Electrophysiological signals identify Parkinson's disease subtypes

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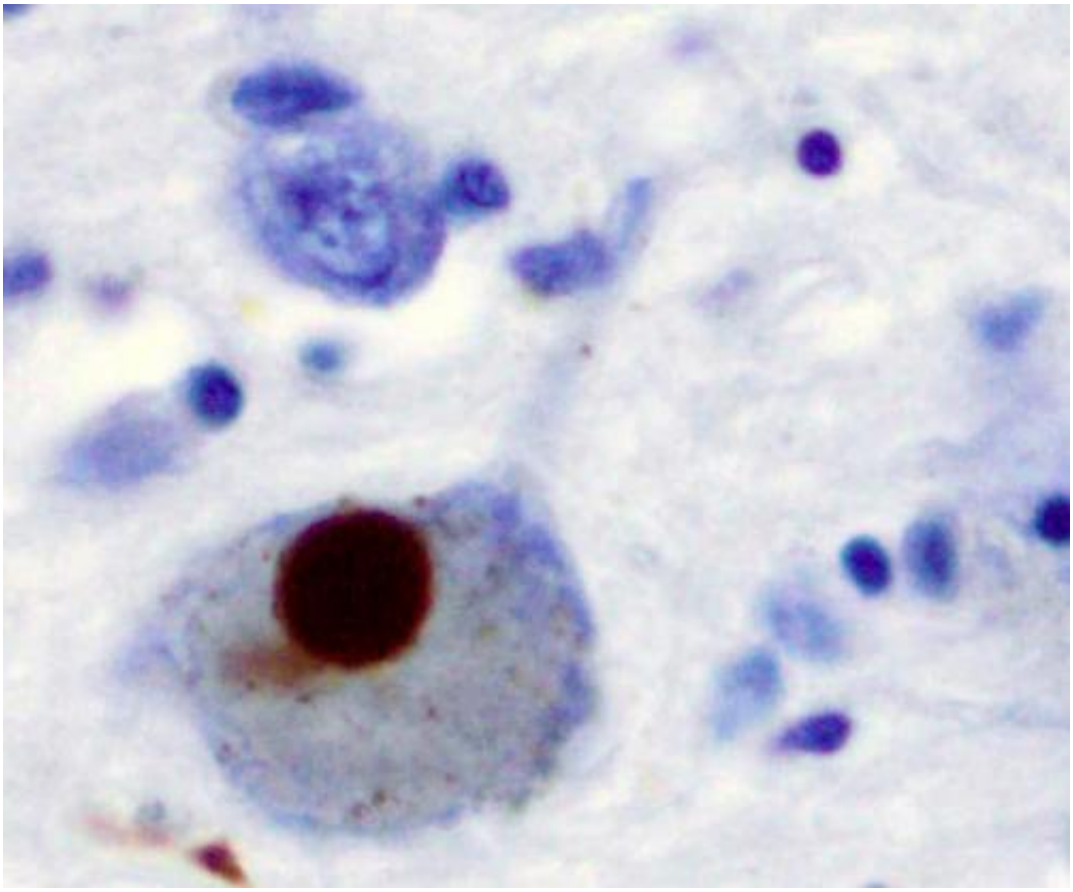

Immunohistochemistry for alpha-synuclein showing positive staining (brown) of an intraneural Lewy-body in the Substantia nigra in Parkinson's disease. Credit: Wikipedia

Tremor, rigidity and bradykinesia are well known symptoms of

Parkinson's disease, occurring in different combinations in individual patients. However, there have not been any neuronal components that definitively identify the main symptom groupings – including tremor-dominant forms and those without tremor – that can be used to guide treatment approaches.

In a new study, researchers at Baylor College of Medicine have now found neural correlates of two main Parkinson's disease phenotypes that could lead to more precise or personalized deep brain stimulation treatments or future neuromodulation technologies to treat this disorder.

The findings appear in the latest edition of the *Proceedings of the National Academy of Sciences.*

The study focuses on the subthalamic nucleus, a part of the brain that makes up the basal ganglia system, which contributes to motor control, learning and carrying out behaviors and emotions. It is an area that is associated with certain movement disorders, and is one of the areas that is frequently targeted in the use of deep brain stimulation to treat Parkinson's disease.

"It is an area believed to show electrophysiological abnormalities that accompany the motor symptoms, but very limited data exists," said Dr. Joohi Jimenez-Shahed, associate professor of neurology and director of the Deep Brain Stimulation Program at Baylor. "In our study, we were able to find distinct patterns between these two most common phenotypes when recording local field potentials of the subthalamic nucleus."

Local field potentials are signals made by the combined activity of a group of neurons. Researchers studied 24 patients with Parkinson's disease, dividing them into two groups based on the physical symptoms – tremor-dominant or postural instability and gait difficulty subtypes. By

analyzing recordings from multiple microelectrodes in sub-territories of the subthalamic nucleus, they were able to record electrophysiological abnormalities that distinguished between the two sets of motor symptoms.

"Deep brain stimulation of this region is an effective therapy for the treatment of these motor symptoms, but an important goal during this type of surgery is placement of the electrode within the motor territory of the subthalamic nucleus in a location that leads to the greatest therapeutic effect," Jimenez-Shahed said. "Our findings demonstrate the feasibility of using microelectrode local field potentials to identify physiological signatures of Parkinson's disease symptoms to further pinpoint these areas."

Researchers also added that being able to identify these precise areas could lead to more individualized treatment for each patient, thereby resulting in greater benefits and fewer side effects.

More information: Ilknur Telkes et al. Local field potentials of subthalamic nucleus contain electrophysiological footprints of motor subtypes of Parkinson's disease, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1810589115

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