

SHP Neuroscience

Lecture 4: Learning and Memory

October 12, 2013

Learning Objectives:

- (1) Know the two ways that NMDA receptors are unique from other glutamate receptors.
- (2) Understand how NMDA receptors cause associations to form, and how this can lead to classical conditioning.
- (3) Learn some basic mechanisms of synaptic plasticity.
- (4) Understand what it means for a transmitter to be “neuromodulatory”, and know some major modulatory neurotransmitters.

Supplement:

Excitatory post-synaptic potential (EPSP): depolarizing voltage change in a post-synaptic cell caused by synaptic release onto its dendrites at an excitatory synapse.

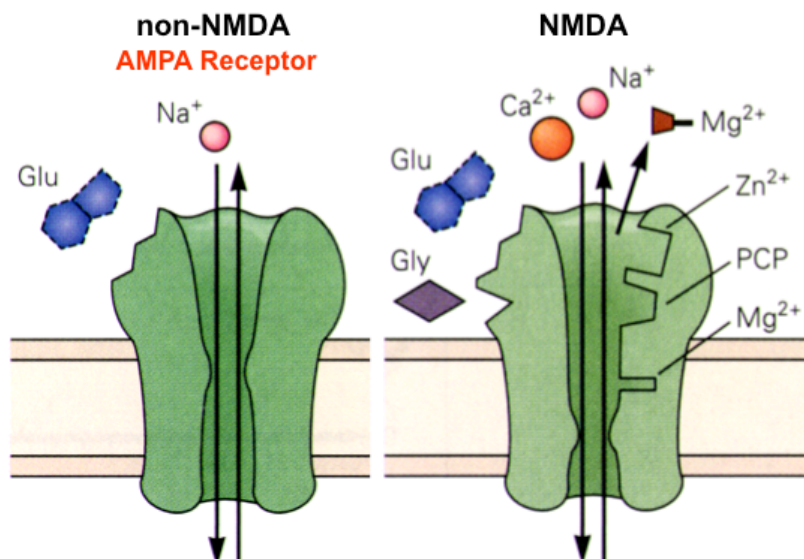
Inhibitory post-synaptic potential (IPSP): hyperpolarizing voltage change in a post-synaptic cell caused by activation of an inhibitory synapse.

Unconditioned Stimulus: any stimulus that produces a natural response in an animal without any prior learning (*e.g.* painful shock or smell of food).

Conditioned Stimulus: normally neutral stimulus that, after association with an unconditioned stimulus, can alone produce an unconditioned response.

Classical Conditioning: simple form of learning that results from temporal pairing of a conditioned stimulus with an unconditioned stimulus, such that the conditioned stimulus alone can reproduce the unconditioned response (think Pavlov’s dogs).

Glutamate Receptors:



NMDA receptors require simultaneous:

- 1) presynaptic glutamate release
- 2) postsynaptic depolarization

in order to become active and allow ions (including Ca²⁺!) to flow