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Nitric Oxide Diffusive Plasticity Model in Cerebellar SNN

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Nitric Oxide (NO) is an essential molecule involved in the synaptic plasticity of many areas of the brain and in neurovascular coupling. NO is known to be present in the cerebellum, both in the Granular and the Molecular layers and it is thought to have an enabling function in plasticity mechanisms. NO plasticity dependency has been investigated mainly in experimental studies, and few mathematical models replicate its function on simple networks, but it has not been included in *in silico* simulations of large spiking neural networks (SNN). In this project, we aim to create a Python module for simulating NO diffusion and integrate it in a NEST simulation of a cerebellar micro-circuit to test its effect on plasticity between parallel fibres (pf) and Purkinje cells (PC). In each pf-PC synapse, we place sources of NO that receive stimuli from the pf and produce NO accordingly. NO diffusion is then simulated in the network, and its concentration is evaluated in each synapse. We then modified the STDP learning rule at the pf-PC synapse level, by implementing a dependency on the [NO] concentration values, and we assessed the spatiality and the effects of the plasticity enabling, following different stimulation protocols.

This computational model presents itself as a useful and simple tool to simulate the functional role of Nitric Oxide in Neural Networks and its functional role.

Acknowledgements

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models and applications

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Talk (& optional poster)

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