Abnormal oscillation in the brain causes motor deficits in Parkinson's disease

November 1 2011

The research group headed by Professor Atsushi Nambu (The National Institute for Physiological Sciences) and Professor Masahiko Takada (Primate Research Institute, Kyoto University) has shown that the 'oscillatory' nature of electrical signals in subcortical nuclei, the basal ganglia, causes severe motor deficits in Parkinson's disease, by disturbing the information flow of motor commands. The group also found that chemical inactivation of the subthalamic nucleus (a structure of the basal ganglia) in parkinsonian monkeys improved the motor impairments by reducing the 'oscillations.' The results of this study were reported in *European Journal of Neuroscience*, November 2011 issue.

A member of the research group, Assistant Professor Yoshihisa Tachibana, succeeded to record electrical signals in monkey basal ganglia neurons under unanesthetized conditions. The group found that neurons in the parkinsonian basal ganglia showed abnormal 'oscillatory' activity, which was rarely seen in normal subjects. The abnormal rhythm was completely eliminated by systemic administration of a dopamine precursor (L-DOPA), which is clinically used for human parkinsonian patients. The group considered that loss of dopamine induced the 'oscillations' in the basal ganglia and that the following disturbances in information flow of motor commands impaired motor performances. Abnormal neuronal oscillations were already reported in parkinsonian patients and animal models, but this report has provided the direct evidence that 'oscillations' are associated with motor abnormalities. Moreover, it was also shown that the injection of a chemical inhibitor, muscimol, into the subthalamic nucleus silenced the oscillatory signals,

and eventually reversed parkinsonian motor signs.

Professor Nambu claims, "By investigating the 'oscillatory' nature of electrical signals in the basal ganglia, we can advance our understanding of the pathophysiology of Parkinson's disease. We improved motor deficits by means of infusion of the chemical inhibitor (muscimol) into the subthalamic nucleus to silence the 'oscillatory' signals in the brain structure. This may provide us important clues to developing new treatments for Parkinson's disease."

Provided by National Institute for Physiological Sciences