Researchers develop safer way to make induced pluripotent stem cells

February 1 2011

Researchers at Johns Hopkins have found a better way to create induced pluripotent stem (iPS) cells -- adult cells reprogrammed with the properties of embryonic stem cells -- from a small blood sample. This new method, described last week in *Cell Research*, avoids creating DNA changes that could lead to tumor formation.

“These iPS cells are much safer than ones made with previous technologies because they don’t involve integrating foreign viruses that can potentially lead to uncontrolled, cancerous cell growth,” says Linzhao Cheng, Ph.D., an associate professor of medicine in the Division of Hematology and a member of the Johns Hopkins Institute of Cell Engineering. “This is important if iPS cells are to be used as therapies one day.”

Cheng says the higher-quality iPS cells will also be more reliable in research studies, “since we don’t have to worry about extra genetic changes associated with previous technologies interfering with study results.”

Johns Hopkins researchers created the safer iPS cells by transferring a circular piece of DNA into blood cells from anonymous donors to deliver the needed genetic components. The traditional way is to use viruses to carry DNA into a cell’s genome. Unlike the viral methods, the circular DNA the Hopkins team used is designed to stay separate from the host cell’s genome. After the iPS cells formed, the circular DNA delivered into the blood cells was gradually lost.

Using about a tablespoon of human adult blood or umbilical cord blood, the researchers grew the blood cells in the lab for eight to nine days. The researchers then transferred the circular DNA into the blood cells, where the introduced genes turned on to convert the blood cells to iPS cells within 14 days.

The research group verified conversion from mature blood cells to iPS cells by testing their ability to behave like stem cells and differentiate into other cell types, such as bone, muscle or neural cells. They also looked at the DNA from a dozen iPS cell lines to make sure there were no DNA rearrangements.

Cheng says the new method is also more efficient than the traditional use of skin cells to make iPS cells. “After a skin biopsy, it takes a full month to grow the skin cells before they are ready to be reprogrammed into iPS cells, unlike the blood cells that only need to grow for eight or nine days,” says Cheng. “The time it takes to reprogram the iPS cells from blood cells is also shortened to two weeks, compared to the month it takes when using skin cells.”

Cheng says “this easy method of generating integration-free human iPS cells from blood cells will accelerate their use in both research and future clinical applications.”

More information: Cell Research: www.nature.com/cr/index.html

Provided by Johns Hopkins University