Watching stem cells repair the human brain

August 19 2009

This is Dr. Yoram Cohen of Tel Aviv University. Credit: AFTAU

There is no known cure for neurodegenerative diseases such as Huntington's, Alzheimer's and Parkinson's. But new hope, in the form of stem cells created from the patient's own bone marrow, can be found — and literally seen — in laboratories at Tel Aviv University.

Dr. Yoram Cohen of TAU's School of Chemistry has recently proven the viability of these innovative stem cells, called mesenchymal stem cells, using in-vivo MRI. Dr. Cohen has been able to track their progress within the brain, and initial studies indicate they can identify unhealthy or damaged tissues, migrate to them, and potentially repair or halt cell degeneration. His findings have been reported in the journal *Stem Cells*.

"By monitoring the motion of these cells, you get information about how viable they are, and how they can benefit the tissue," he explains. "We

have been able to prove that these stem cells travel within the brain, and only travel where they are needed. They read the chemical signalling of the tissue, which indicate areas of stress. And then they go and try to repair the situation."

Tracking live cells in the brain

To test the capabilities of this innovative new stem cells, Dr. Cohen created a study to track the activity of the live cells within the brain using the in-vivo MRI at the Strauss Centre for Computational Neuro-Imaging. Watching the live, active cells has been central to establishing their viability as a therapy for neurodegenerative disease.

Dr. Cohen and his team of researchers took magnetic iron oxide nanoparticles and used them to label the stem cells they tested. When injected into the brain, they could then be identified as clear black dots on an MRI picture. The stem cells were then injected into the brain of an animal that had an experimental model of Huntington's disease. These animals suffer from a similar neuropathology as the one seen in human Huntington's patients, and therefore serve as research tool for the disease.

On MRI, it was possible to watch the stem cells migrating towards the diseased area of the brain. "Cells that go toward a certain position that needs to be rescued are the best indirect proof that they are live and viable," explains Dr. Cohen. "If they can migrate towards the target, they are alive and can read chemical signalling."

An ethically viable stem cell

This study is based on differentiated mesenchymal cells (MSC), which were discovered at Tel Aviv University. Bone marrow cells are

transformed into NTFs-secreting stem cells, which can then be used to treat neurodegenerative diseases. This advance circumvents the ethical debate caused by the use of stem cells obtained from embryos.

Although there is a drawback to using this particular type of stem cell — the higher degree of difficulty involved in rendering them "neuron-like" — the benefits are numerous. "Bone marrow-derived MSCs bypass ethical and production complications," says Dr. Cohen, "and in the long run, the cells are less likely to be rejected because they come from the patients themselves. This means you don't need immunosuppressant therapy."

Working towards a real-life therapy

Dr. Cohen says the next step is to develop a real-life therapy for those suffering from neurodegenerative diseases. The ultimate goal is to repair neuronal cells and tissues. Stem cell therapy is thought to be the most promising future therapy to combat diseases such as Huntington's, Alzheimer's and Parkinson's diseases, and researchers may also be able to develop a therapy for stroke victims. If post-stroke cell degeneration can be stopped at an early stage, says Dr. Cohen, patients can live for many years with a good quality of life.

Source: Tel Aviv University (news : web)