How slow cortical neurons in layer 4 manage to make fast decisions

ELSC cordially invites you to the lecture given by:

Michael Gutnick

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On the topic of:

How slow cortical neurons in layer 4 manage to make fast decisions

The lecture will be held on Thursday January 19th, 2017 at 17:00

at ELSC: Silberman Bldg., 3rd Wing, 6th Floor,

Edmond J. Safra Campus

Light refreshments served at 16:45

Abstract:
Most excitatory cells in layer 4 of the mouse somatosensory cortex are spiny stellate (SpSt) neurons, which receive nearly all their excitatory input from the thalamus and from other SpSt neurons in the same barrel. Because layer 4 is the key entrance point into the cortical circuit, we assume that SpSt neurons respond rapidly to sensory input. However, these cells are very small, and there are strong theoretical reasons to suspect that their compact morphology could impair their capacity to encode high input frequencies and thus hamper the temporal fidelity of cortical processing. We use whole-cell patch clamp to measure the temporal properties of asynchronous noise in SpSt cells as compared with the much larger layer 5 pyramidal (Pyr) cells, and characterize the capabilities of both cell types to encode high frequencies in a synaptically active-like environment. We find that individual SpSt cells indeed have a much narrower dynamic range than Pyr cells when probed with inputs on a background of identical noise characteristics.
However, the synaptic dynamics in SpSt cells, as evidenced by the correlation time of asynchronous noise, is slower than in Pyr neurons, and the slower correlation time of the SpSt cells is associated with significant broadening of their dynamic range. We further show that this compensatory improvement in encoding bandwidth of sensory input depends on activation of potassium conductances, as it decreases when potassium channels are pharmacologically blocked.

Tags: Events 2016-2017 Seminars