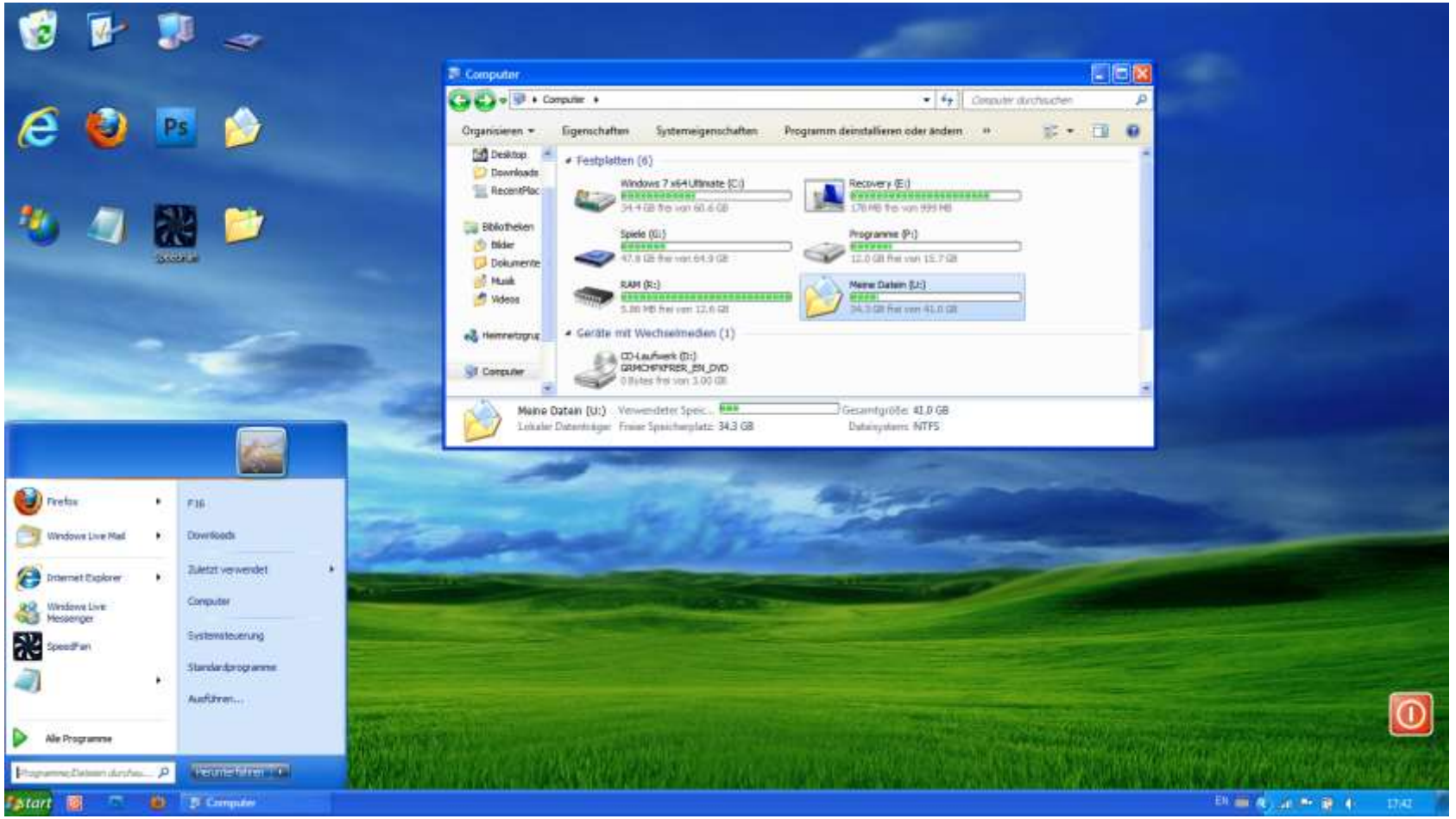
Introduction to Brain and Neuroscience (BM 1060)

Course Introduction

Levels of abstraction

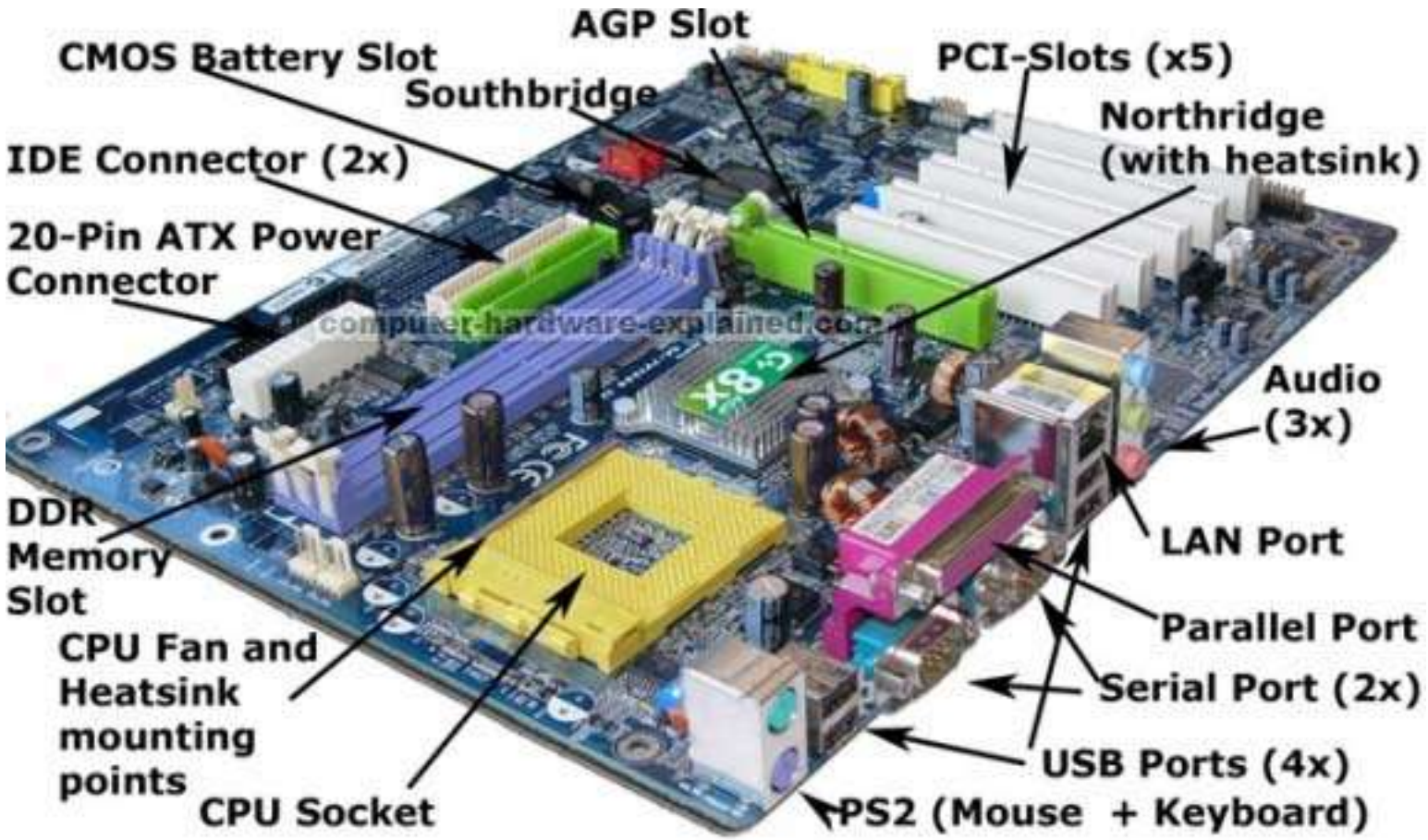
E.g. PC

User : OS and applications

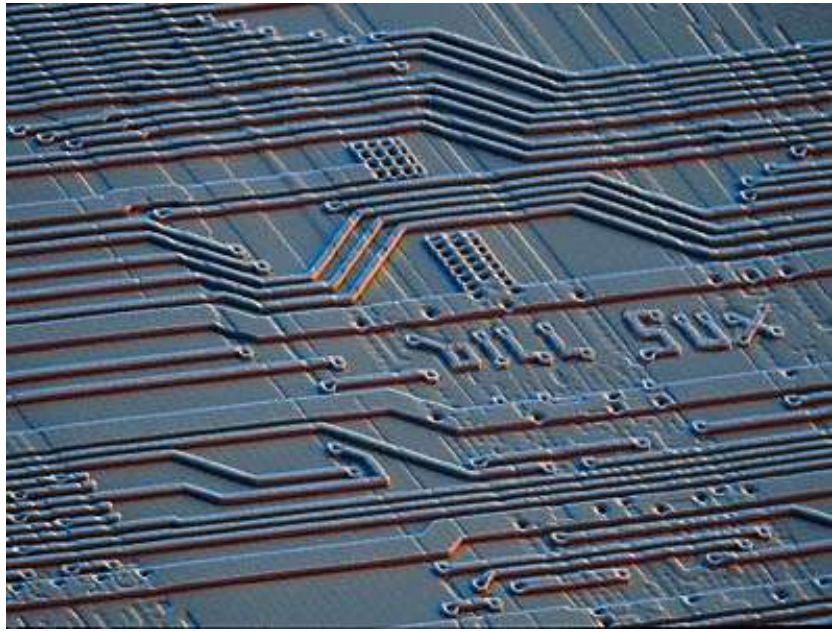


Under the hood

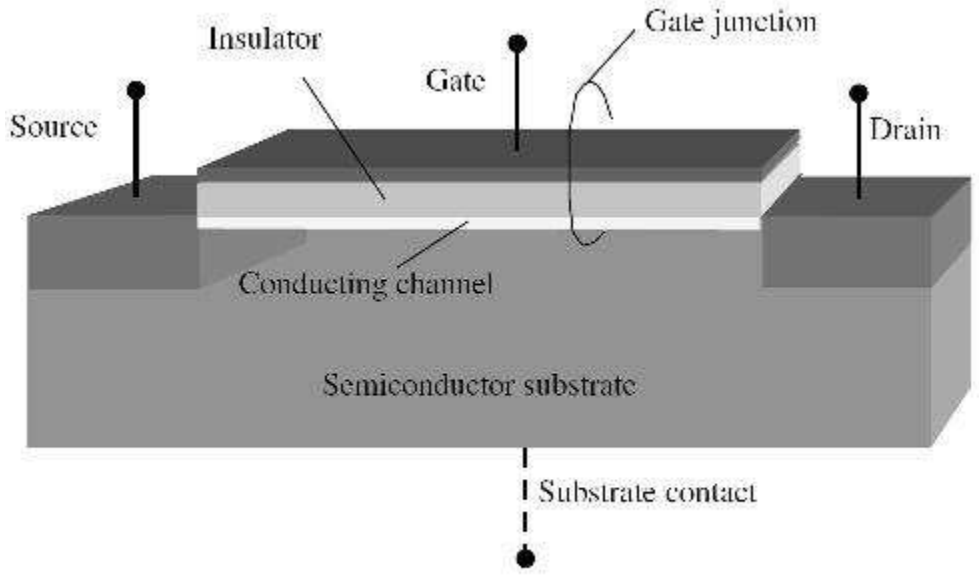
Components : Motherboard, SMPS etc



Deep inside the processor : SEM image of Pentium processor



Dive deeper !
Device Physics

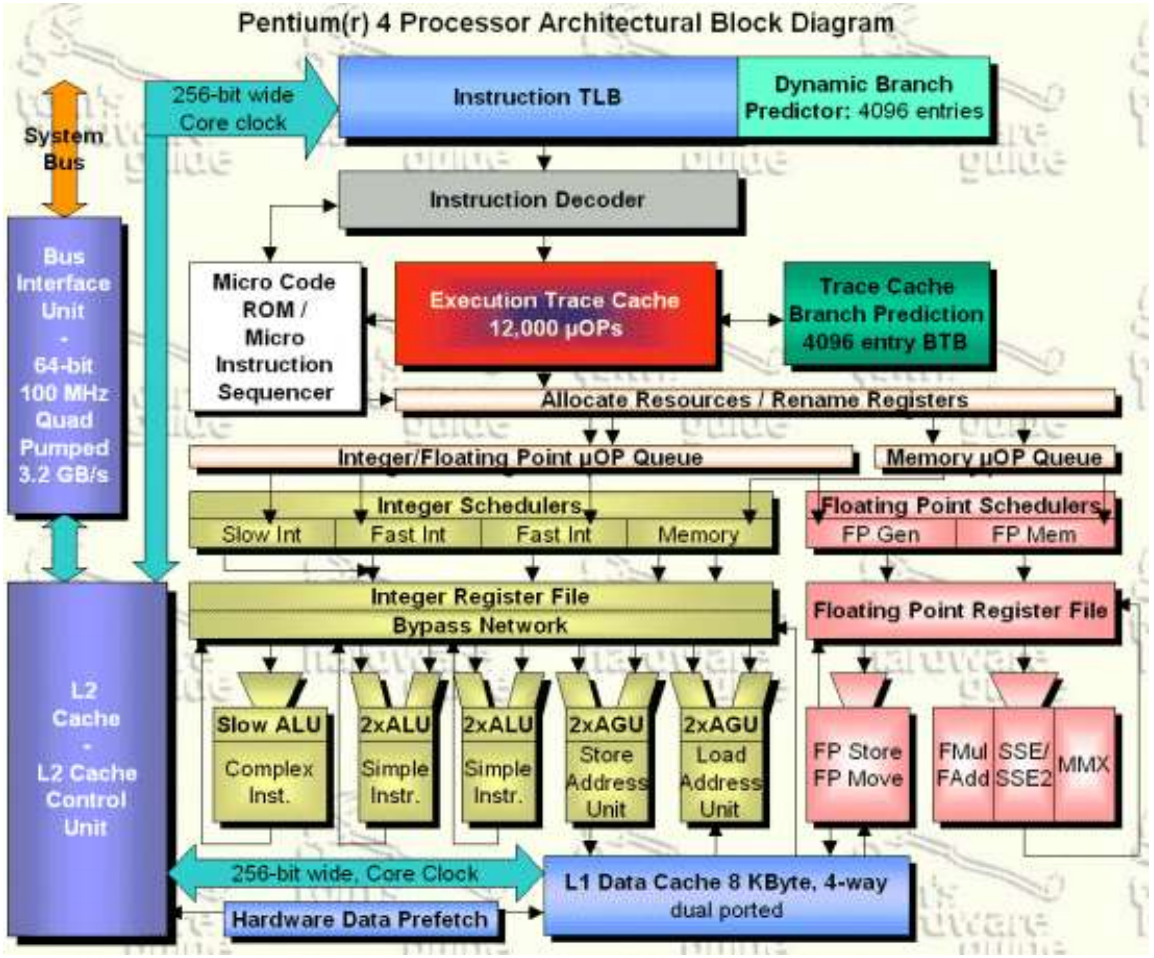


Question to ponder :

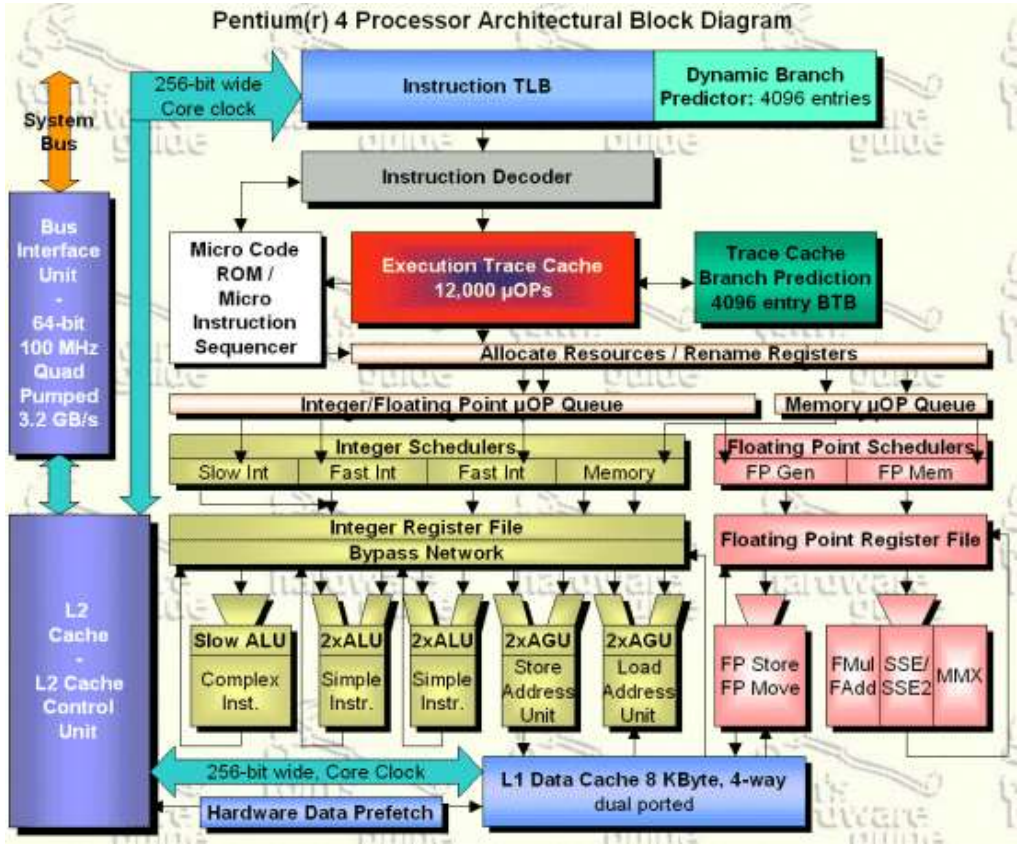
- You’ve just landed from Mars ☺
- You find a computer
- Can you understand the working and design of the computer just by looking at immensely powerful microscope images ?
- What else do you need to do ?

Test and Experiment

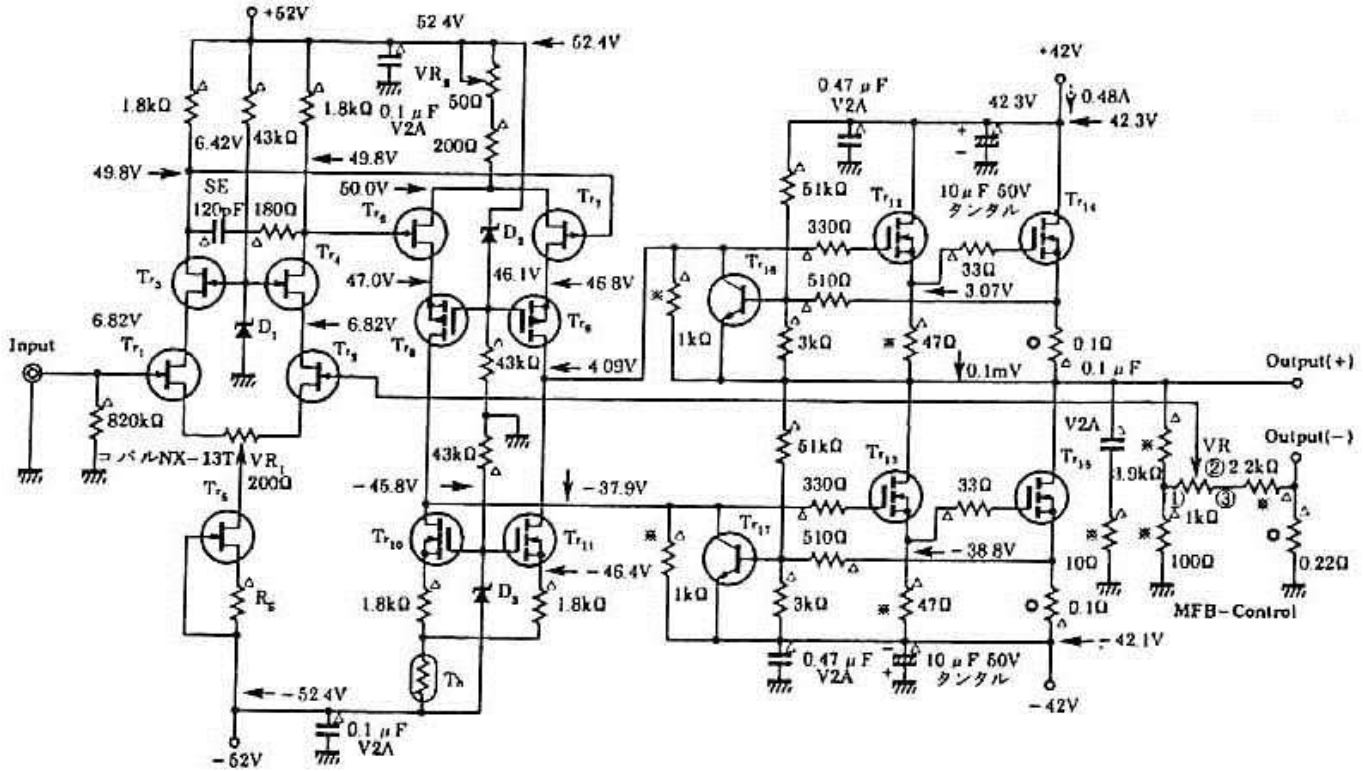
Conceptualize :
Identify the major blocks !



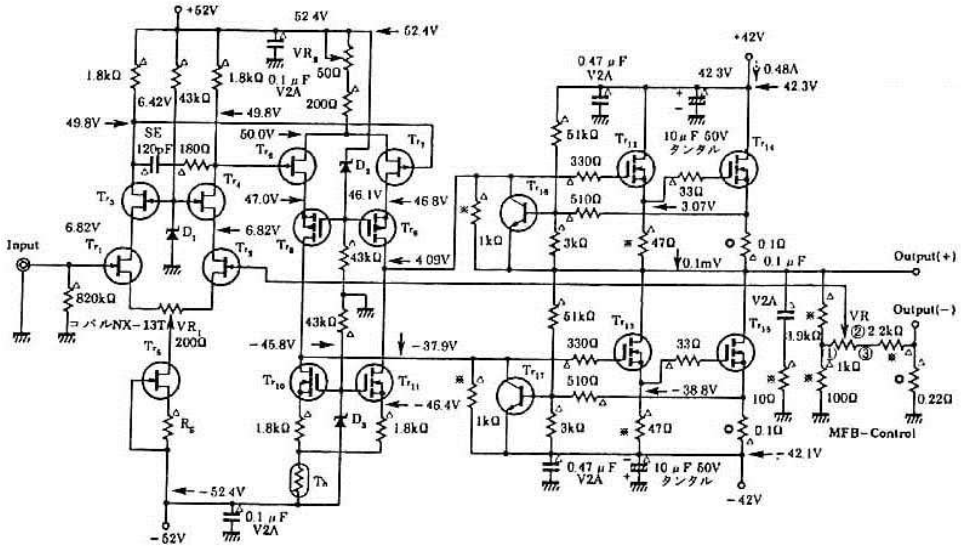
Test your concepts again…



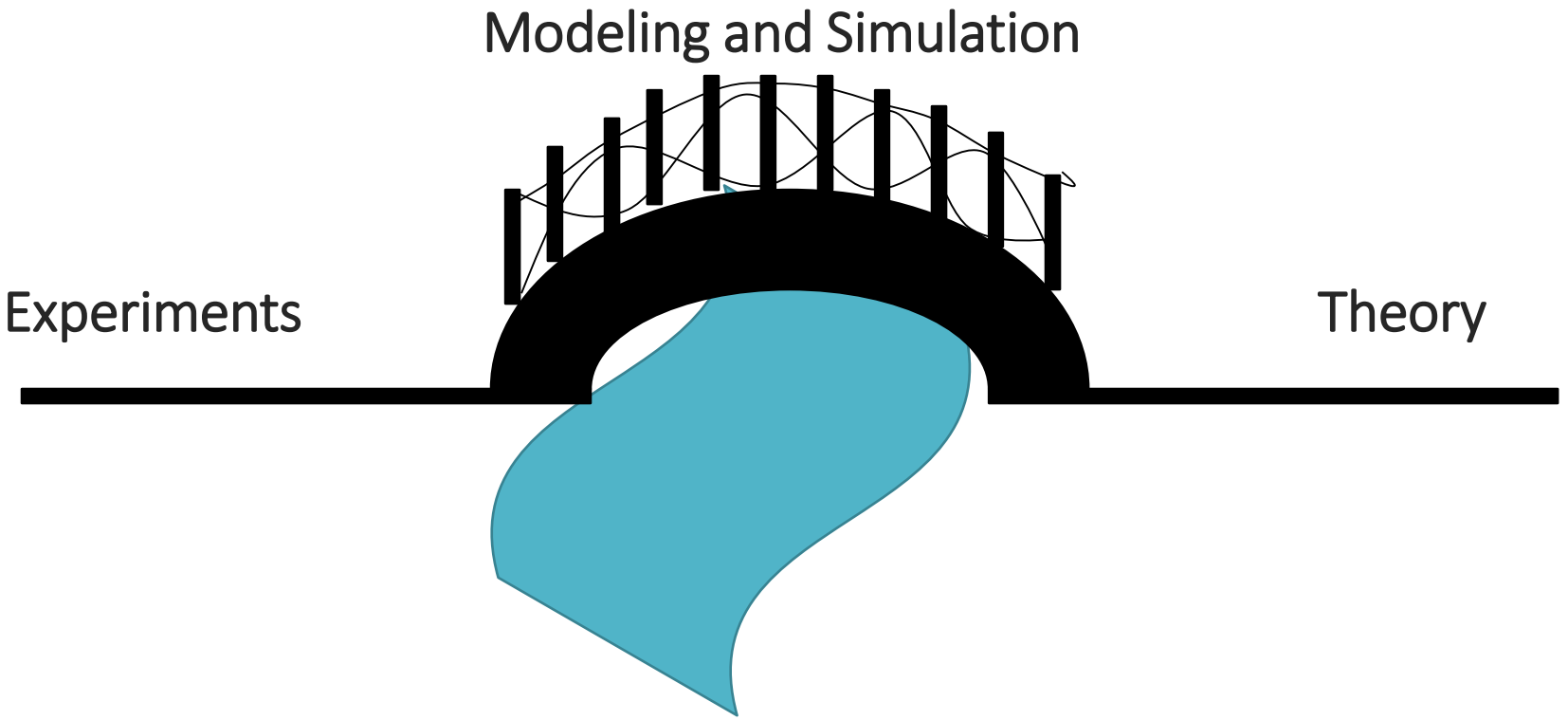
Work out the details !



Test your concepts



Simulation : A “bridge”



Why model or simulate ?

What I cannot create, I do not understand

- Richard Feynman

Levels of abstraction in Neuroscience

Behaviour	Responses to stimuli, choices etc
Systems	e.g. Visual, Auditory, Motor
Areas	e.g. Frontal, Temporal lobes
Circuit	e.g. cortical column
Neurons	A Cell
Synapse	Connection between cells
Molecule	Molecules, ions entering/leaving the cell

Cognitive Neuroscience / Psychology

Non-invasive , usually conducted on human subjects

http://www.shimadzu.com/

http://the-brain-box.blogspot.com

http://blog.art21.org

Under the hood : Brain & spinal cord

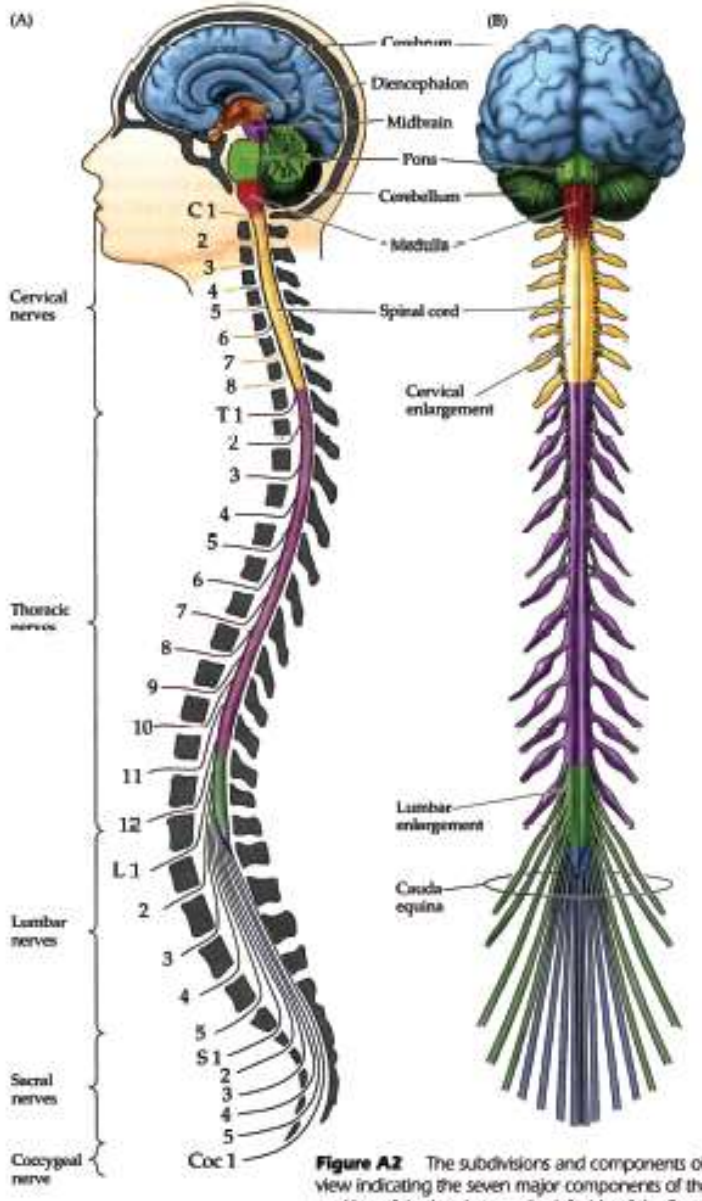


Figure A2 The subdivisions and components of the central nervous system. (A) A lateral view indicating the seven major components of the central nervous system. (Note that the position of the brackets on the left side of the figure refers to the location of the spinal nerves as they exit the intervertebral foramina, not the position of the corresponding spinal cord segments.) (B) The central nervous system in ventral view, indicating the emergence of the segmental nerves, the cervical and lumbar enlargements and the cauda equina.

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Systems

E.g. Somatic-sensory system

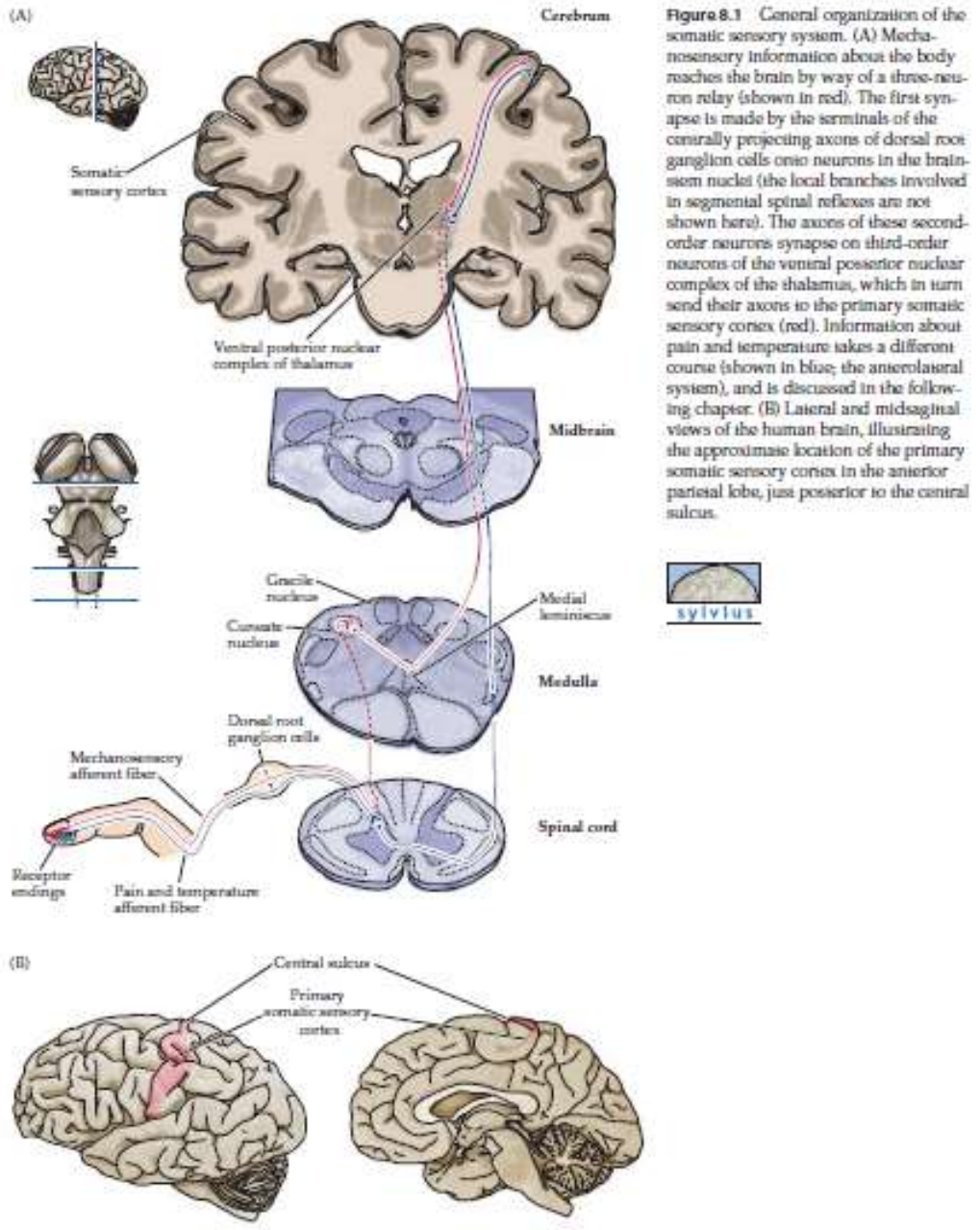

Figure 8.1 General organization of the somatic sensory system. (A) Mechanosensory information about the body reaches the brain by way of a three-neuron relay (shown in red). The first synapse is made by the terminals of the centrally projecting axons of dorsal root ganglion cells onto neurons in the brainstem nuclei (the local branches involved in segmental spinal reflexes are not shown here). The axons of these second-order neurons synapse on third-order neurons of the ventral posterior nuclear complex of the thalamus, which in turn send their axons to the primary somatic sensory cortex (red). Information about pain and temperature takes a different course (shown in blue; the anterolateral system), and is discussed in the following chapter. (B) Lateral and midsagittal views of the human brain, illustrating the approximate location of the primary somatic sensory cortex in the anterior parietal lobe, just posterior to the central sulcus.

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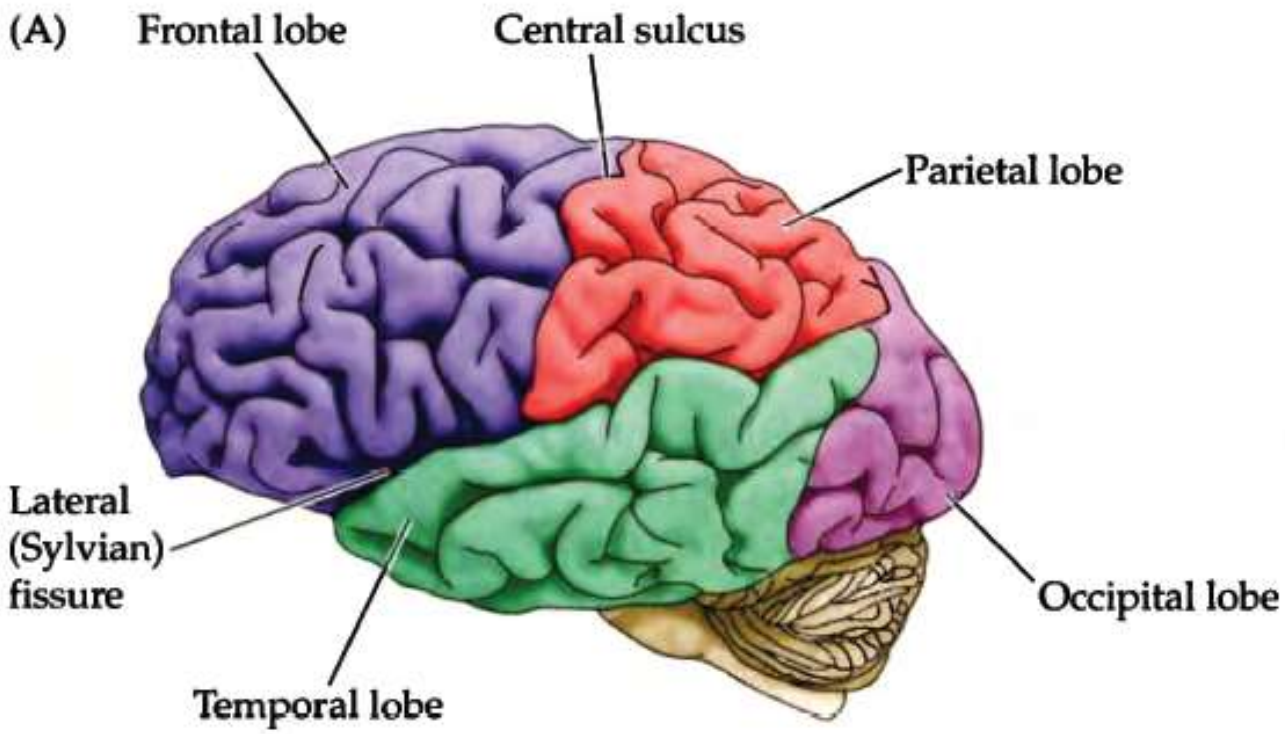
Brain areas



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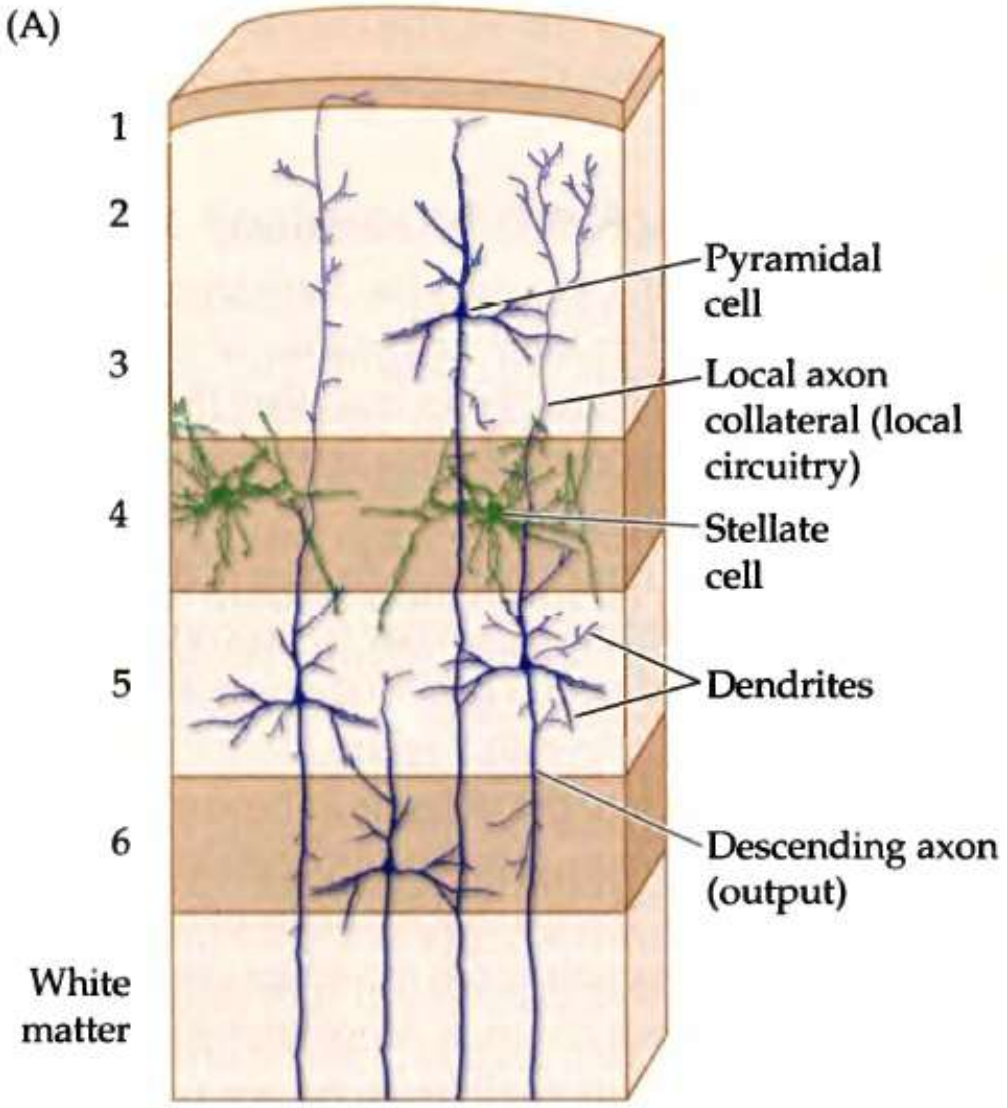
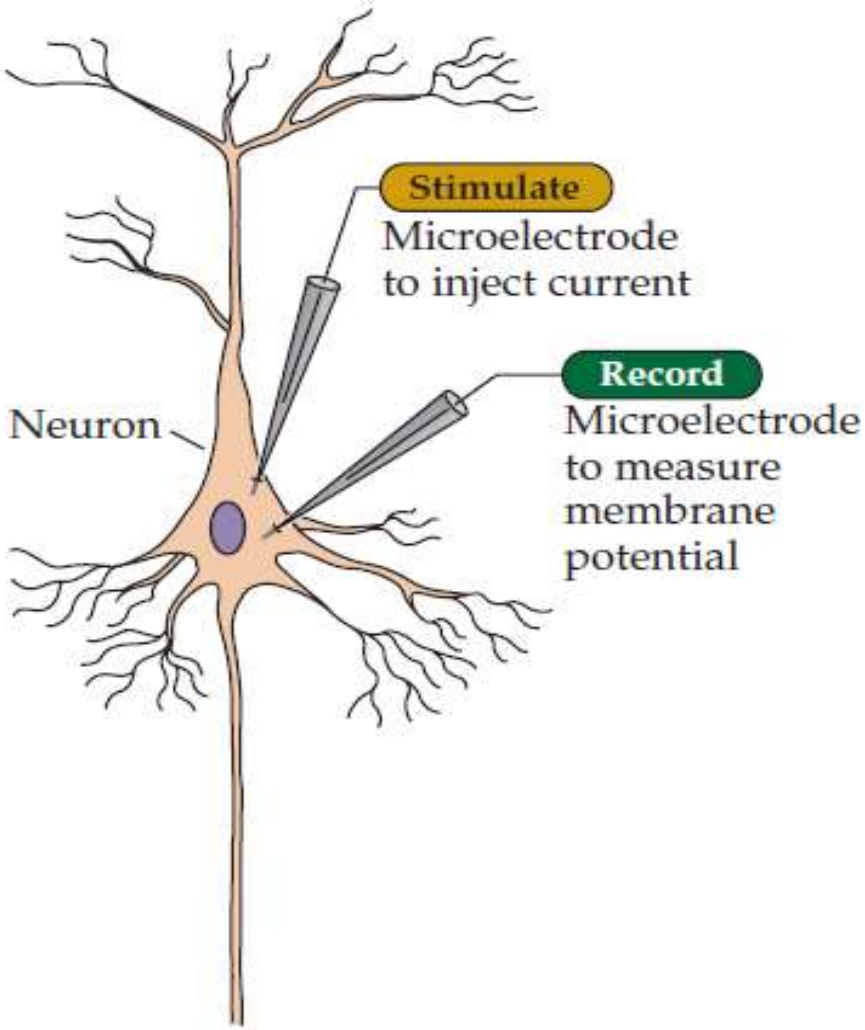
A cortical microcircuit



Neuron & Synapse



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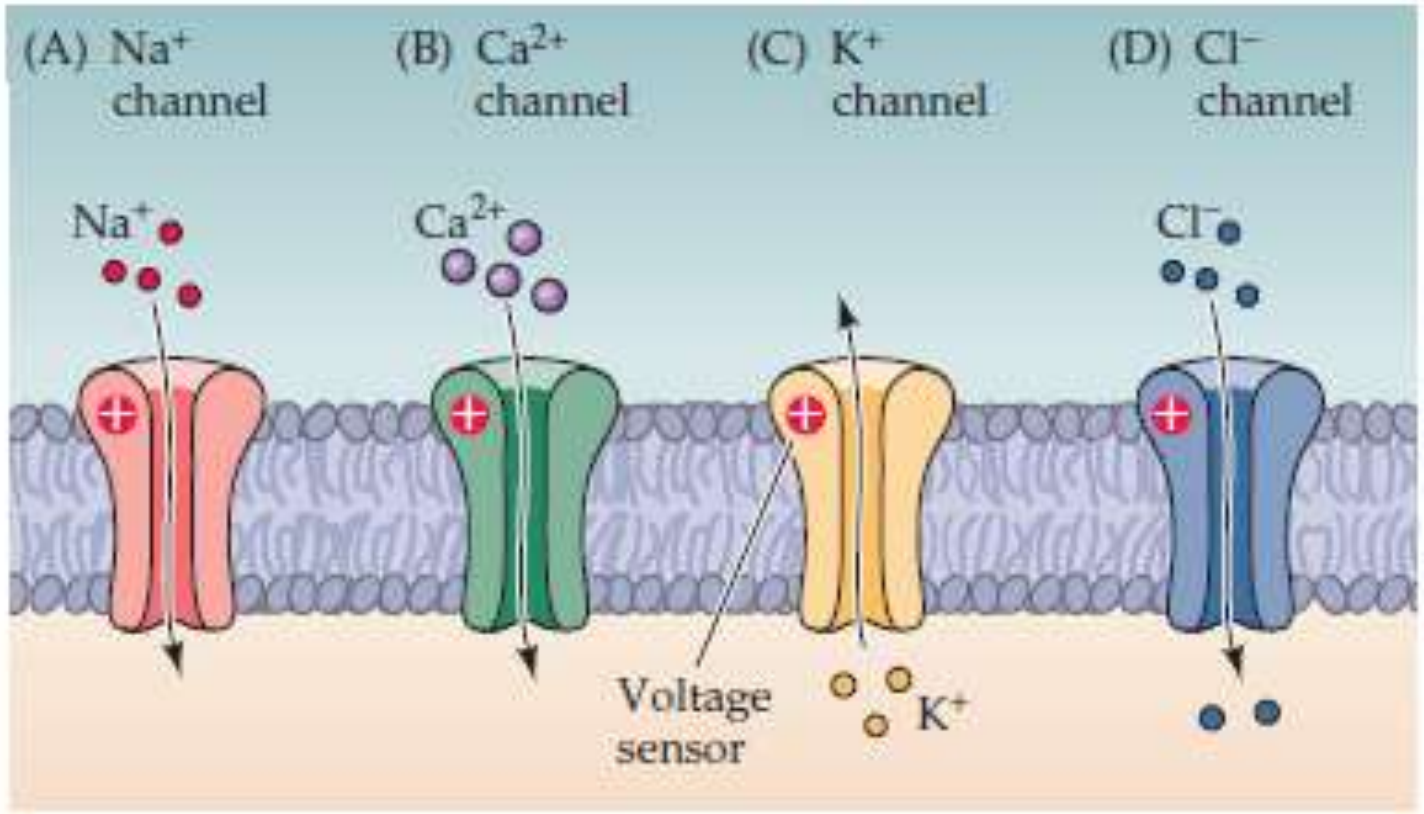
Ion channels



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Thank you !