Tissue engineering the retinal ganglion cell nerve fiber layer

Kador KE, Montero RB, Venugopalan P, Hertz J, Zindell AN, Valenzuela DA, Uddin MS, Lavik EB, Muller KJ, Andreopoulos FM, Goldberg JL

SourceBascom Palmer Eye Institute and Interdisciplinary Stem Cell Institute, Miller School of Medicine, University of Miami, 1501 NW 10th Ave, BRB Building Room 832, Miami, FL 33136, USA.

Retinal degenerative diseases, such as glaucoma and macular degeneration, affect millions of people worldwide and ultimately lead to retinal cell death and blindness. Cell transplantation therapies for photoreceptors demonstrate integration and restoration of function, but transplantation into the ganglion cell layer is more complex, requiring guidance of axons from transplanted cells to the optic nerve head in order to reach targets in the brain.

Here we create a biodegradable electrospun (ES) scaffold designed to direct the growth of retinal ganglion cell (RGC) axons radially, mimicking axon orientation in the retina. Using this scaffold we observed an increase in RGC survival and no significant change in their electrophysiological properties. When analyzed for alignment, 81% of RGCs were observed to project axons radially along the scaffold fibers, with no difference in alignment compared to the nerve fiber layer of retinal explants.

When transplanted onto retinal explants, RGCs on ES scaffolds followed the radial pattern of the host retinal nerve fibers, whereas RGCs transplanted directly grew axons in a random pattern.

Thus, the use of this scaffold as a cell delivery device represents a significant step towards the use of cell transplant therapies for the treatment of glaucoma and other retinal degenerative diseases.

Biomaterials. 2013 Mar 11. pii: S0142-9612(13) 00196-8. doi: 10.1016/j.biomaterials.2013.02.027.

PMID: 23489919
http://www.ncbi.nlm.nih.gov/pubmed/23489919