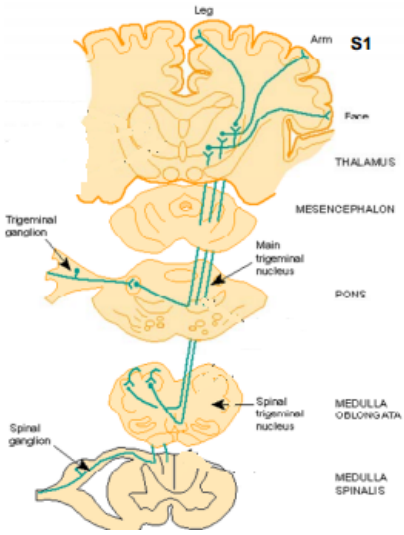
# 1. Brain maps

## Multiple maps

### Topography

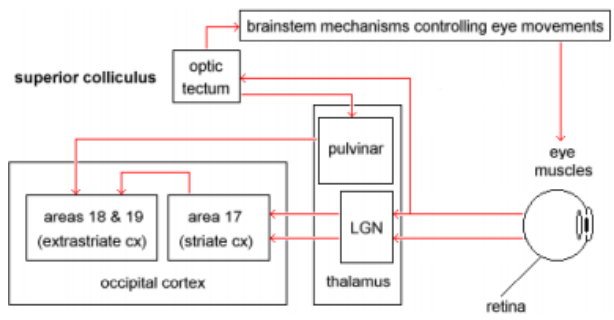



Tactile pathway

Tactile stimuli activate the neurons to travel up to the brainstem and cross over at the brainstem. Facial senses come in from trigeminal ganglion and crosses over immediately.

Tactile topography [somatotopy]

Topography is the cortical organisation that preserves the local relationship of afferents. Topography for the body map is called somatotopy. Somatotopy is sequentially organised in regards to the body parts (toes, foot, leg, hip next to each other) rather than randomly. Also the area dedicated in the cortex to each part of the body is not the same, the more nerves there are (i.e. the more sensitive it is) the larger the area in the cortex, e.g. homunculus reflects peripheral receptor density.

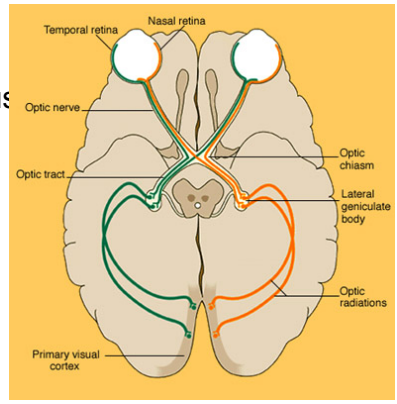



Visual pathway

The sensory system travels in 2 ways:

1. geniculostriate system - to occipital cortex through LGN (thalamus)

2. tectopulvinar system - to optic tectum which is a brainstem structure controlling eye movements



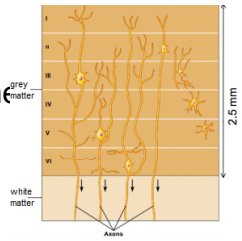

In lower animals, a non-geniculate pathway (2) to superior colliculus dominates, and may account for “blindsight” in humans.

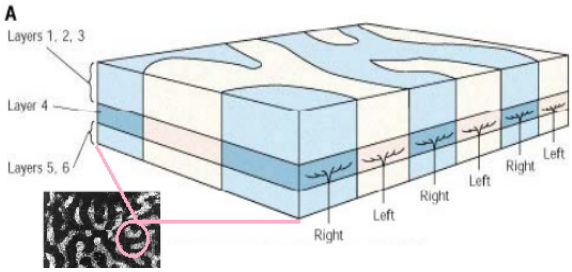
Visual topography [visuotopy]

Vision has hemi-fields, i.e. our right cortex sees the left half of the world. At the optic chiasm, crossing over occurs (nasal information cross over to the other cortex).

Organising multiple maps

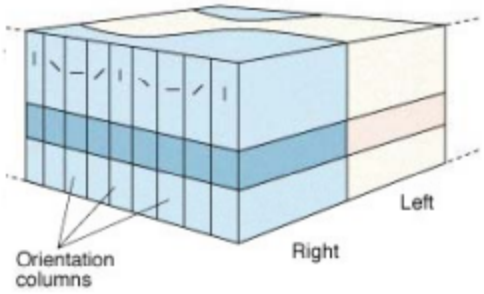
Cortex is layered, with vertically aligned neurons, which gives rise to 2D maps. All the neurons in grey matter (6 layers) carry information down the axons towards the white matter (centre).

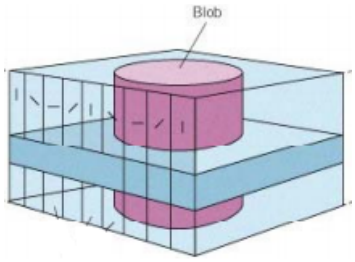



**Receptive field** is coded in the primary visual cortex (V1) in *ocular dominance bands*. That is, in the 4th layer of cortical layers (grey matter), the information from left and right eyes are segregated in altering sequence. However, layers of the cortex does not have a stripe formation, but swirled random pattern because information need to be mixed up and swirled around.

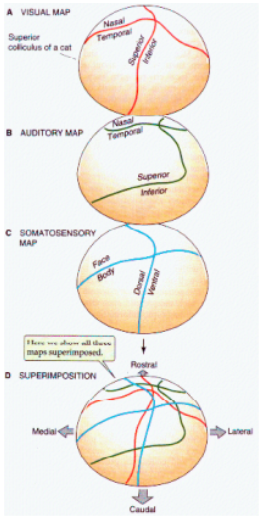
**Orientation** preference is encoded by *cortical columns* in V1. That is, each neuron is assigned to a certain angle (slanting) because each column has one neuron.



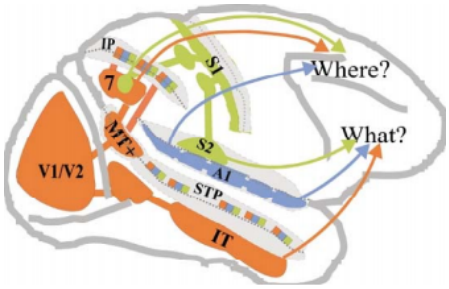

**Colour** signals to V1 terminate in "blobs"

Thus, parameter maps overlay to create a "module" encoding all parameters.




Combining senses

In our brain, we need to combine different senses (i.e. visual, auditory, somatosensory), that is, sensory maps of surrounding space are superimposed in the **superior colliculus** (involved in eye movement and orienting responses).




IP (infraparietal) and STP (superior temporal) areas have neurons responding to multiple senses.

V1 - visual...

S2 - somatosensory...

A1 - auditory... primary sensory cortex

These neurons process afferent information to find what and where the stimulus is.

Parietal lobe lesions:

- S1 (anterior):
  - lose localisation of touch and recognition of the object
  - distorted perception of body image and spatial relations

- V1
  - lose vision

- IP (posterior):
  **left** hemisphere - disorders of language
  - confusion of left and right, cannot name finger touched
  - dysgraphia: writing impairment
  - dyscalculia: calculation/counting impairment

  **right** hemisphere - Neglect syndrome: space distortion but neglect left side of the world, e.g. drawing flower, patient is often unaware of the bad drawing if 1 flower is in focus but if there are a lot, they notice the oddness.