
Many neurons in macaque visual area MT retain responsiveness, direction selectivity and binocularity following removal or inactivation of striate cortex. Preliminary studies suggested that the residual activity might depend on inputs from the superior colliculus relayed by the pulvinar (Rodman et al., Neurosci. Abs., 11:1246, 1985). We have now examined the response properties of MT neurons after combined lesions of striate cortex and the superior colliculus and after lesions of the colliculus alone.

Superior colliculus lesions were made using radio-frequency current in two monkeys which had previously been studied following bilateral removal of striate cortex. The animals were anesthetized with N_2O and immobilized during recording. 161 single- and multi-units were tested for responsiveness using spots and slits of light and dark edges. Within the portion of the visual field representation included in both lesions, virtually no responsiveness was found. In an animal with partial striate removal, units with receptive fields in the portion of the representation covered only by the colliculus lesion showed apparently normal responsiveness and direction selectivity.

In two additional monkeys, MT responses were studied following unilateral lesions of the superior colliculus alone. In most respects, the responses of MT neurons deprived of their colliculus input resembled those of neurons in normal MT. Over 50 single units were tested extensively for direction and orientation selectivity. As in normal MT, nearly all neurons were strongly responsive to both a moving spot and a moving slit of light, and mean direction tuning bandwidth did not differ significantly from that obtained in normal MT; mean index of directionality was likewise similar to that obtained in normal MT. Over three-quarters of the cells tested also responded to a stationary flashed slit, and mean orientation tuning bandwidth did not differ from that obtained in the normal animal. The proportion of neurons exhibiting sustained responses to the stationary slit was slightly greater than that of cells exhibiting transient ones, in contrast to the predominance of transient responses to stationary stimulus presentation in normal MT. Finally, nearly all neurons were about equally well activated from both eyes, again resembling MT cells in the normal animal.

In conclusion, it appears that inputs from the superior colliculus are sufficient but not necessary for visual responsiveness, direction selectivity and binocularity in this region of extrastriate cortex.