Optical Fiber based Methods for Deep Brain Calcium Signal Measurements in Behaving Mice

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Abstract: Dysfunctions of many nuclei in the brain are associated with highly prevalent mental diseases. It is of prime importance to uncover the fundamental behavioral functions and mechanisms of these nuclei that underlie conditions of both health and disease in model animals. Optical calcium imaging is a powerful tool to record neural activity indicated by calcium transients both in vitro and in vivo [1], but its imaging depth is restricted within 1 mm due to the high scattering and absorption of biological tissues. Moreover, the traditional optical systems are not suitable for many behavioral paradigms [2]. Here, we developed two new imaging tools: a multichannel fiber photometry and a GRIN lens based confocal microscope system, which can enable neuroscientists to measure cell-type specific neuronal activities in both deep-brain areas and freely-behaving animals. With the multichannel fiber photometry, we simultaneously acquired calcium signals from the bilateral barrel cortices of a head-restrained mouse or from the orbitofrontal cortices of three freely moving mice. Moreover, we successfully acquired the calcium signals in the dorsal striatum and orbitofrontal cortex of head-fixed mice using this GRIN lens-based deep-brain calcium imaging system.

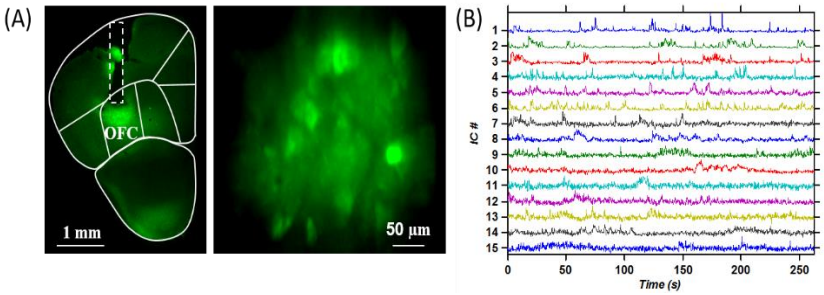

Figure. the result of recording of calcium signal from OFC. (A) Image of neurons and (B) Calcium signals

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