

LEVELS OF BRAIN ORGANIZATION

Jordi Peña-Casanova

Secció de Neurologia de la Conducta i Demències

Servei de Neurologia. Hospital del Mar

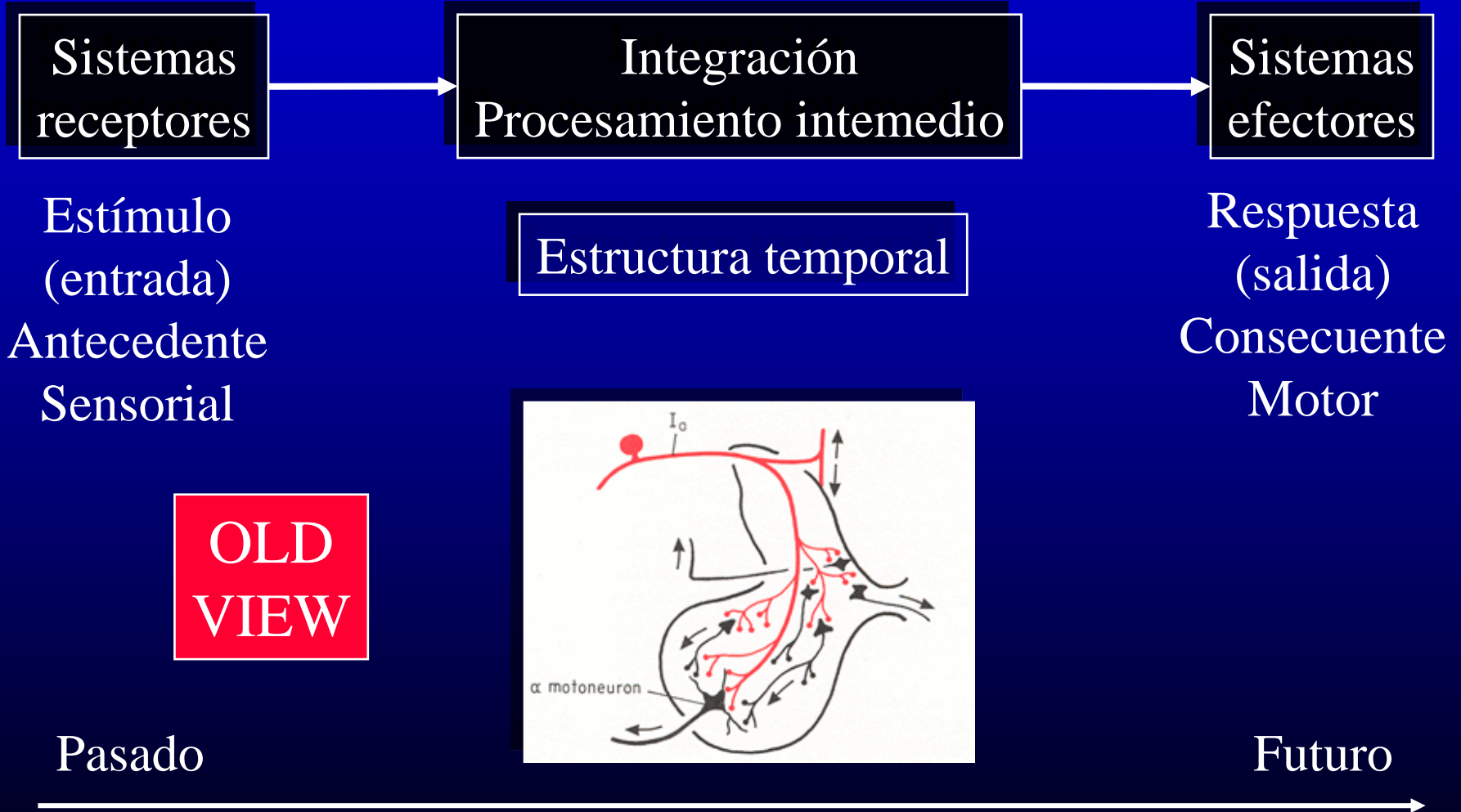
Unitat de Recerca en Serveis Sanitaris

Institut Municipal d'Investigació Mèdica

NEURO-COG

<http://www.neuro-cog.com>

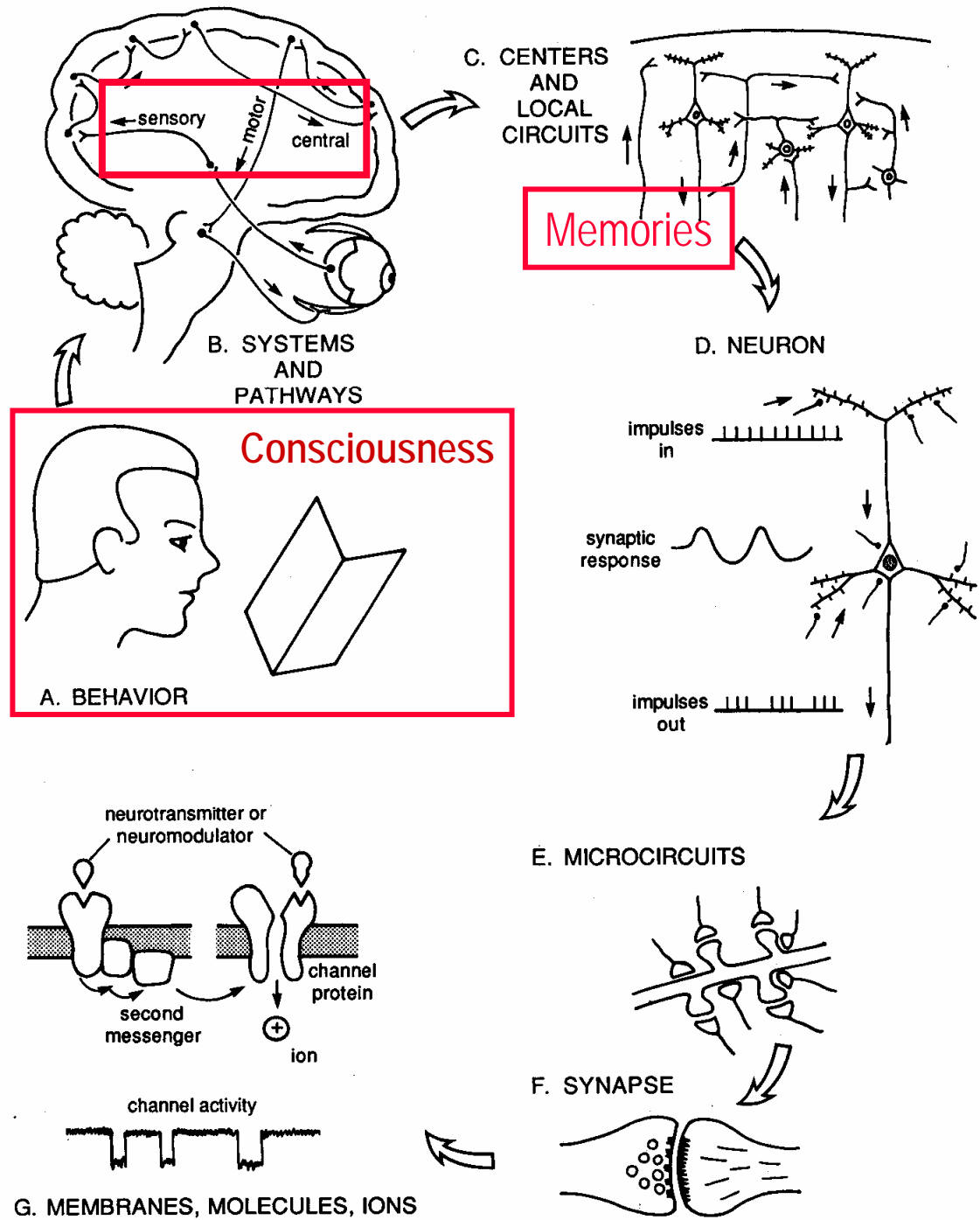
Organización del Sistema Nervioso



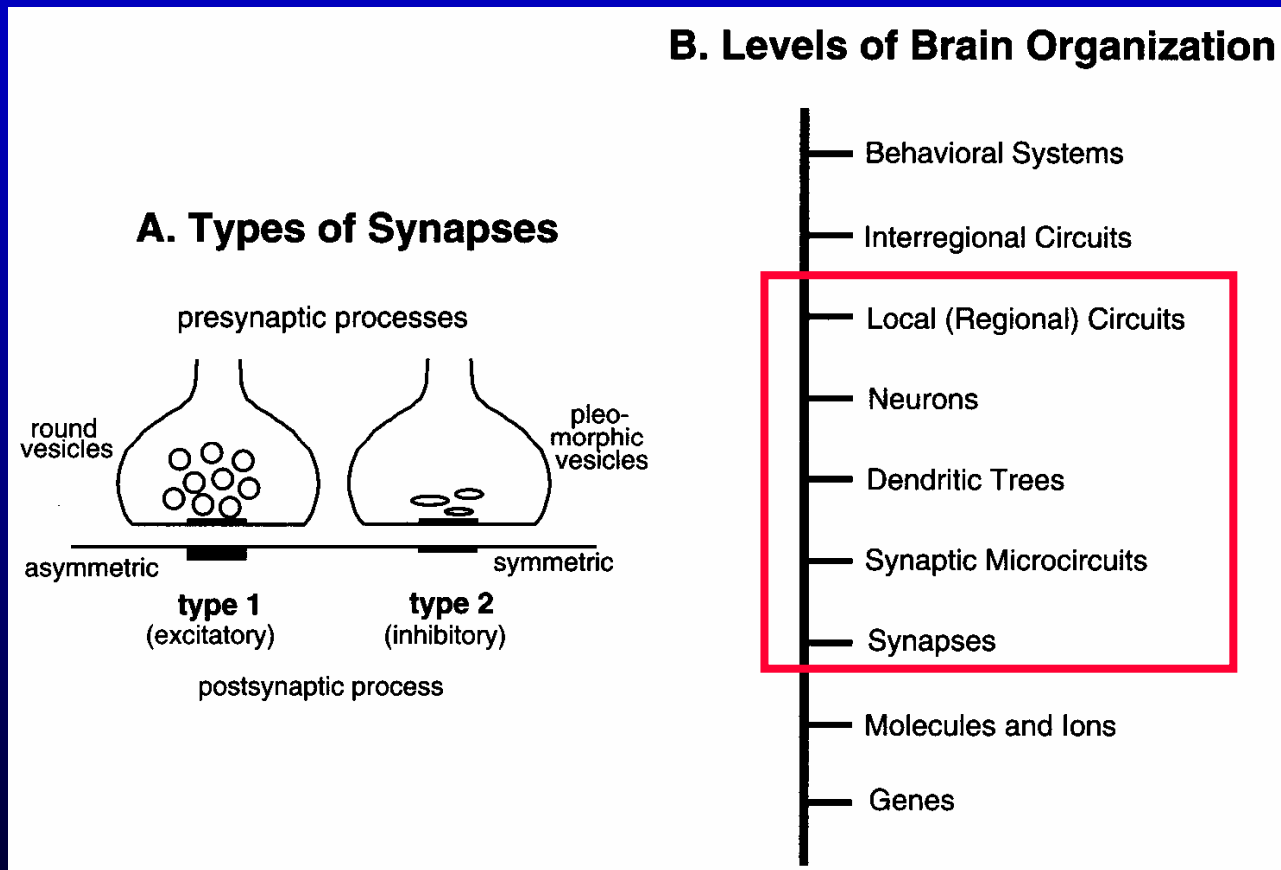
Levels of brain organization

- *“A general principle of biology is that any given behavior of an organism depends on a hierarchy of levels of organization, with spatial and temporal scales spanning many orders of magnitude”* (Shepherd GM. The synaptic organization of the brain. Ed 5. New York; Oxford University Press 2004, p. 6)

Behavioral systems
 |
 Interregional circuits
 |
 Local (regional) circuits
 |
 Neurons
 |
 Dendritic trees
 |
 Synaptic microcircuits
 |
 Synapses
 |
 Molecules & ions
 |
 Genes



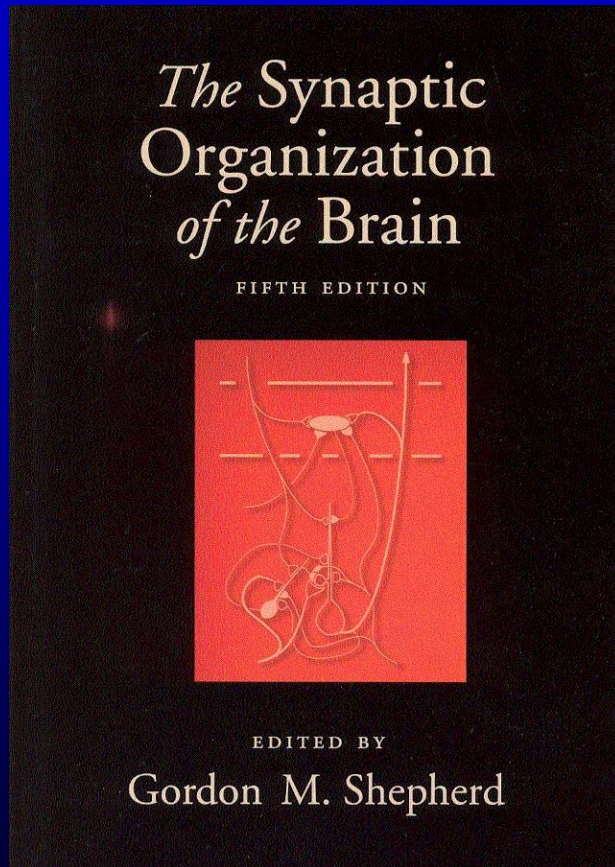
From synapses to local circuits



Two main types of synapses

Multiple levels of organization

Principles underlying circuits...



- Shepherd GM. (ed) The Synaptic Organization of the Brain. Fifth edition. New York: Oxford University Press, 2004

Online resources (Yale University)

- Cell Properties Database (CellPropDB)
 - <http://senselab.med.yale.edu/senselab/cellpropdb>
- Neuron Database (NeuronDB)
 - <http://senselab.med.yale.edu/senselab/neurondb>
- Model Database (ModelDB)
 - <http://senselab.med.yale.edu/senselab/modeldb>

Resources

- Human Brain Project web
 - <http://www.nimh.nih.gov/neuroinformatics/>
- Reconstruction and representations of Cerebral Cortex
 - <http://stp.wustl.edu> (Van Essen Lab)
- Three-dimensional structure & function of synapses in the brain
 - <http://synapses.mcg.edu>
- Generation and description of dendritic morphology
 - <http://www.krasnow.gmu.edu/L-Neuron/index.html>

The triad of neuronal elements

Local regions and interregional pathways

- **Principal neuron**
 - P: Pyramidal neuron
 - **Intrinsic neuron**
 - S: Stellate neuron
 - **Input fiber**
-
- DRG: dorsal root ganglion cell
 - M: Motoneuron

