University of Maryland

Neuroscience and Cognitive Science Seminar

Single-trial decisions are accurately predicted by inhibitory neural population activity

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Decisions are driven by the coordinated activity of diverse neural populations in multiple structures. Inhibitory neurons play a critical role in many models of decision-making, but the difficulty in measuring large inhibitory populations in behaving animals has left their in vivo role mysterious. To understand the contributions of excitatory and inhibitory neural populations to perceptual decision-making, we measured neural responses in transgenic mice expressing tdTomato in inhibitory neurons (GAD2-Cre crossed with Ai14 reporter line). To record neural activity, mice were injected with AAV9-Synapsin-GCaMP6f in the posterior parietal cortex (PPC). Mice were then presented with a series of multisensory "events" (clicks and flashes), the rate of which fluctuated stochastically over a 1000 ms period. Mice were trained to lick to a right (left) spout to report that event rates were judged above (below) an abstract category boundary (16 Hz). 2-photon imaging was used to measure single-neuron responses during these decisions. In each session, ~600 neurons were simultaneously recorded while mice performed ~400 trials.

To evaluate the relationship between neural activity and decision-making, we trained linear classifiers to distinguish activity preceding left vs. right choices on single trials. In keeping with previous work, we observed that overall population activity could reliably predict the animal's choice. To understand how specific cell types shape this population activity, we evaluated excitatory and inhibitory neurons separately. Surprisingly, inhibitory population activity alone could reliably predict the animal's choice at a level that was indistinguishable from excitatory neurons. Importantly, the distributions of weights assigned by the classifiers were similar for excitatory and inhibitory populations. This argues that for both cell types, the pooled activity of many neurons can effectively distinguish decision outcomes.

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10:15am, Room 1103 Bioscience Research Building

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