Controlling Retinal Cell Fate Using Nanotopography and Neurotrophic Factors

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AIM
Identify crucial chemical and physical factors for advancements in retinal cell replacement therapies.
Evaluate the effect of neurotrophic factor supplementation, substrate-topography and functionalisation on retinal cell behavior.

BACKGROUND
Bioscaffolds, supporting cell survival and guiding axonal growth, holds great promise for the advancement of cell-based therapies for retinal neurodegenerations. Increased knowledge is required on the effect of nanotopographies, extracellular matrix (ECM) proteins and neurotrophic factors on retinal cell fate, morphology and axonal guidance. Hence, we here investigated the influence of nanotopography using electrospun polycaprolactone (PCL) fibers, laminin (ECM protein) and neurotrophic factor enriched medium (Full-SATO medium) on retinal ganglion cells, photoreceptors and glial cells.

EXPERIMENTAL DESIGN

RESULTS
Full-SATO significantly increase neuronal cell number

β-tubulin III

Rhodopsin

GFAP

CONCLUSION
- Full-SATO medium promotes neurite outgrowth, neurite network formation, and increase in cell number of neurons, photoreceptors and glial cells
- Laminin-coating of aligned PCL nanofibers shifts neurite orientation
- PCL nanofibers and Full-SATO medium yielded promising results for future transplantation studies of retinal cell layers

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Electrospinning parameters: 15 kV, PCL in acetone, 22 G blunt needle, 20 cm Random foams (62G): 1.5 ml/h flow rate, 20 kV
Aligned fibers (607 nm): 3.0 ml/h flow rate, 17.5 kV, 5500 rpm

Medium used
Basic Neuronal medium: DMEM/F12, 3% B27 supplement and 2% L-glutamine + Pen/Strep
Full-SATO medium: Neurons and medium supplemented with SATO mix (transferrin, BSA, progesterone, putrescine, sodium selenite, insulin, sodium pyruvate, penicillin/streptomycin, thiodo-l-lysine, L-glutamine, N2 supplement, N-acetyl-L-cysteine, B27 supplement) and forskolin, GNTF and BDNF growth factors, at concentrations described in Cold Spring Harbor Protocols.