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Presentation Abstract

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Presentation Title:	How SOM+ and PV+ inhibitory neurons could differentially modulate surround suppression of cortical neurons
Location:	WCC Hall A-C
Presentation time:	Tuesday, Nov 18, 2014, 8:00 AM -12:00 PM
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Topic:	++D.04.d. Striate cortex: Local circuitry
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Abstract:	Surround suppression in the cortex can be explained by normalization models in which the output is modulated by the summed local activity. In these models, the region of the sensory space that is pooled to produce suppression to a neuron is larger than that for summation. The neural implementation of normalization in the visual cortex is thought to involve inhibitory neurons that contribute the suppressive field by summing over a larger visual space compared to the local pyramidal neurons. There are two competing models for the action of inhibitory neurons in the neural implementation of surround suppression: The lateral inhibition model proposes that local inhibitory neurons increase their activity in response to stimulation of a larger visual space. On the other hand, the inhibition-stabilized network model predicts the activity of inhibitory neurons to decrease in response to stimulation of a larger visual space (Tsodyks et al., 1997; Ozeki et al., 2009). Empirical evidence from the visual cortex suggests both an increase (Haider et al., 2010) and a decrease in inhibitory activity (Ozeki et al., 2009) in response to surround suppression. Activity of Somatostatin-expressing (SOM+) inhibitory neurons increases during surround suppression and their optogenetic

silencing weakens the suppression, thus supporting the lateral inhibition model (Adesnik et al., 2012). However, the contribution and operating regime of other subclasses of inhibitory neurons, for example the Parvalbumin-expressing (PV+) inhibitory neurons, during surround suppression is not well understood. Since the exquisite sensitivity of the cortical circuit to the manipulation of PV+ inhibitory neurons offers significant experimental challenges, we explore the two competing proposals with a computational approach. We propose a model for the surround suppression circuitry consisting of both SOM+ and PV+ inhibitory neurons in which the differences in experimental observations are accounted for by differences in the inhibitory neuron subclasses in terms of their network connectivity and post-synaptic targets.

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