

DISCUSSION SESSION: GROSS ANATOMY

ONN BLOCK

Thursday Feb 11, 2021

Discuss Larynx, Ear

LARYNX

Actions muscles of Larynx

- Change pitch of sound**
- Open close airway**

**Anaphylactic shock – block
airway; open by Cricothyrotomy**

**Damage to nerves to Larynx -
Recurrent Laryngeal nerve**

LARYNX

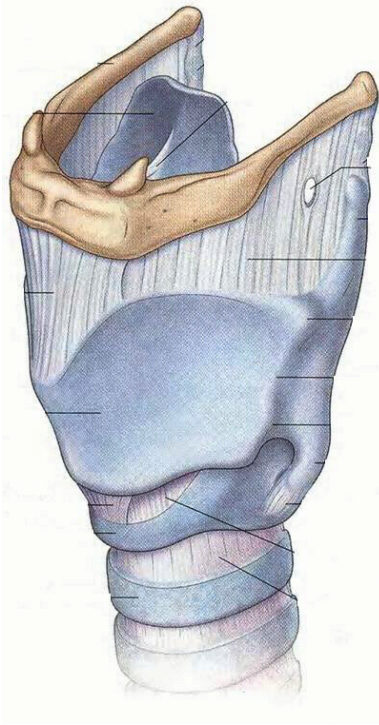


**Billie Holiday – Greatest Jazz
Singer of All Time**

**LARYNX IS SOUND
GENERATOR** - SOUNDS ARE
EXTENSIVELY MODIFIED IN
SPEECH AND SINGING BY
RESONANCE OF PHARYNX, NASAL
CAVITY, ORAL CAVITY

**LARYNX REGULATES AIR
FLOW TO RESPIRATORY
SYSTEM** - MUSCLES OF
LARYNX OPEN AIRWAY FOR DEEP
BREATHING; MUSCLE CAN CLOSE
AIRWAY, ALLOWING FOR
INCREASE IN PRESSURE IN
ABDOMINAL AND PELVIC CAVITIES
(EX. CHILDBIRTH, DEFECATION,
ETC.)

LARYNX CONSISTS OF CARTILAGES (WITH JOINTS) MOVED BY SKELETAL MUSCLES



**THYROID
CARTILAGE**

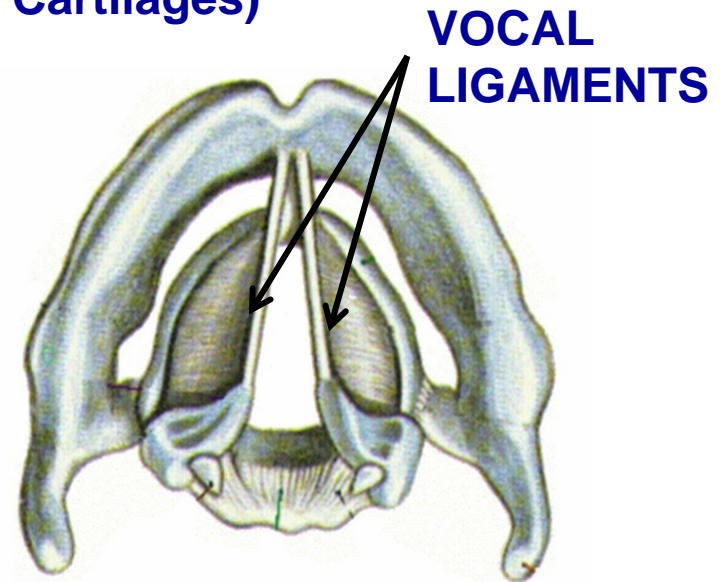
**ARYTENOID
CARTILAGES**



**CRICOID
CARTILAGE**

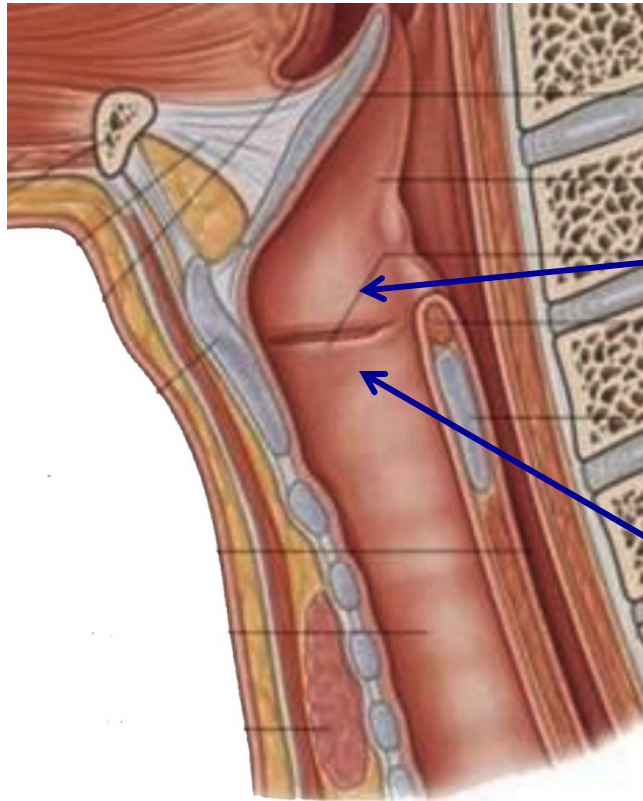
View with
Thyroid Cartilage
Removed

SOUND IS PRODUCED BY
FORCING AIR THROUGH
VIBRATING INTERNAL
LIGAMENTS (VOCAL
LIGAMENTS (extend from
Thyroid to Arytenoid
Cartilages)



Vocal ligaments act like lips
of a trumpet player

INTERNAL VIEW OF LARYNX

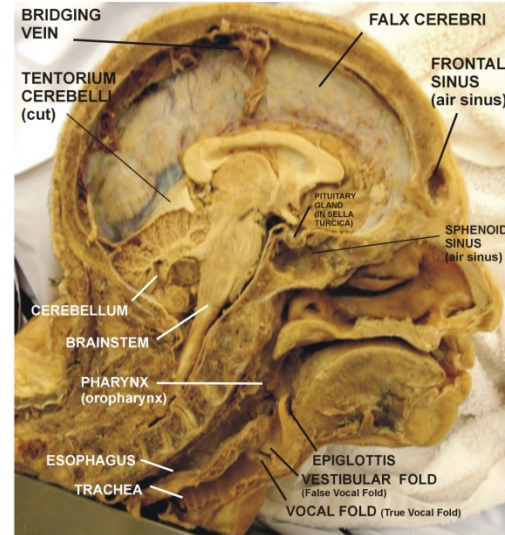


VESTIBULAR (FALSE VOCAL) FOLDS - overlie vestibular ligaments

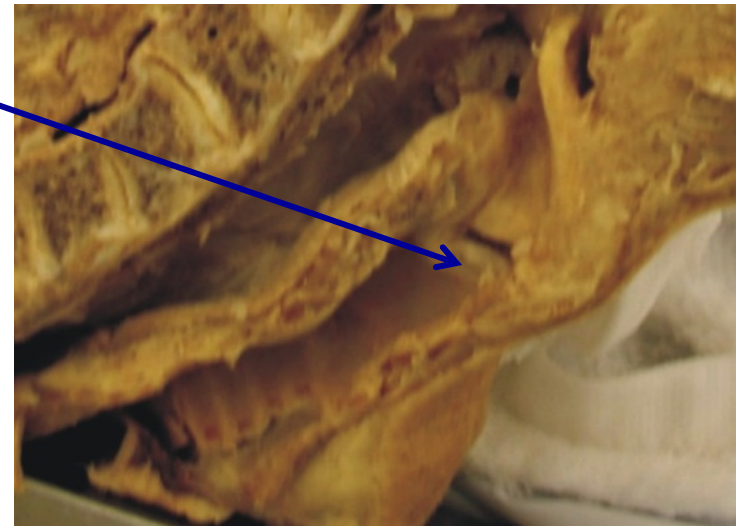
VOCAL (TRUE VOCAL) FOLDS - overlie vocal ligaments

BISECTED HEAD WITH INTACT FALX CEREBRI

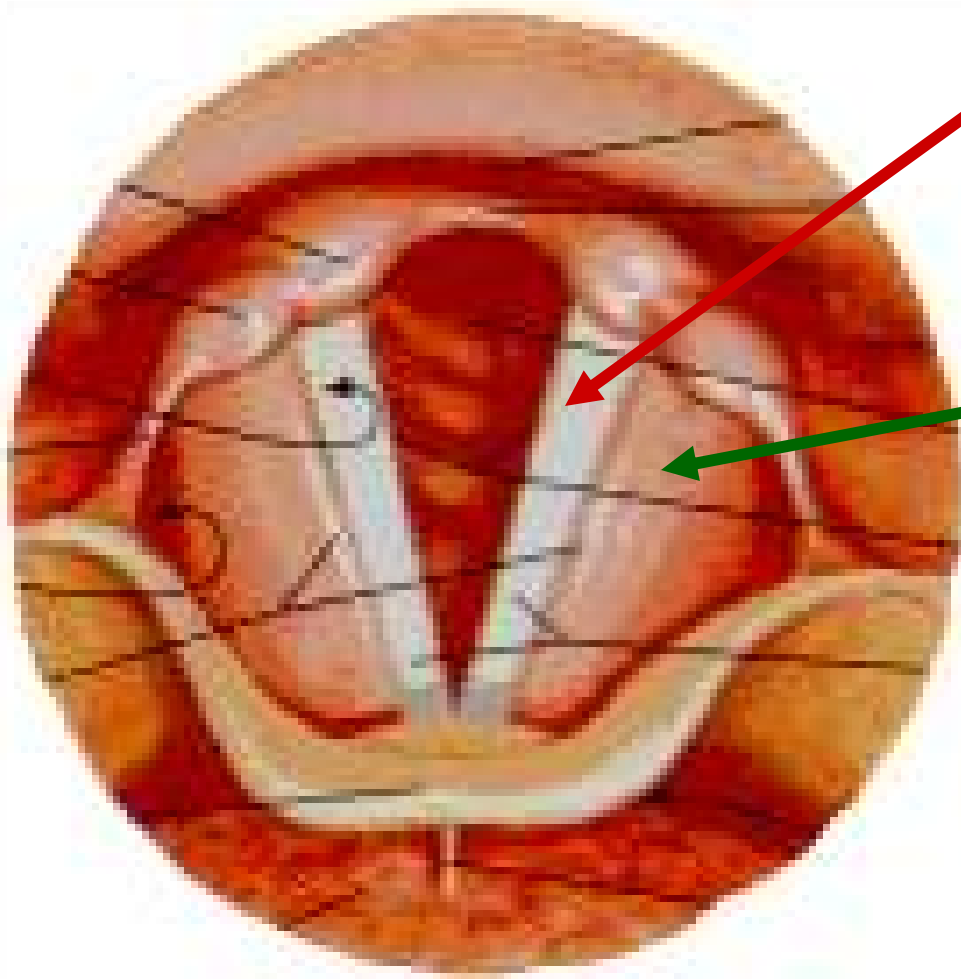
75



Note: Bridging Vein - cut when brain removed but still attached and entering Sup. Sagittal Sinus



LARYNGOSCOPE VIEW OF LARYNX



TRUE VOCAL FOLDS
- overlie vocal
ligaments

**FALSE VOCAL
FOLDS - overlie
vestibular ligaments**

LARYNGOSCOPE VIEW OF LARYNX

DEEP BREATHING



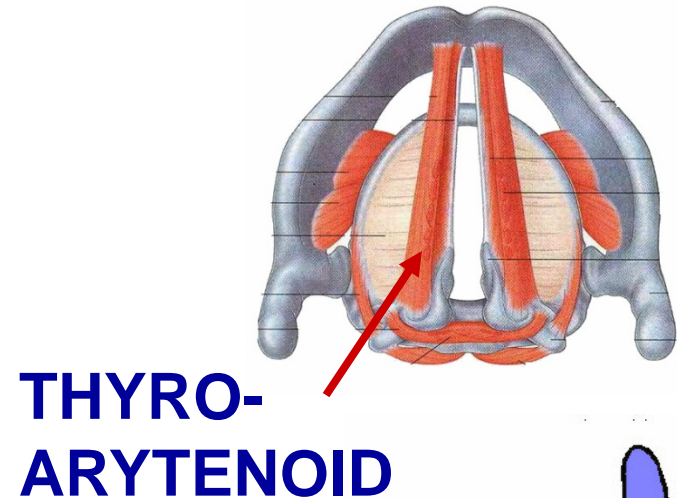
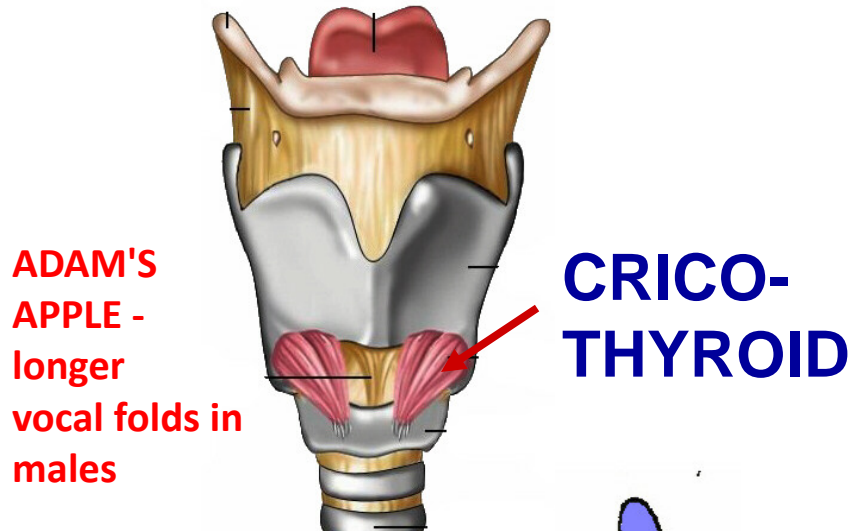
**TRUE VOCAL FOLDS
SPREAD APART – OPEN
LARYNX**

PRODUCE SOUND

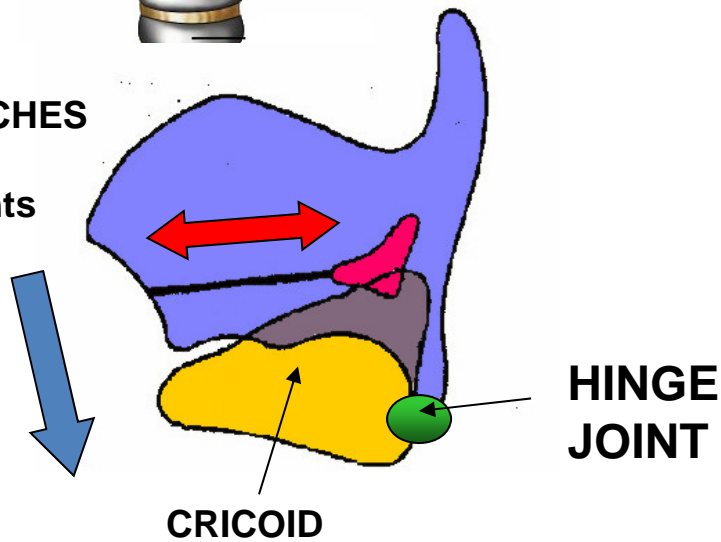


**TRUE VOCAL FOLDS
BROUGHT TOGETHER –
VIBRATE AND
PRODUCE SOUND**

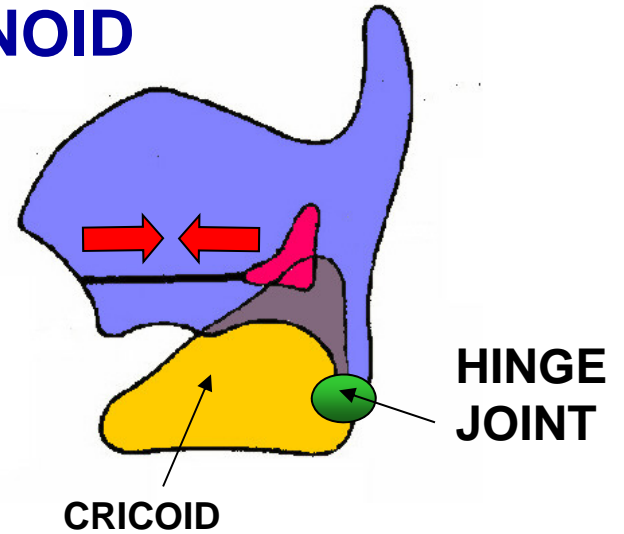
MUSCLES OF LARYNX: RAISE/LOWER PITCH



Tilting -
STRETCHES
vocal
ligaments

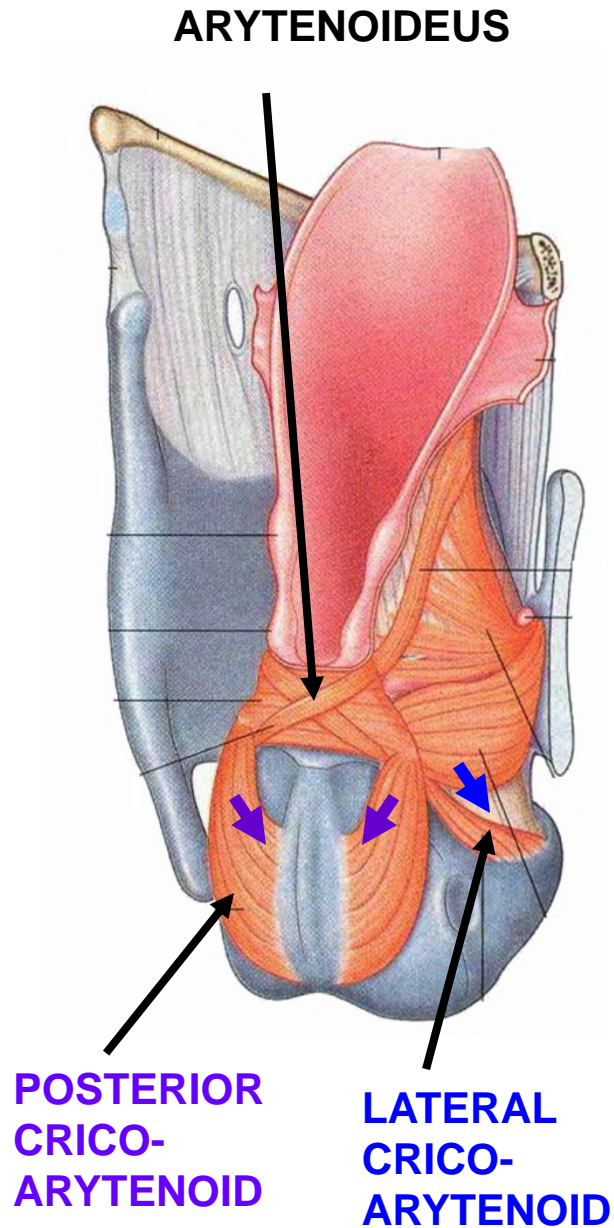


STRETCH vocal ligament
INCREASE PITCH -
CRICOTHYROID



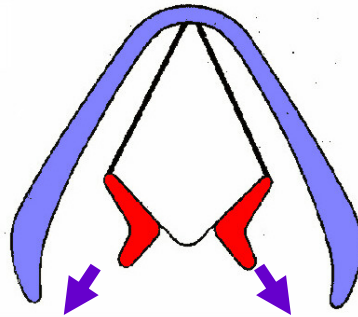
RELAX vocal ligament
DECREASE PITCH -
THYROARYTENOID

OPEN AND CLOSE LARYNX – (OPENING CALLED RIMA GLOTTIDIS)



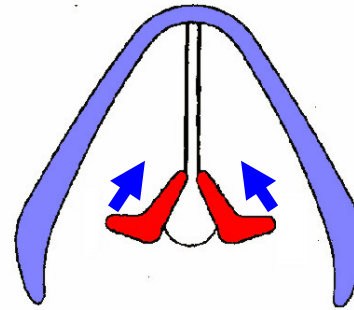
OPEN

POST.
CRICO-
ARYTENOID



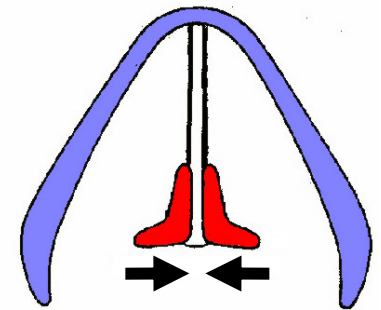
CLOSE

LATERAL
CRICO-
ARYTENOID



CLOSE

ARYTENOIDEUS



Open - deep breathing

Close - speech; also raise abdominal pressure (childbirth, defecation, micturition = empty urinary bladder)

CHART: ACTIONS OF LARYNGEAL MUSCLES



MUSCLE	ACTION	NERVE
Cricothyroid	Tenses vocal fold, Raises pitch of sound	External Laryngeal n. (X)
Thyroarytenoid	Relaxes vocal fold, Decreases pitch of sound	Recurrent Laryngeal n. (X)
Posterior cricoarytenoid	Abducts vocal folds, opens <u>rima glottides</u> (open larynx)	Recurrent Laryngeal n. (X)
Lateral cricoarytenoid	Adducts vocal folds, closes <u>rima glottides</u> (close larynx)	Recurrent Laryngeal n. (X)
Arytenoid (Transverse arytenoid)	Adducts vocal folds, closes <u>rima glottides</u> (close larynx)	Recurrent Laryngeal n. (X)

NERVES OF LARYNX –

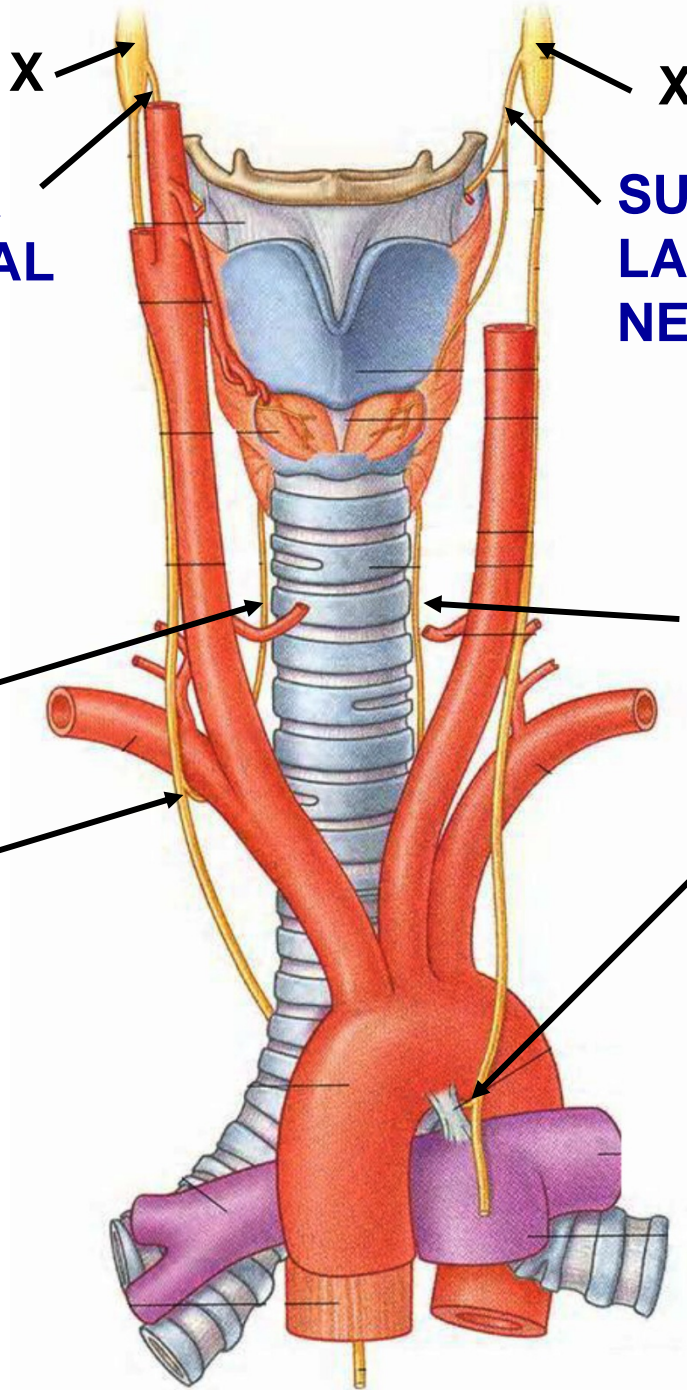
All are
Branches of
Vagus CN X

SUPERIOR
LARYNGEAL
NERVE

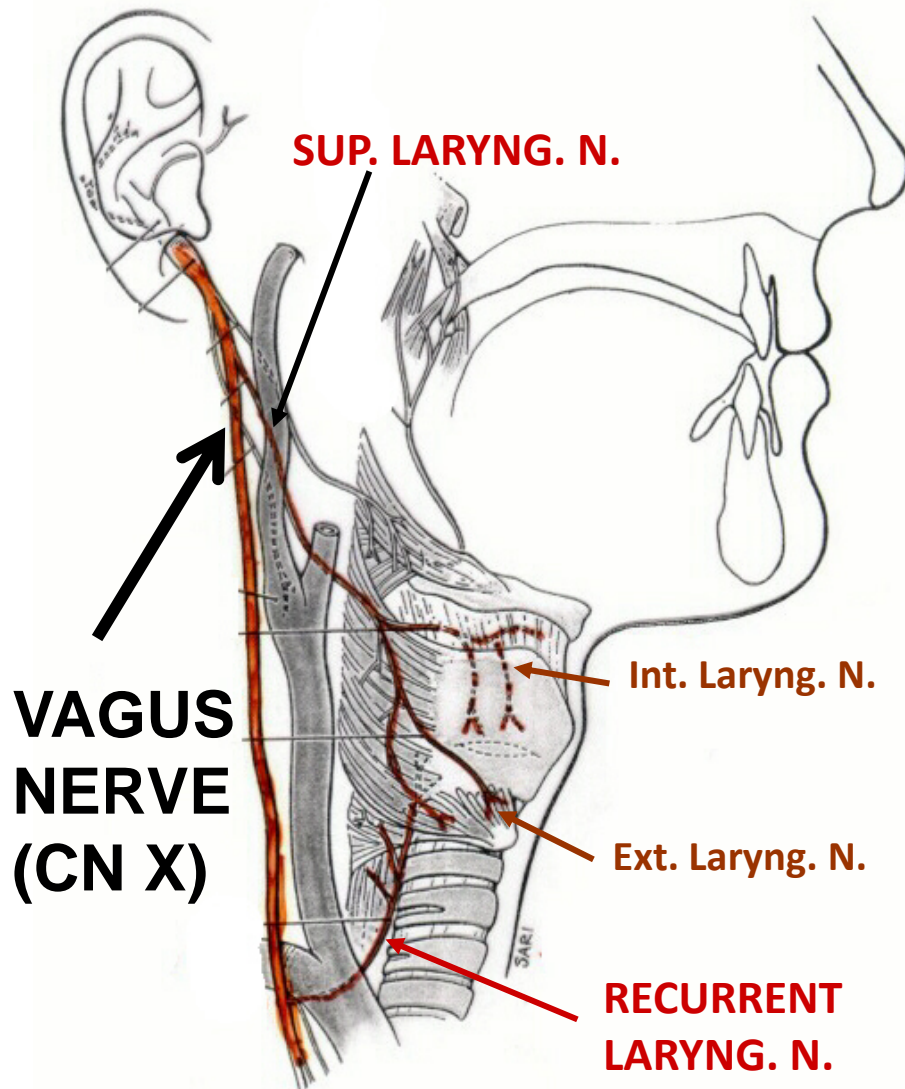
SUPERIOR
LARYNGEAL
NERVE

RIGHT
RECURRENT
LARYNGEAL
NERVE - passes
under
Subclavian
Artery

LEFT
RECURRENT
LARYNGEAL
NERVE - passes
under
Arch of
Aorta



DAMAGE TO RECURRENT LARYNGEAL NERVE



ALL NERVES ARE BRANCHES OF VAGUS (CN X)

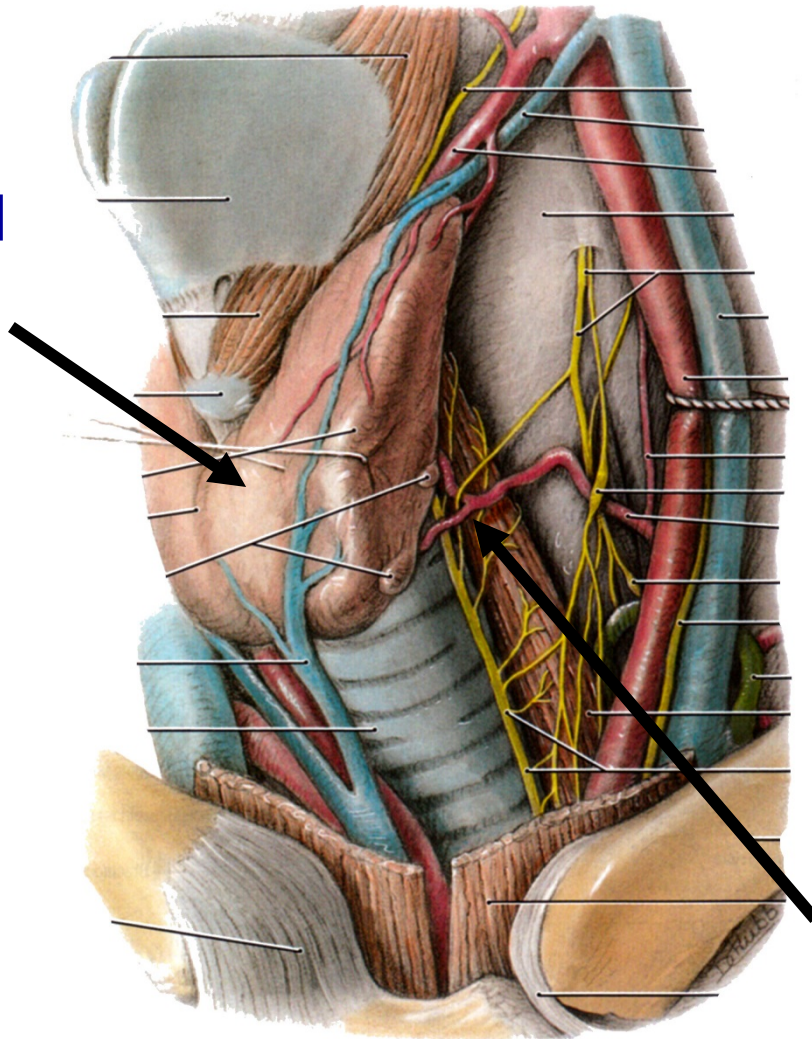
A. Superior Laryngeal N. motor to Cricothyroid

B. Recurrent Laryngeal N. motor to All other Muscles of Larynx

DAMAGE TO RECURRENT LARYNGEAL NERVE - can occur in Thyroid Surgery; paralyze all muscles one side except Cricothyroid; permanent hoarse voice

DAMAGE RECURRENT LARYNGEAL NERVE IN THYROID AND OTHER NECK SURGERY

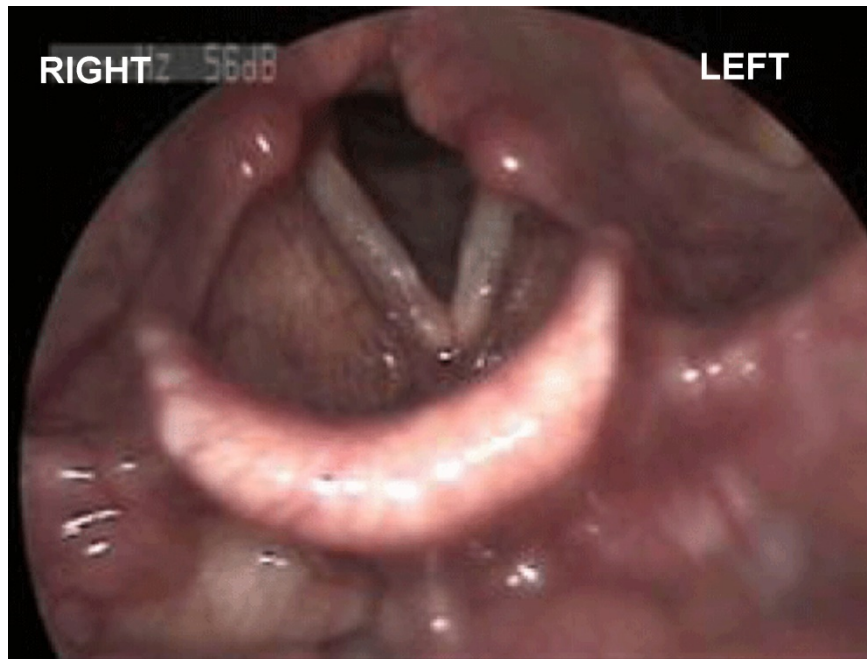
**Thyroid
Gland**



**DAMAGE TO
RECURRENT
LARYNGEAL NERVE -
can occur in Thyroid
Surgery; paralyze all
muscles one side
except Cricothyroid;
permanent hoarse
voice**

**Recurrent
Laryngeal
Nerve**

PRACTICE QUESTION CLINICAL VIGNETTE



A patient undergoes surgery for **removal of thyroid nodules**. The nodules are found to be noncancerous but post-operatively the patient has a 'hoarse' voice. Laryngoscopic examination (photo left) shows **asymmetry in position of the vocal folds when the patient is told to breathe deeply**. The physician suspects that this is due to damage of which of the following structures?

- A. Right Superior Laryngeal nerve
- B. Right Recurrent Laryngeal nerve
- C. Left Superior Laryngeal nerve
- D. Left Recurrent Laryngeal nerve
- E. Right Sympathetic chain

NERVES OF LARYNX –

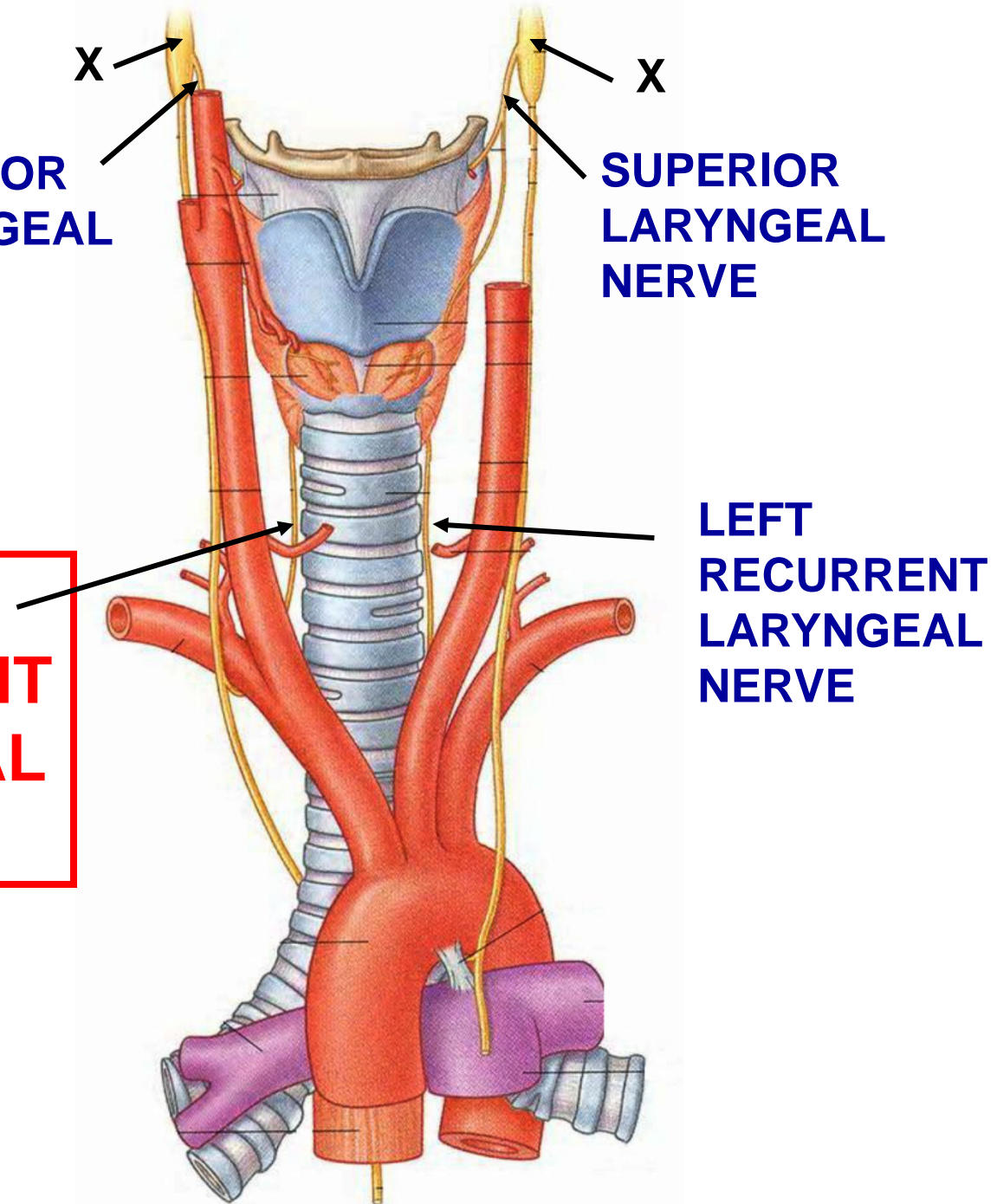
All are
Branches of
Vagus CN X

SUPERIOR
LARYNGEAL
NERVE

SUPERIOR
LARYNGEAL
NERVE

**RIGHT
RECURRENT
LARYNGEAL
NERVE**

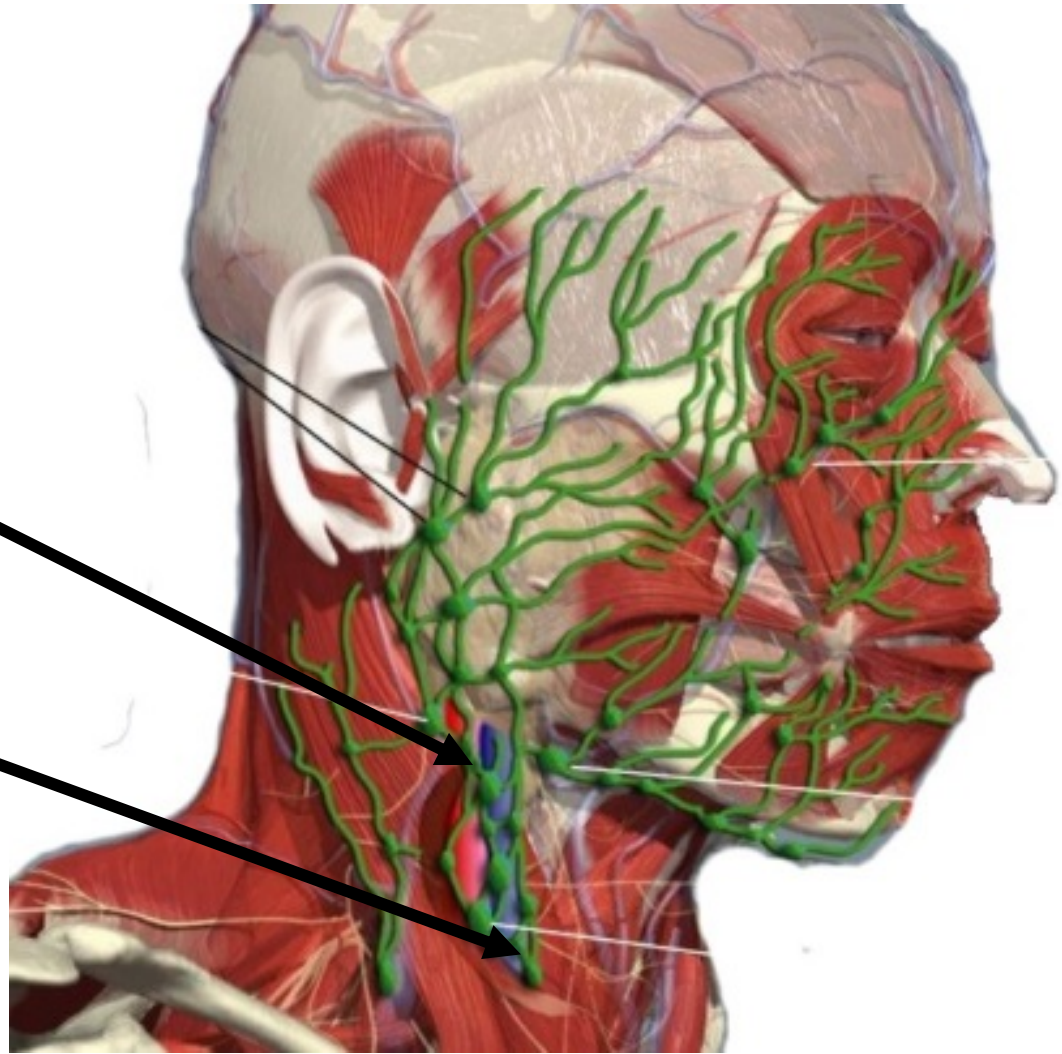
LEFT
RECURRENT
LARYNGEAL
NERVE



LARYNX - LYMPHATICS

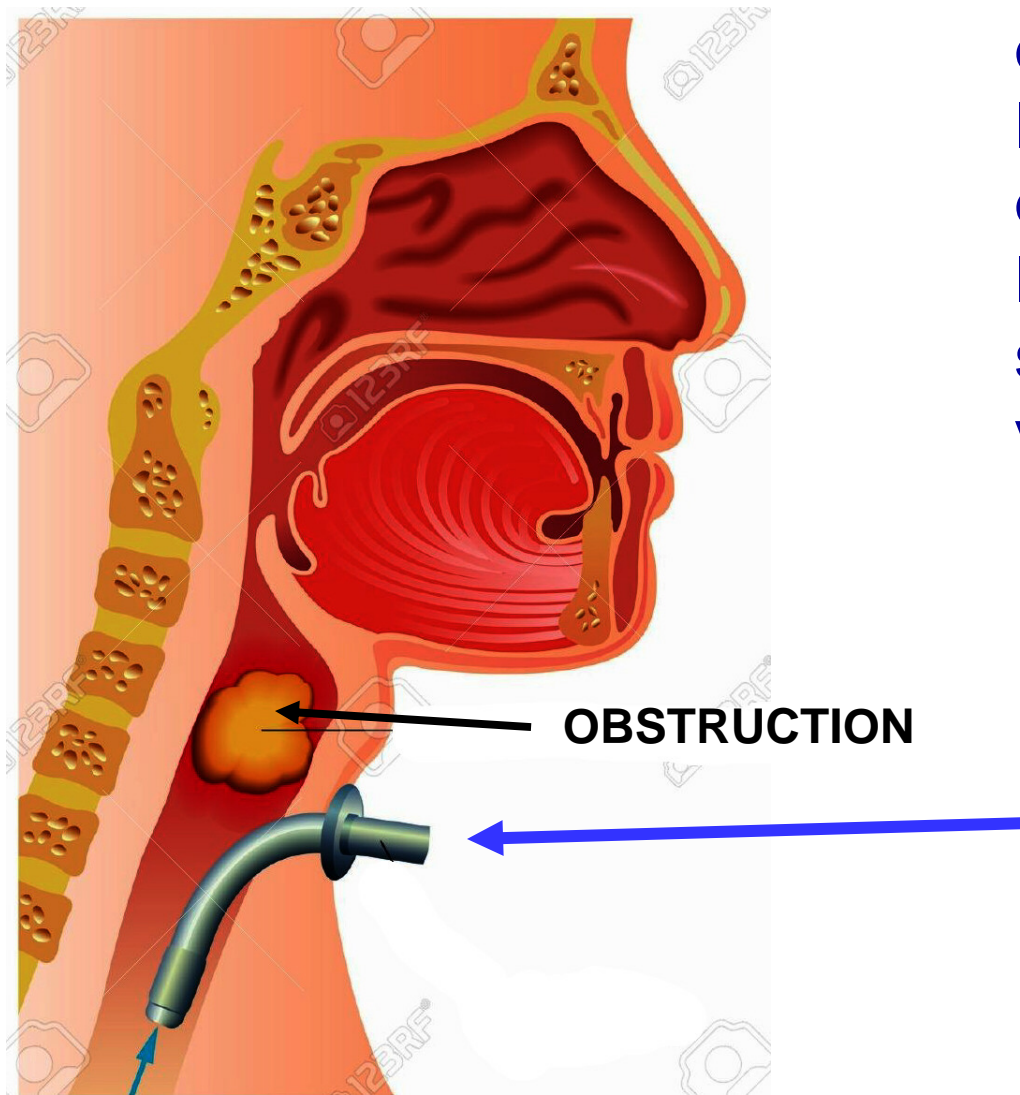
Superior Deep
Cervical Nodes -
drain Larynx above
true vocal folds

Inferior Deep
Cervical Nodes -
drain Larynx below
true vocal folds



CLINICAL Note: Mucosa is tightly attached to vocal folds; in Anaphylactic Shock (acute allergic reaction) swelling of Vestibular folds can constrict airway and lead to Suffocation

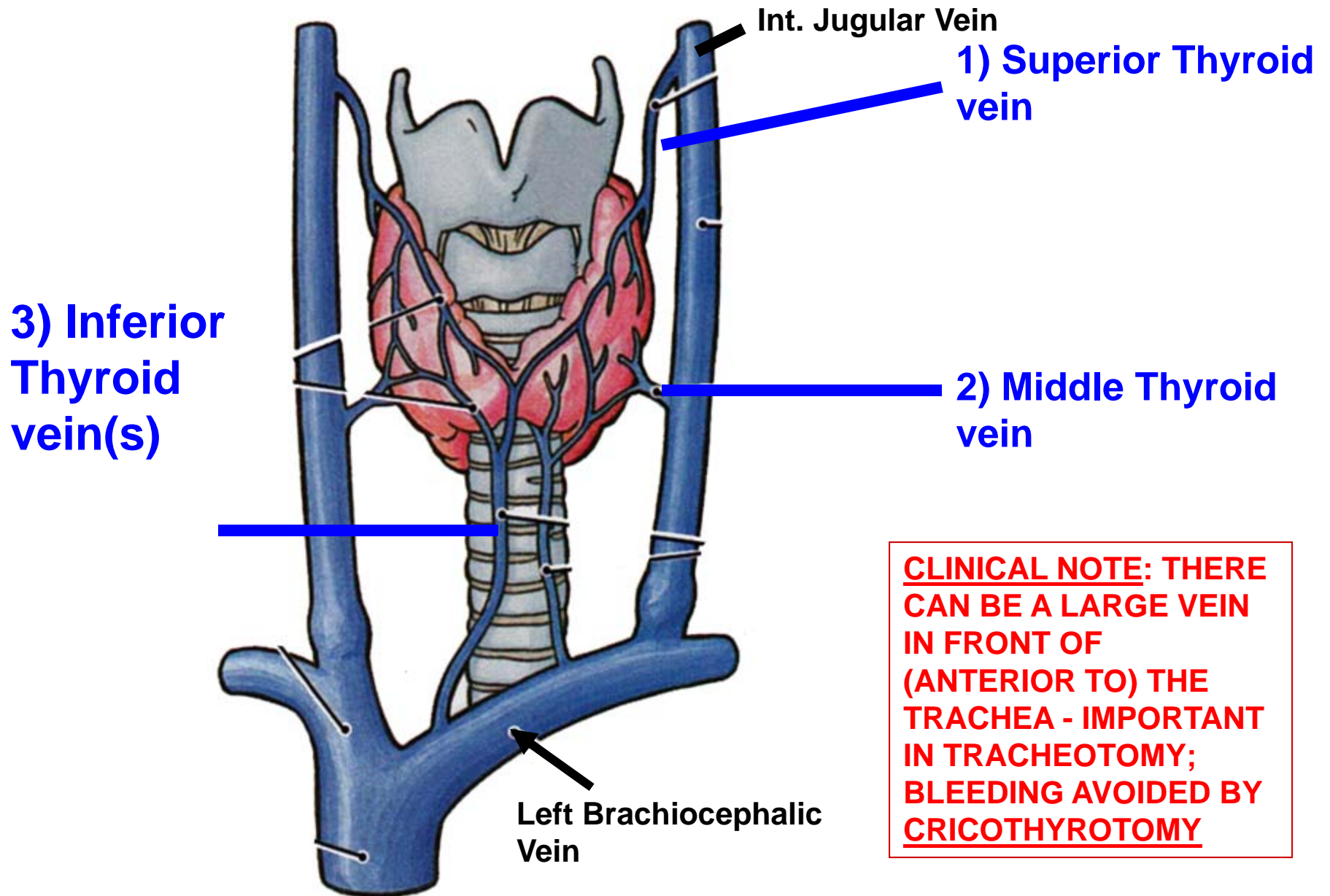
OBSTRUCTION OF LARYNX: TRACHEOTOMY



open airway to
lungs below
obstructed
larynx OR
swollen
vestibular folds

Tracheotomy
- cut between
1st and 2nd or
2nd and 3rd
Tracheal
cartilages

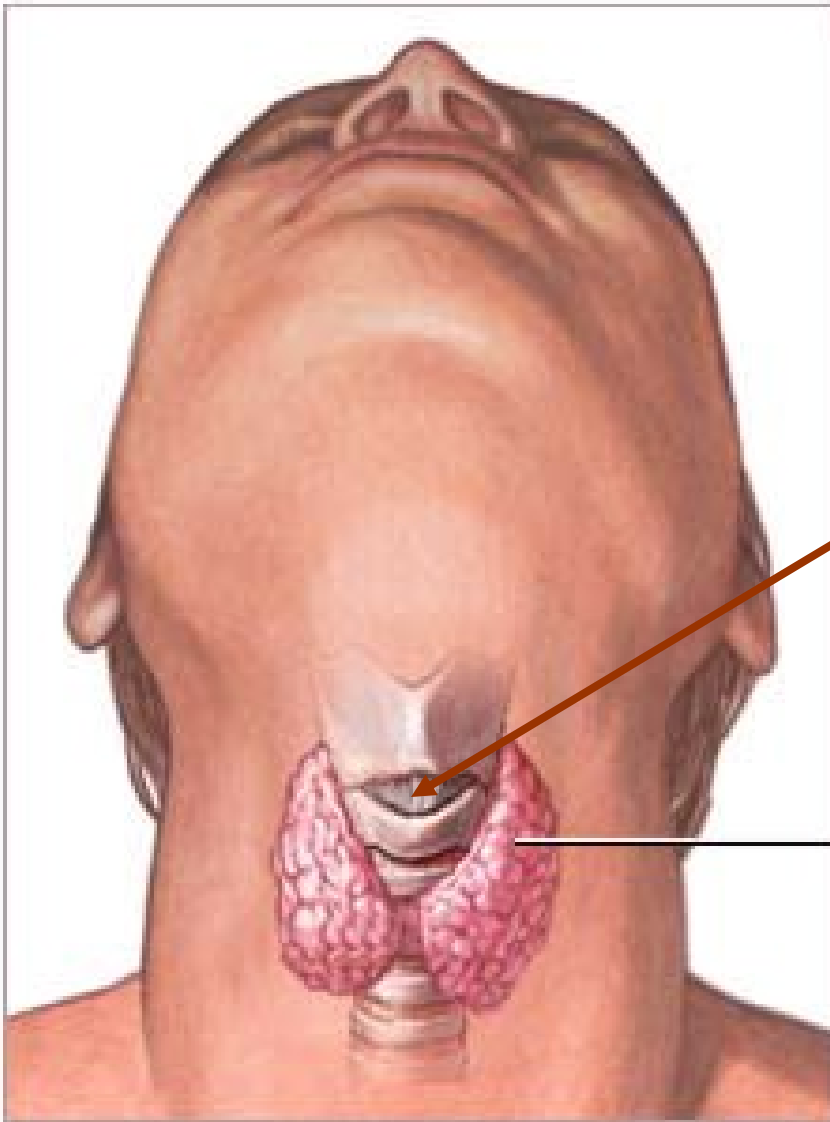
THYROID GLAND - LOTS OF VEINS



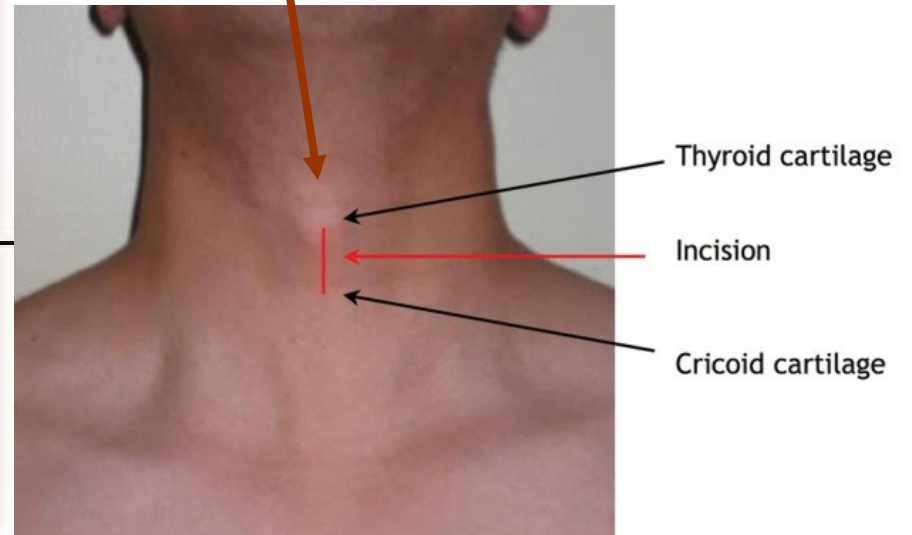
CLINICAL NOTE: THERE CAN BE A LARGE VEIN IN FRONT OF (ANTERIOR TO) THE TRACHEA - IMPORTANT IN TRACHEOTOMY; BLEEDING AVOIDED BY CRICOTHYROTOMY

OBSTRUCTION OF LARYNX: CRICOTHYROTOMY

**CLINICALLY IMPORTANT:
IN ANAPHYLACTIC SHOCK,
INSERT TUBE TO
CRICOTHYROID
MEMBRANE (LESS BLEEDING
THAN TRACHEOTOMY)**



**Cricothyroid
Membrane**



EAR

Otitis media – spread of infection

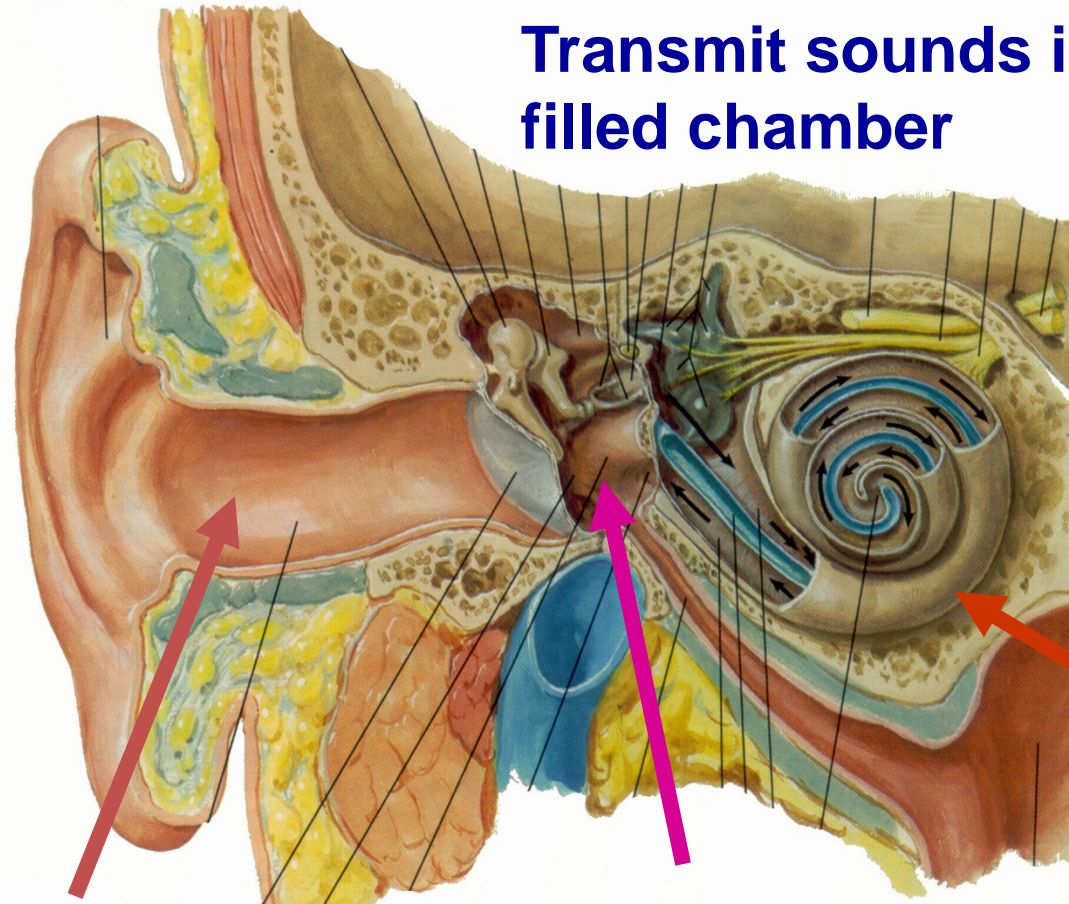
Muscles that dampen sound – Stapedius, Tensor Tympani

Loss of taste if damage branches of VII that cross middle ear

Innervation of skin of outer ear

EAR

Transmit sounds in air to fluid filled chamber



REGIONS

A. Outer Ear
directs sound
(pressure waves in
air) to tympanic
membrane

**B. Middle Ear - air-filled
chamber**
- bones link tympanic
membrane to cochlea;
amplify force/area
- muscles can dampen
loud sounds

**C. Inner Ear-
fluid-filled
chamber
inside BONE**
Cochlea-
hearing;
Vestibular
apparatus-
gravity,
balance

CONDUCT SOUND

(CONDUCTIVE HEARING LOSS)

DETECT SOUND

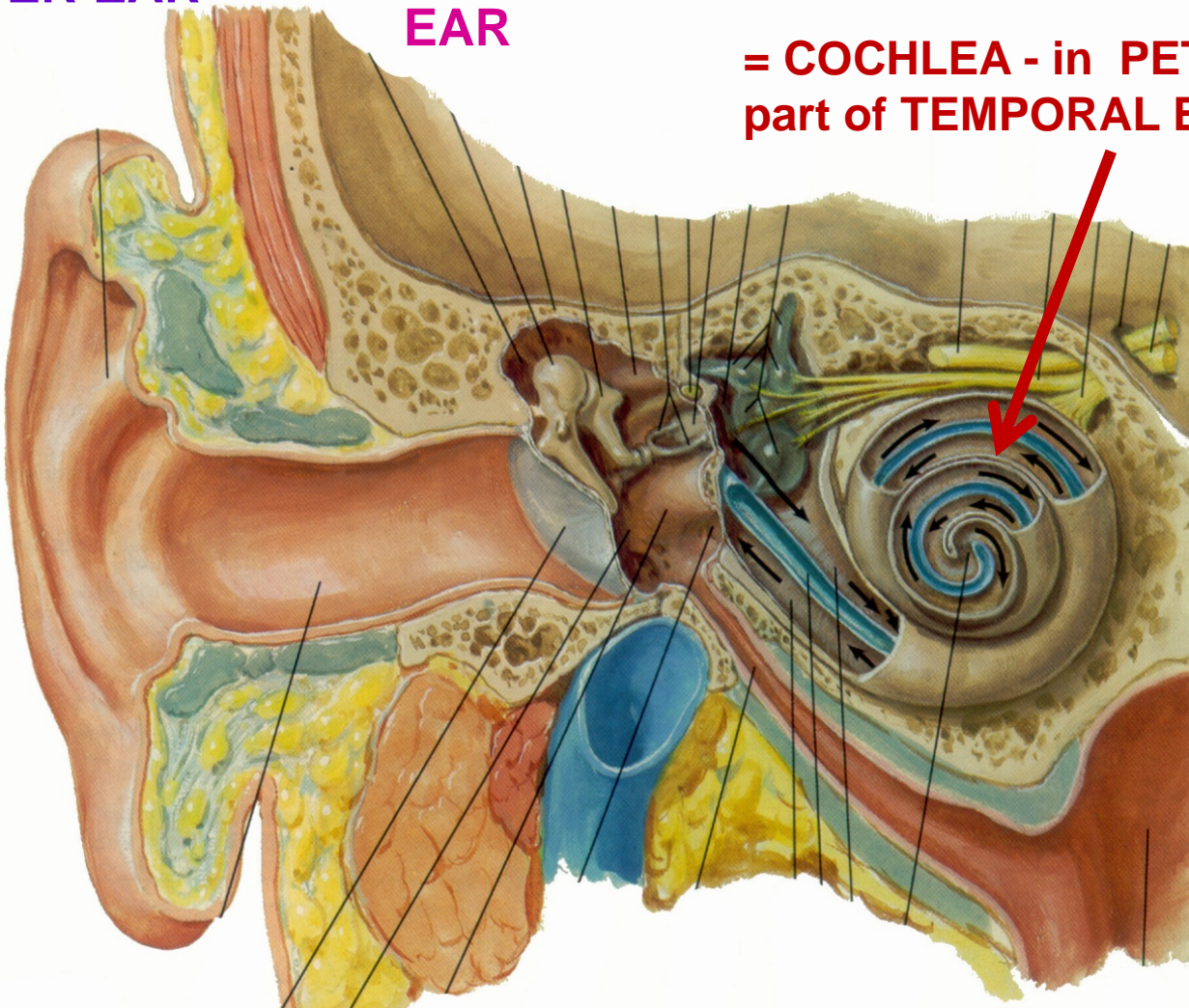
(= SENSORINEURAL PART)

OUTER EAR

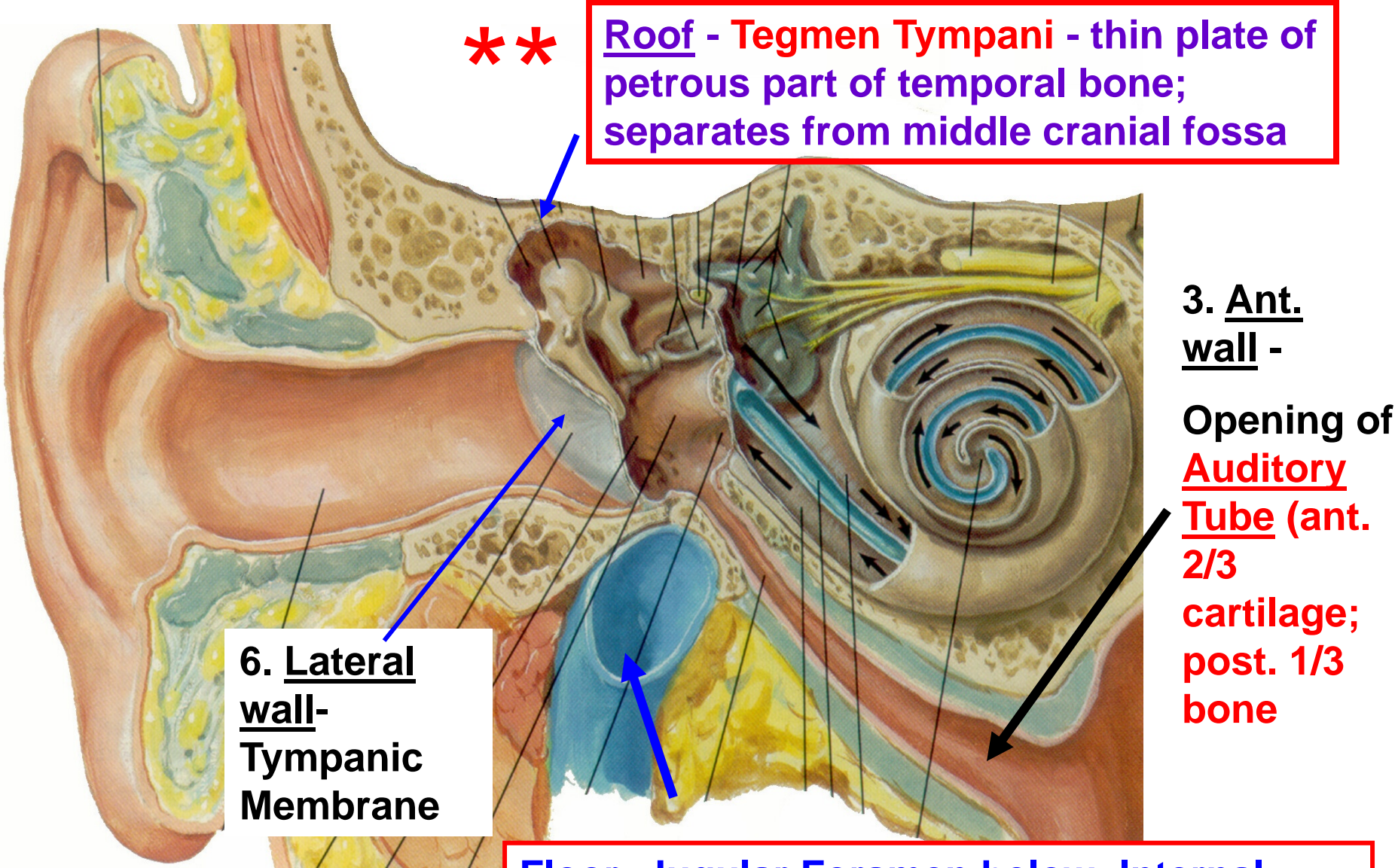
**MIDDLE
EAR**

INNER EAR

= COCHLEA - in PETROUS
part of TEMPORAL BONE



MIDDLE EAR - BOUNDARIES



Roof - **Tegmen Tympani** - thin plate of petrous part of temporal bone; separates from middle cranial fossa

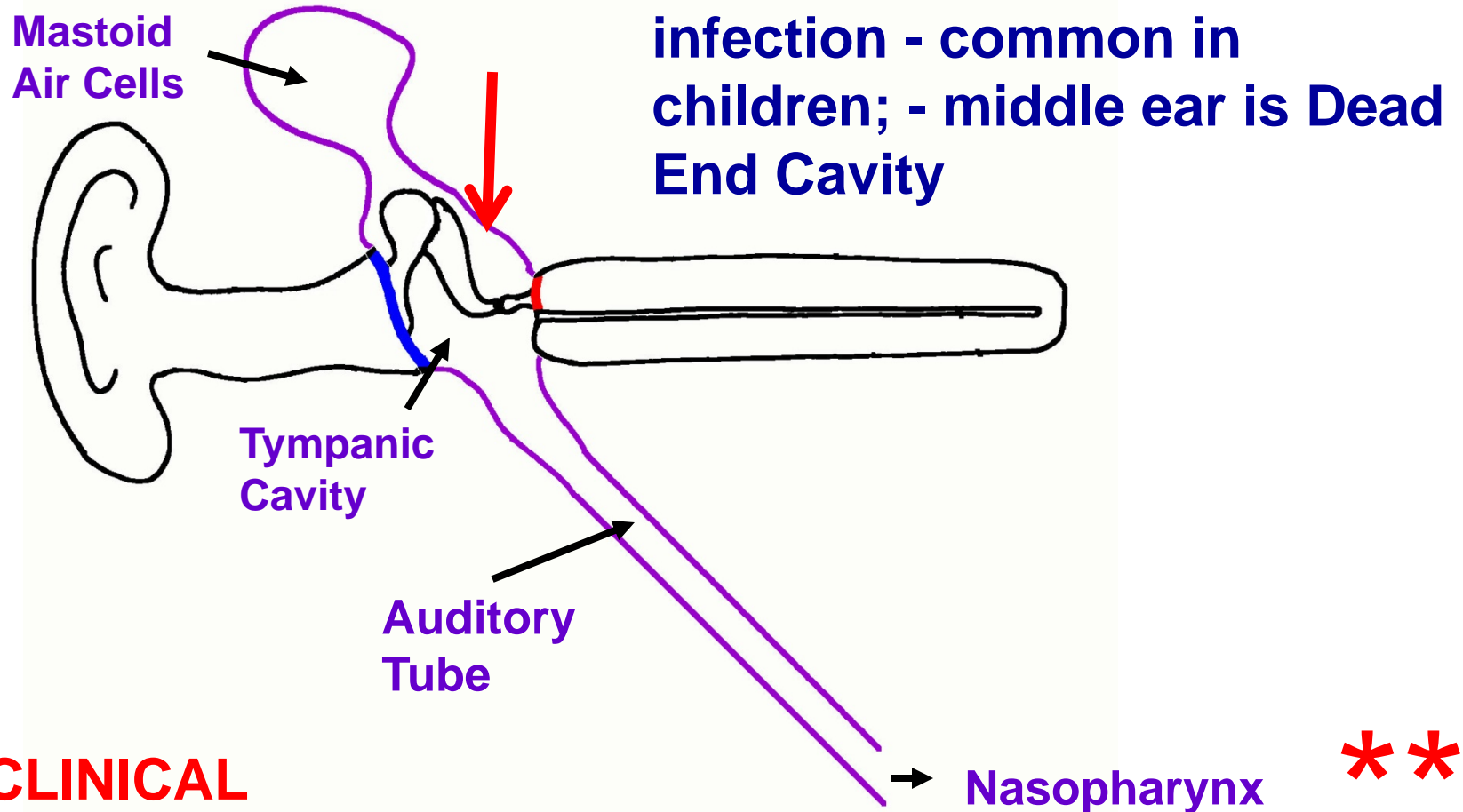
3. Ant. wall -
Opening of Auditory Tube (ant. 2/3 cartilage; post. 1/3 bone)

6. Lateral wall-
Tympanic Membrane

Floor- Jugular Foramen below- Internal Jugular vein can rupture to middle ear

Tegmen = L. roof

OTITIS MEDIA



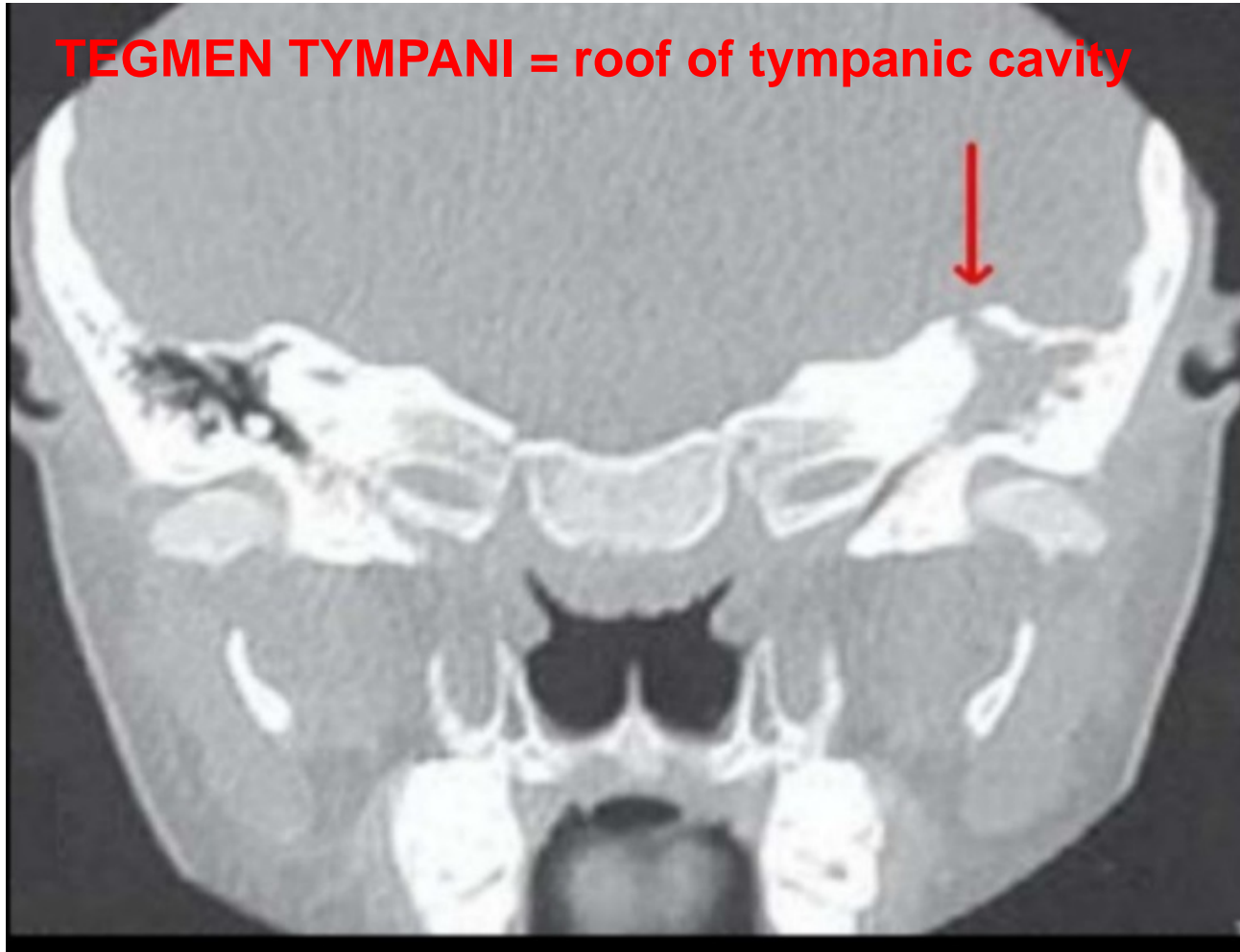
CLINICAL

Spread of infection from Respiratory System can damage Auditory Ossicles - Hearing Loss; Prolonged infection - Tegmen Tympani to Brain; treatment tympanostomy - tube through tympanic membrane

INFECTION IN OTITIS MEDIA CAN SPREAD TO MIDDLE CRANIAL FOSSA

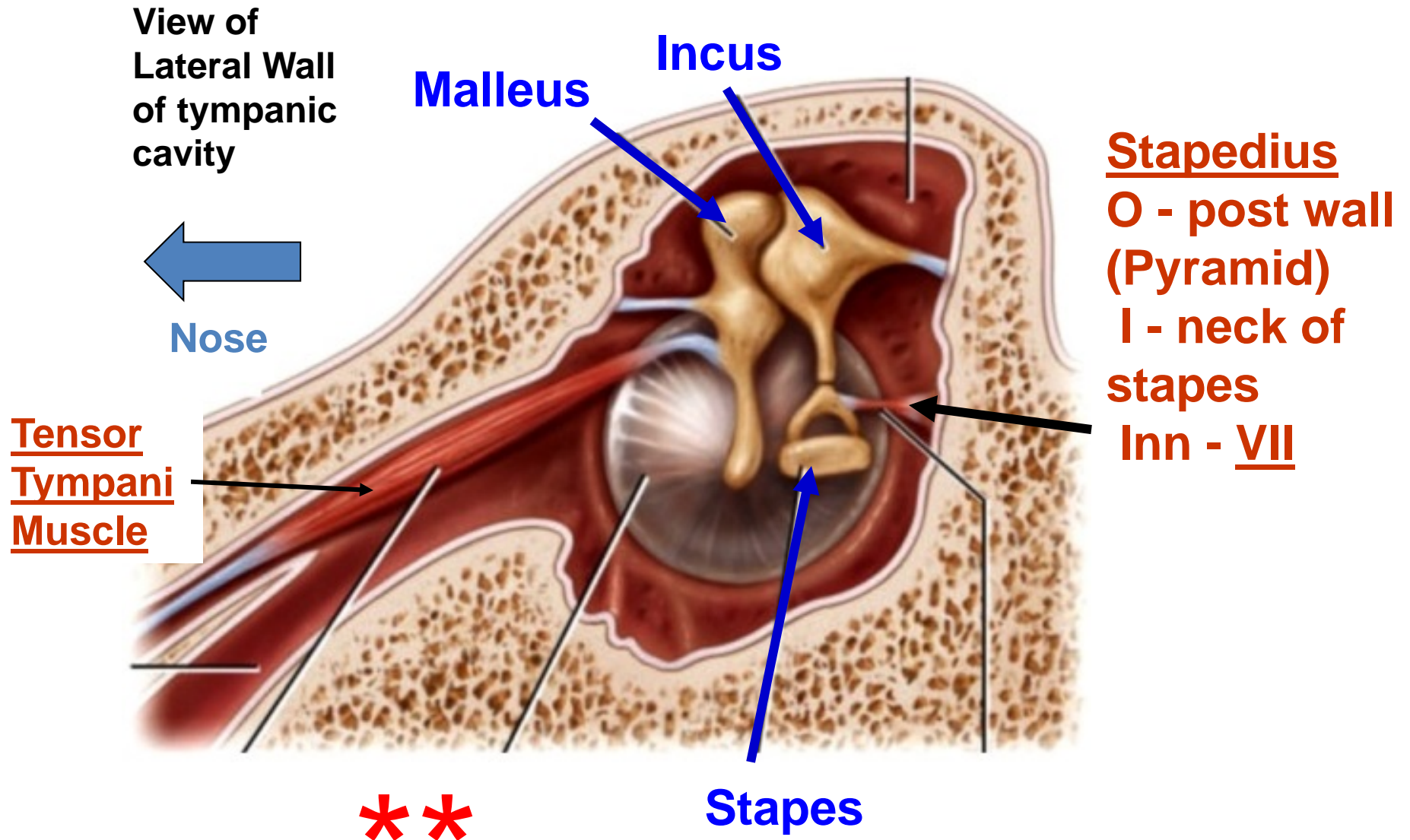
TEGMEN TYMPANI = roof of tympanic cavity

tegman L. =
covering



In prolonged Otitis media, infection can spread to Middle Cranial Fossa by eroding Tegmen Tympani (roof of tympanic cavity, middle ear)

MUSCLES OF MIDDLE EAR - dampen sound



Damage to VII - Hyperacusia - sounds seem too loud

PRACTICE QUESTION CLINICAL VIGNETTE



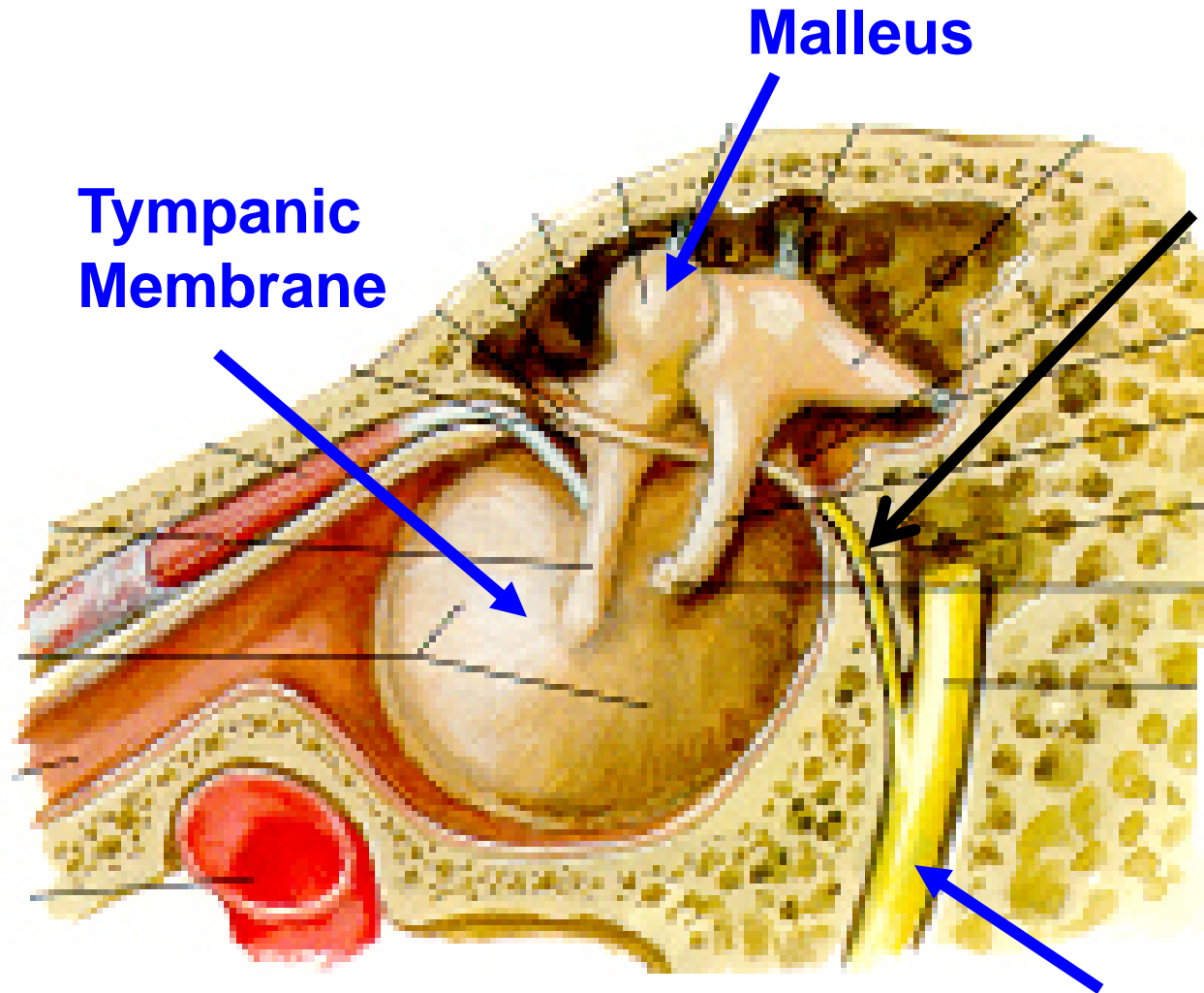
. ____ A 6-year old child is seen at a rural clinic for a persistent ear infection on the left side. The parents indicate that the child has had recurrent ear infections for several years that have been resistant to antibiotic treatment. The infection is diagnosed as chronic otitis media and a tympanostomy tube is inserted through the tympanic membrane. The tube is removed after 6 months and successful resolution of the infection. However, the pediatrician carefully tests for potential complications and **finds that there is loss of taste to the anterior tongue on the left side**. This could indicate damage to which of the following nerves?

- A. Tympanic nerve (CN IX)
- B. Chorda tympani (CN VII)
- C. Auriculotemporal nerve (CN V)
- D. nerve to Stapedius (CN VII)
- E. Buccal nerve (CN V)

CHORDA TYMPANI

CLINICAL

Taste to ant. 2/3 of tongue
Parasympathetic to Submandibular, Sublingual Salivary glands



- Chorda Tympani has no function in middle ear
- Crosses through tympanic cavity
- Over handle of malleus

FACIAL NERVE

OTOSCOPE VIEW OF TYMPANIC MEMBRANE

Pars
flaccida

**CHORDA
TYMPANI:
TASTE,
VISCERAL
MOTOR
(parasymp)**

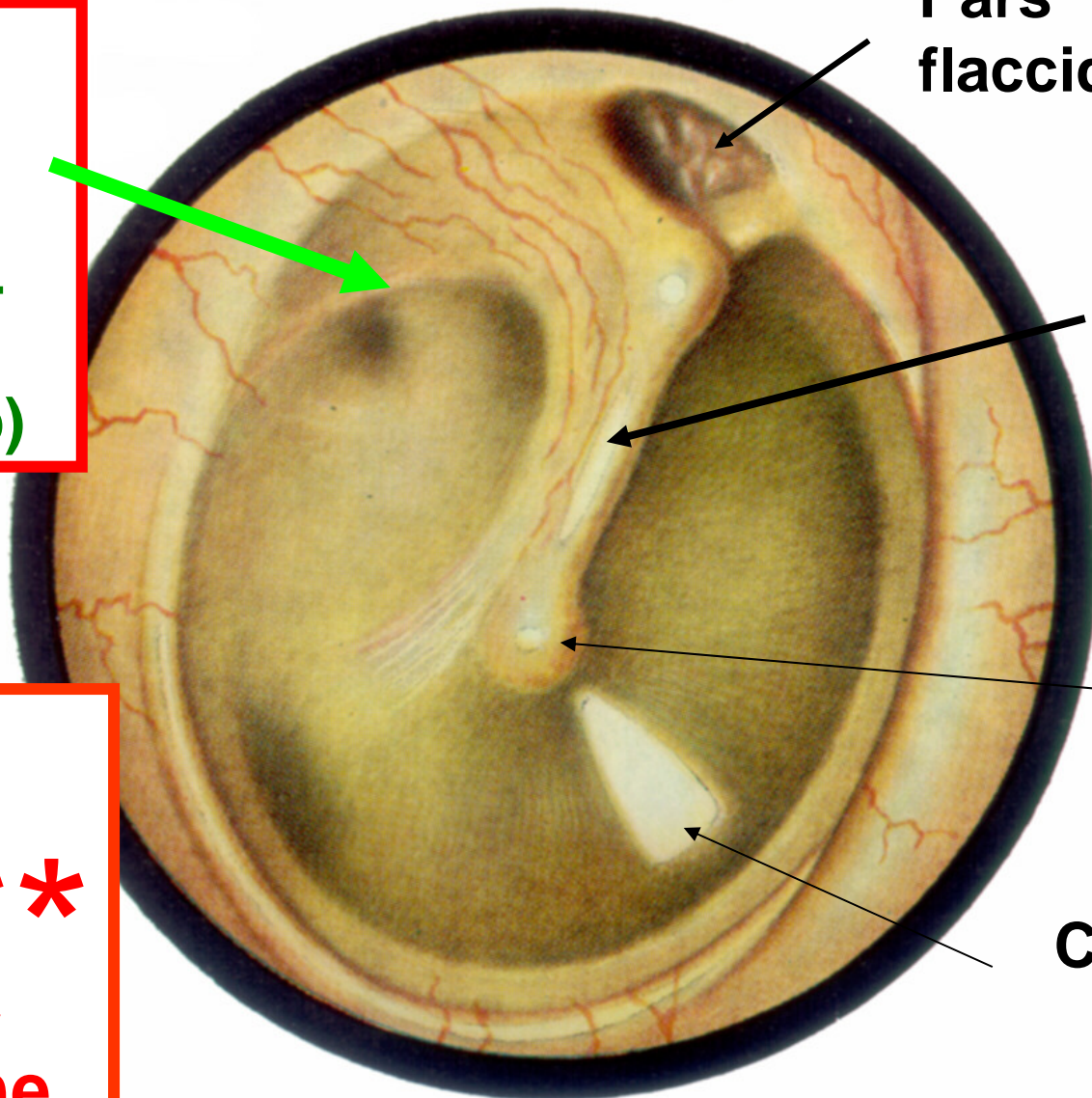
**MALLEUS –
manubrium
(handle)**

CLINICAL*

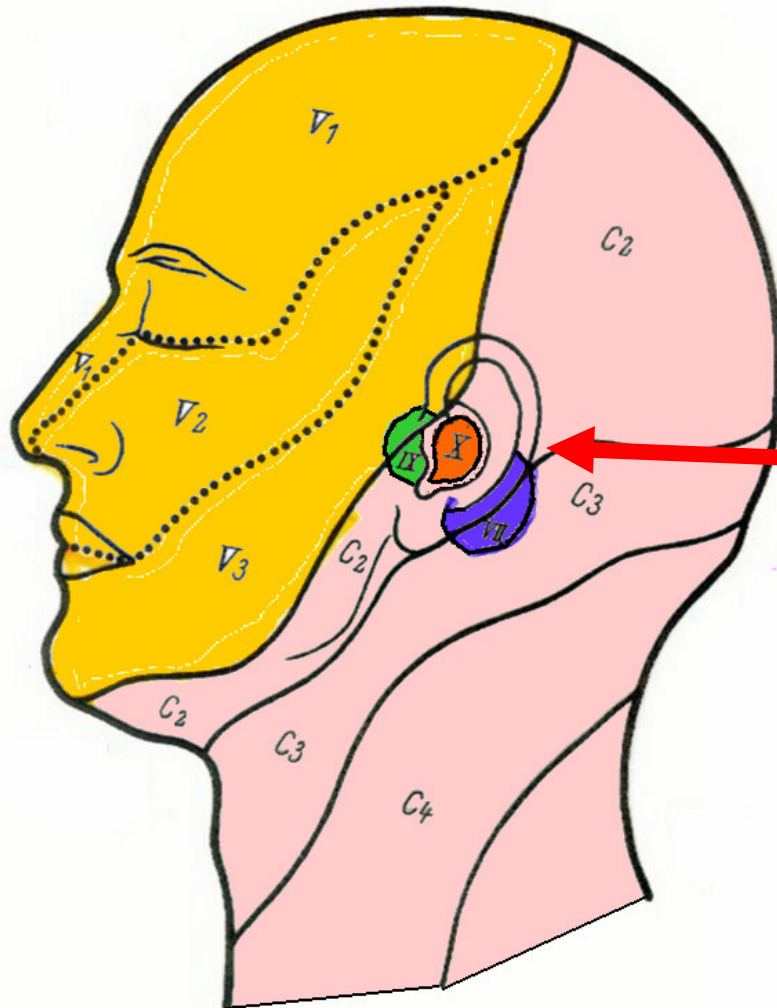
**Lose
taste if
pierce **
tympanic
membrane**

Umbo

Cone of light



SOMATIC SENSORY TO OUTER EAR



**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**