

Lateral Inhibitory Interactions in the Intermediate Layers of the Monkey Superior Colliculus

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Munoz, Douglas P. and Peter J. Istvan. Lateral inhibitory interactions in the intermediate layers of the monkey superior colliculus. *J. Neurophysiol.* 79: 1193–1209, 1998. The intermediate layers of the monkey superior colliculus (SC) contain neurons the discharges of which are modulated by visual fixation and saccadic eye movements. Fixation neurons, located in the rostral pole of the SC, discharge action potentials tonically during visual fixation and pause for most saccades. Saccade neurons, located throughout the remainder of the intermediate layers of the SC, discharge action potentials for saccades to a restricted region of the visual field. We defined the fixation zone as that region of the rostral SC containing fixation neurons and the saccade zone as the remainder of the SC. It recently has been hypothesized that a network of local inhibitory interneurons may help shape the reciprocal discharge pattern of fixation and saccade neurons. To test this hypothesis, we combined extracellular recording and microstimulation techniques in awake monkeys trained to perform oculomotor paradigms that enabled us to classify collicular fixation and saccade neurons. Microstimulation was used to electrically activate the fixation and saccade zones of the ipsilateral and contralateral SC to test for inhibitory and excitatory inputs onto fixation and saccade neurons. Saccade neurons were inhibited at short latencies following electrical stimulation of either the ipsilateral (1–5 ms) or contralateral (2–7 ms) fixation or saccade zones. Fixation neurons were inhibited 1–4 ms after electrical stimulation of the ipsilateral saccade zone. Stimulation of the contralateral saccade zone led to much weaker inhibition of fixation neurons. Stimulation of the contralateral fixation zone led to short-latency (1–2 ms) excitation of fixation neurons. Only a small percentage of saccade and fixation neurons were activated by the electrical stimulation (latency: 0.5–2.0 ms). These responses were confirmed as either orthodromic or antidromic responses using collision testing. The results suggest that a local network of inhibitory interneurons may help shape not only the reciprocal discharge pattern of fixation and saccade neurons but also permit lateral interactions between all regions of the ipsilateral and contralateral SC. These interactions therefore may be critical for maintaining stable visual fixation, suppressing unwanted saccades, and initiating saccadic eye movements to targets of interest.