Center for Molecular Spectroscopy and Dynamics, IBS-Korea University

IBS Center for Molecular Spectroscopy and Dynamics

Seminar

- **SPEAKER**
  Prof. Jeehyun Kwag (Dep. of Brain and Cognitive Engineering, Korea Uni.)

- **TITLE**
  Distinct functional roles of PV and SST interneurons in the synchronization of precise spike-times in the cortical feedforward network in vivo

- **ABSTRACT**
  Precisely timed spikes that are spatially coordinated/synchronized across multiple neurons with millisecond temporal precision have been shown to encode sensory information about stimuli in primary sensory cortex (S1). Yet, the neural circuit mechanisms supporting the generation of highly synchronized spike sequences across cortical layers remain unknown. One potential mechanism for spatio-temporal synchronization of precise spike-times is inhibition. Cortical inhibition is provided by distinct subtypes of interneurons, such as parvalbumin-positive (PV) and somatostatin-positive (SST) interneurons, however, their contribution to the synchronization of sensory information-carrying spike-time synchronization is unclear. In this talk, we introduce our recent results where we address this question by performing in vivo single-unit recording in S1 during whisker stimulation with optogenetic modulation of PV and SST interneurons. We find that the whisker-evoked spike-times and their sequences are precisely synchronized between the granular layer (layer 4) and sub-granular layers in subpopulation of neurons (layers 5-6). Using optogenetic perturbations of PV and SST interneurons, we demonstrate that both PV and SST interneurons promote the synchronization of precise spike-times through these pathways, but with distinct contributions depending on the instantaneous firing rate (iFR) of inter-spike interval (ISI) of the granule layer. Furthermore, using a computational model of spike-timing synchronization in a three-layered network with different levels of feedforward and feedback inhibition, we find that these results can be explained by a greater contribution to feedforward inhibition from PV interneurons, and a greater contribution to feedback inhibition from SST interneurons. Our data provide evidence for a role of specialized inhibitory circuit motifs in the neocortex for the spatio-temporal synchronization of precise spike-times, which may be critical to information processing in the neocortex.

- **DATE AND VENUE**
  July 22, 2019 (Monday, 4:00 - 5:00 pm)
  Seminar Room A (116), KU R&D Center

- **INVITED BY**
  Associate Director Wonshik Choi