Stem cell first: Creating induced pluripotent stem cells

August 23 2010

In a world first, Australian researchers have created induced pluripotent stem (iPS) cells from human skin without the use of viruses or genetic manipulation, an important step toward their eventual use in treating human disease.

The University of New South Wales breakthrough means work can now progress on the use of iPS cells to generate brain cells for the study and eventual treatment of degenerative brain diseases.

“By successfully creating iPS cells without resorting to viruses or genetic manipulation we have removed a major hurdle to their therapeutic use,” said UNSW’s Stem Cell Lab Director, Associate Professor Kuldip Sidhu.

The lab is now working closely with Scientia Professor Perminder Sachdev from UNSW’s School of Psychiatry to produce Alzheimer’s, Huntington’s and Parkinson’s stem cell lines.

A paper outlining the breakthrough appears this month in the prestigious journal *PLoS One*.

First generated from human skin by Japanese scientists in 2007, iPS cells revolutionized stem cell research by potentially eliminating the need to harvest human embryos. Therapeutics derived from the iPS cells are also less prone to immune rejection than those using embryonic stem cells because they are derived entirely from the patient.

However, the Japanese process required the use of lentiviruses, which raised concerns about the introduction of viral DNA sequences into the genome of the recipient cell, increasing the likelihood of future cancers and other mutations.

The technique developed at UNSW's Stem Cell Lab circumvents this danger, A/Professor Sidhu said. "Because we have bypassed having to use viral particles or any genetic manipulation, the fear of mutations like cancer is almost negligible," he said.

In the two-stage process, reagents were first used to bring about epigenetic changes in human skin cells. This was followed by treatment with an embryonic stem cell extract to induce reprogramming and pluripotency.

While the breakthrough technique makes the use of iPS cells in human therapies more likely, Professor Sidhu said it was still too early to assume they were the preferred alternative to embryonic stem cells.

"The iPS cells we've created appear very similar to embryonic stem cells, but they also exhibit variability and instability in culture. The next step is to make these cells suitable for long-term propagation, so they can be used in therapies," A/Professor Sidhu said.

The study forms the basis of the PhD work of Jin Han, funded by UNSW Medicine and an Australian Postgraduate Award.

Provided by University of New South Wales