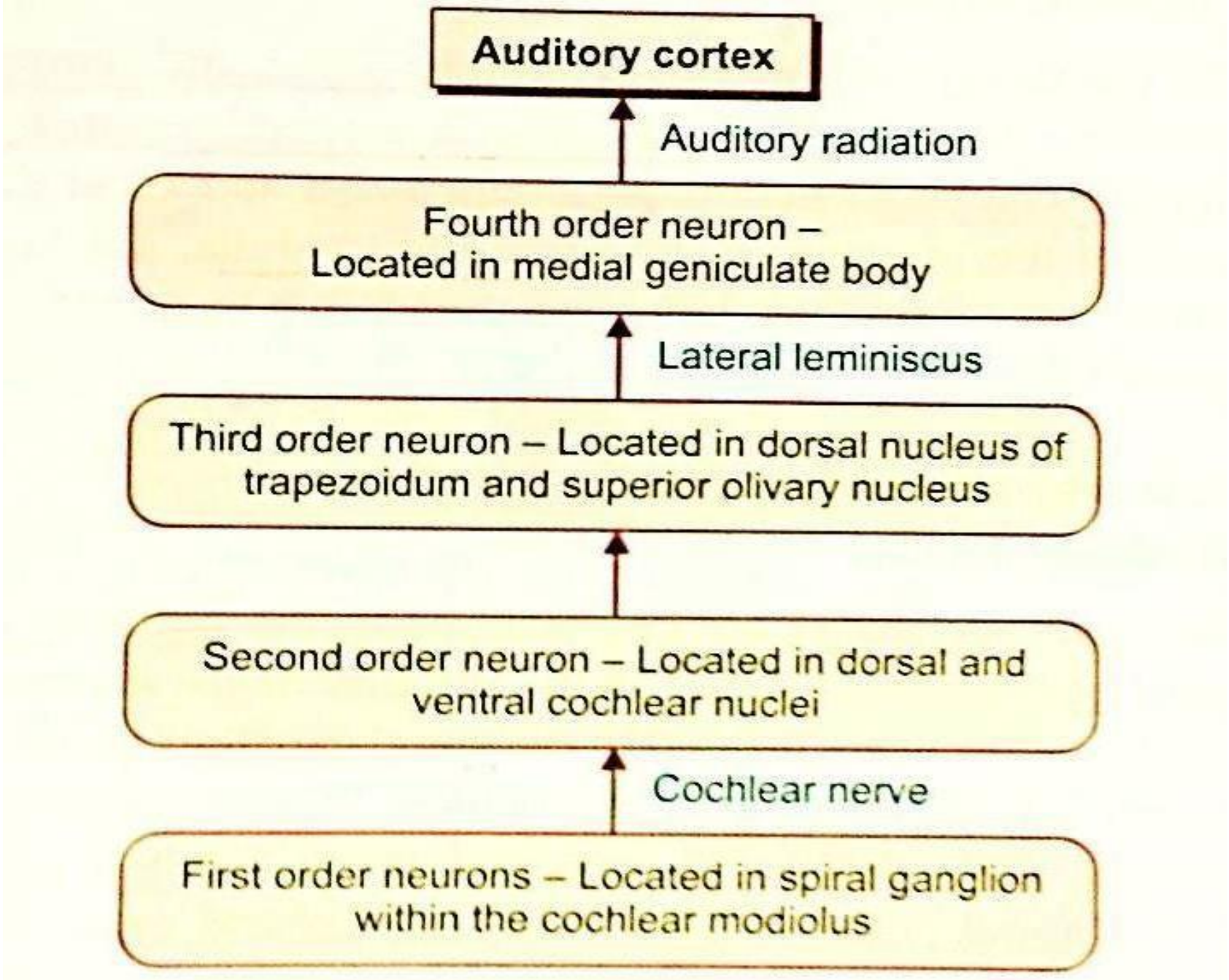
Learning objectives

- Receptors
- Ascending pathway of hearing
- Involvement of nuclei at different level
- Applied anatomy

Auditory pathway

- Transmits auditory stimulus from hearing receptors (organ of corti`s) to auditory area in cerebral cortex.

1. Organ of Corti (receptor)
2. Dorsal & ventral cochlear nuclei
3. Trapezoid body & Superior olivary nuclei
4. Lateral lamniscus
5. Inferior colliculus
6. Medial geniculate body
7. Auditory radiation
8. Auditory cortex

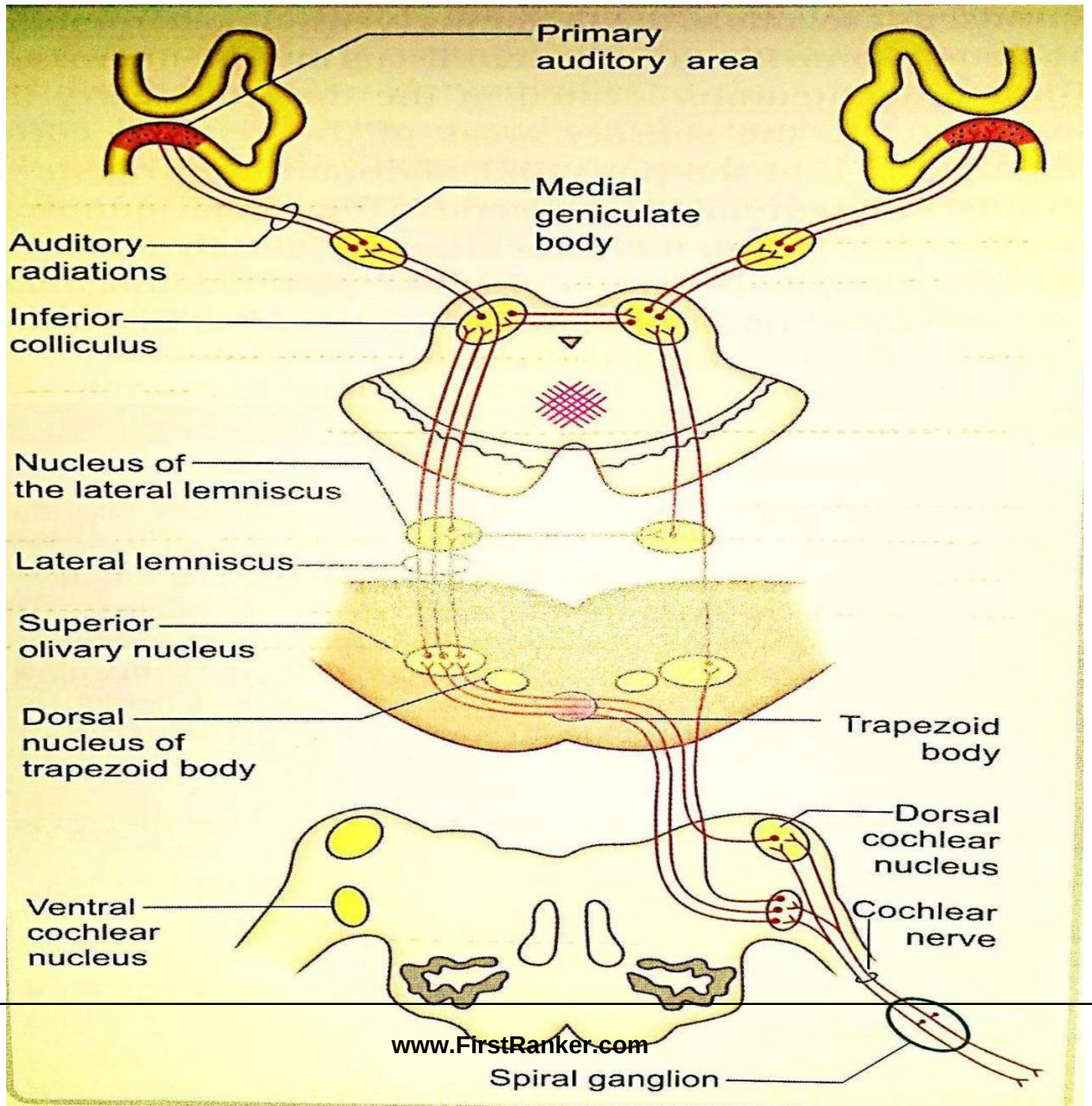


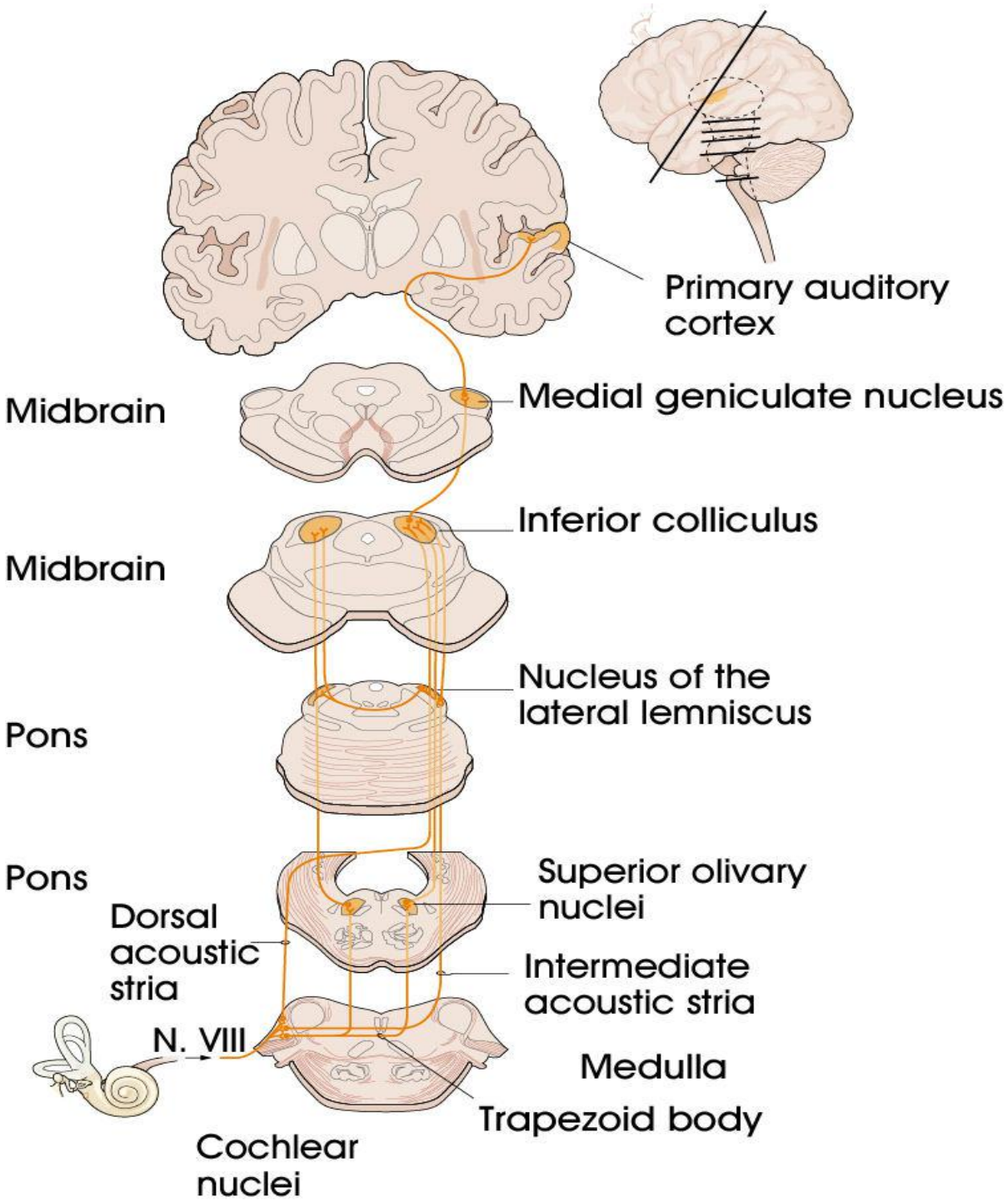
Auditory pathway

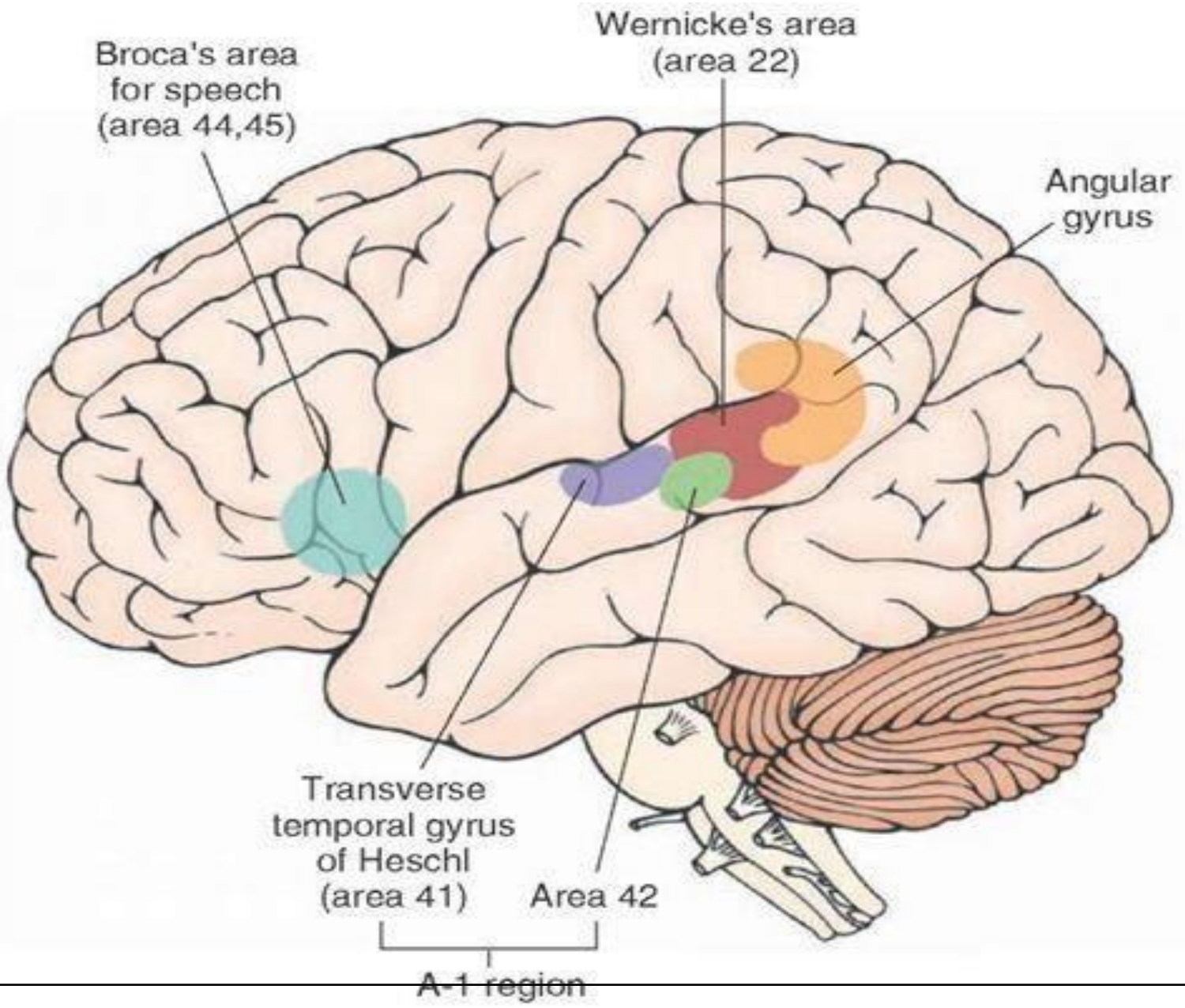
- Cochlear nu-**receptors**- hair cells in Organ of Corti
- **1st order neuron-** spiral ganglion- bipolar neurons – peripheral process- hair cells of spiral ganglion – central processes & axons - cochlear nerve- bifurcates & terminate in →Dorsal & Ventral Cochlear Nu **– 2nd order neurons** - dorsal & ventral – axons CROSS & few uncrossed in dorsal part of Lower part of pons - **Superior Olivary nucleus-**
- **3rd Neuron** – Superior Olivary Nucleus - **lateral lemniscus** Formation of Trapezoid body- In dorsal part of pons – intermediate /dorsal acoustic striae-nucleus of trapezoid body.
- Lateral lemniscus – terminate at –Inferior Colliculus (MB)
- Inferior colliculus - **4th order of neuron- (Inf Brachiaum)**

Auditory pathway

- **Inferior colliculus - 4th Order Neuron - center for auditory reflexes → Medial Geniculate body** through inferior brachium.
- **Medial Geniculate body - 5th order of neuron** & is - **Final Relay Station** - hearing pathway.
- 5th order of neuron – starts from MGB- forms **acoustic radiation** -reaches- acoustic area of cerebral hemisphere –
- Acoustic area accepts **bilateral impulses**.
- **Temporal lobe -** Superior Temporal gyrus area 41,42.







Auditory area….

- Primary auditory area - **floor of post ramus of lateral sulcus**.
- Superior surface of superior temporal gyrus has two transverse temporal gyri **(Heschl's gyrus)**
- **area-41 & 42** receives inputs from **medial geniculate body**.

Auditory areas

- **Primary auditory area** – **area 41**
- Superior temporal gyrus – **bilateral representation**
- Detection of direction & frequency of sound.
- **Lower frequencies** are located in anterior/lateral part & **higher frequencies** are located in posterior/medial part
- **Auditory association area** - **area 42 –** co-relates and comprehension of present stimulus to past ones
- **Higher Auditory association area** - area 22 – Wernicke's area- comprehension of spoken language & interpretation of sound.

Auditory areas

- **Lesion of primary auditory area** 41 & 42 of one side produces bilateral partial deafness, b/o bilateral receiving of inputs via medial geniculate body.
- **Auditory association cortex-** area 22 , Wernicke's speech area. Interpretation of sounds on past experiences. **Sensory aphasia**.
- Olfactory area- 28 , lateral olfactory stria & gyrus ,anterior part of parahippocampal gyrus & uncinate gyrus.

- **Area 8 – frontal eye field**
- **Area 44 & 45 – Broca's speech area** – motor speech area in **dominant** cerebral hemisphere.
- **Prefrontal cortex- (area - 9-12)**
- Depth of feeling
- Foresightedness
- Tactfulness
- Mature judgement
- Pleasure & displeasure

- Lesion of **prefrontal cortex (9 -12)** - Lack of self responsibility ,Vulgarity of speech, euphoria , clownish behaviour
- **Area-40**- Astereognosis & **tactile aphasia**
- **Area-39** – **word blindness** – unable to read words even if were written by one self
- **Area 22** - **word deafness** - **sensory aphasia**. Decreased interpretation of sounds/words and increased frequency of word produced….
- **Area 44 & 45** – **motor aphasia**

Speech area….

- Wernicke's area- 22, dominant hemisphere , interpretation of spoken ,written ,symbols & signs. Allows understanding of written & spoken language. **Angular gyrus** - interconnects -visual area & auditory areas.
- **Wernicke's** is necessary for- language comprehension while Broca's area, 44, language production. Superior longitudinal fasciculus or **arcuate fasciculus** interconnect these two areas.
- **Sensory aphasia-** unable to understand written or spoken words with normal vision/hearing.

Speech area's.....

- **Apraxia- parietal lobe -impairment of performance of learned movements.**
- Wernicke's aphasia- inability to understand spoken or written words – Broca's ok- uses all meaningless and incorrect words…no meaning. Called-fluent aphasia or receptive aphasia ,
- Broca's aphasia- unable to articulate words- nonfluent aphasia, hesitant aphasia /distorted-
- What they wish to say but can not speak.
- Global aphasia- extensive damage to cortex