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REALISTIC SIMULATIONS OF SYNCHRONIZATION IN NETWORKS OF LAYER V NEURONS IN CAT PRIMARY VISUAL CORTEX. Paul Bush*, Charles Gray and Terrence Sejnowski Salk Institute, La Jolla, CA 92138-9216 USA.

Synchronization of the firing of visual cortical neurons in response to spatially coherent stimuli has been observed in awake and anesthetized monkeys and cats. We have constructed a detailed model of a column in Layer 5 of primary visual cortex consisting of 80 excitatory pyramidal and 20 inhibitory basket reduced compartmental neurons. The dendrites were modeled by 8 compartments and HH kinetics of 4 channels were included in the soma. The pyramidal cells fire repetitive bursts in response to constant current injection, each with a different intrinsic frequency. The basket cells fire nonadapting, high-frequency spike trains. When connected together in a random fashion with a 10% connection density, such a network produces synchronized firing in response to Poisson spike train input to the pyramidal cells. This synchronization is resistant to noise directly injected into the neurons and persists over wide variations in the synaptic strengths and synaptic delays.

When two such networks are connected with 3% connection density (simulating inter-column connectivity) they rapidly (within 1 or 2 cycles) synchronize with zero phase lag. This synchronization has been observed to spontaneously disappear and reappear with no change in the input to the network. Similar responses have been observed in recordings from neurons in the cat visual cortex *in vivo*.