“Künstliche Intelligenz oder “reale Intelligenz”

Das Netzwerk “Gehirn”

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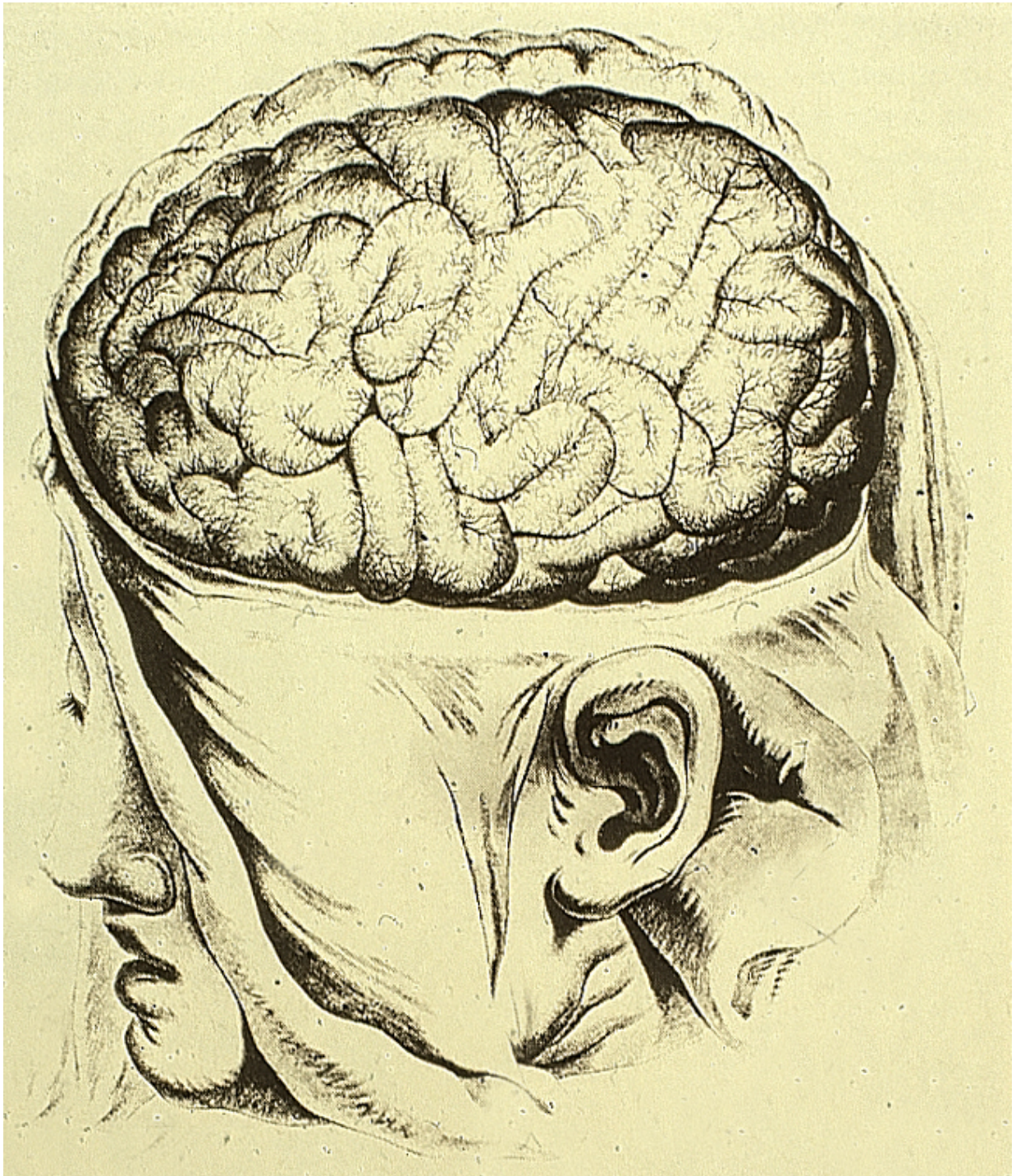


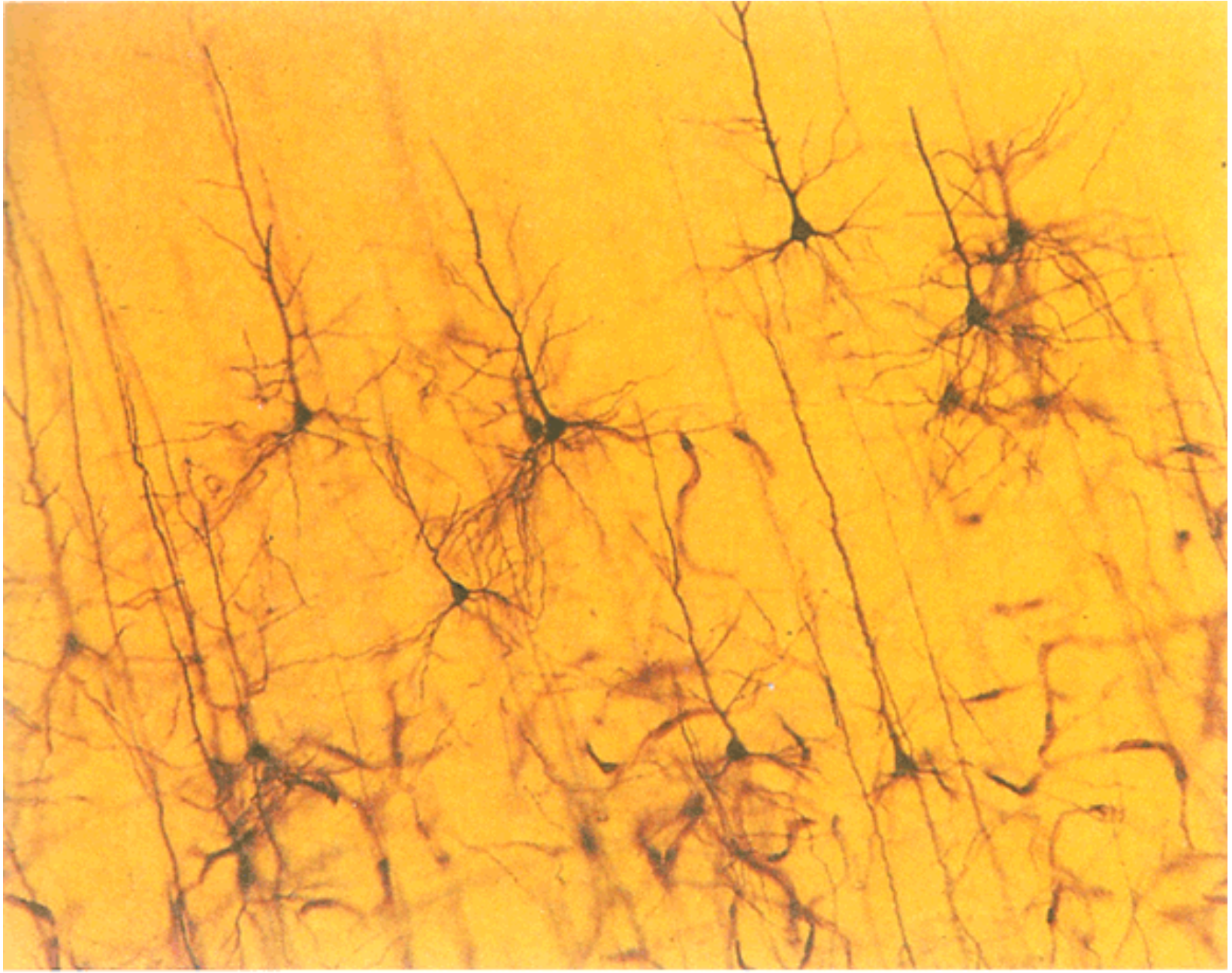


Figure 2.3
Golgi-stained neurons. (Source: Hubel, 1988, p. 126.)

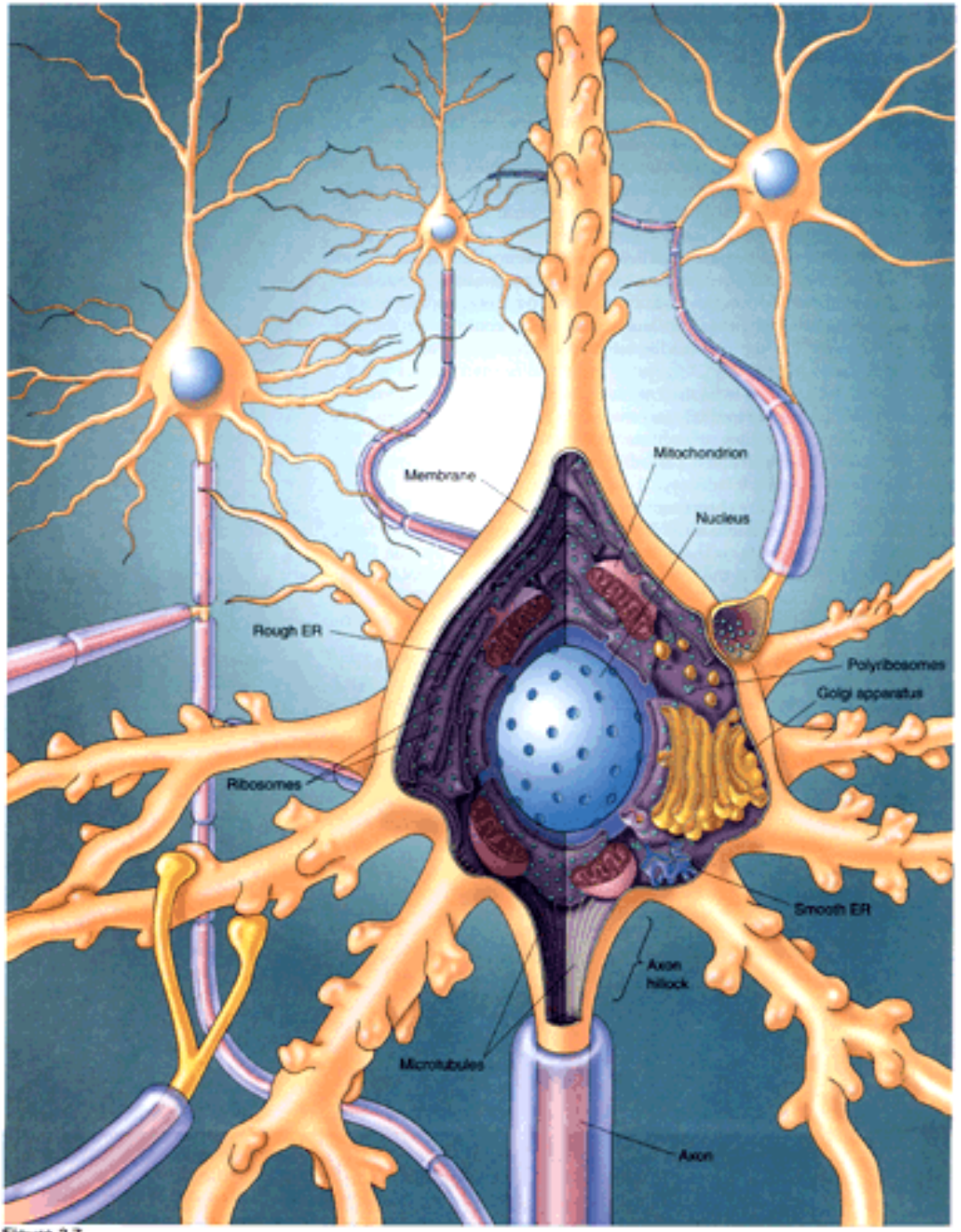
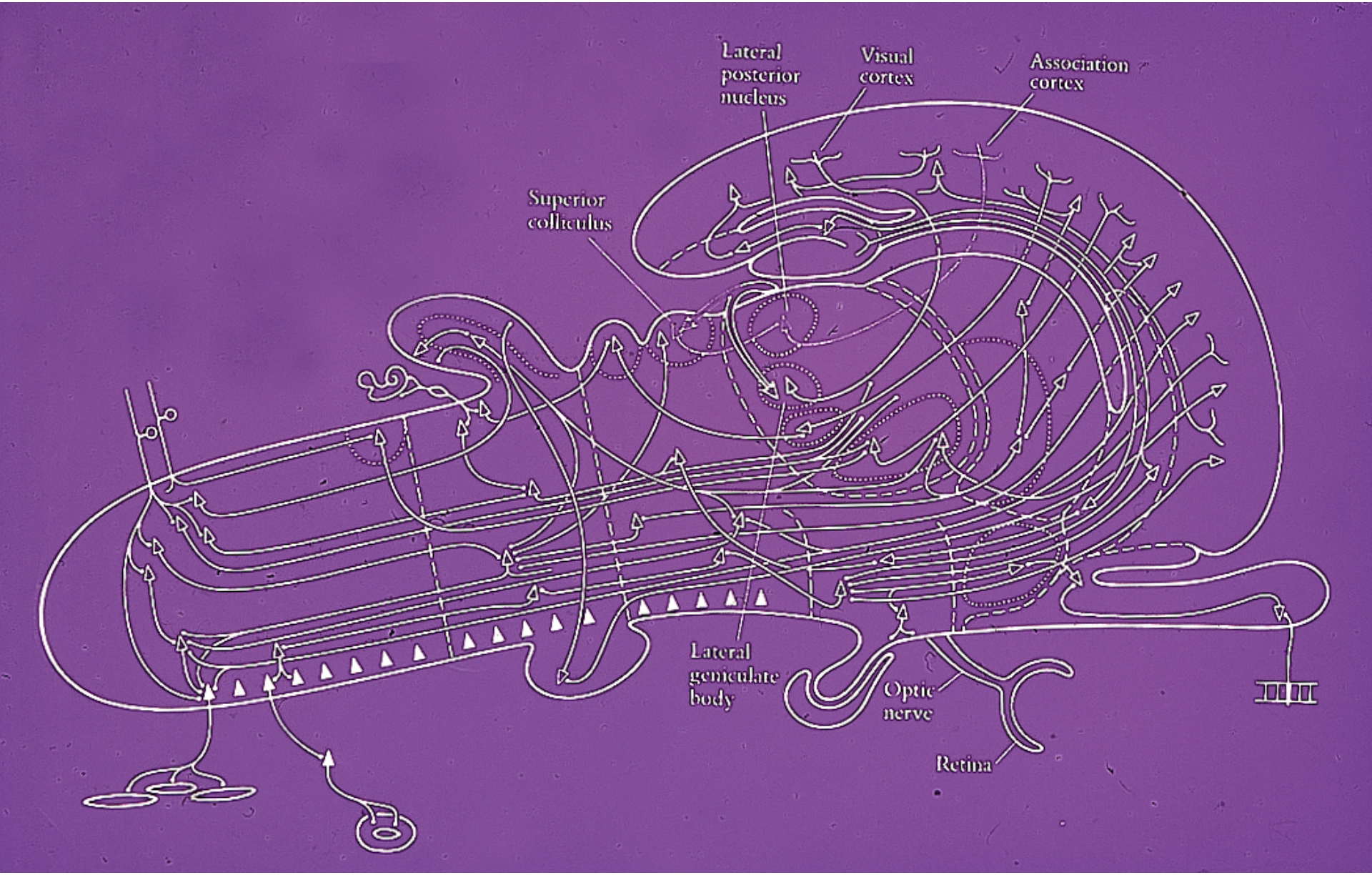


Figure 2.7
A tour of the neuron.


Lateral posterior nucleus
Visual cortex
Association cortex
Superior colliculus
Lateral geniculate body
Optic nerve
Retina

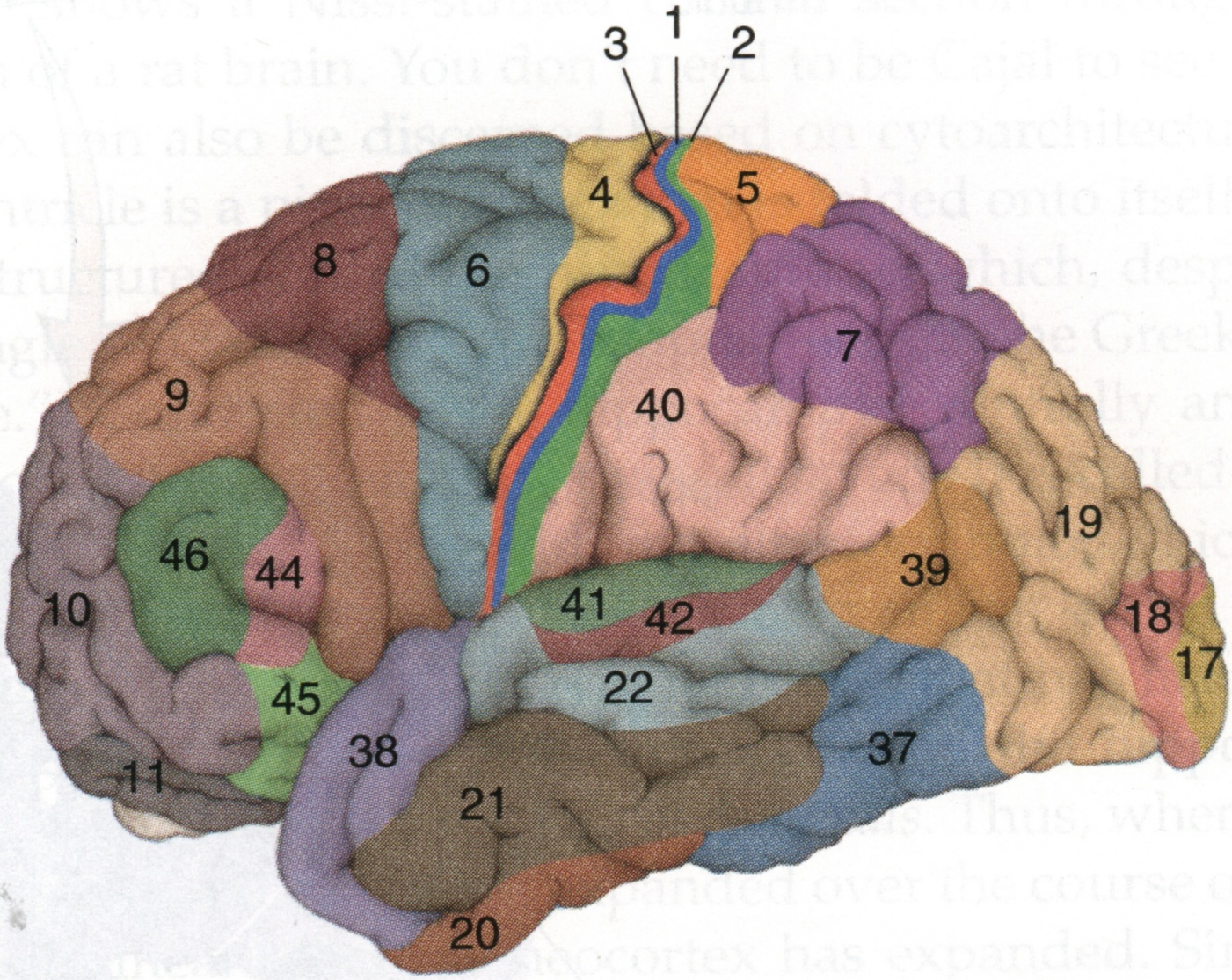
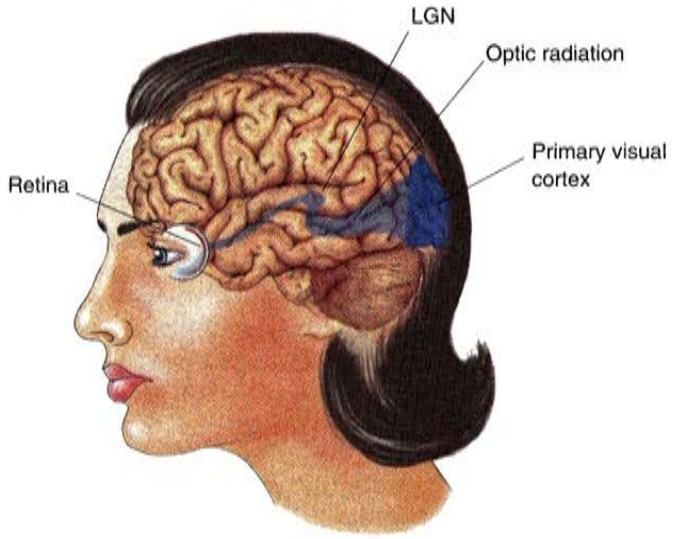
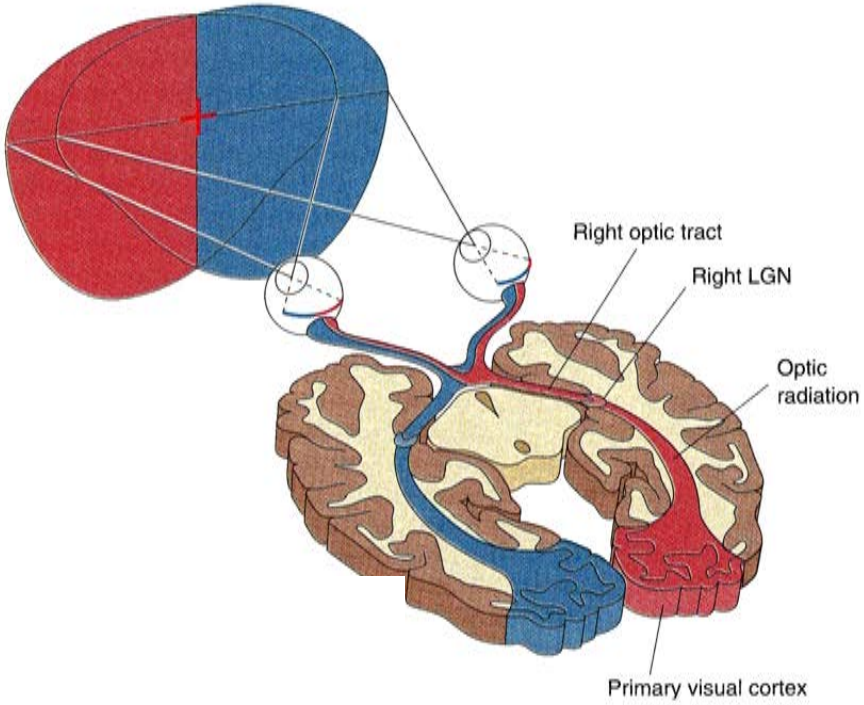


Figure 7.26
Brodmann's cytoarchitectural map of the human cerebral cortex.

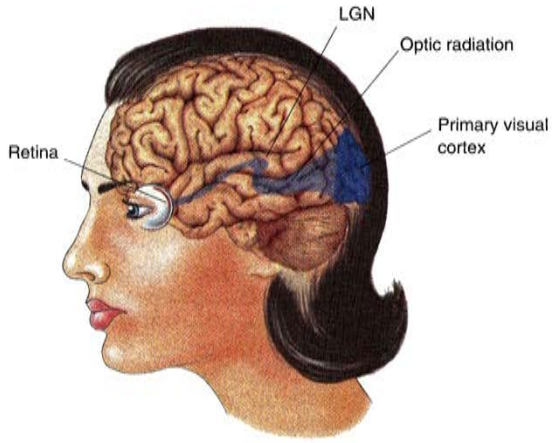

LGN
Optic radiation
Primary visual cortex
Retina

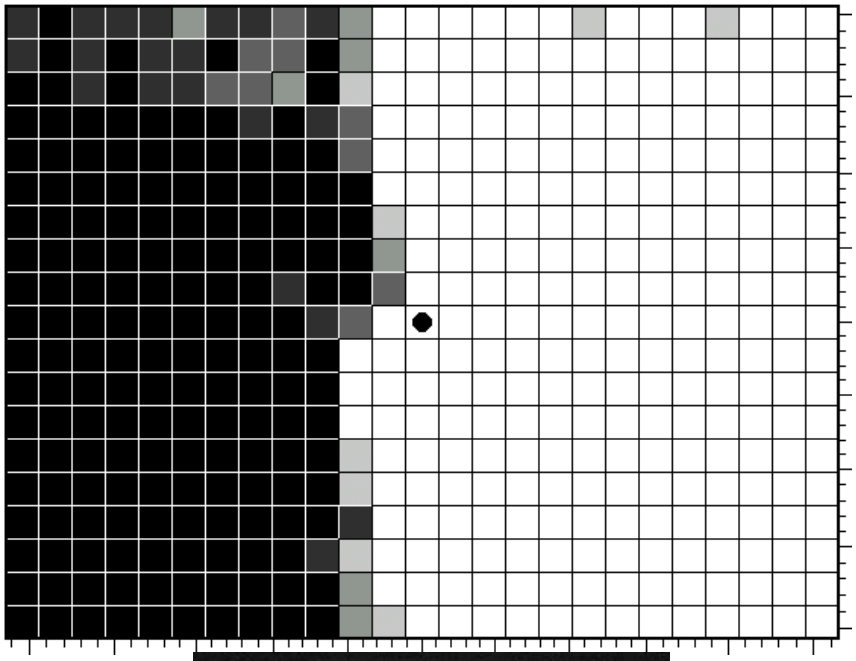
(a)

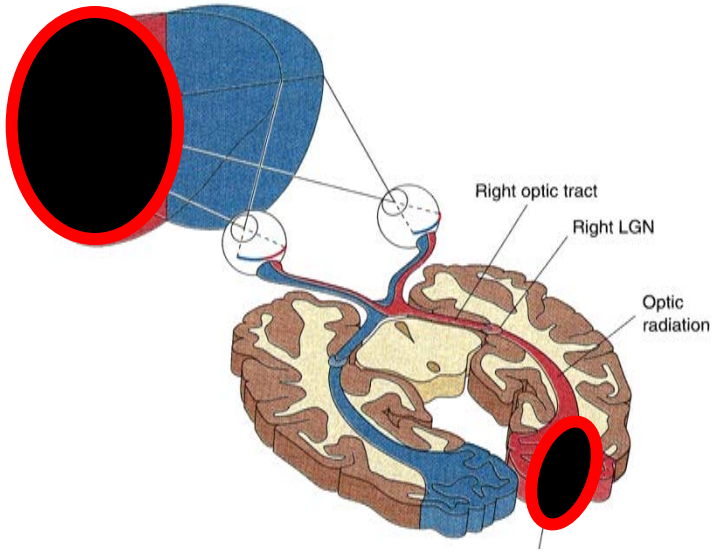

Right optic tract
Right LGN
Optic radiation
Primary visual cortex

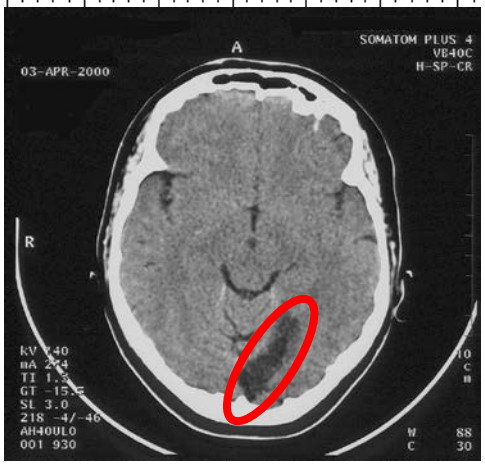
Low vision after brain damage

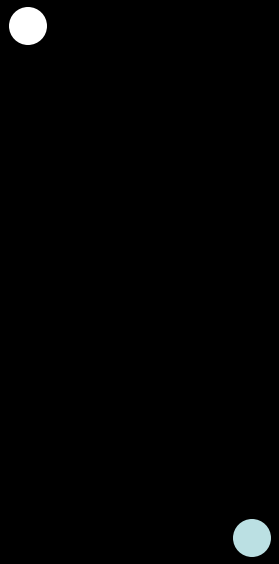
black-and-white view of the visual world

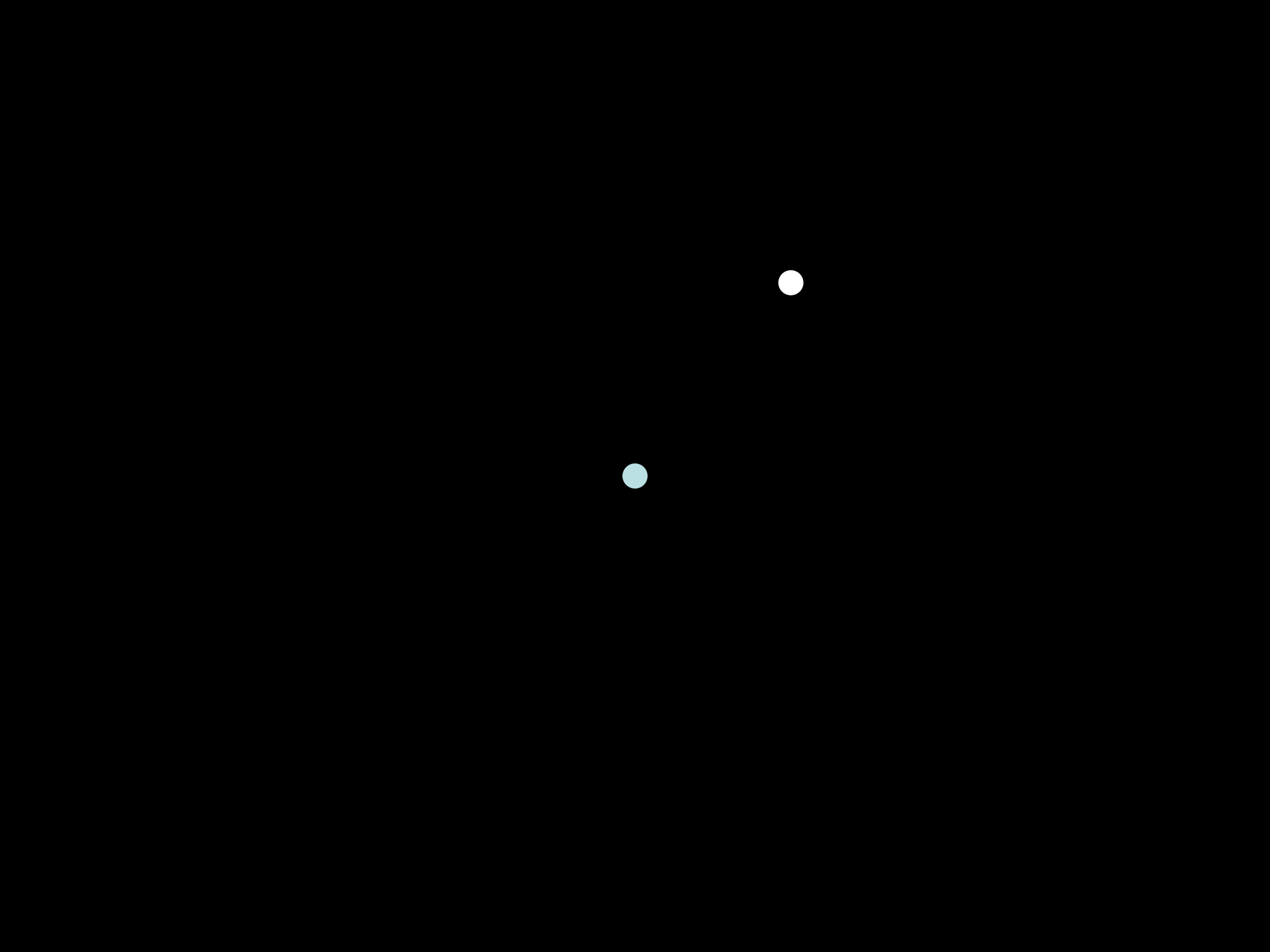


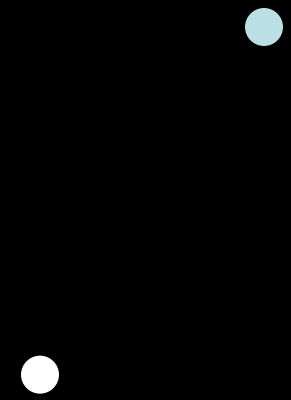













Measuring the visual field with computer-based perimetry

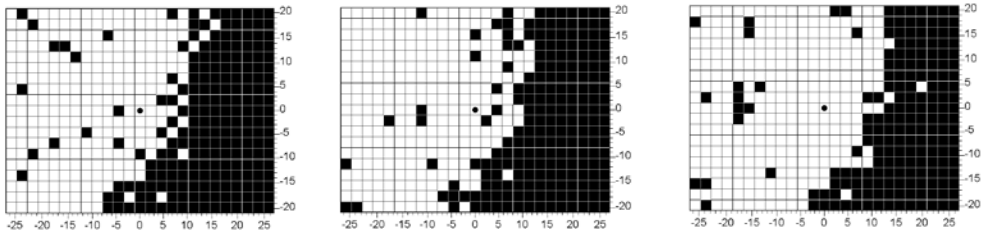
Visual field chart shows detection performance in a hemianopic patient.
White: seeing area; black: blind area.
But: the border is usually fuzzy and variable !
This is one region of particular interest for vision restoration

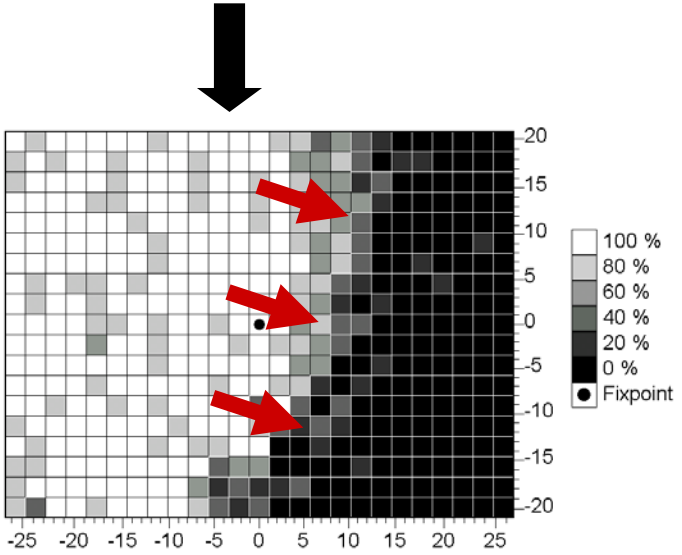
Residual vision after brain damage:

Not „black or white“ but „shades of grey“

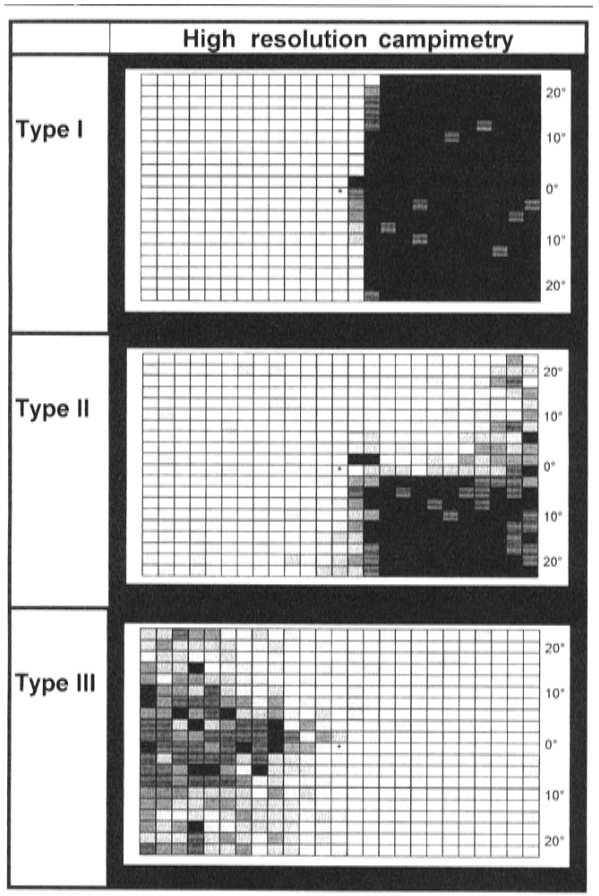
Areas of „residual vision“ (=relative defects) are shown in grey: they are revealed by repeated visual field testing of by near-threshold testing

The size of areas of areas of residual vision (grey) are different in different patients. They range from Type I very small („sharp borders“) with a large region of absolute blindness to large (Type III)

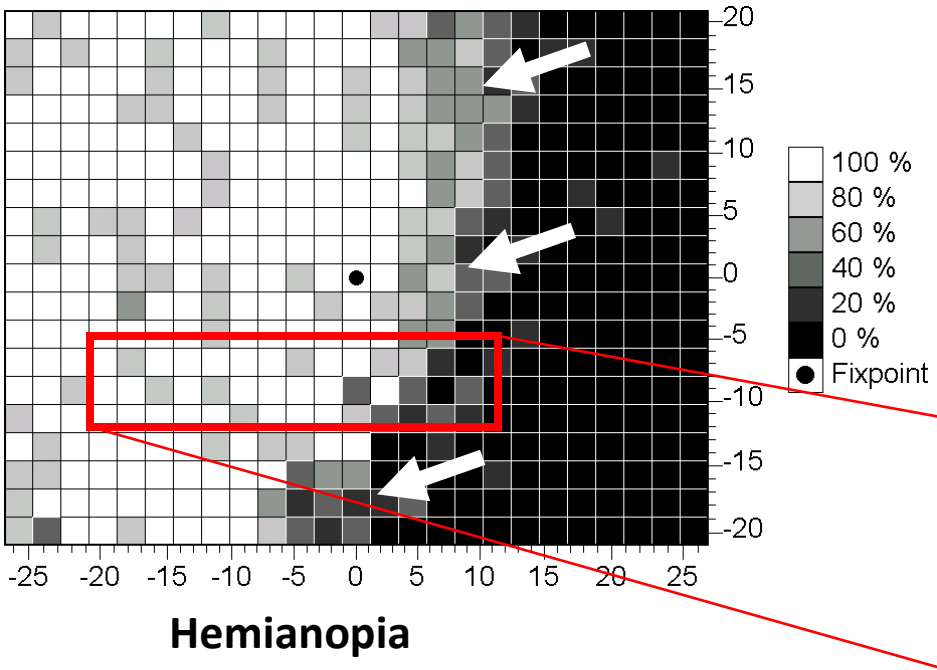




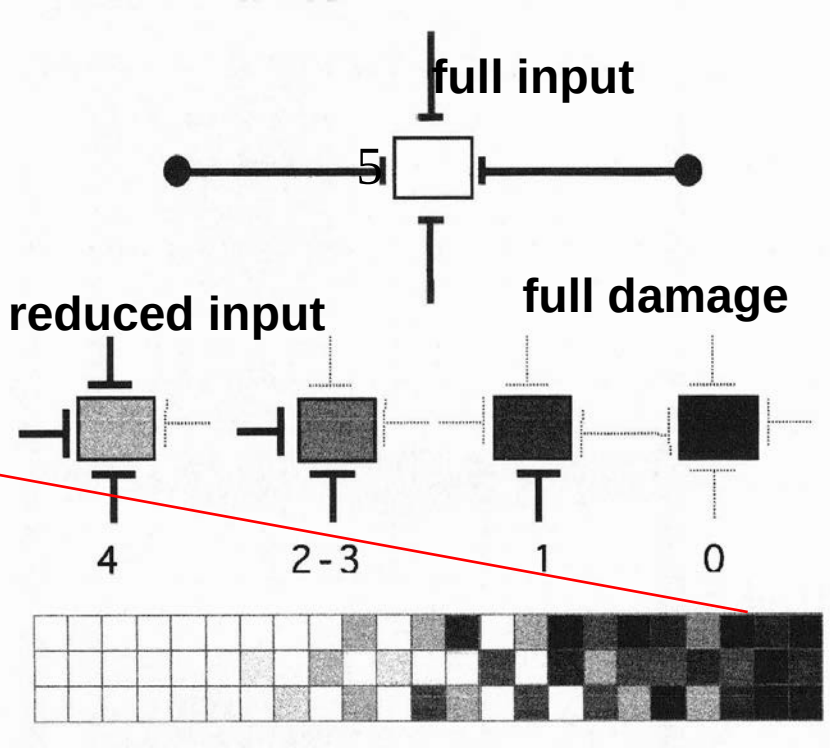
Residual Vision



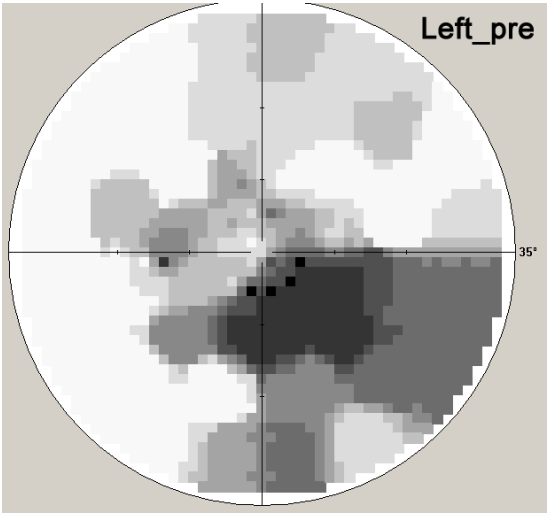
Residual vision: not black-or-white, but shades of grey



Hemianopia



Vision intact ARV blind



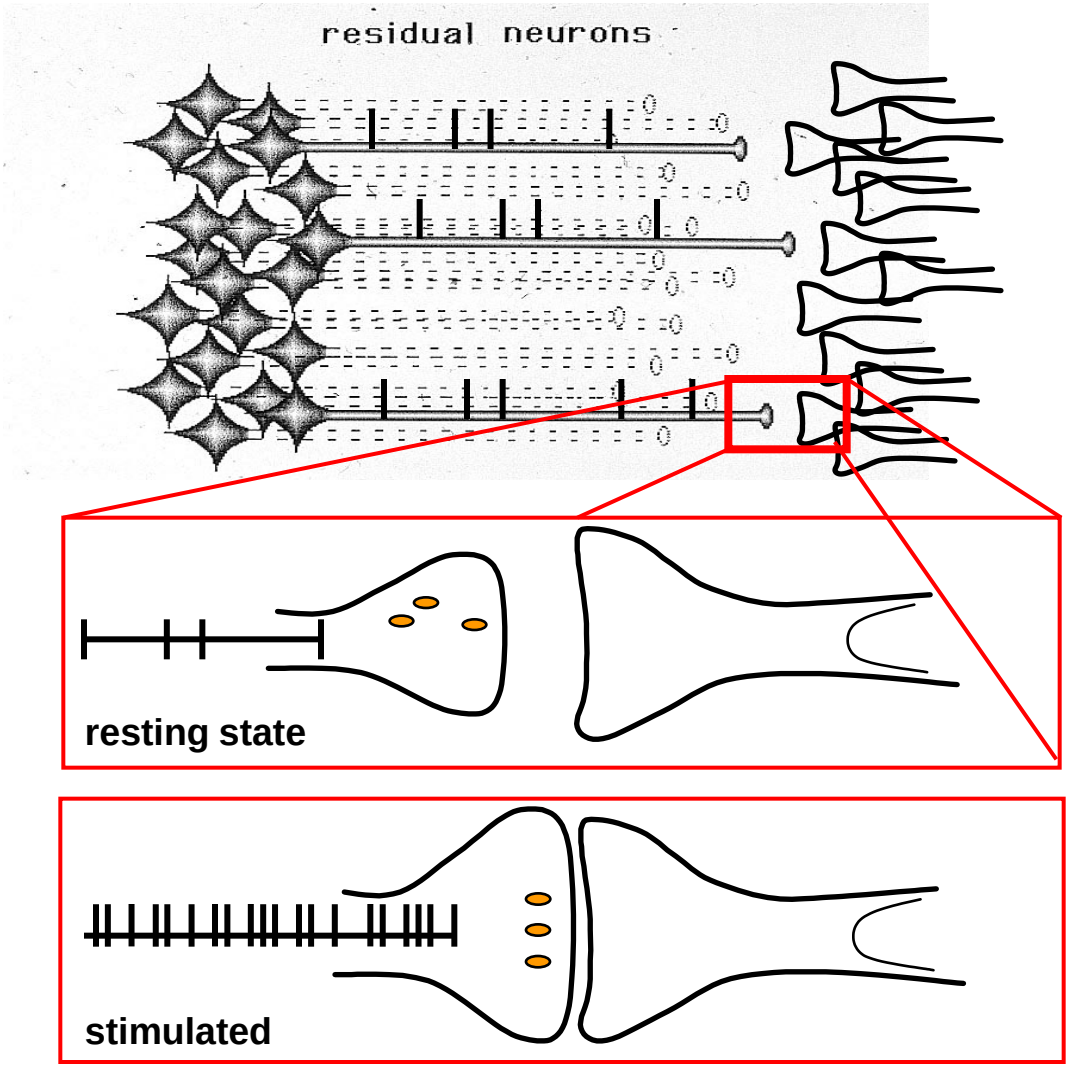
Glaucoma

The extent of vision loss (detection ability) is a direct function of neuron loss: the greater the cell loss, the greater is the field defect in different regions of the visual field. Areas of residual vision (ARVs) can be found in all kinds of visual field defects such as after stroke (hemianopia) or retinal damage (glaucoma)

Sabel et al., Progr Brain Res, 2011

Question: how to maintain stimulation effects?

Answer: Synaptic plasticity after partial brain injury: Long-term potentation



When a neuronal network is repeatedly stimulated, it will strengthen its synaptic transmission (=long term potentiation = learning). This principle holds true also for partially damaged networks

Pre-synaptic **Post-synaptic**

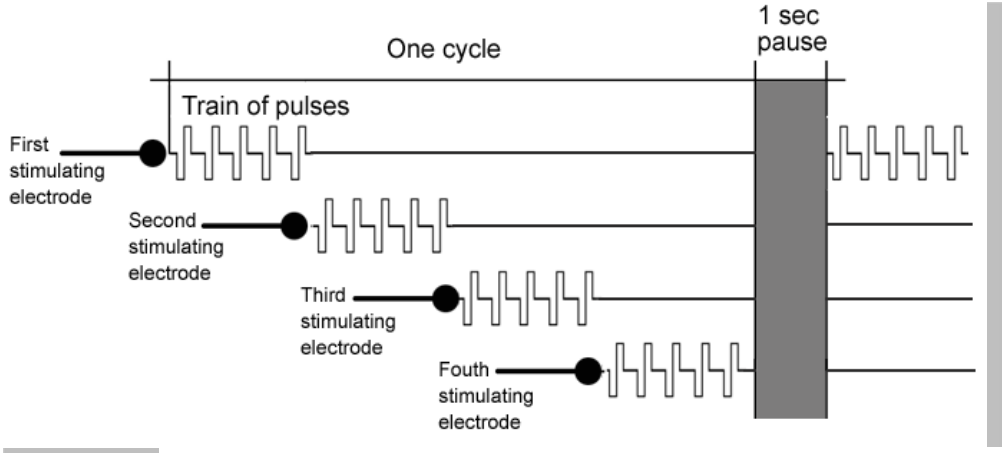
Sabel et al., Progr Brain Res, 2011

Treatment:

Non-invasive repetitive transorbital ACS (rtACS)

(10 days, approx. 20- 40 min daily, treatment of *intact* and *damage* eye)

Stimulation device by EBS Technologies

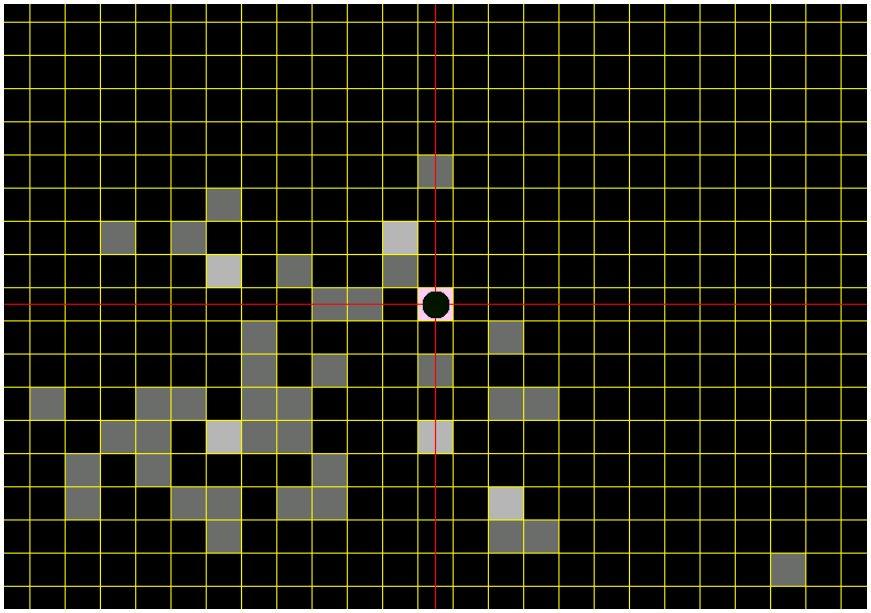


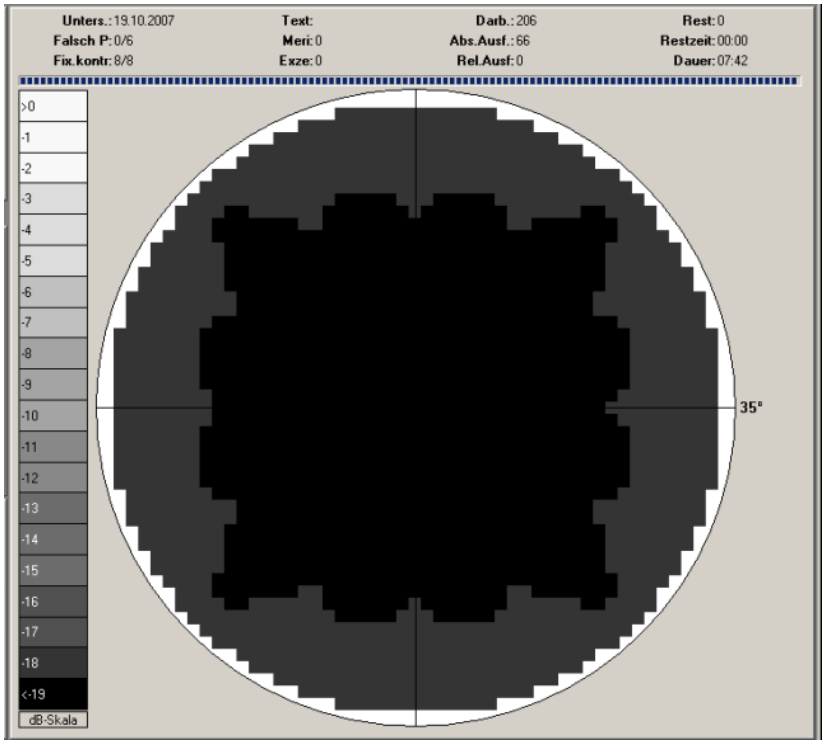
Stimulation parameters:

- → Determine current thresholds for phosphene perception
- → Stimulate above phosphene threshold (max. current intensity =1000µA)
- → Frequencies random between individual α-range (min) in background EEG and flicker fusion (max)

Results:
Visual fields after optic nerve lesion

baseline





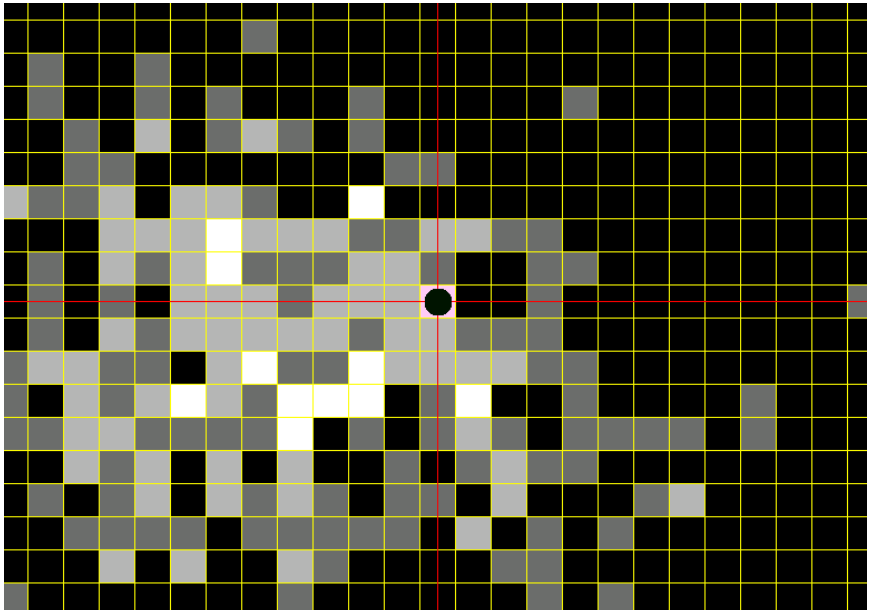
HRP

Standard Perimetry

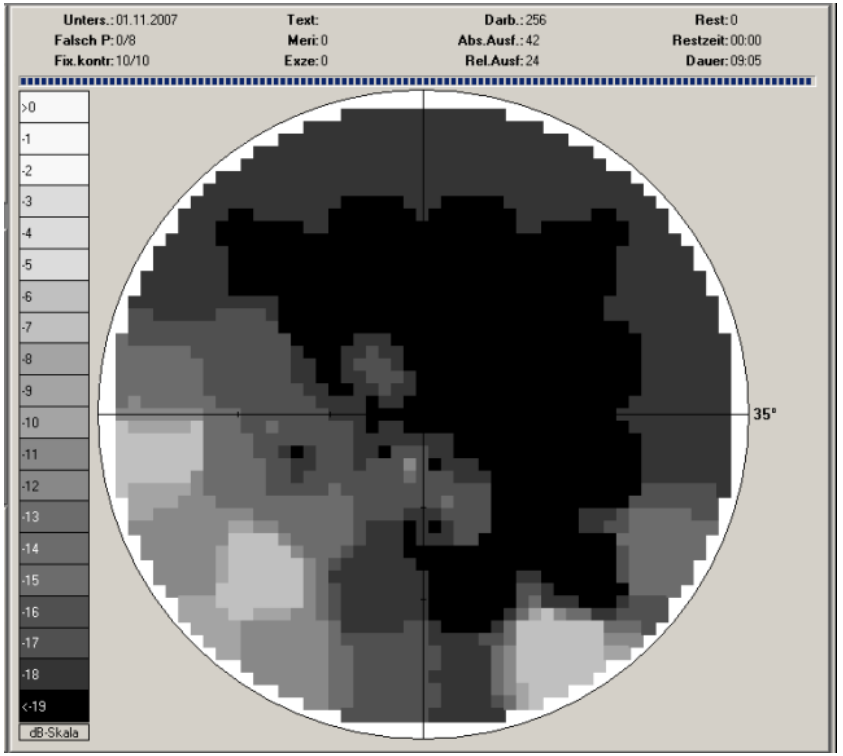
Patient CG: Traumatic optic nerve lesion

Visual field after optic nerve lesion

After 10 days of rtACS therapy

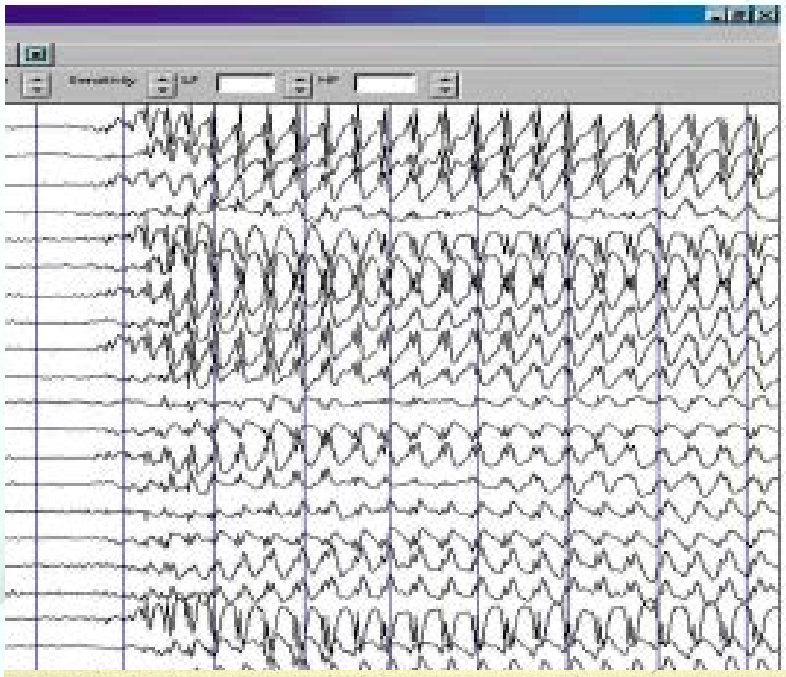


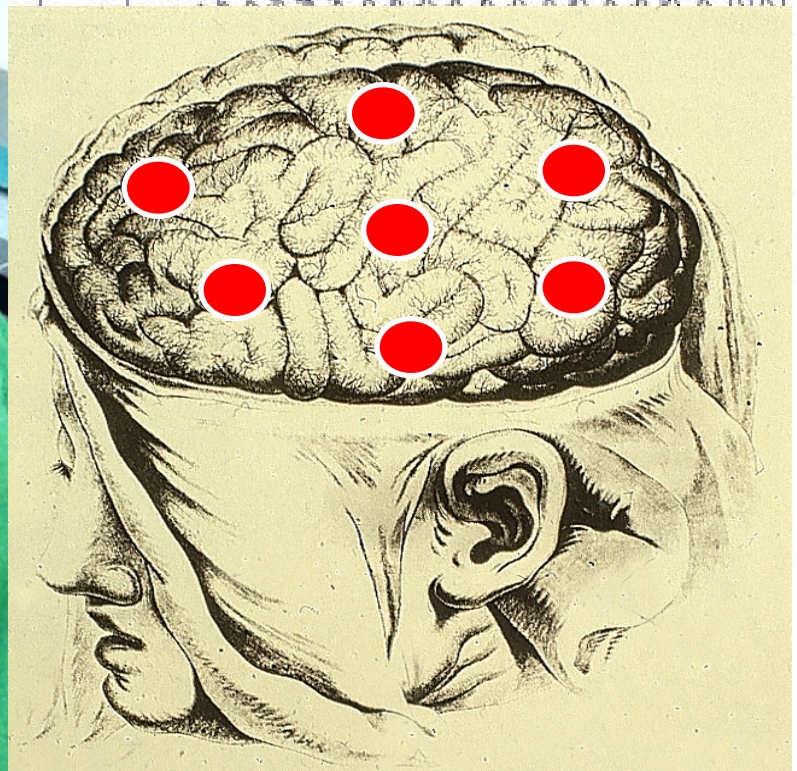
HRP



Standard Perimetry

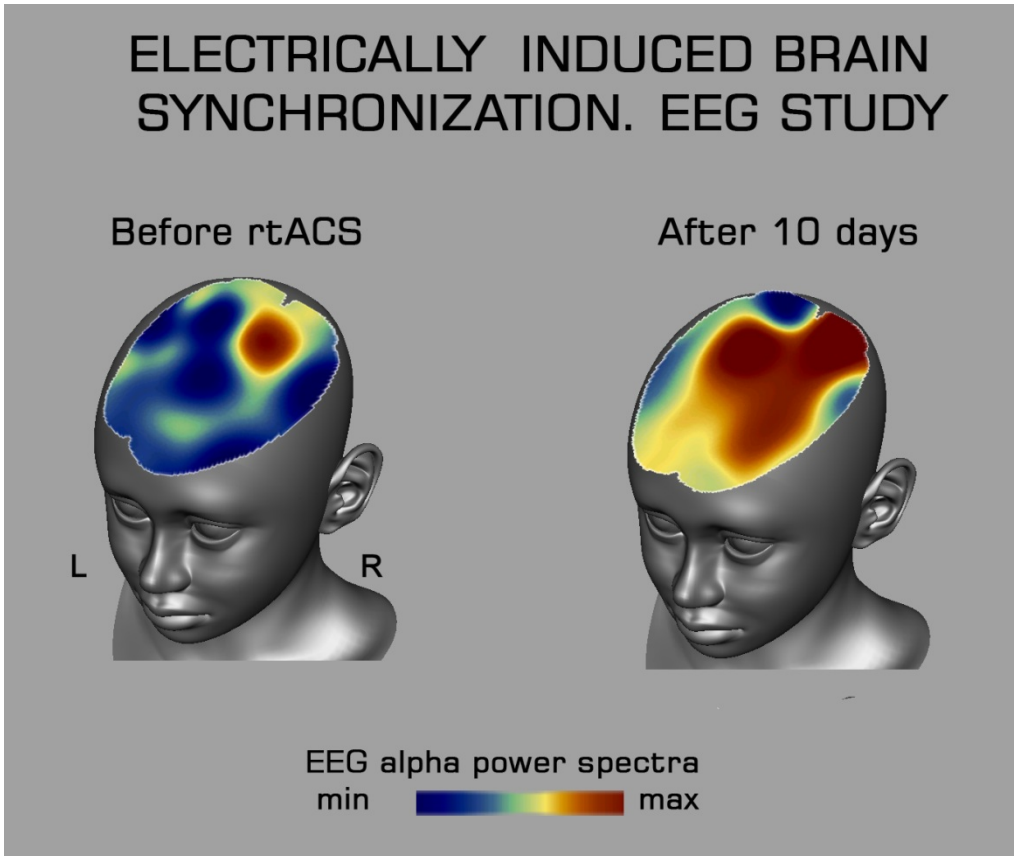
Patient CG: Traumatic optic nerve lesion



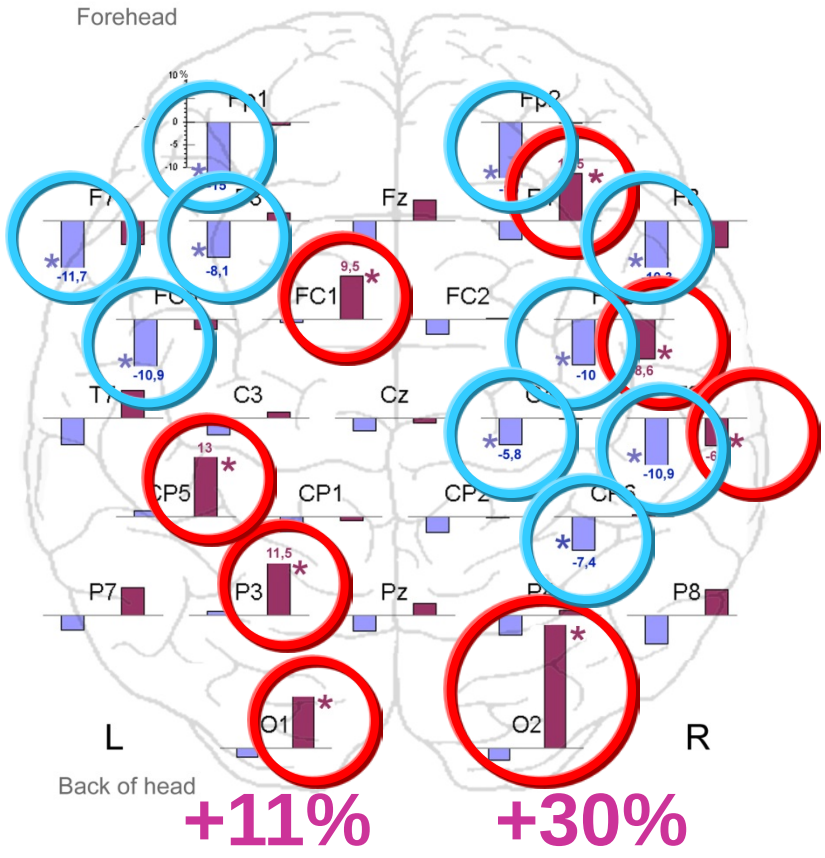


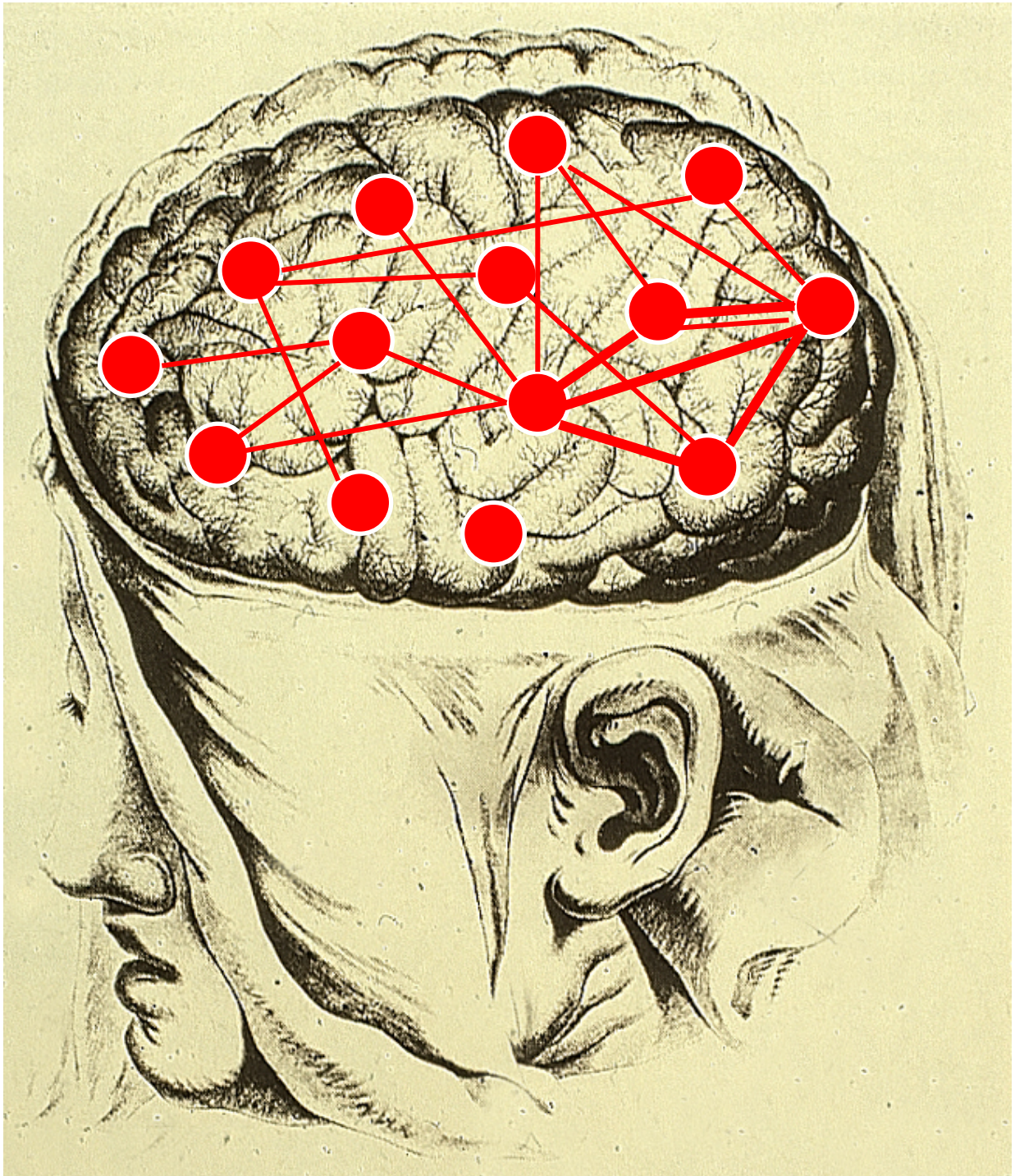
Stimulation with non-invasive brain stimulation improves vision

Study I: randomized, double-blind, placebo-controlled clinical trial - **EEG analysis**

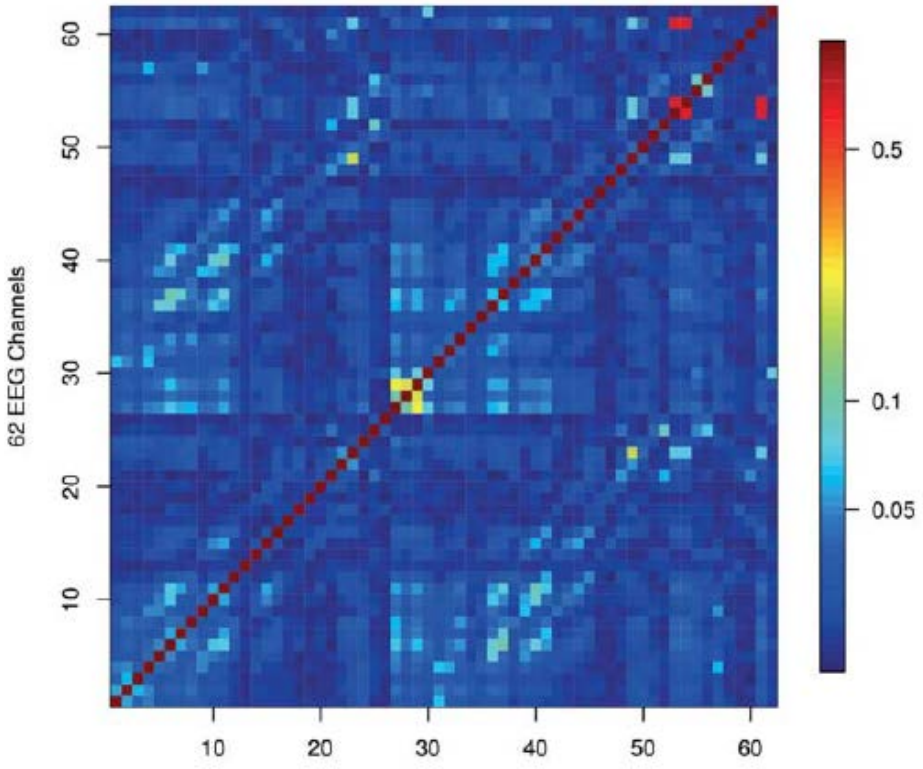


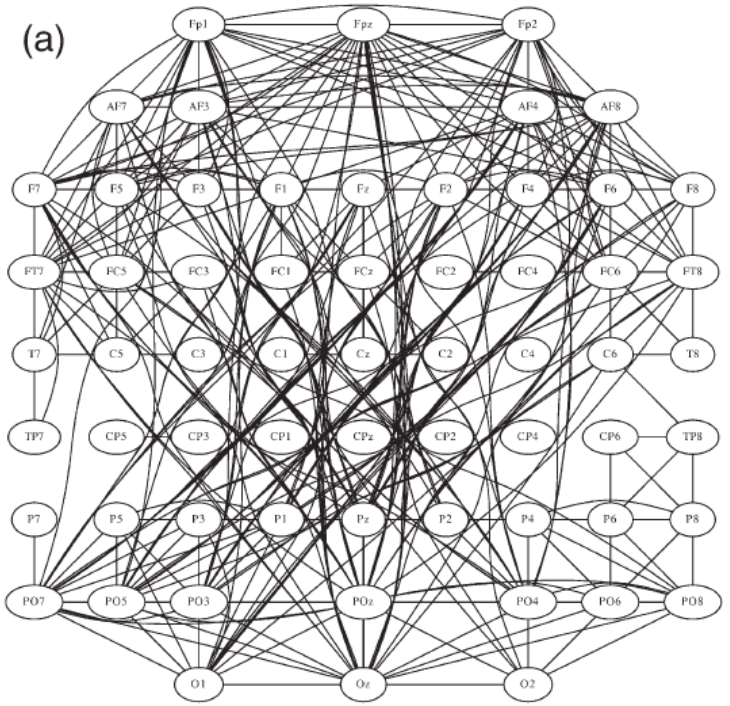
rtACS group





Connectivity charts show which brain regions talk to each other





High-Gamma Band (60-90Hz): Finger-tapping motor task

Before tDCS

After tDCS