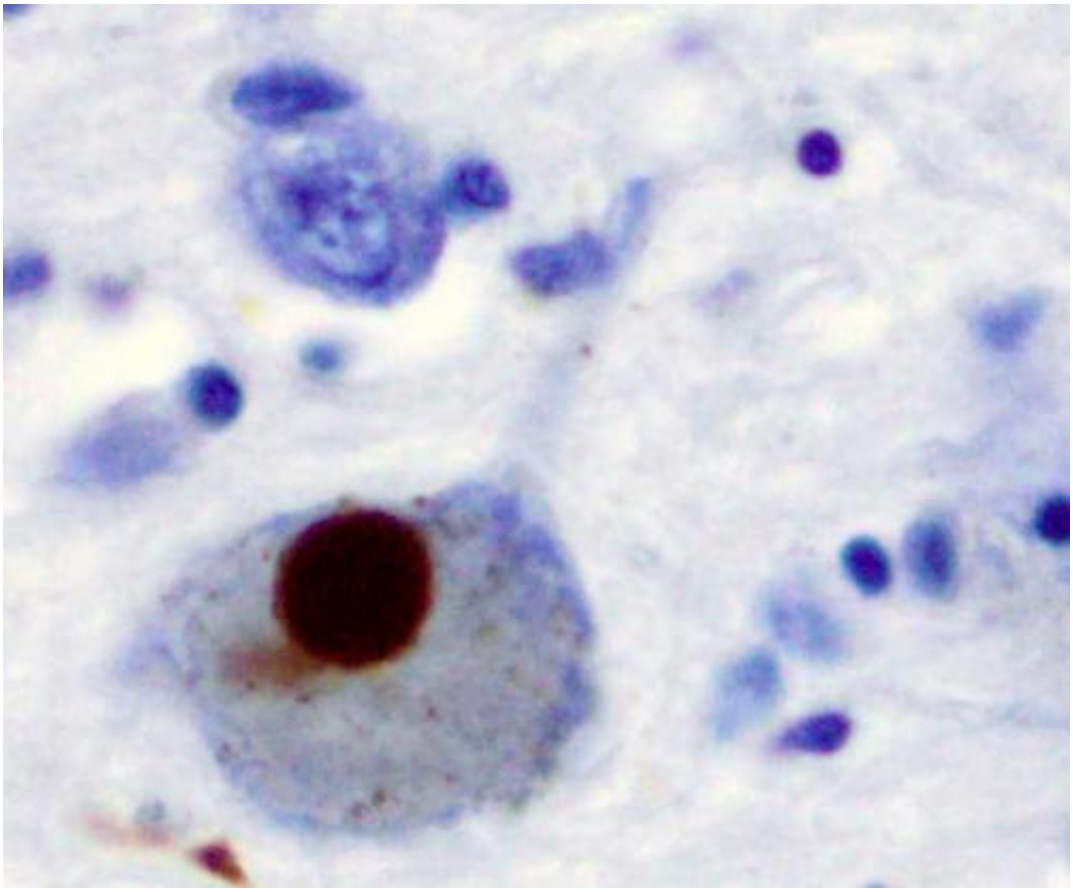
Researchers debunk myth about Parkinson's disease

September 16 2014



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

Using advanced computer models, neuroscience researchers at the

University of Copenhagen have gained new knowledge about the complex processes that cause Parkinson's disease. The findings have recently been published in the prestigious *Journal of Neuroscience*.

The defining symptoms of Parkinson's disease are slow movements, muscular stiffness and shaking. There is currently no cure for the condition, so it is essential to conduct innovative research with the potential to shed some light on this terrible disruption to the central nervous system. Using advanced computer models, neuroscience researchers at the University of Copenhagen have gained new knowledge about the complex processes that cause Parkinson?s disease.

Dopamine is an important neurotransmitter which affects physical and psychological functions such as motor control, learning and memory. Levels of this substance are regulated by special dopamine cells. When the level of dopamine drops, nerve cells that constitute part of the brain's 'stop signal' are activated.

"This stop signal is rather like the safety lever on a motorised lawn mower: if you take your hand off the lever, the mower's motor stops. Similarly, dopamine must always be present in the system to block the stop signal. Parkinson's disease arises because for some reason the dopamine cells in the brain are lost, and it is known that the stop signal is being over-activated somehow or other. Many researchers have therefore considered it obvious that long-term lack of dopamine must be the cause of the distinctive symptoms that accompanies the disease. However, we can now use advanced computer simulations to challenge the existing paradigm and put forward a different theory about what actually takes place in the brain when the dopamine cells gradually die," explains Jakob Kisbye Dreyer, Postdoc at the Department of Neuroscience and Pharmacology, University of Copenhagen.

A thorn in the side

Scanning the brain of a patient suffering from Parkinson's disease reveals that in spite of dopamine cell death, there are no signs of a lack of dopamine – even at a comparatively late stage in the process.

"The inability to establish a lack of dopamine until advanced cases of Parkinson's disease has been a thorn in the side of researchers for many years. On the one hand, the symptoms indicate that the stop signal is over-activated, and patients are treated accordingly with a fair degree of success. On the other hand, data prove that they are not lacking dopamine," says Postdoc Jakob Kisbye Dreyer.

Computer models predict the progress of the disease

"Our calculations indicate that cell death only affects the level of dopamine very late in the process, but that symptoms can arise long before the level of the neurotransmitter starts to decline. The reason for this is that the fluctuations that normally make up a signal become weaker. In the computer model, the brain compensates for the shortage of signals by creating additional dopamine receptors. This has a positive effect initially, but as cell death progresses further, the correct signal may almost disappear. At this stage, the compensation becomes so overwhelming that even small variations in the level of dopamine trigger the stop signal – which can therefore cause the patient to develop the disease."

The new research findings may pave the way for earlier diagnosis of Parkinson's disease.

More information: Read the article in *Journal of Neuroscience*.

Provided by University of Copenhagen