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Could LTP and LTD Drive the Place Cells' Physiology Where no Previous State Would Interfere on the New Dynamic Functions? A Hypothesis based on Neurobiology and Neural Modeling Studies

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Introduction

Since LTP and LTD were discovered more than thousands research articles have been devoted to study both on several subsets. The first and more accepted function is that these processes are devoted to the memory consolidation; more specifically, episodic memory. Besides, several functions have been attributed to the hippocampus, as visual navigation, episodic memory, emotional responses, attention phenomena and adaptively timed learning. However, the role of these two activities on each function and also on memory consolidation is not yet understood.

The essential thinking is that LTP act by favoring the consolidation of memories processed by the hippocampus. But how could a so simple structure participate on these whole activities, sometimes simultaneously, storing many kinds of distinct information without errors?

The hippocampal complex receives many afferent connections from several cerebral and brainstem areas participating on the functions above described. If we assume the hippocampus as the principal structure on each one, it is easy to understand why many proposed models aren't sufficient to account for the global functions that are processed on this intriguing structure.

Methods and Results

This paper intends to show how the advancement on neurobiological knowledge sustains both, questions about the LTP and LTD functions, and also the use of neural network tools as opponent processing on self organizing networks for the modeling of the hippocampal dynamics. Besides, recent neurobiological findings sustain some distinct interpretation of LTP and LTD. We will propose that a probable function would be related to the driving of the place cells' physiology toward a pattern of activity where previous state would not interfere on the processing of new functions.

Conclusions

Our first question is: how could the hippocampus store information if this will be "deleted" by LTP and/or LTD? Our answer refers to the coherence of the oscillations arriving from distinct sites to generate place fields, which would be the real system of storage. But how could it be stored? On a self-organizing network it would be possible

that the same pattern of temporal coherence could generate a similar representation and reinforce the cerebral processes already developed.

As a general conclusion we think reasonable construct models more able to reproduce dynamic properties observed in any kind of behavior, trying to link every all at a realistic perspective of the hippocampus processing, than explain any respective function through a linear reasoning.

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