Dissecting long-range circuits in macaque cortex by registering optogenetically driven neural activity with anatomical connectivity

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Introduction:
Previous work in the lab suggests that neurons that have correlated activity with other brain areas have enhanced representations of behavioral plans. We used optogenetic techniques to causally test the role of connectivity in relaying neural signals across long-range circuits by measuring how coherence affects the non-local response to driven input. We also compared physiological connectivity with anatomical connectivity by performing a reconstruction of the tissue and measuring the amount of GFP labelling at recording sites.

Responses to optogenetic stimulation in motor cortex recorded in parietal cortex in an anesthetized macaque

Weons to optogenetic stimulation in motor cortex recorded in parietal cortex in an anesthetized macaque

Sites with higher baseline coherence have larger evoked potentials

Baseline coherence predicts coherence during stimulation

Recording sites with more labelling had larger driven responses

Conclusions:
Optogenetic stimulation is able to drive evoked potentials and spiking activity outside of the stimulated area.

Long-range circuits that have higher baseline coherence and greater anatomical connections with the stimulated region are more likely to have a greater response to stimulation.

Coherence may be useful for dissecting the circuits which route information.

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