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Researchers use single gene to return mature stem cells to embryonic state

By: MARK JOHNSON

German scientists have sent mouse stem cells back to their embryonic origin by introducing just a single gene, a finding that could eventually lead to simpler, safer ways of generating cells for human medicine.

A little more than a year ago, researchers in Madison and Japan proved that it was not only possible to turn a mature cell into something with the healing potential of an embryonic stem cell, but also far less difficult than most imagined.

The new work, published today in the journal Cell, shows that it may be simpler still.

The German team took neural stem cells from the brains of mice and used a virus to introduce a gene called Oct4. The gene is one of the four used by groups at the University of Wisconsin-Madison and Kyoto University in Japan when they reprogrammed human skin cells. The German experiment found that in mice, a single gene was all it took to transform the neural stem cells into the equivalent of embryonic stem cells.

Hans Schöler of the Max Planck Institute for Molecular Biomedicine led the research and called it "a major step ahead" in the effort to reduce the number of genes and viruses used to reprogram cells. The techniques used in Madison and Japan - viruses carrying genes - risk causing cancer and therefore are not considered safe for humans.

Whether the new work can be extended from mice to humans "is part of future experiments," Schöler said by e-mail.

The German paper continues the drive to create a safe alternative to embryonic stem cells, one that does not require destruction of human embryos.

Prized for their ability to grow forever in a lab and become any cell in the body, embryonic stem cells offer medicine the possibility of a vast repair kit for use against a broad spectrum of diseases and conditions. But the controversy surrounding the special cells and the possibility that the human body will reject transplanted cells from another person has led scientists to seek an alternative.

"With a single gene, it makes the reprogramming system simpler. And it's better for studying the mechanism. The mechanism, I would say, is still a black box," said Junying Yu, an associate scientist who worked with UW stem cell pioneer James Thomson on the reprogramming project.

In an e-mail, George Daley, a stem cell researcher at Children's Hospital Boston, said, "This paper suggests that reprogramming might be reduced to a very simple formula in the future."

The simplicity of the new experiments might be explained in part by the fact that German researchers were working with neural stem cells, which are closer to the embryonic state than the skin cells that UW and Kyoto scientists reprogrammed with four genes. Schöler and his colleagues chose the neural stem cells because they already expressed three of the four genes used by Kyoto scientist Shinya Yamanaka.