PROGRESS IN NEUROSCIENCE PINS

Seminar Series of the
Brain & Mind Research Institute
Weill Cornell Medical College (WCMC)
&
The Graduate Program in Neuroscience of
WCMC and Sloan Kettering Institute

Thursday, 4/17/14, 4 PM, coffee at 3:45 PM
Weill Auditorium

Brain Rhythms Organize Cell Assemblies for Memory

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Abstract:

The dominant theoretical form of mental structure of the last century was implicitly a neuropsychological model. At the center of this model, necessary for episodic free recall, planning or logical reasoning, is Hebb¹s phase sequences of neuronal assemblies, i.e., hypothetical self-propagating loops of neuronal coalitions connected by modifiable synapses. These phase sequences can be activated by exogenous or endogenous (internal) sources of stimulation, independent from environmental determinants of behavior. The neurophysiological implication of this conjecture for episodic recall is that hippocampal networks are endowed by an internal mechanism that can generate a perpetually changing neuronal activity even in the absence of environmental inputs. Recall of similar episodes would generate similar cell assembly sequences, and uniquely different sequence patterns would reflect different episodes. Using large-scale recording of neuronal ensembles in the behaving rat, I will show experimental support of self-perpetuating activity neuronal assemblies and demonstrate how oscillations support precise spike timing across neuronal populations. The physiological characteristics of these assemblies are virtually identical to features of hippocampal place cells controlled by environmental and/or idiothetic stimuli. I hypothesize that neuronal mechanisms introduced for navigation in the physical environment in ³simpler² animals are identical to those needed for memory recall and/or planning animals with larger brains. The different appearance of representations in the hippocampus of different species and different segments of the hippocampus in the same species may reflect its functional connectivity with the neocortex and other structures.

Recent relevant publications:

Buzsáki G, Logothetis N, Singer W. Scaling brain size, keeping timing: evolutionary preservation of brain rhythms.<http://www.ncbi.nlm.nih.gov/pubmed/24183025> Neuron. 2013 Oct 30;80(3):751-64.

Buzsaki G. Neural syntax: cell assemblies, synapsembles, and readers. Neuron 68:362-85, 2010.

Buzsaki, G. Rhythms of the Brain (Oxford University Press). 2006.

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