regulate neuronal activity.

499.1

PRESERVATION OF SPIKE TIMING AND INCREASED EXCITABILITY UNDER CHOLINERGIC MODULATION IN NEOCORTICAL NEURONS Akaysha C. Tang*, and Terrence J. Sejnowski. The Salk Institute, Computational Neurobiology Lab, La Jolla, CA 92037.

Acetylcholine (ACh) enhances neuronal responsiveness of cortical neurons. Associated with this enhancement is a reduction in spike frequency adaptation: interspike intervals increase with time when a constant depolarizing current is injected. As a result, ACh appears to not only increase the firing rate but also to alter the temporal structure of the spike train. This cholinergic modification of spike timing would lead to a failure in faithful transmission of the input signal if a neural code based on spike timing were used by the brain. We have examined the effects of ACh on spike timing in rat neocortical neurons using the whole cell patch clamp technique (Science 95, Vol268:1503–1506). When physiologically realistic fluctuating inputs are used, ACh preserves the timing of action potentials in the spike train, while at the same time increasing the firing rate by inserting spikes between existing spikes. These two contrasting effects of ACh suggest that under in vivo conditions, cholinergic modulation may be more protean and less limited than we had previously envisaged—permiting the preservation of spike timing information, and at the same time, enhancing the output signal by increasing the firing rate.

Supported by the Howard Huges Medical Institute.

499.3