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Poster presentation

Links between complex spikes and multiple synaptic plasticity mechanisms in the cerebellar cortex

Rodrigo Publio*[1] and Erik De Schutter[1,2]

Address: [1]Computational Neuroscience Unit, Okinawa Institute of Science and Technology, Okinawa 904-0411, Japan and [2]Theoretical Neurobiology, University of Antwerp, B-2610 Antwerpen, Belgium

Email: Rodrigo Publio* - publio@oist.jp

* Corresponding author

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Introduction

In the classic cerebellar learning theory the climbing fiber (CF) is activated when the movement is inaccurate and this activation leads changes in the synaptic strength and in the Purkinje cell (PC) output [1,2]. Stimulation of a single CF activates hundreds of synaptic contacts across PC dendrites and triggers a high frequency burst of spikes called complex spike (CS) [3]. However, it is still unclear how changes in the complex spike probability and the time interval between the parallel fiber (PF) and CF inputs will affect the PC single spike response and learning, considering multiple plasticity mechanisms present at PF and CF synapses [4]. In this work, we used a computational model for synaptic transmission to simulate both long-term and short-term plasticity [5,6] and a single compartmental model of the PC [7] to investigate the links between CS probability, multiple plasticity mechanisms and changes in the PC output. The computational model includes the post-synaptic expression of long-term depression between CF and PC [8], long-term potentiation and depression between PF and PC [5] and short-term facilitation between PF and PC [6]. The models were based in previous models for synaptic transmission and were validated according to the available experimental data (Figure 1).

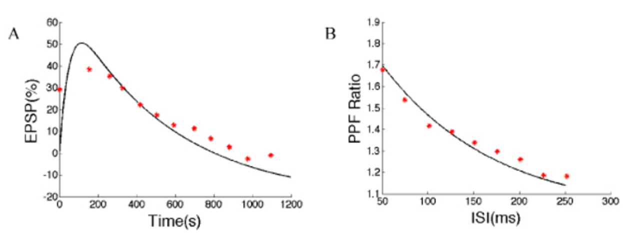

Figure 1

Periodic stimuli induced short-term facilitation (A) and paired pulse facilitation (PPF) at PF-PC synapse (B). The solid lines represent the model results for the parameter set that best fit the experimental data [6,9].

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