guardian.co.uk

Sending electric signals into the brain could eliminate Parkinson's symptoms

Symptoms of Parkinson's disease in mice disappeared when their brains were stimulated via spinal electrodes

Ian Sample, science correspondent

guardian.co.uk, Thursday 19 March 2009 18.00 GMT

Spinal electrical stimulation restored movement to mice that had barely been able to walk Link to this video

A ground-breaking medical device that eliminates the symptoms of Parkinson's disease by electrically stimulating the brain could be tested in humans as early as next year, according to scientists working on the project.

The device has produced dramatic improvements in mice with a Parkinson's-like disease, raising hopes that it could transform the lives of the four million people worldwide who have the devastating condition.

In tests, mice that suffered constant tremors and were barely able to walk because of the disease started moving around, groomed themselves and began eating and drinking normally when the device was switched on.

"If we see the same effect in people as we see in rodents, then Parkinson's patients will be able to walk and move around the way they could before the disease came on. This could lead to a very dramatic improvement in their quality of life," said Miguel Nicolelis, the neuroscientist who led the study at Duke University in Durham, North Carolina.

Nicolelis is one of the world's leading researchers on "brain-machine interfaces". In recent years, he has developed brain implants that can read people's thoughts, allowing them to move cursors on a screen and even use artificial limbs. Such devices are expected to lead to a new generation of mind-controlled prosthetics for the severely disabled.

Nicolelis got the idea for the latest device after studying brain activty in mice that had been bred to develop a disease very similar to Parkinson's disease. In humans, Parkinson's disease occurs when neurons that produce a vital brain chemical called dopamine die off.

Nicolelis noticed that as the disease progressed in the animals, vast numbers of neurons in two regions of the brain started firing at the same time. The abnormal activity looked almost identical to activity in a brain that is having an epileptic seizure.

Ten years ago, Nicolelis had found that he could stop epileptic fits by sending pulses of electricity up the spinal cord and into the part of the brain where the seizures were happening. He decided to test whether the same technique could have an affect on Parkinson's disease.

In the lab, Nicolelis's team videoed mice with Parkinson's-like disease and noticed that as the disease progressed, they developed severe tremors and their movements became ever more rigid. The researchers then implanted tiny electrodes into the vertebrae between the animals' shoulder blades and applied pulses of electricity. Moments after receiving the electric pulses, the mice began walking around, sniffing their cage and behaving normally.

When the current was switched off, the mice became severely disabled again.

Writing in the US journal Science, Nicolelis describes how the electrodes are placed in such a way that electrical signals are sent up into the brain, where they disrupt the abnormal activity caused by disease.

Patients with Parkinson's disease are usually treated with a drug called L-Dopa, which replaces missing dopamine in the brain. But over time many patients find the drug becomes less effective. In extreme cases, they can be treated with "deep brain stimulation", which involves major surgery to implant fine wires into the brain.

Nicolelis's research suggests it may be possible to control the symptoms of Parkinson's disease more easily, and with less drastic surgery, by sending electrical pulses along spinal cord nerves and into the brain. The stimulation would cause a tingling sensation, Nicolelis told the Guardian, but the brain would soon adapt to this, in the same way we become used to having clothes rubbing against our skin.

The team is now testing the technique at a lab in Brazil to see if it works in primates. If the experiments are successful, the device could be cleared for clinical trials in humans next year.

"If we can demonstrate that the device is safe and effective over the long term in primates and then humans, virtually every patient could be eligible for this treatment in the near future," Nicolelis said.

Dr Kieran Breen, director of research and development at the Parkinson's Disease Society, said: "Deep brain stimulation can be very effective in the treatment of some people with Parkinson's, but it is very invasive to the brain and can cause side effects. This new study suggests that it may be possible to stimulate the nerves in the spine to send an electrical signal up into the brain with a similar effect to that seen in DBS, without being as invasive."

"These initial studies have been carried out in animals," he added, "but if they become possible for people with Parkinson's, it could greatly increase the range of treatment options available for the condition. An operation of this kind would cost significantly less than DBS, so is likely to be more widely available."