

**Brain-wide Organization of Neuronal Activity and Convergent Sensorimotor Transformations  
in Larval Zebrafish**

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**Abstract:**

Simultaneous recordings of large populations of neurons in behaving animals allow detailed observation of high-dimensional, complex brain activity. Here we utilized light-sheet imaging to obtain whole-brain neuronal activity data for larval zebrafish presented a battery of visual stimuli. We identified neurons tuned to each stimulus and motor output, and discovered groups of neurons in the anterior hindbrain that respond to multiple stimuli that elicit similar behavioral responses. Importantly, these neurons are only weakly correlated with the moment-to-moment variability in motor output, suggesting that they critically inform, but do not directly generate, behavioral choices. To study brain-wide activity beyond explicit sensorimotor processing, we developed an unsupervised clustering technique that organizes neurons into functional groups. The analysis recovers known brain nuclei as well as circuits that are not targeted by the presented stimuli. Efforts towards mechanistic understandings of the functional organization will also be discussed.