Medical Xpress

First signals from brain nerve cells with ultrathin nanowires

February 20 2013

Electrodes operated into the brain are today used in research and to treat diseases such as Parkinson's. However, their use has been limited by their size. At Lund University in Sweden, researchers have, for the first time, succeeded in implanting an ultrathin nanowire-based electrode and capturing signals from the nerve cells in the brain of a laboratory animal.

The researchers work at Lund University's Neuronano Research Centre in an interdisciplinary collaboration between experts in subjects including neurophysiology, biomaterials, electrical measurements and nanotechnology. Their electrode is composed of a group of nanowires, each of which measures only 200 nanometres (billionths of a metre) in diameter.

Such thin electrodes have previously only been used in experiments with cell cultures.

"Carrying out experiments on a living animal is much more difficult. We are pleased that we have succeeded in developing a functioning nano-electrode, getting it into place and capturing signals from nerve cells", says Professor Jens Schouenborg, who is head of the Neuronano Research Centre.

He sees this as a real breakthrough, but also as only a step on the way. The research group has already worked for several years to develop electrodes that are thin and flexible enough not to disturb the brain tissue , and with material that does not irritate the cells nearby. They now have the first evidence that it is possible to obtain useful nerve signals from nanometer-sized electrodes.

The research will now take a number of directions. The researchers want to try and reduce the size of the base to which the nanowires are attached, improve the connection between the electrode and the electronics that receive the signals from the nerve cells, and experiment with the surface structure of the electrodes to see what produces the best signals without damaging the brain cells.

"In the future, we hope to be able to make electrodes with nanostructured surfaces that are adapted to the various parts of the nerve cells – parts that are no bigger than a few billionths of a metre. Then we could tailor-make each electrode based on where it is going to be placed and what signals it is to capture or emit", says Jens Schouenborg.

When an electrode is inserted into the brain of a patient or a laboratory animal, it is generally anchored to the skull. This means that it doesn't move smoothly with the brain, which floats inside the skull, but rather rubs against the surrounding tissue, which in the long term causes the signals to deteriorate. The Lund group's electrodes will instead be anchored by their surface structure.

"With the right pattern on the surface, they will stay in place yet still move with the body – and the brain – thereby opening up for long-term monitoring of neurones", explains Jens Schouenborg.

He praises the collaboration between medics, physicists and others at the Neuronano Research Centre, and mentions physicist Dmitry B. Suyatin in particular. He is the principal author of the article which the researchers have now published in the international journal *PLOS ONE.*

The overall goal of the Neuronano Research Centre is to develop electrodes that can be inserted into the brain to study learning, pain and other mechanisms, and, in the long term, to treat conditions such as chronic pain, depression and Parkinson's disease.

More information: The article in *PLOS ONE* can be found here.

Provided by Lund University