Olfaction workshop, 26 July 2012 at CNS*2012

## Circuit mechanisms for temporal coding in olfaction

### Nitin Gupta, Mark Stopfer, National Institutes of Health

Odors are encoded as time-varying patterns of activity in populations of olfactory neurons. Experiments in the insect olfactory system show these temporal patterns originate in the receptor neurons, and are substantially elaborated by the oscillatory dynamics of the antennal lobe circuits before being relayed by the projection neurons to two downstream areas – the mushroom body and the lateral horn.In the mushroom body, the dense firing patterns of the projection neurons are transformed into very specific and sparse firing patterns of the Kenyon cells. This dramatic transformation has been thought to depend on multiple factors, including the intrinsic membrane properties of the Kenyon cells, feedback inhibition from a giant GABAergic neuron (GGN), and feedforward inhibition from the lateral horn. However, our recent experimental survey of the anatomy and responses of lateral horn neurons significantly alters this view: we found no evidence that the lateral horn provides feedforward inhibition to the Kenyon cells. Although feedforward and feedback inhibition provide different computational properties, we found feedback inhibition from GGN could explain most roles previously assigned to feedforward inhibition from the lateral horn. In addition, our results point to three other functional roles the lateral horn may play in olfaction.