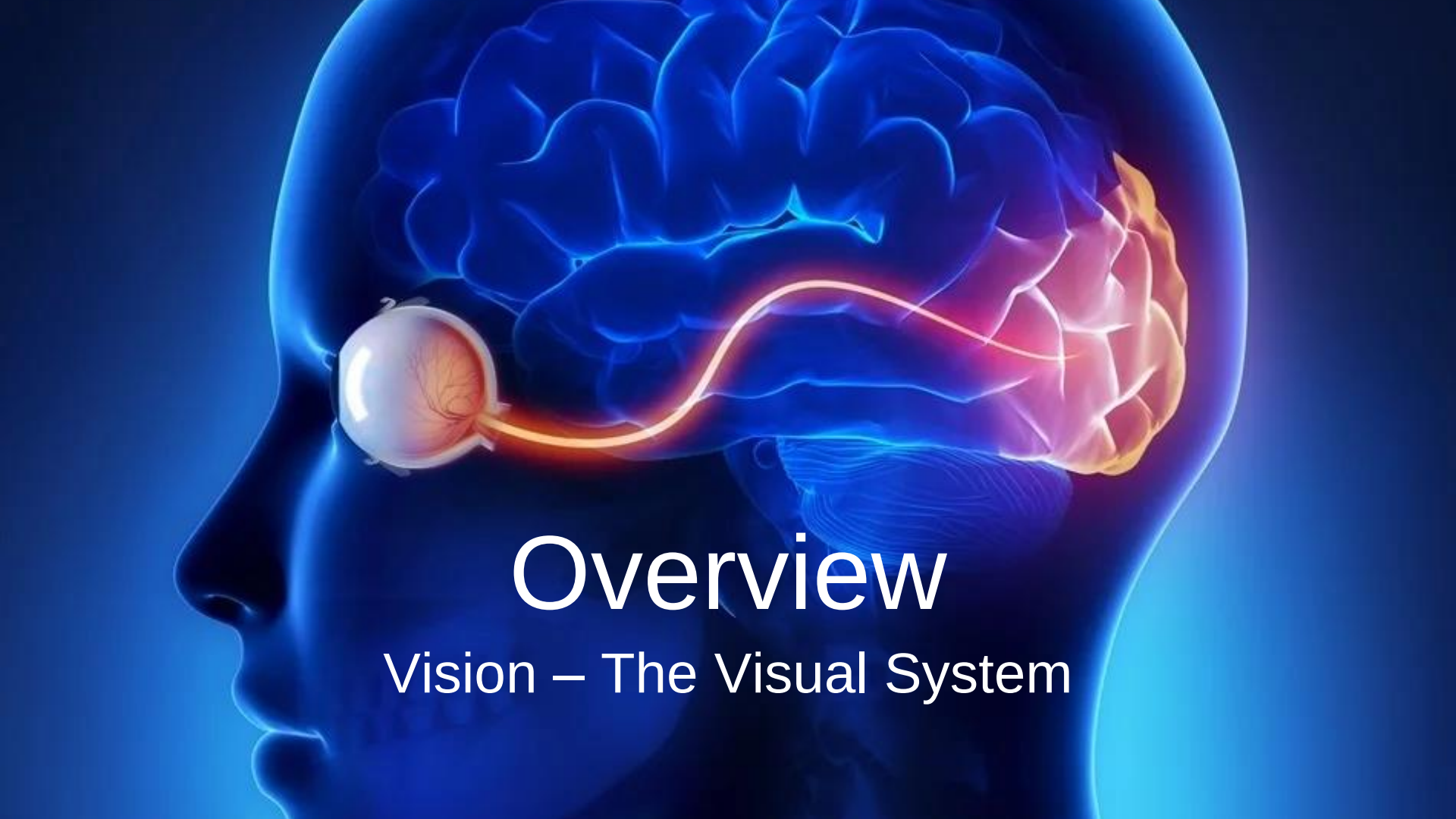


Overview

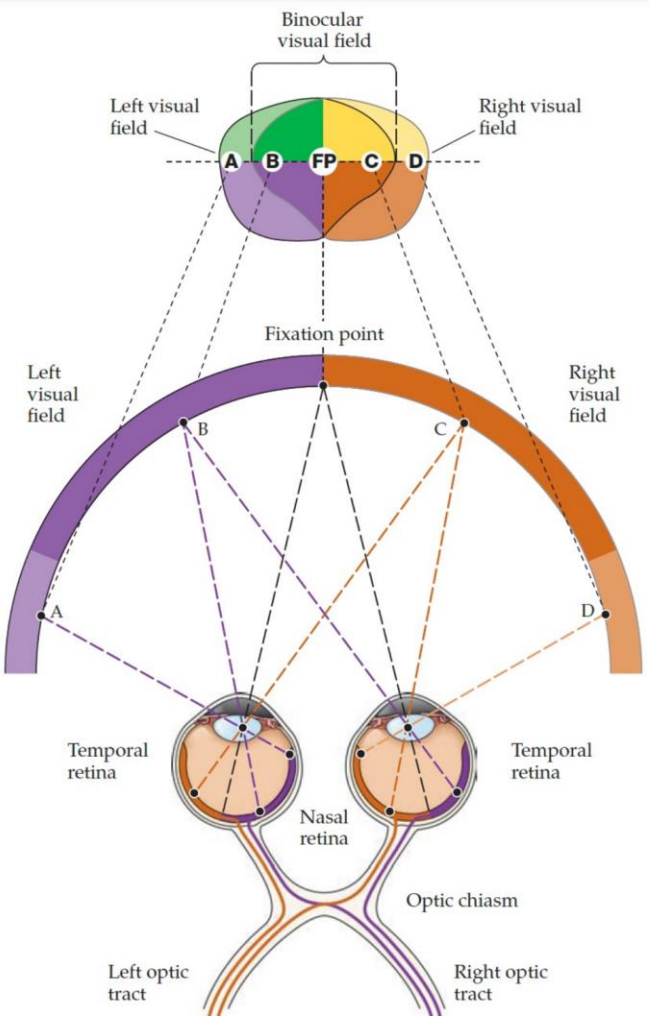
Vision – The Visual System

Outline - key concepts

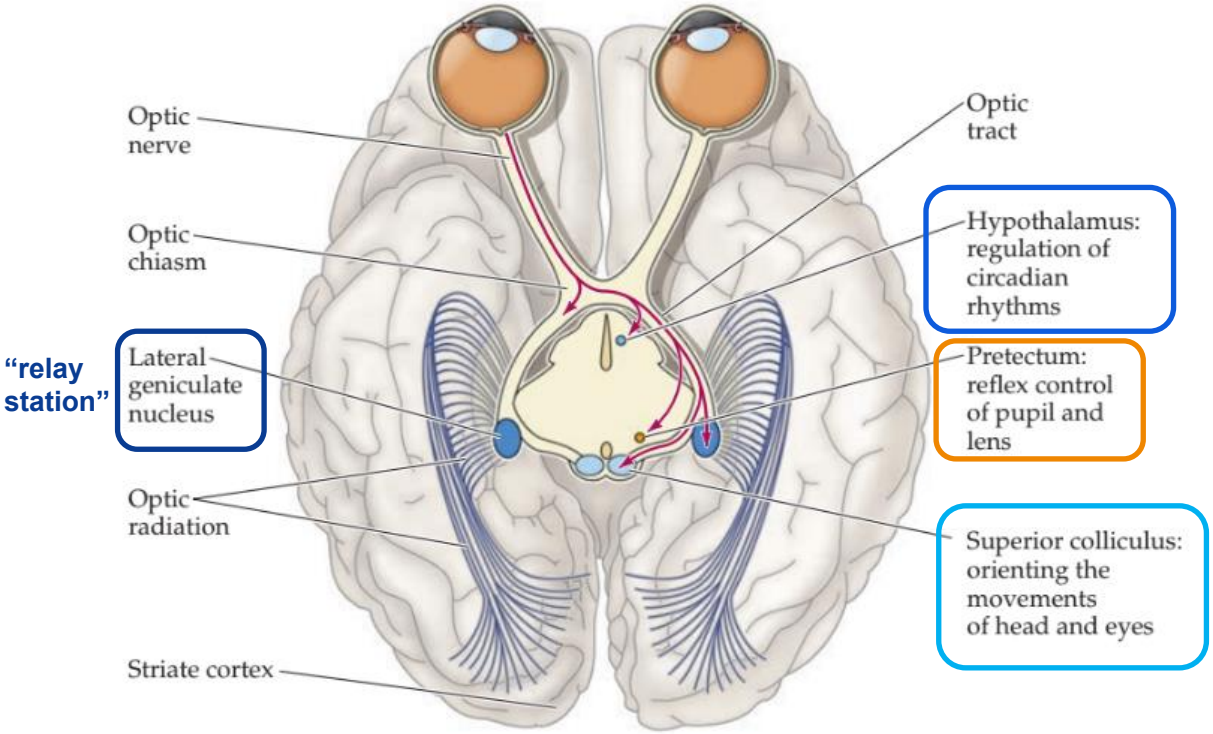
- Binocular vision
- The different targets of the retinal ganglion cells and their functions
- The retinogeniculostriate pathway (from the retina to V1)
- Lateral geniculate nucleus (LGN) organization
- Retinotopic map
- General layer organization of the primary visual cortex
- Columnar organization of V1 (orientation, ocular dominance)
- Receptive fields in the visual system

The binocular vision

- Most of the visual field is **binocular** which allows depth and 3D perception
- The peripheral visual field is strictly **monocular**



Where do retinal ganglion cells (RGC) project?



1) **Lateral Geniculate Nucleus** (object recognition)

2) **Hypothalamus** (circadian rhythms)

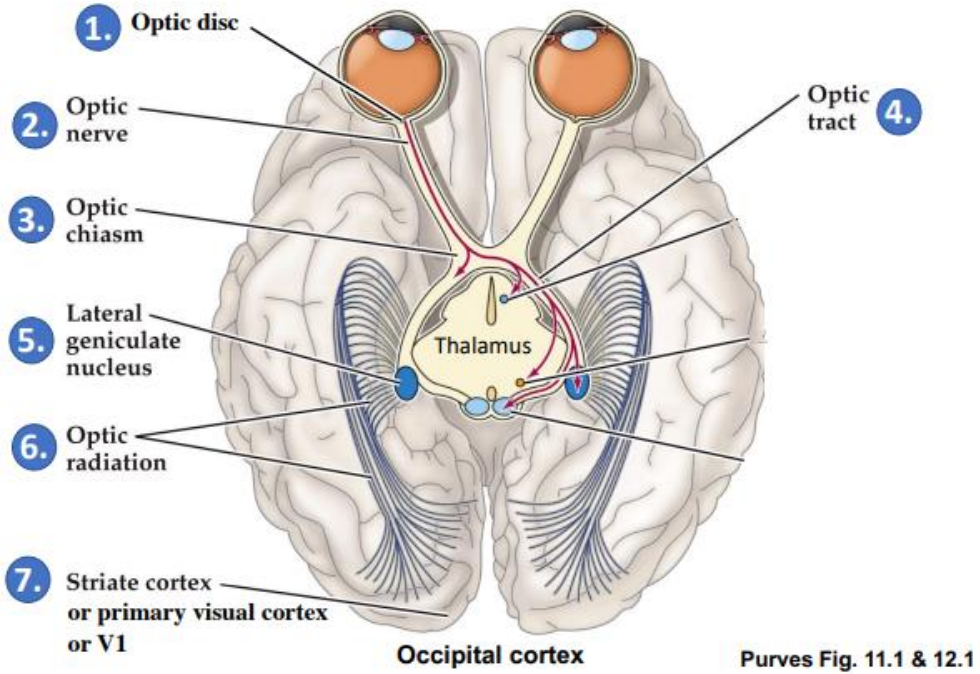
3) **Pretectum** (pupillary light reflex)

4) **Superior Colliculus** (head and eyes movement)

The retinogeniculostriate pathway

From the retina…

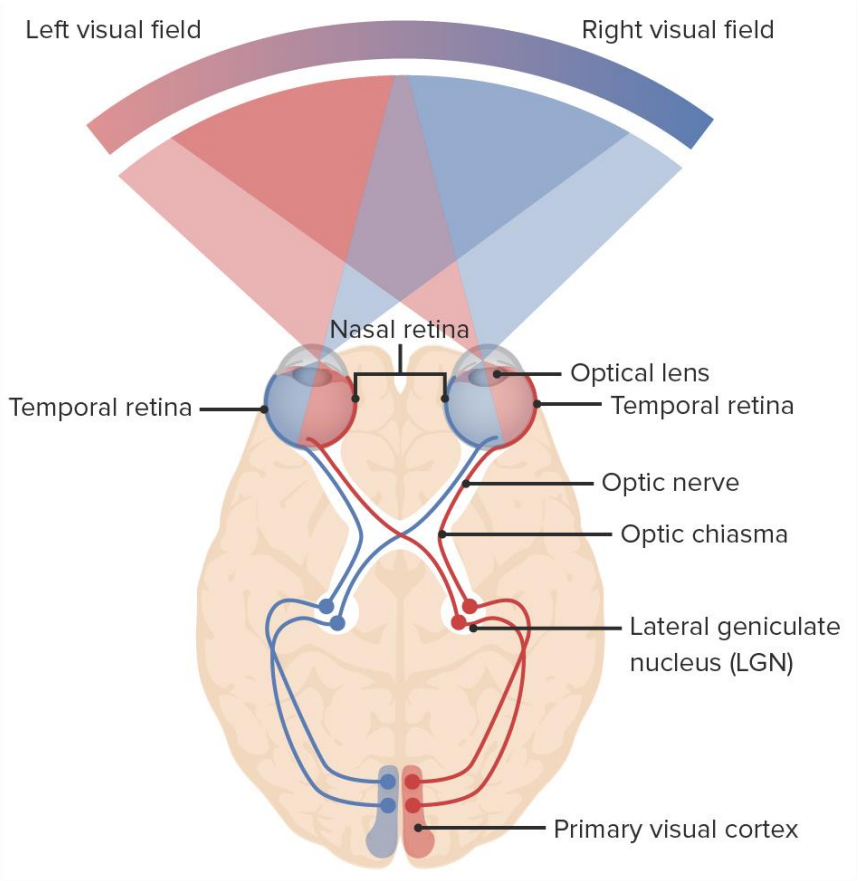
… to the primary visual cortex



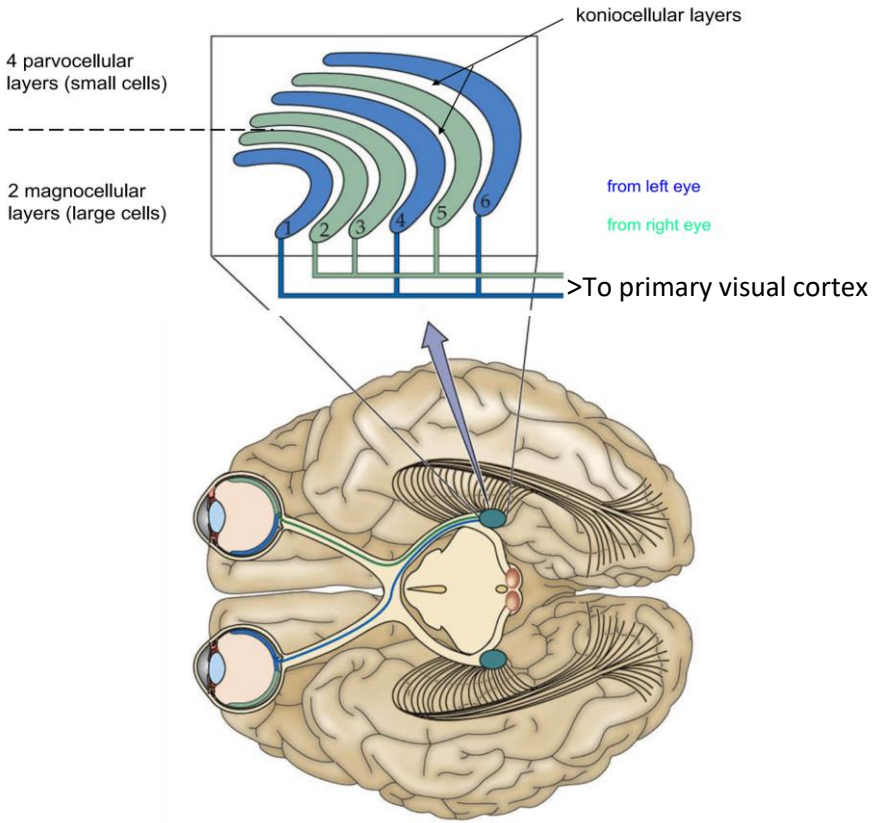
Purves Fig. 11.1 & 12.1

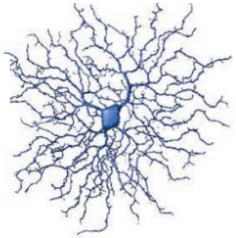
The retinogeniculostriate pathway

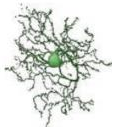
Side-Switching! Information from the left half of the visual world, whether it originates from the left or right eye, is represented in the right half of the brain, and vice versa.



Visual Field - The Lateral Geniculate Nucleus

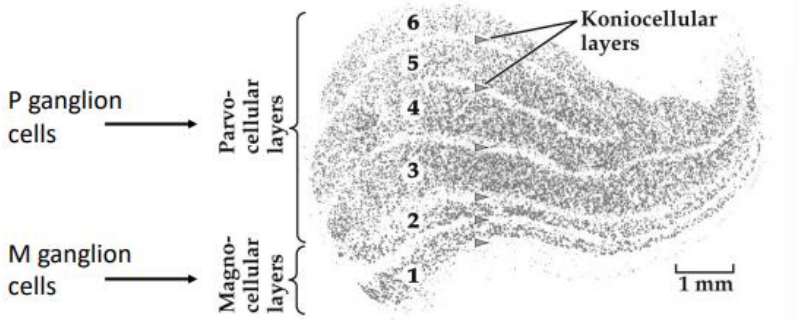






M-cells (layers 1, and 2) focus on high temporal resolution such as movement and location of objects.

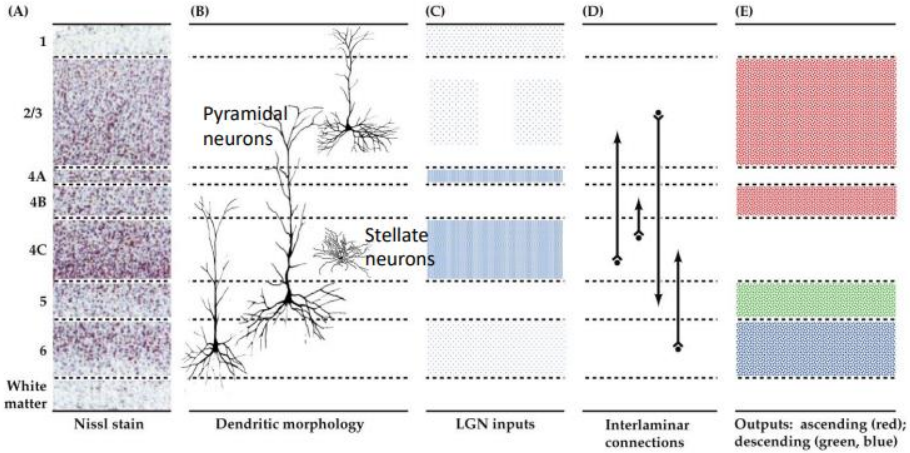
P-cells (layers 3, 4, 5, and 6) focus on spatial resolution and perceive color, shape, size of objects

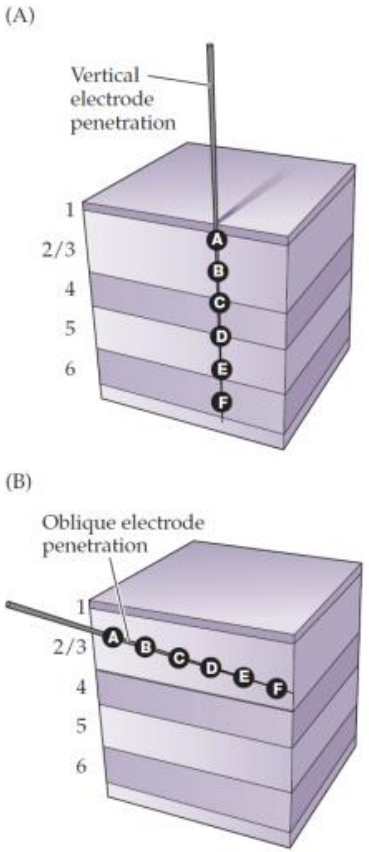


Purves Fig. 12.11; 12.13

Organization of the visual cortex

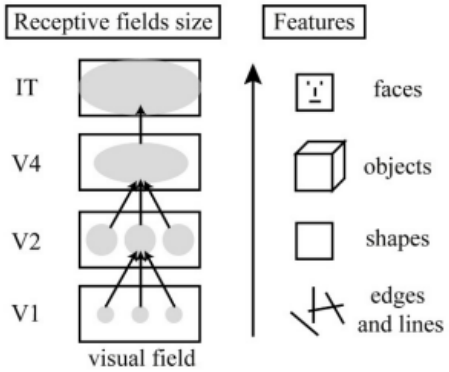
- 6 layers have similar receptive fields
- Adjacent columns have adjacent receptive fields

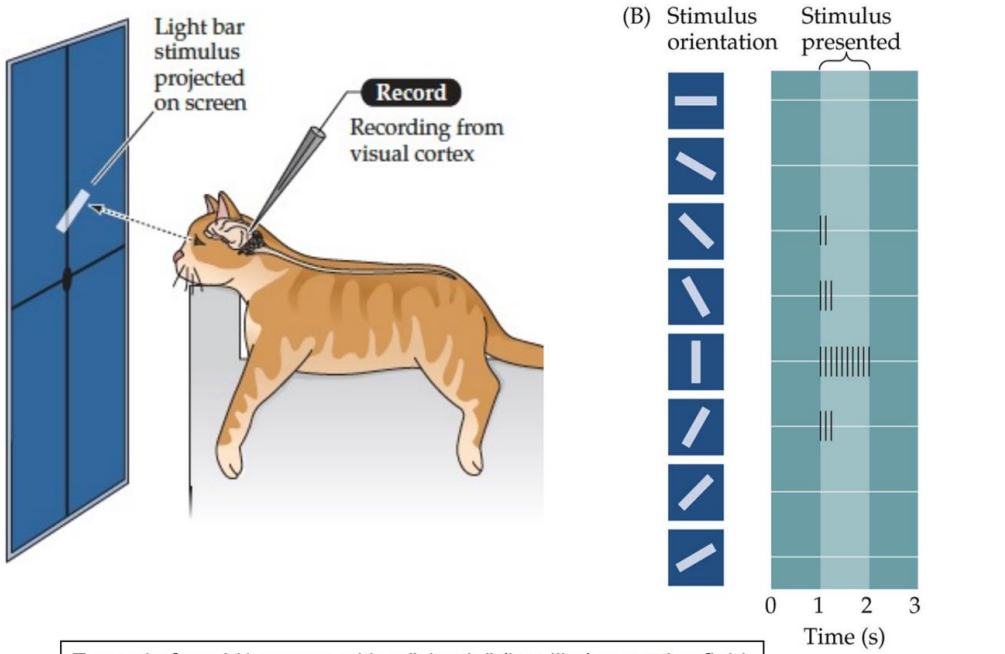




Receptive field of neurons in the primary visual cortex

Bar-like receptive field





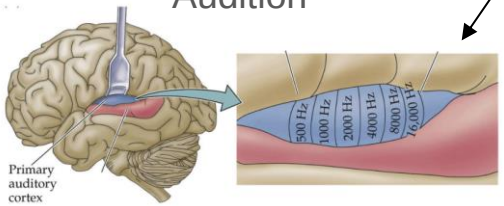
Example for a V1 neuron with a "simple" (bar-like) receptive field

Purves Fig. 12.8

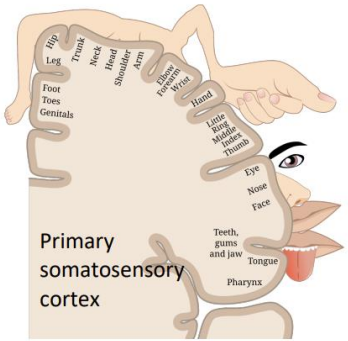
A topographic map for vision: the retinotopic map!

Topographic maps

Audition

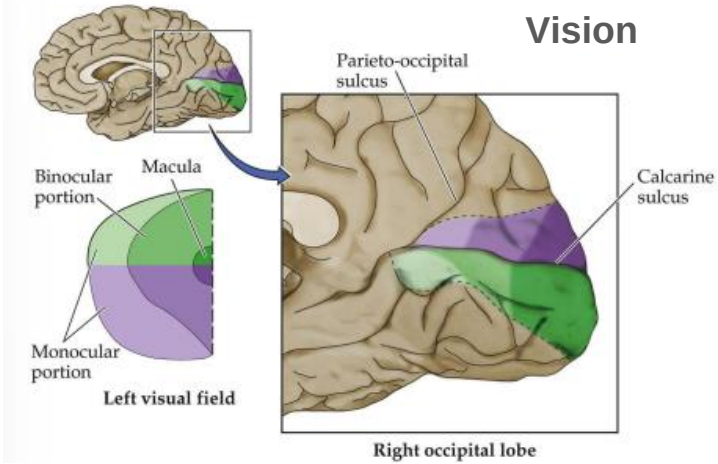


Cortical magnification: the dedicated brain surface area is proportional to the density of receptors

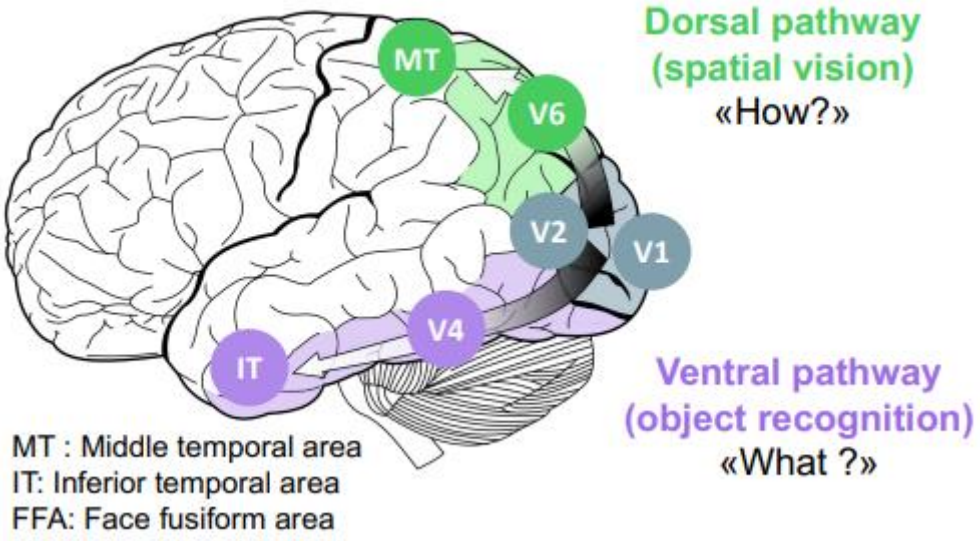


Touch

Vision



Visual Pathways - Dorsal vs Ventral visual pathway



- From V1/V2, the visual pathway “splits” in two
- One to the inferior temporal area : **object recognition**
- One to the middle temporal area : **spatial vision**

V4 responds selectively to color of visual stimulus without regard to its direction of movement.

MT (middle temporal, sometimes called V5) responds selectively to direction of a moving edge without regard to its color.