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9 November 2006 - Precursor Cell Transplantation Improves Vision

Breakthrough in retinal cell transplantation

You may have seen recent media coverage on retinal cell transplantation in mice stemming from an article in the 9 November issue in Nature.

Who conducted the research?

The work was carried out by scientists at UCL Institute of Ophthalmology and UCL Institute of Child Health, Professor Robin Ali, Dr. Jane Sowden, Dr. Rachael Pearson, Dr. Angus MacNeil, Mr. Robert MacLaren, Professor Tom Salt and Mr Ron H Douglas of City University together with collaborators from the University of Michigan Dr. A. Swaroop and Dr. M. Akimoto.

This work was supported by grants from the Medical Research Council UK, the Royal Blind Asylum and School and The Scottish National Institute for the War Blinded.

What is a photoreceptor?

Photoreceptors are the light sensitive nerve cells that line the back of the eye, like the pixels of a digital camera. They contain chemicals that change when they are hit by light which causes an electrical signal which is then sent to the brain along the optic nerve.

About six or seven million cells called cones are concentrated in the central portion of the retina which allow us to see fine detail and colour. Away from the central portion of the retina are about 120 million cells, which are mostly rod cells. They enable us to see when light is dim and provide peripheral vision outside of the main line of sight. Usually once the photoreceptors are lost they cannot be replaced.

What actually happened during the research process?

The research team took cells from three-to-five day old mice as they were at a stage when photoreceptors are formed. The researchers transplanted photoreceptor precursors into the retina of mice that were blind due to a genetic defect which mimicked a disease in humans known as retinitis pigmentosa.

The transplants were successful; the photoreceptors implanted and made electrical connections to the animal's existing retinal nerve cells – which is key to allowing them to see again. Tests showed that the mice's pupils responded to light and that there was activity in the optic nerve which demonstrated signals were being carried to the brain.

Did the research involve stem cells?

No. Stem cells are slightly different. When a stem cell divides, each new cell has the potential to either remain a stem cell or become another type of cell with a more specialised function. In this research, the cells were extracted directly from the mice rather than cultivated in a laboratory.

Why was the retina in particular chosen?

It is thought the retina is one of the best places to try out cell transplant therapy because photoreceptor loss initially leaves the rest of the wiring to the brain intact. There have been previous attempts to transplant stem cells, which can turn into any kind of cell in the body in the hope that they will become photoreceptors, there was limited success but an improvement in visual function was observed.

Dr. Sowden comments: "Remarkably, we found that the mature retina, previously believed to have no capacity for repair, is in fact able to support the development of a new functional photoreceptors."

The photoreceptor transplant has worked in mice, can it work in humans?

Mr. MacLaren comments: "We still have a long way to go before translating this into everyday clinical treatment."

What conditions could this potentially help in the future?

If the results can be translated into a treatment for human eye disease, it could help patients with retinitis pigmentosa.

Can I be added to the clinical trials list, as and when the treatment is made available?

As the research is at a very early stage, and is possibly years away from a human transplant, we are not coordinating any lists for clinical trials.

Further information:

<http://www.ucl.ac.uk/news/news-articles/0611/06110901>

<http://www.ucl.ac.uk/ioo/index.php>

<http://www.ich.ucl.ac.uk>

<http://www.mrc.ac.uk/NewsViewsAndEvents/News/MRC003363>

'Nature' - <http://www.nature.com/nature/journal/v444/n7116/index.html>