

Researchers create retina from human embryonic stem cells

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UC Irvine scientists have created an eight-layer, early-stage retina from human embryonic stem cells, the first three-dimensional tissue structure to be made from stem cells.

It also marks the first step toward the development of transplant-ready retinas to treat eye disorders such as retinitis pigmentosa and macular degeneration that affect millions.

"We made a complex structure consisting of many cell types," said study leader Hans Keirstead of the Reeve-Irvine Research Center and the Sue and Bill Gross Stem Cell Research Center at UCI. "This is a major advance in our quest to treat [retinal disease](#)."

In previous studies on spinal cord injury, the Keirstead group originated a method by which human [embryonic stem cells](#) could be directed to become specific cell types, a process called differentiation. Results of those studies are leading to the world's first clinical trial using a stem cell-based therapy for acute spinal cord injury.

In this study, the Keirstead team utilized the differentiation technique to create the multiple cell types necessary for the retina. The greatest challenge, Keirstead said, was in the engineering. To mimic early-stage retinal development, the researchers needed to build microscopic gradients for solutions in which to bathe the stem cells to initiate specific differentiation paths.

"Creating this complex tissue is a first for the stem cell field," Keirstead said. "Dr. Gabriel Nistor in our group addressed a really interesting scientific problem with an engineering solution, showing that gradients of solutions can create complex stem cell-based tissues."

The retina is the inside back layer of the eye that records the images a person sees and sends them via the [optic nerve](#) from the eye to the brain.

Retinal diseases are particularly damaging to sight. More than 10 million Americans suffer from macular degeneration, the leading cause of blindness in people over 55. About 100,000 have retinitis pigmentosa, a progressive, [genetic disorder](#) that usually manifests in childhood.

"What's so exciting with our discovery," Keirstead said, "is that creating transplantable retinas from stem cells could help millions of people, and we are well on the way."

The UCI researchers are testing the early-stage retinas in animal models to learn how much they improve vision. Positive results would lead to human clinical trials.

More information: The study appears online in the Journal of Neuroscience Methods.

Provided by University of California - Irvine

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