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Poster Presentation

Hippocampus-Neocortical Communication in Learning

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Abstract

The hippocampus is located in the medial temporal lobe and is a part of the forebrain. It plays a critical role in formation of declared memories. The hippocampus is banana-shaped and communicates with all parts of neocortex. Reptiles and birds have structures like hippocampus that potentially serve as navigation functions. During the mammalian evolution, the neocortex has a large expansion. There are Granule cells in the hippocampus with multitude functions which are not present in the neocortex. Physiological roles of granule cells reveal a key step to understanding hippocampal computation. At first, memories are stored in the hippocampal system via synaptic changes. In fact, when a new experience happens, it either disappears or consolidates into a long-term form of memory. It is shown that, during learning, synapses are strengthened through long-term potentiation (LTP). The hippocampus stored new input data then replays to neocortical system, and these recent memory changes reinstatements in the neocortex. Acetylcholine is essential for learning and its presence in the neocortex helps to restore memory following damage. The neocortex discovers the structure of items in ensembles of experiences, so it learns slowly, but the hippocampus system learns new items rapidly without disrupting this structure. The hippocampus permits reinstatement of new memories and integrates them into structured neocortical memory system via memory consolidation process, a process which in it memories are gradually transferred to neocortical stores. The hippocampus has a subsystem that encodes pathways between the neocortex and entorhinal cortex; and cholinergic system plays an important role in this process. Here, it could be concluded that learning new items happens in hippocampus via synaptic changes and these new items consolidate into a structured memory in the neocortex.

Keywords: Hippocampus, Neocortex, Memory, Learning.

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