Center for Memory and Brain
2011-2012 Memory Lunch Seminar Series

September 26, 2011
Babak Tahvildari, Ph.D.
Yale University

Role of Inhibition in Cortical Neural Network Activity In-vitro

Abstract.
The cerebral cortex consists of a large sheet of highly interconnected excitatory principal neurons and local GABA-ergic inhibitory interneurons. Dynamic interactions between excitatory and inhibitory neurons enable the cerebral cortex to operate accurately. The proper functionality of the cerebral cortex depends critically upon neural network oscillations one of which is known as the slow oscillation. Excitatory cells comprise most of the cortical neurons of the cerebral cortex; however, local inhibitory GABA-ergic interneurons cover only small fraction. Despite their minority, they possess a wide range of complex and heterogeneous diversities suggesting distinctive roles in shaping cortical neural network activity. Interneurons can be classified based on a variety of characteristics including morphological properties, neuropeptide content and calcium binding protein expression. In this seminar, I will present recent data obtained using slice electrophysiology in combination with morphological characterization of different identified interneurons of the entorhinal cortex during a spontaneous slow neural oscillation in-vitro. Using several genetically manipulated mice expressing green fluorescent protein in subpopulation of identified interneurons, I will show that distinct interneuron types contribute in unique ways to the slow oscillation. The firing patterns and post-synaptic potentials of individual interneurons of the same class are remarkably stereotyped and provide unique signatures for each class. Taken together, I conclude that the diversity of interneurons emerged to coordinate the activity of excitatory and inhibitory cells in a distinct manner.

October 31, 2011
Professor Jozsef Csicsvari
Institute of Science and Technology Austria

Encoding and reactivation of spatial memory traces by hippocampal cell assemblies

Abstract
We recorded place cell activity in behaving rats during a matching-to-multiple-places task that requires frequent updating of memories for goal locations. The task took place on a cheeseboard maze where rats had to find a set of hidden rewards. The place-related firing patterns in CA1 region reorganised to over-represent the learned goal locations whereas such reorganisation did not take place in CA3. Moreover the learning-related CA1 population firing patterns representing learned locations predicted memory performances in subsequent memory retention tests. At the goal locations 200Hz high-frequency network oscillations, called sharp-wave/ripples (SWR) were observed. Place cells encoding goal locations increased their firing rate during these SWRs. Moreover, SWRs facilitated the synchronisation of place cells encoding the same goal locations, hence promoting the stabilisation of new place representations. During sleep period following learning, the firing patterns of goal-encoding cells exhibited stronger reactivation than other place cells and their reactivation predicted subsequent memory performances. Altogether, these results suggest that the reorganisation and reactivation of goal-related population firing patterns sustain spatial learning and memory retention abilities.

Mark your Calendars

December 7, 2011
Charles River Association for Memory
Fall 2011 Meeting – Superior Memory

Keynote Speakers: James McGaugh and K. Anders Ericsson

James McGaugh
University of California, Irvine

Making Lasting Memories

Abstract
Emotionally arousing experiences are well remembered. Extensive evidence indicates that that adrenal stress hormones released by arousal regulate memory consolidation via converging influences on β-noradrenergic activation within the BLA. Activation of the BLA enhances memory via projections to other brain regions involved in processing different aspects of memory. The findings of both animal and human studies provide compelling evidence that stress-induced activation of the BLA and its projections to other brain regions plays a critical role in insuring that emotionally significant experiences are remembered. Our recent research has identified individuals who have very strong and accurate memory: They have detailed memories of personal experiences and public events for most of the days of their lives. Current research is investigating the structure (MRI) of these individuals' brains to determine whether specific brain systems are involved in enabling such strong autobiographical memories.

K. Anders Ericsson
Florida State University

Title to follow.