NEURAL SUBSTRATES OF ASSOCIATIVE, ELECTIVE, AND COOPERATIVE LEARNING TASKS

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While contemporary Neuroscience is paying increasing attention to subcellular and molecular events underlying the acquisition, storage, and retrieval of newly acquired motor and cognitive abilities, a similar attention should be paid to the study of electrophysiological phenomena taking place at cortical and subcortical sites during the very moment in which complex forms of learning processes are being acquired. These *in vivo* approaches to the study of individual and social learning will allow the proper integration of the important information already collected from *in vitro* and delayed molecular studies. During my presentation, I will summarize studies carried out in our laboratory on activity-dependent changes in unitary activity, synaptic strength, and local field potentials taking place in hippocampal, motor, prefrontal and related cortical and subcortical circuits during the acquisition of associative, elective, and cooperative learning paradigms. Available data allow to suggest that different hippocampal synapses are selectively modified in strength during the acquisition of classical, but not instrumental, conditioning paradigms. In contrast, selected prefrontal and striatum synapses are more directly modified by instrumental conditioning tasks. These studies also show that besides NMDA receptors, many other neurotransmitter, intracellular mediating, and transcription factors participate in these two types of associative learning. Interestingly, structures as the medial prefrontal cortex, the amygdala, the claustrum and the accumbens nucleus are selectively involved in the behavioral and/or cognitive components of other complex forms of associative learning as cooperative behaviors, and decision making and go/no-go situations. The differential roles of these cortical and subcortical structures during these different types of associative learning will be described and the distributed and timed nature of associative learning abilities will be stressed.