Scientists see new hope for restoring vision with stem cell help

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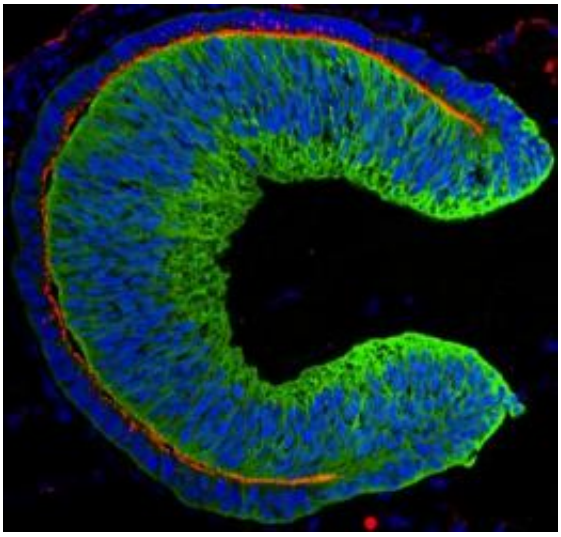

This is a human ES cell-derived optic cup generated in our self-organization culture (culture day 26). Bright green, neural retina; off green, pigment epithelium; blue, nuclei; red, active myosin (strong in the inner surface of pigment epithelium). Credit: Nakano et al. *Cell Stem Cell* Volume 10 Issue 6

Human-derived stem cells can spontaneously form the tissue that develops into the part of the eye that allows us to see, according to a study published by Cell Press in the 5th anniversary issue of the journal *Cell Stem Cell*. Transplantation of this 3D tissue in the future could help patients with visual impairments see clearly.

"This is an important milestone for a new generation of regenerative

medicine," says senior study author Yoshiki Sasai of the RIKEN Center for Developmental Biology. "Our approach opens a new avenue to the use of human stem cell-derived complex tissues for therapy, as well as for other medical studies related to pathogenesis and drug discovery."

During development, light-sensitive tissue lining the back of the eye, called the retina, forms from a structure known as the optic cup. In the new study, this structure spontaneously emerged from human embryonic stem cells (hESCs)—cells derived from human embryos that are capable of developing into a variety of tissues—thanks to the cell culture methods optimized by Sasai and his team.

The hESC-derived cells formed the correct 3D shape and the two layers of the optic cup, including a layer containing a large number of light-responsive cells called photoreceptors. Because retinal degeneration primarily results from damage to these cells, the hESC-derived tissue could be ideal transplantation material.

Beyond the clinical implications, the study will likely accelerate the acquisition of knowledge in the field of developmental biology. For instance, the hESC-derived optic cup is much larger than the optic cup that Sasai and collaborators previously derived from mouse embryonic stem cells, suggesting that these cells contain innate species-specific instructions for building this eye structure. "This study opens the door to understanding human-specific aspects of eye development that researchers were not able to investigate before," Sasai says.

The anniversary issue containing Sasai's study will be given to each delegate attending the 2012 ISSCR meeting in Yokohama, Japan. To highlight the ISSCR meeting and showcase the strong advances made by Japanese scientists in the stem cell field, the issue will also feature two other papers from Japanese authors, including the research groups of Akira Onishi and Jun Yamashita. In addition, the issue contains a series

of reviews and perspectives from worldwide leaders in stem cell research.

More information: Nakano et al.: "Self-Formation of Optic Cups and Storable Stratified Neural Retina from Human ESCs." DOI 10.1016/j.stem.2012.05.009

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