WHITAKER BIOMEDICAL ENGINEERING INSTITUTE

DEPARTMENT OF BIOMEDICAL ENGINEERING
FRIDAY SEMINAR SERIES

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Professor
Center for Neural Science and Courant Institute of Mathematical Sciences
New York University

"Network Oscillations in Developing Spinal Cord"

DATE: February 13, 2004

TIME: 1:00 – 2:00 p.m.

PLACE: **Traylor 709**

Hosted by: Kechen Zhang, Ph.D.

Abstract:
Many developing circuits show spontaneous oscillations. We study models for the slow episodic population rhythms (time scale, mins) that are seen in chick embryonic spinal cord. We use mean field models for the population firing rate in a recurrent network of functionally excitatory coupled cells. The primary candidate for the slow negative feedback mechanism that sets the interburst period is synaptic depression. The individual units have simple tonic firing properties. Specific predictions based on the model about how the rhythm is affected due to brief stimuli that switch the system from the quiescent to the active phase have now been confirmed in experiments. A positive correlation was found between episode duration and the preceding inter-episode interval, but not with the following interval, suggesting that episode onset is stochastic while episode termination occurs deterministically, when network excitability falls to a fixed level. We also predicted, and confirmed experimentally, that during glutamatergic blockade the interepisode interval increases and the network operates in a range of lessened depression, i.e. at compensatory increased level of network excitability. We further formulate and analyze a minimal model that demonstrates the plausibility of a specific mechanism for depression: the slow modulation of the synaptic reversal potential (for the GABA synapses, which are depolarizing at this stage of development). Preliminary results show that a cell-based network (integrate-and-fire units) with synaptic depression can also alternate between phases of active firing and quiescence. (with J Tabak (NIH), M O'Donovan (NIH), B Vladimirski, C Marchetti)
J Tabak, W Senn, MJ O'Donovan, J Rinzel: Modeling of spontaneous activity in developing spinal cord using activity-dependent depression in an excitatory network. J Neuroscience 20:3041-3056, 2000.

J Tabak, J Rinzel, M O'Donovan: The role of activity-dependent network depression in the expression and self-regulation of spontaneous activity in the developing spinal cord. J Neuroscience 21: 8966-8976, 2001.

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