CISC 3250
Systems Neuroscience

Perception
(Vision)

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Pathways to perception in 3 (or fewer) synaptic steps

0 Input through sensory organ/tissue

1 Synapse onto neurons in spinal cord/brain stem

Bundled track of nerves to brain: spinal cord/cranial nerve

2 Synapse onto neurons in thalamus

3 Synapse onto cortical neurons in "primary ____ cortex"

4+ Further cortical processing

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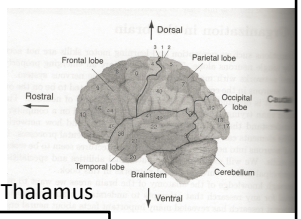
Touch/"Tactile"

Skin → Spinal cord → Dorsal horn → spinal cord → Thalamus: Ventral postero-lateral (VPL) nucleus → Cortex: Post-central sulcus (MI)



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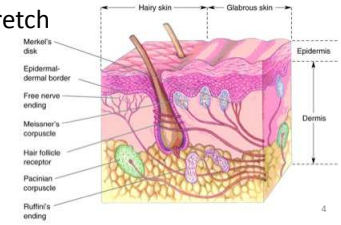
Touch: Inputs

Mechanoreceptors in skin

- Pacinian corpuscles – vibrations
- Meissner's corpuscles – light touch
- Merkel's discs – pressure and texture
- Ruffini endings – stretch



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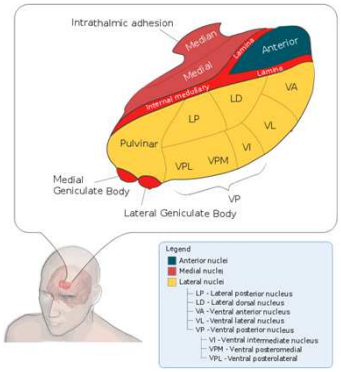
Thalamus – the "relay" station



http://en.wikipedia.org/wiki/File:Thalamus-schematic.svg

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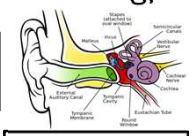
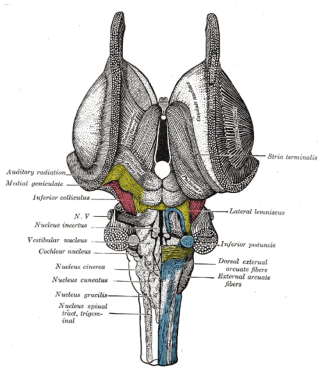
Hearing/"Auditory"

Cochlea → Cochlear nerve → Cochlear nucleus (-> Superior olive) -> Inferior colliculus → Brain stem → Thalamus: Medial geniculate nucleus (MGN) → Cortex: Primary auditory cortex (AI)



Regions of the brainstem



Dorsal view (back-of-the-head)

2-3 synapses in auditory brainstem path

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Seeing/"Visual"

Retina

Optic nerve

Thalamus

Lateral geniculate nucleus (LGN)

Cortex

Primary visual cortex (VI)

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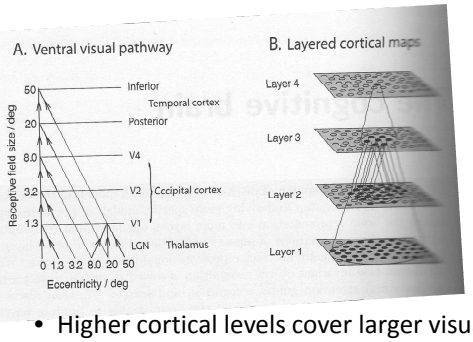
HMAX – model of hierarchical vision



- Higher cortical levels cover larger visual spans
- Gabor filters -> Max pool -> Sum -> Max -> …

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