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"La mente è come un paracadute.
Funziona solo se si apre"
A. Einstein

Stochastic analysis of a dual phosphorylation cycle: implications for synaptic plasticity

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Abstract

A 2-step phospho/dephosphorylation cycle for the alpha-amino-3-hydroxy-5-methyl-4-isoxazole proprionic acid receptor (AMPAR), as used in in vivo learning experiments to assess long-term potentiation (LTP) induction and establishment, exhibits bistability for a wide range of parameters, consistent with values derived from biological literature. The AMPAR model we propose, hence, is a candidate for memory storage and switching behavior at a molecular-microscopic level. Furthermore, the stochastic formulation of the deterministic model leads to a mesoscopic interpretation by considering the effect of enzymatic fluctuations on the Michelis-Menten average dynamics. A further consequence is that the bistable regime occurs only within certain parametric windows, which may simulate a "history-dependent threshold". This effect might be related to the Bienenstock-Cooper-Munro theory of synaptic plasticity.

Aula Conferenze, Viale Manzoni 30, Roma   Venerdì 22 Ottobre 2010 alle ore 11:00