Abstract Submitted
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Measuring Whole-Brain Neural Dynamics and Behavior of Freely-Moving *C. elegans* [1] FREDERICK SHIPLEY, JEFFREY NGUYEN, GEORGE PLUMMER, JOSHUA SHAEVITZ, ANDREW LEIFER, Princeton University — Bridging the gap between an organism's neural dynamics and its ultimate behavior is the fundamental goal of neuroscience. Previously, to probe neural dynamics, we have been limited to measuring from a limited number of neurons, whether by electrode or optogenetic measurements. Here we present an instrument to simultaneously monitor neural activity from every neuron in a freely moving *Caenorhabditis elegans*' head, while recording behavior at the same time. Previously, whole-brain imaging has been demonstrated in *C. elegans*, but only in restrained and anesthetized animals (1). For studying neural coding of behavior it is crucial to study neural activity in freely behaving animals. Neural activity is recorded optically from cells expressing a calcium indicator, GCaMP6. Real time computer vision tracks the worm's position in x-y, while a piezo stage sweeps through the brain in z, yielding five brain-volumes per second. Behavior is recorded under infrared, dark-field imaging. This tool will allow us to directly correlate neural activity with behavior and we will present progress toward this goal.

[1] Robert Prevedel et al., "Simultaneous Whole-Animal 3D Imaging of Neuronal Activity Using Light-Field Microscopy," *Nature Methods* 11, no.7 (July 2014): 727-30

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