'Cross fire' from the brain makes patients tremble

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A typical symptom of Parkinson's disease is tremor in patients. A group of scientists, including Professor Peter Tass from Forschungszentrum Jülich have succeeded in demonstrating the mechanisms which cause the so-called tremor: neuron clusters in the depths of the brain drive the tremor. This discovery supports Tass' research activities aiming at developing a therapy for Parkinson's disease. A new deep brain pacemaker is to bring cells out of the diseased mode for good.

Today's article in the high-impact journal "*Europhysics Letters*" shows that the scientists from Forschungszentrum Jülich, a member of the Helmholtz Association, are on the right track. Their new deep brain pacemaker is to help Parkinson's patients on a large scale for the first time in 2009. Communication between the networks of neurons is disturbed in people suffering from Parkinson's disease. These "fire" their stimuli at the same time thus causing the typical tremor. The frequency measured here is 5 hertz (Hz), i.e. five oscillations per second. In Germany, there are officially around 150,000 Parkinson's patients, although it is estimated that up to 450,000 people are affected.

To date, scientists have assumed that the 5-Hz rhythm deep in the brain resulted from nerve signals, which are transmitted from muscles in the limbs back to the brain. The scientific term for this response is "proprioceptive feedback". The prevailing opinion of many scientists to date, however, is that the "cross fire" is not emitted by the brain. The reason for this assumption was that the measured frequency of the "proprioceptive feedback" and the frequency in a specific core region of

the brain, in the thalamus and the basal ganglia, were not completely synchronous.

With a combination of several state-of-the-art analytical processes, the team has now succeeded in demonstrating that it is not only nerve signals from the muscles as feedback that drive the diseased 5-Hz rhythm in the brain. Headed by Prof. Volker Sturm, neurosurgeons in Cologne implanted electrodes in patients for the measurements, and scientists in Saratov, Russia, recalculated the obtained data together with scientists from Jülich. "Signals in the frequency domain of 5 Hz from the core region of the brain also drive the tremor", explained Peter Tass. "The difference: the feedback from the limbs is a fast and easy stimulus transmission. The signals from the thalamus and the basal ganglia are, however, transmitted to certain loop-like neuron pathways of the brain and spinal cord. Therefore, the dynamics are more complicated and the pathway is longer."

The Jülich medical scientist, mathematician and physicist believes that these new findings reinforce the theoretical basis of "his" deep brain pacemaker. This device influences the disturbed neurons in the core region of the brain and effectively removes their compulsion to "fire" at the same time. Tass' new development disturbs this compulsory diseased mode by using very mild, targeted and desynchronized stimuli in different places. In this way, the rhythm becomes irregular and breaks down. Compared to conventional devices of this type, the Jülich deep brain pacemaker puts less strain on the patient and needs less energy. Moreover, the nerve tissue is stimulated in such a way that the neurons abandon their diseased strong synaptic networks and thus forget their compulsion to develop diseased rhythms.

The pacemaker consists of two electrodes that are carefully located at the dysregulated parts of the brain. The so-called stimulator provides the electrodes with energy and signals to stimulate the neurons in the brain.

This device is implanted below the collarbone under the skin and thin wires also connect it with the electrodes under the skin.

Source: Helmholtz Association of German Research Centres