FENS Forum 2008

For posters, morning sessions: 9:30-13:30; afternoon sessions 13:30-17:30.
Authors are expected to be in attendance at their posters at the time indicated.
For other sessions, time indicates the beginning and end of the sessions.

First author Markram, Henry (poster)

Poster board D53 - Tue 15/07/2008, 12:15 - Hall 1
Session 154 - Tactile-somatosensory 2
Abstract n° 154.33
Publication ref.: *FENS Abstr., vol.4, 154.33, 2008*

Authors Markram H. (1), Druckmann S. (3), Gidon A. (4), Hay E. (3), King J. G. (1), Ramaswamy S. (1), Ranjan R. (1), Riachi I. (1), Sfyrakis K. (1), Schuermann F. (1) & Hill S. L. (1, 2)

Addresses (1) Brain Mind Inst., EPFL, Lausanne, Switzerland; (2) IBM T. J. Watson Research Center, Yorktown Heights, USA; (3) Interdisciplinary Center for Neural Computation, Jerusalem, Israel; (4) Dept. of Neurobiol., Hebrew University, Jerusalem, Israel

Title Calibrating and validating the biological accuracy of a model neocortical column: from ion channels to network dynamics.

Text The Blue Brain Project has developed a simulation-based research environment for modeling and studying the neocortical column (NCC) model of the rat somatosensory cortex. A tool-chain has been constructed to build three-dimensional cellular reconstructions of the neocortical column based on data from the somatosensory cortex of the young Wistar rat. Models of ion channels, single neuron morphologies, electrical firing properties and synapses are fitted to experimental measurements and used as the building blocks of the column. The NCC model is composed of 10, 000 three-dimensional reconstructed neurons arranged in mini-columns that extend throughout 6 layers of cortex. Model ion channels are distributed on the model morphology to recreate measured electrical properties of real neurons. Structural contacts between neurons determine potential synaptic locations, while functional synapses are assigned - with short-term synaptic properties - according the experimentally measured probabilities. After the column is constructed, a calibration process for the neocortical column model checks the biological fitness of: 1. layer boundaries, volume, density and composition of the column; 2. single cell electrical behavior and ion channel kinetics; 3. dendritic integration properties including backpropagating spike attenuation, linear/supralinear summation and dendritic resonance; 4. morphology repair and cloning; 5. monosynaptic properties including rise-time, amplitude and latency; 6. short-term synaptic facilitation and depression; 7. polysynaptic loops including layer V pyramidal cell (L5PC) -Martinotti and L5PC-L5PC interactions; 8. structural connectivity properties; and 9. emergent phenomena including network oscillations and population responses to stimuli. This modeling and calibration process highlights missing data, guides the acquisition of new data, helps to define new experiments and improves the modeling process.

Theme D - Sensory and motor systems
Tactile/somatosensory - Brain stem, thalamus, cortex