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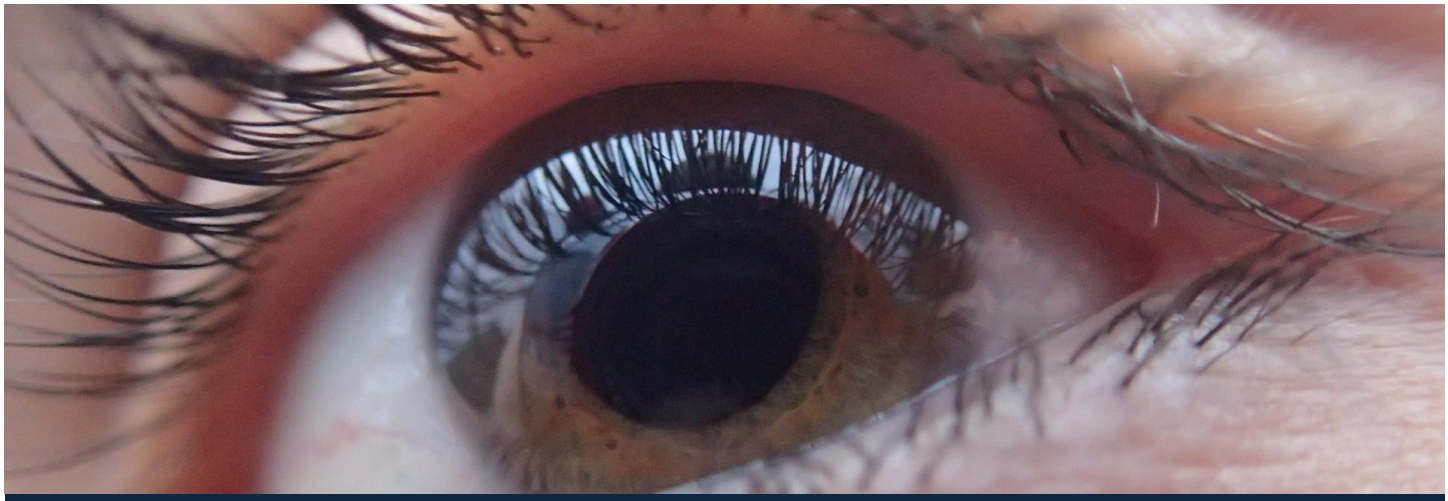


Using Trabecular Meshwork Stem Cells to Treat Glaucoma ID: 2257

Featured Innovators: Yiqin Du, MD, PhD, James Funderburgh, PhD, and Joel Schuman, MD

Glaucoma is the second leading cause of irreversible blindness worldwide. The major risk factor for most glaucoma patients — and the focus of treatment — is increased intraocular pressure (IOP). One factor that correlates with IOP rise is trabecular meshwork (TM) decellularization, which occurs naturally with age. Replacing those lost TM cells using stem cells from the same region could restore healthy aqueous outflow and return IOP to normal, thereby slowing glaucoma progression and preserving vision.

Technology Description

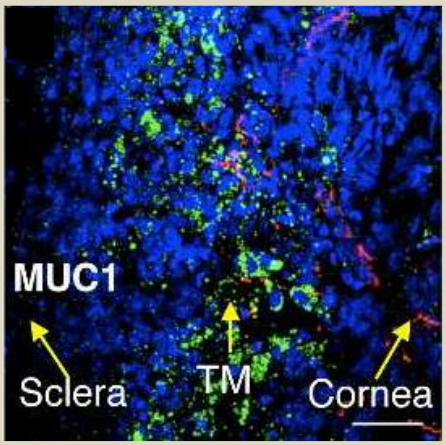
Stem cells are abundant throughout the human TM. They can be isolated *in vitro* using fluorescence-activated cell sorting (FACS) or clonal growth and then cultured for several generations without losing multipotency. Once induced to differentiate into TM cells, TM stem cells had a similar gene expression profile to primary TM cells and were phagocytic like primary TM cells. Finally, when transplanted into the anterior chambers of mice *in vivo*, TM stem cells automatically moved into the TM region, differentiated, and integrated into the TM tissue there which means they are functional *in vivo*. These transplanted cells did not evoke an inflammatory response from the host tissue and remained viable for at least four months. Unlike current treatments for glaucoma involving pharmacological and surgical aqueous humor reduction, our cell-based approach has the potential to actually repair the pathological tissue.

Advantages

- TM stem cells can retain multipotency in culture which ensures sufficient cell numbers for multiple transplantations from one single donor.
- TM cells derived from stem cells function like native TM cells
- Injected TM stem cells localize into TM tissue and function without rejection

Applications

- Cell-based therapy for glaucoma



Four weeks after injection into mouse anterior chamber, human TM stem cells (green) are present in the TM region of the mouse eye.

Stage of Development

in vivo data

IP Status

Patent application US 2015 / 0231180 published

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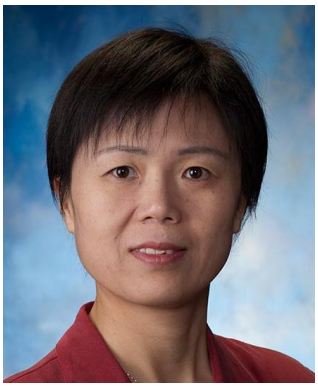

Yiqin Du, MD, PhD

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University of Pittsburgh

Dr. Du's current research efforts include projects to investigate stem cells from trabecular meshwork and other stem cell types and cell-based therapy for glaucoma, and a project to elucidate the biological properties of adult stem cells from corneal stroma and discover their roles in corneal maintenance and healing and immunosuppression property.

Education
PhD, Peking University, China
MD, Xuzhou Medical College, China

Publications

- Yun H, Zhou Y, Wills A, Du Y (2016). Stem cells in the trabecular meshwork for regulating intraocular pressure. *Journal of Ocular Pharmacology and Therapeutics*, 32(5), 253-260.
- Yun H, Schuman JS, Du Y (2014). Trabecular meshwork stem cells. In: *Regenerative Biology of the Eye* (pp. 203-214). Springer, New York, NY.
- Du Y, Yun H, Yang E, Schuman JS (2013). Stem cells from trabecular meshwork home to TM tissue in vivo. *Investigative ophthalmology & visual science*, 54(2), 1450-1459.
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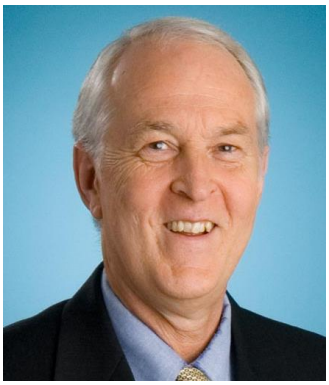
- Du Y, Mann MM, Roh DS, Funderburgh ML, Schuman JS, Funderburgh JL (2010). Characteristics of Trabecular Meshwork Stem Cells. *Investigative Ophthalmology & Visual Science*, 51(13), 1627-1627.



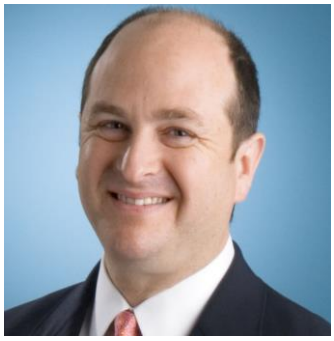
James Funderburgh, PhD

Professor
Department of Ophthalmology
Department of Cell Biology and Molecular Physiology
University of Pittsburgh

Associate Director
Louis J. Fox Center for Vision Restoration

Dr. Funderburgh's current research interests include extracellular matrix biochemistry, proteoglycans, tissue engineering, corneal cell biology, wound healing, and stem cell biology.

Education
PhD, University of Wisconsin, Madison
MS, University of Minnesota
BA, University of Texas, Austin



Joel Schuman, MD

Professor and Chair
Department of Ophthalmology
New York University

Director
NYU Lagone Eye Center

Former Director
UPMC Eye Center

Dr. Schuman helped to develop optical coherence tomography (OCT), which to-date is the most powerful tool available for early detection of the disease. Dr. Schuman is responsible for constantly upgrading this technology, now known as Spectral OCT, which quickly and noninvasively produces a 3-D map of the eye and compares it to images of what healthy eye tissue should look like. Dr. Schuman and his colleagues were also the first to identify a molecular marker for human glaucoma, as published in *Nature Medicine*. This discovery has paved the way for other significant advances in the treatment and diagnosis of glaucoma.

Education
MD Mount Sinai School of Medicine
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