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INPUT–OUTPUT RELATIONS OF THE RED NUCLEUS IN THE CAT

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SUMMARY

In unanesthetized cats, microstimulation within the red nucleus produces contraction of single muscles of the contralateral limbs and face. Separate zones may activate different muscles. Forelimb muscles were primarily activated from areas in the dorsomedial quadrants of the red nucleus whereas hindlimb muscles were predominantly activated from the ventrolateral quadrants. With stimulus currents of 10 μA there was considerable overlap in the effective zones activating different muscles. In the majority of cases the minimal threshold was under 10 μA when stimilating with a 50-msec pulse train. Current thresholds for electromyographic changes in the muscles varied inversely with pulse frequency and train duration. When long stimulus trains were applied to the red nucleus, the resulting muscle contraction was sustained for the duration of the stimulus. These motor effects did not depend upon the motor cortex or pyramidal tract but were mediated by a tract in contralateral dorsal quadrants of the spinal cord which was likely to be the rubrospinal tract.

Units within the red nucleus typically had wide cutaneous receptive fields and responded to deep pressure and joint rotation in one or more limbs. Usually the focus driving the cell most briskly was located in one of the contralateral limbs and corresponded to the limb where muscle contraction was elicited by microstimulation with the same electrode.

It is concluded that the red nucleus includes overlapping efferent neuronal colonies controlling individual muscles irrespective of their functional class. This property is shared by the motor cortex and suggests that these two structures may complement each other in the control of movement. The more diffuse activation of rubral than cortical neurons by natural stimuli suggests that rubral activity may not be as tightly linked as that of the motor cortex to specific peripheral input.