

POSTER PRESENTATION

Open Access

A simple effective model for STDP: from spike pairs and triplets to rate-encoding plasticity

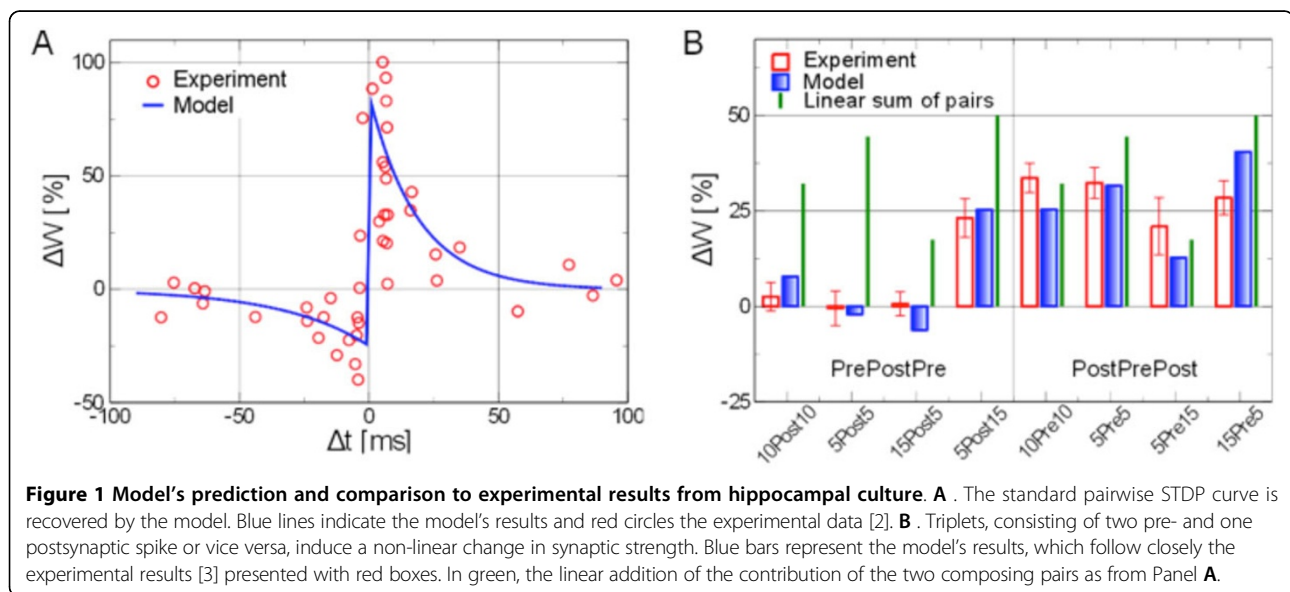
Rodrigo Echeveste*, Claudius Gros

From 24th Annual Computational Neuroscience Meeting: CNS*2015
Prague, Czech Republic. 18-23 July 2015

In the present work [1] we propose an effective model formulating synaptic potentiation and depression in terms of two interacting traces, representing the fraction of open NMDA receptors and the Ca^{2+} concentration in the post-synaptic neuron, respectively. These two traces then determine the evolution of the synaptic strength. We first confirm that the standard pairwise STDP curve is obtained for low frequency trains of pairs of pre- and post-synaptic spikes and we then evaluate triplet effects (see Figure 1), comparing the model's results to experimental data from hippocampal culture [2,3]. Finally, we evaluate the model's predictions for spike trains of different frequencies

and degrees of correlation, observing that a BCM-like rule for plasticity as a function of the pre- and post-synaptic firing rates is recovered when employing uncorrelated poisson trains of pre- and postsynaptic spikes.

Having a low number of parameters and being composed of only polynomial differential equations, the model is able nonetheless to reproduce key features of LTP and LTD. Moreover, since the parameters of the model are easily related to the dynamical properties of the synapse, we believe the model constitutes a useful tool to study extended neural networks from a dynamical system's point of view.



* Correspondence: echeveste@itp.uni-frankfurt.de
Institute for Theoretical Physics, Goethe University Frankfurt, Hessen, 60438, Germany

Acknowledgements

The support of the German Science Foundation (DFG) and the German Academic Exchange Service (DAAD) are acknowledged.

Published: 18 December 2015

References

1. Echeveste R, Gros C: **Two-trace model for spike-timing-dependent synaptic plasticity.** *Neural comput* .
2. Bi GQ, Poo MM: **Synaptic Modifications in Cultured Hippocampal Neurons: Dependence on Spike Timing, Synaptic Strength, and Postsynaptic Cell Type.** *J Neurosci* 1998, **18**:10464-10472.
3. Wang HX, Gerkin RC, Nauen DW, Bi GQ: **Coactivation and timing-dependent integration of synaptic potentiation and depression.** *Nat Neurosci* 2005, **8**:87-193.

doi:10.1186/1471-2202-16-S1-P87

Cite this article as: Echeveste and Gros: A simple effective model for STDP: from spike pairs and triplets to rate-encoding plasticity. *BMC Neuroscience* 2015 **16**(Suppl 1):P87.

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

