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Format: Abstract

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Control of orienting gaze shifts by the tectoreticulospinal system in the head-free cat. III. Spatiotemporal characteristics of phasic motor discharges.

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Abstract

1. In this paper we describe the movement-related discharges of tectoreticular and tectoreticulospinal neurons [together called TR (S) Ns] that were recorded in the superior colliculus (SC) of alert cats trained to generate orienting movements in various behavioral situations; the cats' heads were either completely unrestrained (head free) or immobilized (head fixed). TR (S) Ns are organized into a retinotopically coded motor map. These cells can be divided into two groups, fixation TR (S) Ns [f TR (S) Ns] and orientation TR (S) Ns [oTR(S)Ns], depending on whether they are located, respectively, within or outside the zero (or area centralis) representation of the motor map in the rostral SC. 2. oTR(S)Ns discharged phasic motor bursts immediately before the onset of gaze shifts in both the head-free and head-fixed conditions. Ninety-five percent of the oTR(S)Ns tested (62/65) increased their rate of discharge before a visually triggered gaze shift, the amplitude and direction of which matched the cell's preferred movement vector. For movements along the optimal direction, each cell produced a burst discharge for gaze shifts of all amplitudes equal to or greater than the optimum. Hence, oTR(S)Ns had no distal limit to their movement fields. The timing of the burst relative to the onset of the gaze shift, however, depended on gaze shift amplitude: each TR(S)N reached its peak discharge when the instantaneous position of the visual axis relative to the target (i.e., instantaneous gaze motor error) matched the cell's optimal vector, regardless of the overall amplitude of the movement. 3. The intensity of the movement-related burst discharge

depended on the behavioral context. For the same vector, the movement-related increase in firing was greatest for visually triggered movements and less pronounced when the cat oriented to a predicted target, a condition in which only 76% of the cells tested (35/46) increased their discharge rate. The weakest movement-related discharges were associated with spontaneous gaze shifts. 4. For some oTR(S)Ns, the average firing frequency in the movement-related burst was correlated to the peak velocity of the movement trajectory in both head-fixed and head-free conditions. Typically, when the head was unrestrained, the correlation to peak gaze velocity was better than that to either peak eye or head velocity alone. 5. Gaze shifts triggered by a high-frequency train of collicular microstimulation had greater peak velocities than comparable amplitude movements elicited by a low-frequency train of stimulation.(ABSTRACT TRUNCATED AT 400 WORDS).

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