Scientists program blood stem cells to become vision cells

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University of Florida researchers were able to program bone marrow stem cells to repair damaged retinas in mice, suggesting a potential treatment for one of the most common causes of vision loss in older people.

The success in repairing a damaged layer of retinal cells in mice implies that blood stem cells taken from bone marrow can be programmed to restore a variety of cells and tissues, including ones involved in cardiovascular disorders such as atherosclerosis and coronary artery disease.

"To our knowledge, this is the first report using targeted gene manipulation to specifically program an adult stem cell to become a new cell type," said Maria B. Grant, M.D., a professor of pharmacology and therapeutics at UF's College of Medicine. "Although we used genes, we also suggest you can do the same thing with drugs — but ultimately you would not give the drugs to the patient, you would give the drugs to their cells. Take the cells out, activate certain chemical pathways, and put the cells back into the patient."

In a paper slated to appear in the September issue of the journal *Molecular Therapy*, scientists describe how they used a virus carrying a gene that gently pushed cultured adult stem cells from mice toward a fate as retinal cells. Only after the stem cells were reintroduced into the mice did they completely transform into the desired type of vision cells, apparently taking environmental cues from the damaged retinas.

After studying the cell-transformation process, scientists were able to bypass the gene manipulation step entirely and instead use chemical compounds that mirrored environmental conditions in the body, thus pointing the stem cells toward their ultimate identities as vision cells.

"First we were able to show you can overexpress a protein unique to a retinal cell type and trick the stem cell into thinking it is that kind of cell," said Grant, who collaborated with Edward Scott, Ph.D., the director of the Program in Stem Cell Biology and Regenerative Medicine at UF's McKnight Brain Institute. "As we proceeded, we found we could activate the stem cells by mimicking the body's natural signaling channels with chemicals. This implies a whole new field of stem cell research that uses drug manipulation rather than genetic manipulation to send these immature cells along new pathways."

Scientists chose to build retinal pigment epithelial cells, which form the outer barrier of the retina. In addition to being very specialized and easy to identify, RPE cells are faulty in many retinal diseases, including age-related macular degeneration, which affects nearly 2 million people in the United States, and some forms of blindness related to diabetes.

"This work applies to 85 percent of patients who have age-related macular degeneration," Grant said. "There are no therapies for this devastating disease."

The work was supported by the National Eye Institute. Researchers removed blood stem cells from the bone marrow of mice, modified the cells in cultures, and injected them back into the animals' circulatory systems. From there, the stem cells were able to home in on the eye injury and become retinal cells.

At 28 days after receiving the modified stem cells, mice that had previously demonstrated no retinal function were no different than normal mice in electrical measures of their response to light.

Grant and UF have patented some technology involved in the research.

Source: University of Florida (news : web)