3D Vascularized Human Ocular Tissue for Cell Therapy and Drug Discovery

Summary (1024-character limit)
Scientists at the National Eye Institute (NEI) have developed a technology for a 3D bioprinting process. Through the process, an artificial blood retinal barrier (BRB) is constructed that may be used as a graft to potentially replace BRB tissues that are lost or damaged in many ocular disorders. The printed tissue structures might be therapeutically useful for grafts or as model systems to test function and physiological responses to drugs or other variables introduced into the system.

NIH Reference Number
E-004-2017

Product Type
• Therapeutics

Keywords
• Cell therapy, Ocular cell therapy scaffold, 3D bio-printing, Retinal Pigment Epithelium Cells, Retinal disorder, Blood Retinal Barrier Disorder, BRB, in Vitro Human Blood Retinal Barrier Model, Bharti

Collaboration Opportunity
This invention is available for licensing and co-development.

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Description of Technology
Degeneration of retinal tissues occurs in many ocular disorders resulting in the loss of vision. Dysfunction and/or loss of Retinal Pigment Epithelium Cells (RPE) and disruption of the associated blood retinal barrier (BRB) tissue structures are linked with many ocular diseases and conditions including: age-related macular degeneration (AMD), Best disease, and retinitis pigmentosa. Engineered tissue structures that are able to replicate the function of lost BRB structures may restore lost vision and provide insight into new treatments and mechanisms of the underlying conditions.

Scientists at the National Eye Institute (NEI) have developed a technology for a 3D bioprinting process. Through the process, an artificial blood retinal barrier (BRB) is constructed that may be used as a graft to potentially replace BRB tissues that are lost or damaged in many ocular disorders. The layers of BRB
structures are printed as “bio-ink” (a specified formulation of cells that may be mixed with other biomaterials). The formulation of the bio-inks in each layer can be controlled. For example, induced pluripotent stem cells can be differentiated into RPE cells and endothelial cells, fibroblasts and pericytes. These differentiated cells may be used to formulate the desired composition for each bio-ink. Each formulated bio-ink layer may then be printed in a precise, user-defined, spatial and temporally-controlled pattern to build a 3D tissue architecture. Through this process, a 3D printed tissue architecture, similar in structure and function to natural BRB tissues, may be created. The printed tissue structures might be therapeutically useful for grafts or as model systems to test function and physiological responses to drugs or other variables introduced into the system.

The NEI is seeking partners for commercial licensing & development and for possible collaborative research related to the development of this technology.

Potential Commercial Applications
• Cell based therapy
• Develop a human model for disease & drug target testing, and identification

Competitive Advantages
• No current in vitro model of human BRB diseases
• No current effective therapy to restore BRB tissue lost in human BRB disorders

Inventor(s)
Kapil Bharti (NEI)

Development Stage
• Pre-clinical (in vivo)

Patent Status

Therapeutic Area
• Eye and Ear, Nose & Throat