

Chronic functional ultrasound imaging of freely moving cats combined with optogenetics

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Perception and behavioral commands are computed by neuronal circuits organized into brain-wide networks. How the activity of distinct cell types is contributing to brain-wide network dynamics remains not well understood. We combine functional ultrasound imaging (fUSI) with optogenetic stimulation to reveal the network of brain regions functionally activated during a visuomotor task in freely behaving cats. Here, we present a novel modular chronic neural interface for monitoring and manipulating neural activity. The interface allows us to perform mesoscale measurements with fUSI in freely behaving animals, at an order of magnitude better spatiotemporal resolution than conventional fMRI can provide. Monitoring the effect of optogenetic perturbation may give causal proof on the role of cortical and subcortical cell types in visually guided behavior. Thus, our method could provide insight into the functional organisation of the networks governing behavior in freely-moving large animal species.

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