOGY



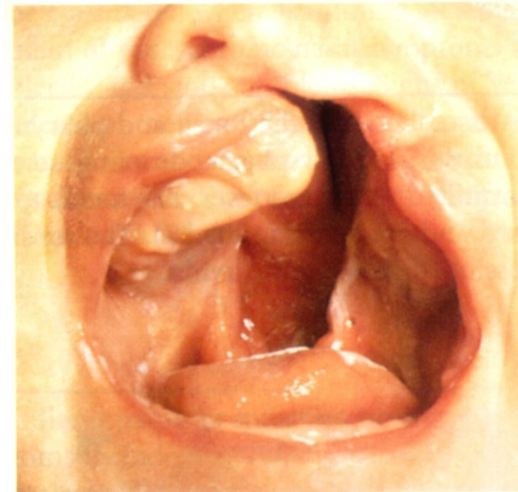
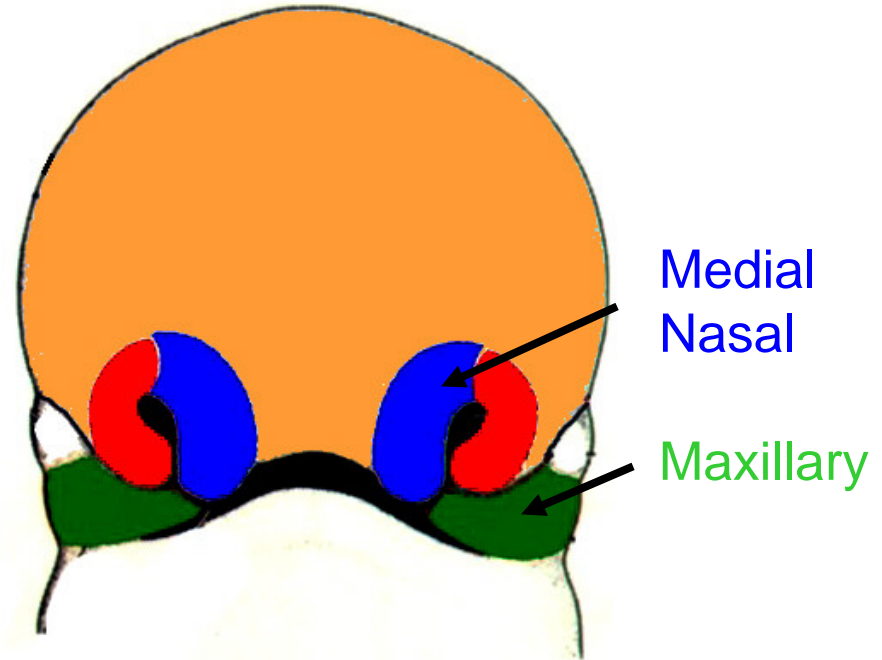
1. A neonate is examined and found to have a large defect located at the philtrum of the upper lip (photo). This condition arises because of failure of fusion of structures in embryonic development. Failure of fusion of which structures would result in this condition?

CLEFT LIP = CHEILOSCHISIS

*
– failure of fusion of Medial Nasal Process and Maxillary process

- 1/1000 Births, can be unilateral or bilateral
- At philtrum of lip

CLEFT LIP (cheiloschisis)
CAN OCCUR
IN COMBINATION WITH
CLEFT PALATE
(palatoschisis)



Gk. Cheilos,
Lip;
Pronounce -
KAI-LOS'-KESIS

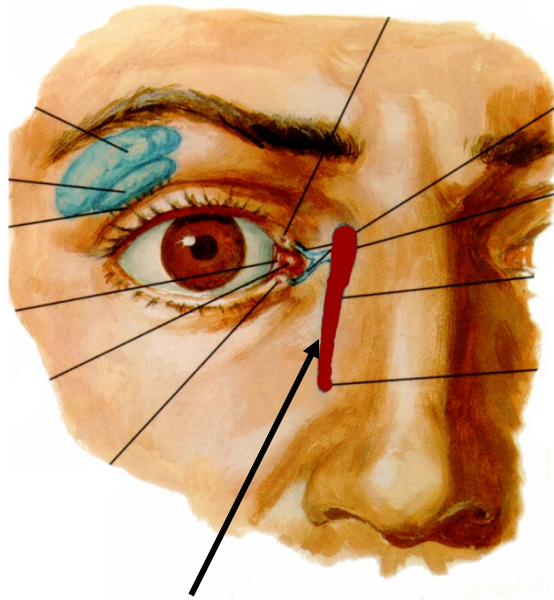
PRACTICE QUESTION: EMBRYOLOGY



An infant has a continuous secretion of tears from the left eye (photo above). MRI of the orbit appears normal and the lacrimal gland is not enlarged. The physician suspects that the condition the result of a developmental abnormality.

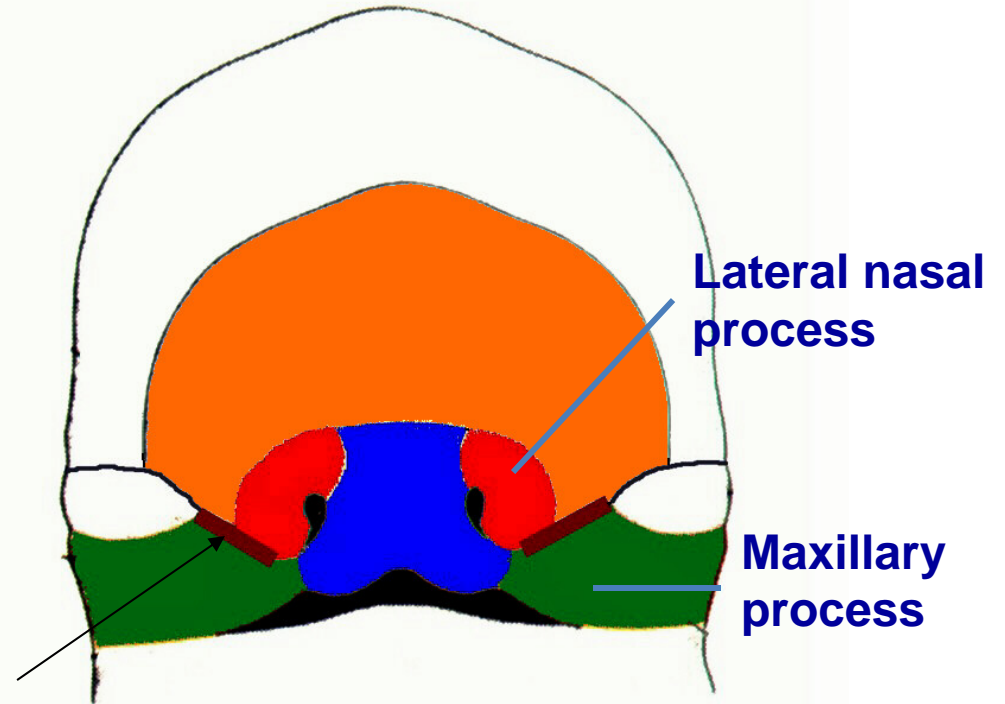
What structure has not developed normally?

DEVELOPMENT OF NASOLACRIMAL DUCT



NASOLACRIMAL DUCT

– connects anterior eye to nasal cavity



- Develops as solid cord from medial angle of eye to nasal cavity
- becomes canalized.



Obstructed Duct - failure of duct to canalize; opened surgically for tears to drain to nasal cavity

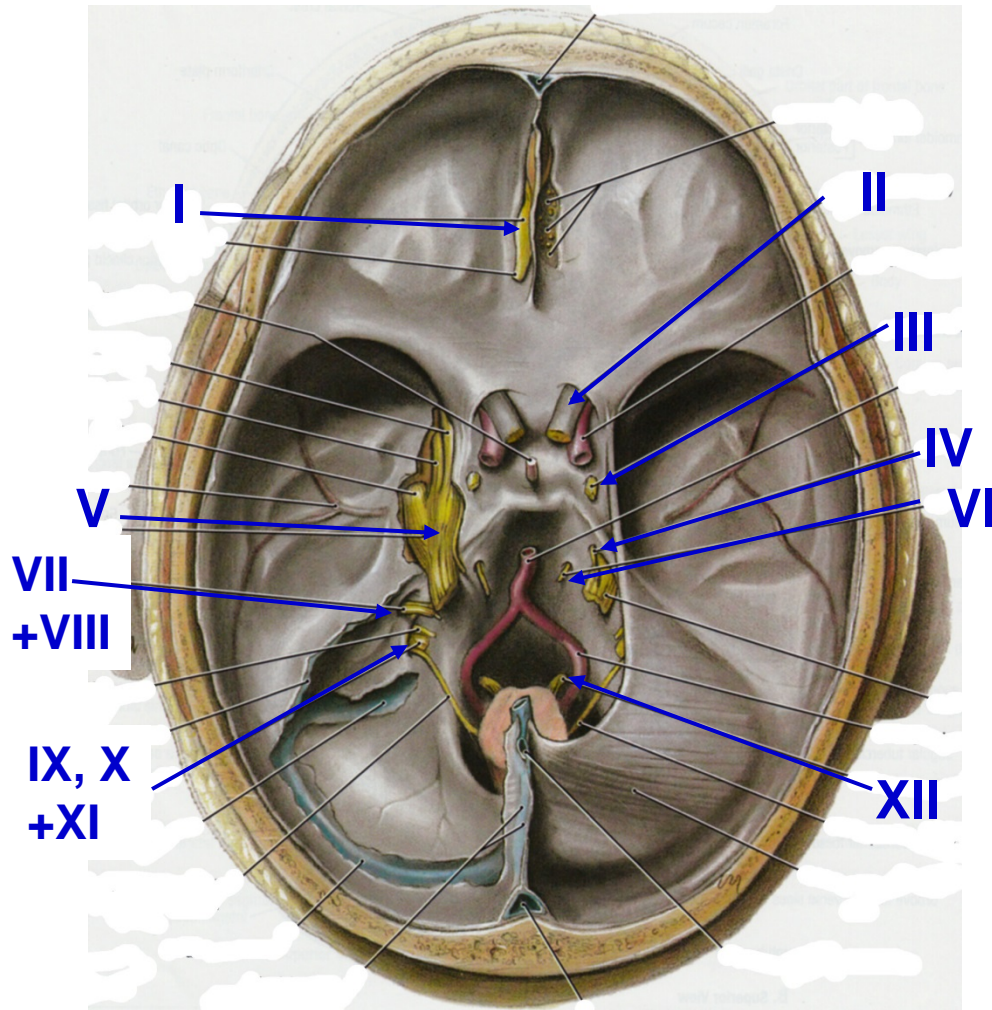
CRANIAL NERVES

Types of neurons – important in Neuro;

Voluntary Skeletal muscle (somatic, branchial)

Somatic sensory - Precise localization

LEARN NAMES AND NUMBERS OF CRANIAL NERVES



- I. OLFACTORY - sense of smell
- II. OPTIC - vision
- III. OCULOMOTOR - eye movement
- IV. TROCHLEAR - eye movement
- V. TRIGEMINAL - touch, general sensation to skin, oral cavity, nasal cavity + more
- VI. ABDUCENS - eye movement
- VII. FACIAL - muscles of facial expression + lots more
- VIII. VESTIBULO-COCHLEAR - hearing and balance
- IX. GLOSSOPHARYNGEAL - sensory to pharynx + more
- X. VAGUS - larynx, pharynx + rest of body
- XI. ACCESSORY - sternocleidomastoid, trapezius
- XII. HYPOGLOSSAL - muscles of tongue

SUMMARY TYPES OF NEURONS IN CRANIAL NERVES

TYPES OF NEURONS	INNERVATE	ASSOCIATED CRANIAL NERVES	CLINICAL
SOMATIC MOTOR (GSE)	Motor to voluntary skeletal muscles (derived from somites)	CN III, IV, VI - 1) Extraocular muscles (pre-otic somites) CN XII - muscles of tongue (occipital somites)	see ORBIT, TONGUE lectures
SOMATIC SENSORY (GSA)	<u>Precise sensation</u> Sensory to skin, joints (oral cavity, nasal cavity)	CN V - mostly V1 - Ophthalmic (above angle of eye) V2 - Maxillary (angle of eye to angle of mouth) V3 - Mandibular (below angle of mouth) also Skin of External (Outer) Ear - V, VII, IX, X	1) Trigeminal Neuralgia - pain in region of affected division 2) Bell's palsy (VII) - pain in outer ear
VISCERAL MOTOR (GVE) (Parasympathetics in Cranial Nerves)	Smooth muscles, Glands, etc. (ganglia close to target organ)	III - Ciliary ganglion - Pupillary constrictor, Ciliary muscle VII - Pterygopalatine ganglion - Lacrimal gland, mucous glands of nose and palate VII - Submandibular ganglion - Submandibular, Sublingual salivary glands IX - Otic ganglion - Parotid	see Associated lectures (Orbit; Nasal, Oral Cavities; Ear)
VISCERAL SENSORY (GVA)	<u>Imprecise sensation:</u> Innervation of Gut, Blood Vessels, etc. Specific for Innervation of Pharynx, Middle Ear	Pharynx VII - Nasopharynx IX - Oropharynx X - Laryngopharynx also Middle Ear - IX	Imprecise localization in Choking on food; Middle ear infections
SPECIAL SENSES (SSA)	Vision, Audition, Balance	II - Vision VIII - Audition (hearing), Balance (vestibular apparatus)	many; see associated lectures
CHEMICAL SENSE (SVA)	Taste, Smell	Taste is distributed: VII - anterior 2/3 of tongue IX - posterior 1/3 of tongue X - taste buds anterior to epiglottis Smell - I - olfaction	Damage produces loss of taste in region of innervation
BRANCHIO-MOTOR (SVE)	Voluntary skeletal muscles derived from Branchial Arches	V - muscles of First Branchial Arch VII - muscles of Second Branchial Arch IX - muscles of Third Branchial Arch X - muscles of Fourth and Sixth Branchial Arches XI - muscles of caudal Sixth Branchial arch (disagreement among authors)	see Branchial arch chart (above); also Branchial Arch Lecture, etc.

Note: No questions on quiz require knowledge of three letter description of types of neurons (ex. GSE)

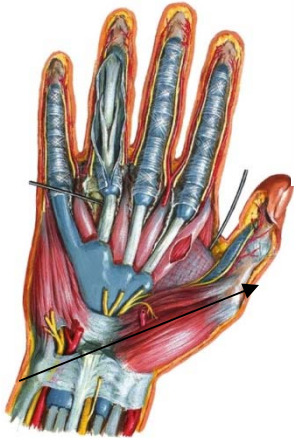
However, may appear in future lectures in Neuro

(INCANTATION)

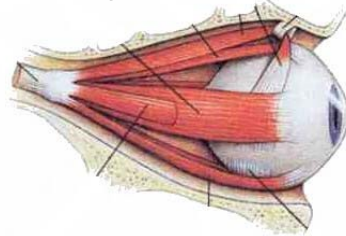
SOMATIC MOTOR – SKELETAL MUSCLE

SOMATIC MOTOR -
motor axons to skeletal muscles

ex. muscles of hand



eye muscles



move eyes

muscles of tongue



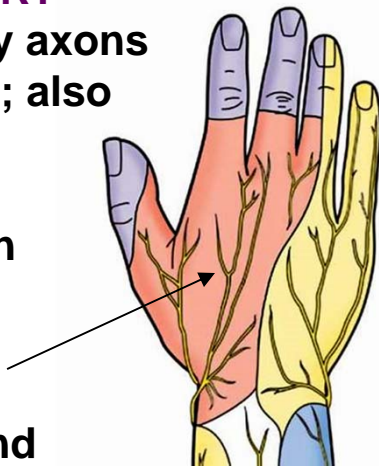
move tongue

SOMATIC MOTOR IN HEAD - limited to two groups

- 1. EYE MUSCLES -** extraocular muscles that move eye (and lift upper eyelid)
- 2. MUSCLES OF TONGUE**

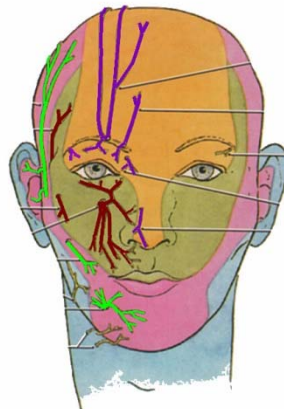
SOMATIC SENSORY-
sensory axons to skin ; also joints, body position

ex. skin of hand

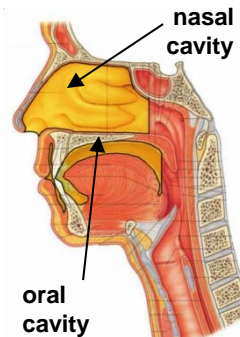


IN HEAD

skin of head

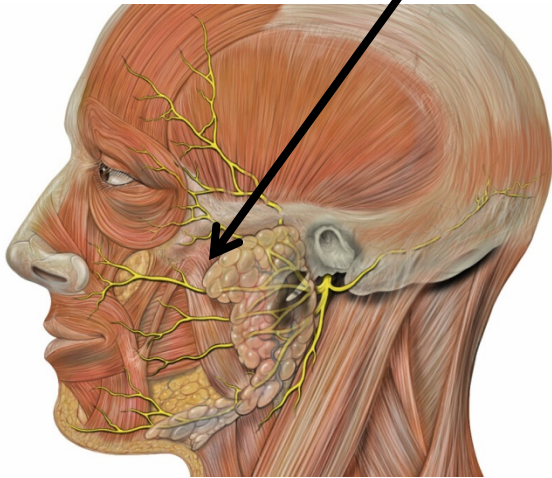


oral, nasal cavities



SOMATIC SENSORY IN HEAD - precise sensation sensory to skin ; also oral cavity (inside mouth), nasal cavity (inside nose)

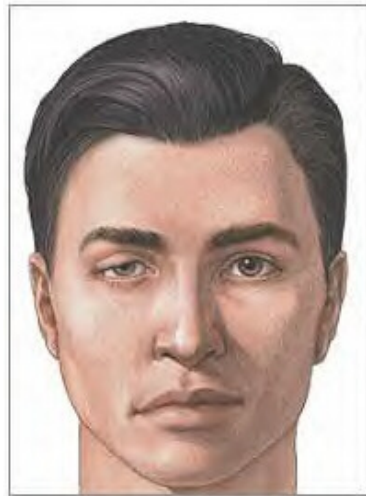
MUSCLES OF FACIAL EXPRESSION



BRANCHIOMOTOR – also voluntary skeletal muscle; same as Somatic motor; except different embryology, different **located of nuclei in brainstem**

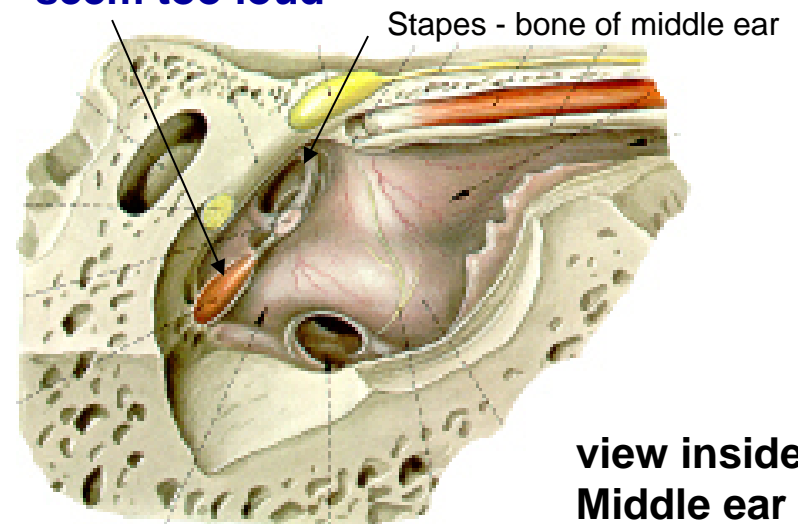
FACIAL PARALYSIS

sagging face
loss of naso-labial fold
inability to close eye



also **HYPERACOUSIS** – sounds seem too loud

STAPEDIUS - dampens sound -
DAMAGE HYPERCOUSIA - sounds seem too loud



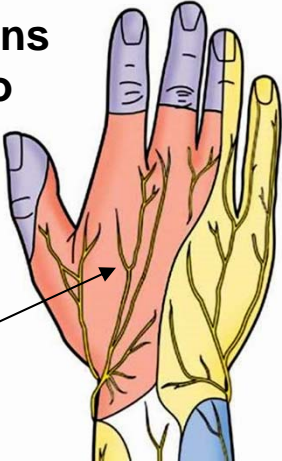
view inside
Middle ear

SOMATIC SENSORY – PRECISE LOCALIZATION

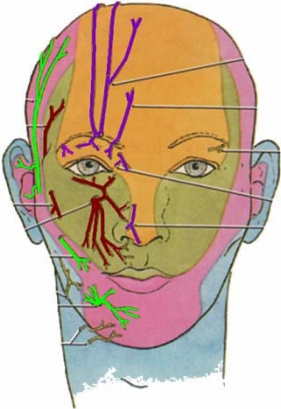
IN HEAD

skin of head

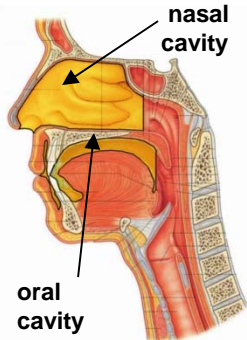
SOMATIC SENSORY-
sensory axons
to skin ; also
joints,
body
position



ex.
skin
of hand

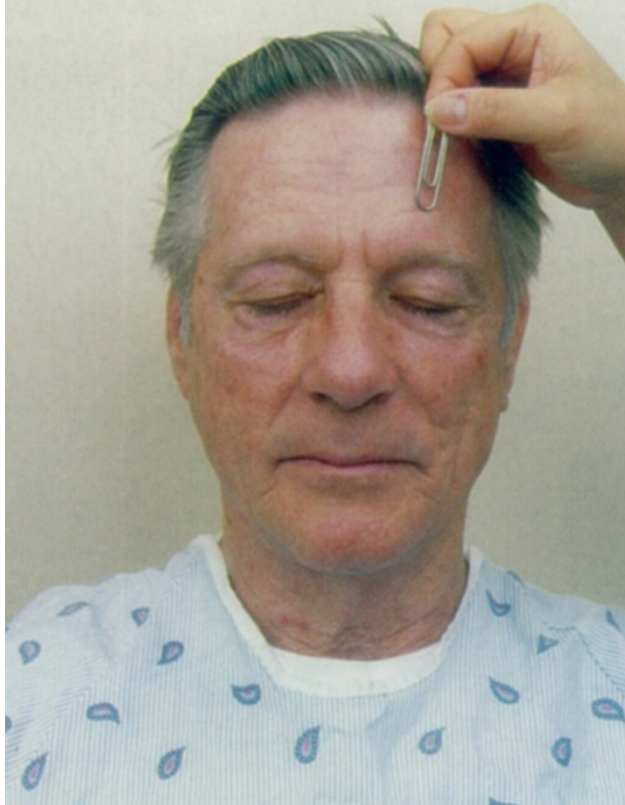


oral, nasal
cavities



**SOMATIC SENSORY
IN HEAD - precise
sensation sensory to
skin ; also oral
cavity (inside
mouth),
nasal cavity (inside
nose)**

PRACTICE QUESTION: CRANIAL NERVES



A patient complains that he has lost sensation on his face and that the skin of his face feels numb. The physician tests tactile acuity by touching the forehead and finds severe loss of sensation.

Which cranial nerve is being tested (be specific)?

What is the location of the sensory neuron cell bodies in the skin of the face?

TRIGEMINAL NERVE - 3 DIVISIONS (MAJOR BRANCHES)

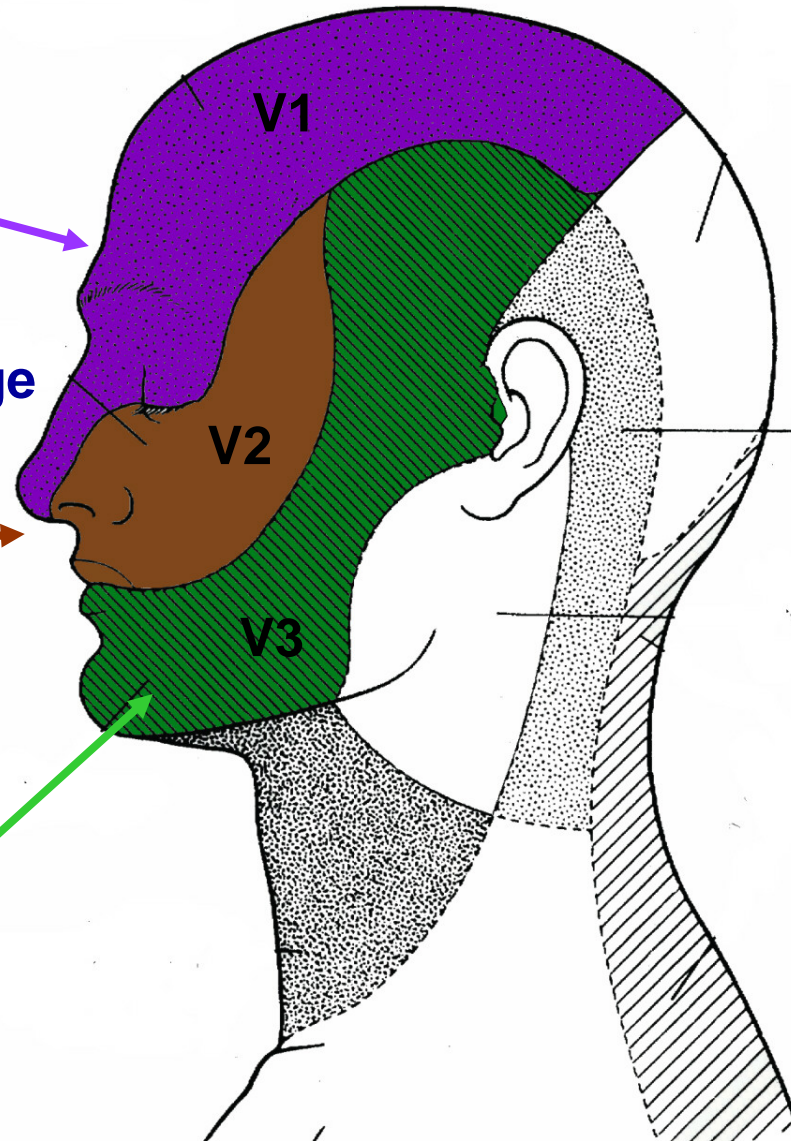
**V1 –
OPHTHALMIC
DIVISION**

**V2 –
MAXILLARY
DIVISION**

**V3 –
MANDIBULAR
DIVISION**

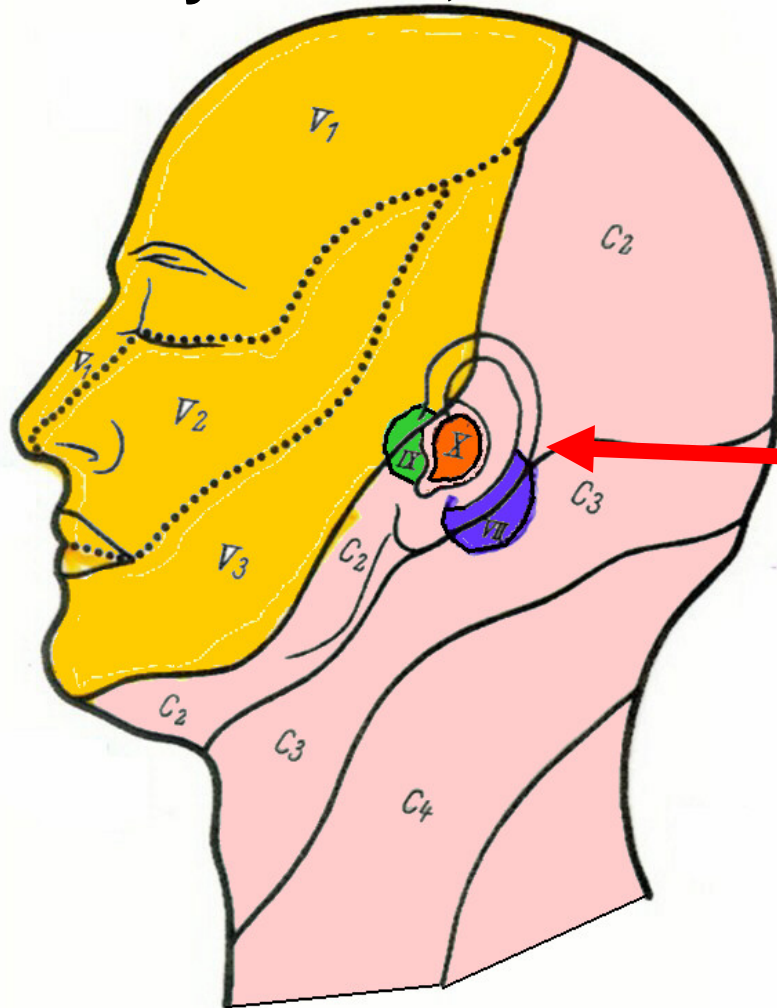
Boundary-
Lateral edge
of eye

Boundary
Lateral
edge
of mouth



SOMATIC SENSORY

sensory to skin, ORAL cavity, NASAL cavity, joints, muscles



**ALMOST ALL
TRIGEMINAL V
EXCEPTION:
SKIN OF OUTER EAR –
FOUR CRANIAL
NERVES**

- 1) V - TRIGEMINAL
- 2) VII- FACIAL
- 3) IX - GLOSSO-PHARYNGEAL
- 4) X - VAGUS

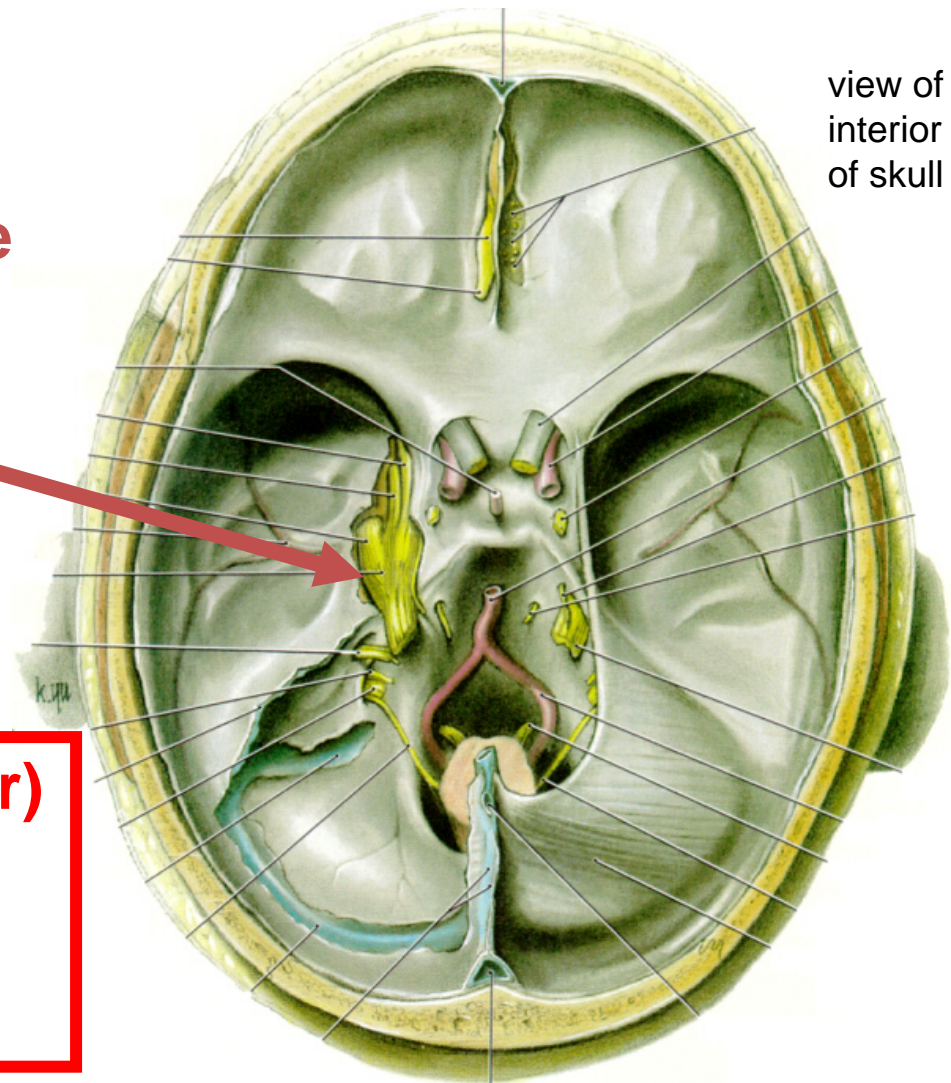
BELL'S PALSY (VII) - PARALYSIS OF FACIAL MUSCLES; IN RECOVERY, PATIENTS COMPLAIN OF EARACHES

SENSORY GANGLIA ARE ATTACHED TO CRANIAL NERVES

- cell bodies of sensory neurons in Trigeminal Nerve are in Trigeminal (Semilunar) Ganglion

Clinical - Mass (ex. tumor) pressing on Trigeminal Ganglion can produce numbness, intense pain

Cell bodies of sensory neurons in VII (Facial Nerve) in Geniculate Ganglion



DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

Discuss Branchial Arches, Neck

BRANCHIAL ARCHES

Know – Branchial cartilages, muscles, nerves, pouches

Clinical Branchial Cleft Syndromes

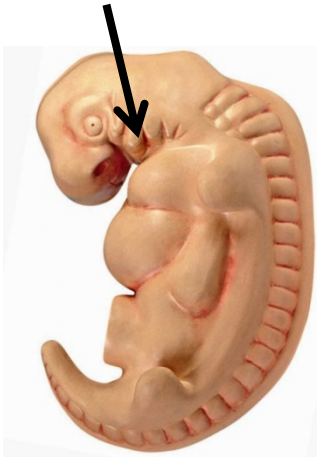
ALSO NOT DERIVED FROM BRANCHIAL ARCHES

Abnormalities of Thyroid development

DEVELOPMENT OF BRANCHIAL ARCHES

EMBRYOLOGICAL DEVELOPMENT

FORM GILLS IN FISH

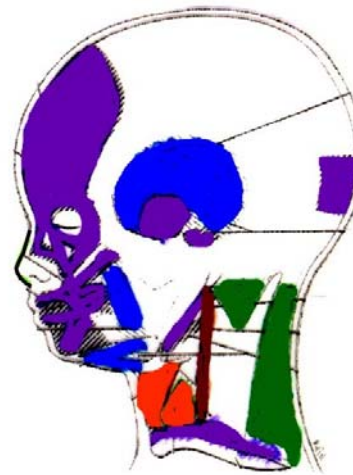


~4 weeks

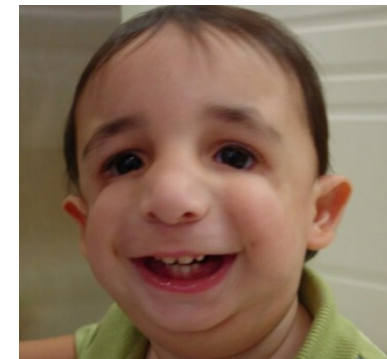


~11 weeks

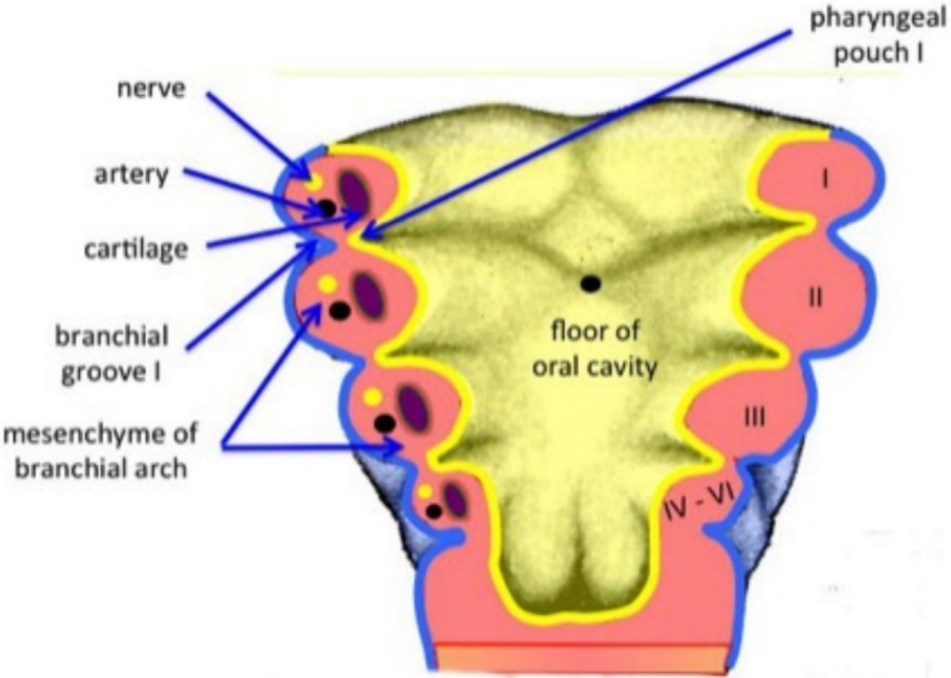
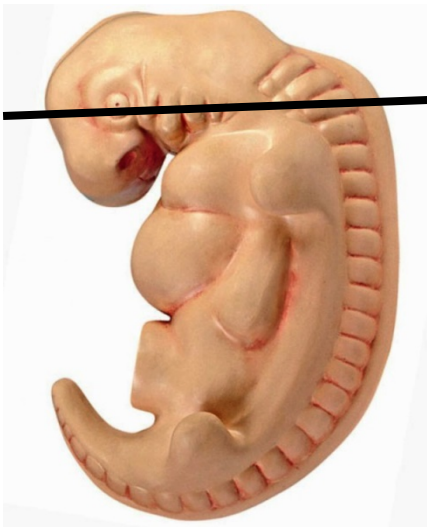
ANATOMY



CLINICAL SYNDROMES



BRANCHIAL ARCHES HAVE CARTILAGES, MUSCLES, ARTERIES



**FORM - CLEFTS ON OUTSIDE (ECTODERM)
POUCHES ON INSIDE (ENDODERM)**

CHART OF BRANCHIAL ARCH DERIVATIVES FROM FIRST AID - MEMORIZE

Branchial arch derivatives				
ARCH	CARTILAGE	MUSCLES	NERVES ^a	ABNORMALITIES/COMMENTS
1st branchial arch	<p>Maxillary process → Maxilla, zygomatic bone</p> <p>Mandibular process → Meckel cartilage → Mandible, Malleus and incus, sphenomandibular ligament</p>	<p>Muscles of Mastication (temporalis, Masseter, lateral and Medial pterygoids), Mylohyoid, anterior belly of digastric, tensor tympani, anterior 2/3 of tongue, tensor veli palatini</p>	CN V ₃ chew	<p>Pierre Robin sequence – micrognathia, glossoptosis, cleft palate, airway obstruction</p> <p>Treacher Collins syndrome – neural crest dysfunction → mandibular hypoplasia, facial abnormalities</p>
2nd branchial arch	<p>Reichert cartilage: Stapes, Styloid process, lesser horn of hyoid, Stylohyoid ligament</p>	<p>Muscles of facial expression, Stapedius, Stylohyoid, platysma, posterior belly of digastric</p>	CN VII (facial expression) smile	
3rd branchial arch	<p>Greater horn of hyoid</p>	<p>Stylopharyngeus (think of stylopharyngeus innervated by glossopharyngeal nerve)</p>	CN IX (stylopharyngeus) swallow stylishly	
4th–6th branchial arches	<p>Arytenoids, Cricoid, Corniculate, Cuneiform, Thyroid (used to sing and ACCCT)</p>	<p>4th arch: most pharyngeal constrictors; cricothyroid, levator veli palatini</p> <p>6th arch: all intrinsic muscles of larynx except cricothyroid</p>	<p>4th arch: CN X (superior laryngeal branch) simply swallow</p> <p>6th arch: CN X (recurrent/inferior laryngeal branch) speak</p>	<p>Arches 3 and 4 form posterior 1/3 of tongue; arch 5 makes no major developmental contributions</p>

KNOW THIS FOR STEP 1

BREAK DOWN TO COMPONENT IN LECTURE HANDOUT

STRUCTURES DERIVED FROM BRANCHIAL ARCHES

ARCH/NERVE	SKELETAL	LIGAMENTS	MUSCLES
First (V)	1) Malleus 2) Incus	1) Ant. ligament of malleus 2) Sphenomandibular ligament	1) Muscles of Mastication 2) Tensor tympani 3) Tensor palati 4) Mylohyoid 5) Ant. belly of Digastric
Second (VII)	1) Stapes 2) Styloid process 3) Hyoid bone - lesser horn, upper half of body	Stylohyoid ligament	1) Muscles of Facial Expression 2) Stapedius 3) Stylohyoid 4) Post. belly of Digastric
Third (IX)	Hyoid bone - greater horn, lower half of body	-----	Stylopharyngeus
Fourth (X)	Cartilages of Larynx	-----	1) All muscles of Larynx 2) All muscles of Pharynx (except Stylopharyngeus) 3) All muscles of Soft Palate (except Tensor palati)
Sixth (XI)	-----	-----	1) Sternocleidomastoid 2) Trapezius

CHART OF BRANCHIAL ARCH DERIVATIVES FROM FIRST AID - MEMORIZE

PRACTICE QUESTION CLINICAL VIGNETTE



A young child is brought to a pediatrician by his parents. The child (photo above) shows micrognathia (small mandible) and downward slanting eyes. Tests of auditory function indicate a hearing loss. The physician suspects that the child has Treacher-Collins syndrome, a congenital disorder associated with malformation of structures that develop in association with the first branchial arch. Which of the following structures normally develops with the first branchial arch and could have been malformed to cause the hearing loss?

- A. Auditory tube
- B. Cochlea
- C. Malleus and Incus
- D. Vestibulocochlear nerve
- E. Stapes

MUSCLES AND NERVES = BRANCHIOMOTOR MUSCLES FROM CRANIAL NERVES HANDOUT (INCANTATION)

10) BRANCHIOMOTOR - voluntary motor to skeletal muscles of face, ear, pharynx and neck that are derived from branchial arches.

<u>Nerve</u>	<u>Innervates</u>
V (Trigeminal) (all in V3)	muscles of mastication mylohyoid tensor tympani tensor palati anterior belly of digastric
VII (Facial)	muscles of facial expression stylohyoid posterior belly of digastric stapedius
IX (Glossopharyngeal)	stylopharyngeus
X (Vagus)	all muscles of pharynx (except stylopharyngeus) muscles of larynx all muscles of palate (except tensor palati)
XI (Accessory)	sternocleidomastoid trapezius

FOCUS ON CLINICAL: BRANCHIAL POUCHES, GROOVES, MEMBRANES

POUCH	FORMS	CLINICAL
First	1) Auditory tube 2) Tympanic cavity	First Branchial 'Cleft' cyst - tract linked to external auditory meatus
Second	Lining (crypts) of palatine tonsils	Second Branchial 'Cleft' cyst - tract linked to tonsillar fossa (palatine tonsils)
Third	1) Inferior parathyroid gland 2) Thymus	Third Branchial 'Cleft' cyst - tract at thyrohyoid membrane or piriform recess
Fourth	1) Superior parathyroid gland 2) C-cells of Thyroid	does not form
Sixth (XI)	-----	-----

Note: Cysts and fistuli - in lateral neck are **anterior to Sternocleidomastoid muscle**

CLEFT	FORMS
First	External Auditory Meatus

MEMBRANE	FORMS
First	Tympanic membrane

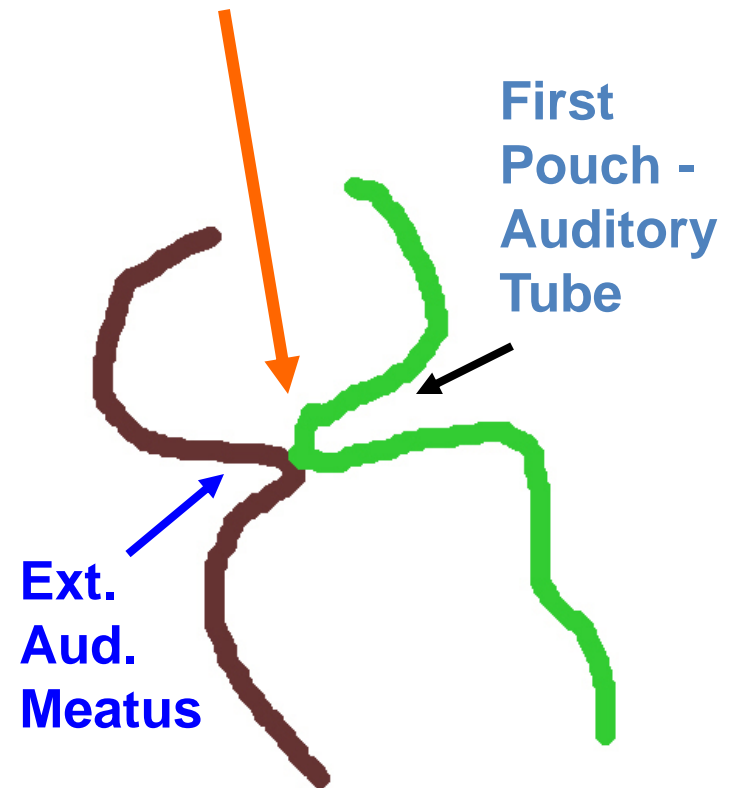
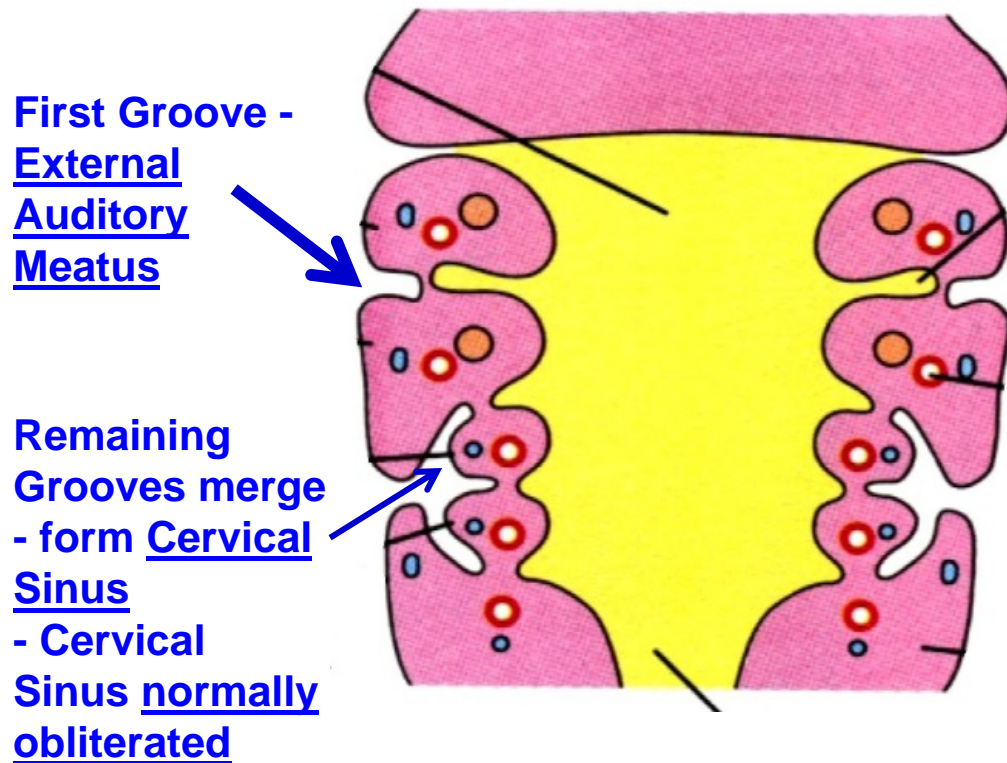
NOTE: CLEFT = GROOVE

BRANCHIAL GROOVES (CLEFTS) AND MEMBRANES

Only First Branchial Groove and Membrane Normally form Structures in Adult

First Groove - External Auditory Meatus

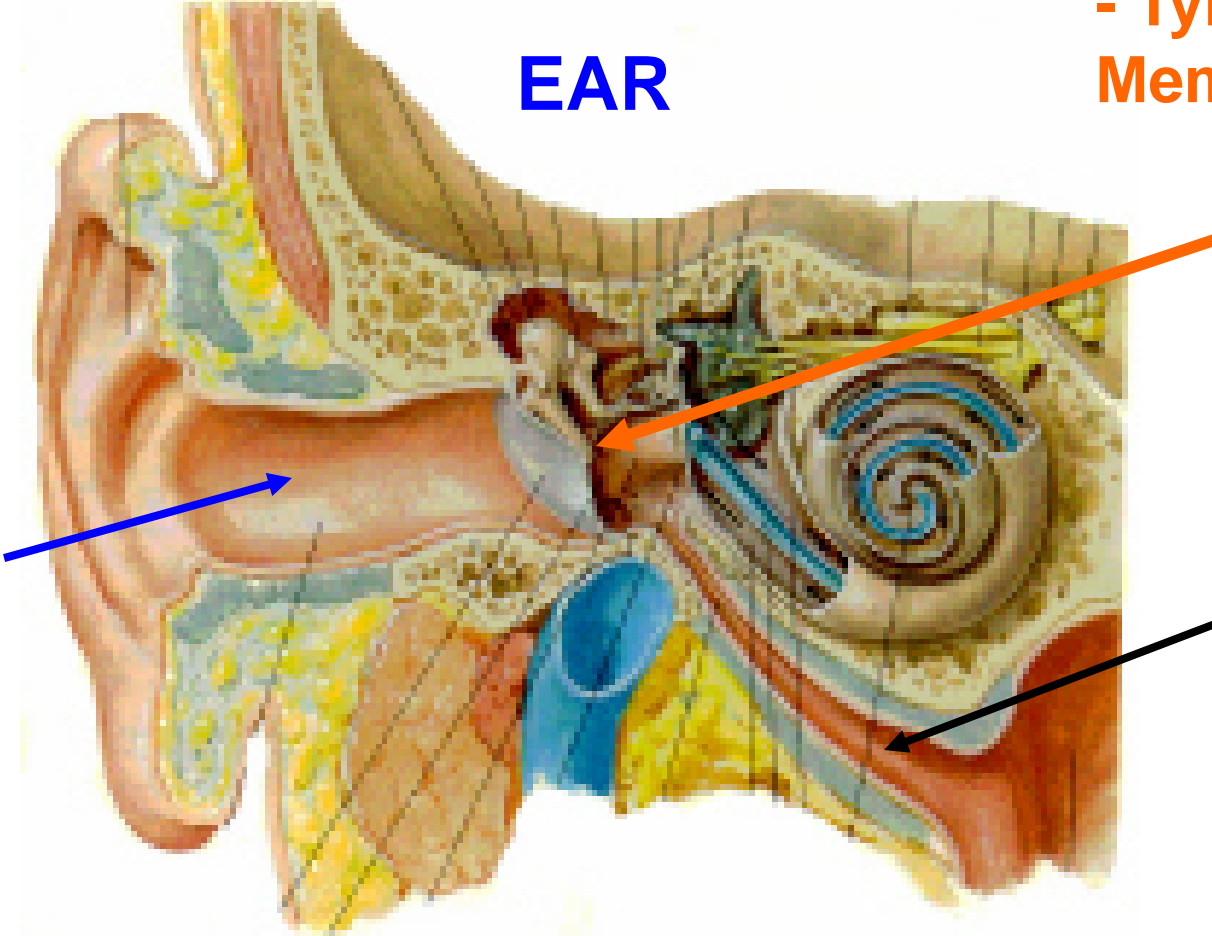
First Membrane = Tympanic Membrane



EAR

First Membrane
- Tympanic
Membrane

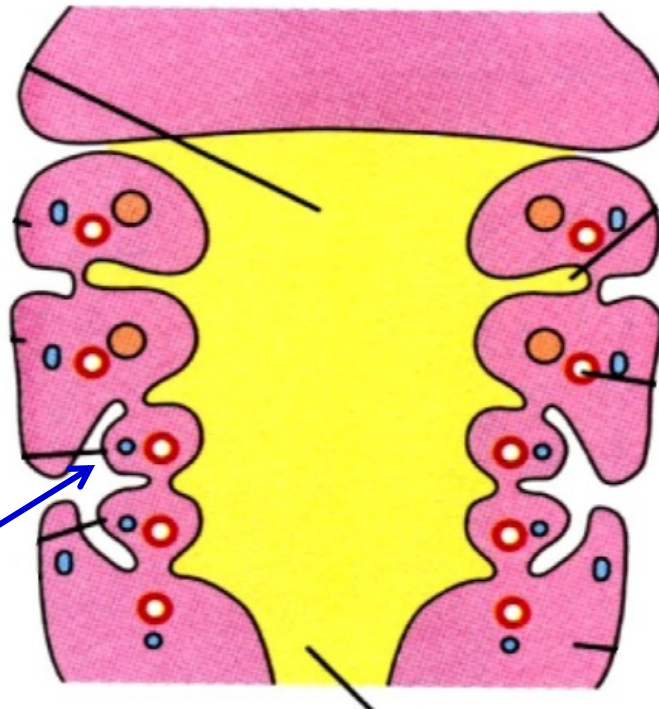
FIRST
GROOVE -
Ext. Aud.
Meatus



FIRST
POUCH -
Auditory
Tube,
Tympanic
Cavity

BRANCHIAL GROOVES

Other Grooves develop in longer depression
Cervical Sinus



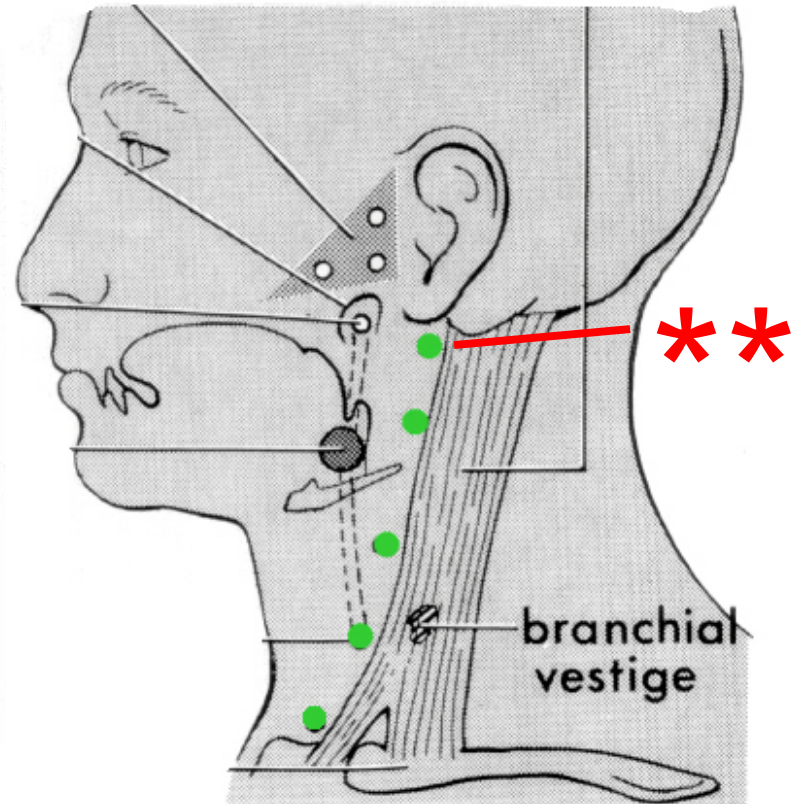
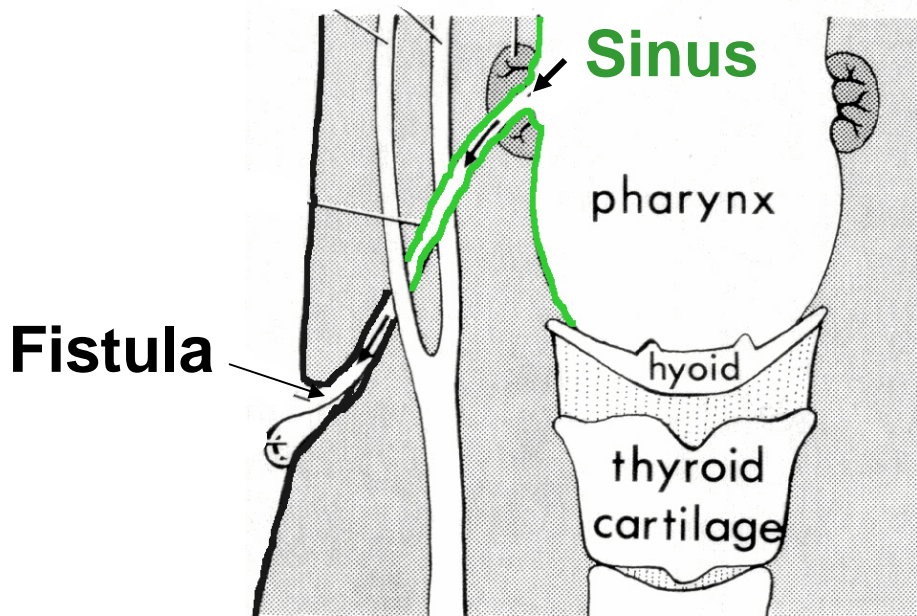
Remaining
Grooves merge
- form Cervical
Sinus
- Cervical
Sinus normally
obliterated

Note:
Cervical
sinus
normally
obliterated
but
can persist

BRANCHIAL ANOMALIES

Branchial Sinus = Blind pouch from Pharynx

Branchial Fistula = Channel, often connecting Pharynx to skin of neck; usually passes Anterior to Sternocleidomastoid, between Int. and Ext. Carotid A.



**

FIRST BRANCHIAL POUCH SYNDROME – channel to External Auditory Meatus

PRACTICE QUESTION CLINICAL VIGNETTE

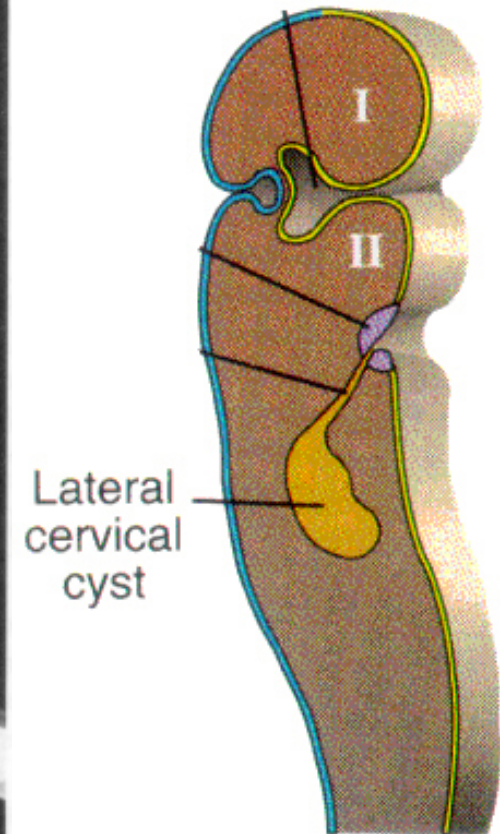
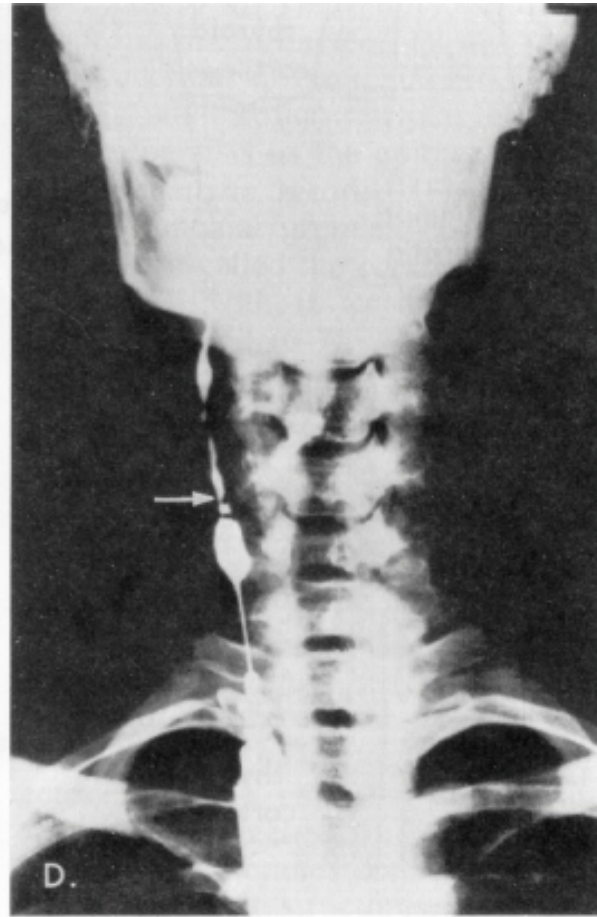


A 24 year old woman develops a mass in her neck (see photo above). The mass is located immediately anterior to the sternocleidomastoid muscle. The physician suspects that this condition has result from a branchial cyst. During surgery, the mass is found to be connected to a tract that extends superiorly and medially. The tract is most likely to be connected to which of the following structures?

- A. Middle meatus of the nasal cavity
- B. Pharyngeal tonsil
- C. Tonsillar fossa (palatine tonsils)
- D. Lingual tonsil
- E. Mandibular fossa

SECOND BRANCHIAL POUCH SYNDROME

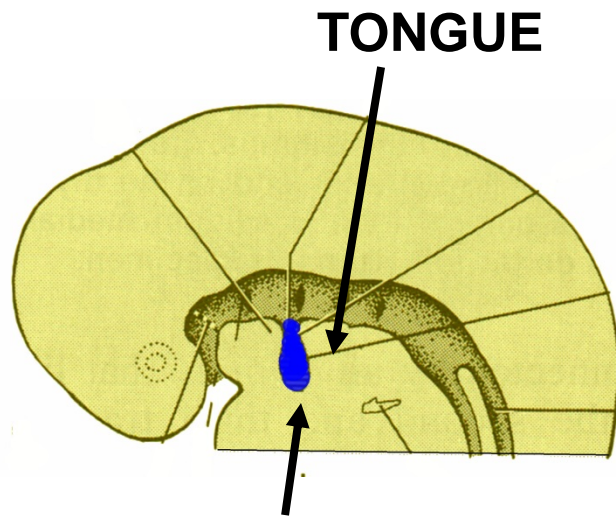
SECOND BRANCHIAL POUCH FORMS CRYPTS (LININGS)
OF PALATINE TONSILS



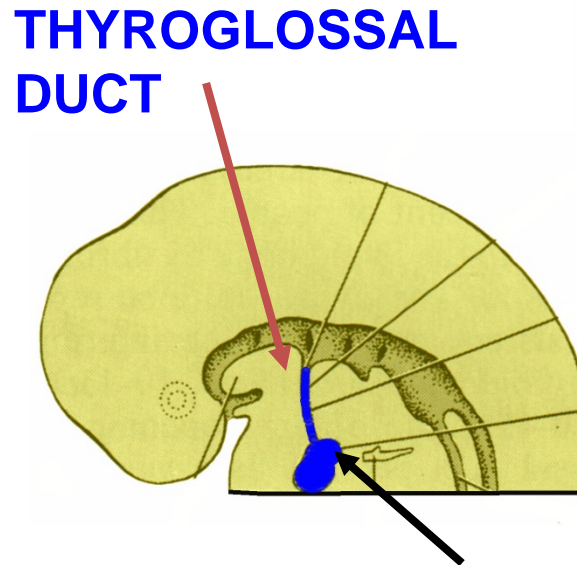
Branchial Fistula - drains to neck

Branchial Cyst
often remnant
of Cervical Sinus

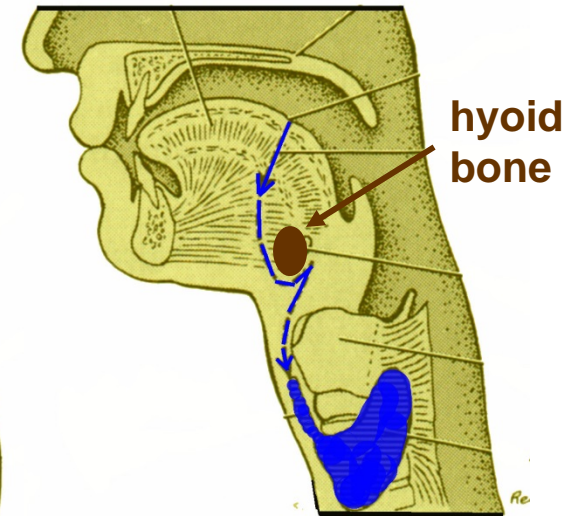
DEVELOPMENT OF THYROID



1) Thyroid start as Median endodermal Thickening on floor of pharynx at **future junction of anterior 2/3 and posterior 1/3 of tongue (marked by Foramen Cecum)**

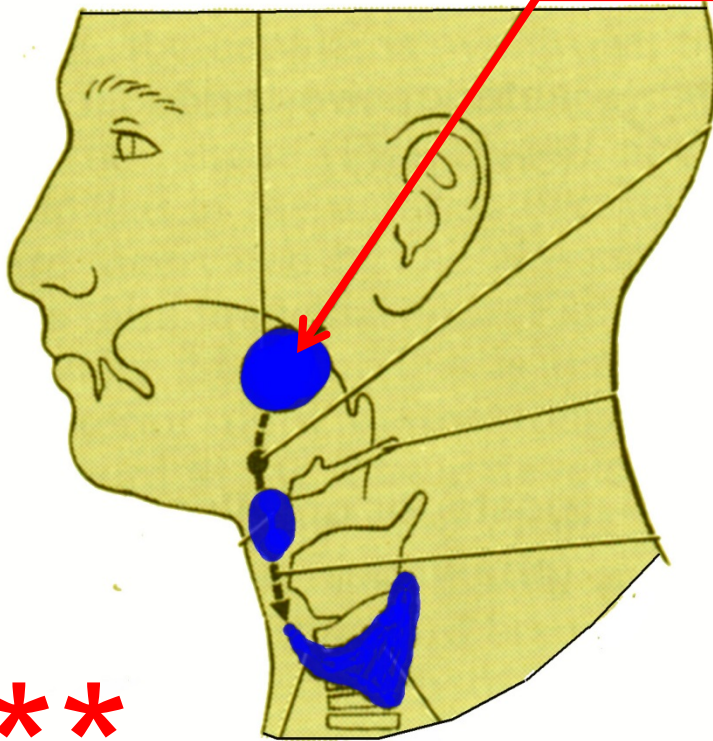


2) Elongates to form Thyroid Diverticulum; descends ant. to hyoid bone and larynx
3) Thyroglossal duct connects Diverticulum to Foramen cecum

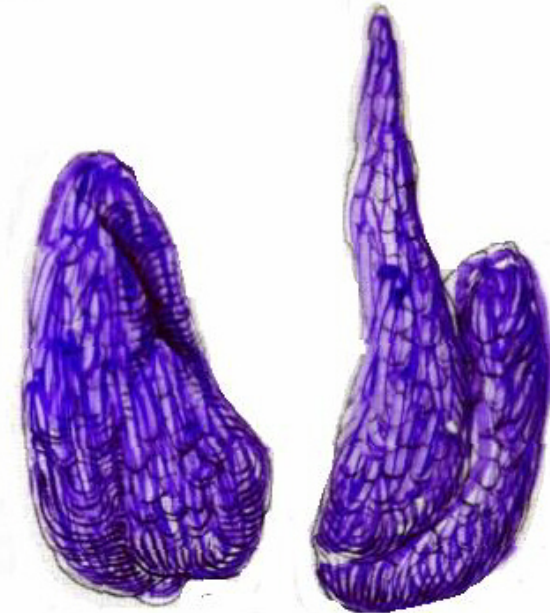


CONGENITAL MALFORMATIONS

LINGUAL THYROID* - gland in tongue



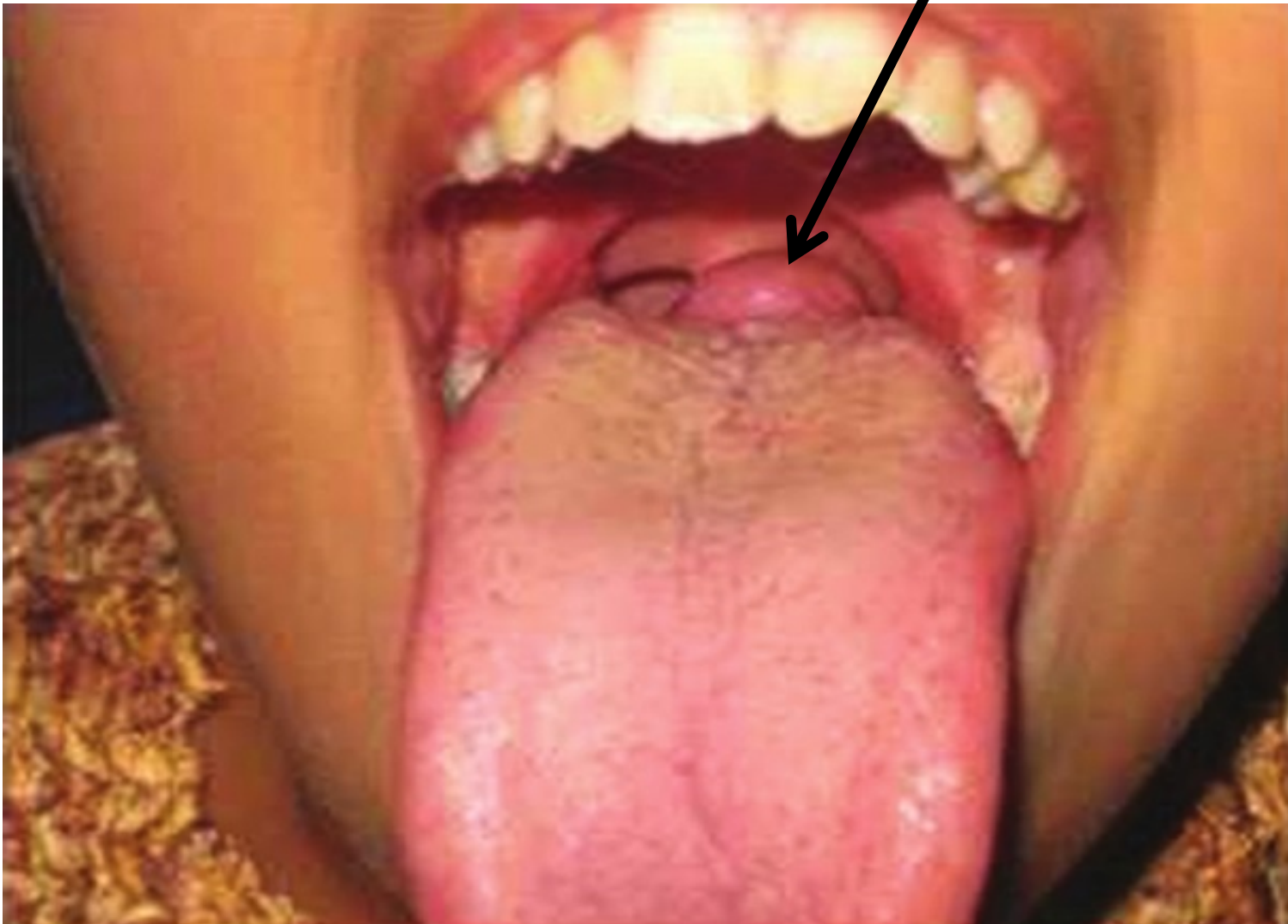
Thyroglossal Duct Remnants - can form thyroid tissue (cysts) along path (midline, ant. to hyoid, larynx)



C. PYRAMIDAL LOBE. ABSENCE OF ISTHMUS

Pyramidal Lobe - 50% of people; attached to hyoid by fibrous strand; no clinical problems

LINGUAL THYROID* - Thyroid gland in tongue



AT: Junction of anterior 2/3 and posterior 1/3 of tongue

NECK

Know Carotid Artery (Internal, External Carotid Arteries)

Muscles: Torticollis, contracture of sternocleidomastoid,
face directed to opposite side

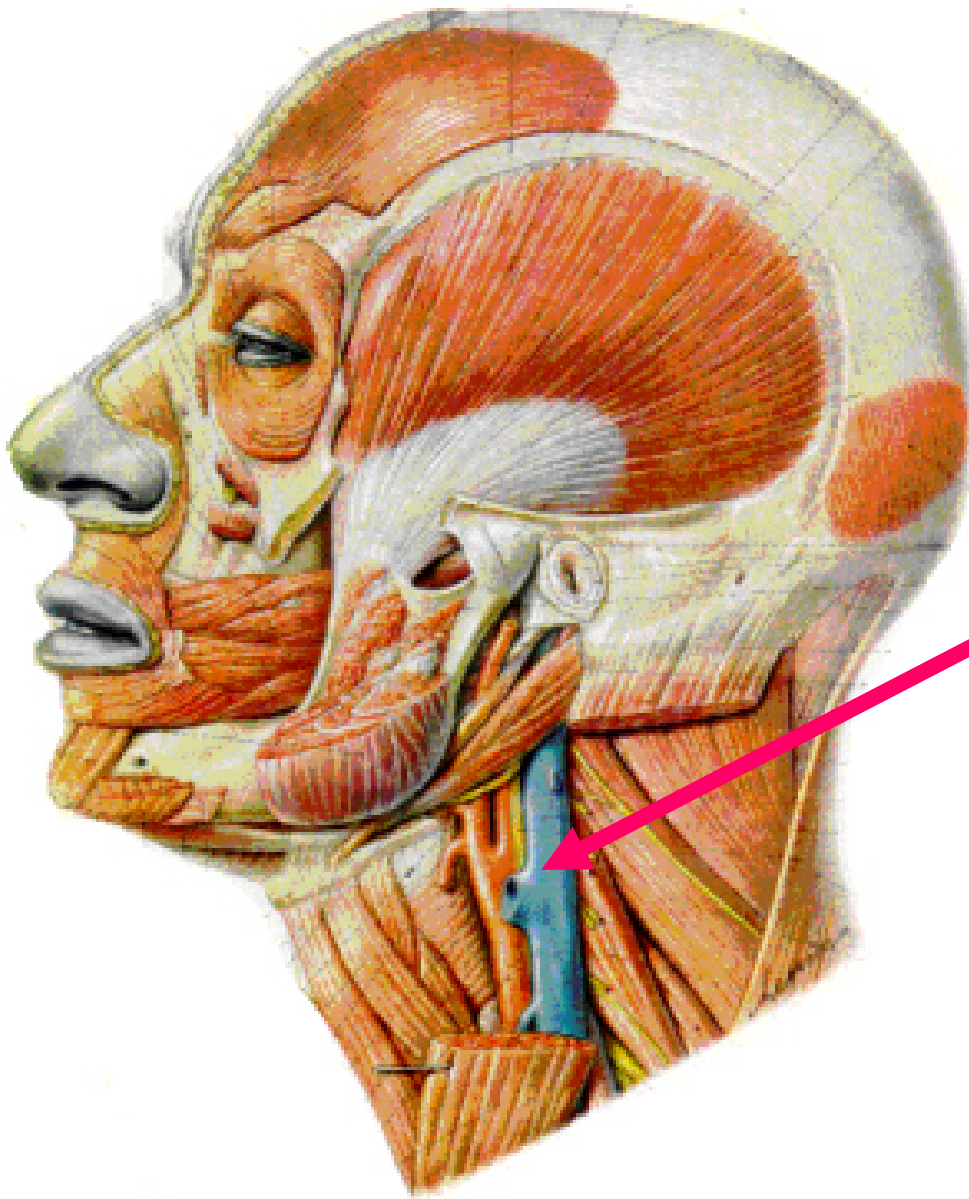
Wounds, surgery to neck damage Phrenic nerve

Pyramidal lobe variant of Thyroid gland no clinical problems
but important in thyroid surgery

Carotid angiogram Superior Thyroid artery

3. LATERAL COMPARTMENT - CAROTID SHEATH

CLINICAL **



Lateral Compartment-
lateral and posterior to
pharynx

Contained in Carotid
Sheath

1) Common and Internal
Carotid arteries; 2)
Internal jugular vein, 3)
Vagus nerve

Note: Sympathetic chain
is posterior to (NOT IN)
Carotid Sheath

A. MUSCLES OF NECK - NOT ATTACHED TO HYOID - move head and neck

1. STERNO-CLEIDOMASTOID

O - Two heads: 1) Manubrium of sternum; 2) Clavicle (L. root - cleido) - medial 1/3

I - Mastoid process of temporal bone

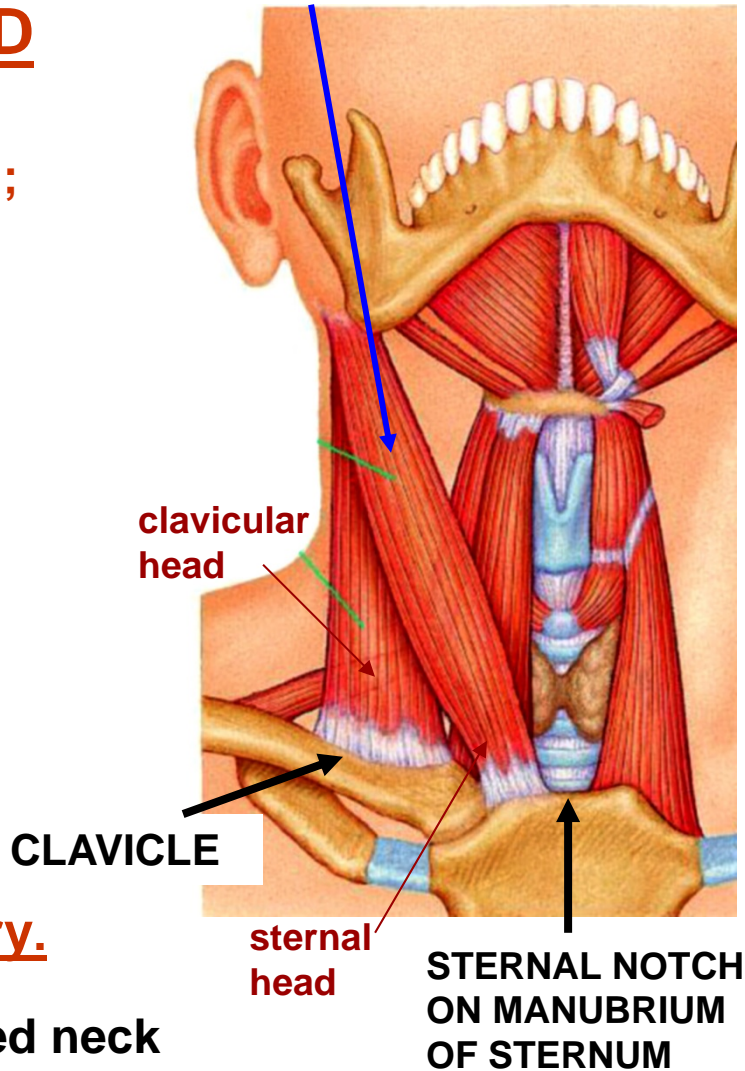
Act - bilateral - flex head; unilateral rotate head, face directed to opposite side

(MASTOID MOVES TOWARD STERNUM)

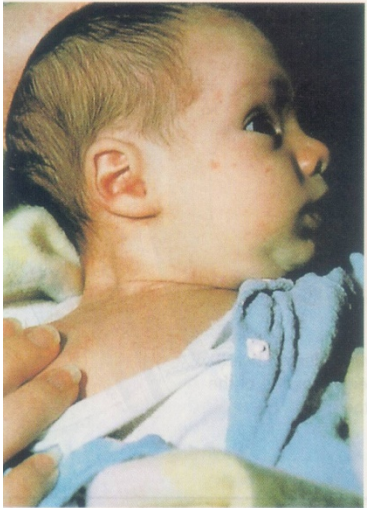
Inn - CN XI Accessory.

TORTICOLLIS = twisted neck

MOST IMPORTANT LANDMARK IN NECK



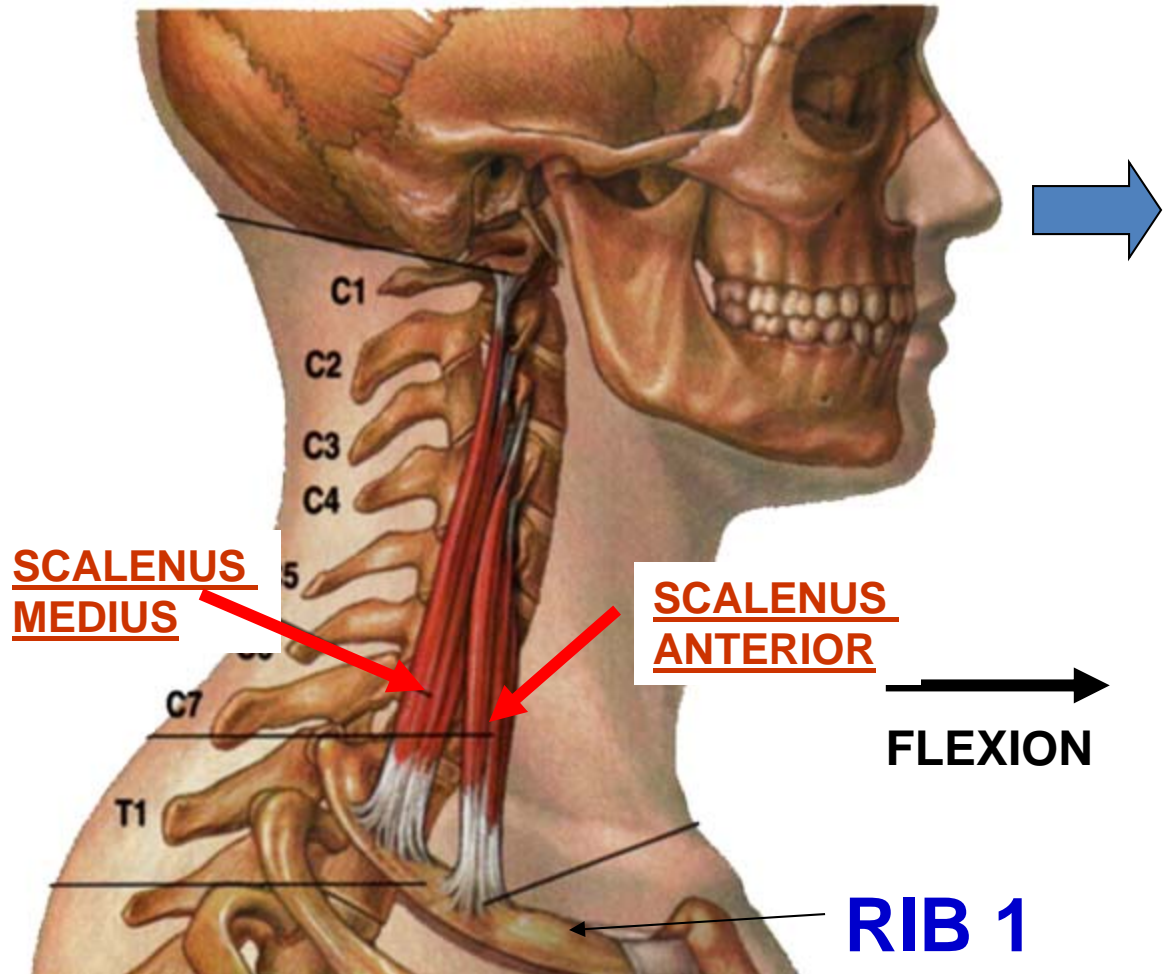
ACTION - PULL MASTOID TOWARD STERNUM



* TORTICOLLIS – Contracture of Sternocleidomastoid (congenital or acquired); face to opposite side

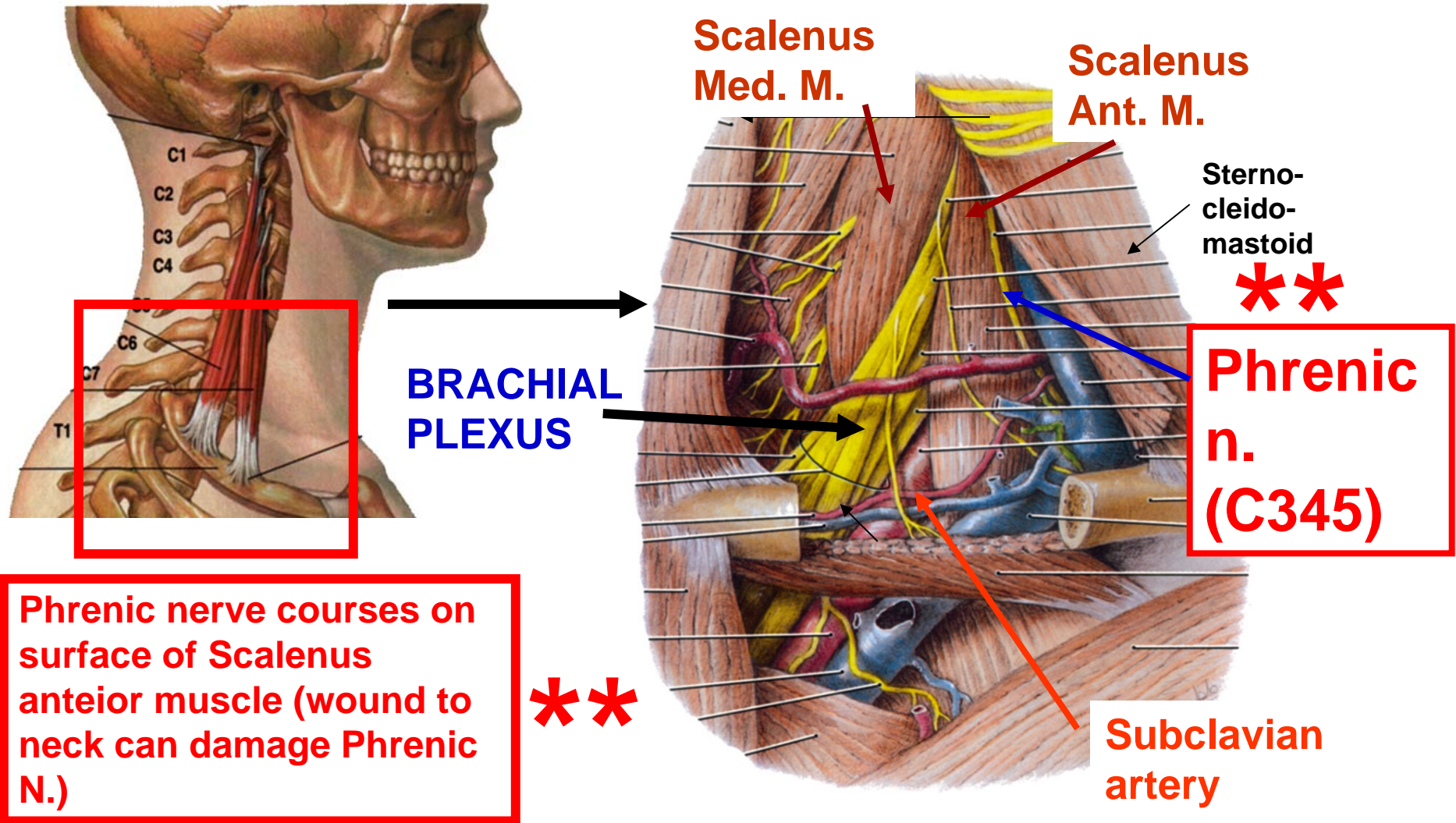
MUSCLES OF NECK – SCALENUS MUSCLES

SCALENUS
ANTERIOR
AND
SCALENUS
MEDIUS



SCALENUS ANTERIOR AND SCALENUS MEDIUS ARE IMPORTANT LANDMARKS

- **Brachial Plexus**, Subclavian Artery pass between Scalenus Ant. and Med.;
- **Phrenic nerve** (to Diaphragm) **courses on Scalenus Anterior**



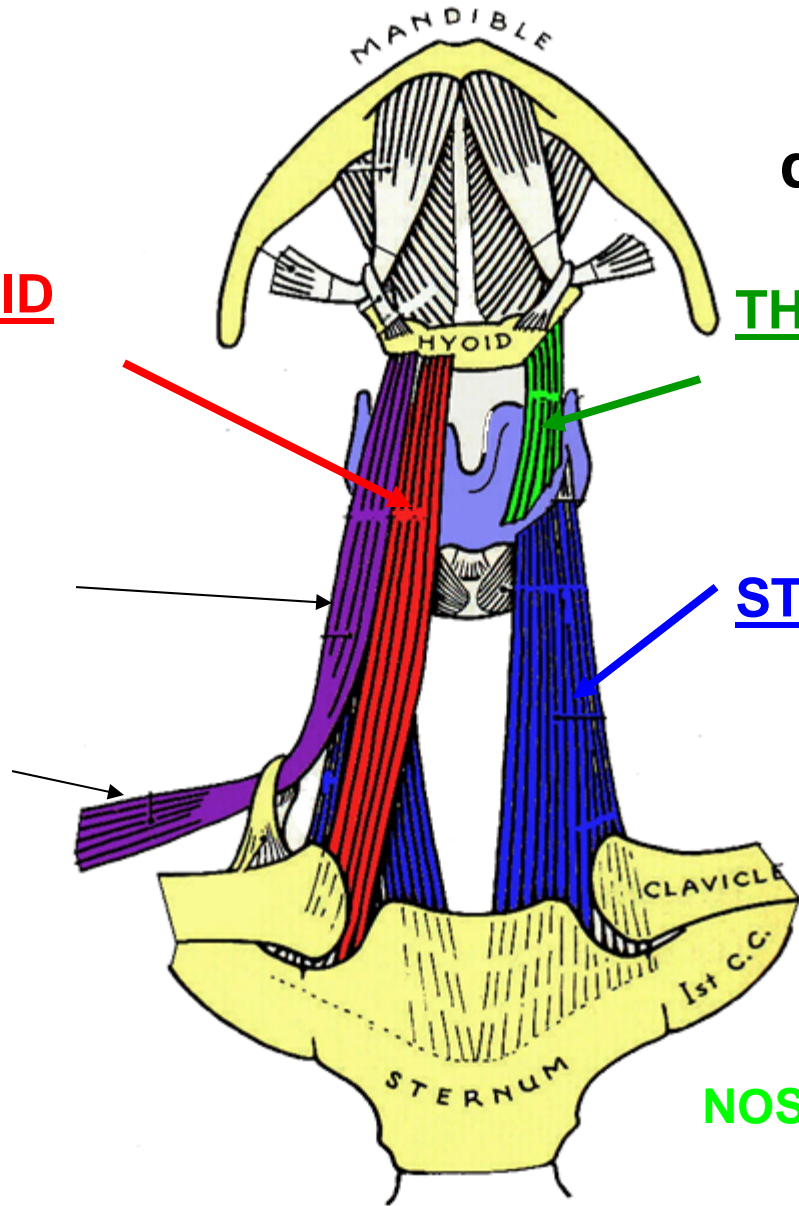
INFRAHYOID MUSCLES - DEEPER

STERNOHYOID

THYROHYOID

OMOHYOID

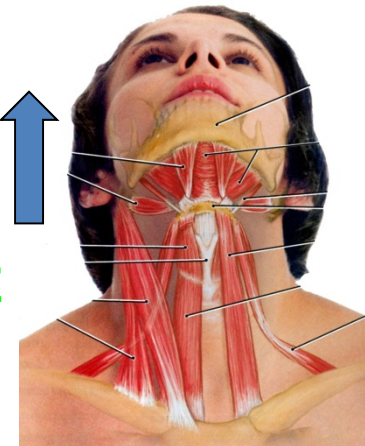
STERNOCLAVICULAR



deeper



NOSE

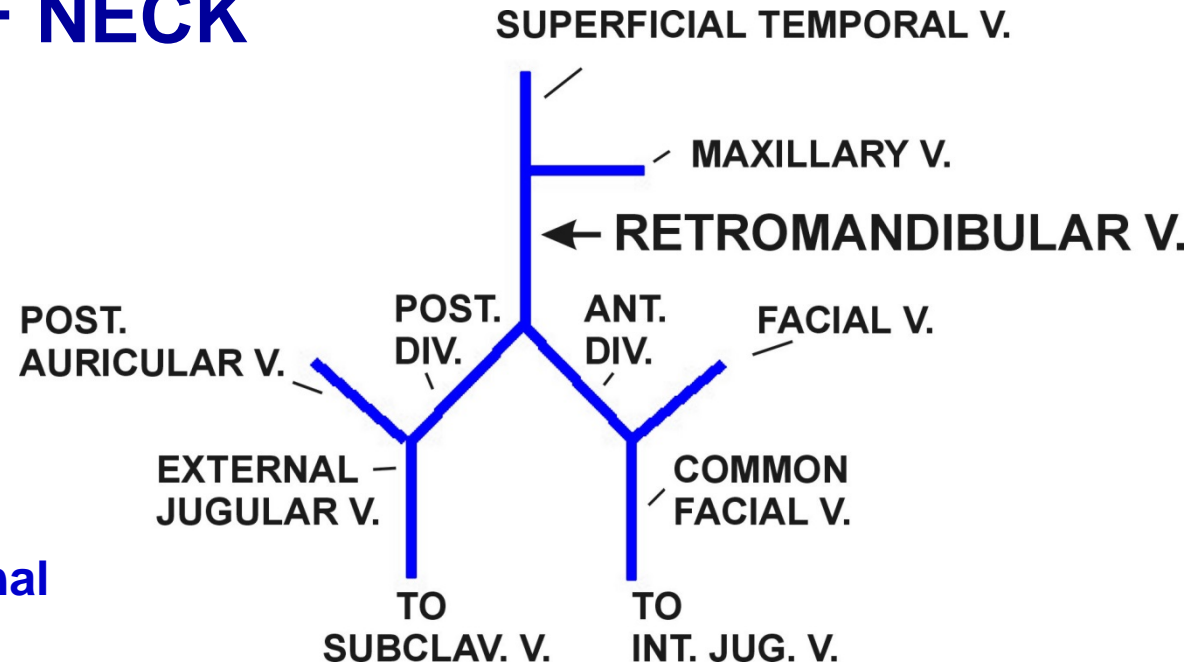


ORIENT -
HEAD
TILTED
BACK

VEINS OF NECK



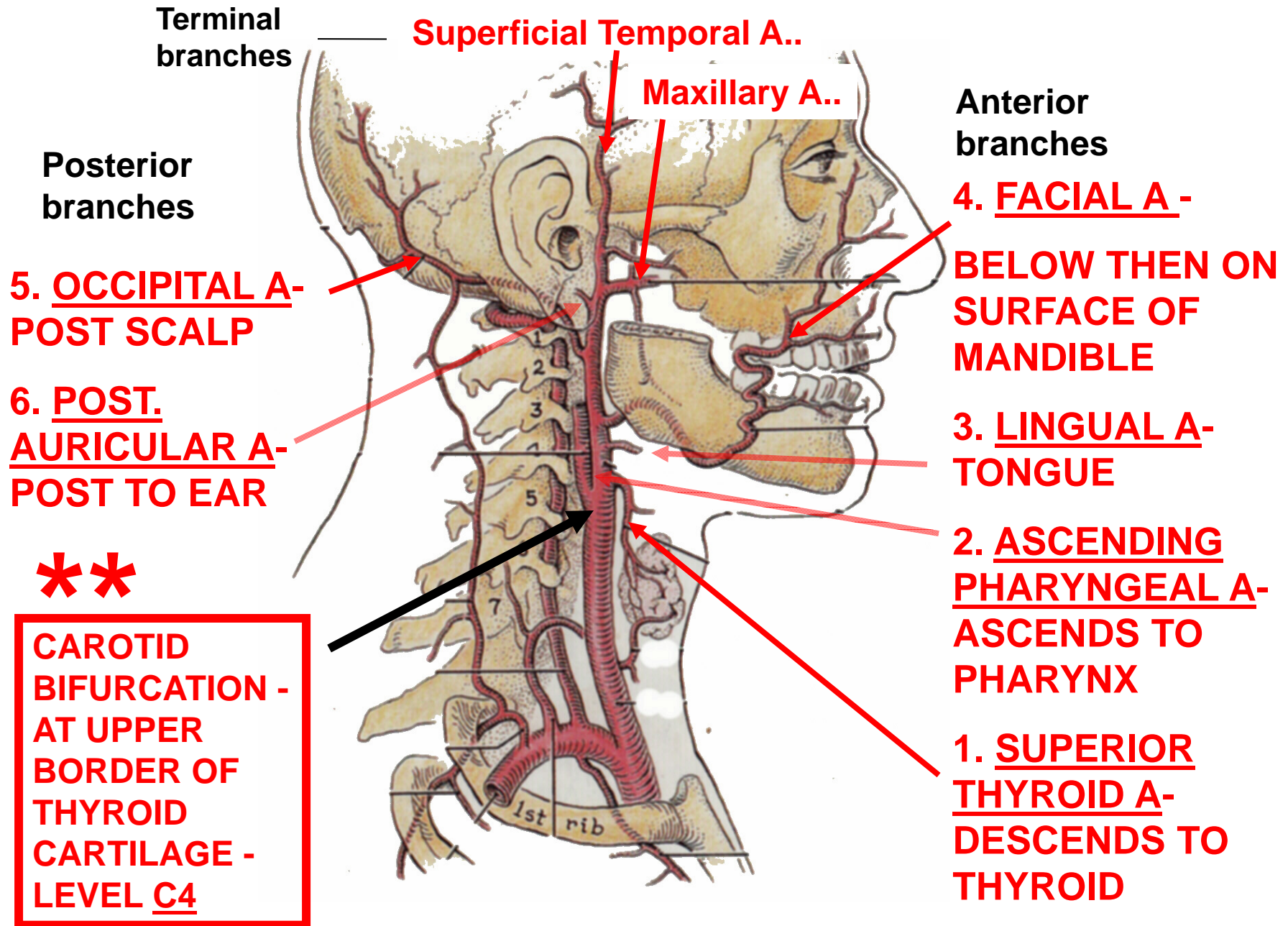
Large External Jugular V.

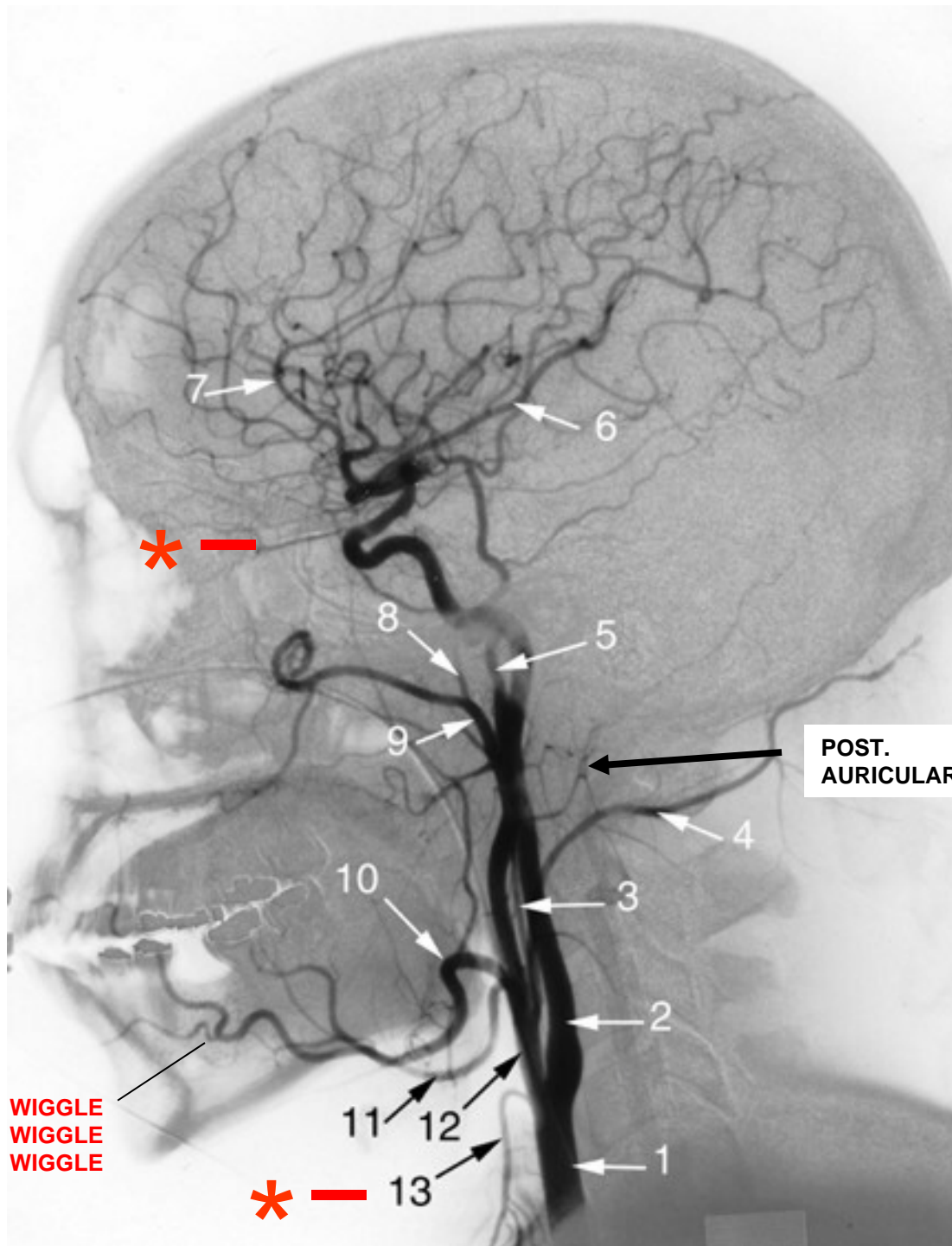


Large Anterior Jugular V.

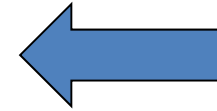
EXTERNAL JUGULAR V. - ON SURFACE OF STERNOCLEIDOMASTOID; NOT IN CAROTID SHEATH
INTERNAL JUGULAR V. - DEEP TO STERNOCLEIDOMASTOID; IN CAROTID SHEATH

EXTERNAL CAROTID ARTERY





NOSE



KNOW THIS SLIDE

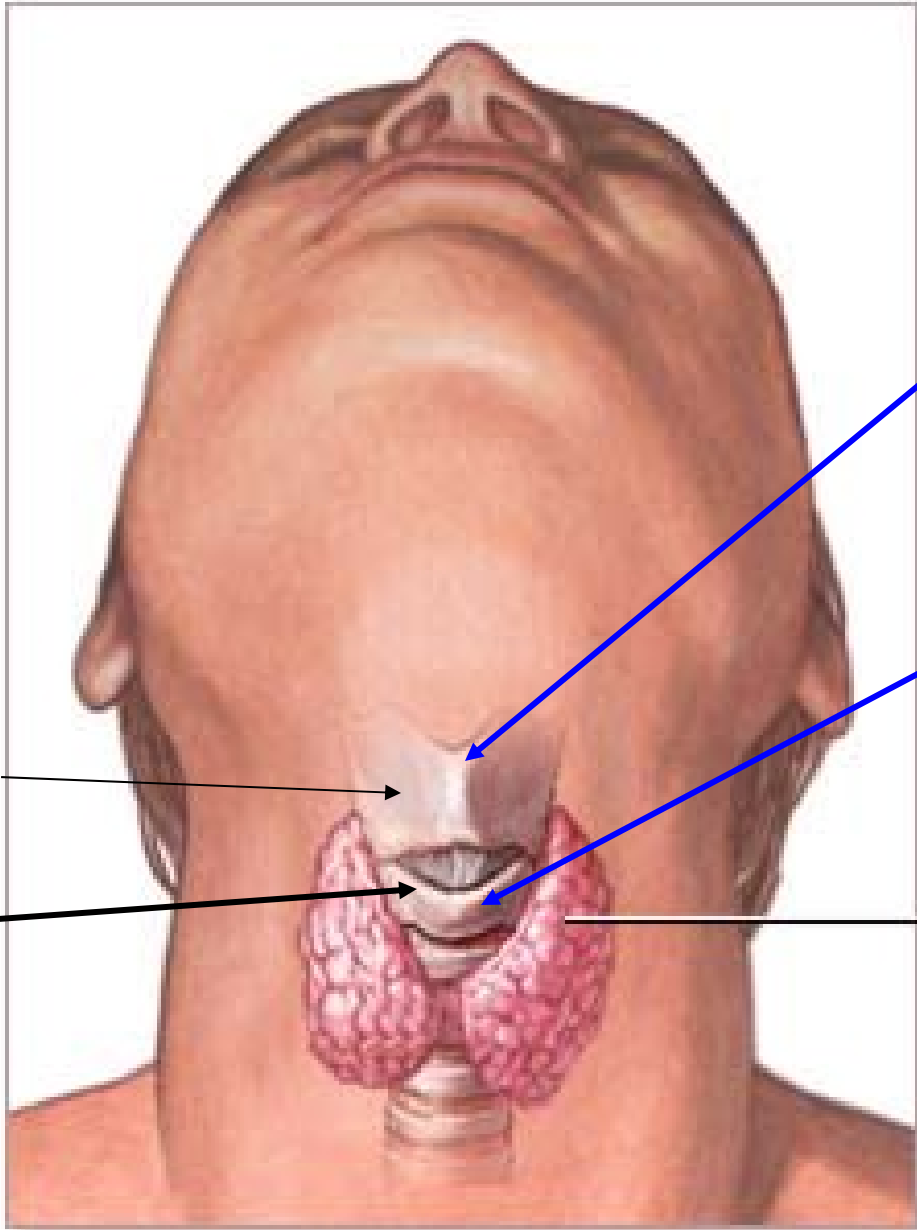
1. COMMON CAROTID
2. INTERNAL CAROTID
3. ASCENDING PHARYNGEAL
4. OCCIPITAL
5. SUPERFICIAL TEMPORAL
6. MIDDLE CEREBRAL
7. ANTERIOR CEREBRAL
8. MIDDLE MENINGEAL
9. MAXILLARY
10. FACIAL
11. LINGUAL
12. EXTERNAL CAROTID

13. SUPERIOR THYROID

***- OPHTHALMIC ARTERY ARISING FROM CAROTID SIPHON**



WIGGLE
WIGGLE
WIGGLE



PALPATE

PLATE

**RING
BELOW**

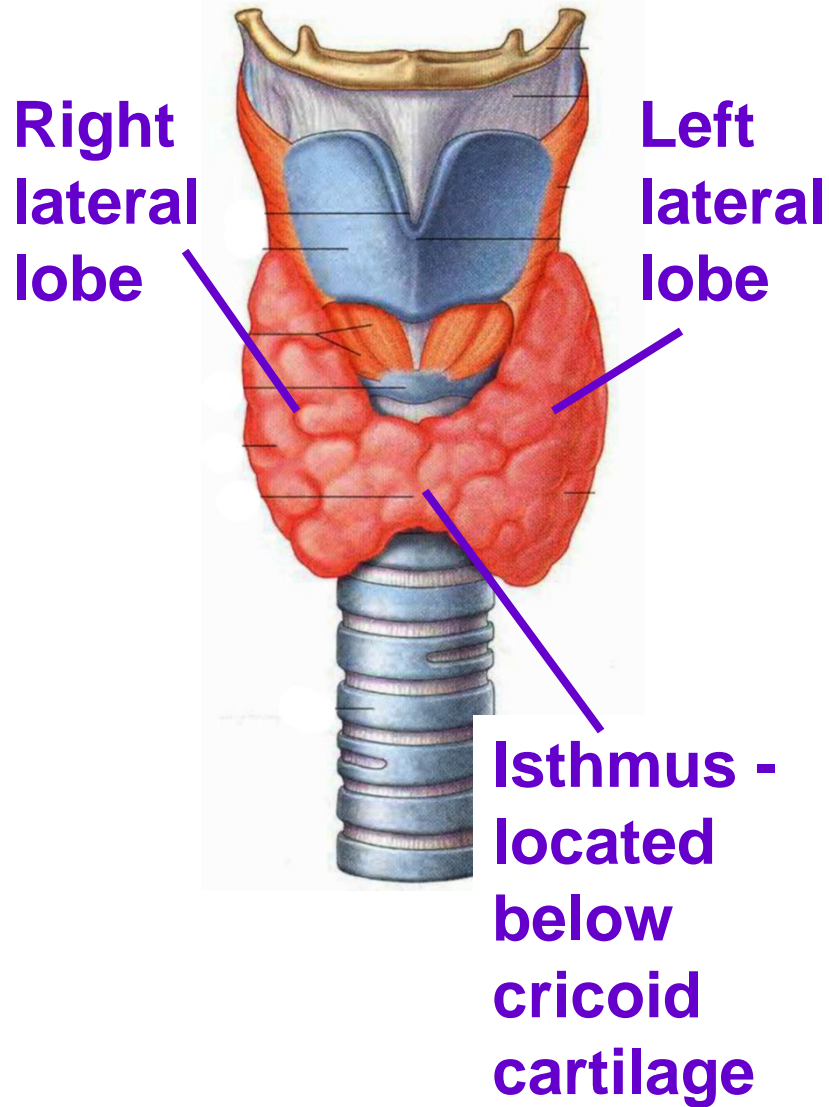
**LARYNGEAL
PROMINENCE
(ADAM'S APPLE)
OF THYROID
CARTILAGE**

**CRICOID
CARTILAGE**

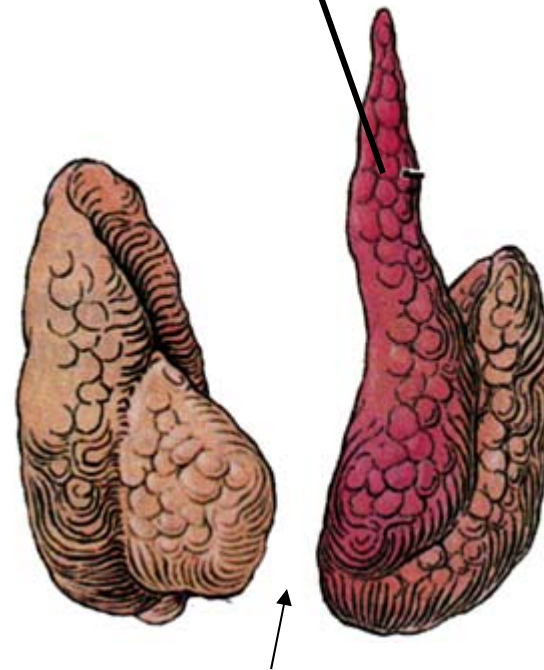
Thyroid gland

THYROID GLAND

Normal variations common

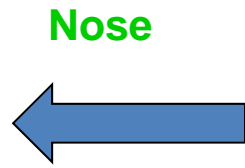


Pyramidal lobe - when present often attached to hyoid bone by fibrous strand

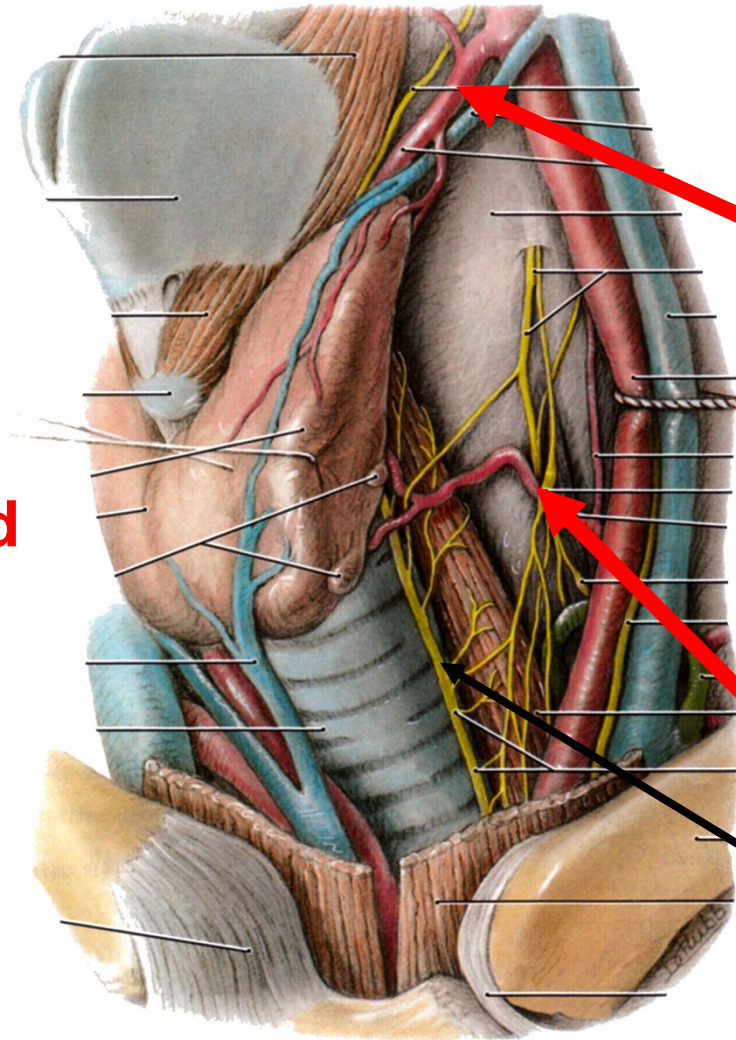


Absence of Isthmus

THYROID GLAND - ARTERIAL SUPPLY



Very vascular-arteries accompanied by nerves



FROM EXT. CAROTID

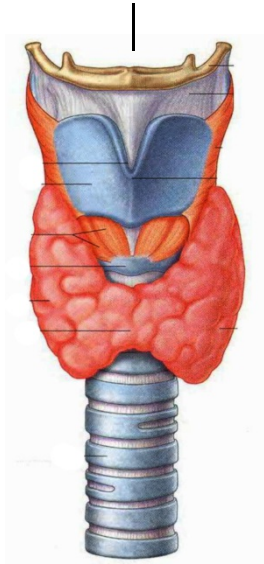
a) Sup. Thyroid artery (courses with Sup. Laryngeal n.)

FROM THYRO-CERVICAL TRUNK

b) Inf. Thyroid artery (courses with Recurrent Laryngeal n.)

Clinical: In thyroid surgery care taken not to damage Recurrent Laryngeal Nerve; paralyze all muscles of Larynx (except Cricothyroid) on one side; patient has only hoarse voice or whisper.

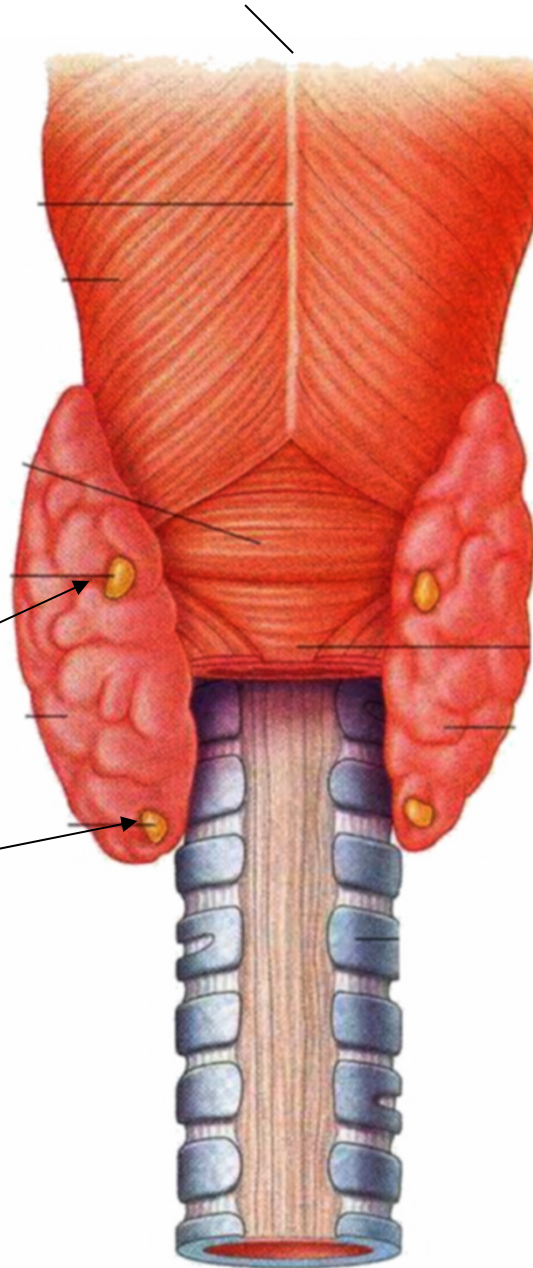
ANT. VIEW



Superior
parathyroid
gland

Inferior
parathyroid
gland

POSTERIOR VIEW



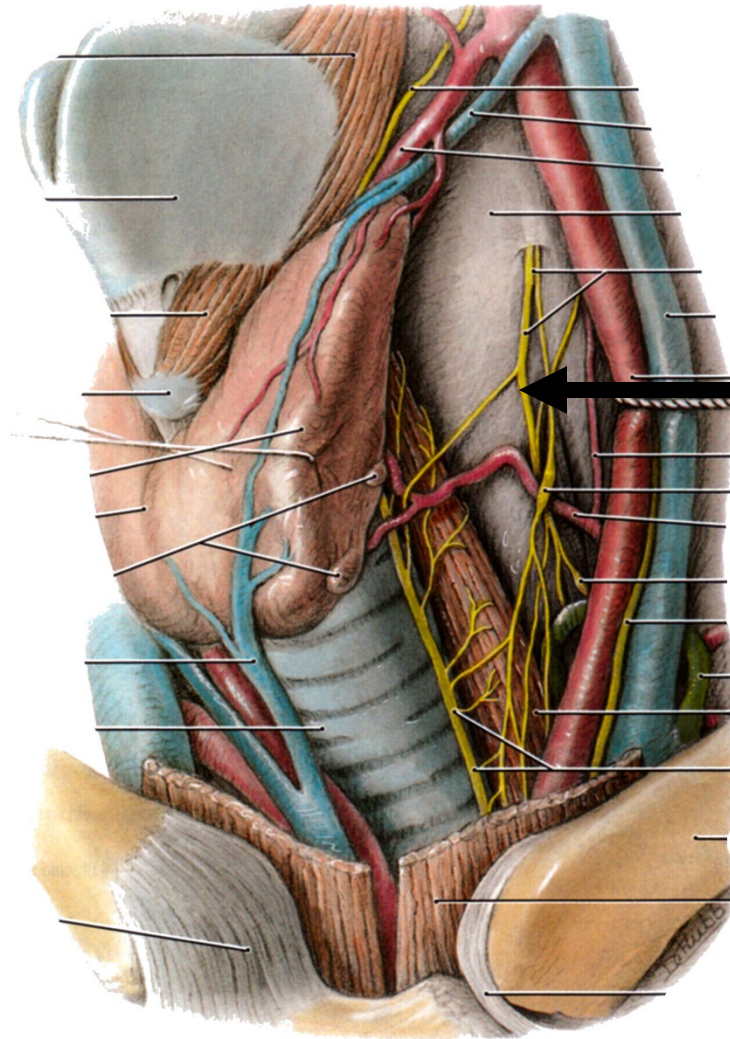
PARATHYROID GLANDS

- 4 small
bodies (2
on each
side)
located
posterior
to or
within
Thyroid
gland

Nose



SYMPATHETIC CHAIN



**

Sympathetic trunk- deep to
(not in)
Carotid Sheath