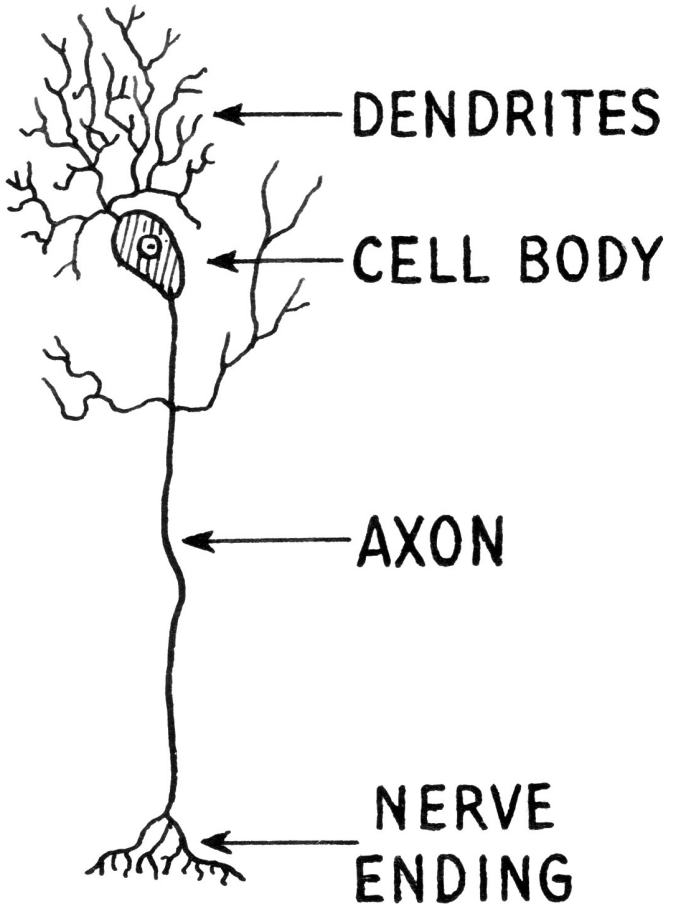
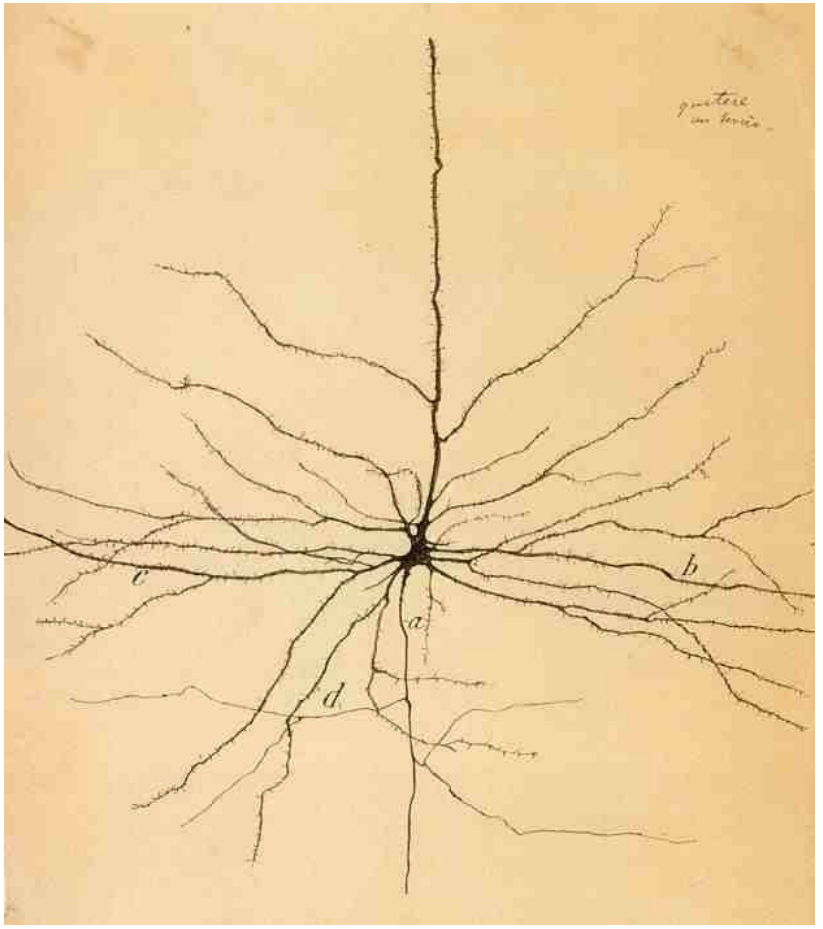
NEURON

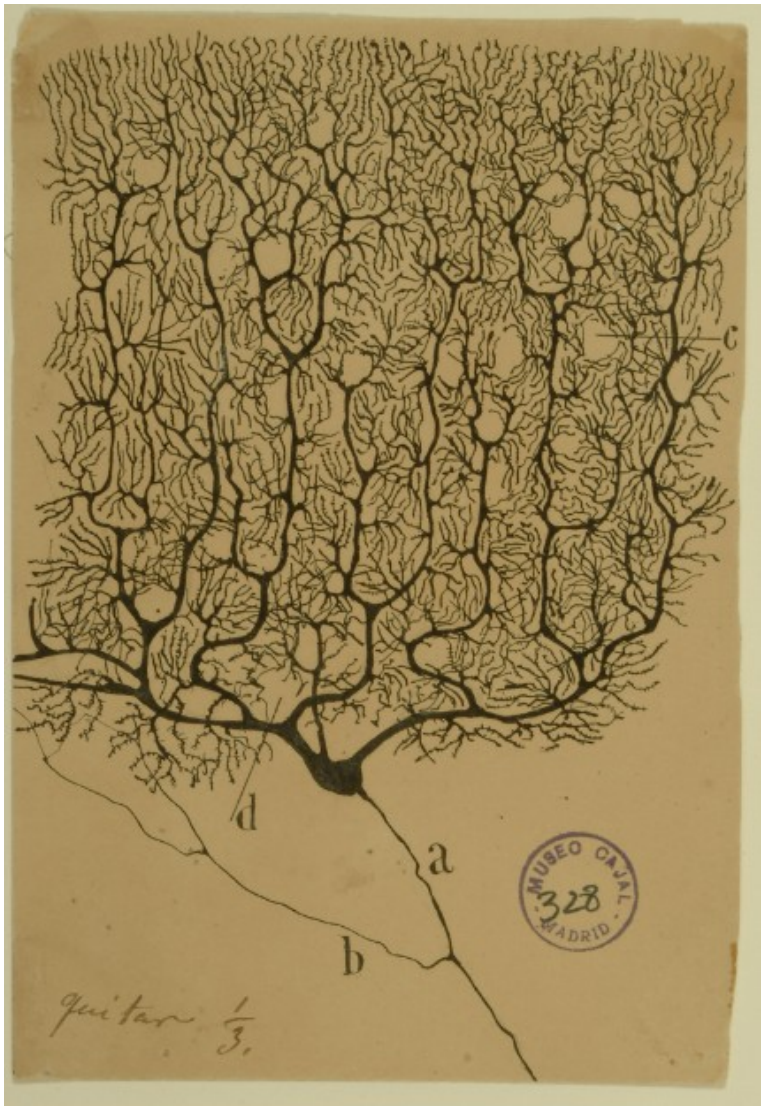


wikimedia commons: http://commons.wikimedia.org/wiki/File:Dendrite_(PSF).png

Cajal – Pyramidal Neuron



Cajal – Purkinke Cell



Action Potential

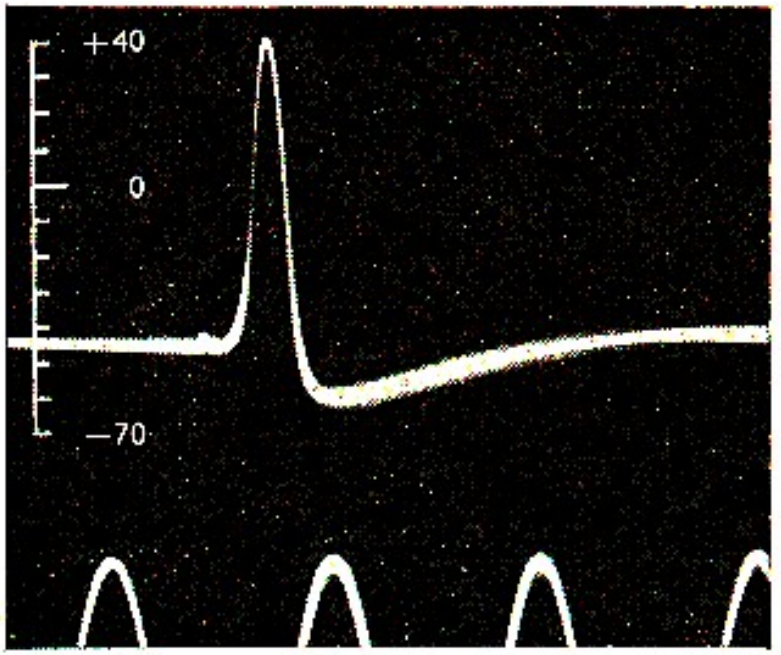


Fig. 6. Action potential and resting potential recorded between inside and outside of axon with capillary filled with sea water. Time marker 500 Hz. The vertical scale indicates the potential of the internal electrode in millivolts, the sea water outside being taken as at zero potential (from Hodgkin & Huxley, 1939; see also Hodgkin & Huxley, 1945; Curtis & Cole, 1940).

Hodgkin, A.L., and Huxley, A.F. (1939).
Action potentials recorded from inside a nerve fiber
Nature, 144:710

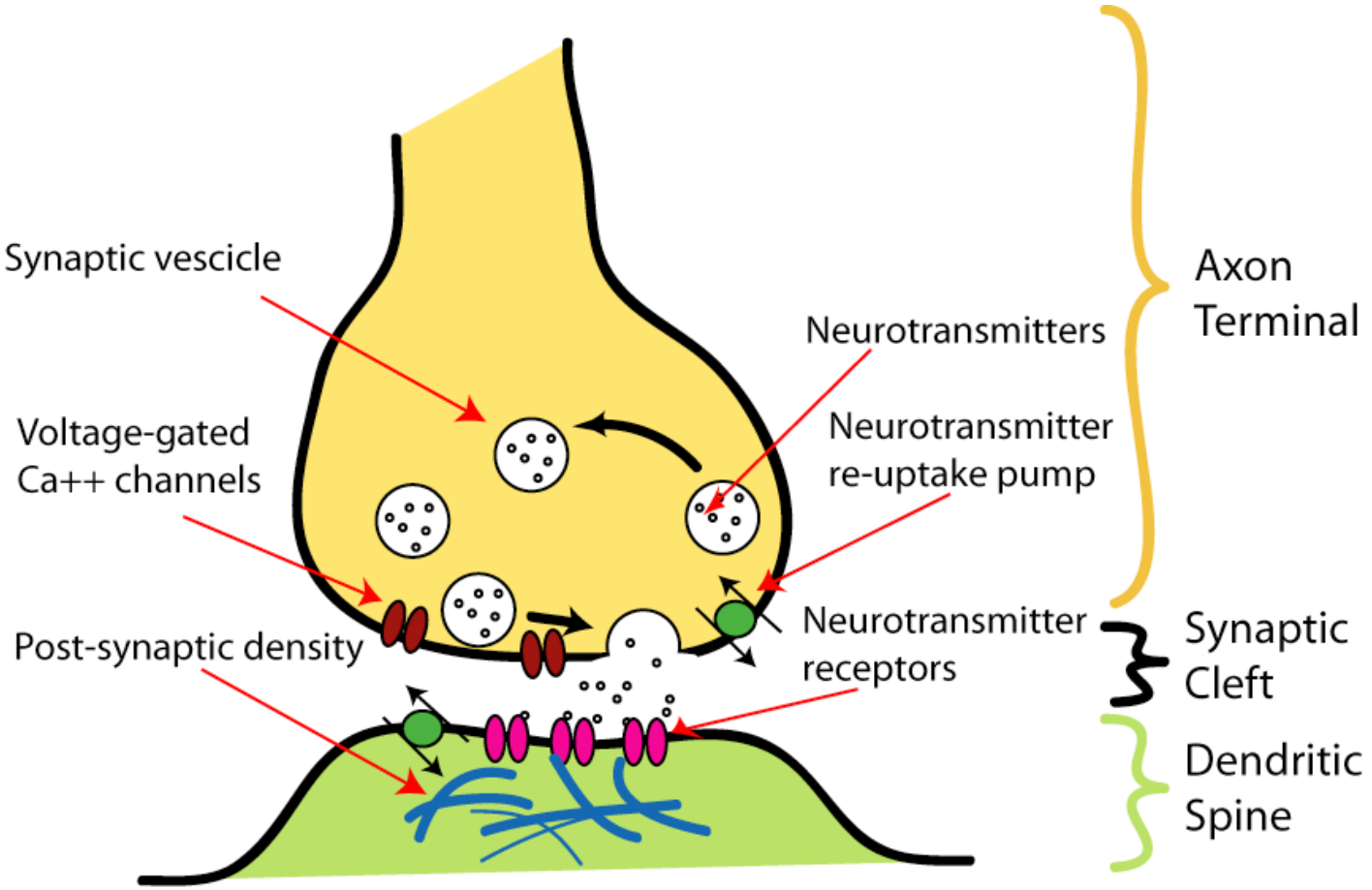
Voltage dynamics

- The voltage inside the cell lower than outside, this is called the membrane potential, between -70mV and -55mV.
- Inputs from other cells change the voltage, inhibitory cells decrease it, excitatory cells increase it.
- If the voltage exceeds a threshold the neuron sends out a spike.

A retinal ganglion cell spiking

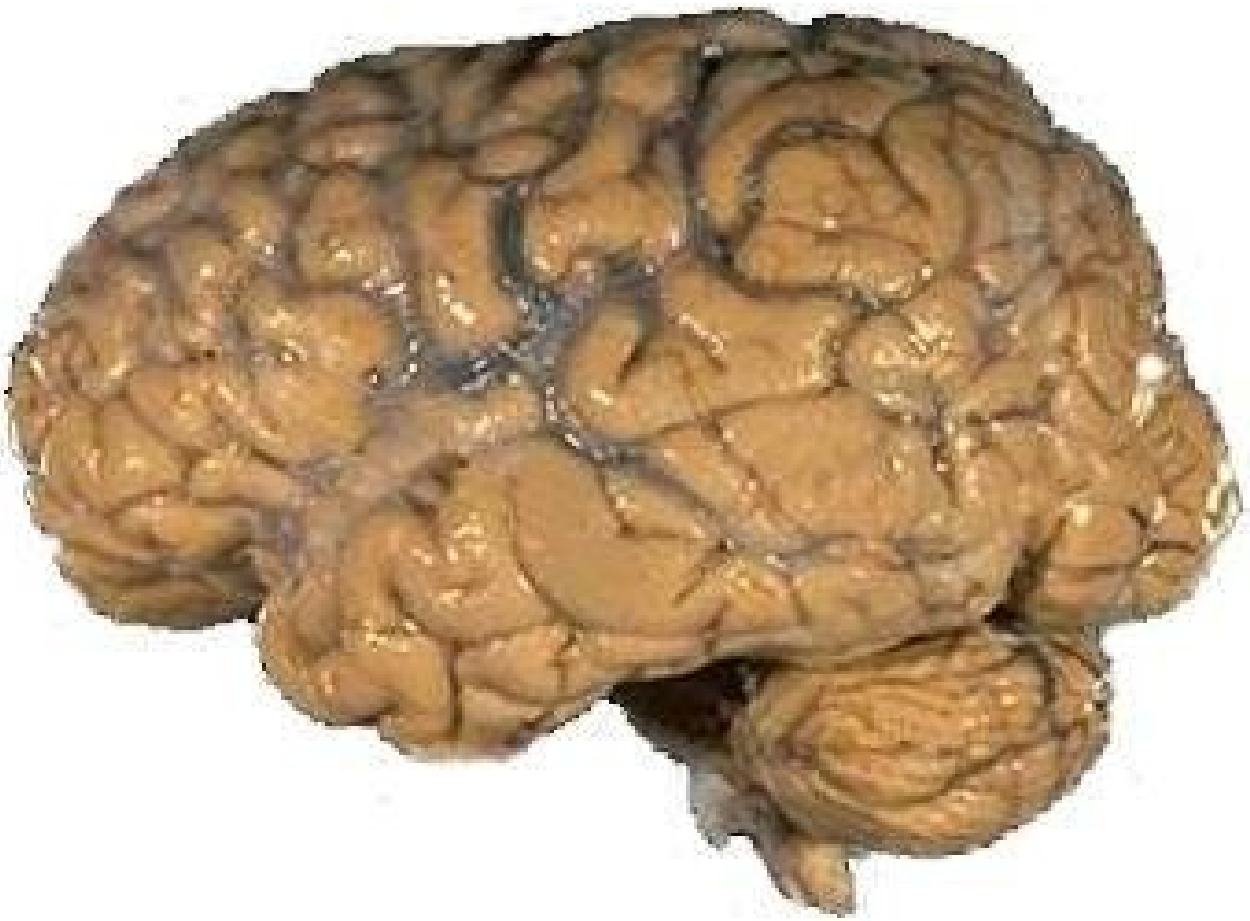
https://www.youtube.com/watch?v=KE952yueVLA

Synapse



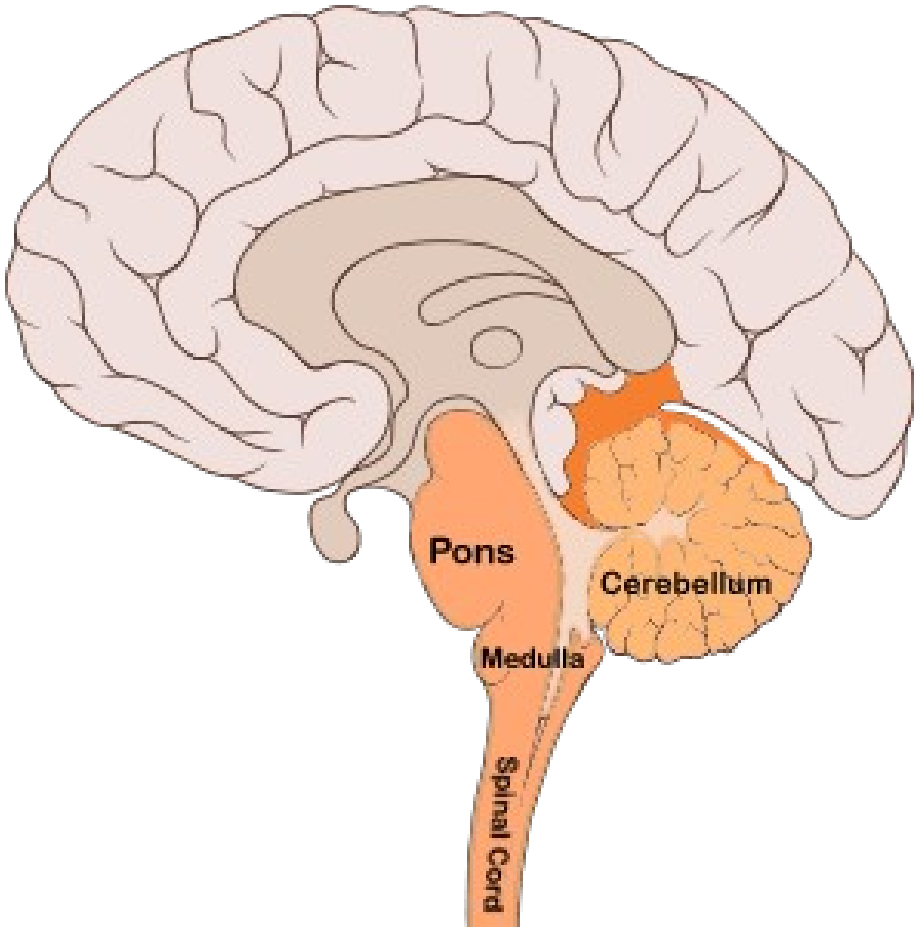
http://upload.wikimedia.org/wikipedia/commons/b/b2/SynapseIllustration2.png

A brain



https://upload.wikimedia.org/wikipedia/commons/4/49/Human_brain_NIH.jpg

Sagital view



https://commons.wikimedia.org/wiki/File:Brain_bulbar_region.PNG

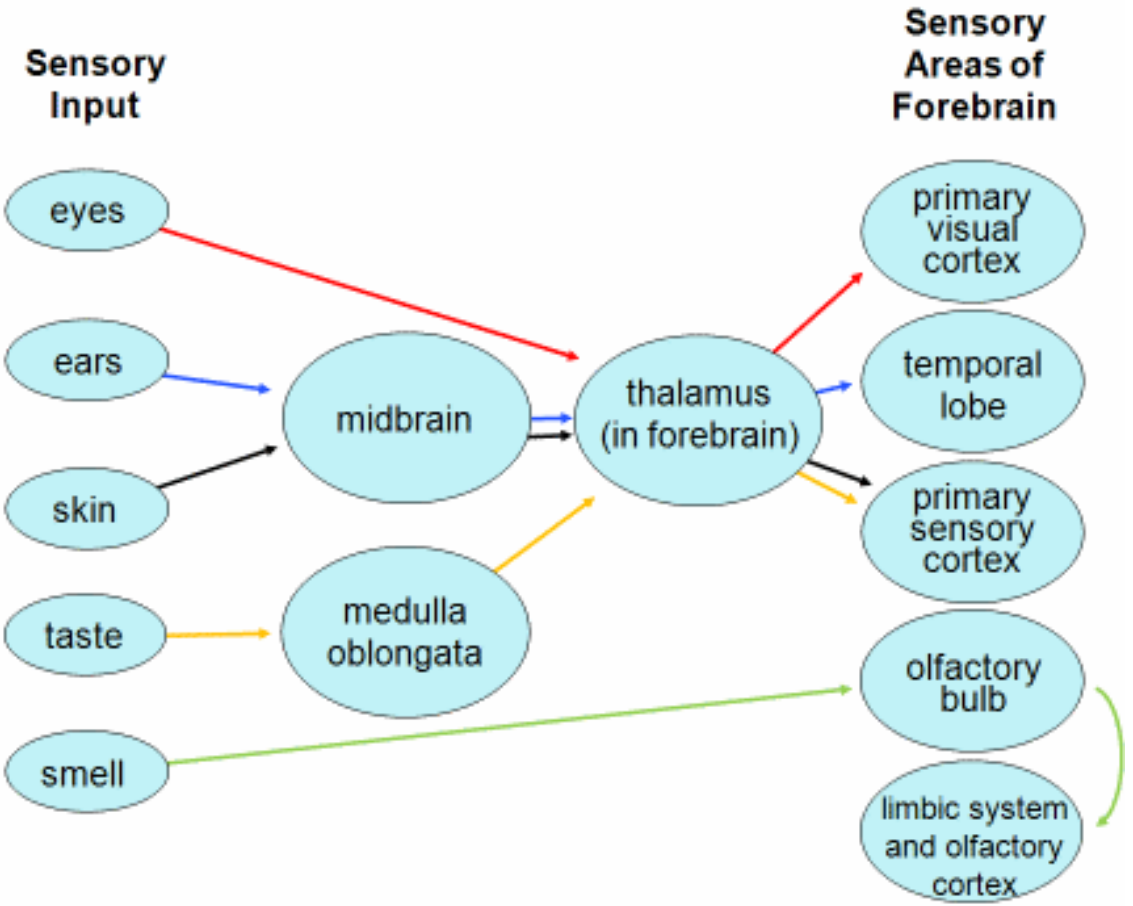
Cerebellar ataxia.

https://en.wikipedia.org/wiki/File:Thomas-fig68,69-p127.png

Thalamus

https://en.wikipedia.org/wiki/File:Brain_chrischan_thalamus.jpg

Thalamus - routing



http://faculty.clintoncc.suny.edu/faculty/michael.gregory/default.htm

http://creativecommons.org/licenses/by-nc-sa/3.0/deed.en_US

Hippocampus

https://commons.wikimedia.org/wiki/File:Hippocampus_small.gif

H.M. - Henry Molaison

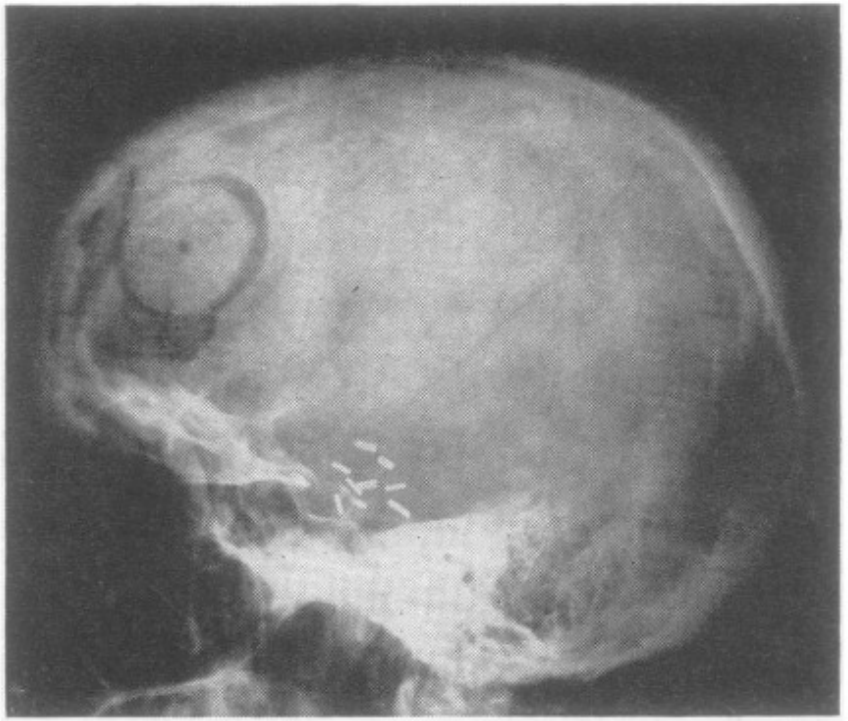


FIG. 3.—Post-operative skull radiograph with silver clip markers outlining extent of bilateral resections limited to the uncus and amygdala.

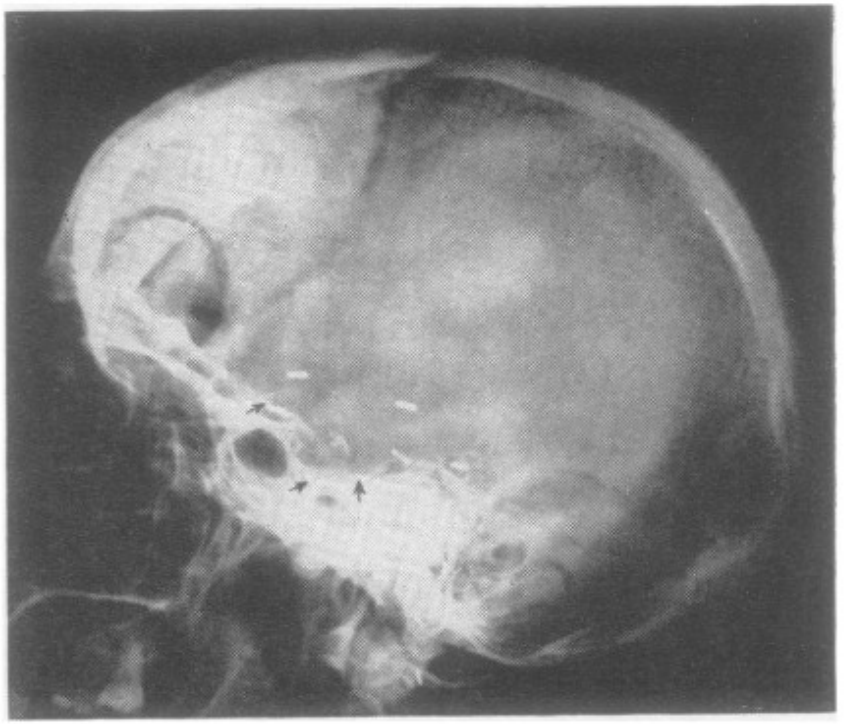


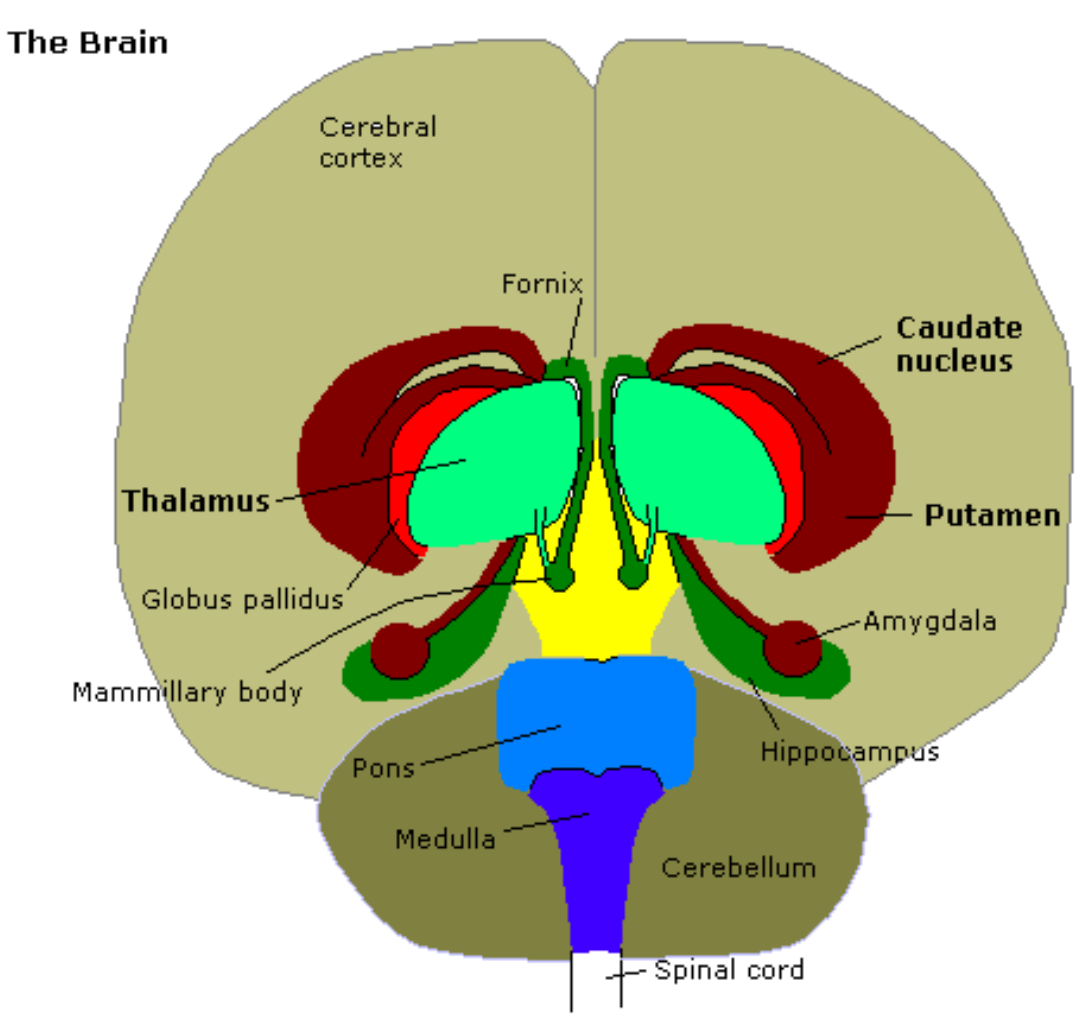
FIG. 4.—Post-operative skull radiograph with silver clip markers outlining the extent of the bilateral resections including the anterior hippocampal complex (approximately 6 cm. posterior to the tip of the anterior temporal fossa).

Scoville, W. B., & Milner, B. (1957).
Loss of recent memory after bilateral hippocampal lesions.
Journal of neurology, neurosurgery, and psychiatry, 20(1), 11.

Clive Wearing

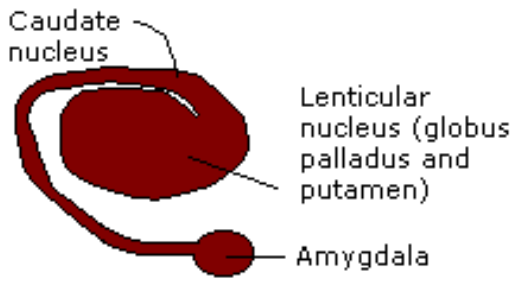
https://www.youtube.com/watch?v=Vwigmktix2Y

Amygdala



The brain as viewed from the underside and front. The thalamus and Corpus Striatum (Putamen, caudate and amygdala) have been splayed out to show detail.

Corpus Striatum



http://en.wikipedia.org/Amygdala

Drawing by S.M.

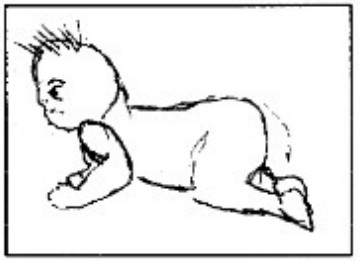
HAPPY

SAD

SURPRISED

DISGUSTED

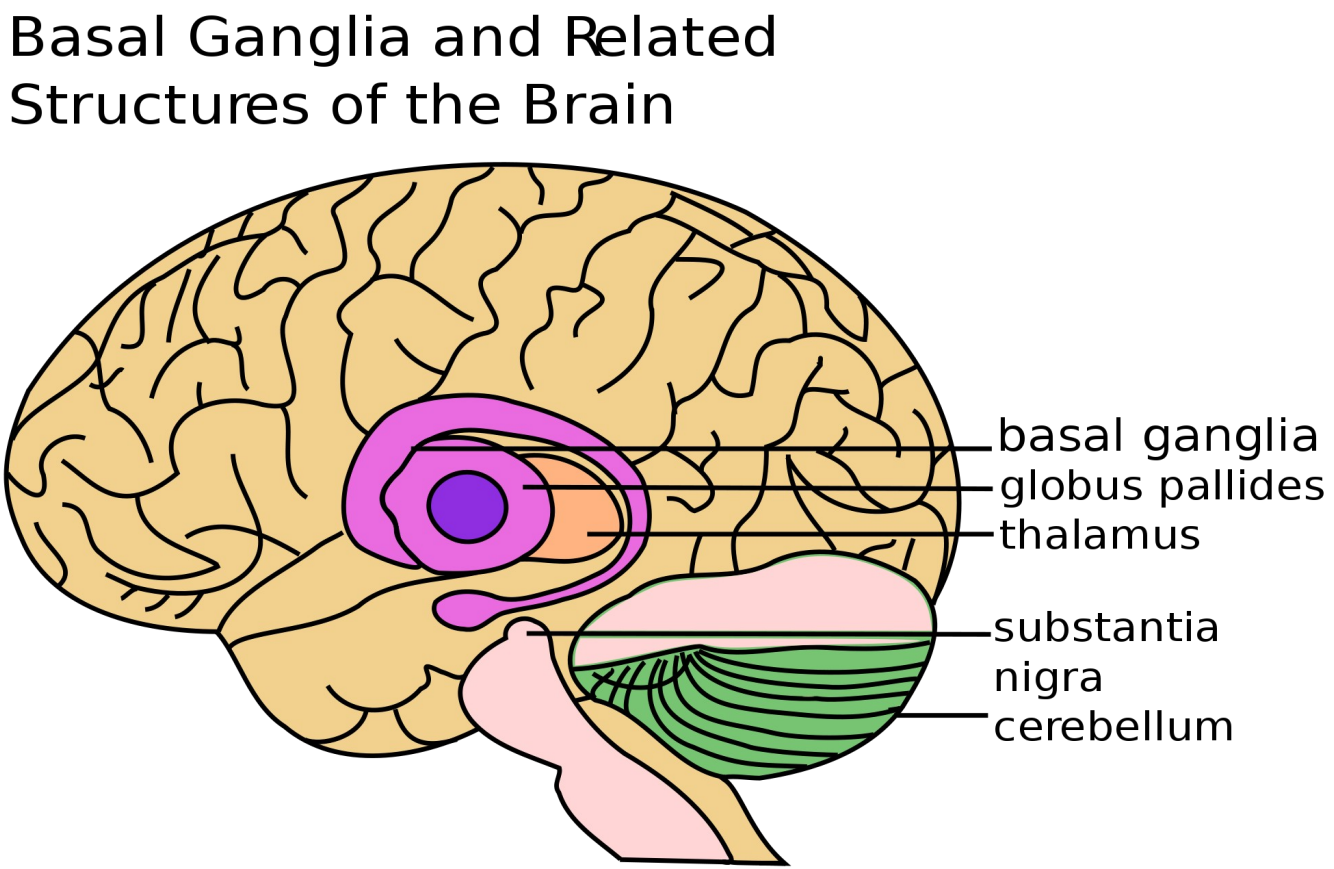
ANGRY



AFRAID

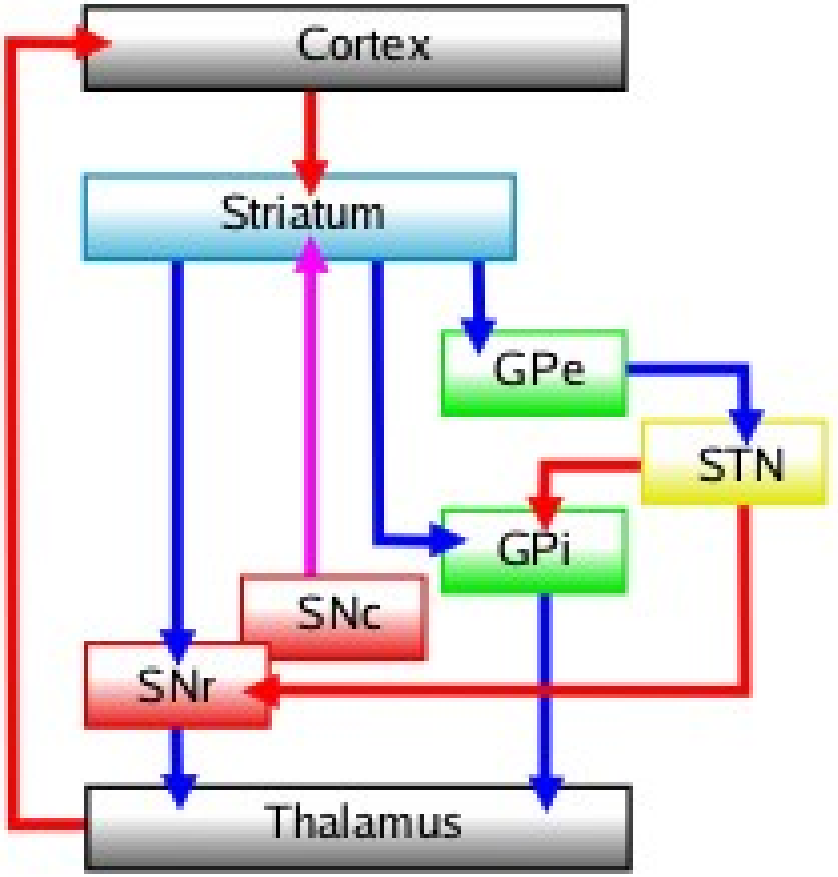
Adolphs, R., Tranel, D., Damasio, H., & Damasio, A. R. (1995).
Fear and the human amygdala.
The Journal of neuroscience, 15(9), 5879-5891.

Basal Ganglia



https://en.wikipedia.org/wiki/File:Basal_Ganglia_and_Related_Structures.svg

Basal ganglia – decides between cortical areas competing for motor control.

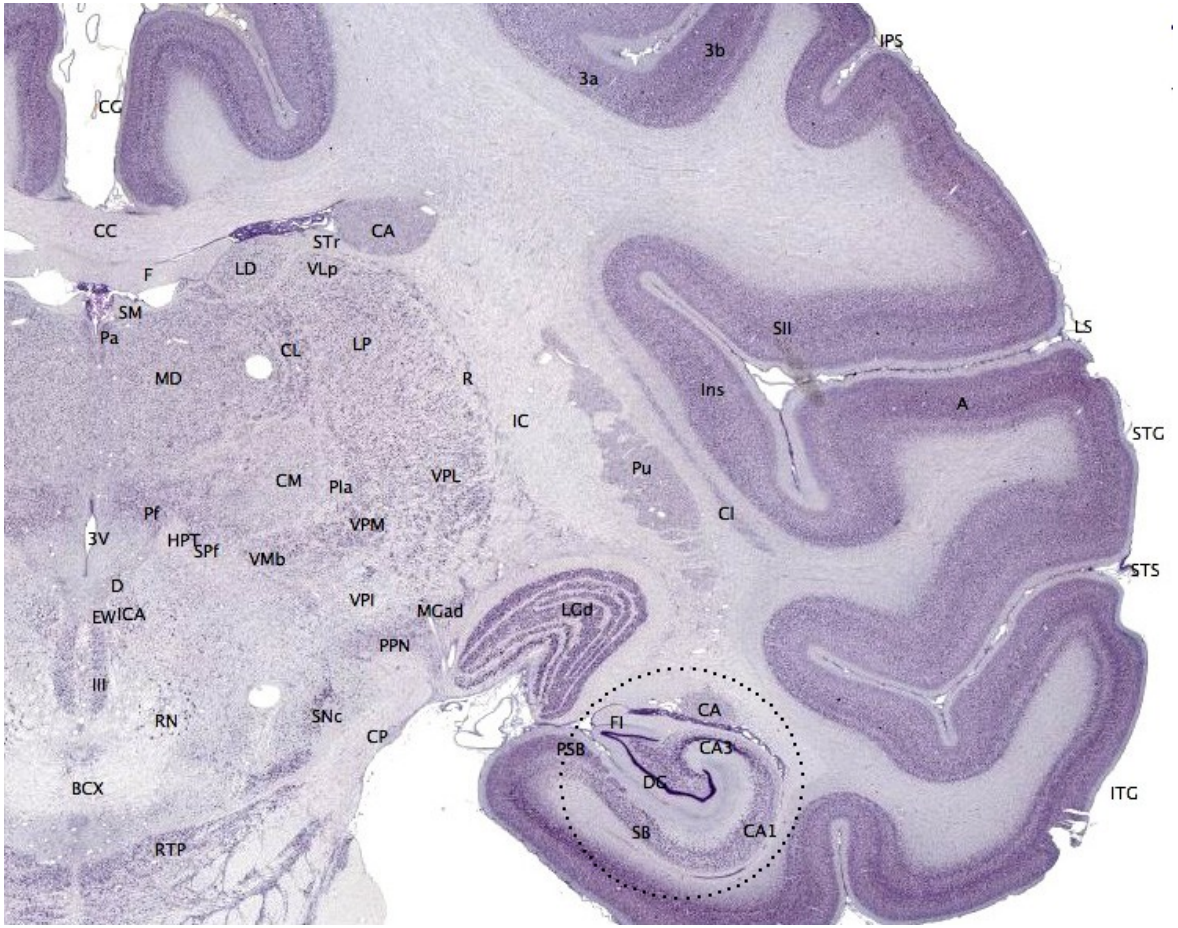


https://en.wikipedia.org/wiki/File:Basal-ganglia-classic.png

Parkinsonian gait

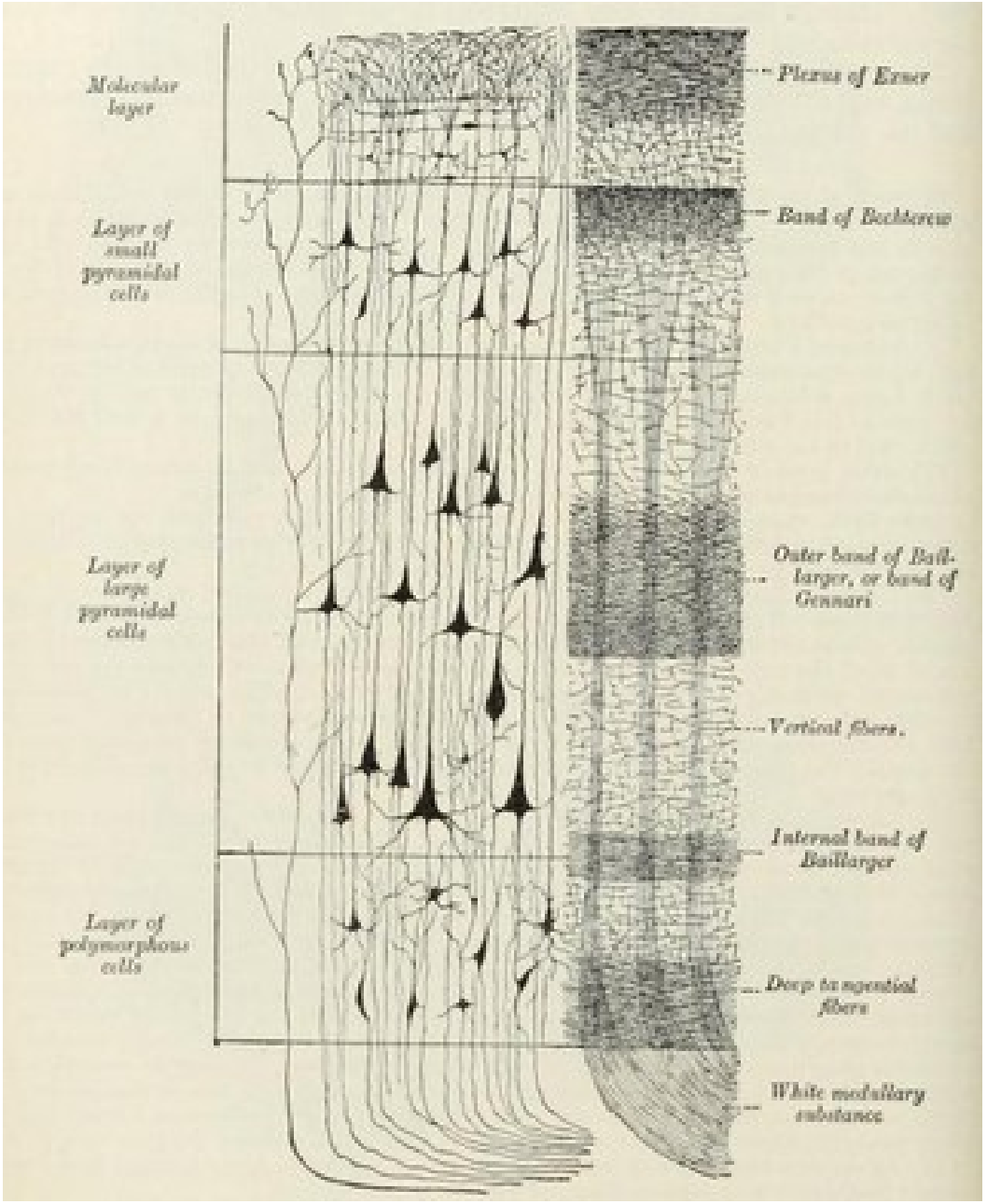
http://en.wikipedia.org/wiki/Parkinson's_disease

Macaque cortex



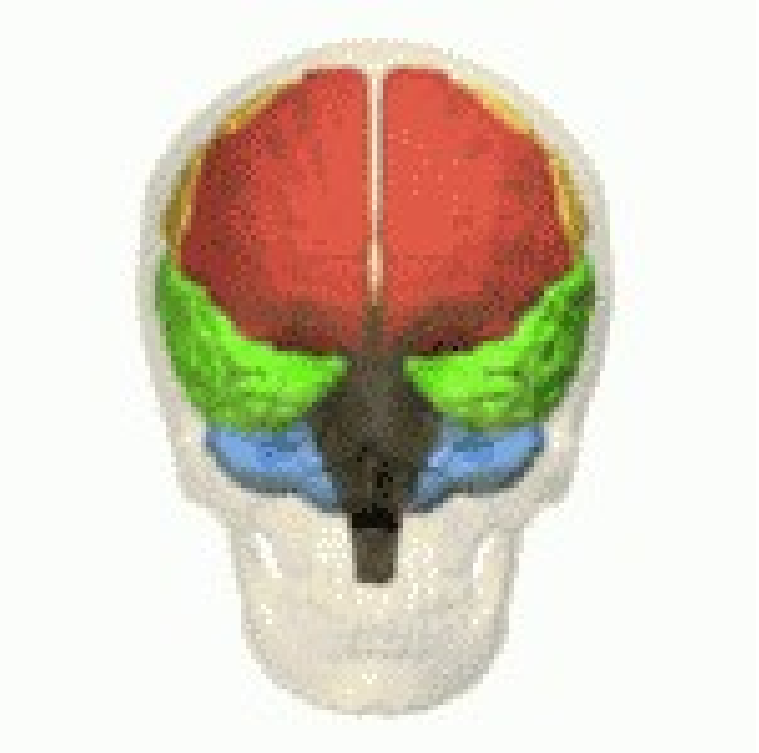
https://en.wikipedia.org/wiki/File:Brainmaps-macaque-hippocampus.jpg

Layers of the neocortex



Gray's anatomy

Lobes of the cortex



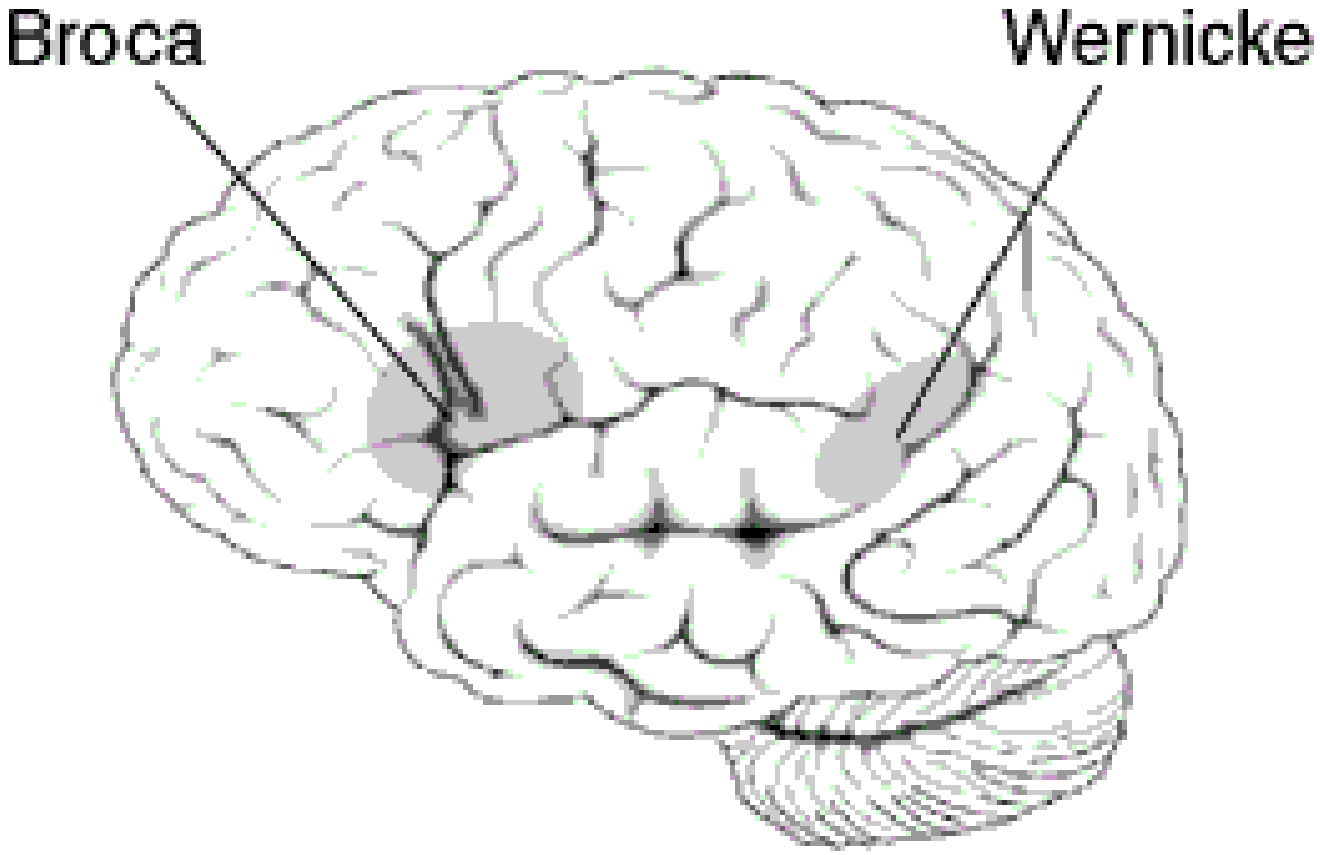
Orange – Frontal Lobe, Yellow – Parietal Lobe
Green – Temporal Lobe, Pink – Occipital Lobe

https://en.wikipedia.org/wiki/File:Four_lobes_animation_small2.gif

Tan / Hodor

https://www.youtube.com/watch?v=h5X6Qn9hQHk

Broca and Wernicke areas



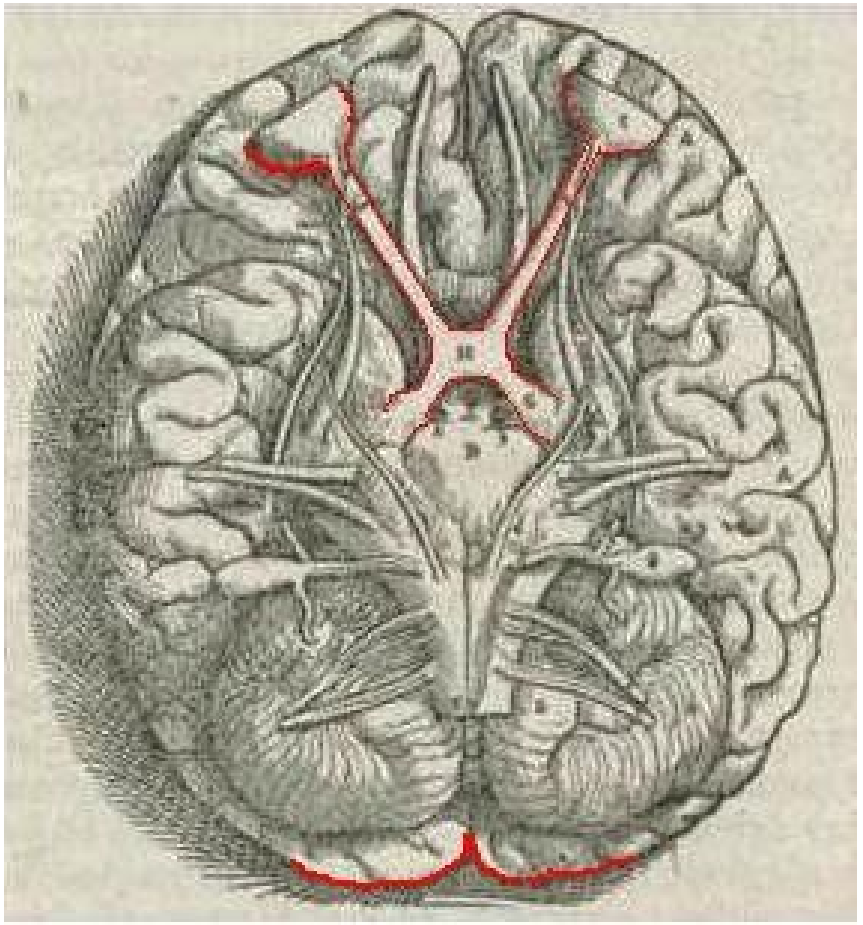
https://en.wikipedia.org/wiki/File:BrocasAreaSmall.png

Secondary zone of left temporal region

Finally, although the phonemic and lexical aspects of the coherent speech of these patients are grossly disturbed, characteristically the *intonational and melodic aspect of their speech as a rule remains intact*, and by its aid the listener can understand the meaning of the patient's apparently incoherent speech. Who, listening to a flow of words such as 'well now. . . I mean . . . so . . .we . . . now . . . went. . .went . . . suddenly . . . now this . . . like this . . . bang! . . . and then – nothing . . . nothing . . . and since . . . little by little . . . better still . . . quite . . . and now . . . do you see?' – completely devoid of substantives, could guess that a person wounded in the temporal region was describing how they were going, how the exploding shell stunned him, how he lost consciousness, and how his consciousness gradually returned, although his speech still remained difficult?

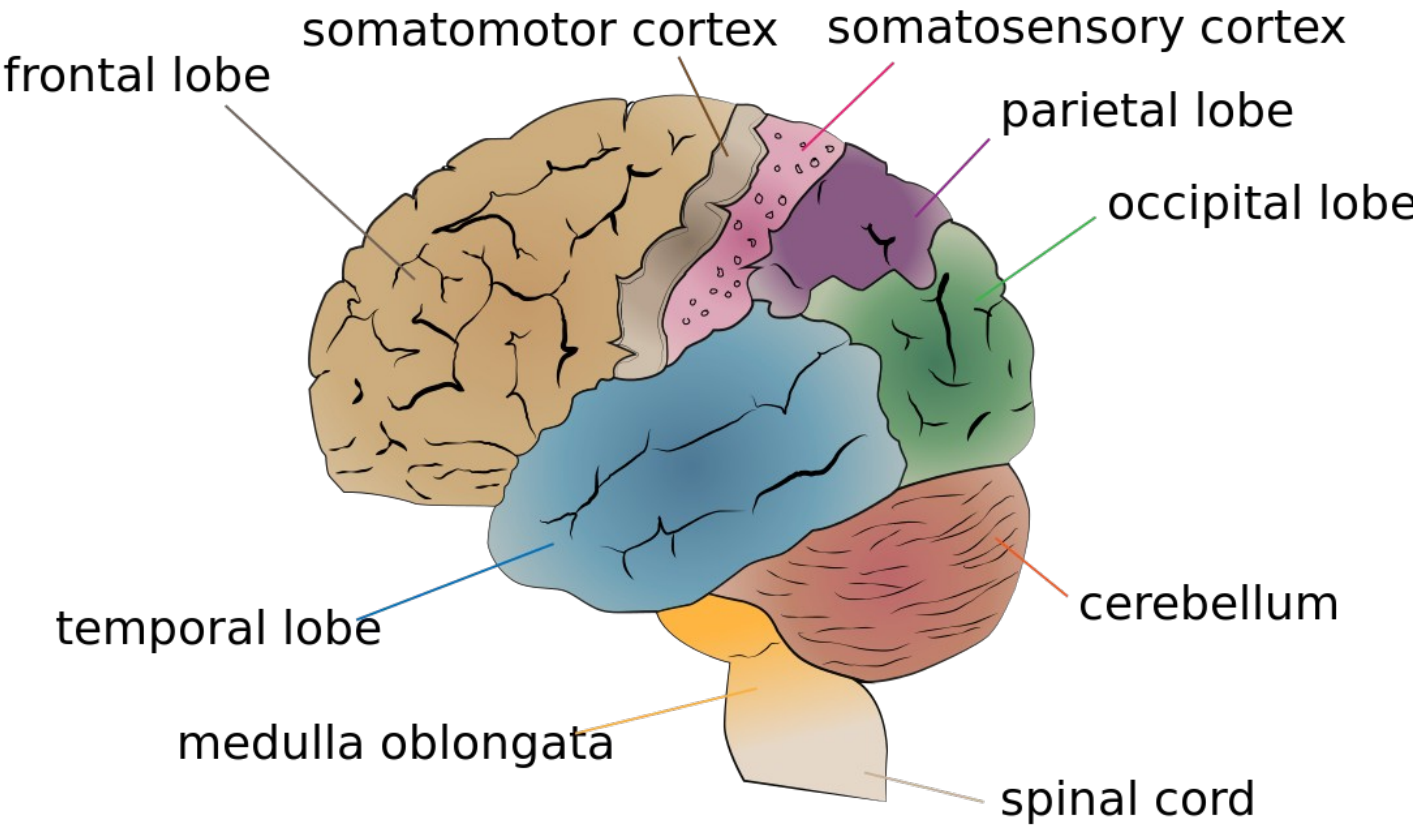
A.R. Luria (1973) The working brain, an introduction to neuropsychology. p140

Andreas Vesalius' sketch of the visual pathway from 1543.



https://en.wikipedia.org/wiki/File:1543,Vesalius%27Fabrica,VisualSystem,V1.jpg

Somatomotor and somatosensory cortex



https://en.wikipedia.org/wiki/File:Cerebrum_lobes.svg

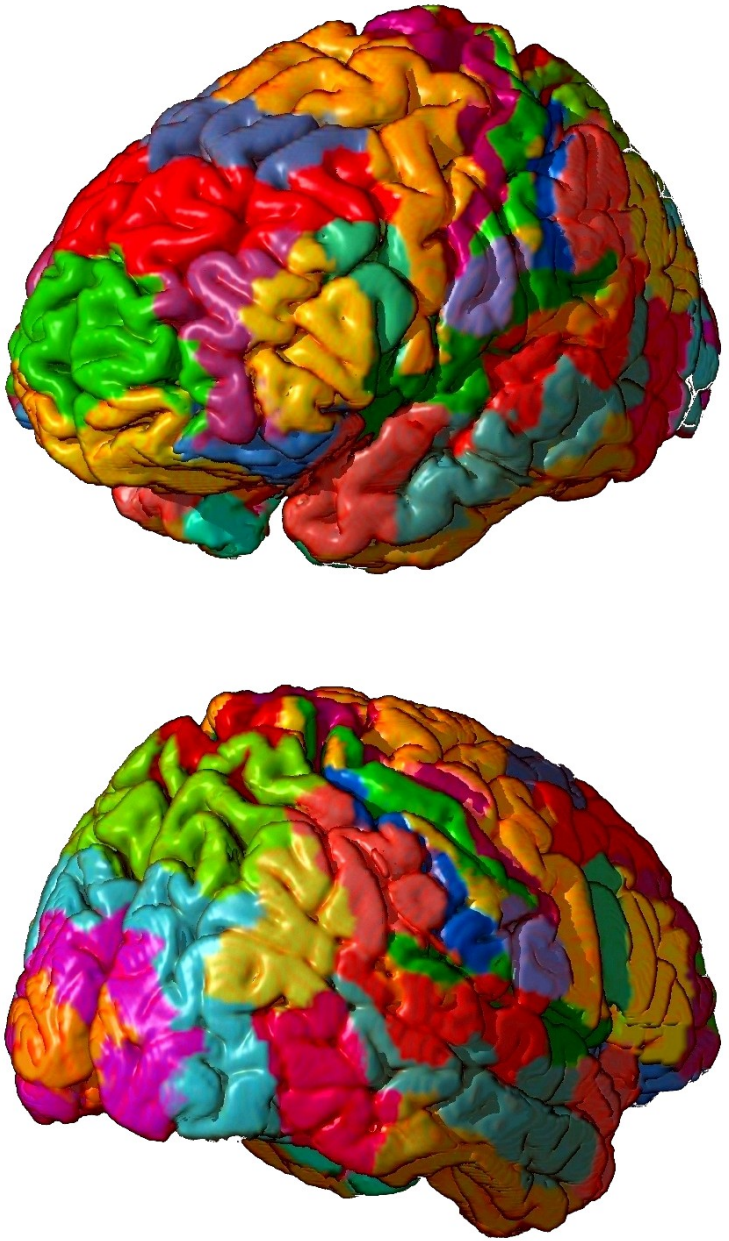
The motor homunculus

http://commons.wikimedia.org/wiki/File:Homunculus.PNG

The sensory homunculus

http://commons.wikimedia.org/wiki/File:Homunculus.jpg

Brodmann areas



https://en.wikipedia.org/wiki/Brodmann_area

Names of brain areas.

Names often reflect shape not function

Abbreviations are often used – see the list on the website.

https://en.wikipedia.org/wiki/File:Hippocampus_and_seahorse_cropped.JPG