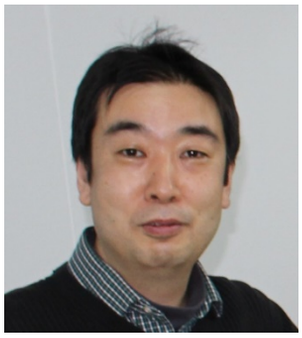

DBN Special Seminar

Prof. Yuji Naya

School of Psychological and Cognitive Sciences Peking University;
Center for Life Sciences Peking University;
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The relationship between object and space in the primate memory system

2019 7.31 Wed 16:30-17:30

3F Seminar Room, Nanobiology Building, Graduate School of Frontier Biosciences

Declarative memory is our so-called daily language memory, which we are able to describe or explicitly experience through the act of remembering. This cognitive function is substantiated by the medial temporal lobe (MTL) which includes the hippocampus (HPC), entorhinal cortex (ERC), parahippocampal cortex (PHC) and perirhinal cortex (PRC). Consistent with the dichotomy in visual processing pathways (i.e., 'what' and 'where'), it has been considered for several decades that item information and spatial information are separately processed in PRC and PHC, and carried via ERC to HPC where the two signals are finally integrated. However, a small but accumulating number of studies show location effects on neuronal representations in area TE, which is the final stage of the ventral visual ('what') pathway sending dense fiber projections to PRC. In order to address this controversy, we examined the contributions of MTL areas to two types of space representations in the brain. First, we examined relational organizations of an item and its location relative to the background during the encoding of a short-term-retention paradigm and during the retrieval of a long-term-memory paradigm using monkey physiology. These studies suggest converging inputs of the space-invariant figure signal and the view-centered background signal to the PRC, and also a primary contribution of the PRC to a storage of long-term associative memory of the figure-background configurations. In the latter paradigm, the to-be-retrieved location signal was combined with an incoming perceptual context in the HPC to provide a goal-directed information, which guides the animals' subsequent action. Second, we investigated the spatial representation defined by relative positions of three objects using human fMRI. A multi-voxel-pattern analysis (MVPA) showed that the HPC represented an object-based cognitive map indicating a spatial relationship among the objects around a participant. The MVPA also showed that the PRC represented the object identity while the PHC signaled a perceived spatial layout of the three objects regardless of their identities that a participant experience during the encoding. Taken together, our present studies suggest two types of spatial information processed in the distinct signal pathways within the MTL (i.e., view-centered background in the PRC and inter-objects frame in the PHC), which may serve for declarative memory and scene perception.

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