

The Stem Cell Research Report

Current News
About Adult,
Embryonic, and
Cord Blood Stem
Cell Research

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Simplified Process Discovered for Converting Adult Stem Cells into Embryonic-like Stem Cells

The recently discovered process of reprogramming adult cells into embryonic-like stem cells has been made simpler, according to a report in the Feb. 6 issue of the journal *Cell*.

Hans R. Schöler of the Max Planck Institute for Molecular Biomedicine in Germany and a team of German scientists demonstrated that neural stem cells taken from adult mice can take on the characteristics of embryonic stem cells with the addition of a single transcription factor.

Transcription factors are genes that control the activity of other genes.

In 2006, a research team led by Dr. Shinya Yamanaka demonstrated that adding four transcription factors



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could transform adult cells taken from mice into induced pluripotent stem cells (iPSCs), which have the same basic characteristics and behavior as embryonic stem cells. Soon thereafter, scientists used these four specific transcription factors—known as Oct4, Sox2, Klf4, and c-Myc—to reprogram human skin cells into an embryonic-like state.

The discovery of a technique for generating iPSCs was groundbreaking, because it affords scientists the opportunity to study embryonic-like cells while avoiding the ethical controversy that surrounds human embryonic stem cell research, in which a human embryo must be destroyed to extract its stem cells.

Subsequent research showed that just two or three of the transcription

factors were sufficient in some cases to bring about the reprogramming. Dr. Schöler and his colleagues had successfully induced pluripotency in neural stem cells using only Oct4 and Klf4.

The latest discovery, again made by Dr. Schöler's team, has shown that Oct4 is the key to converting neural stem cells into iPSCs. Furthermore, this single factor is sufficient for inducing pluripotency in neural stem cells.

Schöler reports that the resulting cells, which he termed "1F iPSC," can differentiate into all three germ layers, which eventually give rise to all of the body's tissues and organs. The ability to induce pluripotency without using c-Myc and Klf4 in the reprogramming process is a welcome discovery, as both are oncogenes—genes that turn normal cells into cancer cells.

However, the research team also showed that the mouse neural stem cells that they reprogrammed formed tumors when injected under the skin of mice. In order to have therapeutic value, future research will need to show that the expression of Oct4 can be induced by non-retroviral means. ■

Source: Kim et al., *Cell*, Vol. 136, No. 3, Feb. 6, 2009, pp. 411–419; doi: 10.1016/j.cell.2009.01.023

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Patients' Bone Marrow Improves Spinal Cord Injury

A study conducted in Ecuador has found that injecting autologous bone marrow stem cells into the spines of patients with spinal cord injuries can improve their quality of life.

Autologous bone marrow stem cells are cells harvested from a patient for that patient's own use. The study examined eight patients, four with recent injuries and four with longer-term injuries. The patients were injected with their own bone marrow stem cells using various methods of transmission—directly into the spinal cord, into the spinal canal, and intravenously. Their progress was monitored for two years, and each patient's

spine was imaged using MRI technology to see if the treatment was causing any changes to the structure of the spinal cord.

"Our objective in this study was to demonstrate that multiple route administration of bone marrow stem cells for spinal cord injury is safe and feasible," said report author Dr. Francisco Silva. "To date, we have administered bone marrow stem cells into 52 patients with spinal cord injuries and have had no tumor formations, no cases of infection or increased pain, and few instances of minor adverse events. We also found that patient quality of life improved."

All of the patients were paraplegic and demonstrated improved mobility, sensation, and bladder function, leading to substantial improvement in quality of life after the treatment. In addition, the MRIs proved that there were structural changes over time occurring within the spinal cord.

"It is important to note," Dr. Silva said, "that all of our patients with acute injuries improved significantly with no signs of deterioration or impediment of presumed spontaneous recovery." ■

Source: Geffner et al. *Cell Transplantation*, Vol. 17, No. 12, 2008, pp. 1277–1293; doi 10.3727/096368908787648074

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