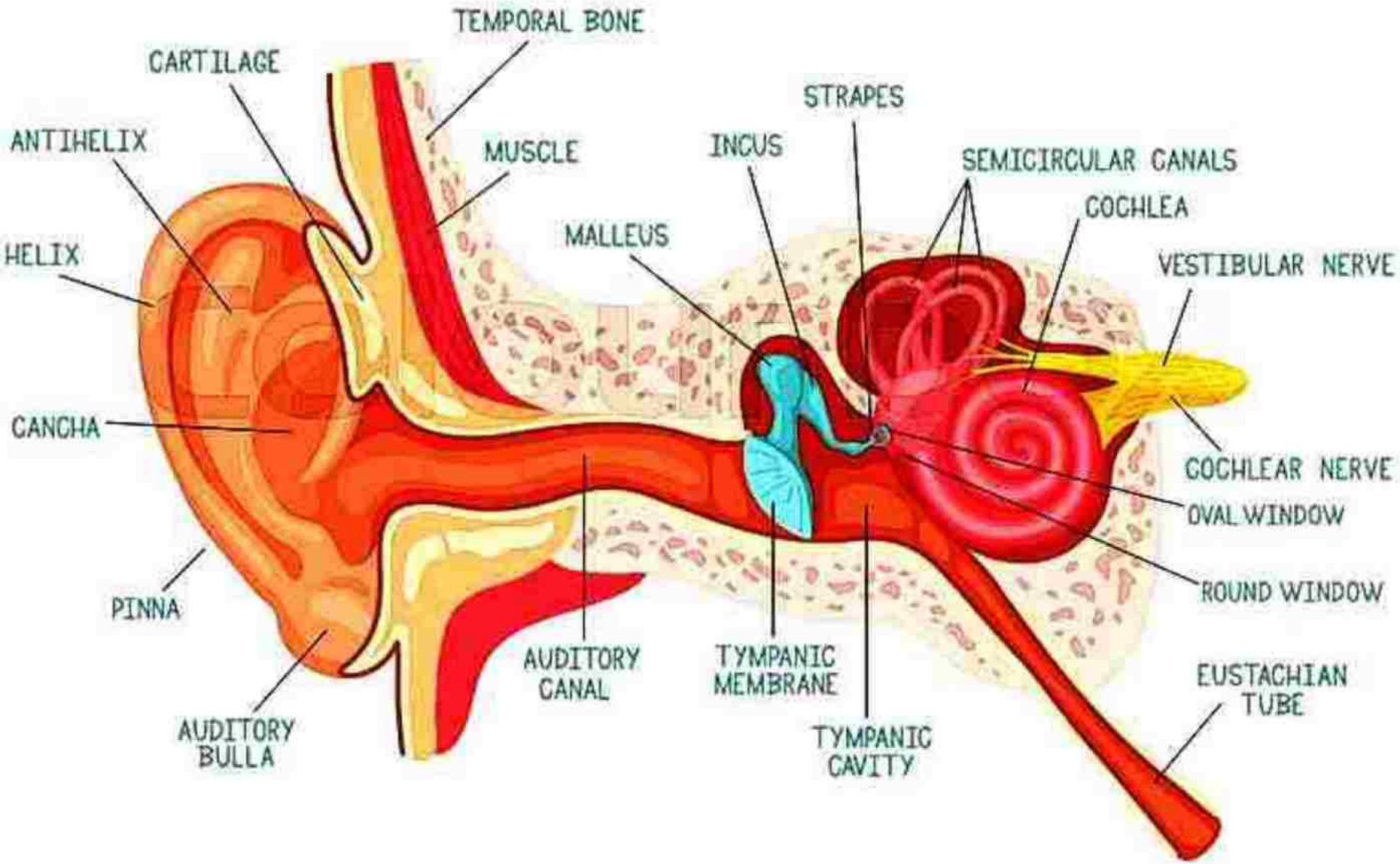
ANATOMY OF HUMAN EAR



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* Ear :-

→ The ear is an organ of Hearing and equilibrium of the Body
→ ear is 50 % Balance of Body.

→ The ear is Divided into 3 Main Region

1) External Ear (बाह्य कर्ण)
2) Middle Ear (मध्य कर्ण)
3) Internal Ear (आन्तः कर्ण)

1) External Ear (बाह्य कर्ण)
- It consists of
a) Ear auricle or Pinna
b) External auditory Meatus.

a) Ear auricle [कर्ण शुक्तिका]

→ It is seen on Surface
→ It is Flap of elastic cartilage, triumph Shaped and covered By Skin.

→ The Rim of the auricle is called Helix.
→ Soft lower Part is called Lobule.

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→ A large Depression in the ear auricle is called concha.

→ Muscle Related to auricle are vestigeal in Man.

- Blood Supply :- Post. auricular and
  :- Superficial auriculare
  Temporal A.

B) External auditory Meatus
or.
canal. [बाह्य श्रवण पथ]

→ It conducts the Sound waves from the concha to tympanic membrane.

→ It is a S Shaped curved tube
Length :- about 24 mm.

→ It 's Medial 2/3rd → 16 mm Length and Bony

→ Lateral 1/3rd → 8 mm Length and cartilagenous.
– It is Situated in Temporal Bone.

→ The Bony part is formed → Tympanic Plate
Plate lie to Perichondrium.
contains :- Hairs
:- Sebaceous glands
:- ceruminous glands.

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• ceruminous glands.
- It is modified sweat glands
- Secrete :- cerumen or ear wax

→ Hair and ear wax Protect the ear from dust and Foreign Bodies.

→ Isthmus :- Narrowest Point of canal.
:- lies at about 5 mm from Tympanic membrane.

• Blood Supply :-

- outer Part of auditory canal → Post. auricular and.
→ Superficial Temporal A.
- Inner Part → maxillary A: Branch of auricular A.

• Tympanic Membrane

→ Thin, Semi transparent Partition B/w the External and Middle ear.

→ It is covered By epidermis → lied By Simple cuboidal epithelium.

→ oval Shaped
→ 1 cm Diameter
→ Placed - obliquely at an angle of 55° with Floor of meatus.

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→ It is directed Downwards, forward and laterally.

→ outer surface → convex.
Inner surface → convex

UMO :- The point of maximum convexity lie at the Tip of the Handle of Malleus.

→ The pars Tensa :- Max. part of tympanic membrane is tense.

→ The pars flaccida :- loose part of tympanic membrane.

→ Tensor Tympani Muscle is Held tense By Inward Pulling to Tympanic Membrane

→ Tensor Tympani Muscle attached to the Handle of Malleus.

→ The Tympanic Membrane is extremely sensitive to pain is innervated By auricular temporal Nerve and auricular Branch of vagus.

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2) Middle Ear (मध्य कर्ण)

→ Narrow air filled space situated in → Petrous Part of Temporal Bone.

→ In Btw external Ear and Internal Ear.

→ Shaped :- cube

- lateral and medial wall is large
- other wall is Narrow

→ Sub divided → tympanic cavity Proper
→ epitympanic Recess (lie above tympanic membrane)

- Communication :-
  - Anteriorly → Nasopharynx through Eustachean Tube.
  - Posteriorly → Mastoid antrum → aditus

- Boundaries

1) Roof :- Thin Plate Bone → Tegmen Tympani Part of Temporal Bone.

2) Floor :- Thin Plate Bone of Temporal separate

Superior Bulb of Internal Jugular vein.

→ glossopharyngeal Nerve.

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3) Anterior wall

- Upper most :- Tensor tympani
  Middle Most :- Auditory tube
  Inner Most :- Thin plate of Bone
  ↓
  Separated - Internal carotid A.

4) Posterior wall.

- Superiorly - aditus → through which → epithelamic Recess.
  (Mastoid) Tympanic antrum. ← communicate

- Opening → for Passage of Tendon of Stapedius Muscle.
  ↓
  Smallest Skeletal Muscle of Body

- Chorda - tympani Nerve Post. edge of Tympanic Membrane.

5) Lateral wall.

- Separate middle ear from external acoustic Meatus.
- Tympanic membrane → along → tympanic Ring & Sulcus.

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6) Medial wall

- It formed the lateral wall of the Inner ear.
- Shows a Rounded Projection called Promontory
- 2 opening
  - i) Fenestral Vestibuli
    - oval shaped opening.
    - closed By Base of Stapes.
  - ii) Fenestral cochlea
    - Round Shaped Opening
    - closed By Secondary tympanic membrane.

→ 3 small Bone → Malleus
→ Incus
→ Stape

→ 2 Muscles.

	Name	origin	Insertion	Nerve
i)	Tensor Tympani	wall of auditory tube	Handle of Malleus	5th cranial Nerve
ii)	Stapedius	Pyramid Post. wall (Bony Projection)	Neck of Stapes	Facial Nerve

↳ Action → Dampen down Vibration

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- Auditory Tube :- extends to anterior wall of the tympanic cavity

- Mastoid Antrum :- lies to Middle ear (Behind) the petrous Part of Temporal Bone.
  :- communicates with the middle ear By aditus

- Mastoid Air cells :- Mastoid Process beings develop during 2nd year of life.
  :- It is Series of Inter connected cavity within the Process.
  :- continuous antrum
  ↓
  Middle ear

- Blood Supply

- Ant. tympanic Branch → Maxillary A.
- Post. tympanic Branch → Post. auricular A.
- Pharyngeal A.

etc--

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3) Internal Ear (अन्त: कर्ण)

→ The Internal Ear is lies in the Petrous Part of Temporal Bone.

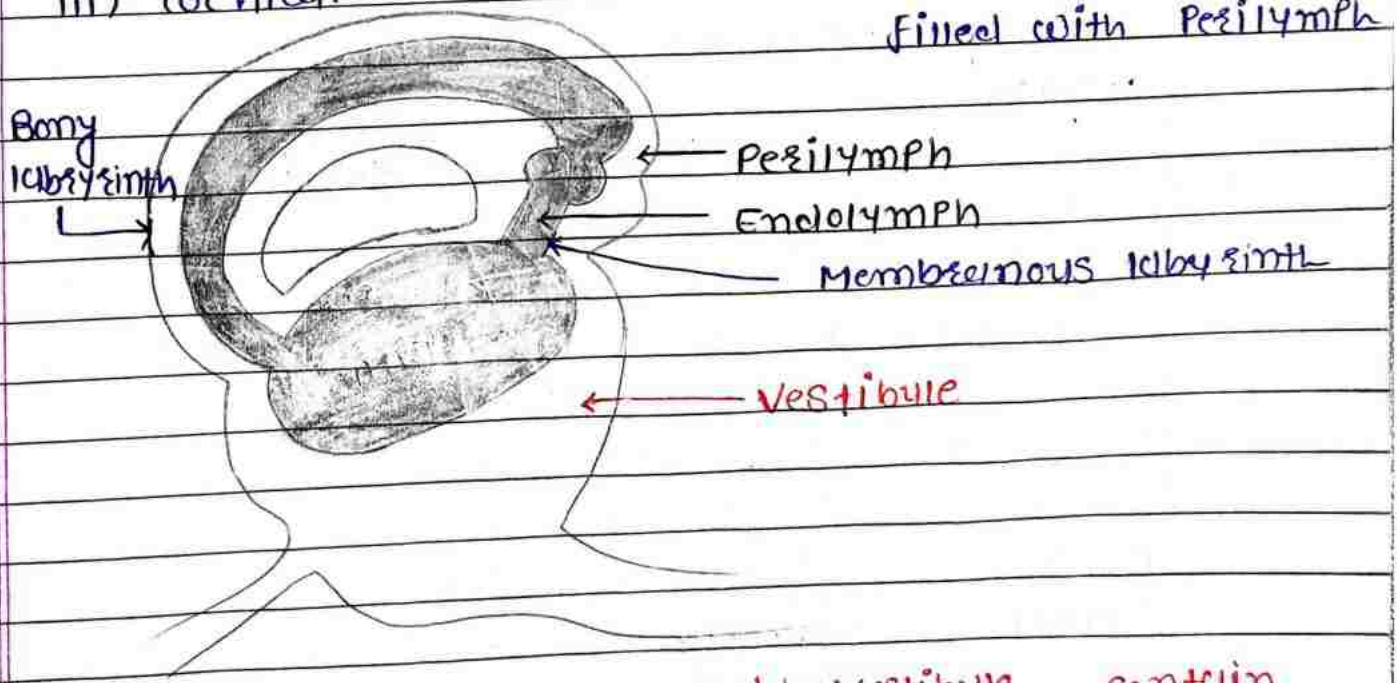
→ also called labyrinth

- Membranous labyrinth :- Bony labyrint is enclosing a Mem. labrinth

i) endolymph → it Membrane is filled with fluid.
ii) Perilymph → Separated from the Bony labrinth By another Fluid.

(*) Bony Labrinth — (Filled with Perilymph)
- consistes 3 Parts.
i) Vestibule
ii) Semicircular canals
iii) cochlea.

- These structure are lined By endosteum & Filled with Perilymph



→ Semicircular canals and Vestibule contain Receptors for equilibrium

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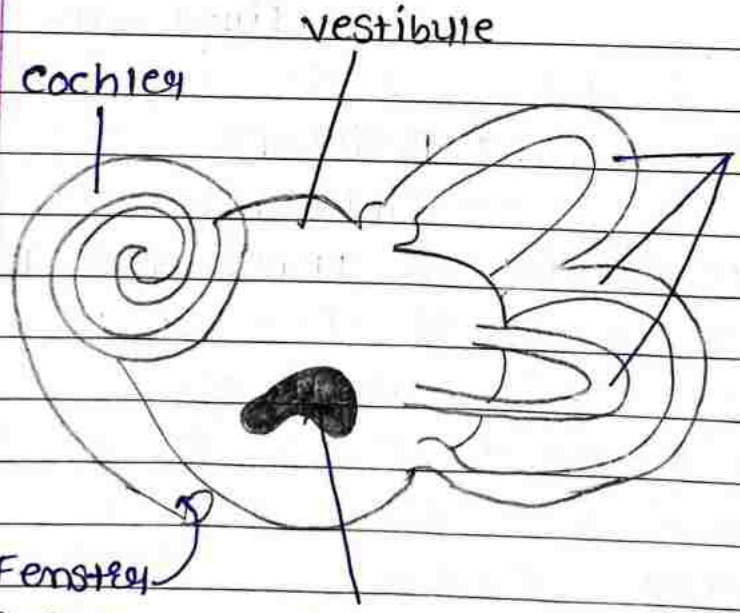
i) Vestibule and Semicircular canal.
- central part of the Bony labyrinth
- 3 Semicircular canals open into the Posterior wall.
5 opening into vestibule.

i) Anterior or. Superior
ii) Posterior
iii) Lateral
] 3 Semicircular canal.

→ End of each canal is dilated to form ampulla.

ii) → Fenestra vestibuli :- Also known oval window
- connects the Middle ear to Inner ear
- membrane covered opening.



[• Bony labyrinth.]

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ii) cochlea

★ → cochlea is contains Receptors of Hearing

- anterior Part of the labyrinth.
- Snail Shell Shaped coiled structure.

- It has a conical central axis called Modiolus around which the cochlear canal makes 2 & 3/4 turns.

- The cochlear canal is divided into

  i) Scala vestibuli ↳ Bico to Scala Media.

  ii) Scala tympani

- Scala vestibuli and Scala tympani are Intercommunicated By a small opening called Helicotrema

Membranous labyrinth [Filled with Endolymph]

- It is a Specialized Receptors.

  i) Receptor of sound → organ of corti
  ii) Static Balance → Macula
  iii) Kinetic Balance → Cristae.

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→ Membranous labyrinth is again consist of 3 main parts —

i) The spiral duct of cochlea (Hearing)
ii) Semicircular ducts (kinetic Balance)
iii) Utricle & Saccule in vestibule (Static Balance)

i) The Spiral Duct of cochlea & Scala Media

- It occupies → Middle part of cochlea and B/w Scala vestibuli and Scala Tympani.

- It is triangular cross section —
  - Floor is formed → Basilar's membrane
  - Roof is formed → Vestibular or Reissner's membrane

→ The organ of corti —

- It's Based on Basilar Membrane
- It is end organ of Hearing

• Sound waves Reaching to → endolymph through vestibular membrane. → Basilar Membrane ← on Make Vibration.

→ Therefor the organ of corti Various Frequencies of Sound. ← Stimulated By

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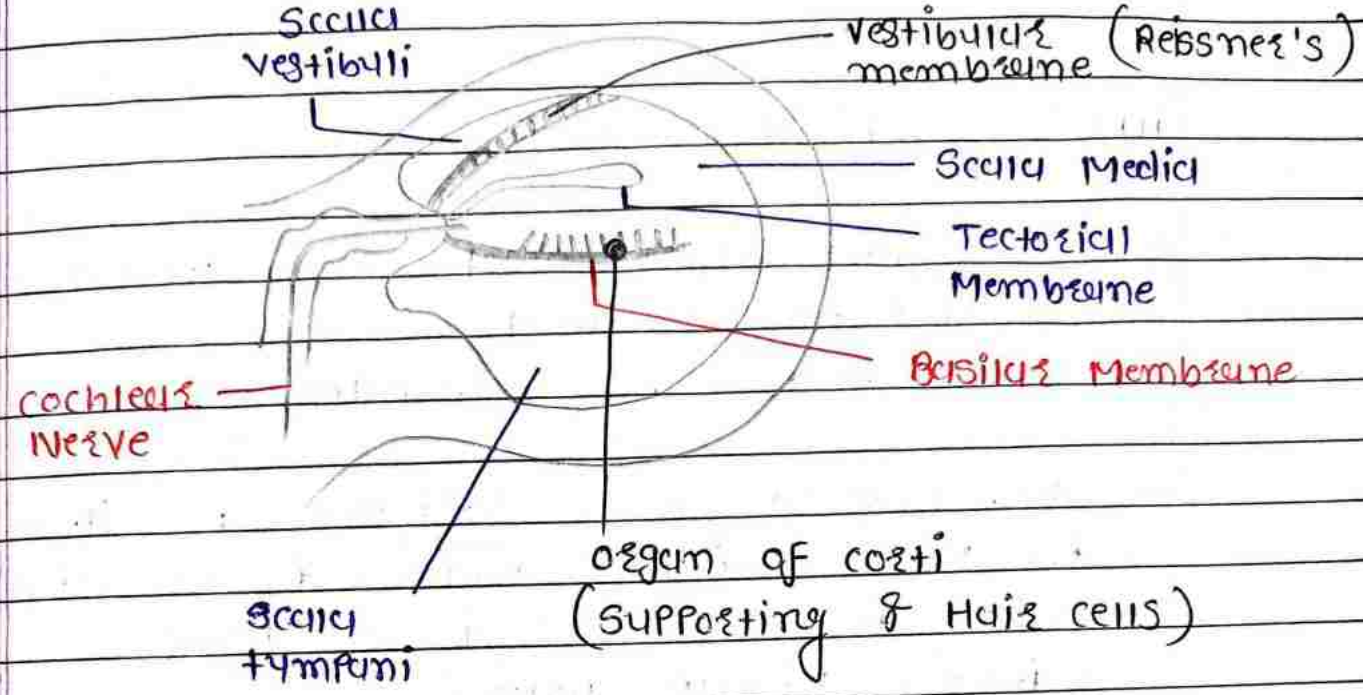
→ In contains 16000 Hair cells.
which are associated with cochlear Nerve



[· Cochlea ·]

ii) Sacculle & utricle —

- Membranous part of the vestibule.
- Responsible for Detecting vertical linear acceleration. and Head Position Relative to gravity (Macula) i.e Static Balance
- working with the utricle to Maintain Balance

- utricle :- lies in the Postero-superior part of vestibule (5 opening & 3 semicircular ductus)

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→ The medial wall of the saccule and utricle are thickened to form a macula in each chamber

iii) Semicircular Ducts —

- 3 Semicircular ducts are situated in semicircular canals.
- Each ducts has ampulla.
- An end organ cristae is situated in the ampulla which is associated with the movement of Head.
  i.e → Kinetic Balance.

• Structure of organ of corti —

- also called coiled sheet of epithelium —
- following cells.
  i) Supporting cells
  ii) Hair cells (16000)
    - Outer (Three Rows)
    - Inner (one Row)
  iii) Pillar cell (external & Internal)
    Rod cell

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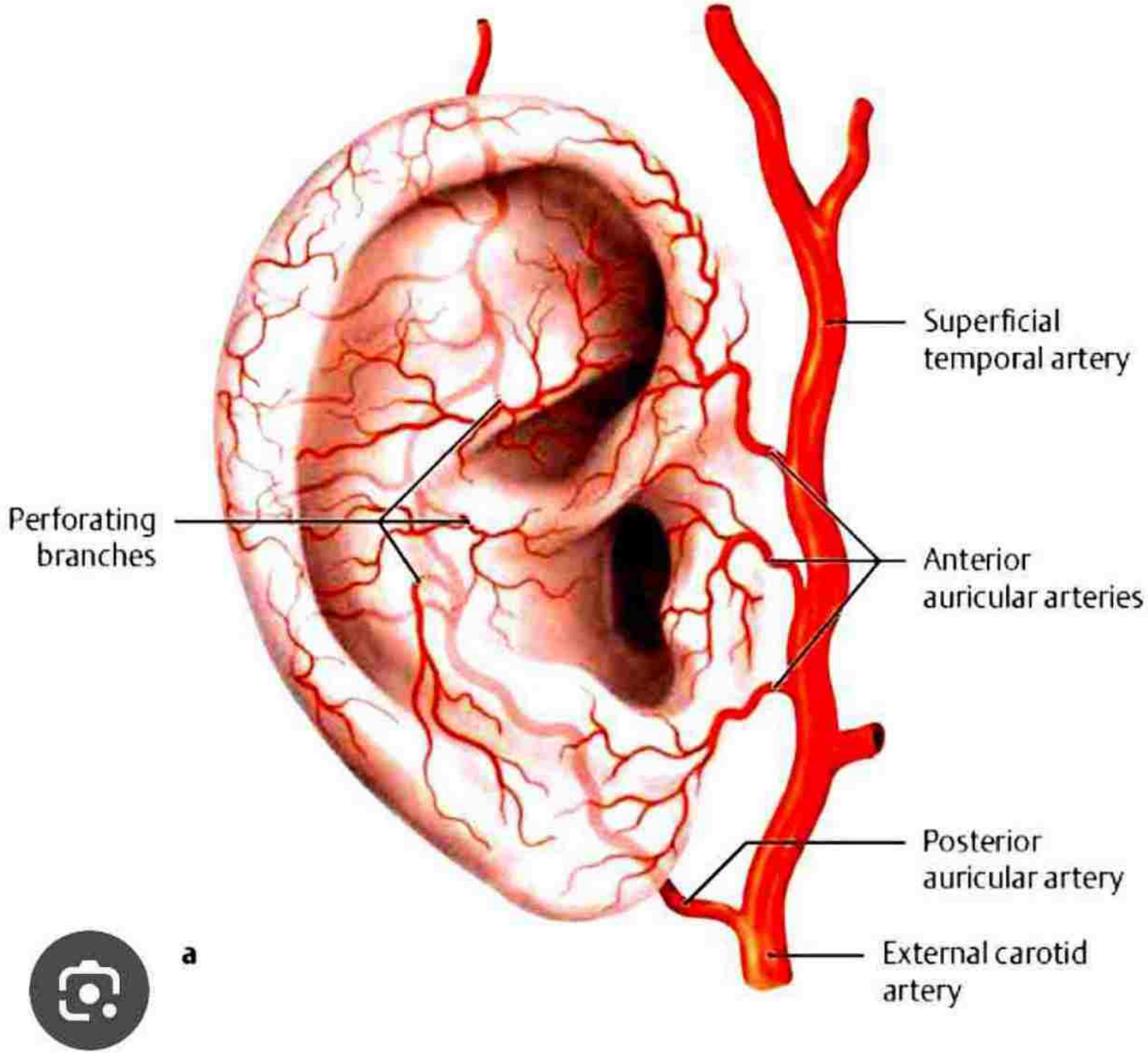
- Tectorial membrane :→ covers the Hair cells of the Spiral organ of corti-

Region	Blood Supply.	Venous Drain	Nerve Supply	Lymph Node
External Ear	STA + PAA - Superficial Temporal A. - Posterior Auricular A.	STV + PAV - Superficial Temporal V. - Posterior Auricular V.	GAN - great Auricular N. - Facial N.	- Parotid - Preauri-cular.
Middle Ear	- ATA Anterior Tympanic A. - Stylomastoid - Inferior Tympanic A.	- Pterygoid plexus	- Tympanic plexus.	- Parotid - Deep cervical
Inner Ear	- Labyrinthine A. - occipital A.	- Superior Petrosal Sinus. Transverse Sinus	- Vestibulo-cochlear Nerve (CN-8)	- Upper Deep cervical.

Arterial Supply :-

- middle ear artery supply
  - o- Anterior tympanic branch – maxillary artery
  - o- Posterior tympanic branch – Posterior auricular artery
  - o- Petrosal and superior tympanic branch – middle meningeal artery
  - o- Branches of ascending pharyngeal artery
  - o- tympanic branches – ICA


Superficial temporal artery
Perforating branches
Anterior auricular arteries
Posterior auricular artery
External carotid artery

a

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* Clinical significance

1) Infection can spread from the Pharynx to the Middle ear through the Pharyngo-tympanic tube.

2) Ear wax Removal can cause irritation of the auricular Branch of the Vagus Nerve in the external ear which can lead to cough, Vomitting or Death

3) Otitis External → Infections of External ear.
4) Otitis Media → Infections & Inflammation of Middle Ear.
5) Otitis Interna → Infection & Inflammation (labyrinthitis) of Inner ear

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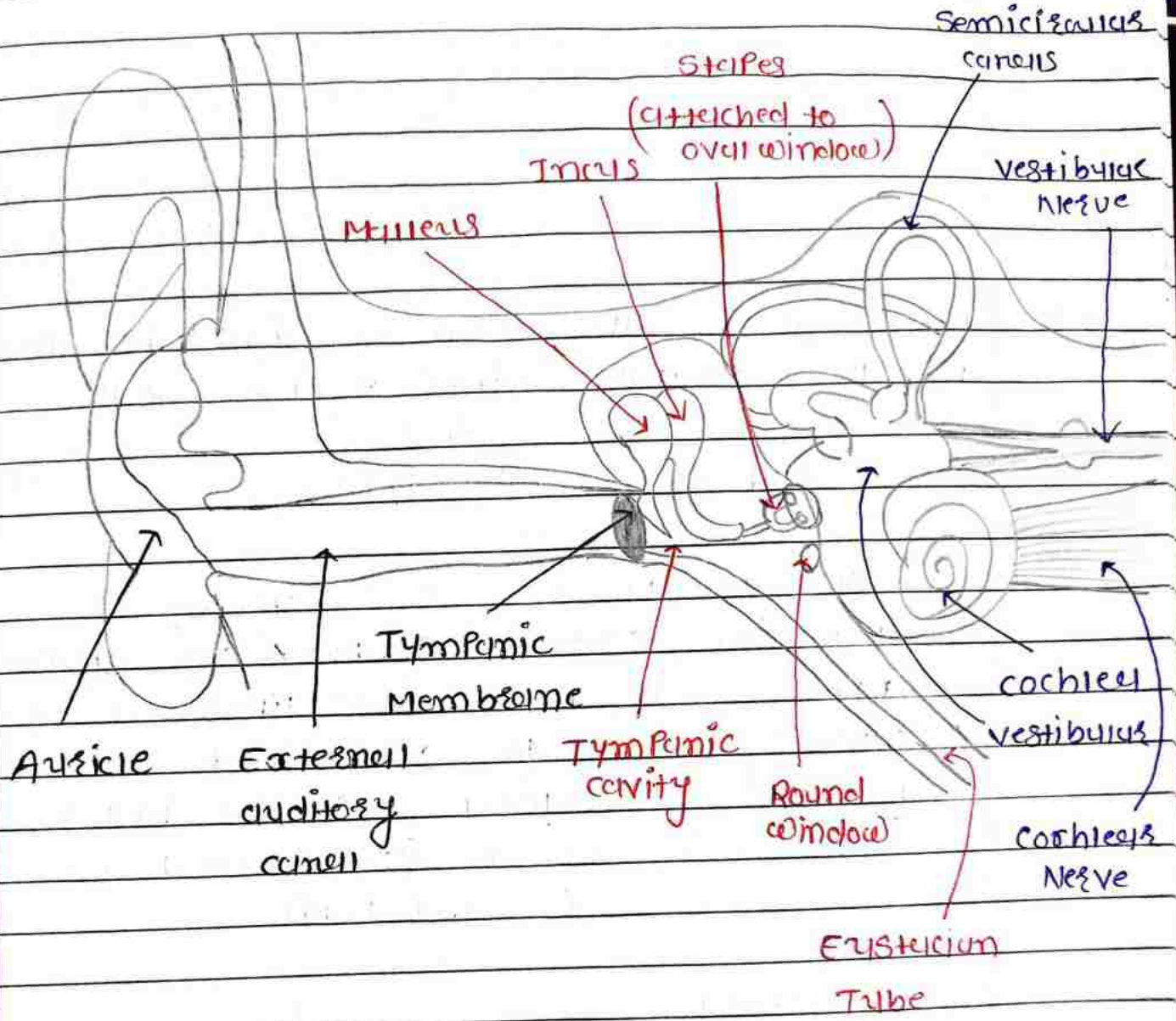
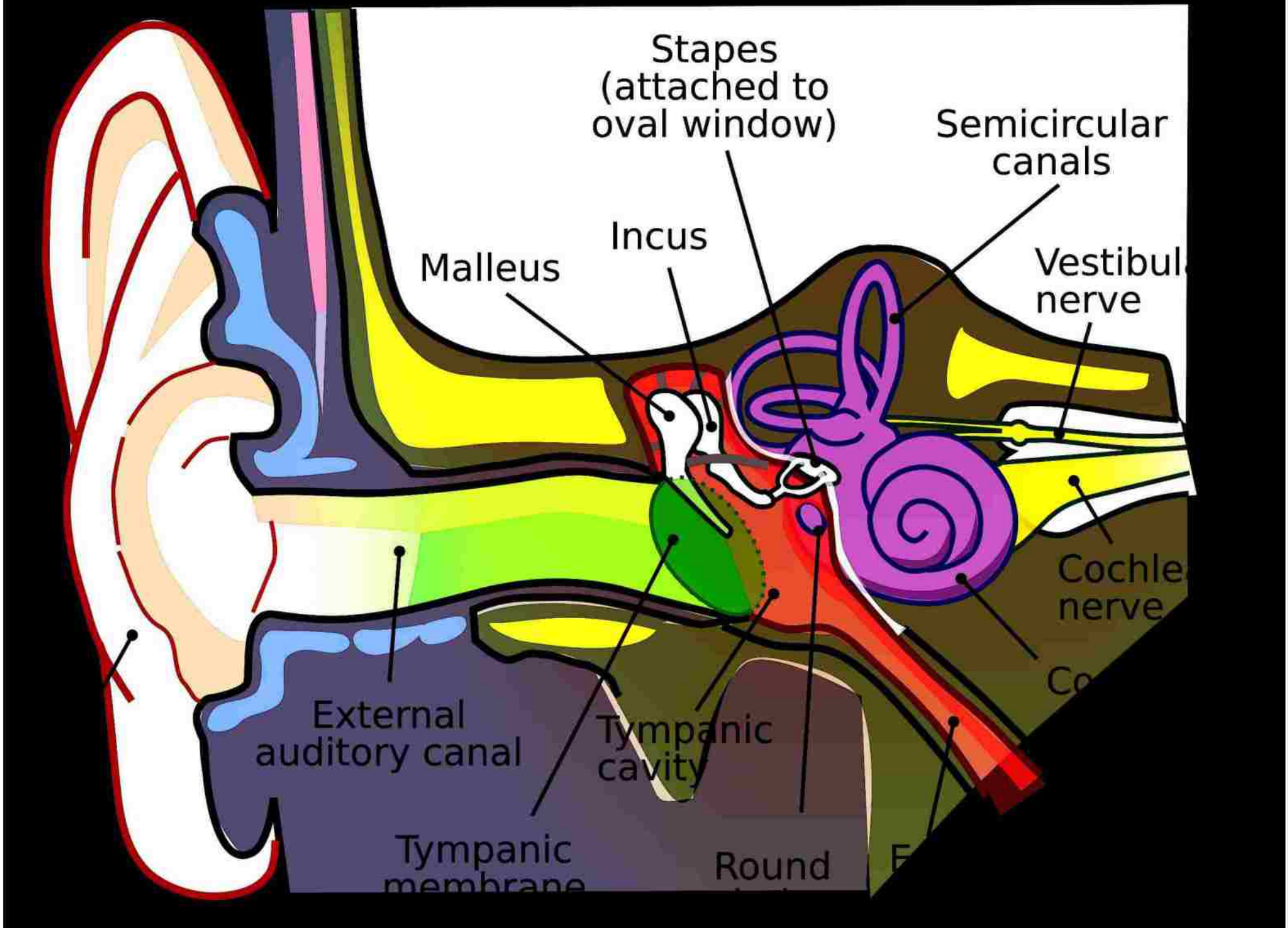
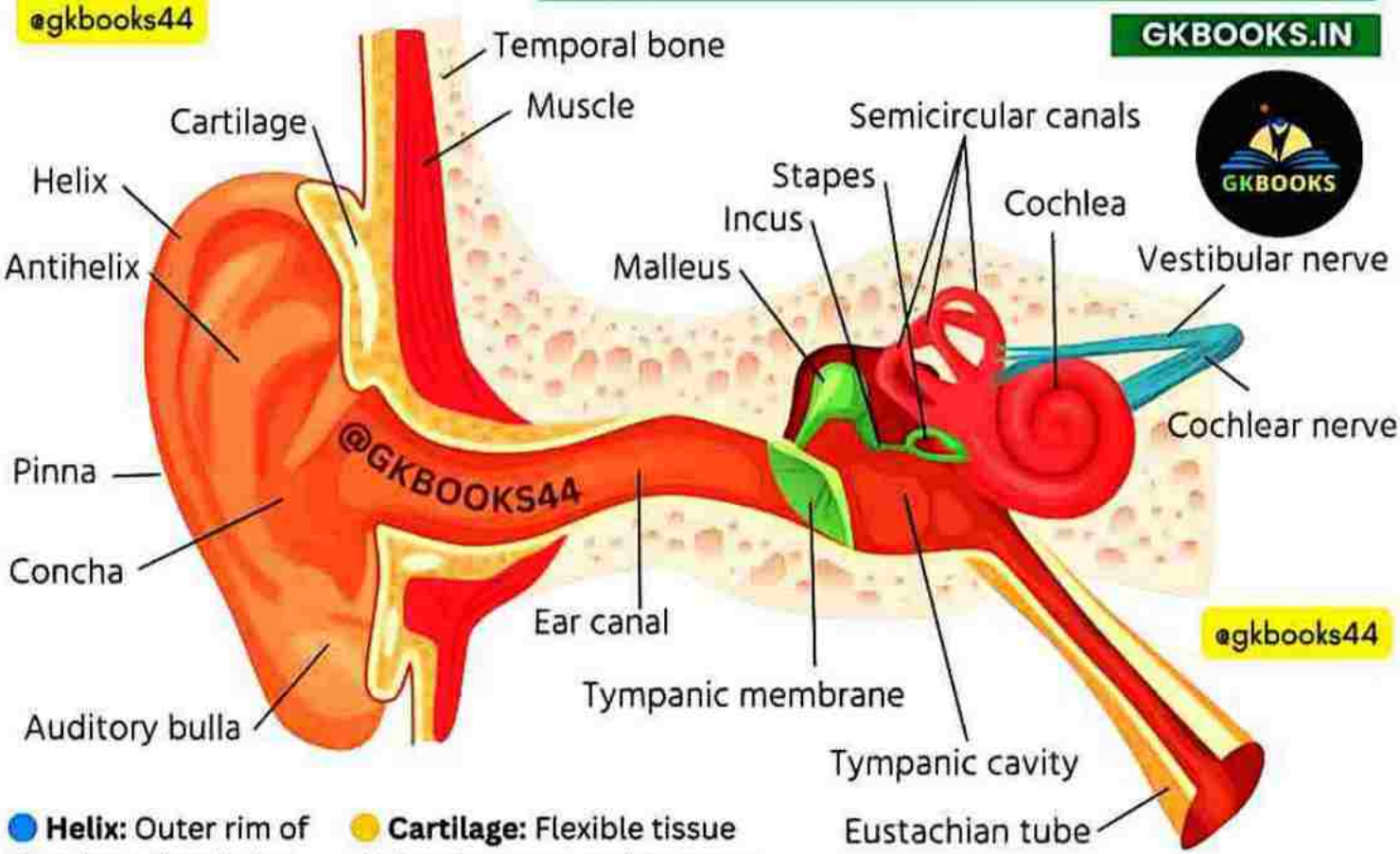


[• Ear •]


Stapes
(attached to
oval window)
Semicircular
canals
Incus
Malleus
Vestibul
nerve
Cochle
nerve
External
auditory canal
Tympanic
cavity
Tympanic
membrane
Round

Human Ear Anatomy



- **Helix:** Outer rim of the pinna that helps collect sound waves.
- **Antihelix:** Inner curved ridge that directs sound toward the ear canal.
- **Pinna:** External flap of the ear designed to capture and funnel sound.
- **Concha:** Bowl-shaped depression channeling sound into the ear canal.
- **Auditory bulla:** Bony chamber protecting middle and inner ear parts.
- **Cartilage:** Flexible tissue giving structure and support to the outer ear.
- **Ear canal:** Passage that carries sound waves to the eardrum.
- **Tympanic membrane:** Vibrating membrane (eardrum) receiving sound waves.
- **Cochlea:** Spiral organ converting sound vibrations into nerve signals.
- **Malleus:** First ossicle transferring vibrations from eardrum to incus.
- **Vestibular nerve:** Nerve transmitting balance information to the brain.
- **Temporal bone:** Skull bone enclosing and protecting the ear structures.
- **Muscle:** Small muscles that help stabilize or move parts of the ear.
- **Incus:** Middle ossicle that passes vibrations to the stapes.
- **Stapes:** Smallest bone transmitting vibrations to the inner ear.
- **Tympanic cavity:** Air-filled middle-ear chamber holding the ossicles.
- **Eustachian tube:** Tube equalizing air pressure between ear and throat.
- **Cochlear nerve:** Nerve carrying auditory impulses to the brain.
- **Semicircular canals:** Fluid-filled loops controlling balance and rotation.