Optic and auditory pathways

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Optic pathway

General

• Optic nerve is an outgrowth of the diencephalon
• Starts at the optic disc of the retina
• Enters cranial cavity through optic canal
Central pathway

• Fibres enter **optic nerves**
• Optic nerves converge to form **optic chiasma**
• Fibres from nasal halves of retinae decussate; those from temporal halves stay ipsilateral
• Fibres enter **optic tract**
• Optic tracts reach **lateral geniculate bodies** of thalamus
• Synapse with lateral geniculate nucleus
• Through retrolenticular part of internal capsule to form **optic radiation**
• Terminate in **primary visual cortex** in occipital lobe
• Location: superior and inferior to calcarine sulcus medial surface occipital lobe
• Left visual field perceived in right cortex (and R in L)

• A small number of fibres to superior colliculus of midbrain – reflexes

• Meyer’s loop: thalamocortical fibres representing upper part of the visual fields travel some distance into temporal lobe before terminating below calcarine sulcus
Visual field deficits

• When optic chiasma is compressed (e.g. a pituitary tumour), midline fibres are mostly affected (decussating fibres): bitemporal hemianopia

• Lesions distal to optic chiasma: (contralateral) homonymous hemianopia
  e. g. Dividing R optic tract results in a L homonymous hemianopia
• Testing eyes separately shows loss of L visual field in R eye
• Loss of L visual field in L eye
Ascending auditory pathway

• Cochlear nerve: central processes of cells in spiral ganglion of cochlea

• Cochlear nuclei are located close to the dorsal and ventral surfaces of the inferior cerebellar peduncles in the rostral medulla
Simplified schema of ascending auditory pathway
Ascending auditory pathway cont.

- Fibres divide when entering the medulla; one branch entering the dorsal cochlear nucleus and the other the ventral cochlear nucleus; synapse

- Fibres proceed to the ipsilateral or contralateral (the majority) superior olivary nucleus (SON) in the pons; not all fibres synapse here

- Fibres that cross to the contralateral SON, form the trapezoid body

- Fibres proceed cranially as the lateral lemniscus

- The lateral lemniscus reaches the inferior colliculus of the midbrain; synapse

- From inferior colliculus via the brachium of the inferior colliculus to the medial geniculate body (MGB) of the thalamus; synapse
• From MGB through internal capsule to primary auditory cortex

• Location: superior surface of superior temporal gyrus; this area contains transverse gyri; the most anterior of these (Heschl’s gyrus) comprises the primary auditory cortex
Acoustic reflexes

• Collateral branches from the lateral lemniscus form a linkage for reflex arcs

• They establish connections with motor neurones of the trigeminal and facial motor nuclei, causing contraction of the tensor tympani and stapedius muscles in response to loud sounds

Descending auditory pathway

• Originate at various levels in the ascending pathway and end at various levels

• Serves to inhibit reception of sound

• Has a role in suppressing some auditory signals and enhancing others

• It accomplishes the above by influencing the basilar membrane’s response to sound
Lesions

- A unilateral lesion does not cause monaural deafness (deafness in one ear) because some fibres proceed in the ipsilateral pathway.

- Unilateral lesions cause a loss of auditory acuity and inability to localise the directional origin of sounds.
Questions

1. Describe the optic pathway.

2(a). Name the visual field defect that would occur when the decussating fibres of the optic chiasma are interrupted.
(b). Explain the defect named in (a) (what would the patient experience) and elucidate the underlying anatomical principle of this defect.

3(a). Name the nuclei (in correct ascending order) of the ascending auditory pathway and give their locations.
(b). What is the trapezoid body and where is it located?