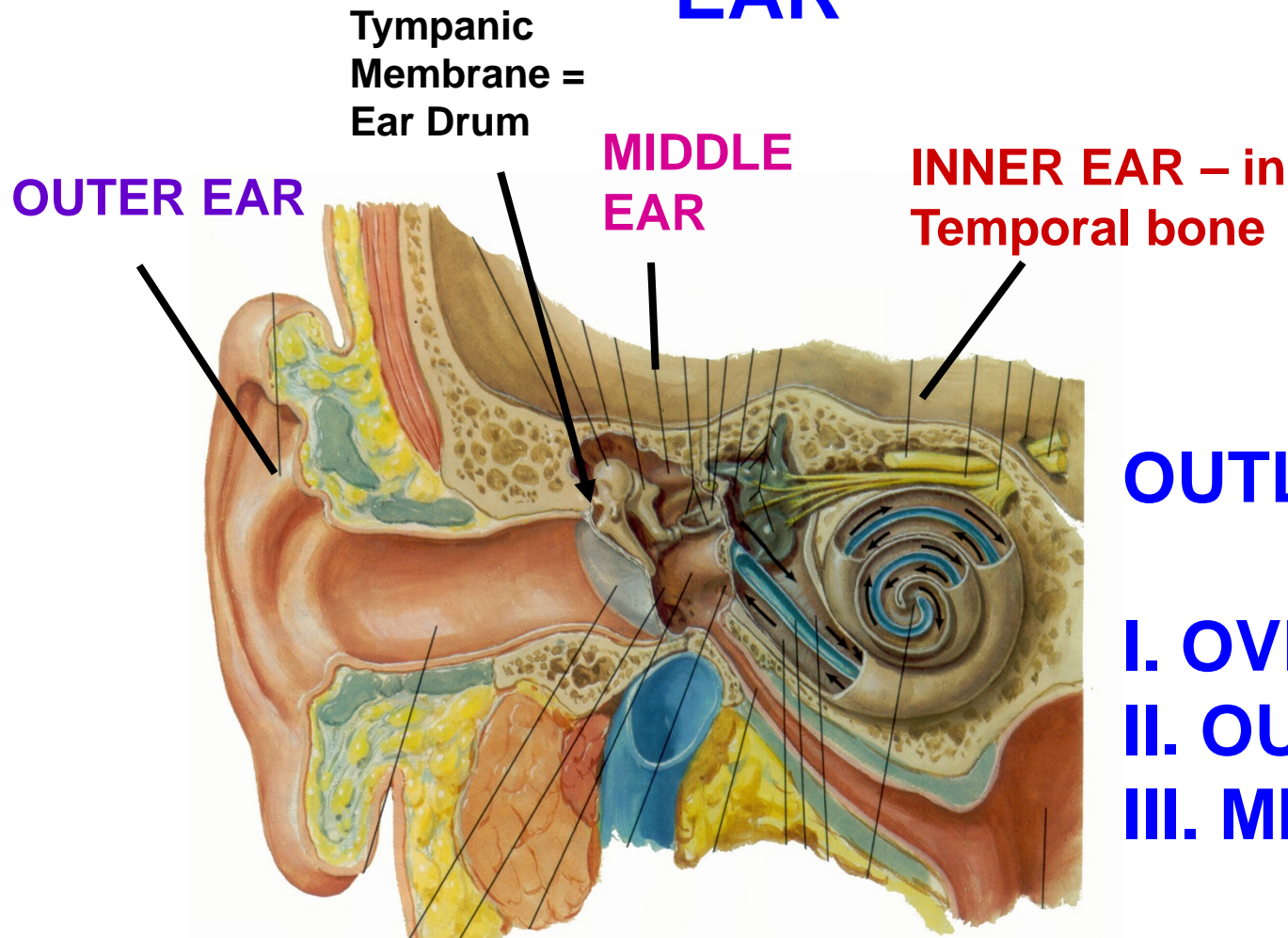


EAR



OUTLINE

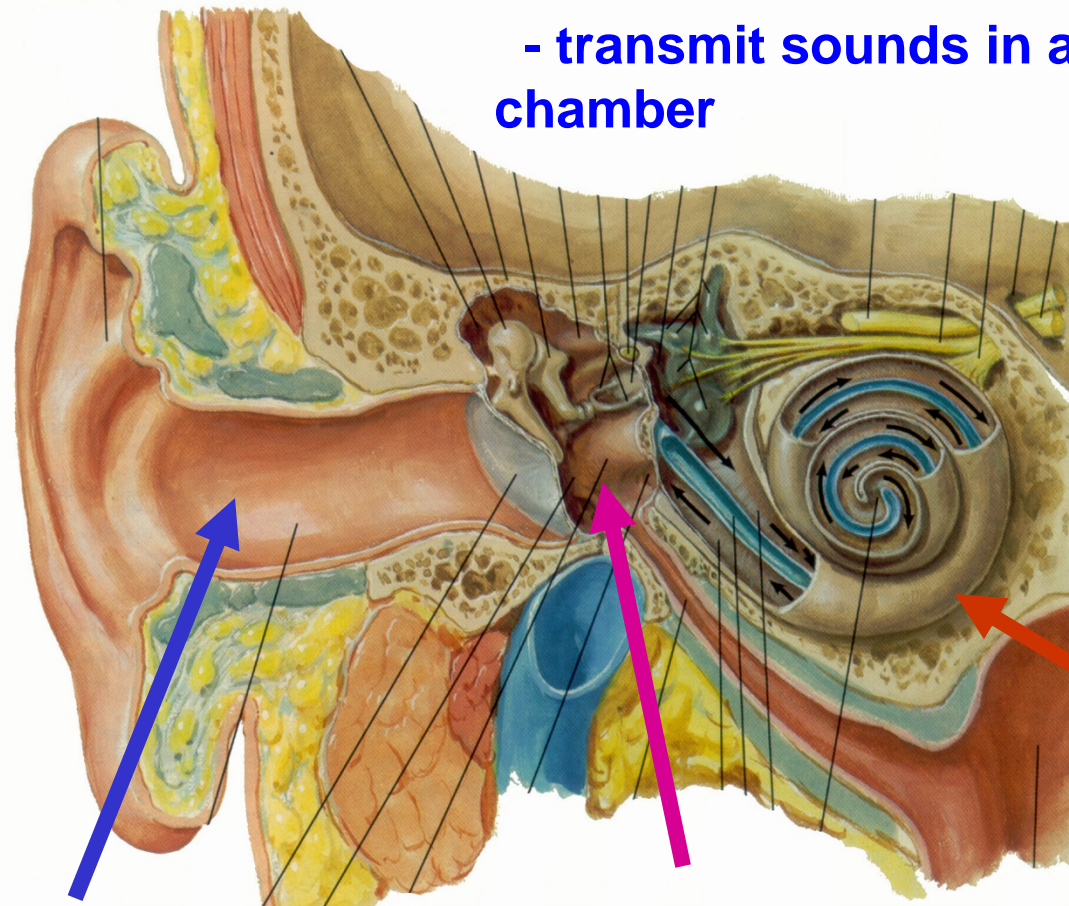
- I. OVERVIEW
- II. OUTER EAR
- III. MIDDLE EAR

Outer and middle ear transmit sound to inner ear.

Middle ear is dead end space filled with air and connected

to nasopharynx; Middle ear infections common (otitis media)

I. EAR - overview



REGIONS

A. Outer Ear

- 1) funnel shaped cartilage and skin
- 2) directs sound (pressure waves in air) to tympanic membrane

B. Middle Ear - air-filled chamber

- 1) bones link tympanic membrane to cochlea; amplify force/area
- 2) muscles can dampen loud sounds

C. Inner Ear- fluid-filled chamber inside BONE

- 1) cochlea- hearing;
- 2) vestibular apparatus- gravity

CONDUCT SOUND

(CONDUCTIVE HEARING LOSS)

DETECT SOUND

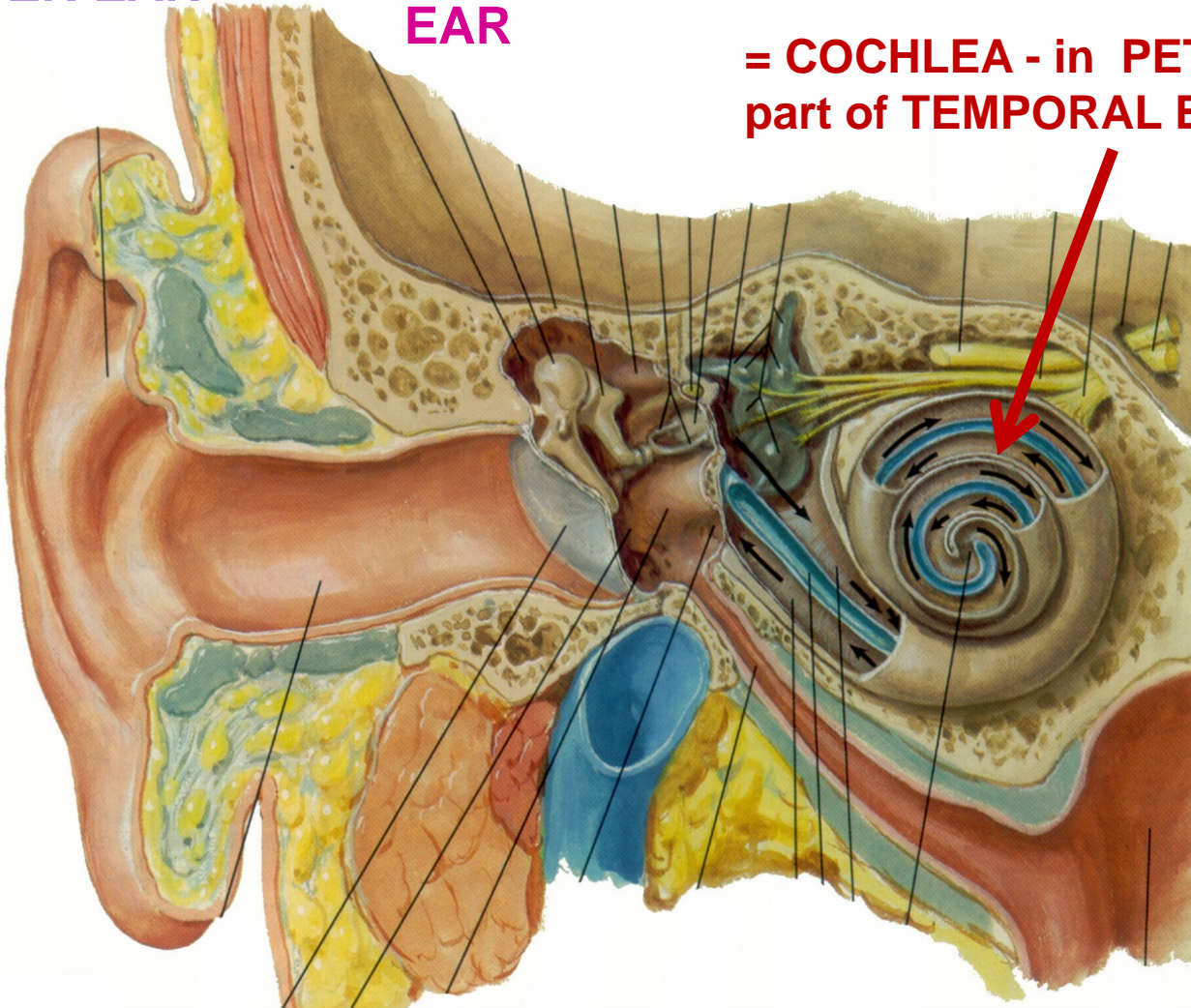
(= SENSORINEURAL PART)

OUTER EAR

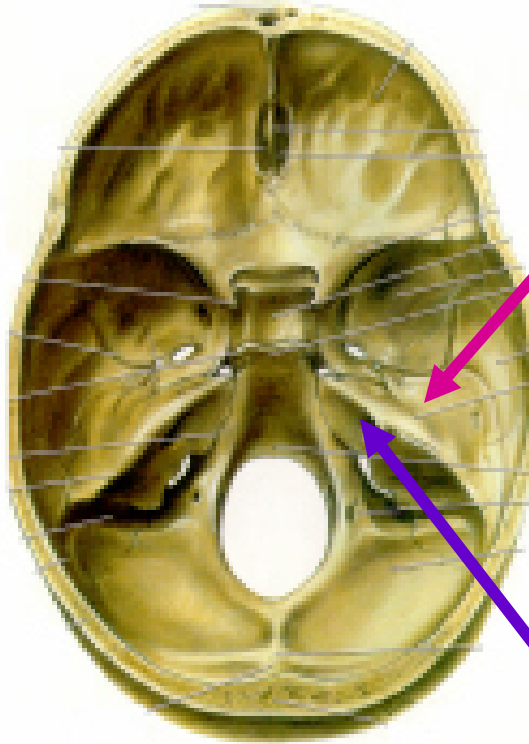
**MIDDLE
EAR**

INNER EAR

= COCHLEA - in PETROUS
part of TEMPORAL BONE

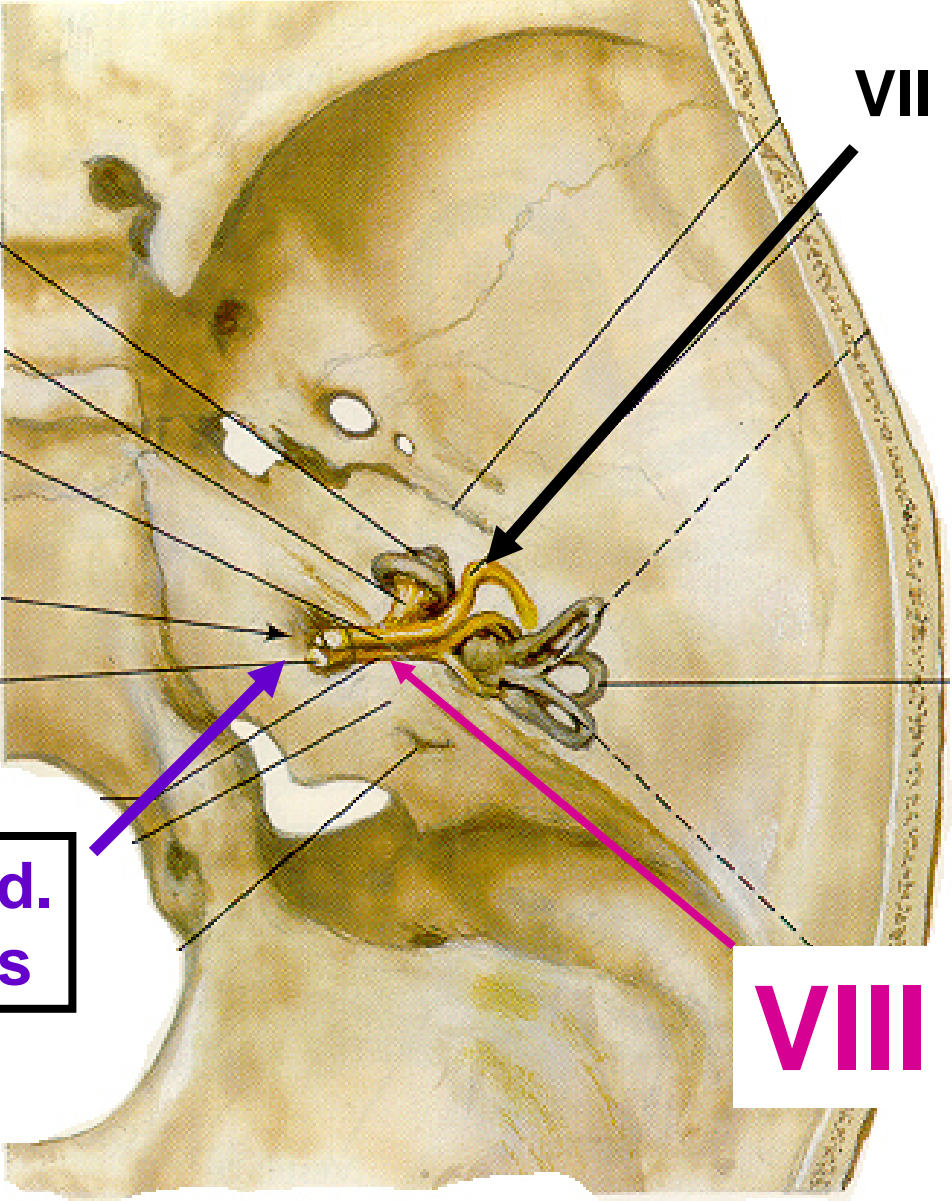


ORIENT: LOCATION OF INNER EAR



Petrous part of temporal bone

Int. aud. meatus



VII

VIII

CLINICAL TEST: INNER EAR DETECTS TRANSMITTED VIBRATIONS

Weber test – tuning fork on calvarium directly causes bone to vibrate; conducted to cochlea by bone; perceived as sound by patient

Can use to test functioning of inner ear (Sensorineural hearing loss) independent of outer, middle ear (Conductive hearing loss)

CONDUCTIVE HEARING LOSS - damage to middle ear (tympanic membrane, auditory ossicles (bones))

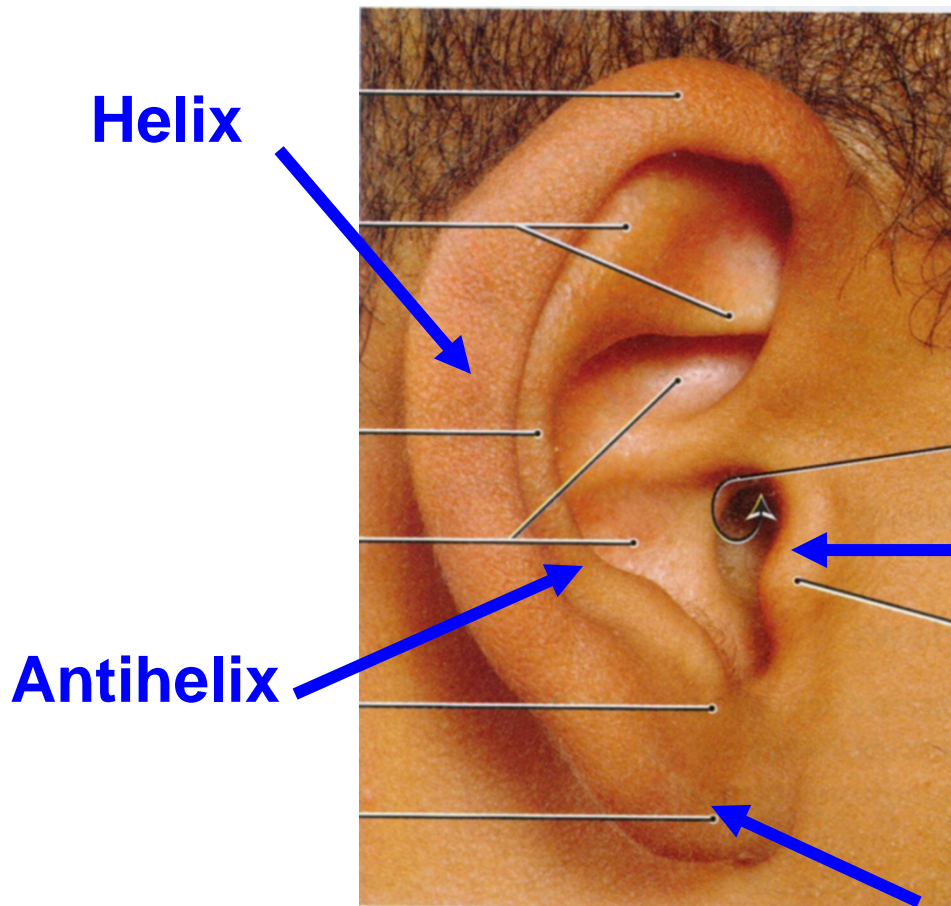
SENSORINEURAL HEARING LOSS - damage to inner ear (cochlea).



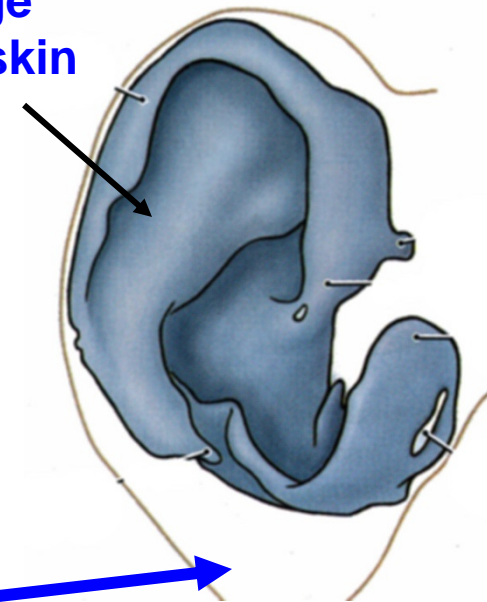
FIGURE 11-18
Weber test. Place the base of the tuning fork on the midline of the skull.

II. OUTER EAR - composed of two parts

A. AURICLE (pinna) -
elastic cartilage and skin -
Reflects sound waves



cartilage
under skin



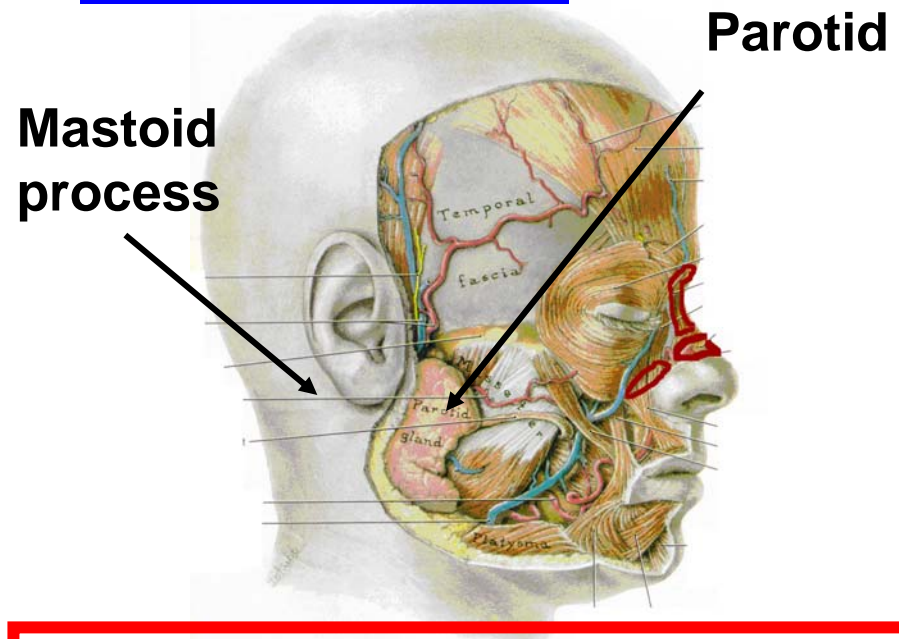
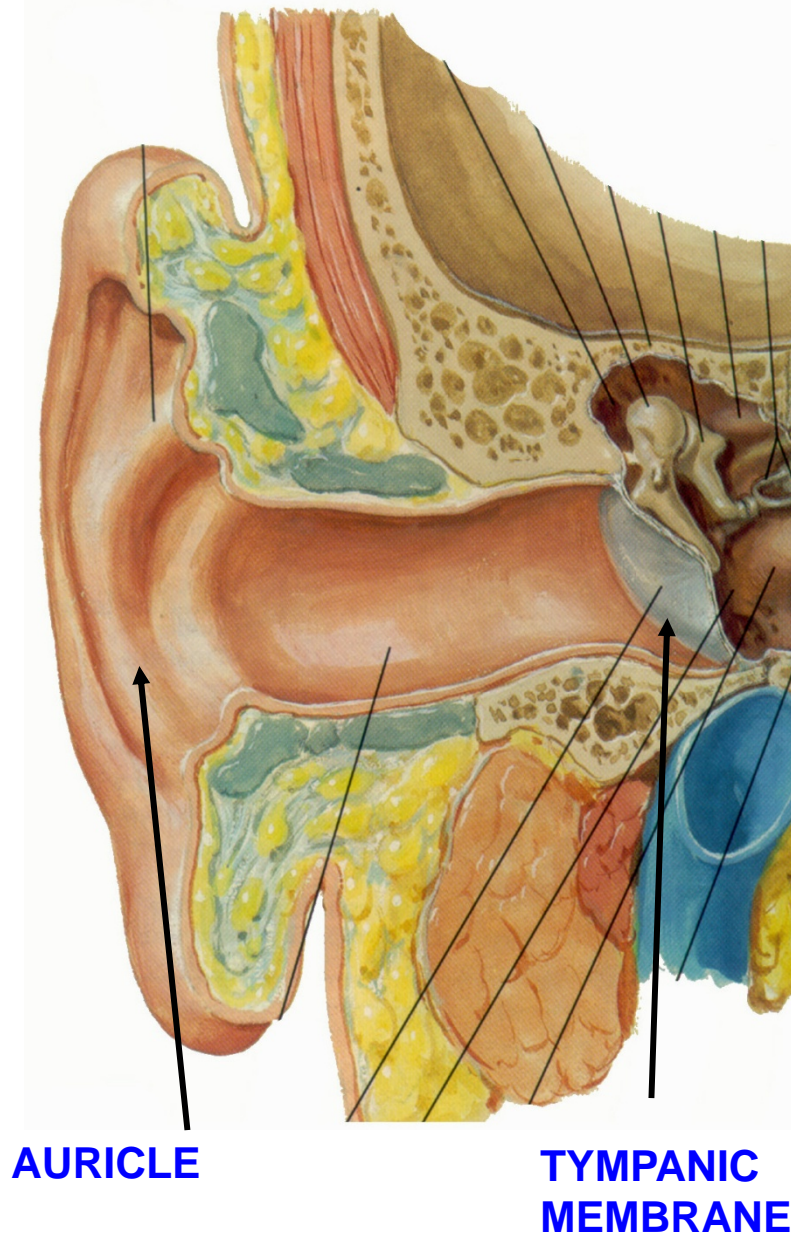
Tragus

Lobule

Cartilage does not extend into lobule - Can safely pierce and suspend
decorative metal objects from lobule

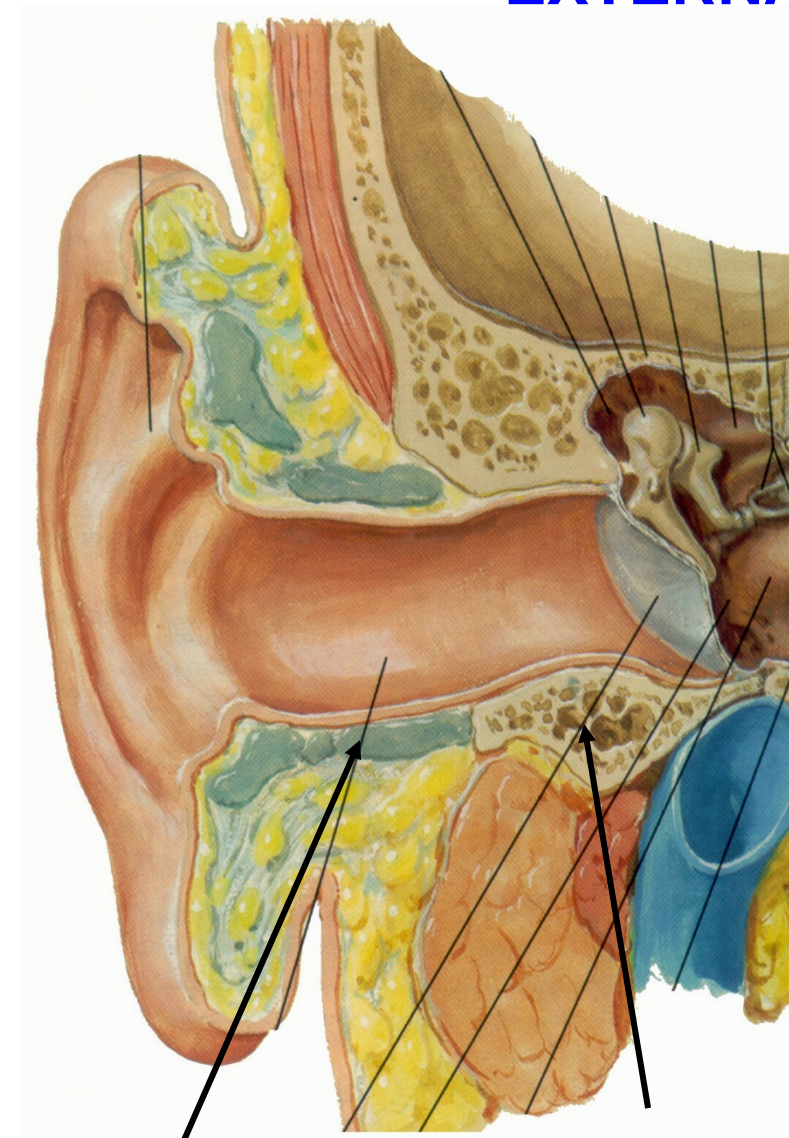
EXTERNAL AUDITORY MEATUS - location

- Tube from auricle to the tympanic membrane; posterior to Parotid gland and TMJ; anterior to mastoid process



Clinical note - sensory innervation of Outer Ear from CN V, VII, IX and X; patient's with Bell's palsy can have sensation of ear ache. **

EXTERNAL AUDITORY MEATUS



OUTER 1/3
CARTILAGE

INNER 2/3
BONE

Outer 1/3 - Cartilage - contains hair, sebaceous and ceruminous glands (ear wax [insect repellent]); protects tympanic membrane,

Inner 2/3 - Bone covered by skin

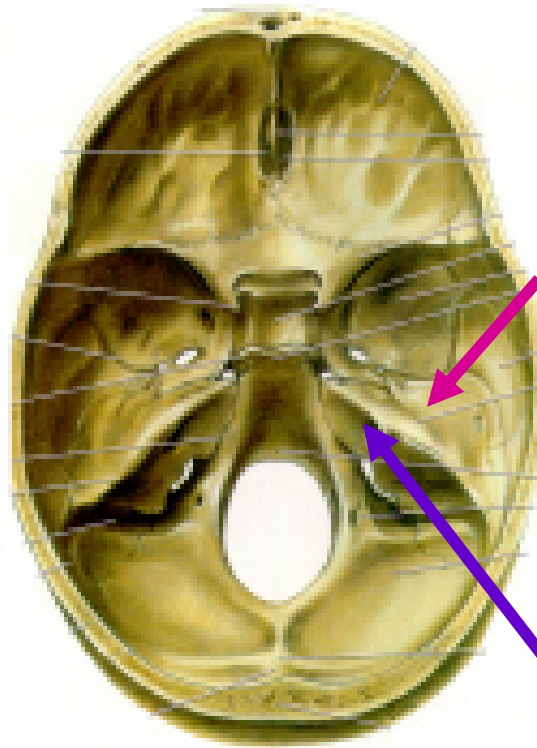
Clinical note: ext. auditory meatus is straight in children, curved anteriorly in adults

In Adult - pull up and back to insert otoscope



III. MIDDLE EAR - hard to visualize

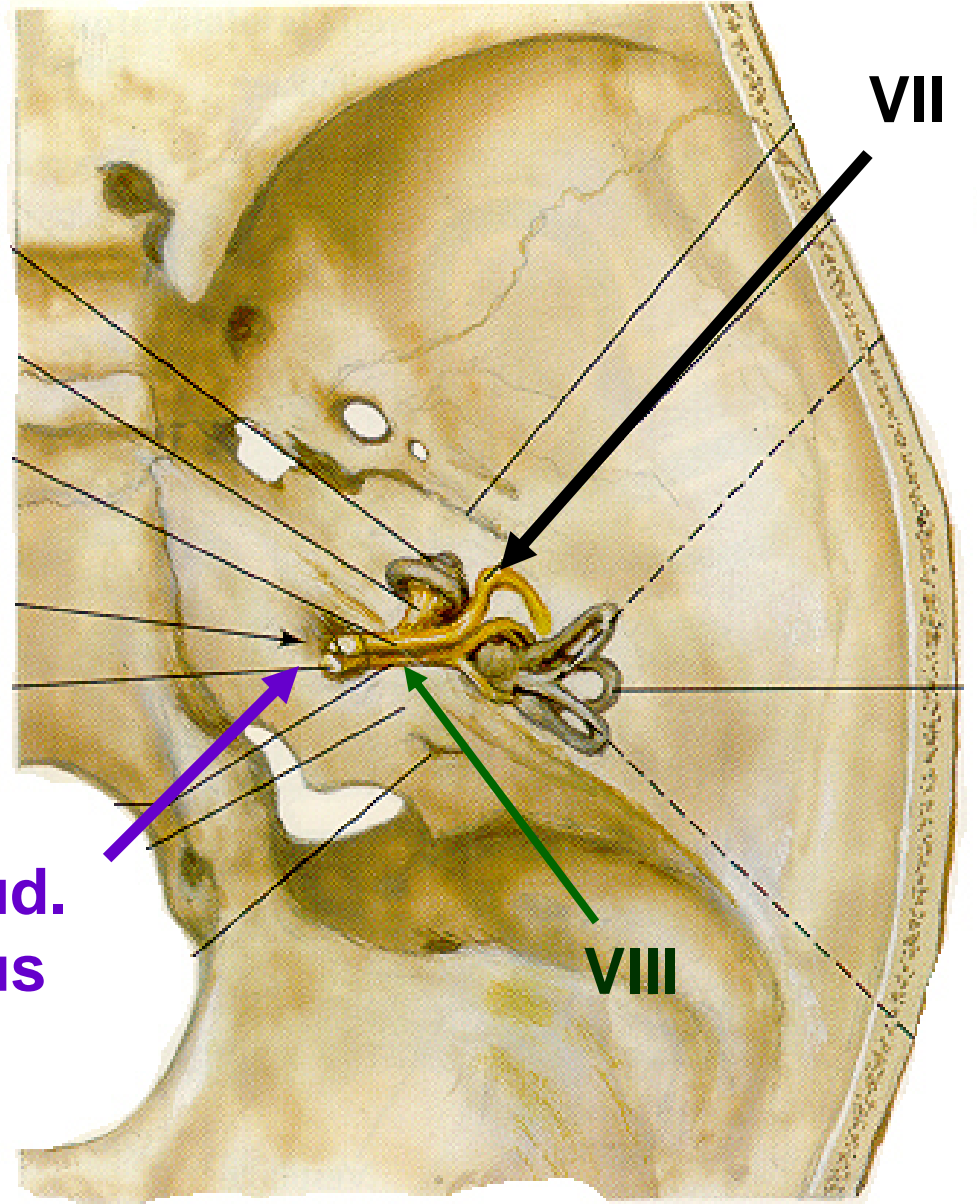
ORIENT: LOCATION OF INNER EAR



Petrous part of temporal bone

LOCATION OF MIDDLE EAR AND INNER EAR DIFFICULT TO DEMONSTRATE

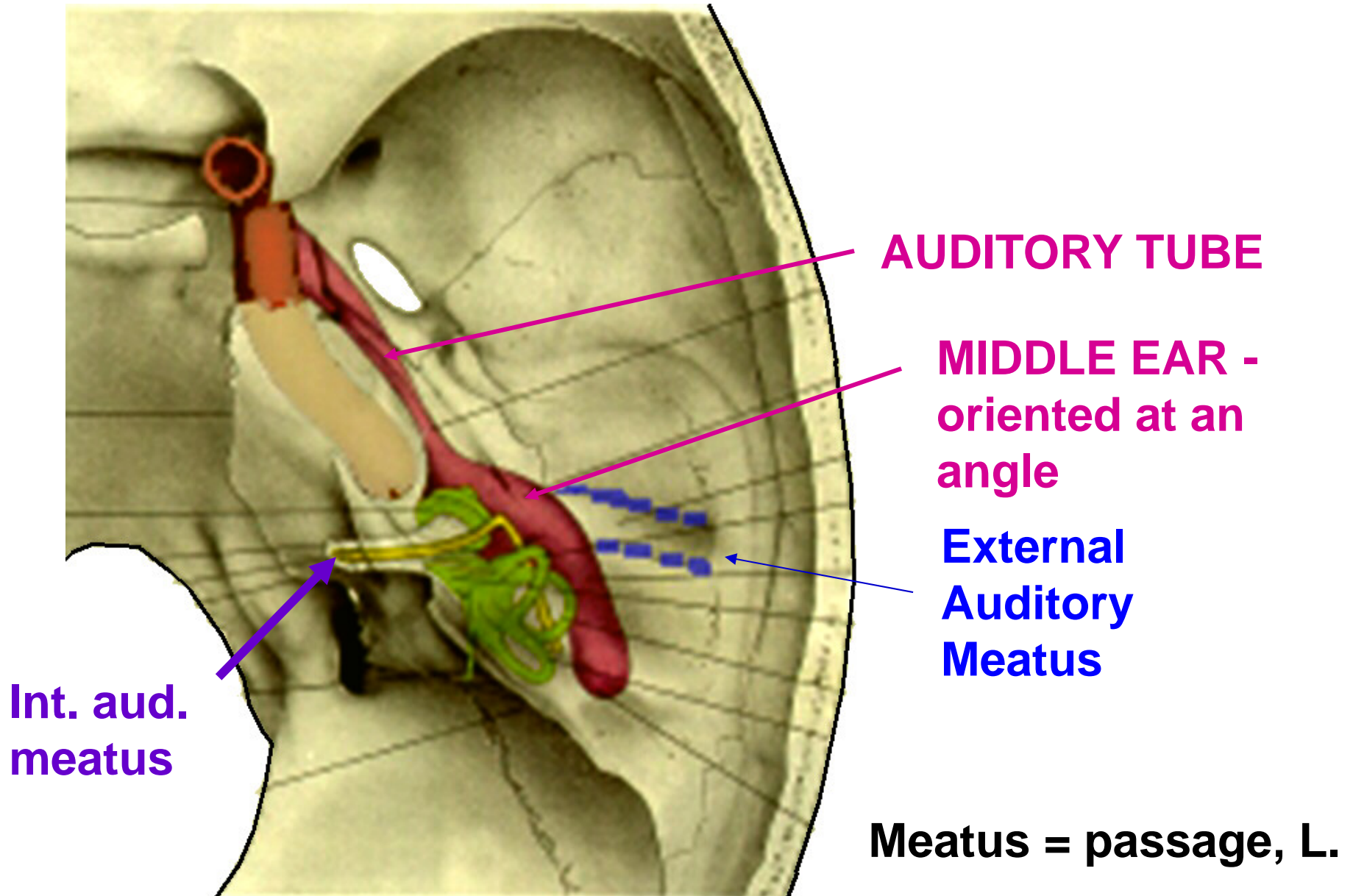
Int. aud. meatus



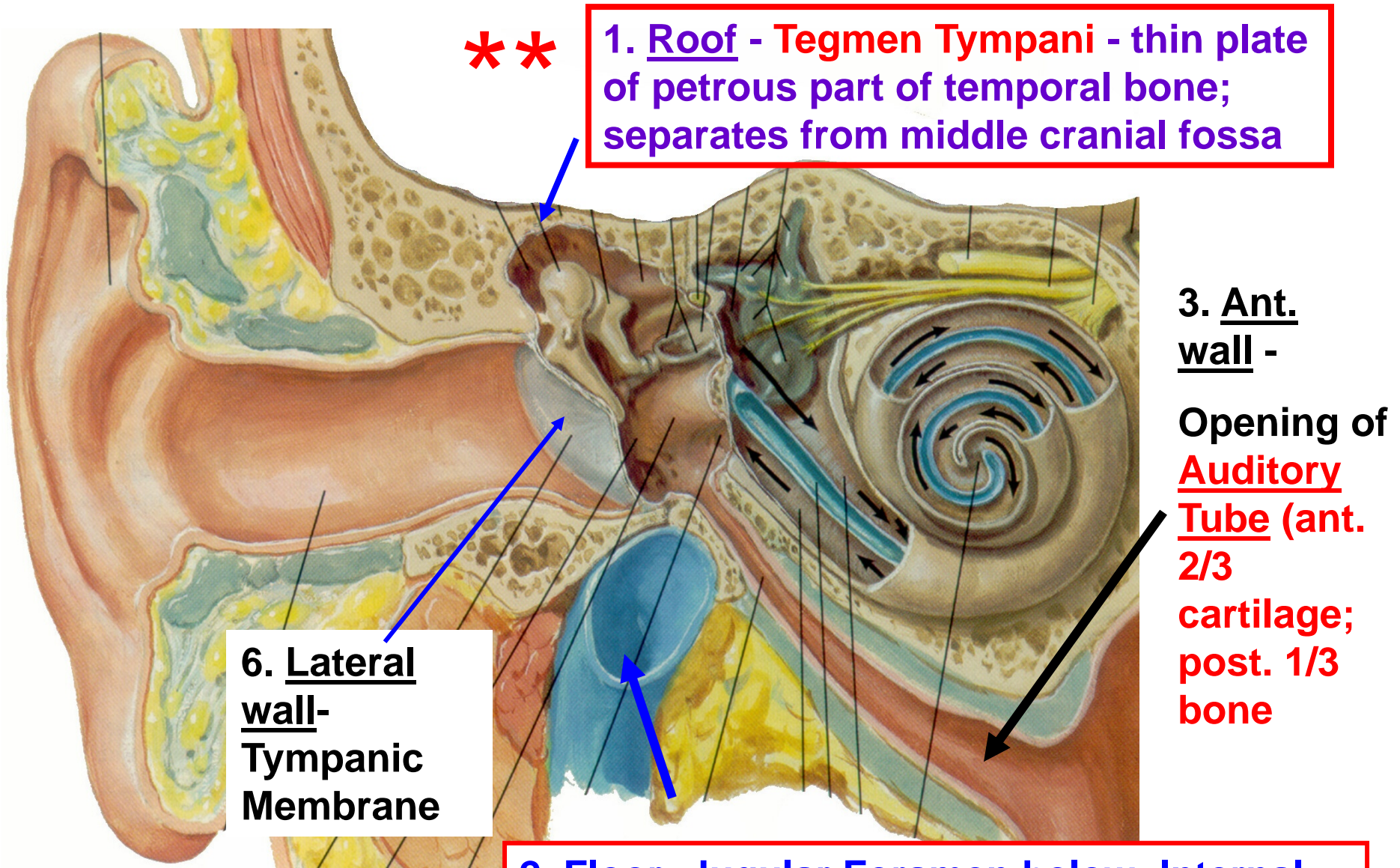
VII

VIII

ORIENT: LOCATION OF MIDDLE EAR



III. MIDDLE EAR - BOUNDARIES



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

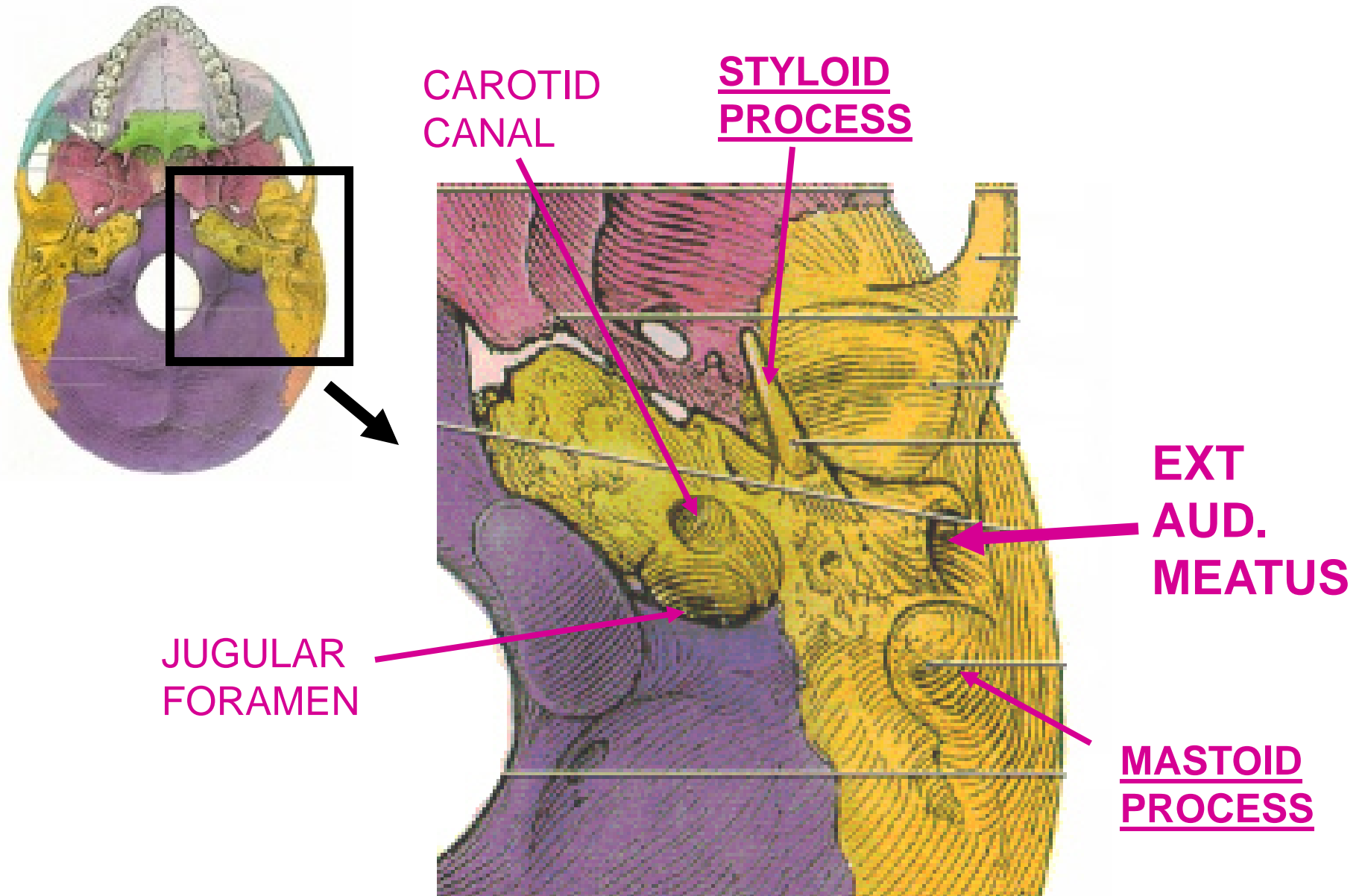
6. Lateral wall-
Tympanic Membrane

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

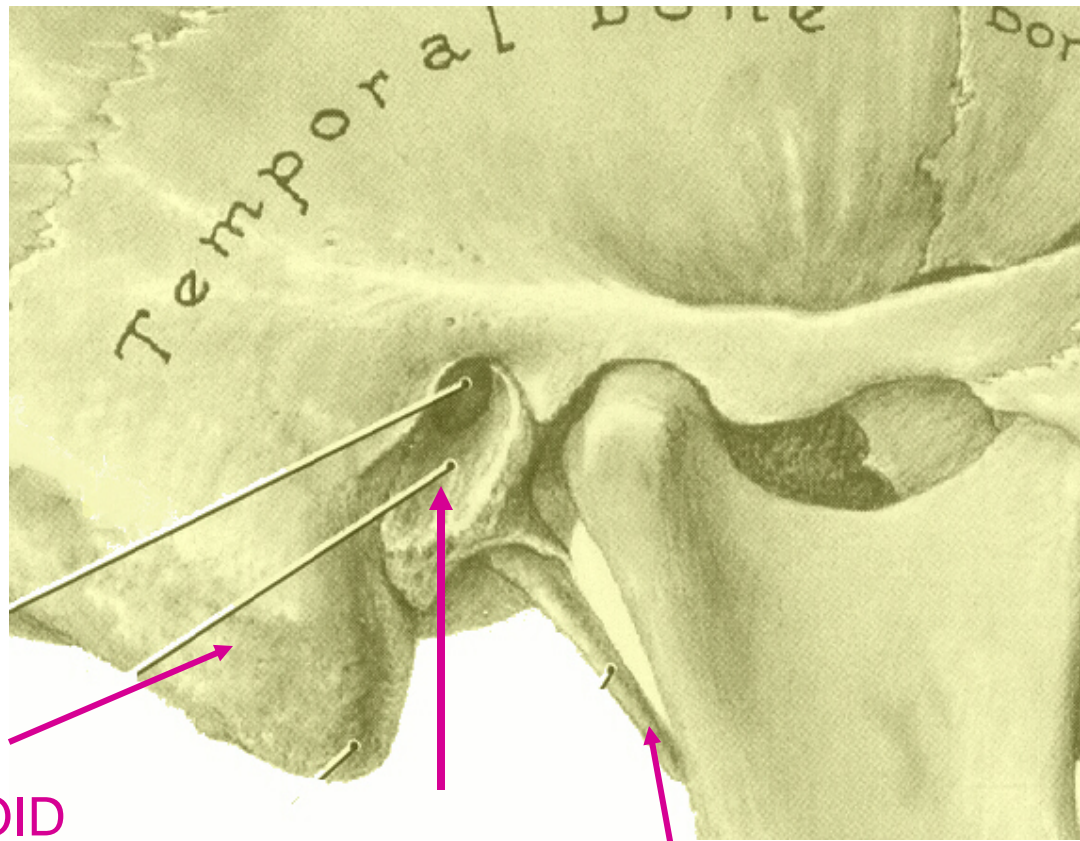
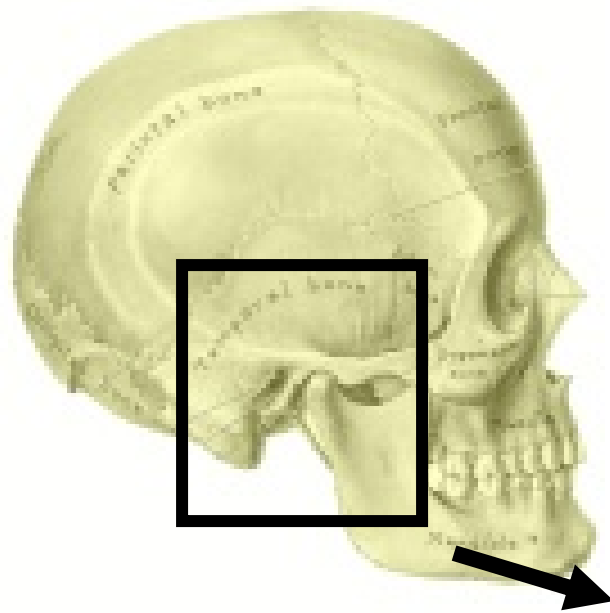
2. Floor- Jugular Foramen below- Internal Jugular vein can rupture to middle ear

Tegmen = L. roof

ORIENT: LOCATION OF MIDDLE EAR ON SKULL



ORIENT: LOCATION OF MIDDLE EAR ON SKULL

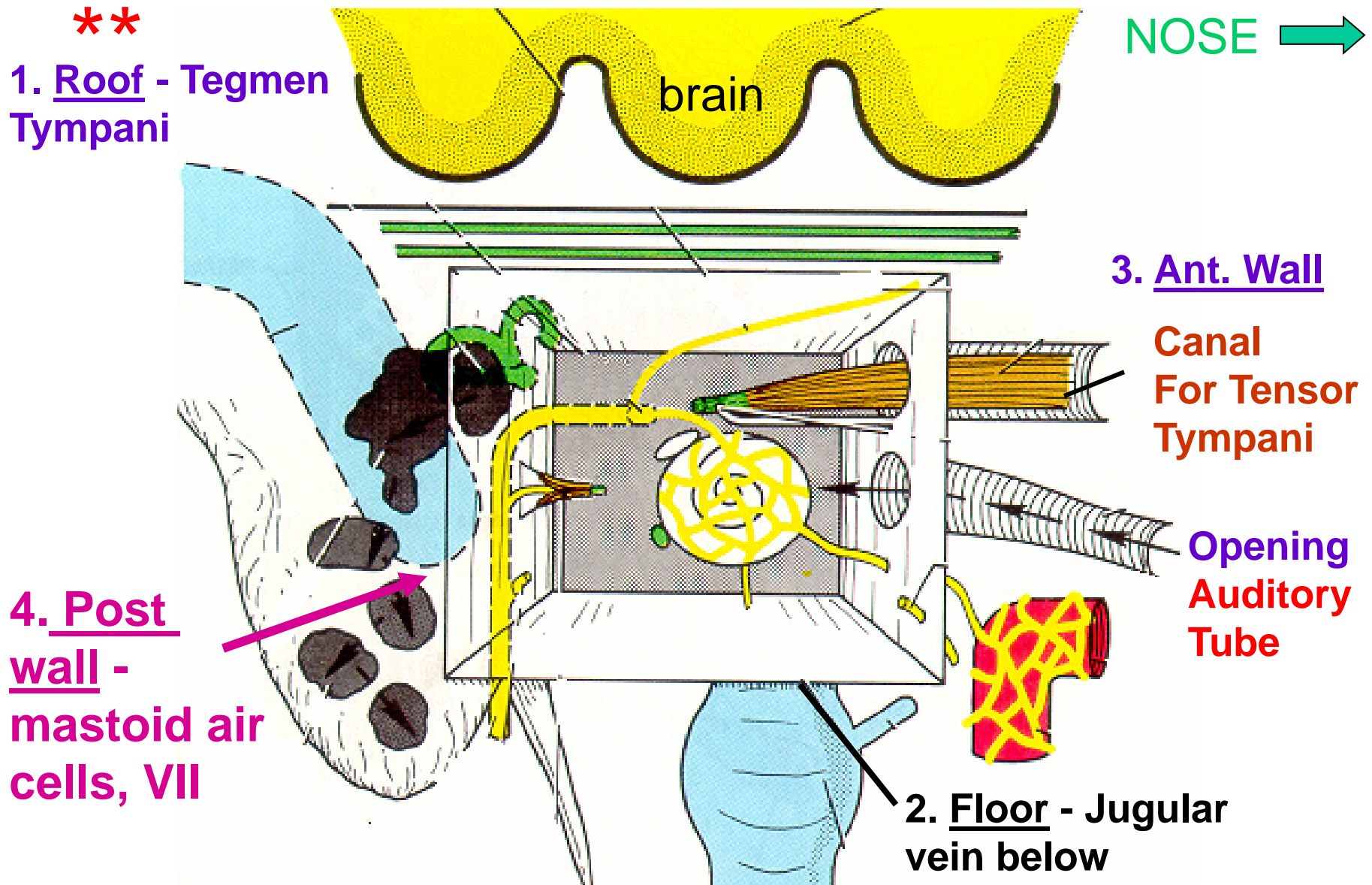


MASTOID
PROCESS

EXT. AUD.
MEATUS

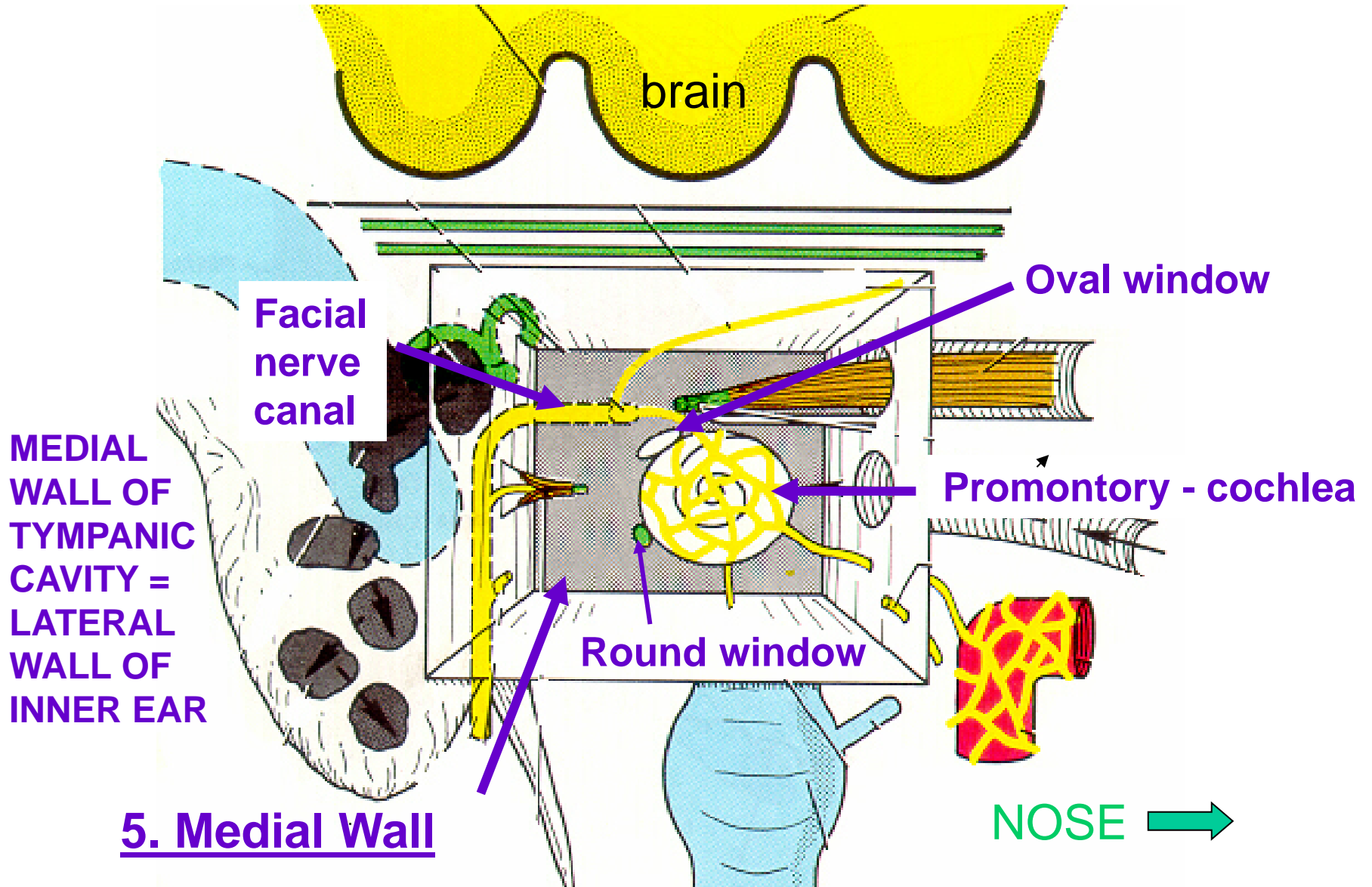
STYLOID
PROCESS

MIDDLE EAR: BOUNDARIES



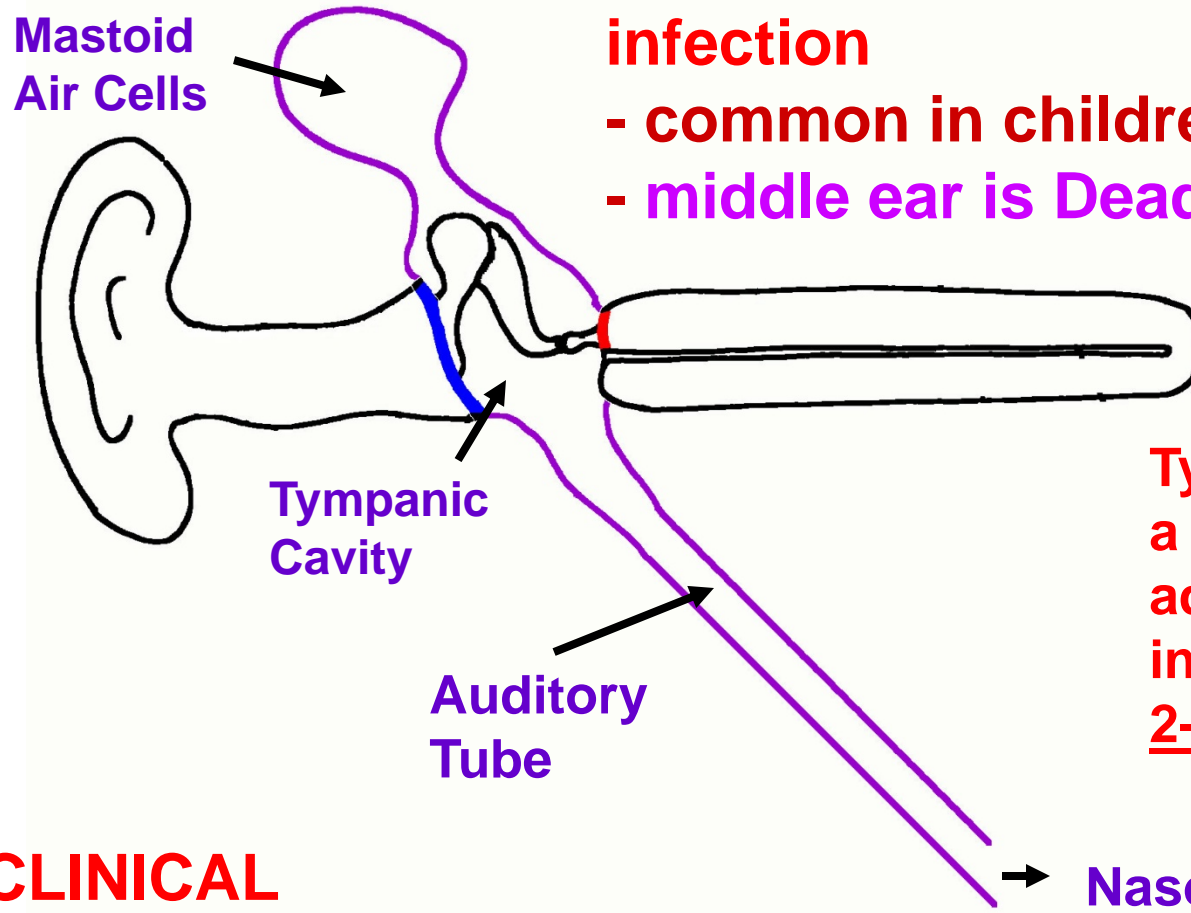
View of Medial Wall of Right Middle Ear with Tympanic membrane and Ossicles Removed (note: Promontory = bulge in wall from Cochlea)

MIDDLE EAR: BOUNDARIES



Oval window (fenestra vestibuli) = attach stapes; Round window (fenestra cochlea) other end of cochlea

OTITIS MEDIA



1. Otitis Media – middle ear infection

- common in children
- middle ear is Dead End Cavity

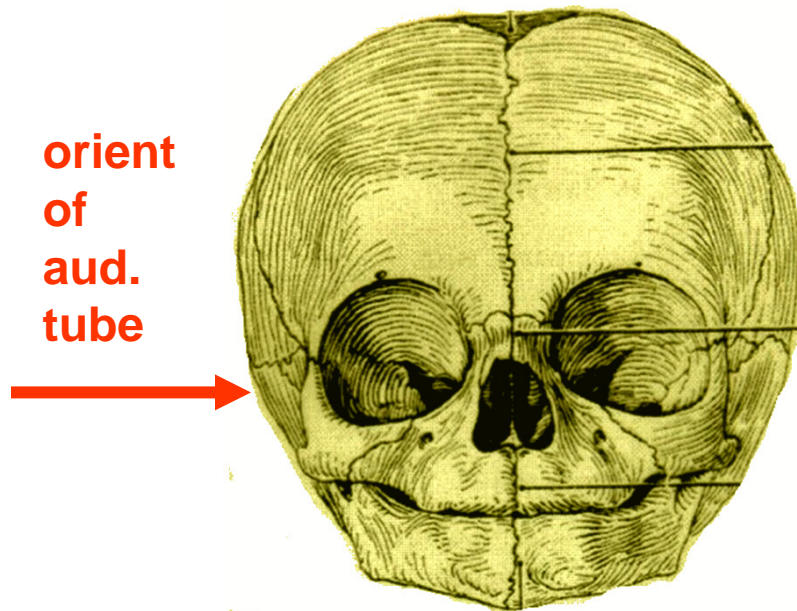
Tympanic Cavity is a Small space - In adult 15 mm. sup-inf, 15 mm. ant-post, 2-5 mm. med-lat

CLINICAL

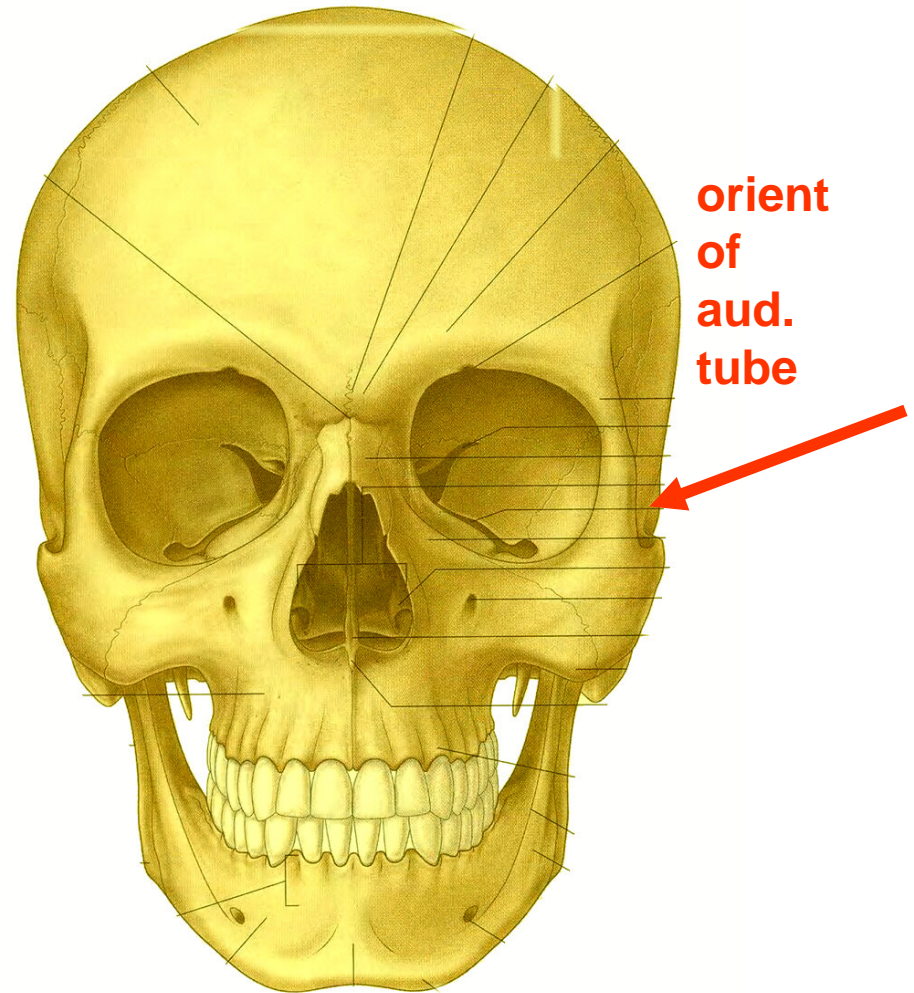
Nasopharynx **

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

OCCURRENCE OF OTITIS MEDIA DECLINES WITH AGE OF CHILD



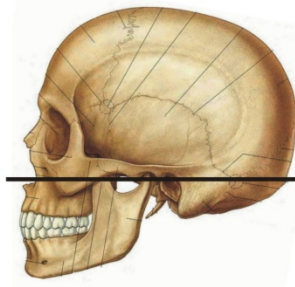
ORIENTATION OF AUDITORY TUBE CHANGES FROM HORIZONTAL TO ANGLED WITH CRANIAL GROWTH (but contribution debated); diameter of lumen of auditory tube also increases



Last peak incidence of Otitis media at about 5 years of age

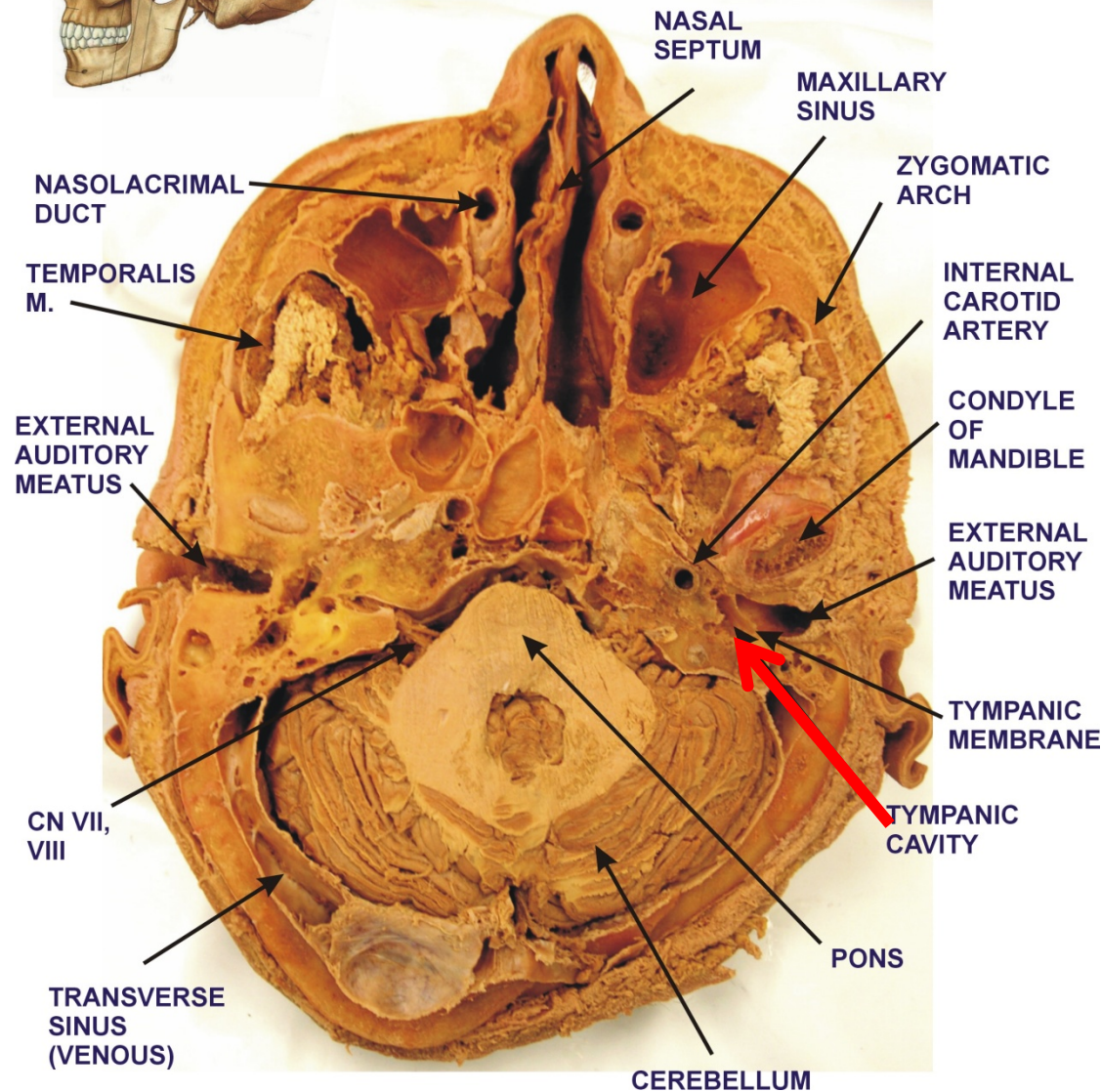
MIDDLE EAR: HEAD IN PLANE OF CT

1067



ORIENT TO PLANE OF SECTION:
Inferior to orbit, through external
auditory meatus

PROSECTIONS BY ELIZABETH DUKE
JCESOM CLASS OF 2010



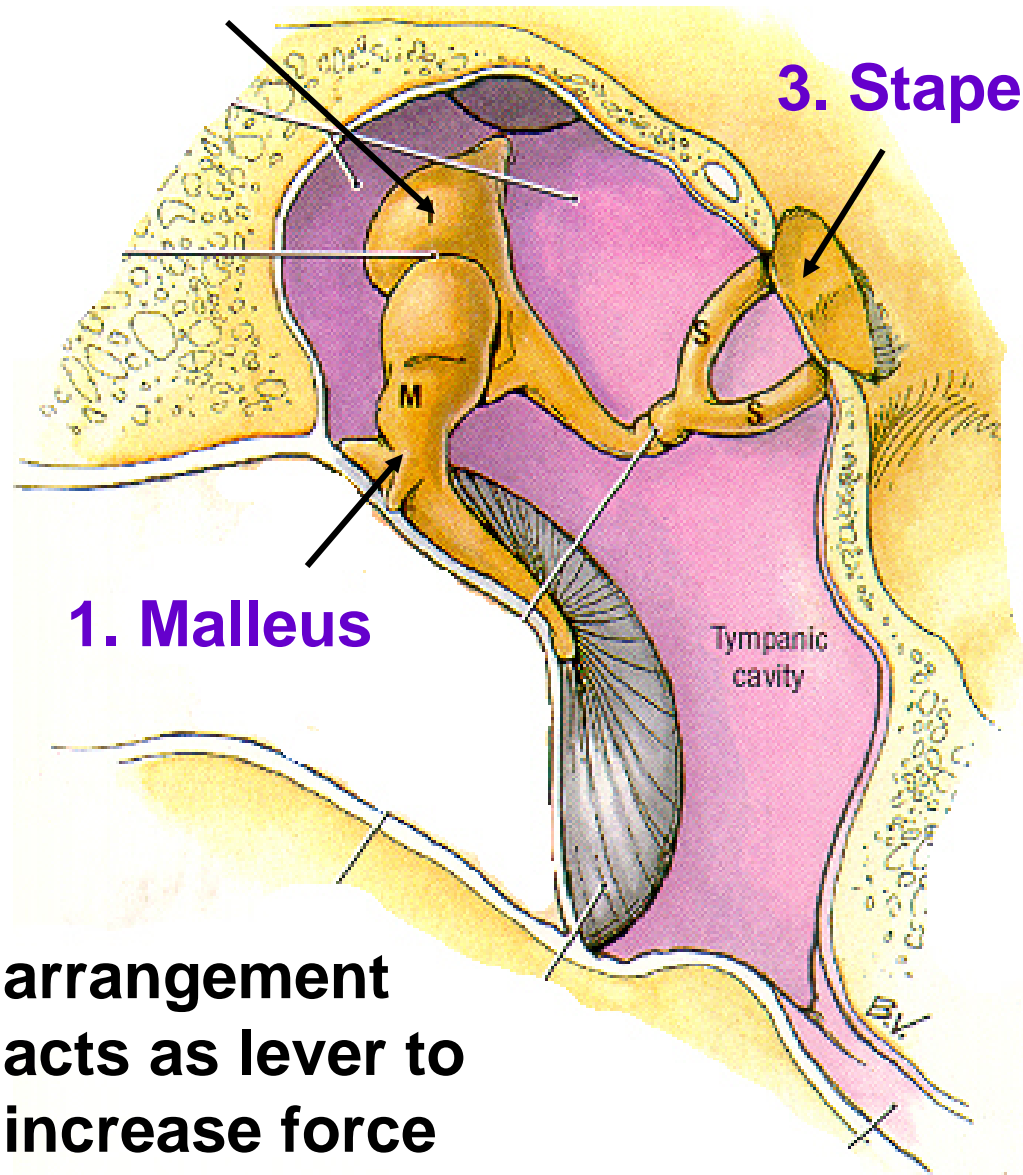
**PROSECTIONS
IN LAB:
NOT
REQUIRED
BUT
INTERESTING
SEE
DIAMETER OF
TYMPANIC
CAVITY**

B. AUDITORY OSSICLES

2. Incus

3. Stapes

1. Malleus



- link tympanic membrane to oval window and cochlea –

- anchored by ligaments

Malleus = hammer

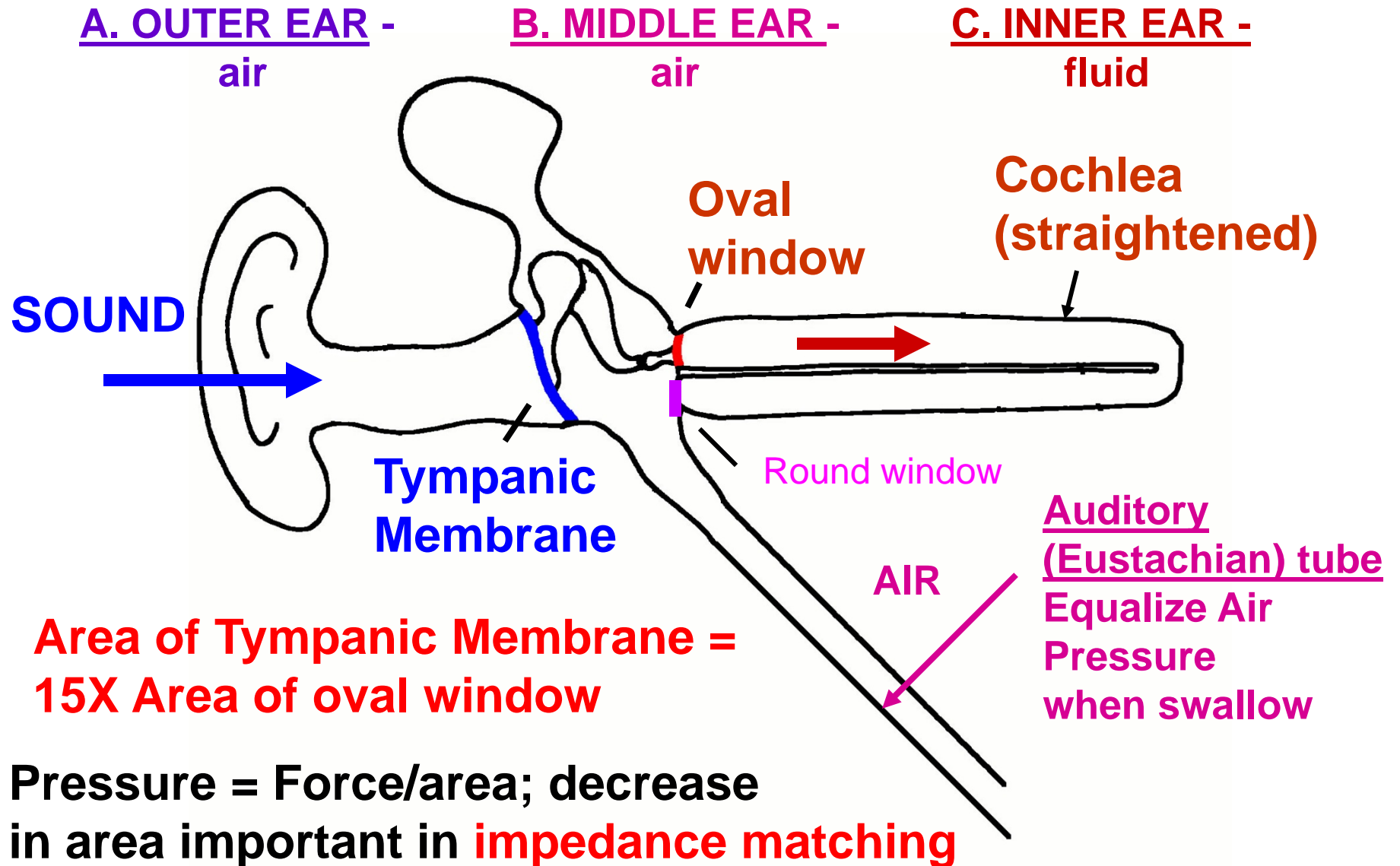
Incus = anvil

Stapes = stirrup

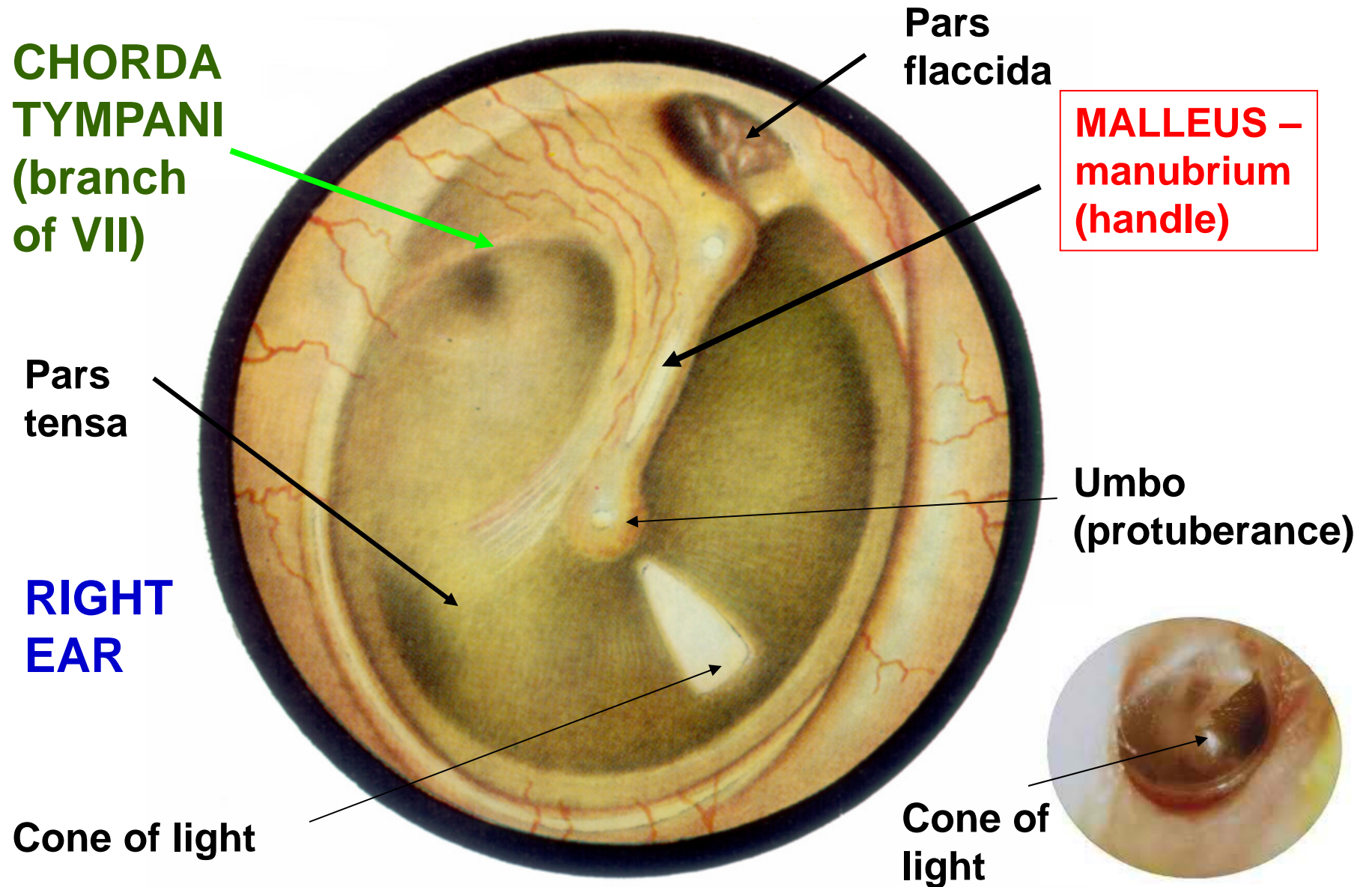
- Broad attachment of Malleus to tympanic membrane

arrangement acts as lever to increase force

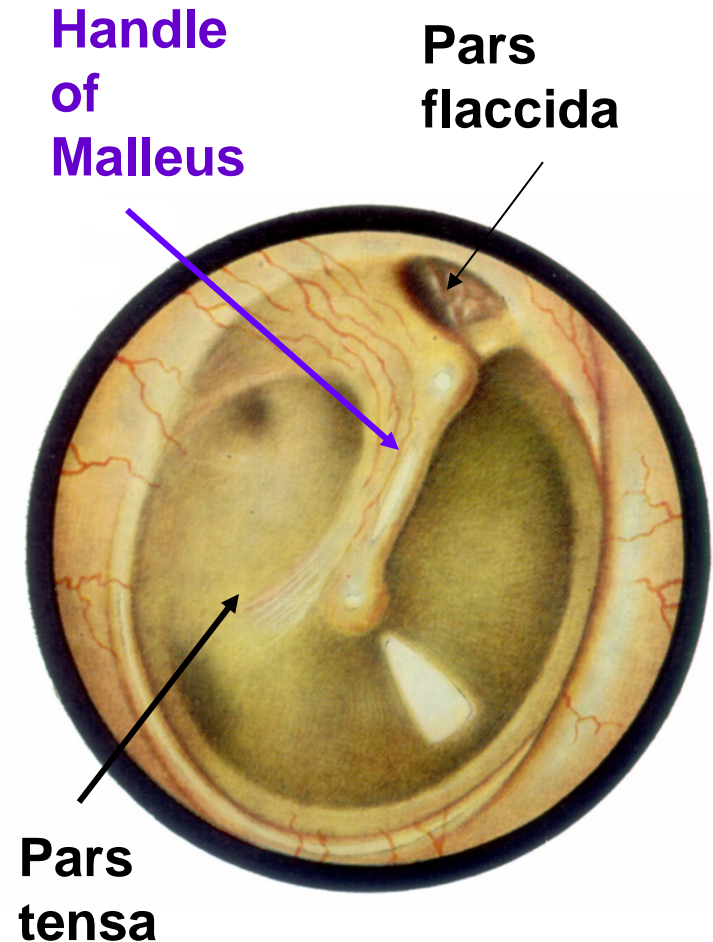
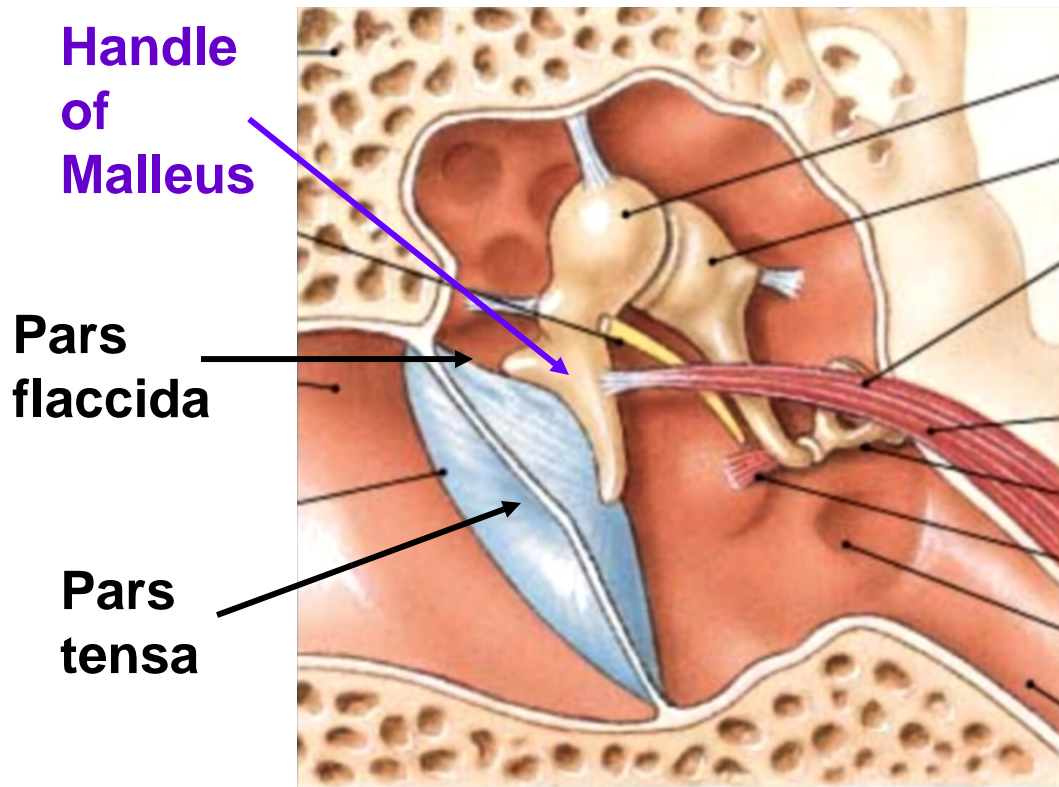
EAR: DIAGRAMMATICALLY - transmission of sound (Cochlea straightened)



OTOSCOPE VIEW OF TYMPANIC MEMBRANE

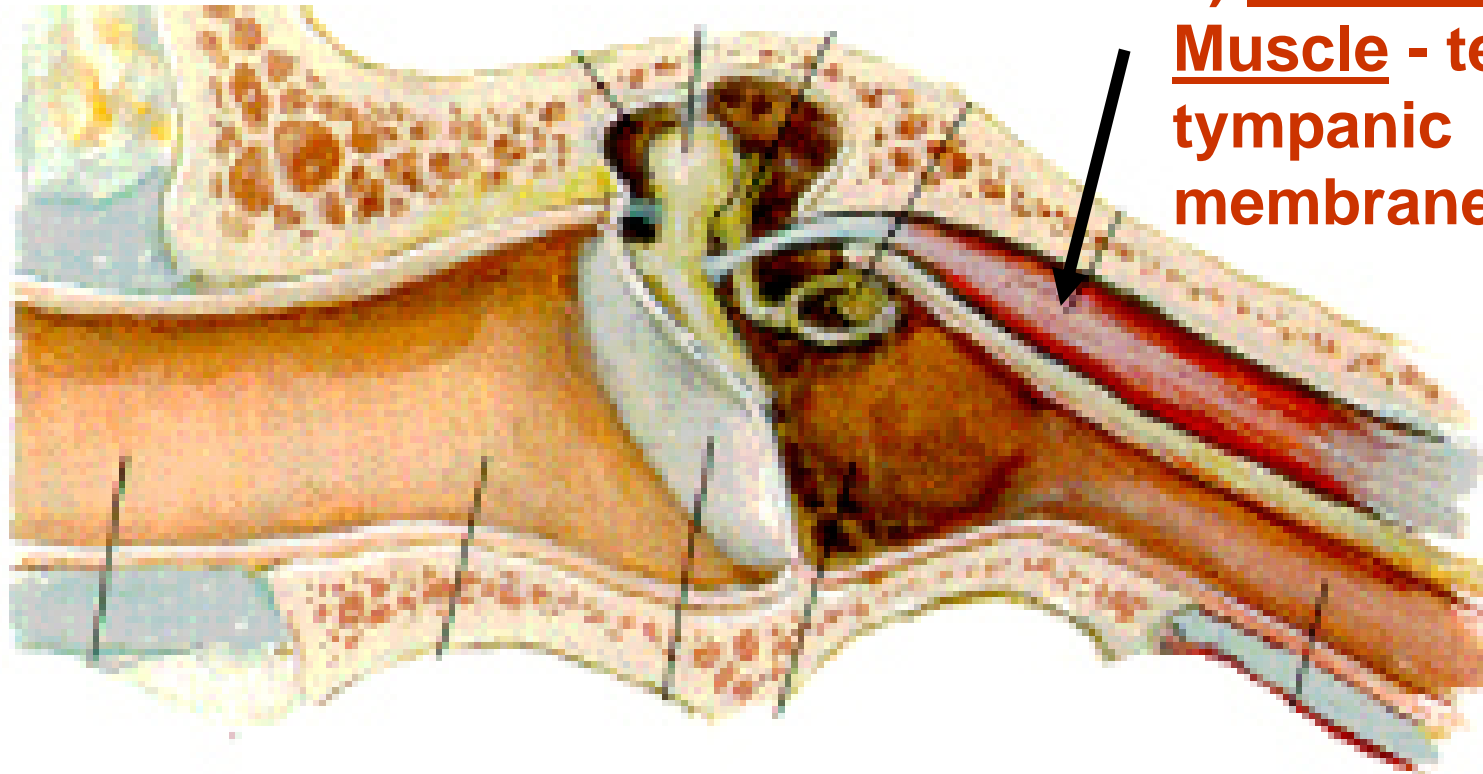


OTOSCOPE VIEW OF TYMPANIC MEMBRANE



Handle malleus is attached to upper half of Tympanic membrane; malleus is supported by ligaments linking it to wall of Tympanic cavity; part of Tympanic membrane surrounding handle is tense (pars tensa); upper end is less tense (pars flaccida)

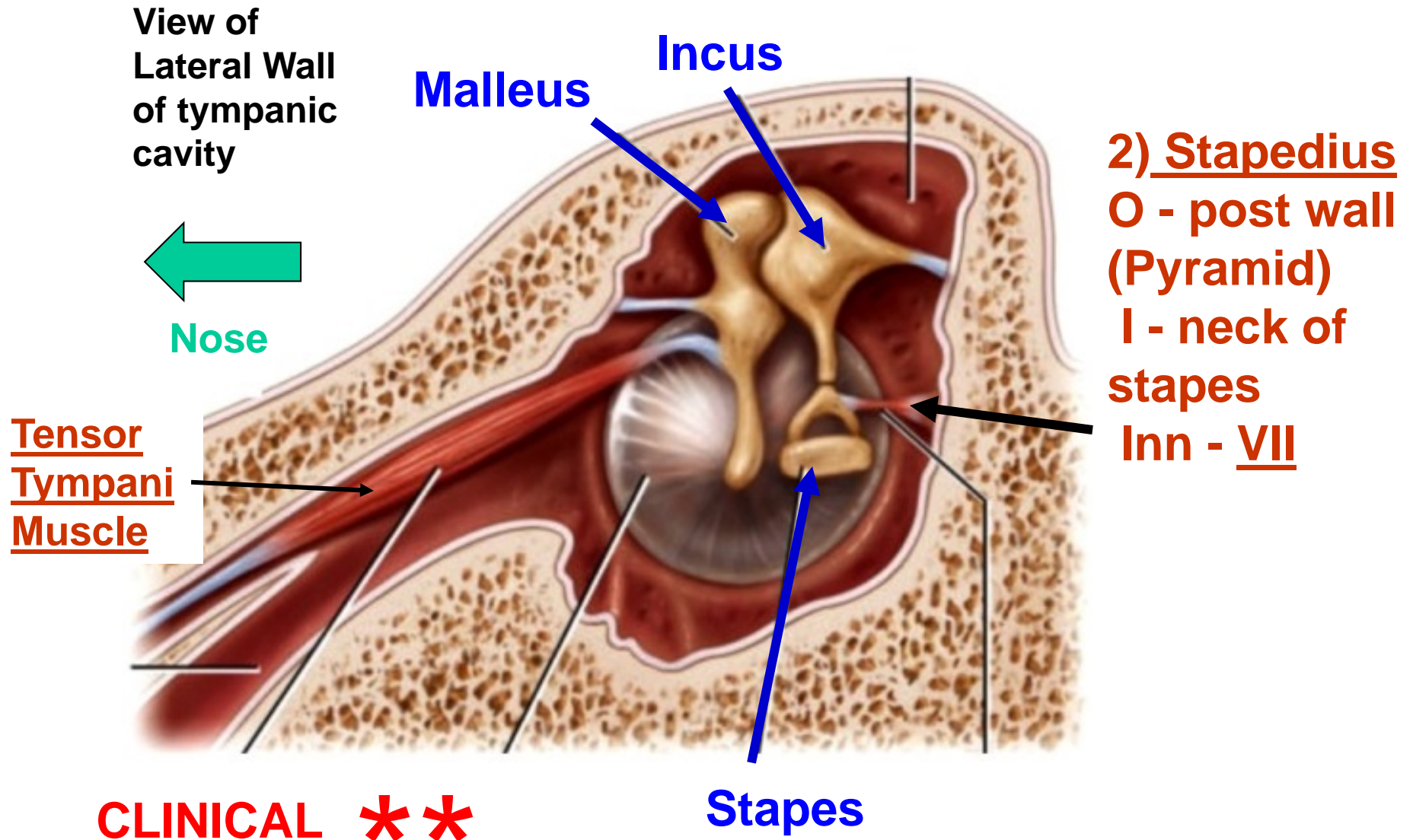
MUSCLES OF MIDDLE EAR - dampen sound



1) Tensor Tympani Muscle - tenses tympanic membrane

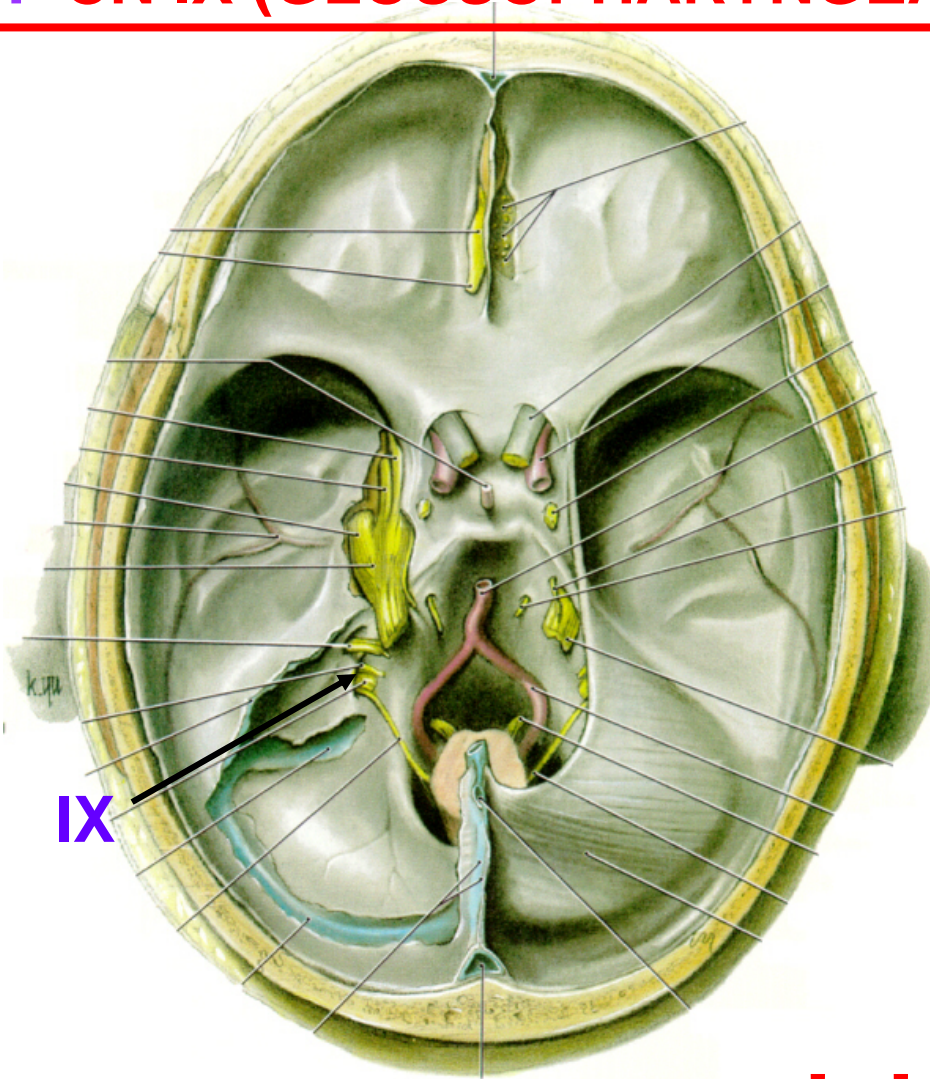
O - canal in ant. wall
I - handle of malleus
Inn - V3

C. MUSCLES OF MIDDLE EAR - dampen sound



Damage to VII - Hyperacusia - sounds seem too loud

**D. SENSORY INNERVATION - VISCERAL
SENSORY (GVA) FROM TYMPANIC PLEXUS
OF CN IX (GLOSSOPHARYNGEAL)**



leaves
Posterior
Cranial
Fossa via
Jugular
Foramen

IX

CLINICAL ***

- Innervation of
middle ear is
visceral sensory
from CN IX
(Glossopharyngeal)
- Children with
Middle Ear
infections cannot
localize pain -
'my head hurts'

BOARD QUESTION

IX - GLOSSOPHARYNGEAL

NOSE



Lesser
Petrosal N.

exits via
Jugular Foramen

Tympanic N.

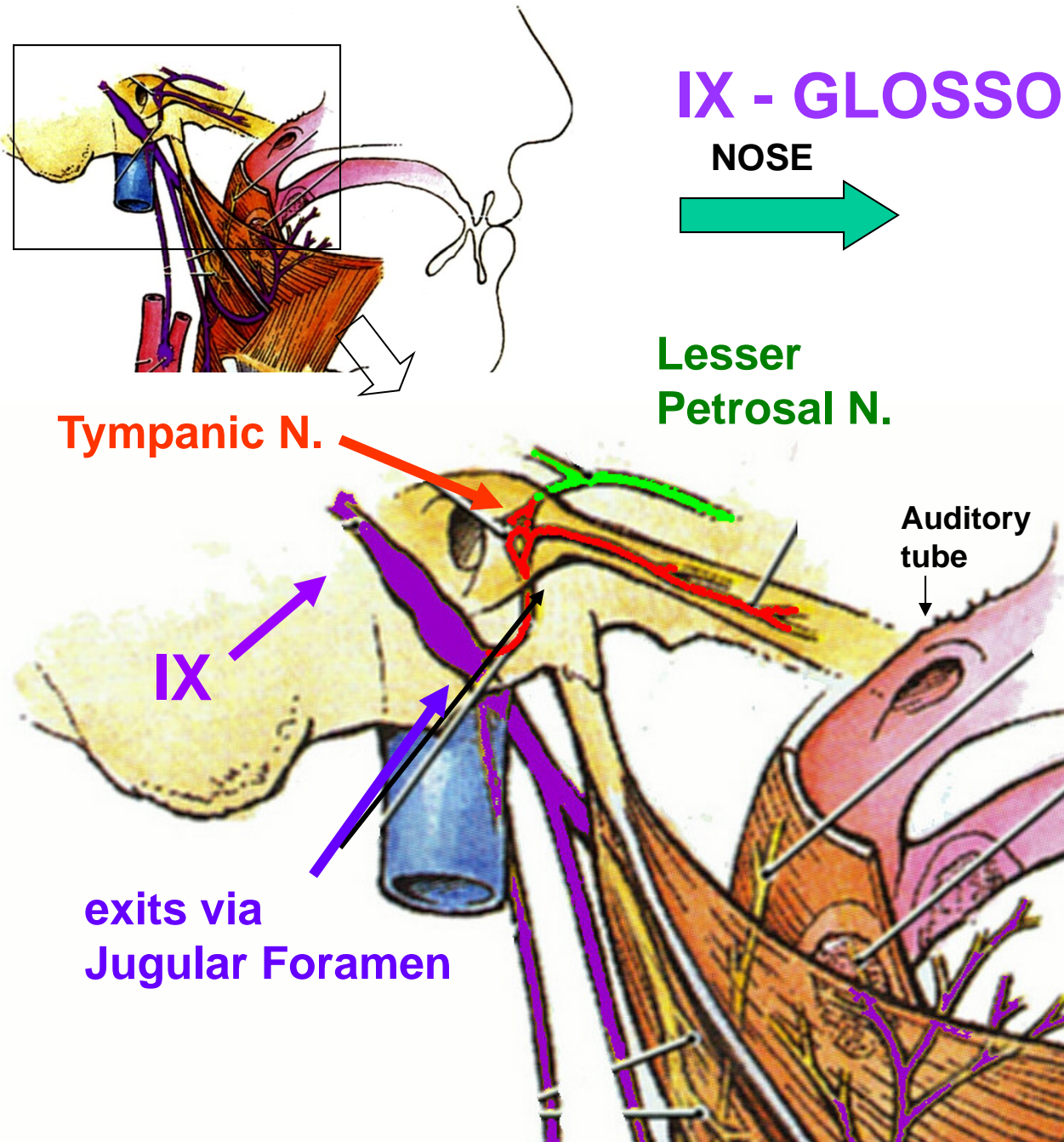
IX

exits via
Jugular Foramen

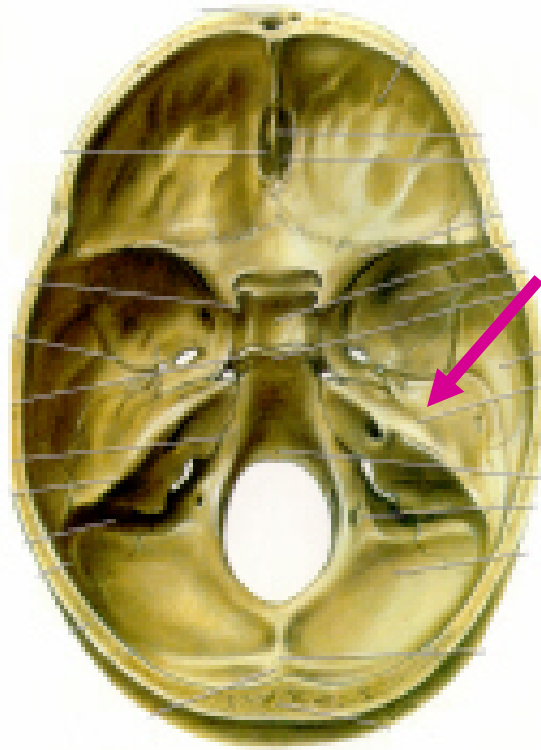
Auditory
tube

1. Tympanic Nerve
Forms tympanic
plexus; **VISCERAL
SENSORY** to
middle ear
Mastoid sinus
auditory tube

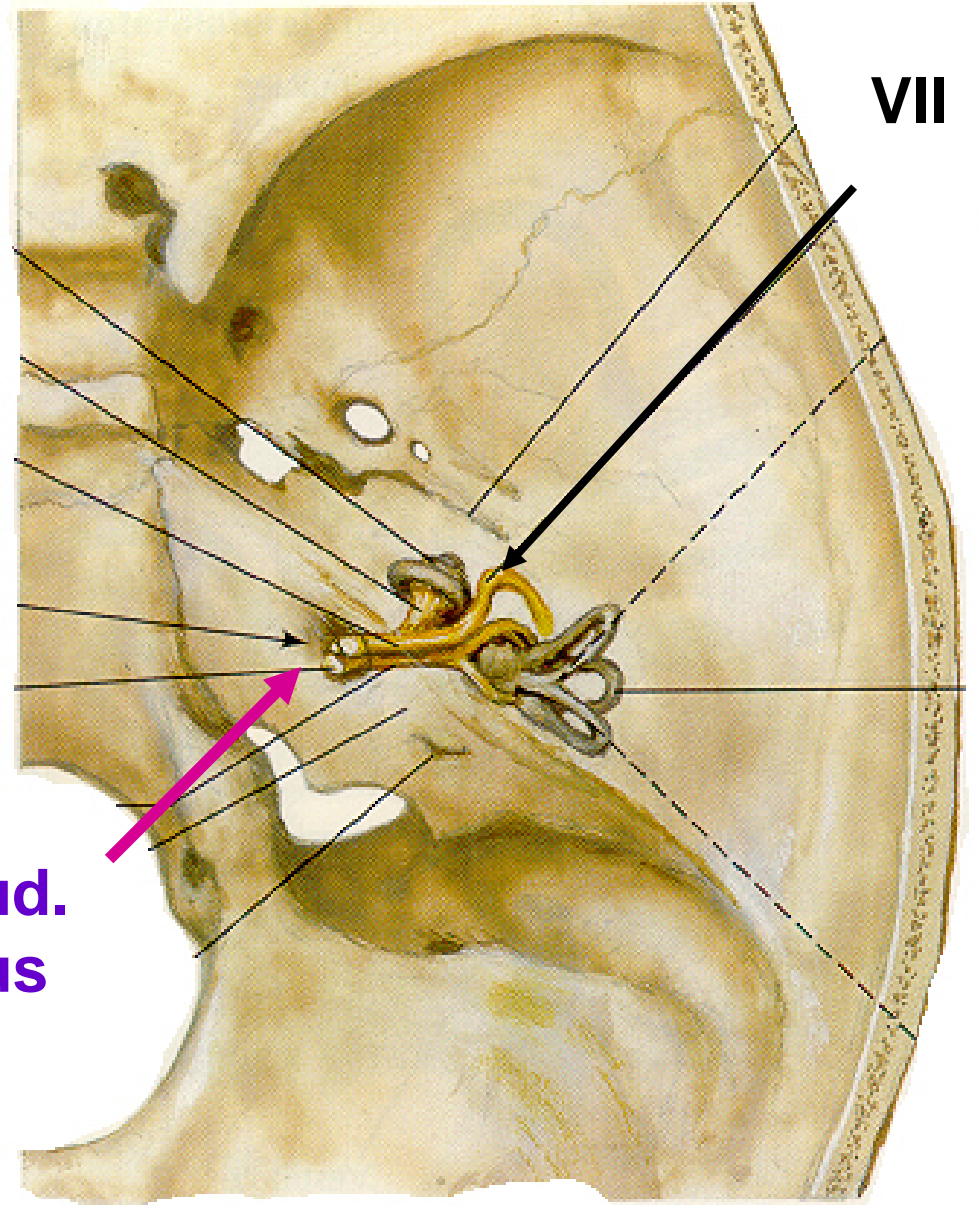
2. Lesser Petrosal
VISCERAL MOTOR
(parasymp)
To Parotid Gland



COURSE OF FACIAL NERVE (VII)



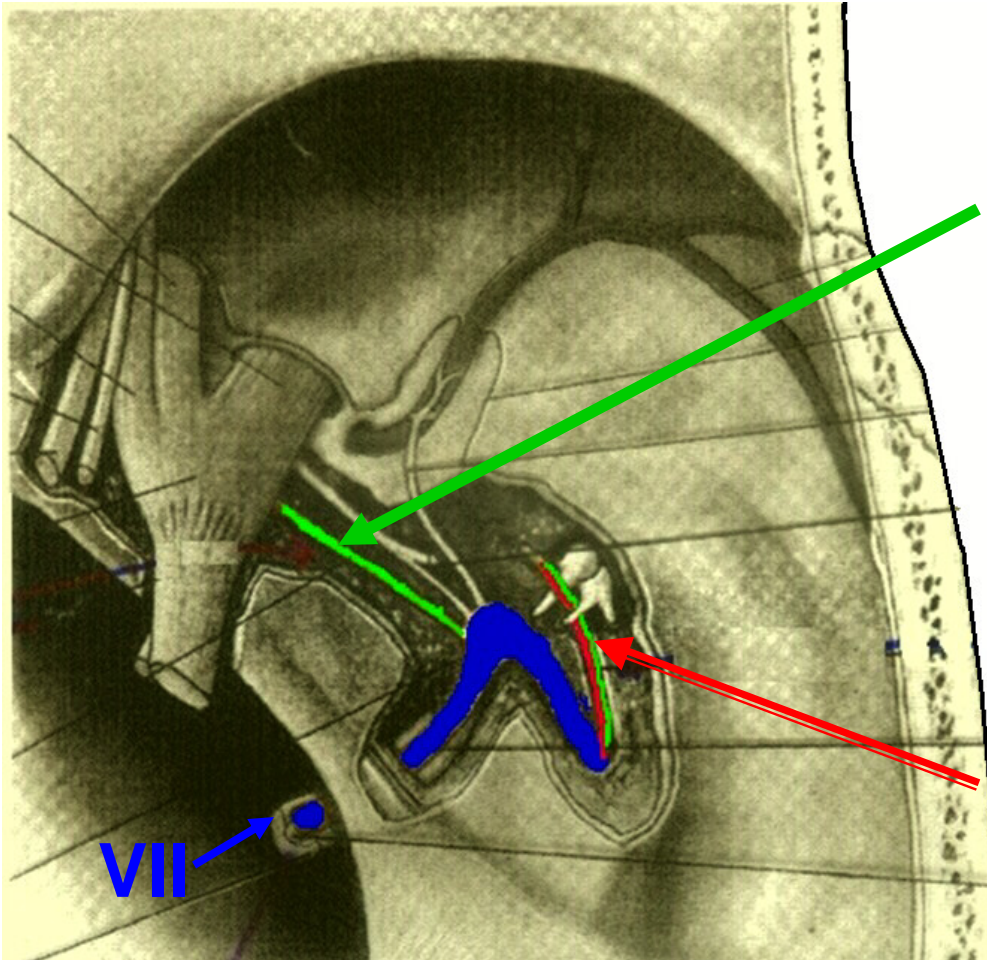
Petrous part of temporal bone



Int. aud. meatus

VII - FACIAL

leaves Posterior Cranial fossa via Internal Auditory Meatus - enters facial canal

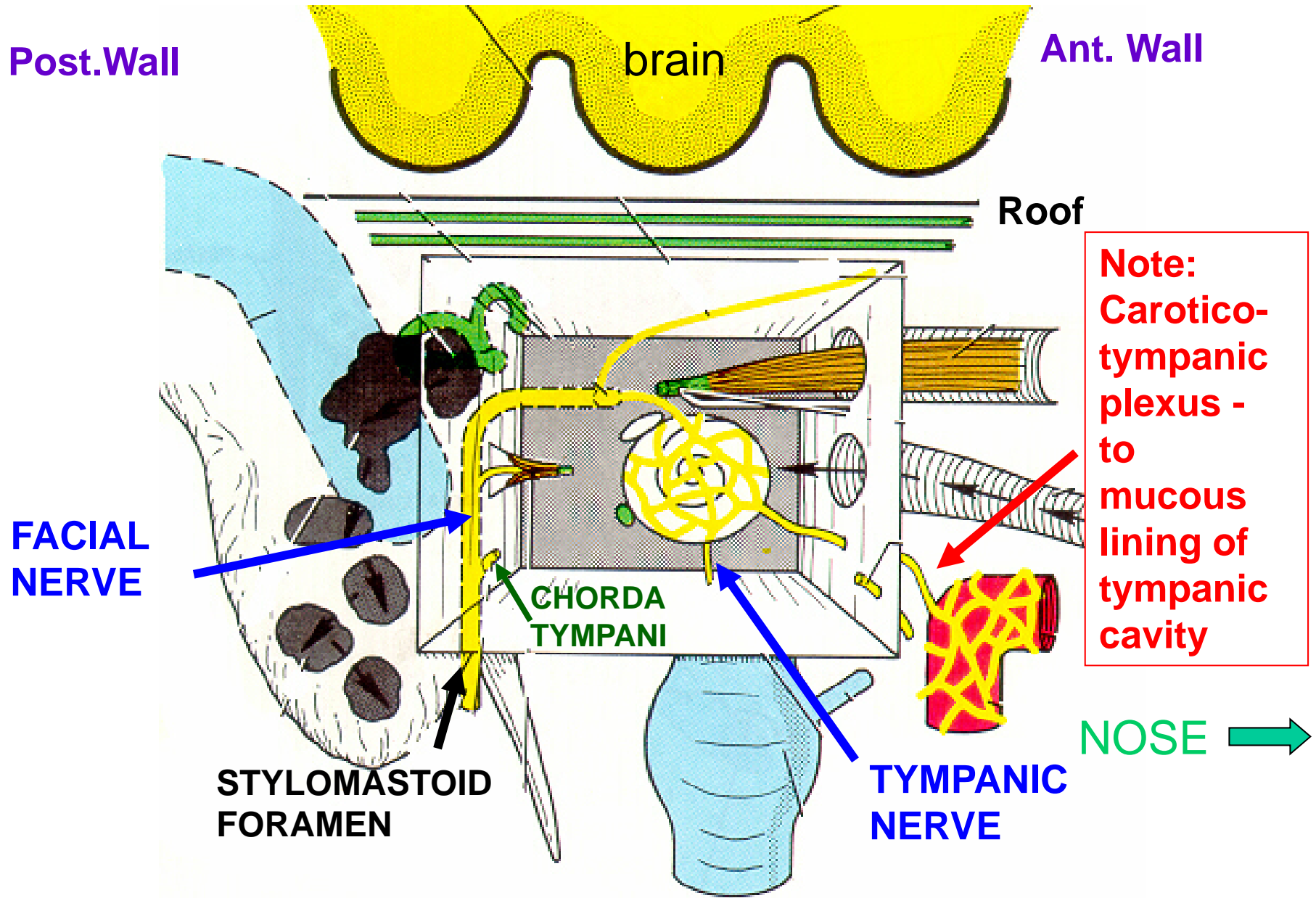


1. Greater Petrosal N.
VISCERAL MOTOR
Parasympathetics to
Lacrimal gland, mucous
glands of nose and palate,
[Visceral sensory to
Nasopharynx]

2. Stapedial N. -
Branchiomotor to
Stapedius

3. Chorda Tympani - has
A) Taste to ant 2/3 tongue
B) Parasympathetics to
Submandibular, Sublingual
salivary glands

LOCATION OF NERVES IN MIDDLE EAR

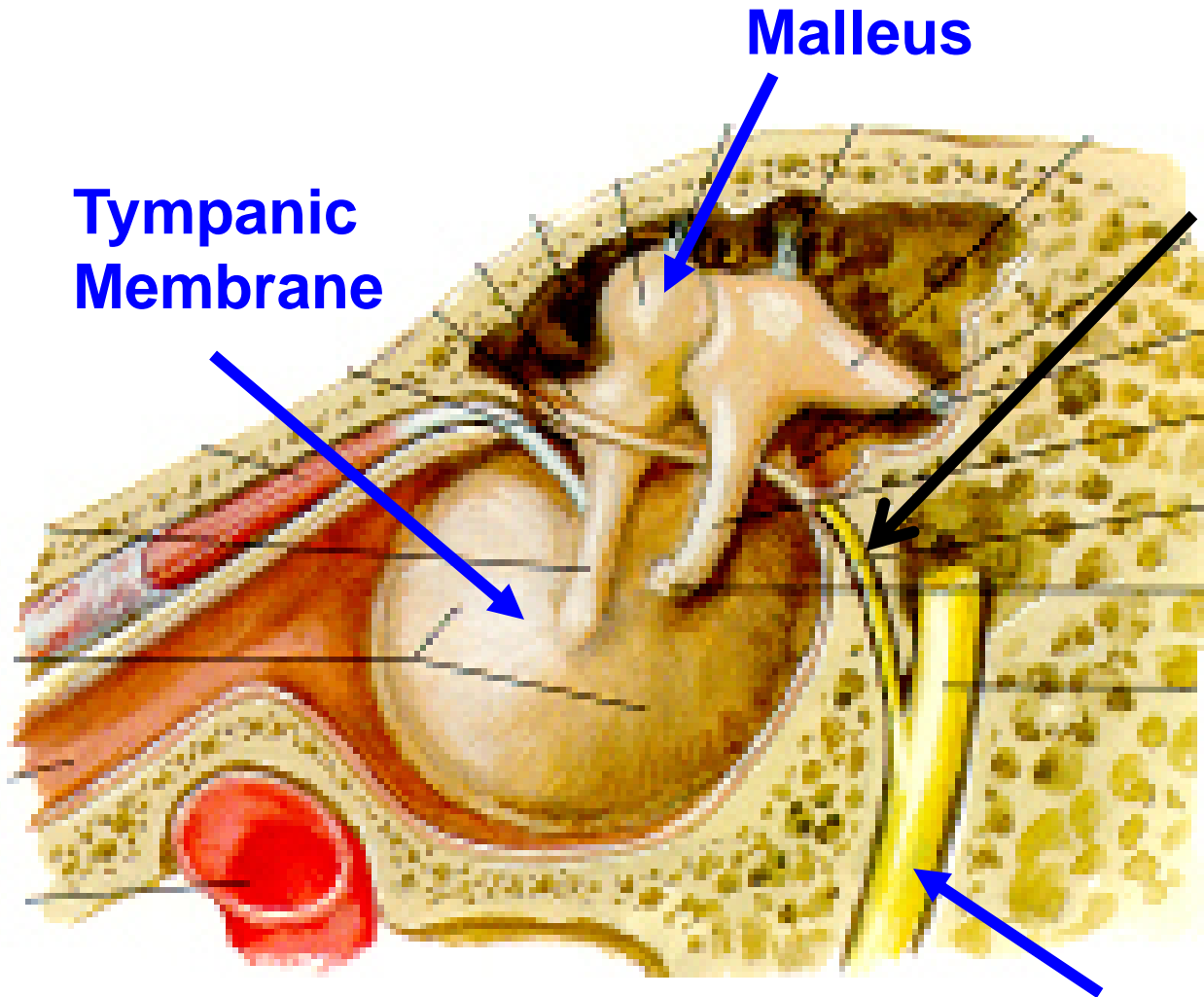


Looking at Medial Wall of Right Middle Ear with Ossicles Removed

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)**

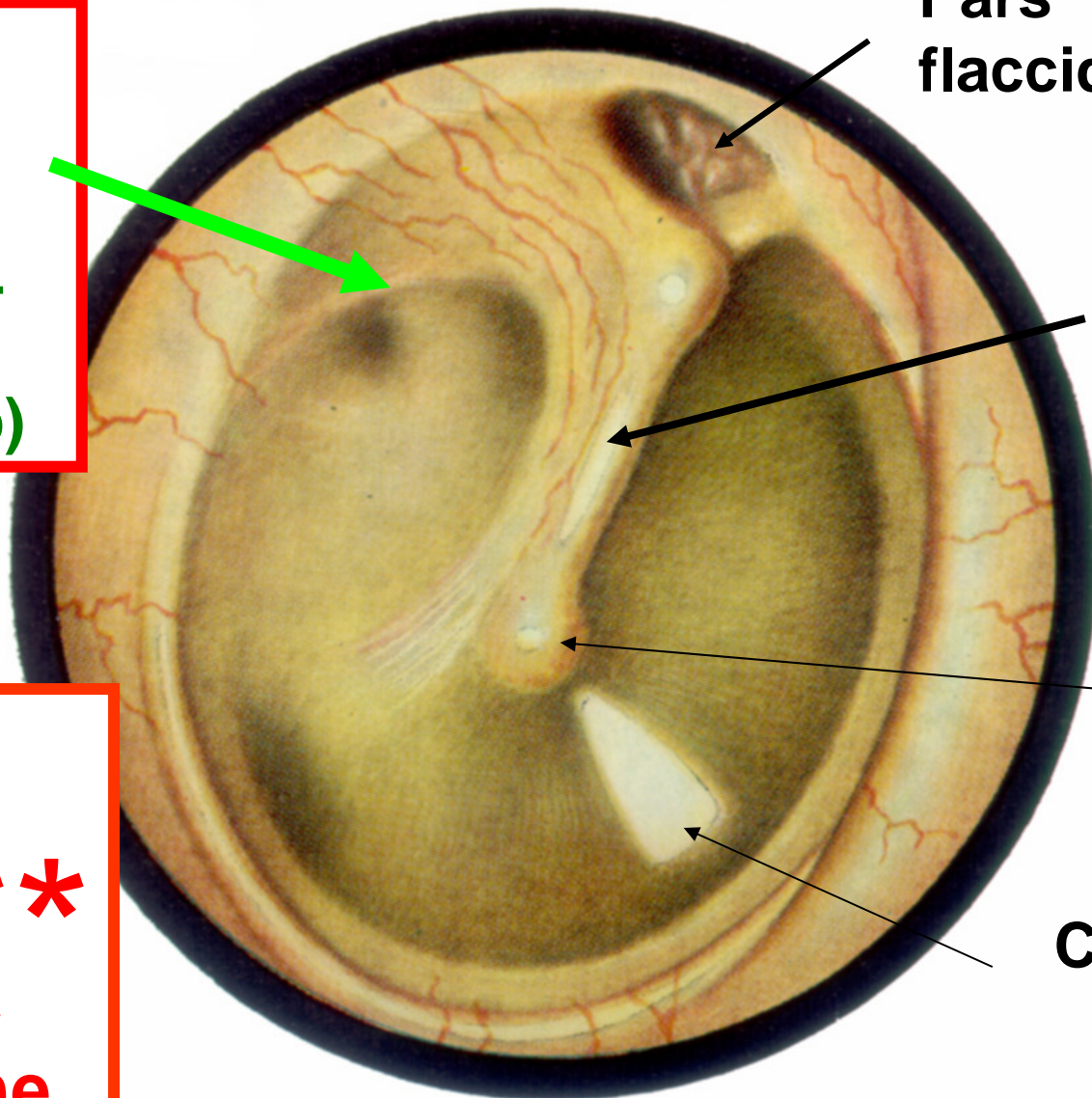
**MALLEUS –
manubrium
(handle)**

CLINICAL*

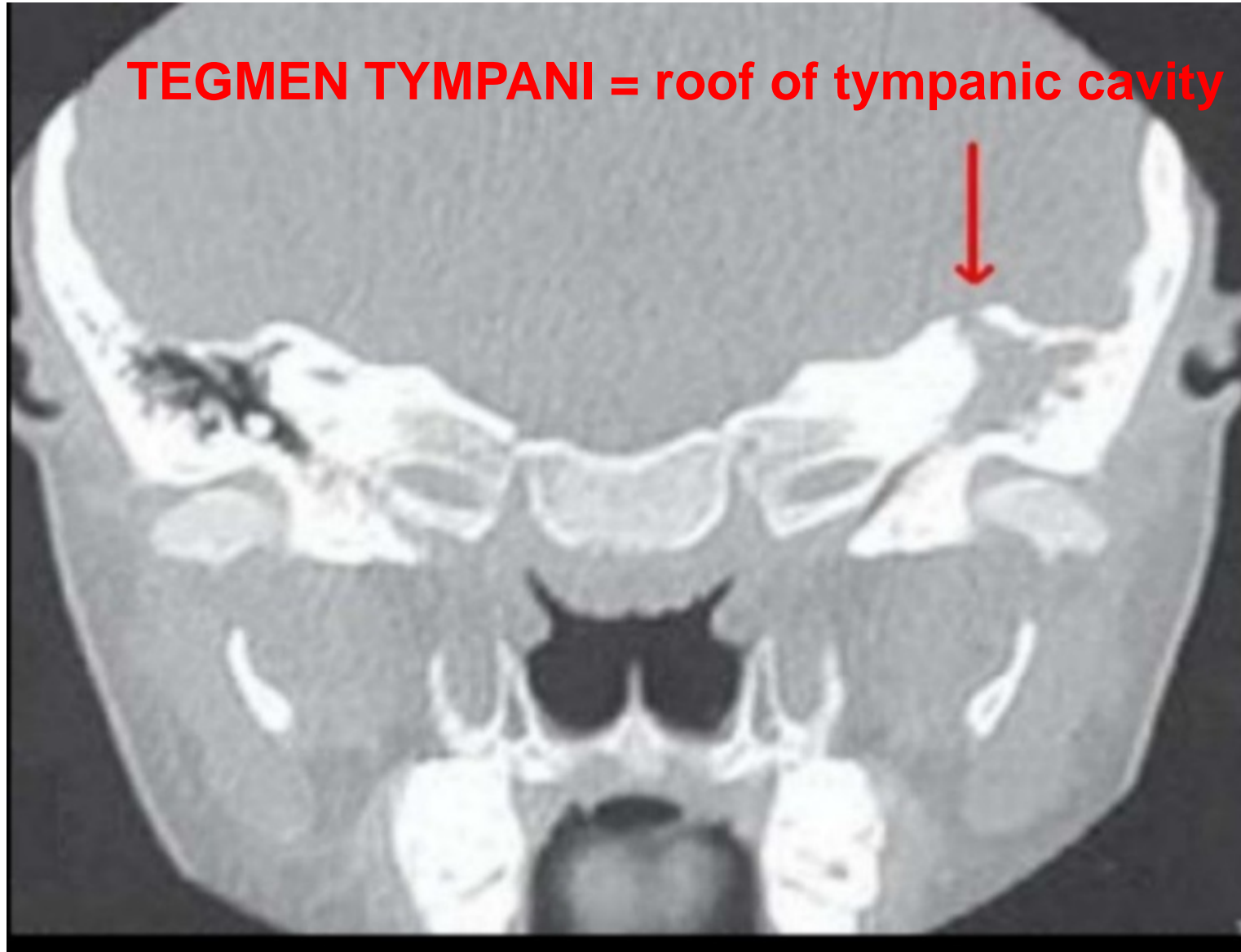
**Lose
taste if
pierce **
tympanic
membrane**

Umbo

Cone of light



EROSION OF TEGMEN TYMPANI IN OTITIS MEDIA



tegman L. = covering