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Research report

Abnormal influences of passive limb movement on the activity of globus pallidus neurons in parkinsonian monkeys

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Abstract

Extracellular single unit activity was recorded in the globus pallidus of waking *Macaca fascicularis* during passive limb movement. The main upper and lower limb joints were investigated bilaterally. The animals were either intact or rendered parkinsonian by the neurotoxin 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP). Cell counts showed that at least 90% of nigral neurons of the compacta-type were degenerated in the parkinsonian animals. In the intact animals, only 17% of the pallidal neurons responded to the natural stimulus. As already reported by others, the responses were typically related to movement about a single contralateral joint and in only one direction. In the parkinsonian animals, however, more neurons responded, often more vigorously, to the same stimulation. In many of these neurons the responses were elicited by movement

about more than one joint of both upper and lower limbs or ipsi- and contralateral sides and in more than one direction. The increase in number and magnitude and loss of specificity of responses were much greater in the internal pallidal segment, where the number of responding neurons quadrupled. These results suggest that dopaminergic mechanisms regulate gain and selectivity in the basal ganglia. In animals with decreased dopaminergic functions, the excessive and unselective motor responses may explain all 3 major signs of parkinsonism: rigidity, tremor and akinesia.



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Keywords

Parkinson's disease; Globus pallidus; Unit activity; 1-Methyl-4-phenyl-1,2,3,6-tetrahydropyridine; Dopamine; Passive movement; Joint rotation; Monkey

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