INTERACTION BETWEEN ELECTRICAL AND SENSORY STIMULATION OF VISUAL CORTICAL NEURONS. P. Kara*, J. S. Pezaris, and R. C. Reid. Department of Neurbiology, Harvard Medical School, Boston, MA, USA.

Electrical stimulation of subcortical inputs has been widely used to test for monosynaptic input to cortical neurons. Typically, strong stimulation has been used to generate orthodromic spikes with high probability. To our knowledge, the interaction between visual stimulation and orthodromic spikes has bot been examined.

If the efficacy of electrical stimulation is low, it can be modulated by visual input. When stimulation evokes orthodromic spikes rarely (less than 5 percent of the time), these spikes must be evoked only when the cell is otherwise near threshold. We made 2D maps of the receptive fields of cortical simple cells in the anesthetized car, with and without electrical stimulation of the LGN. As would be expected, receptive fields of orthodromic spikes evoked by low currents are virtually identical to receptive fields obtained without electrical stimulation.

When electrical stimulation is moderately strong, it produces long lasting inhibition in visual cortex. If inhibition is complete, visual input (necessarily subthreshold) must derive from the LGN. With intracellular recording, this subthreshold activity can be assessed directly (Chung and Ferster, 1998). With extracellular recording and electrical stimulation, one pulse can be used to inactivate cortex and the next to probe the subthreshold activity of a cell. We found that the receptive fields of orthodromic spikes (and thus of the thalamic input alone) closely resemble those obtained without electrical stimulation.

In s summary, the combination of electrical stimulation and sensory input provides a tool to probe subthreshold neural activity without employing intracellular recordings.

Supported by: NIH EY-10115, EY-12196, and the Brooks Fund.

Session 619.36, Vision: striate visual cortex—functional organization II, Society for Neuroscience 31st Annual Meeting, San Diego, November 10–15, 2001.