Abstract for 6th Chinese Computational and Cognitive Neuroscience Conference (CCCN 2024) (July 3-5, 2024)

Regulation of Visual Associative Learning by Orbitofrontal Cortex Circuit

Haishan Yao

Key Laboratory of Brain Cognition and Brain-inspired Intelligence Technology,

Center for Excellence in Brain Science and Intelligence Technology,

Chinese Academy of Sciences, P. R. China

Email: haishanyao@ion.ac.cn

The orbitofrontal cortex (OFC) plays an important role in stimulus-reward association, decision making, and behavioral flexibility. Its direct connections to subcortical regions, such as the basolateral amygdala, ventral tegmental area, and striatum, are known to influence learning and reward-related behaviors. The OFC also interacts with cortical areas, including sensory and prefrontal regions [1]. How the cortico-cortical circuit of the OFC supports learning behavior is not well understood. I will present the findings of our recent studies on this topic. Using mice performing a Go/No-Go visual discrimination task, we found that the projection from the OFC to primary visual cortex (V1) preferentially recruits somatostatin interneurons to reduce the responses of V1 neurons to reward-irrelevant No-Go stimulus, facilitating the learning of correct rejection [2]. As the OFC projects to the ipsilateral V1, we further investigated whether visual learning could transfer across hemispheres. We found that when mice trained with one eye were subsequently presented stimuli to the other eye, their performance dropped and learning was impeded. Intriguingly, lesioning either side of the anterior cingulate cortex (ACC) improved the transfer of learning, suggesting interhemispheric competition. Further experiments indicated that this competition does not involve the callosal-projection neurons in the ACC but may instead occur at the OFC, which receives inputs from both sides of the ACC. We are currently using calcium imaging to monitor task-related activity, including error signals, in OFC-projecting ACC neurons during the learning process. Together, our studies shed light on how the OFC cortical circuit contributes to associative learning.

References:

[1] Y. Zhang, W. Zhang, L. Wang, D. Liu, T. Xie, Z. Le, X. Li, H. Gong, X. H. Xu, M. Xu and H. Yao, Neurosci. Bull. (accepted)

[2] D. Liu, J. Deng, Z. Zhang, Zy. Zhang, Y. G. Sun, T. Yang and H. Yao, Nat. Commun. 11, 2784 (2020).