Spatial Representations of the Primate Declarative-Memory System

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Room 385, Geography Building, Zhongbei Campus, ECNU
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Abstract:

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 some time 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 suggested converging inputs of the space-invariant figure signal and the eye-centered background signal to PRC, and a storage of long-term associative memory of the figure-background configurations there. Second, we investigated the spatial representation defined by relative positions of three objects using human fMRI. A multi-voxel-pattern analysis showed that HPC represented an allocentric cognitive map indicating a spatial relationship among the objects, while PHC but not PRC showed a view-angle-dependent pattern of object positions that were irrelevant to the object identities. Taken together, our present studies suggest complementary contributions of MTL areas to scene representations, which may be implicated in declarative memory and even perception.