

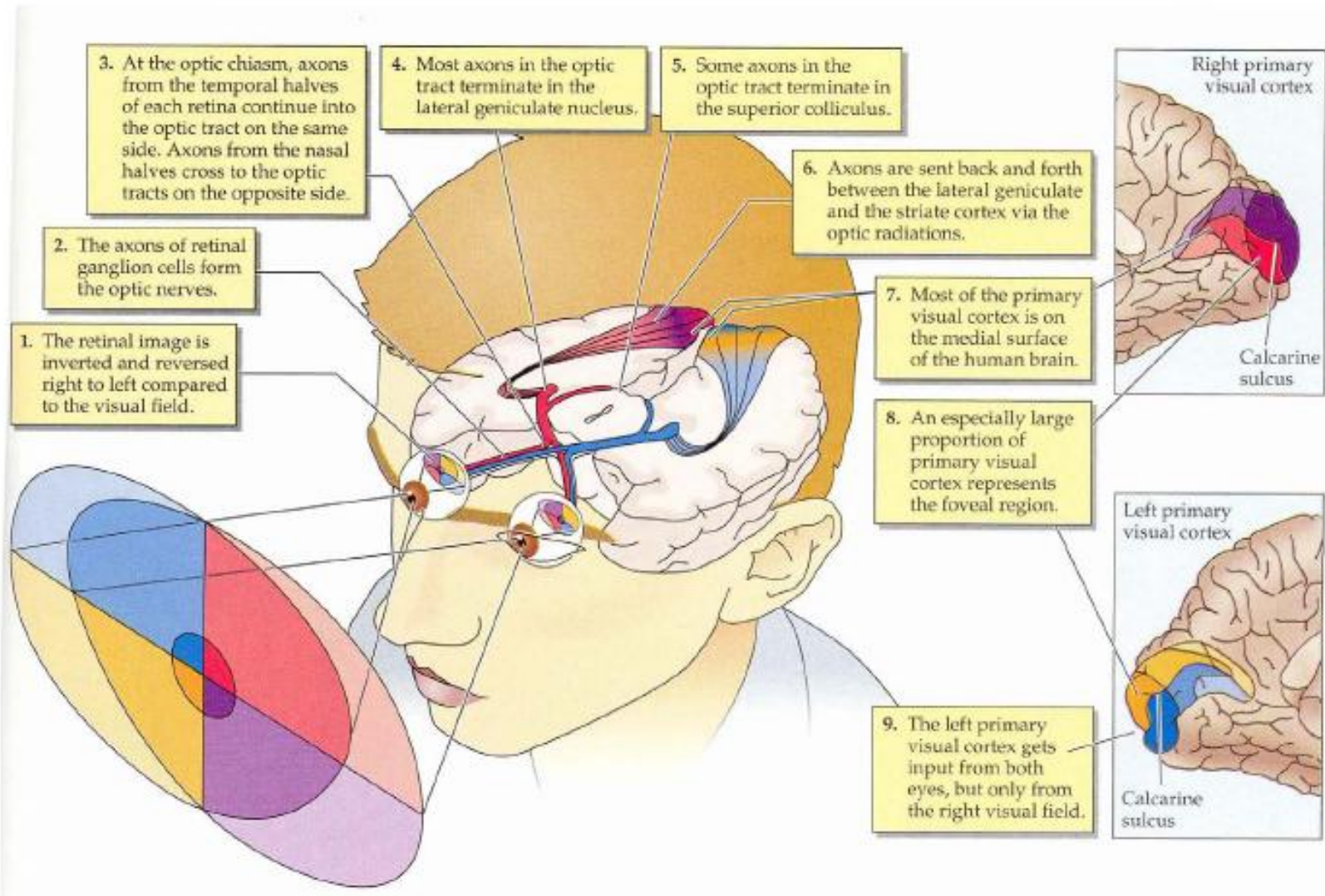
Systems Neuroscience

Daniel Kiper
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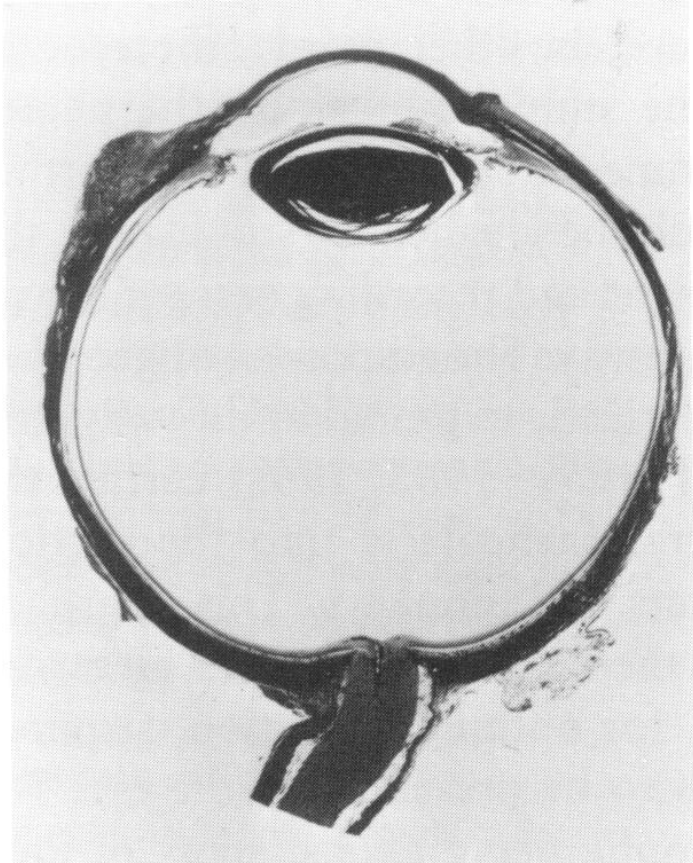
Fall 2025

http://www.ini.uzh.ch/~kiper/system_neurosci.html

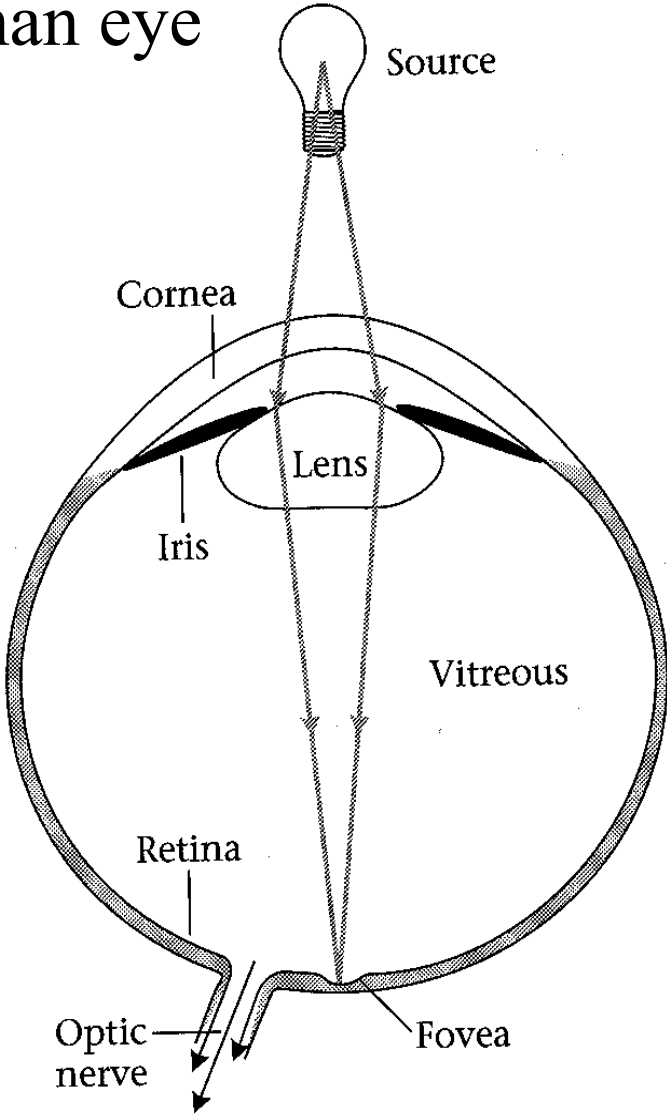
Retinocortical pathways



The human eye

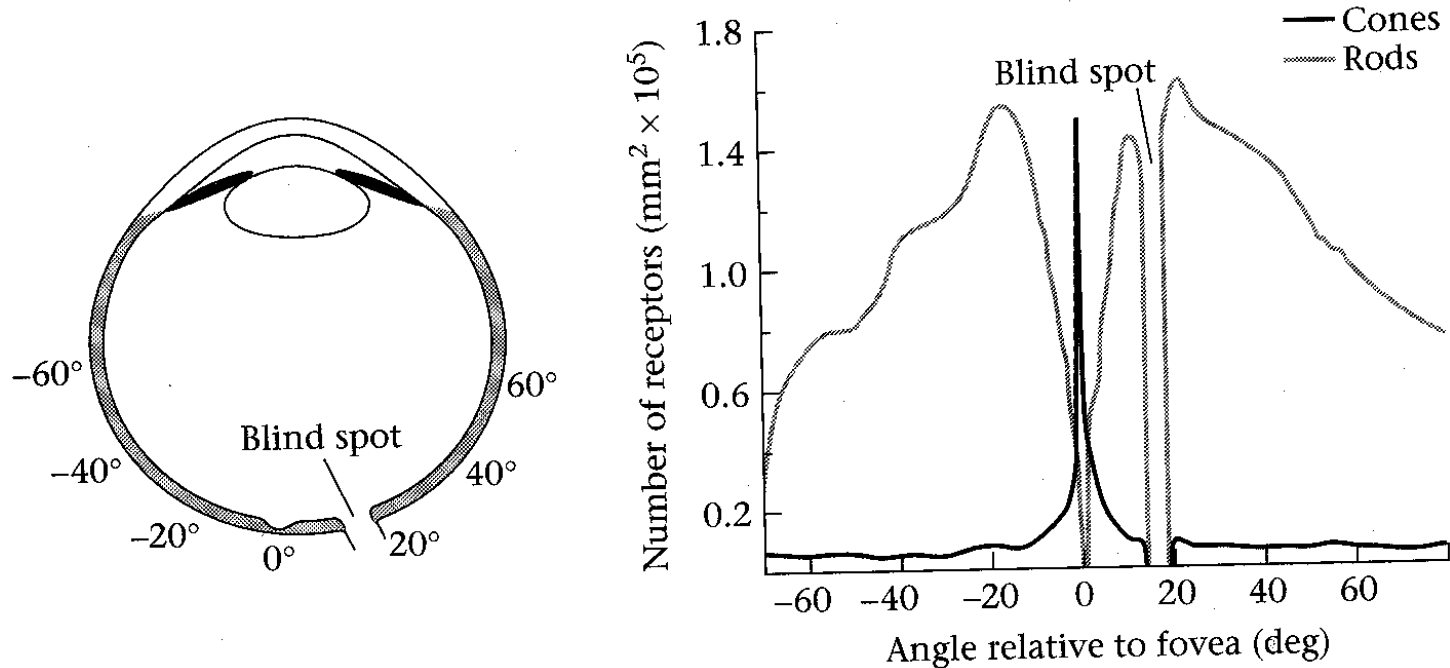


Dowling, 1987 (Fig 1.3a)



Wandell, 1995 (Fig 2.1)

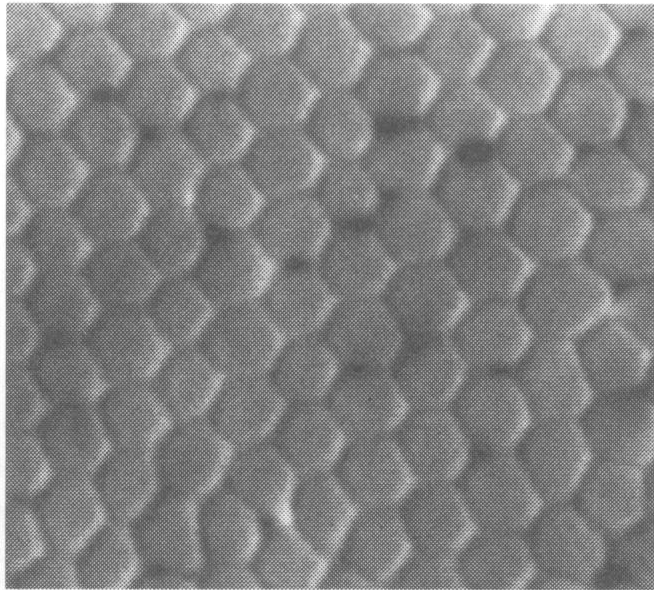
Distribution of rods and cones: a view from the side



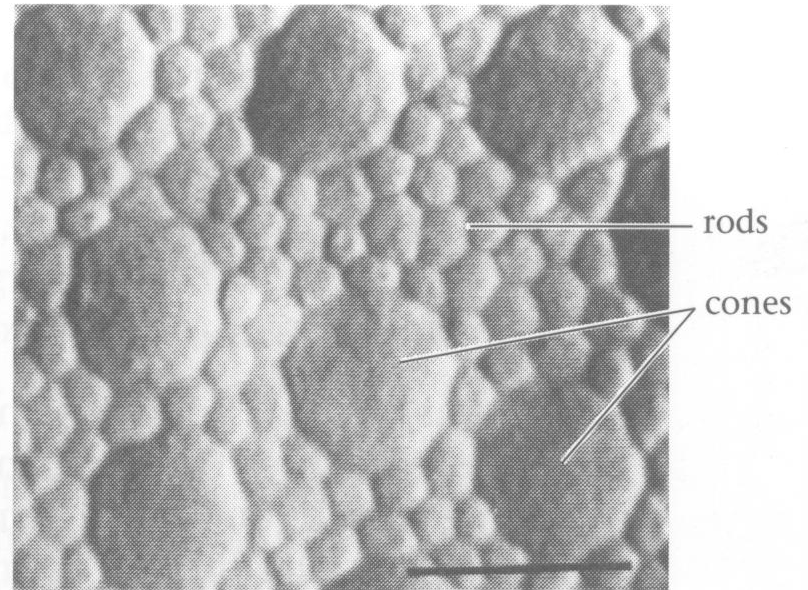
Wandell, 1995 (Fig 3.1)

Distribution of rods and cones: a view from the front

Fovea



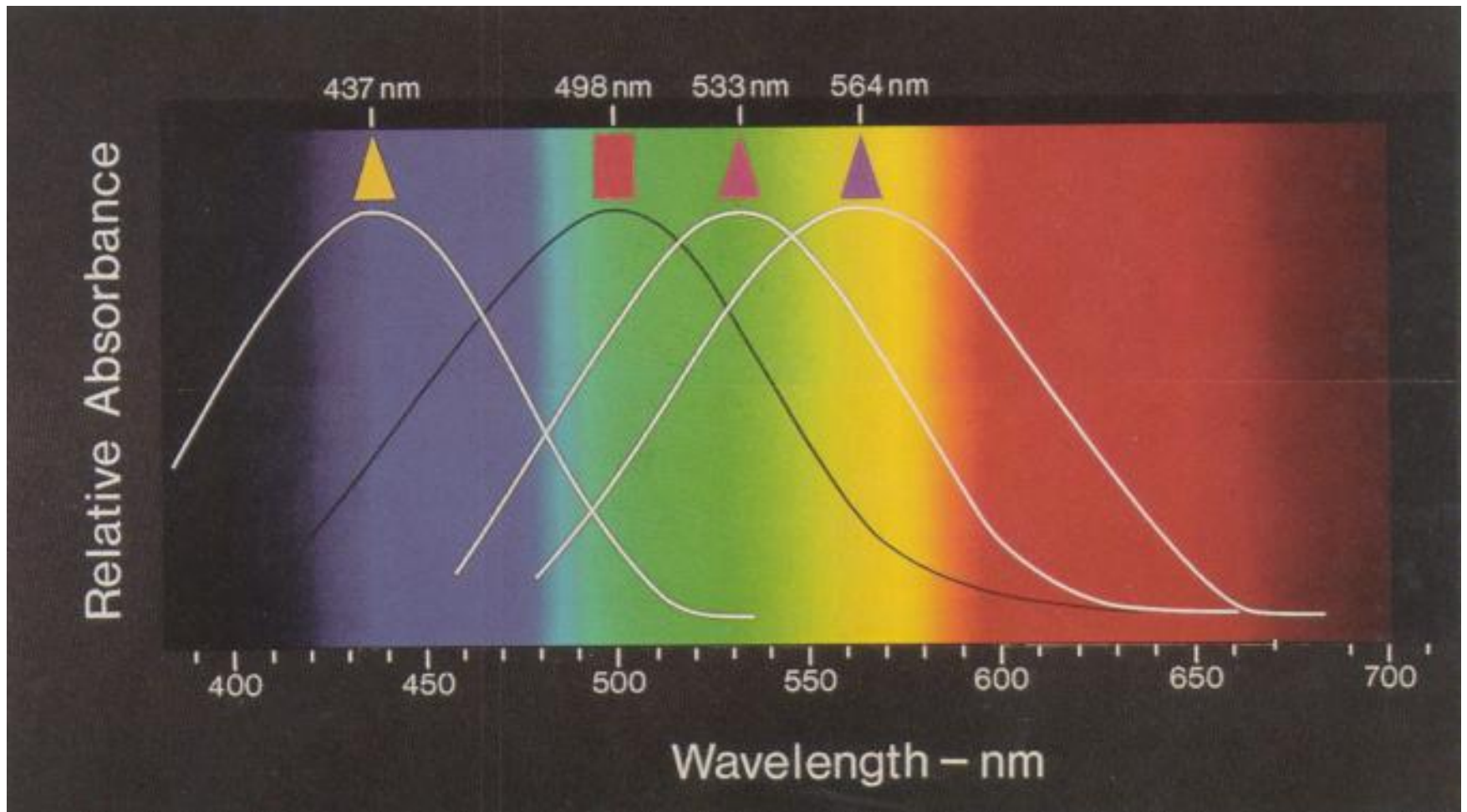
Periphery



10 micron

Sensitivity for wavelength of the 3 types of cones

S Rods M L





Sekuler and Blake, 1985, plate 6

A section through the human retina

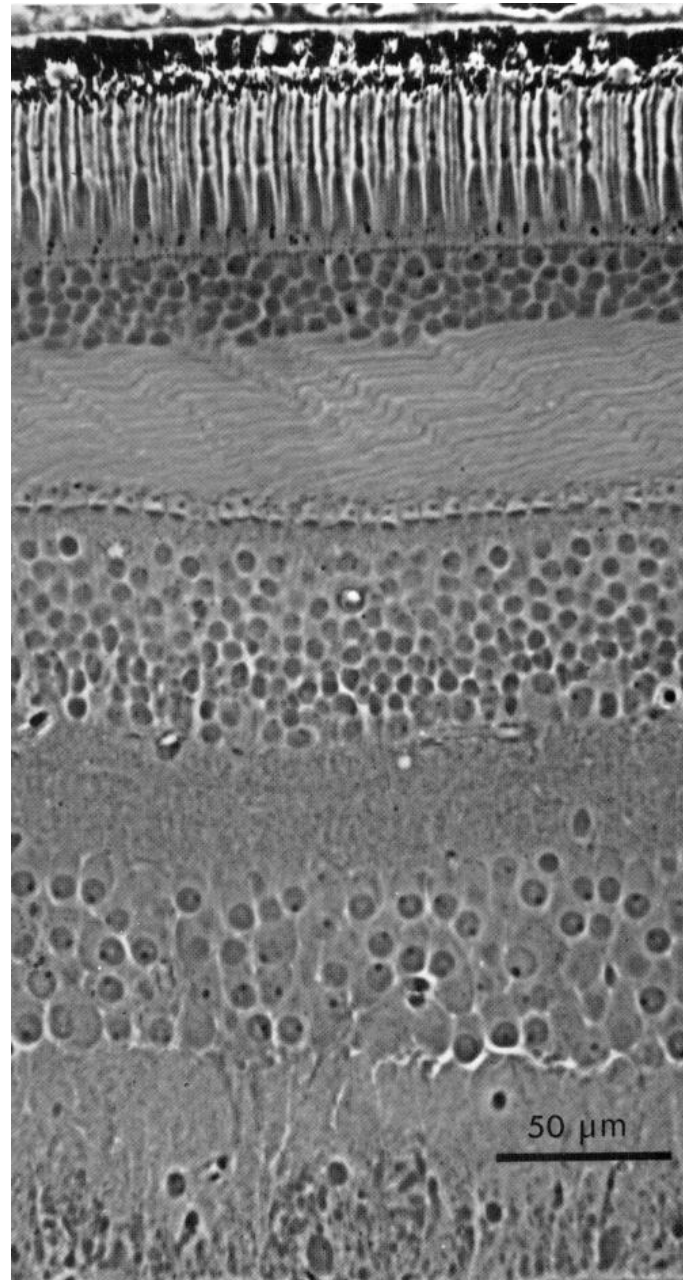
Receptors: rods and cones

Bipolar and Horizontal cells

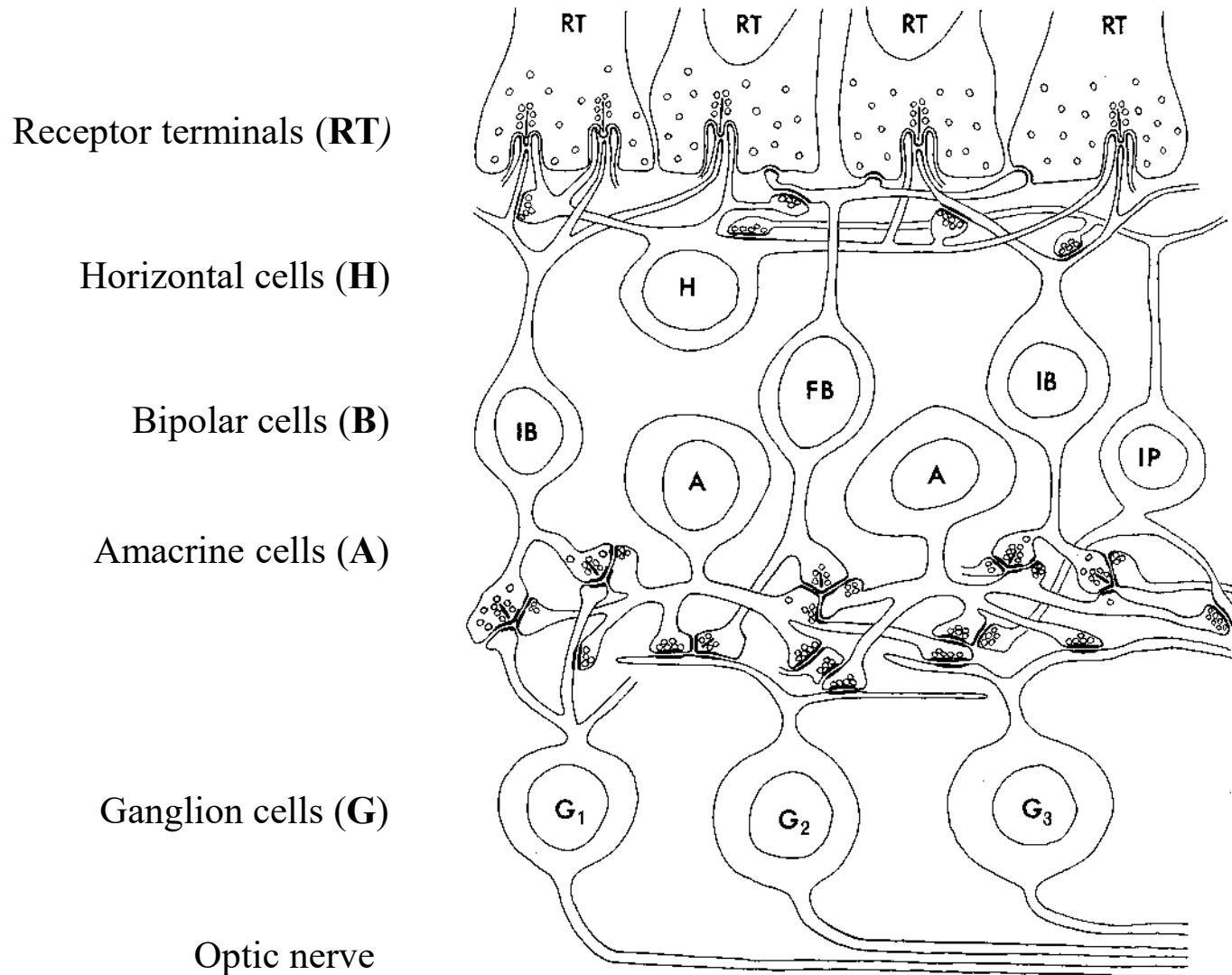
Amacrine cells

Ganglion cells

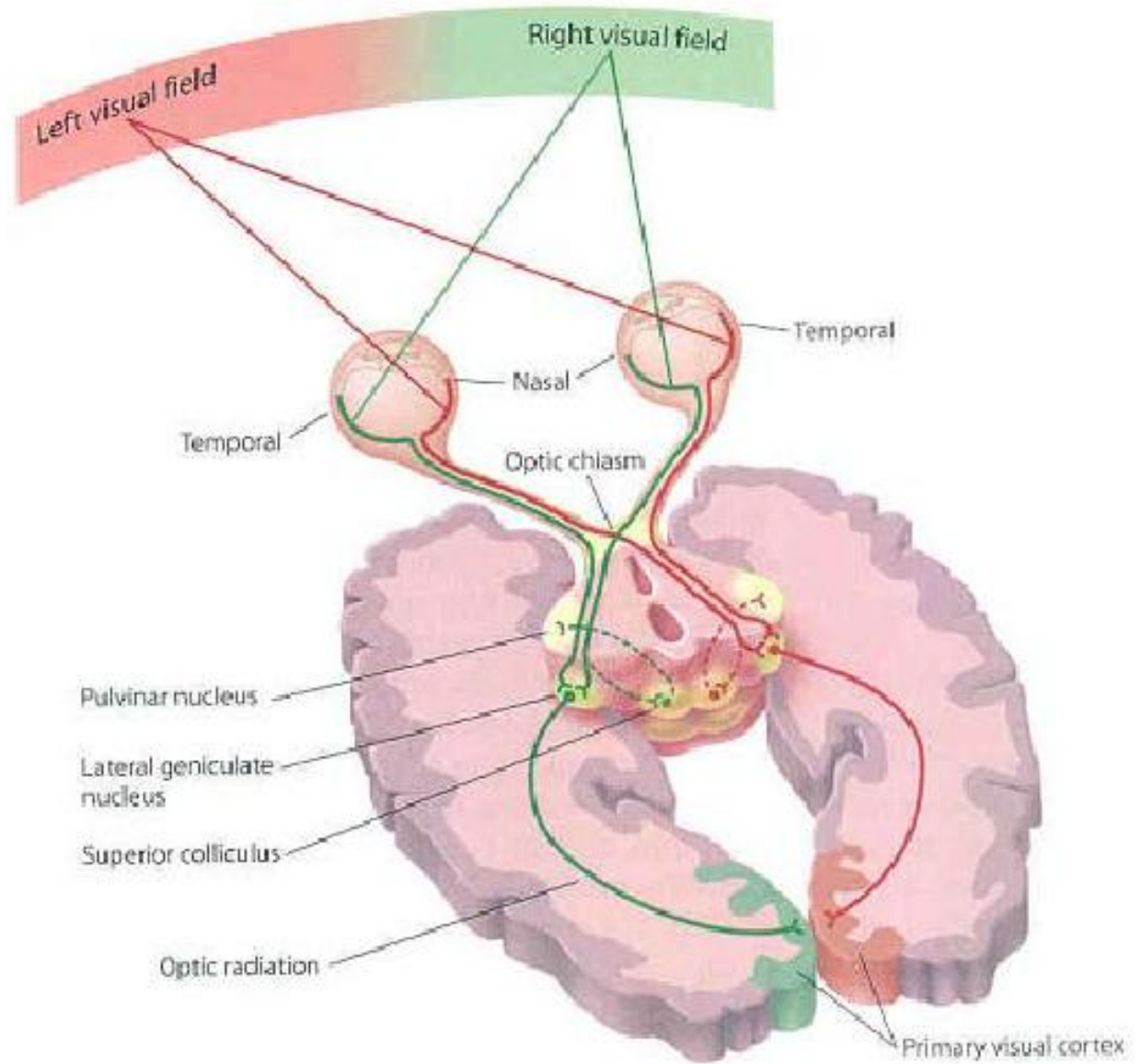
Optic nerve



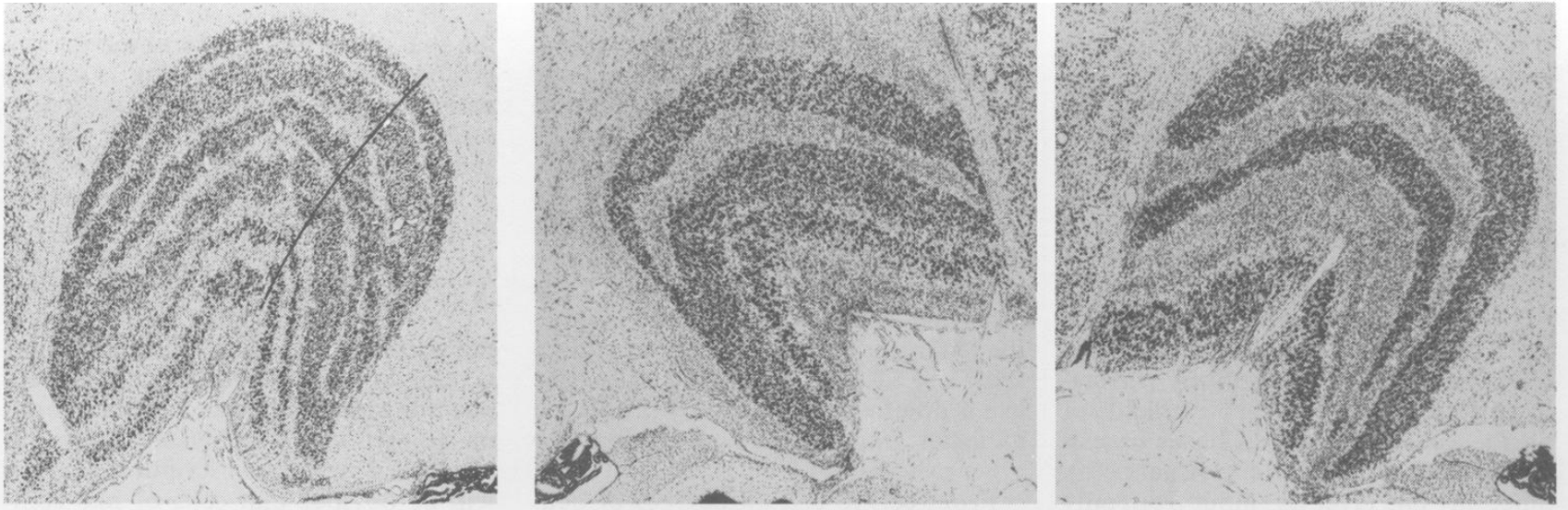
Basic retinal circuitry



Visual Pathways

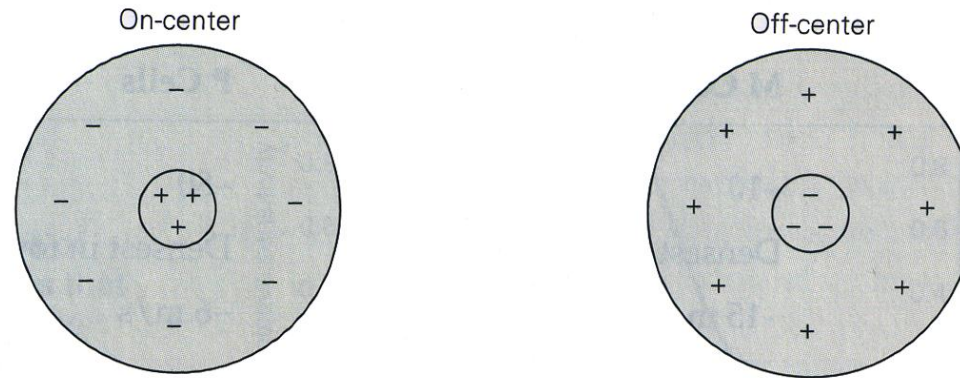


The Lateral Geniculate Nucleus (LGN)

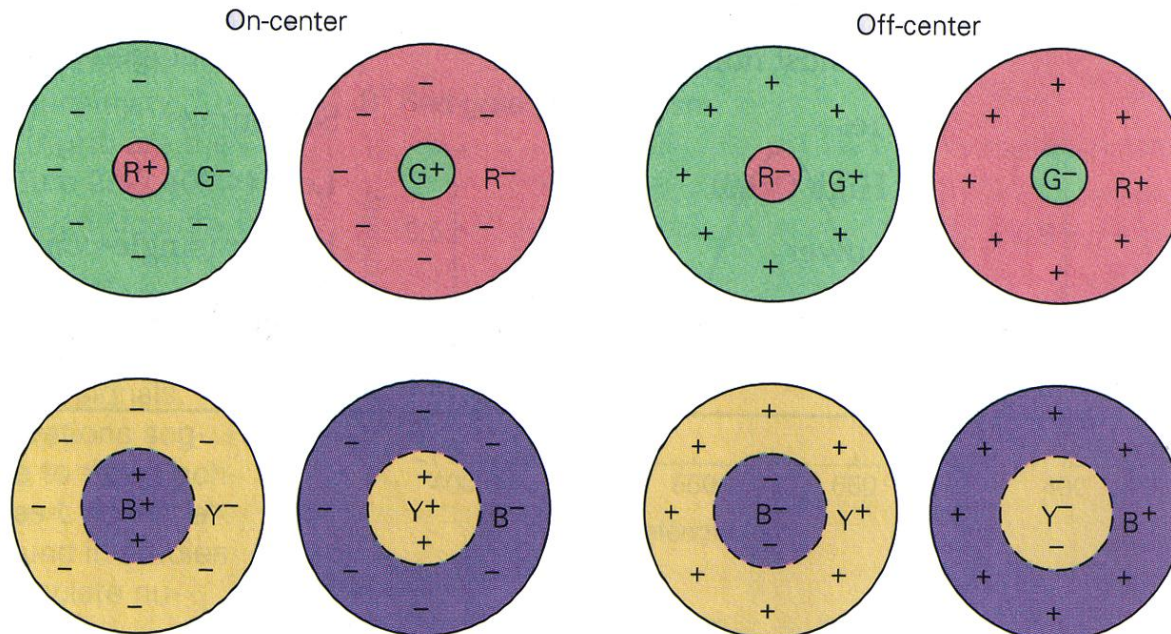


Receptive fields of Ganglion cells and LGN neurones

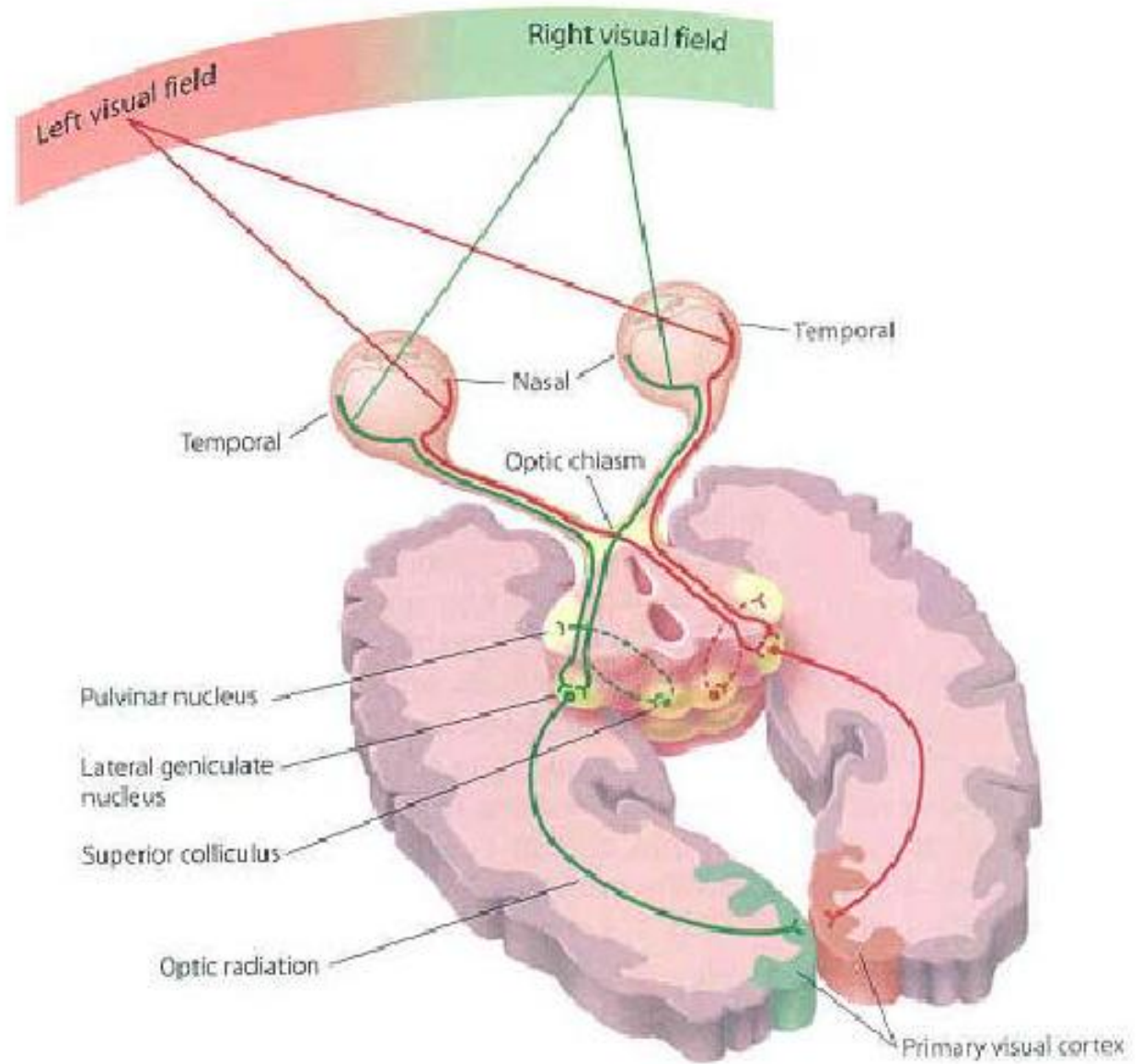
A M cells



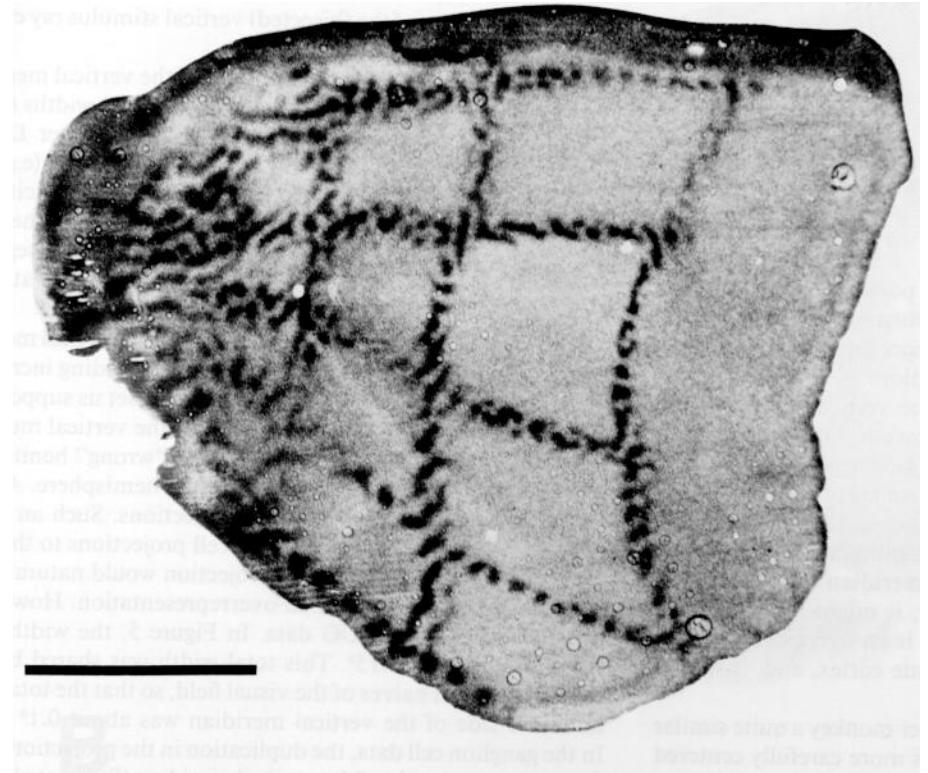
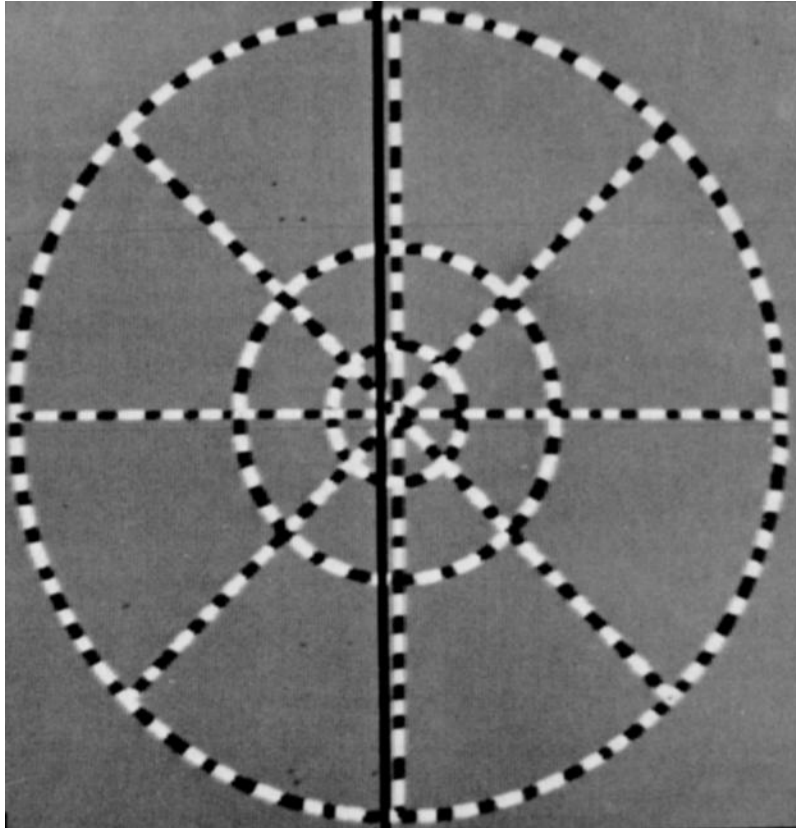
B P cells



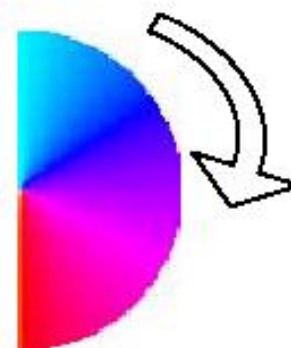
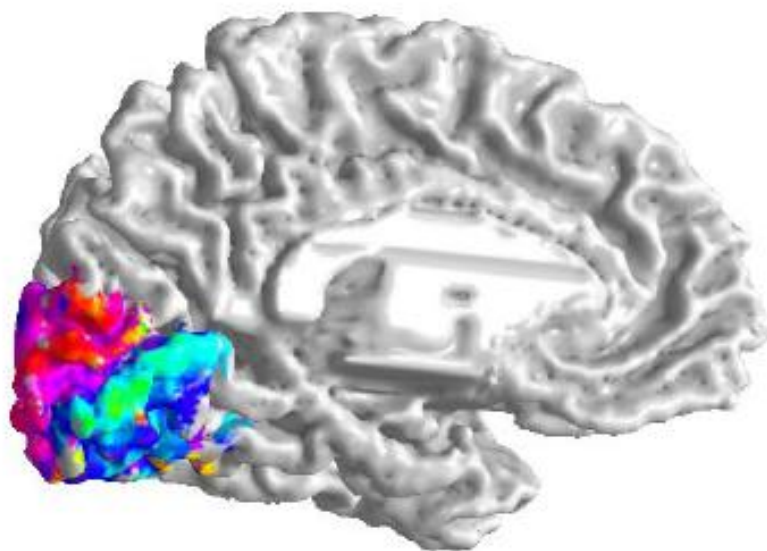
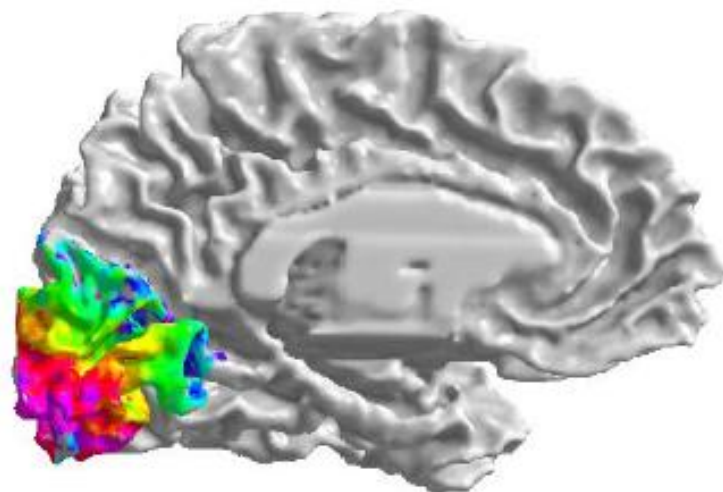
Visual Pathways



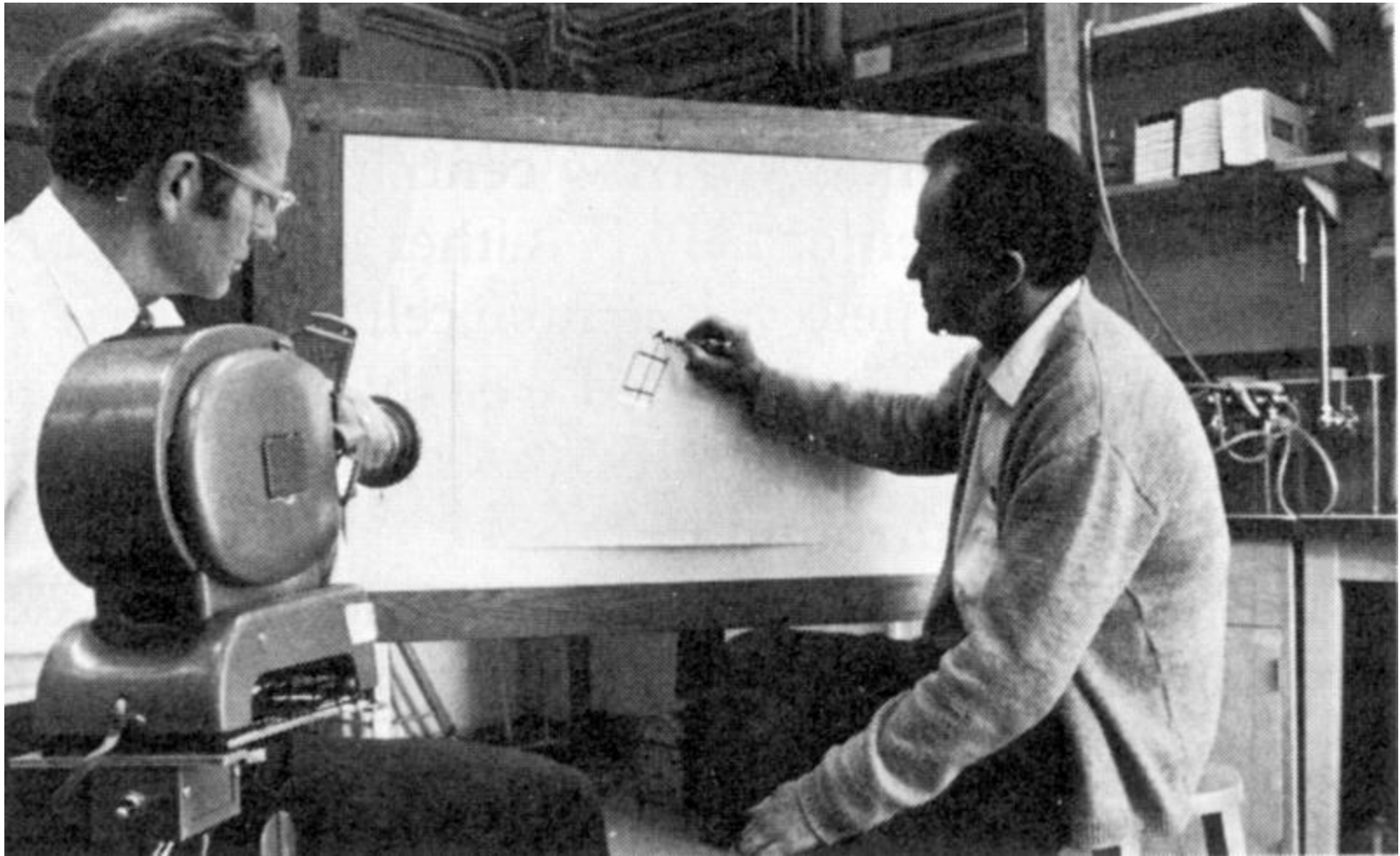
Cortical representation measured with 2-deoxy-glucose



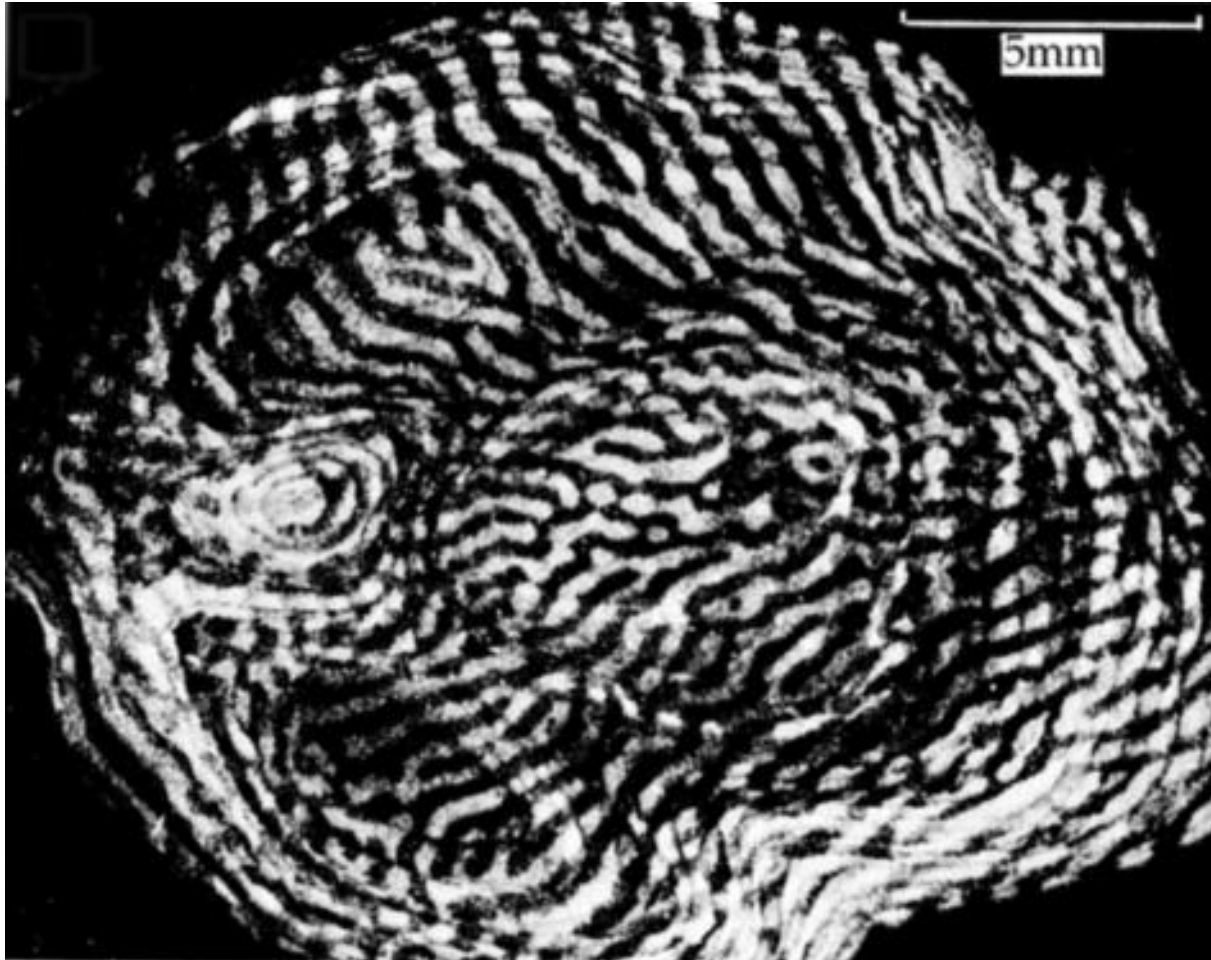
Retinotopic Maps in Human Cortex



Hubel and Wiesel, circa 1969



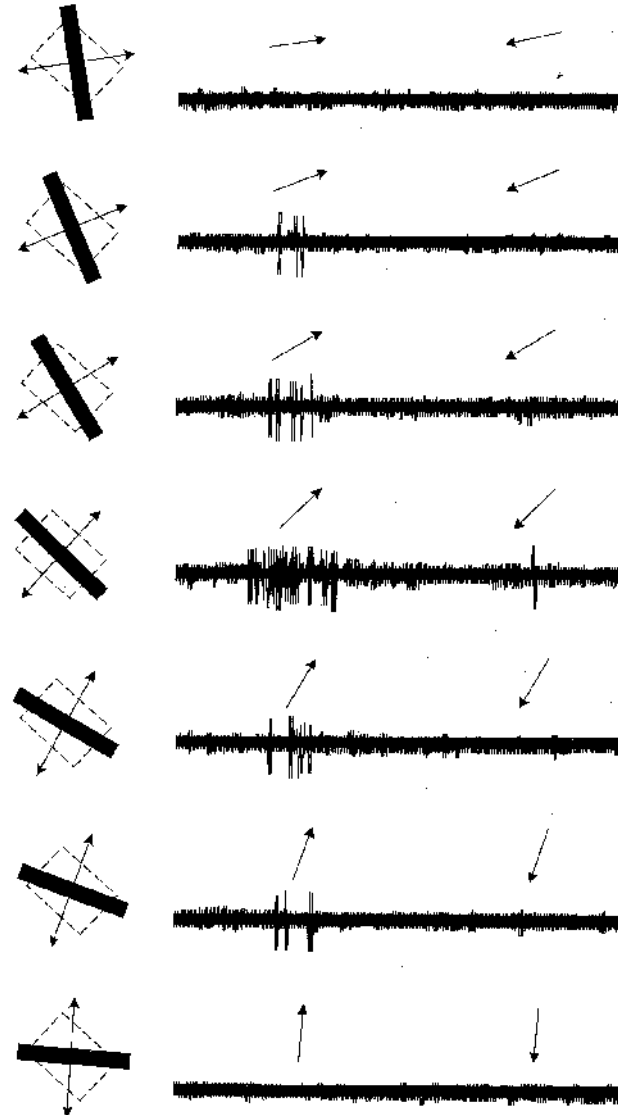
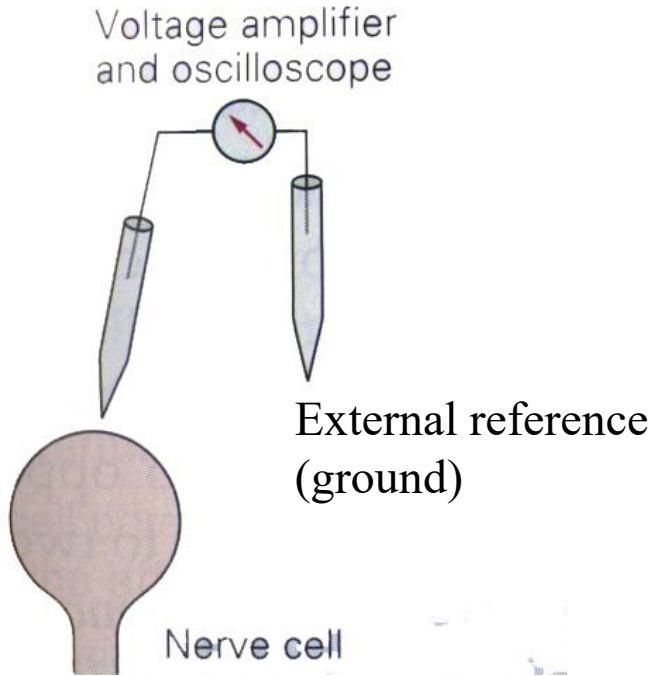
Ocular dominance columns measured with radioactive proline



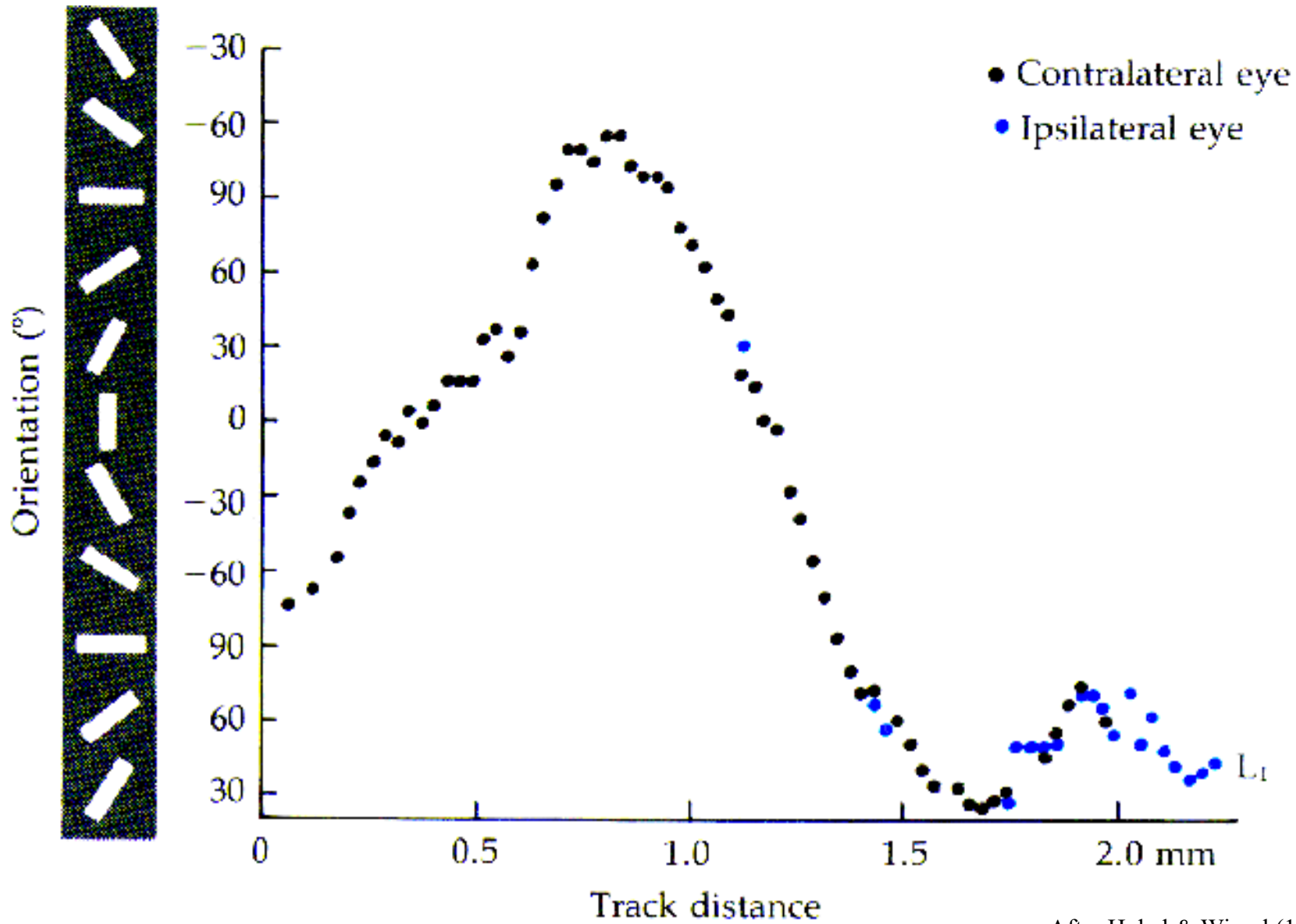
LeVay, Hubel and Wiesel (1975)
in Nicholls et al. (1992)

Extracellular recordings

Selectivity for stimulus orientation and direction in area V1:

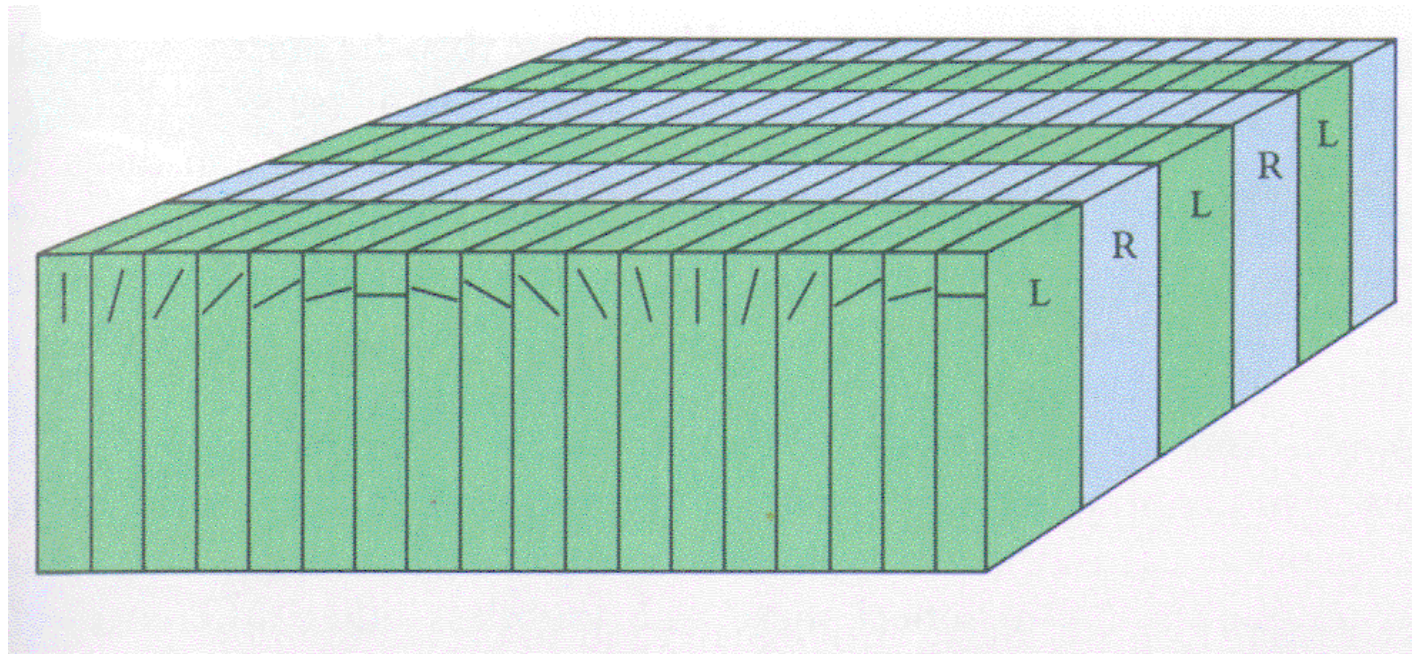


Hubel and Wiesel (1968)
in Wandell (1995)

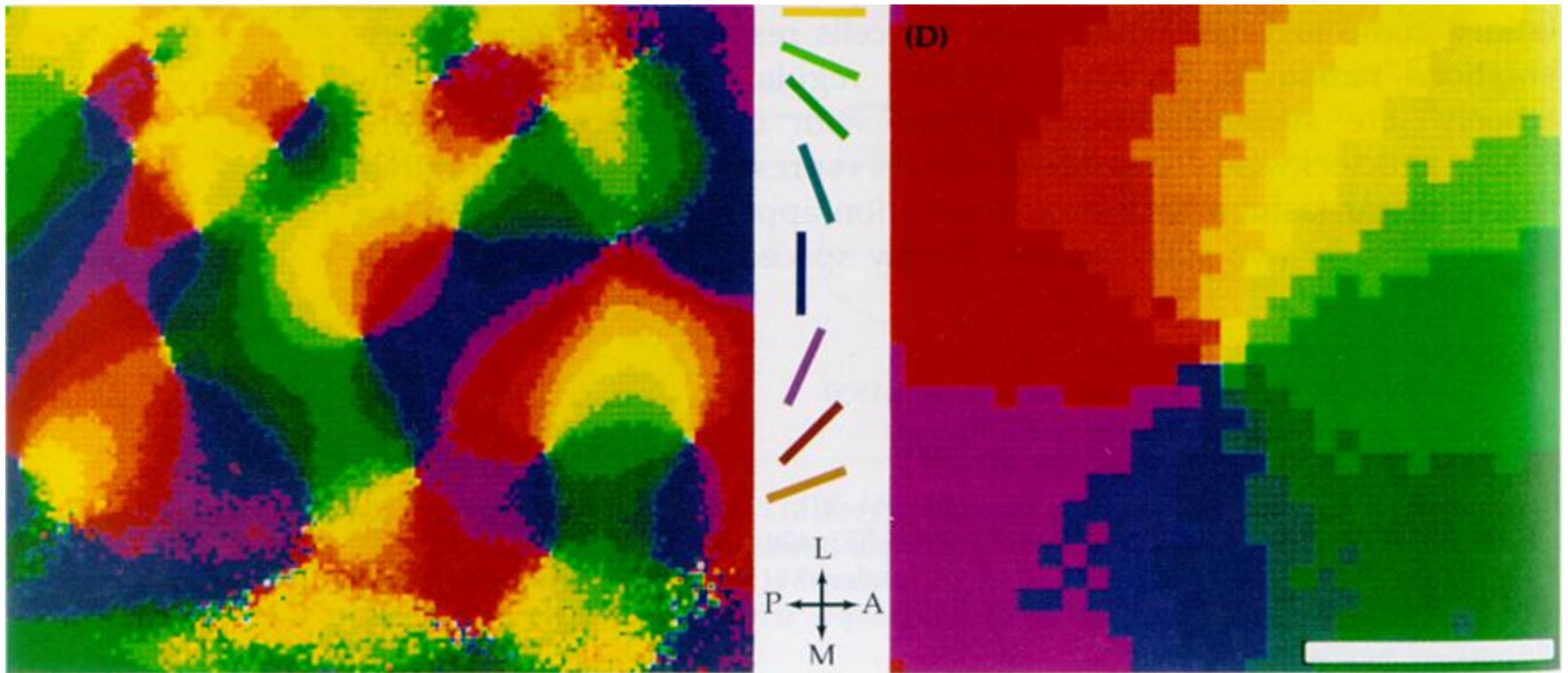


After Hubel & Wiesel (1962)
in Nicholls et al. (1992)

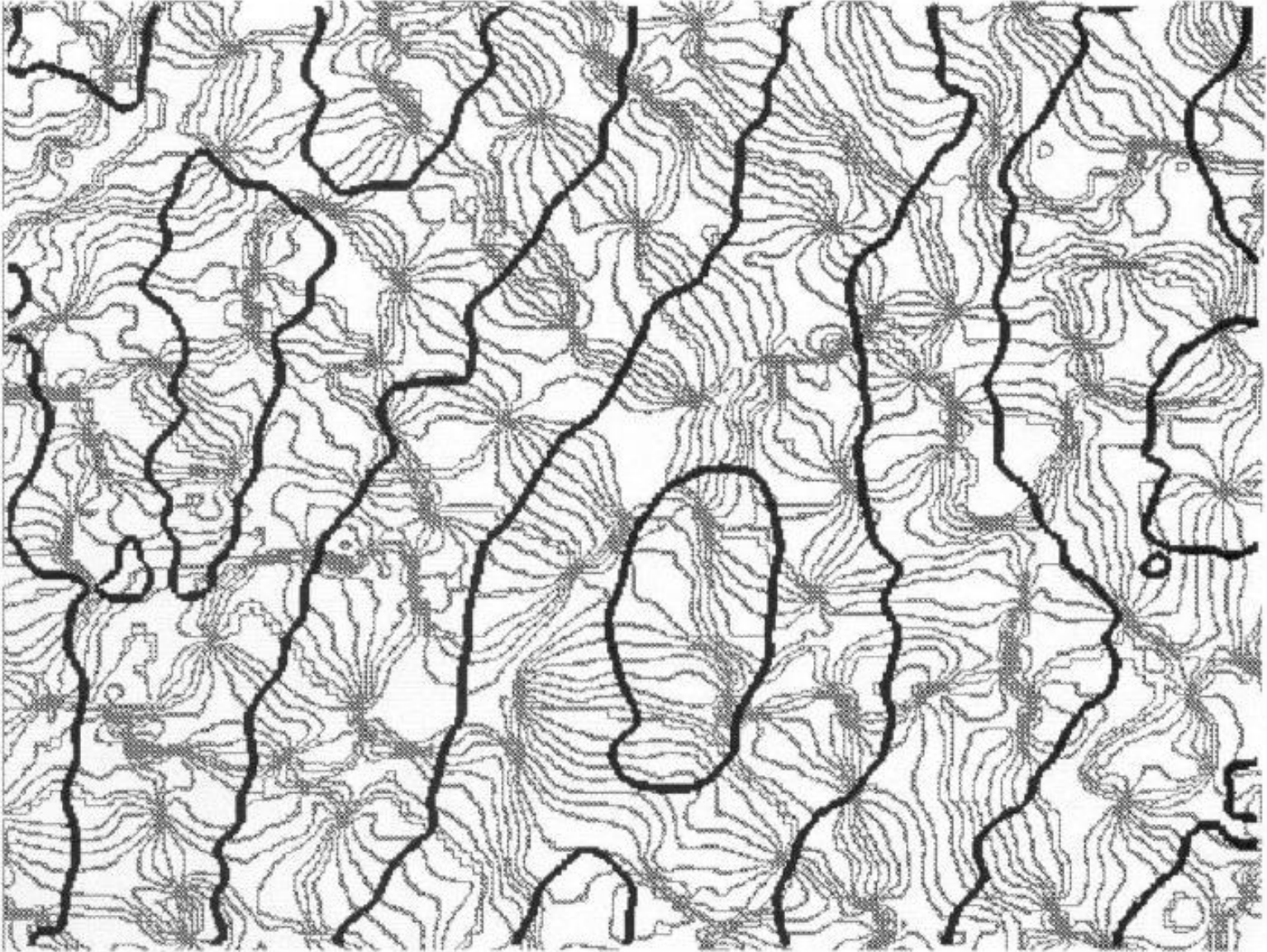
The “ice-cube” model of Hubel and Wiesel



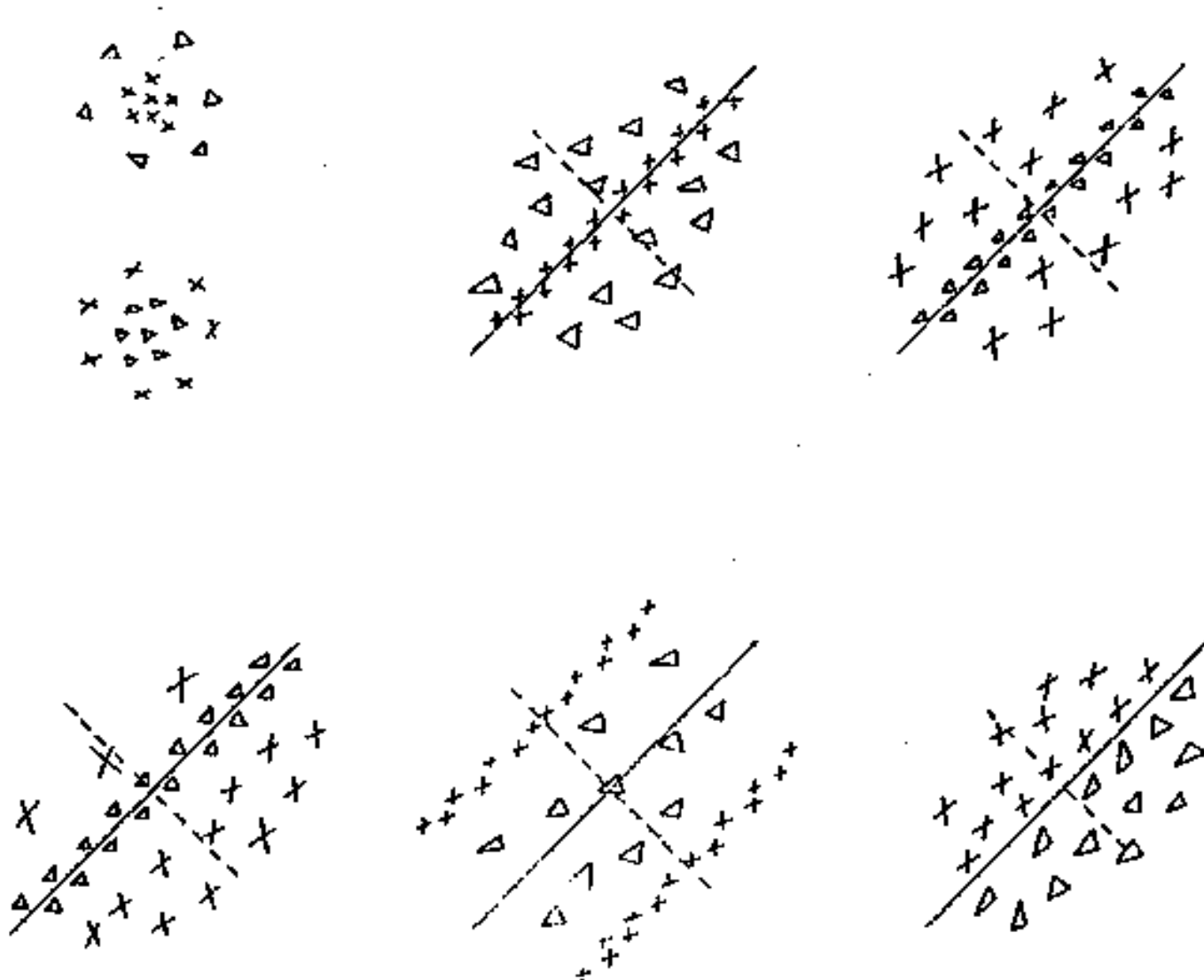
Orientation columns measured with optical imaging



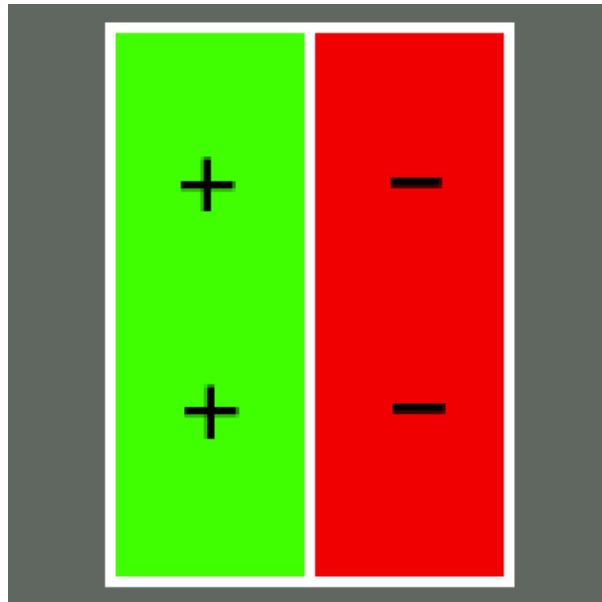
Orientierung und Okular Dominanz Säule



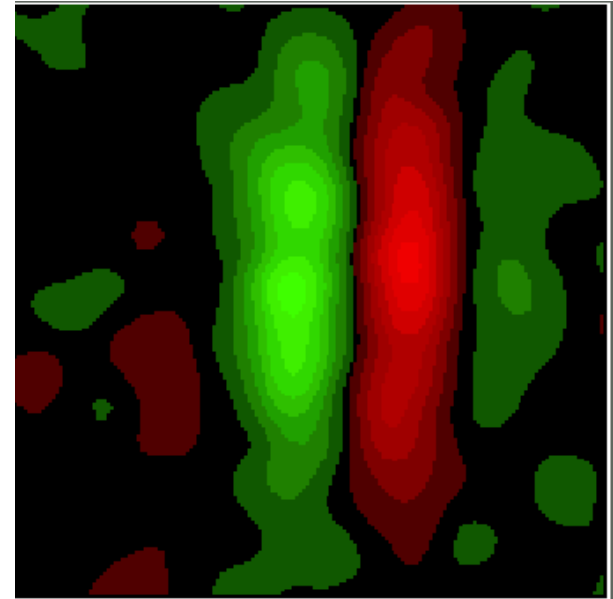
Receptive fields of LGN and V1 simple cells



Receptive field of a simple cell

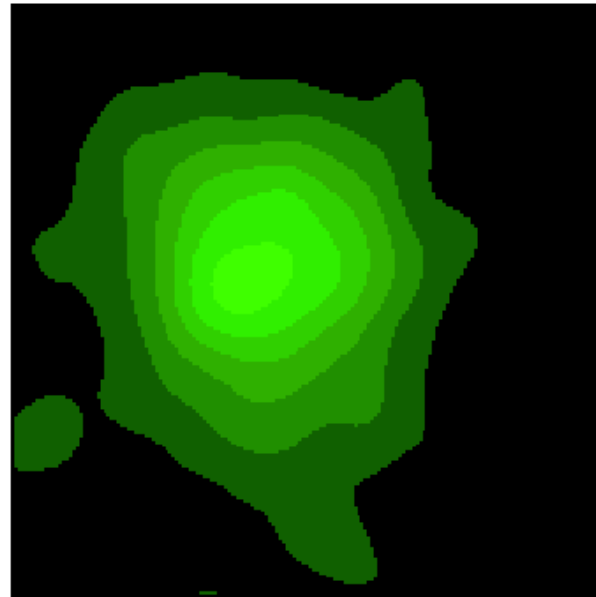
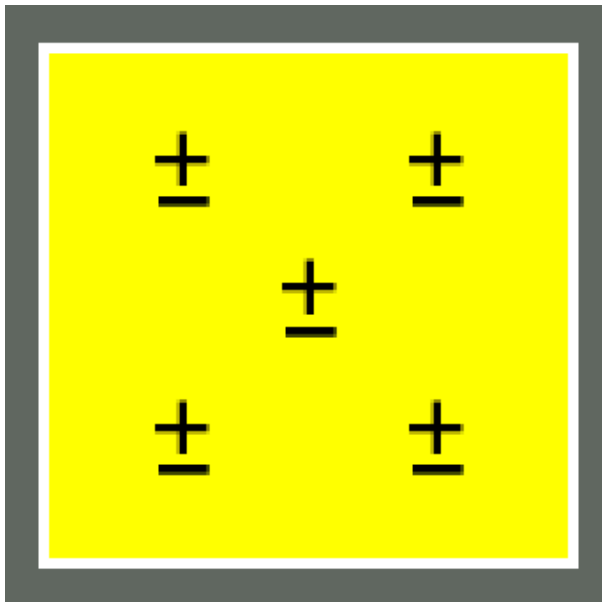


Schematic of the receptive field

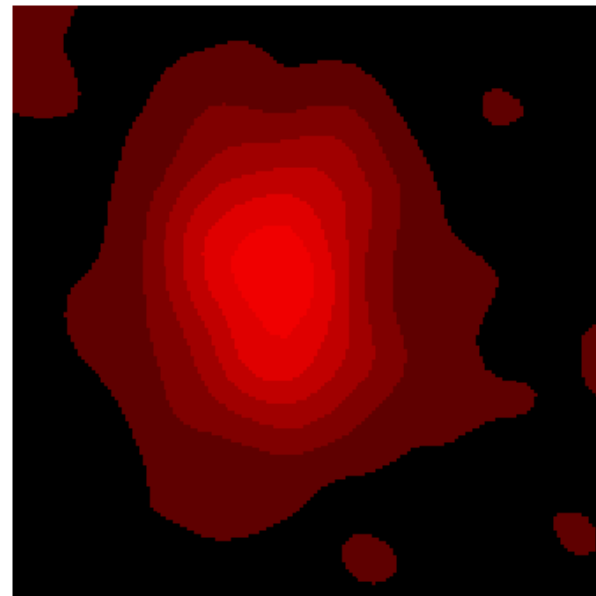


Responses to white dots -
responses to black dots

Receptive field of a complex cell

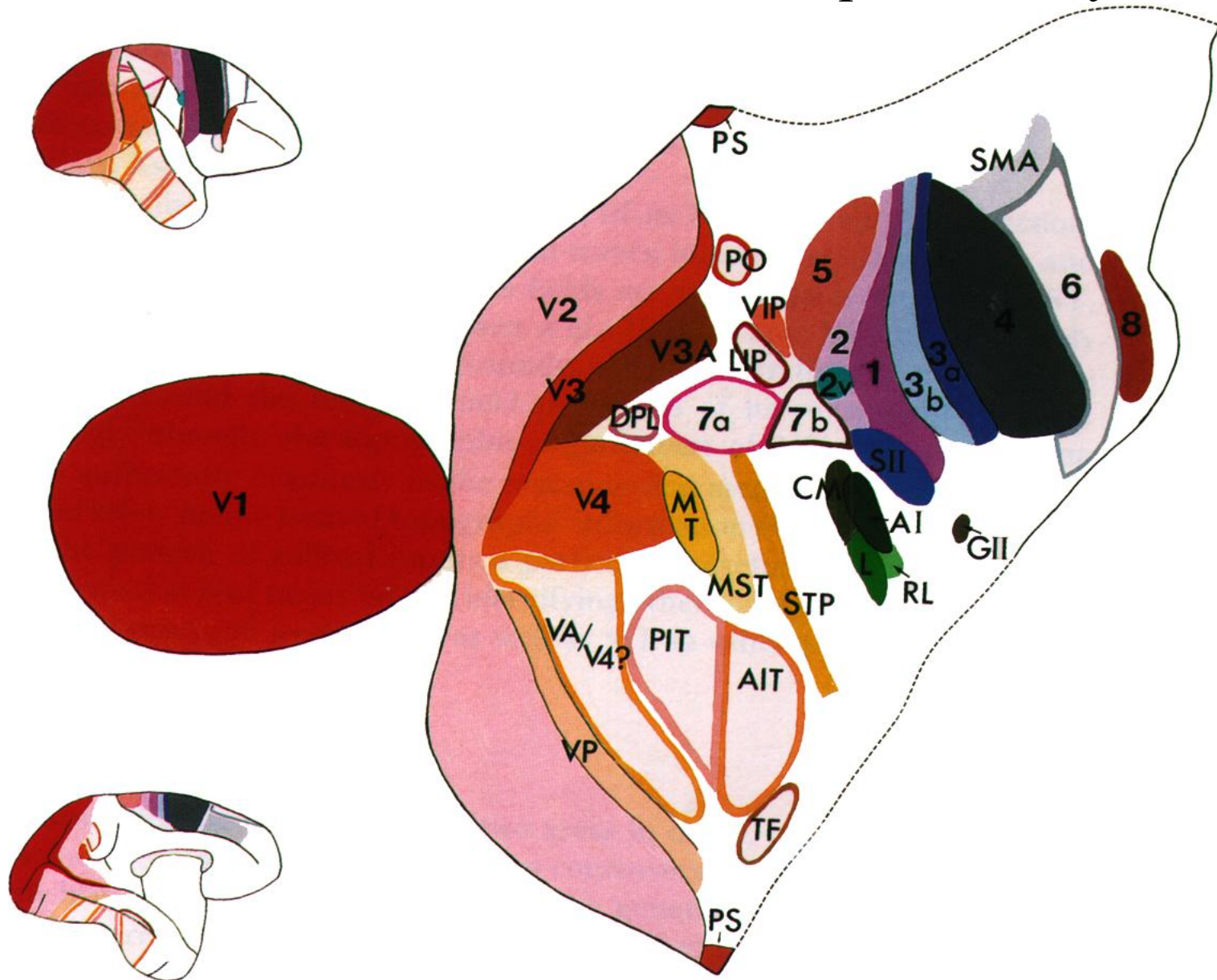


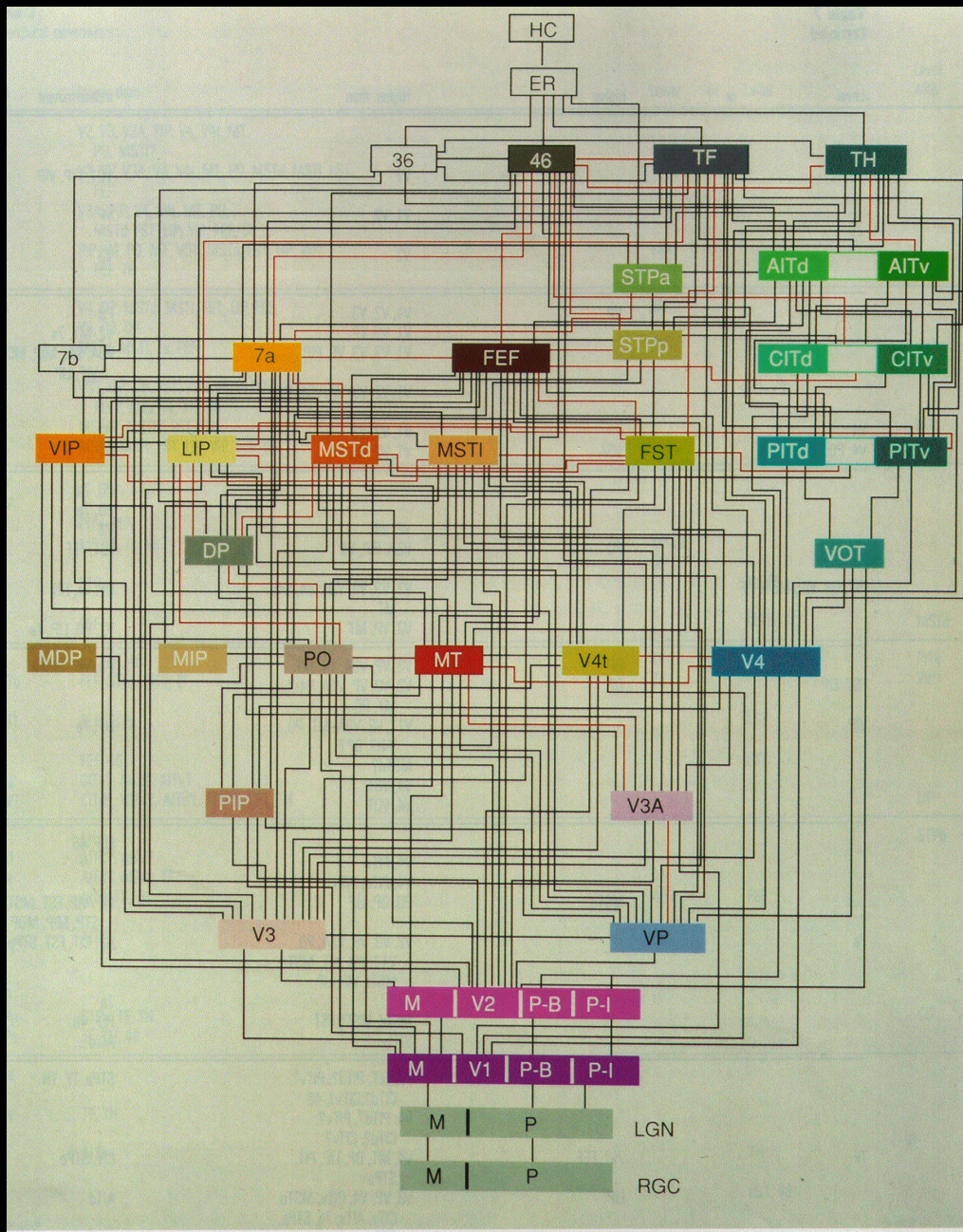
Responses to
white dots



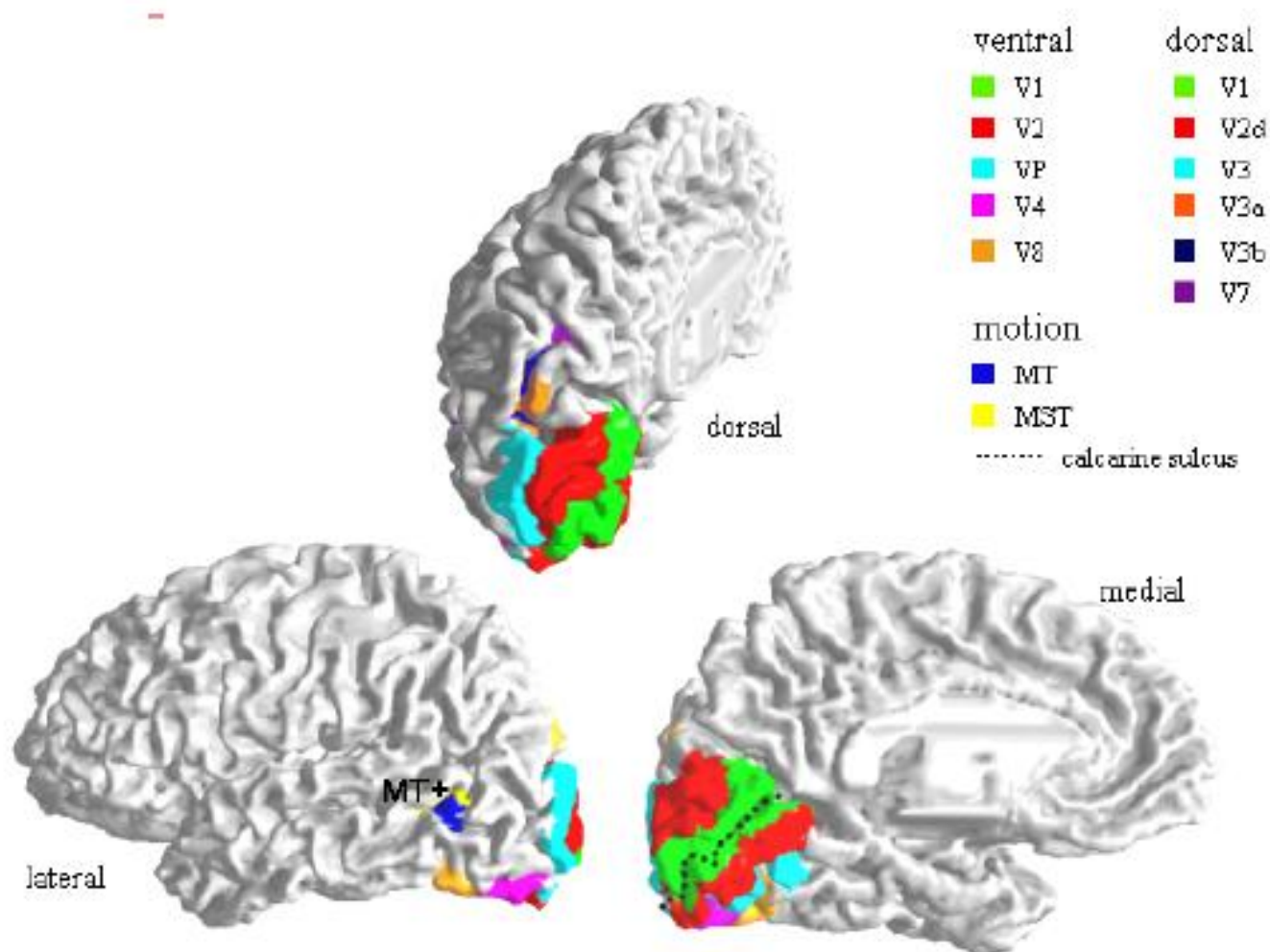
Responses to
black dots

Cortical visual areas of the macaque monkey





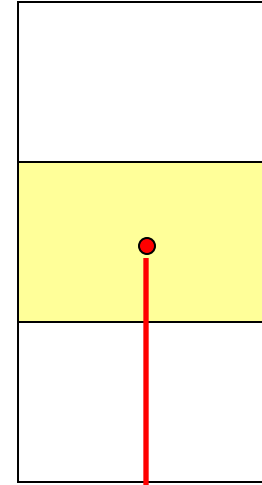
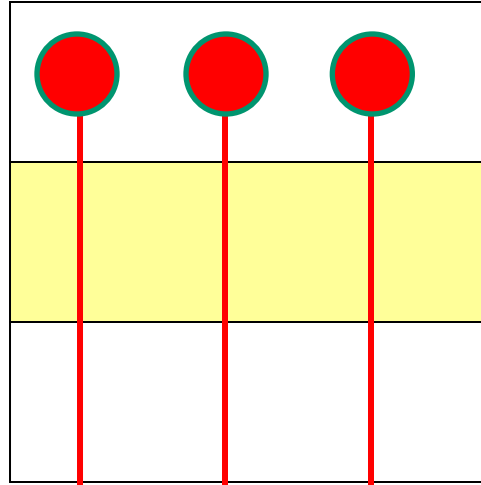
Multiple Visual Areas



Lower area

Higher area

Superficial layers

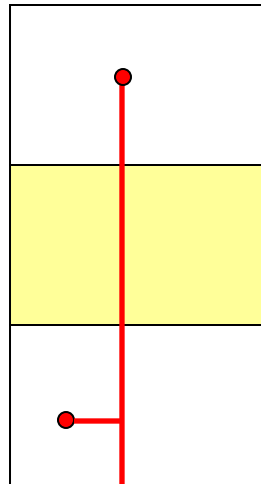


Layer IV

Feedforward

Infragranular layers

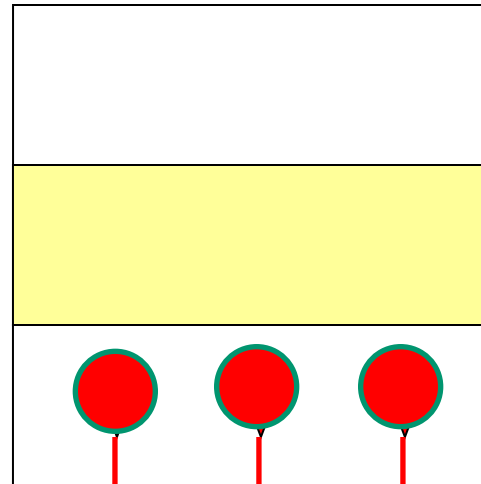
Superficial layers



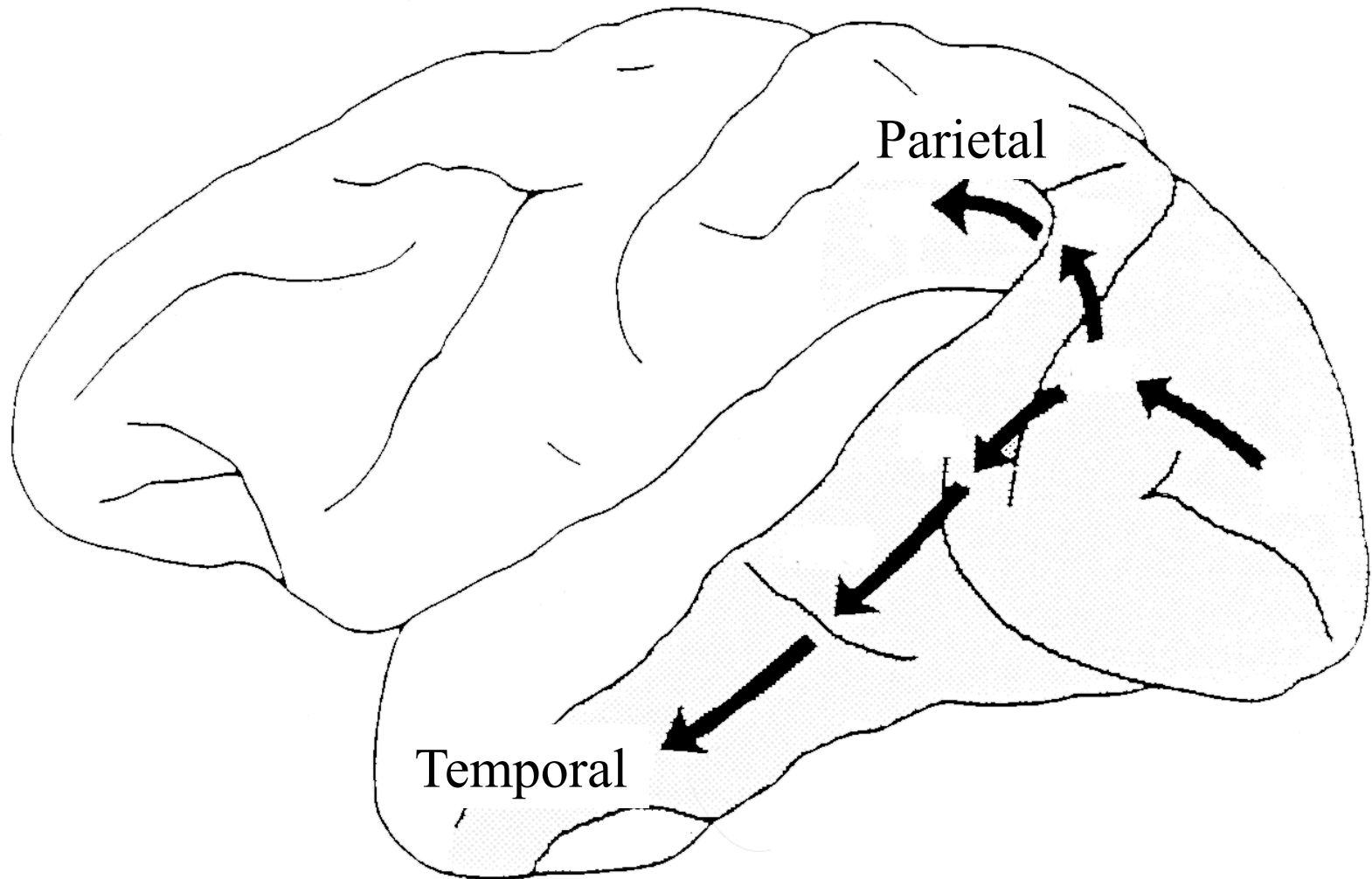
Layer IV

Feedback

Infragranular layers



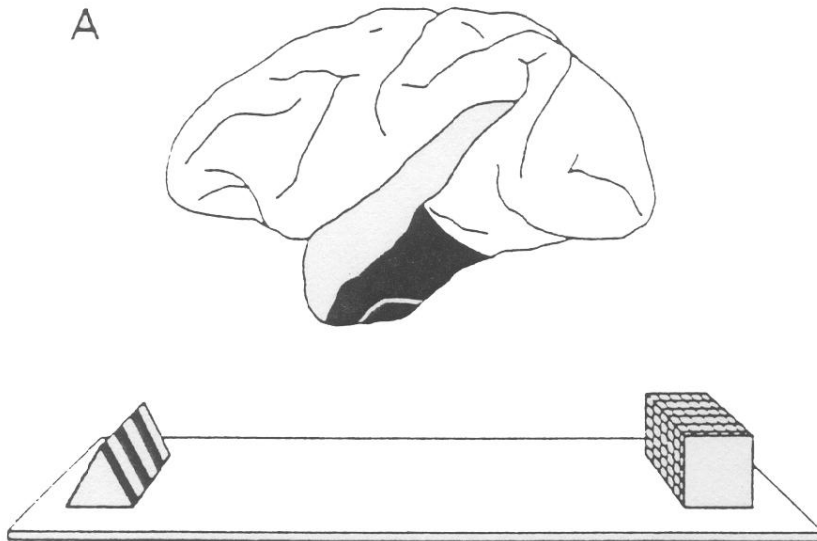
Two cortical functional streams



Effects of lesions in two cortical regions

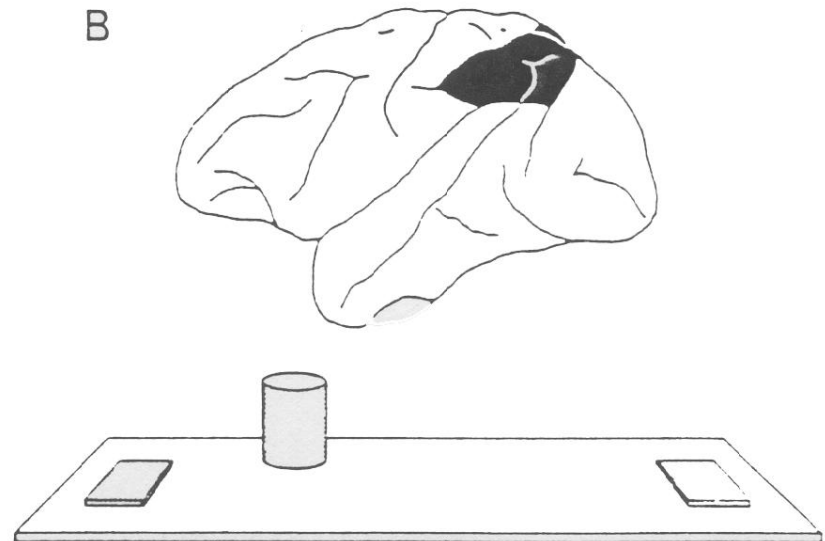
Lesion in temporal cortex

A



Lesion in parietal cortex

B



Parietal stream

Temporal stream

