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Functional MRI with Neural Modulation in Mice

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Functional magnetic resonance imaging (fMRI) indirectly measures neuronal activity by detecting changes in blood flow and oxygenation. Animal fMRI studies provide valuable insights into brain functions through minimally invasive neuronal modulation and the use of transgenic models. Combining brain-wide fMRI mapping with selective modulation of local neuronal populations enables causal investigation of circuit-specific contributions to behavioral performance.

In this study, we investigated fMRI-based approaches to address two main objectives:
1) To determine the contributions of different circuits to functional brain activities
2) To examine how neuromodulation-induced changes affect behaviorally relevant functional networks

For these works, we utilized fMRI with optogenetic or chemogenetic modulations in mice using an ultrahigh field of 15.2 T. Our findings demonstrated that fMRI combined with neuronal modulation allows for identification of circuit-specific contributions to brain-wide fMRI responses. Furthermore, our findings underscore Furthermore, our findings underscore the potential of fMRI-guided chemogenetic approaches to directly link changes in functional brain networks with behavioral outcomes.

Keywords: *Mouse fMRI, Optogenetics, Chemogenetics*