Stem cells from patients make 'early retina in a dish'

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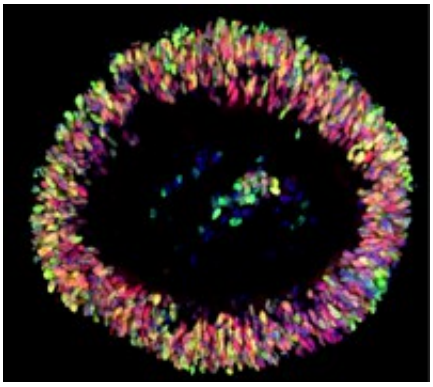

This microscope photo shows human induced pluripotent stem cells beginning to form into a structure like a retina. This vesicle, or early retinal structure, formed in the laboratory into much the same shape that occurs in early eye development. The red cells are retina and the green cells are rapidly dividing cells.

(PhysOrg.com) -- Soon, some treatments for blinding eye diseases might be developed and tested using retina-like tissues produced from the patient's own skin, thanks to a series of discoveries reported by a team of University of Wisconsin-Madison stem cell researchers.

The team, led by stem cell scientist and ophthalmologist Dr. David Gamm of the UW School of Medicine and Public Health and former UW scientist Dr. Jason Meyer, used human embryonic stem (ES) cells and induced pluripotent stem (iPS) cells to generate three-dimensional structures that are similar to those present at the earliest stages of retinal

development.

The Gamm laboratory, based at UW-Madison's Waisman Center, isolated these early retinal structures from other cell groups and grew them in batches in the laboratory, where they produced major retinal cell types, including photoreceptors and retinal pigment epithelium (RPE).

Importantly, cells from these structures matured and responded appropriately to signals involved in normal retinal function, making them potentially valuable not only for studying how the human retina develops, but also how to keep it working in the face of disease.

To demonstrate this potential, UW-Madison researchers created early retinal structures from skin cells of a woman with a rare blinding disease - gyrate atrophy - and directed them to make RPE, the cell type primarily affected by this disorder. Tests on these created cells showed that high doses of vitamin B6, a compound sometimes used to treat gyrate atrophy, could overcome the gene mutation that led to her disease.

In a second test, scientists also corrected the problem by "swapping out" the patient's defective gene for a correct copy using a process described earlier this year by fellow research team members Dr. Sara Howden and Dr. James Thomson of the Morgridge Institute.

The results show the clinical promise of stem cell research, but Gamm is careful to point out that much work is left to be done.

"However, it is remarkable to think that something resembling the retina, one of the most specialized tissues in the human body, may one day be generated from a person's skin," says Gamm, who is encouraged by results from Dr. Yoshiki Sasai's lab in Kobe, Japan, demonstrating that mouse ES cells could produce highly complex retinal tissues in a dish.

Even with current technology, human iPS cells are capable of advancing the field of personalized medicine by providing access to cells that cannot be safely removed from living patients. In turn, these custom cells can be used to test effects of cutting edge treatments (such as gene therapy) or established medications.

"In our case, the individual with gyrate atrophy was thought to be unresponsive to vitamin B6 therapy based on traditional tests, but examination of her own RPE suggested otherwise," Gamm says. "This is another glimpse of how we might use stem cells to help patients in the foreseeable future."

The research is published online in the journal Stem Cells.

Provided by University of Wisconsin-Madison