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Presentation Abstract

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Presentation Title:	Cell-class specific attentional modulation of neuronal responses and synchronization in the frontal eye field and area V4
Location:	WCC Hall A-C
Presentation time:	Sunday, Nov 16, 2014, 8:00 AM -12:00 PM
Presenter at Poster:	Sun, Nov. 16, 2014, 8:00 AM - 9:00 AM
Topic:	++D.04.r. Spatial and feature-based attention
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Abstract:	We have previously shown that attention modulates neuronal responses in the frontal eye field (FEF) and area V4 and increases gamma band neuronal synchronization within and between the two areas in a spatial covert attention task. To explore further the cellular substrate of the attentional modulation of firing rates and synchronization we tested the contribution of putative excitatory and inhibitory neurons in these mechanisms. We recorded spikes from single neurons and local field potentials (LFP) from FEF and area V4 simultaneously, in two monkeys trained to perform a covert attention task. Three sinusoidal drifting gratings - one red, one blue, and one green, positioned at the same distance from the center of the screen and distributed radially around the fixation point at 120deg intervals were presented on a screen. A color cue presented at the center of the screen indicated which of the three colored gratings was the target to be attended. The monkeys had to shift their attention to the target stimulus (while maintaining fixation of the central cue) and respond to the target color change by releasing a bar. We classified the recorded visual neurons as broad spiking (BS) and narrow spiking (NS) using their whole waveform

profile and a k means clustering algorithm. NS (putative inhibitory neurons) exhibited higher firing rates following stimulus onset compared to BS (putative pyramidal neurons) in both areas and had shorter visual onset latencies. Moreover, V4 BS neurons showed greater color selectivity compared to NS and FEF BS neurons had narrower spatial tuning. Attention dependent increases of firing rates were similar for the two neuronal classes with FEF neurons showing overall larger effects following the onset of the cue and V4 showing significantly larger modulation during sustained attention. To explore the contribution of BS and NS neurons in gamma band synchronization we employed the spike-LFP pairwise phase consistency metric (PPC), which is unbiased by spike rate or count. We found that during the sustained stimulation period spikes in both FEF and V4 were strongly locked to the local LFP gamma band oscillations with NS neurons showing significantly stronger locking compared to BS in both areas. When attention was directed toward the neuron's receptive field (RF), gamma PPC values increased significantly for NS FEF neurons and BS V4 neurons. More importantly, when we looked at phase locking between FEF and V4 we found that BS FEF neurons showed significant locking to the V4 LFP gamma oscillations only with attention inside the RF confirming the important role of FEF in driving attention related signals to V4.

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Keyword (s): attention

inhibitory neurons

excitatory neurons

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