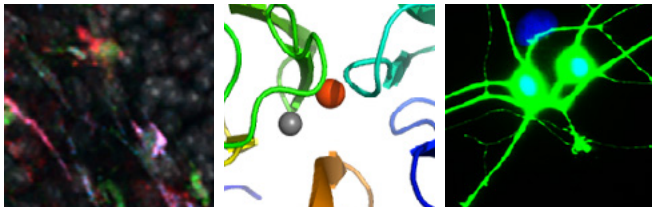


# This Is How.

Projects Inspiring Promise



**Current National  
Glaucoma Research  
Projects**

As of December 2020



**BrightFocus<sup>®</sup>  
Foundation**

**National  
Glaucoma  
Research**

National Glaucoma Research, a BrightFocus Foundation Program

# We're funding 42 projects worldwide this year in research.

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### Cover photos, left to right:

*Gene therapy is being explored as a way to rebalance immune factors in the eye that could protect against glaucoma. Animal models have shown some success, as in this image of neurons (white), microglia (green), and varied gene expression (multicolored). (Courtesy of Alejandra Bosco, PhD, University of Utah)*

*A BrightFocus-funded team was first to unveil the 3D structure of myocilin, a protein linked to inherited forms of glaucoma, to shed light on how it becomes misshapen through genetic miscoding. (Courtesy of Raquel Lieberman, PhD, Georgia Institute of Technology)*

*Progress is being made in the earliest efforts to "grow" eye cells to restore vision. In one such project, retinal ganglion cells (green) were successfully grown and differentiated from human pluripotent stem cells. (Courtesy of Meyer Lab, Indiana University)*

**Glaucoma is a group of eye diseases that can damage the optic nerve and result in vision loss and blindness. It is the second leading cause of irreversible blindness in the United States and worldwide.**

There are about 80 million people in the world today who have glaucoma, and this number is expected to increase to 111 million by 2040. More than three million Americans live with glaucoma, 2.7 million of whom—aged 40 and older— are affected by its most common type, open-angle glaucoma. In the United States, glaucoma is a leading cause of blindness among African Americans and Hispanics.

Since its inception, National Glaucoma Research (NGR), a BrightFocus Foundation program, has awarded more than \$40 million to support research into the causes and potential prevention and treatment of glaucoma.

NGR funds go to support investigator-initiated projects covering a wide range of scientific approaches to ending glaucoma. There are 42 research projects currently supported by NGR that fall into these broad categories:

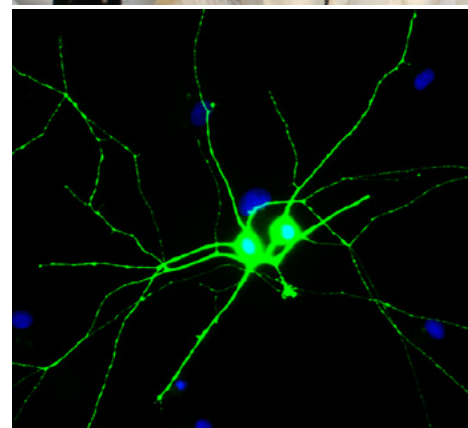
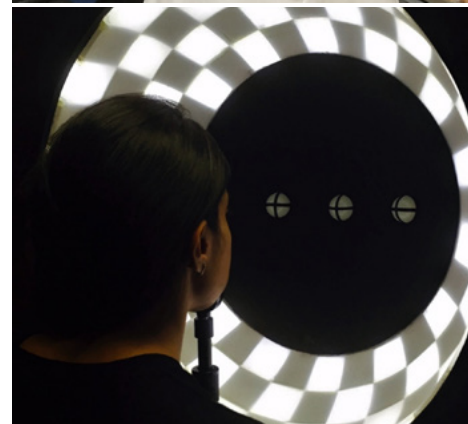
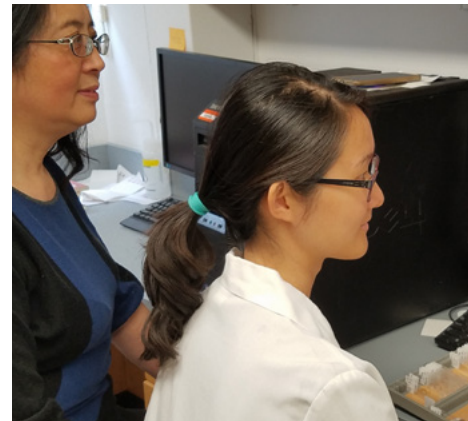
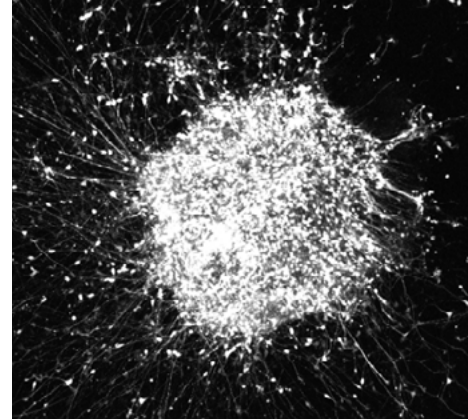
- New Knowledge About What Causes Glaucoma
- New Ways to Predict Progression and Treat Glaucoma
- Controlling Eye Pressure in New Ways
- Imaging and Exploring the Eye-Brain Connection
- Protecting and Regenerating the Optic Nerve

*The scientific images at right were furnished by current NGR grantees and show various aspects of their work. Look inside for a brief description of what's depicted in each image.*

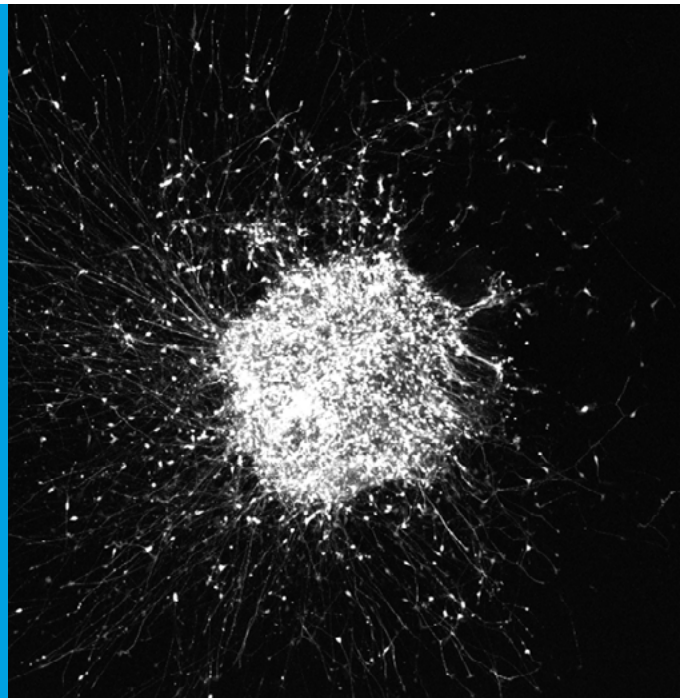
*Co-principal investigator institutions are listed only when they differ from PI institution.*

*Images at right, top to bottom:*

*Courtesy of Robert Johnston, PhD, Johns Hopkins University, Baltimore, MD  
Courtesy of Haiyan Gong, MD, PhD, Boston University School of Medicine, MA  
Courtesy of John Hetling, PhD, University of Illinois at Chicago  
Courtesy of Philip Williams, PhD, Washington University in Saint Louis, MO  
Courtesy of Jason Meyer, PhD, Indiana University, Indianapolis*



# New Knowledge About What Causes Glaucoma



Glaucoma is a group of eye diseases united under one name. Ultimately, glaucoma threatens sight by damaging the optic nerve, at the back of the eye, which carries light signals from the eye to the brain. However, our knowledge of how and when glaucoma damages nerve cells remains imprecise. It's mostly linked to chronic pressure increases inside the eye, referred to as elevated intraocular pressure (IOP), which may be caused by the eye's inability to drain properly. There may be other factors besides IOP

increases that lead to glaucoma. National Glaucoma Research is funding studies on genetics, more sensitive methods to study onset of glaucoma, as well as projects to develop new research models to further understand glaucoma. New understanding will lead to new therapies.

*Above: In a human retinal organoid, or "mini organ" grown in a lab, light-sensing retinal ganglion cells extend thread-like axons to form connections. (Courtesy of Johnston Lab, Johns Hopkins University)*



## **Rouzbeh Amini, PhD**

(7/1/18 - 6/30/21)

*Northeastern University, Boston, MA*

*Co-Principal Investigator: Cyril K. Dorairaj, MD*

*Mayo Clinic, Jacksonville, FL*

## **Detecting Iris Stiffening and Its Significance in Certain Types of Glaucoma**

The main goal of this project is to examine if, why, and how the iris becomes stiffer and consequently becomes abnormally deformed in the eyes of certain groups of patients who suffer from angle-closure glaucoma.

[www.brightfocus.org/grant/G2018177](http://www.brightfocus.org/grant/G2018177)





**Jessica Cooke Bailey, PhD** (7/1/18 - 6/30/21)  
*Case Western Reserve University, Cleveland, OH*  
 Co-Principal Investigator: Jonathan L. Haines, PhD

**Amish Study to Understand Glaucoma Genetics**

With the Genetics of Glaucoma Evaluation in the Amish pilot study (GGLEAM), researchers will study an Amish population concentrated in Holmes County, Ohio, wherein primary open-angle glaucoma is present, with the goal of identifying a novel genetic contributor to this disease.

[www.brightfocus.org/grant/G2018042](http://www.brightfocus.org/grant/G2018042)



**Kathryn Burdon, PhD** (9/1/20 - 8/31/22)  
*University of Tasmania, Australia*  
 Co-Principal Investigator: Girum Gessesse, MD  
*St. Paul's Hospital Millennium Medical College, Ethiopia*

**Genetics of Glaucoma in Africa**

This study will investigate genetics of glaucoma in Ethiopia, expanding our understanding of glaucoma and aiming to make genetic information useful in the diagnosis and management of glaucoma for patients all around the world.

[www.brightfocus.org/grant/G2020293](http://www.brightfocus.org/grant/G2020293)



**John Fingert, MD, PhD** (9/1/20 - 8/31/22)  
*University of Iowa, Iowa City*

**Regulation of APBB2 Gene Expression and How it Influences Risk for Glaucoma**

Researchers in this study have identified a new gene (APBB2, which stands for "amyloid beta precursor protein binding family B member 2") that is the first risk factor for glaucoma that is unique to African American populations and may explain in part why they are at much higher risk for glaucoma than other groups. The current proposal seeks to understand what DNA sequences are responsible for controlling APBB2 gene activity and thus the production of beta amyloid in the retina and risk for glaucoma.

[www.brightfocus.org/grant/G2020119](http://www.brightfocus.org/grant/G2020119)



**F. Kent Hamra, PhD** (7/1/18 - 6/30/21)  
*University of Texas Southwestern Medical Center, Dallas*

**Genetically Engineering a New Animal Model to Find Cures for Glaucoma**

Our project will generate novel visual systems for inventing new glaucoma medicines by genetically engineering an animal model so that their eyes express clinically relevant, heritable human glaucoma-causing genes.

[www.brightfocus.org/grant/G2018080](http://www.brightfocus.org/grant/G2018080)



**Michael Hauser, PhD**  
*Duke University, Durham, NC*

(3/2/21 - 2/8/23)

### **The Genetics of Glaucoma Risk**

Large studies have identified many genes and genetic variants that increase risk of glaucoma, but little is known about the mechanism. The work described in this proposal will examine the levels of these genes in individual cells in the retina, and how genetic variants change those levels. It will provide the basic information that will enable us to understand mechanism and may lead to the development of new treatments for glaucoma. Importantly, this work will follow up new findings in African Americans, a group that is disproportionately affected by glaucoma.

[www.brightfocus.org/grant/G2019357](http://www.brightfocus.org/grant/G2019357)



**Gareth Howell, PhD**  
*The Jackson Laboratory, Bar Harbor, ME*

(9/1/20 - 8/31/22)

### **Determine the Genetic Element on Human Chromosome 9 that Increases the Risk for Glaucoma**

Human genetic studies show glaucoma is caused by a combination of genetic risk factors. However, few specific changes have been determined. This is severely hampering our ability to identify those at risk for developing glaucoma and of developing new treatments. This study aims to determine the specific genetic element in a genomic region that shows one of the strongest associations with glaucoma.

[www.brightfocus.org/grant/G2020254](http://www.brightfocus.org/grant/G2020254)



**Monica Jablonski, PhD**  
*The University of Tennessee, Memphis*

(7/1/18 - 6/30/21)

### **New Glaucoma Models**

This study will identify and characterize new glaucoma models that mimic the human disease more closely. These models will be a very useful resource for all vision scientists.

[www.brightfocus.org/grant/G2018116](http://www.brightfocus.org/grant/G2018116)



**Robert Johnston, PhD** (7/1/19 - 6/30/21)  
*Johns Hopkins University, Baltimore, MD*

### **Growing Human Retina in a Dish to Model Glaucoma**

During glaucoma, the neurons that connect the eye to the brain die, leading to vision loss. In this study, researchers propose to grow human retinas in a dish from adult stem cells to (1) determine what genes are on or off in these critical neurons, (2) develop treatments to increase the number of these neurons, and (3) study how these neurons die and develop ways to prevent their death.

[www.brightfocus.org/grant/G2019300](http://www.brightfocus.org/grant/G2019300)



**Saidas Nair, PhD** (7/1/19 - 6/30/21)  
*University of California, San Francisco*

### **Novel Genetic Model to Study Glaucoma**

Blinding diseases affecting children and young adults are mainly caused by defective genes, which are typically passed on from parent to their children. Our mission is to identify the culprit gene and find out how they act to cause blindness. The completion of this project will help us move forwards towards finding solutions to control and manage the disease.

[www.brightfocus.org/grant/G2019360](http://www.brightfocus.org/grant/G2019360)



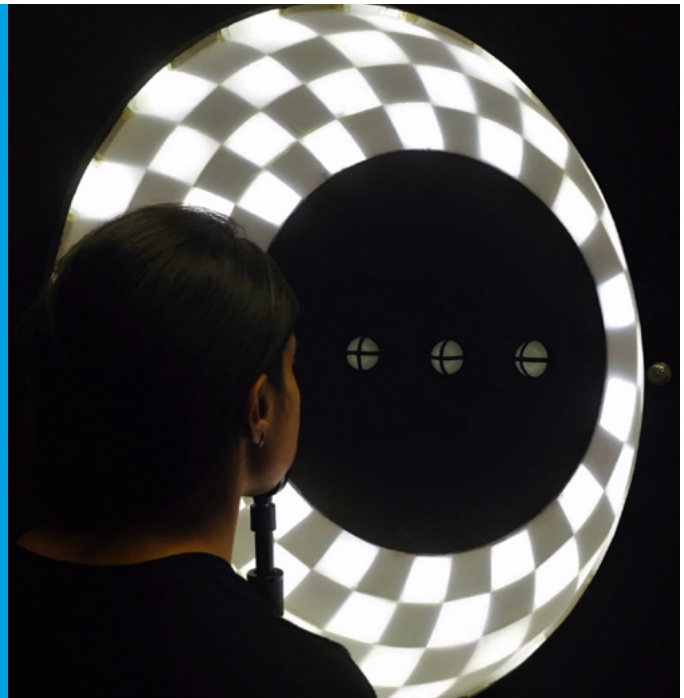
**Alberta Thiadens, MD, PhD** (9/1/20 - 8/31/22)  
*Erasmus Medical Center, Rotterdam, The Netherlands*  
Co-Principal Investigator: Caroline C.W. Klaver, MD, PhD

### **Investigating Risk Factors for Primary Open-Angle Glaucoma in African Descents**

This proposal aims to find the genetic causes for glaucoma in African populations. In addition we will focus on nutritional and environmental influences, and ancestry related anatomical variation of the eye that might explain the higher vulnerability of the optic nerve. This will help us understand why glaucoma is so frequent and severe in persons from African ancestry, provide us with knowledge about the causes of glaucoma, and help create means to cure and prevent this disease.

[www.brightfocus.org/grant/G2020116](http://www.brightfocus.org/grant/G2020116)

# New Ways to Predict Progression and Treat Glaucoma



Currently approved treatments for glaucoma primarily focus on eye pressure. Numerous therapies exist to lower eye pressure effectively; however, the bulk of them (eyedrops and surgeries) require skill and consistency to achieve results. Easier methods are needed, as well as new therapies to address other underlying causes of glaucoma besides intraocular pressure (IOP). National Glaucoma Research grantees are working to develop drugs that will lower eye pressure and protect against nerve cell injury and death, and genome editing approaches to restore

the function of trabecular meshwork (a spongy tissue that drains fluids from the eye). In addition, computerized algorithms are being designed to analyze an assortment of biometric data to better predict and track a patient's risk of progression to vision loss.

*Above: This novel three-dimensional stimulus source, called Peri-Stim (peripheral pattern electroretinogram stimulus source), enables the assessment of retinal ganglion cell health in the peripheral retina. (Courtesy John Hetling, PhD, University of Illinois at Chicago)*



**Suchismita Acharya, PhD**

(7/1/18 - 12/30/20)

University of North Texas Health Science Center, Fort Worth

## A Novel Dual-Active Compound to Treat Glaucoma

This study focuses on discovering multi-functional small molecules that may be used for glaucoma treatment to decrease eye pressure and protect retinal ganglion cells from death.

[www.brightfocus.org/grant/G2018056](http://www.brightfocus.org/grant/G2018056)





**Alejandra Bosco, PhD**  
*University of Utah, Salt Lake City*

(7/1/19 - 6/30/21)

### **Complement-Targeted Therapy to Prevent Glaucoma Progression**

Researchers in this study have developed a new potential treatment that rebalances immune responses and controls glaucoma in old mice, and the goal of this study is to define if it may cure patients by testing it in several experimental models. Furthermore, the interaction between the dying or surviving neurons and the complement signaling will be studied.

[www.brightfocus.org/grant/G2019219](http://www.brightfocus.org/grant/G2019219)

*Recipient of the Thomas R. Lee Award for Glaucoma Research.*



**Karen Curtin, PhD**  
*University of Utah, Salt Lake City*

(9/1/20 - 8/31/22)

Co-Principal Investigator: Barbara M. Wiostko, MD

### **Preventing Vision Loss by Predicting and Treating Exfoliation Syndrome Earlier in Patients**

From researching thousands of medical records of exfoliation syndrome patients to find the clinical conditions and personal characteristics that correlate with changes in their eyes over time, this study will provide direction to doctors who care for these patients and help prevent or delay vision loss from glaucoma through earlier medical treatment.

[www.brightfocus.org/grant/G2020317](http://www.brightfocus.org/grant/G2020317)



**Meredith Gregory-Ksander, PhD**  
*Massachusetts Eye and Ear, and Harvard Medical School, Boston*  
Co-Principal Investigator: Kip M. Connor, PhD

(7/1/19 - 6/30/21)

### **Targeting the Immune System to Prevent Glaucoma**

The researchers in this study have identified an important component of the immune system that becomes dysregulated early in glaucoma and, in this project, they will determine the efficacy of targeting this pathway as a novel treatment approach in glaucoma.

[www.brightfocus.org/grant/G2019340](http://www.brightfocus.org/grant/G2019340)

*Recipient of the Dr. Douglas H. Johnson Award for Glaucoma Research.*



**John Hetling, PhD**

(7/1/19 - 6/30/21)

*University of Illinois at Chicago*

Co-Principal Investigators: Thasarat Vajaranant, MD and Jason McAnany, PhD

**A New Method for Diagnosing Glaucoma in the Peripheral Retina**

Early glaucoma can affect central vision or peripheral vision, so both areas of vision should be tested. Currently, the best objective test for glaucoma evaluates only central vision and researchers in this study have developed a test to evaluate also the peripheral vision. The goal of this project is to perform the central vision and peripheral vision tests to a group of glaucoma patients, to show that the new peripheral vision test helps in the early diagnosis of the disease.

[www.brightfocus.org/grant/G2019356](http://www.brightfocus.org/grant/G2019356)



**Biji Mathew, PhD**

(7/1/18 -6/30/21)

*University of Illinois at Chicago*

**Novel Cell-Free Treatment of Glaucoma**

The objective is to study the use of extracellular vesicles, tiny particles secreted by adult stem cells, as a treatment for glaucoma-induced retinal cell death.

[www.brightfocus.org/grant/G2018168](http://www.brightfocus.org/grant/G2018168)



**Amanda Melin, PhD**

(3/1/21 - 2/28/23)

*University of Calgary, Canada*

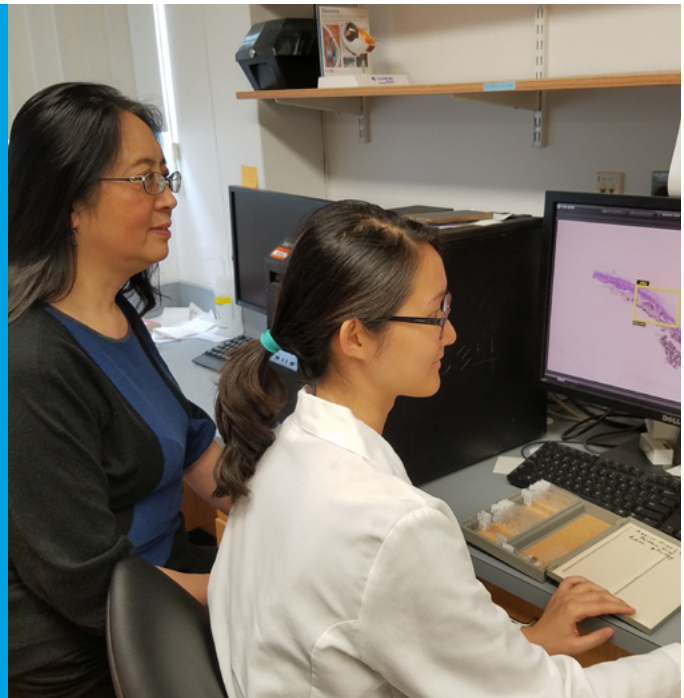
Co-Principal Investigator: James Higham, PhD  
*New York University*

**Insights into a Naturally Occurring Glaucoma Model**

By leveraging access to a large, existing sample of eye tissues, this study proposes to examine genes expressed, their sequences, and the metabolites that are present in individuals with and without naturally-occurring glaucoma-like phenotypes in a closely related animal model. These data have large promise to guide genetic screening panels used in diagnosis and prognosis of glaucoma in humans, and to identify molecules in our blood that can be used for early detection and treatment.

[www.brightfocus.org/grant/G2020047](http://www.brightfocus.org/grant/G2020047)

# Controlling Eye Pressure in New Ways



Elevated eye pressure, or intraocular pressure (IOP), is present in most forms of glaucoma. This can happen when the fluid that constantly bathes the front of the eye, called aqueous humor, gets backed up. Normally it drains through a spongy tissue known as the trabecular meshwork, which is the eye's main drainage channel. The trabecular meshwork offers a certain resistance to the outflow of aqueous humor that is needed to maintain a steady-state eye pressure. In addition, eye pressure can be affected by fluid volume,

and by other factors such as trabecular meshwork stiffness, which is reported to be 20 times higher in individuals with glaucoma than in normal eyes. National Glaucoma Research-funded grantees are unraveling novel mechanisms that regulate eye pressure and are looking for new ways to decrease stiffness and control eye pressure.

*Above: Dr. Haiyan Gong and postdoctoral associate Ruiyi Ren, PhD, examine trabecular meshwork using a transmission electron microscope. (Courtesy Haiyan Gong, MD, PhD, Boston University School of Medicine, MA)*



**Haiyan Gong, MD, PhD** (7/1/19 - 6/30/21)  
*Boston University School of Medicine, MA*

## The Role of Thrombospondin-1 in Regulating Eye Pressure

The proposed research will investigate the mechanisms responsible for regulating the drainage of aqueous humor, by specifically studying an important targeting site along the drainage pathway, the trabecular meshwork. The findings may lead to novel treatments or preventative measures for glaucoma.

[www.brightfocus.org/grant/G2019295](http://www.brightfocus.org/grant/G2019295)



**Chan Young Park, PhD**

(7/1/19 - 6/30/21)

Harvard T.H. Chan School of Public Health, Boston, MA

### Small Molecular Compounds for Glaucoma Therapy

The fluid in glaucoma patients' eyes has a higher concentration of a chemical than the fluid in healthy eyes. This chemical, a growth factor, transforms tissues to be stiffer which is known to increase the chance of glaucoma. This study proposes to test a new drug (called "remodilins") to see if it can make those stiffened tissues go back to a softer state.

[www.brightfocus.org/grant/G2019179](http://www.brightfocus.org/grant/G2019179)

## Imaging and Exploring the Eye-Brain Connection



Eye changes associated with glaucoma contribute to tiny blind spots, known as "visual field defects," which, if they worsen, might advance to vision loss and blindness. The chance of that, and the speed at which it happens, vary greatly from person to person. Early diagnosis is key, and much progress has been made in imaging the eye to detect the tiniest changes that may precede glaucoma. National Glaucoma Research grantees are developing and using new technologies to look at individual retinal ganglion cells (RGCs) of the eye and their nerve fibers, which carry light signals to the brain. It's

challenging because RGCs are nearly transparent and very difficult to image. They are also using new techniques to detect changes to synapses, or connections between cells, and observe the energy regulation in the RGCs. The contribution of cerebrospinal fluid and other mechanisms is also being explored to better understand the eye-brain connection. This exploration may result in earlier detection and new ways to treat glaucoma.

*Above: Dr. Philip Williams in the lab capturing images of retinal ganglion cells. (Courtesy Philip Williams, PhD, Washington University in Saint Louis, MO)*





**Kevin Chan, PhD** (7/1/19 - 6/30/21)  
*New York University School of Medicine, NY*

### **The Role of Brain Waste Clearance Pathway in Glaucoma**

This study will determine the cerebrospinal fluid dynamics along the optic nerve, and the corresponding visual system impairments, using advanced, multi-parametric magnetic resonance imaging in animal models.

[www.brightfocus.org/grant/G2019103](http://www.brightfocus.org/grant/G2019103)

*Recipient of the Thomas R. Lee Award for Glaucoma Research.*



**Yali Jia, PhD** (9/1/20 - 8/31/22)  
*Oregon Health and Science University, Portland*  
Co-Principal Investigator: Shaohua Pi, PhD

### **A Novel Tool for Seeing Neuron Cells in Eyes with Glaucoma**

This study proposes to improve the current state-of-the-art ocular imaging systems using optical tools originally developed for astronomy. This will enhance image quality so that even individual cells in the eye can be clearly seen. The goal of this study is to image glaucoma models using this instrument in order to discover new and improved indicators of glaucoma progression and help understand the nature of the disease.

[www.brightfocus.org/grant/G2020168](http://www.brightfocus.org/grant/G2020168)



**Jason Porter, PhD** (7/1/18 - 6/30/21)  
*University of Houston, TX*

### **A New Method to Detect Glaucoma by Examining Changes in Blood Vessels in the Eye**

This project proposes to use high-resolution in vivo imaging to better clarify changes in the capillaries and optic nerve head in relation to neuronal damage in eyes of animal models with experimental glaucoma. The results of the proposed work may aid in earlier diagnosis and management of this disease.

[www.brightfocus.org/grant/G2018061](http://www.brightfocus.org/grant/G2018061)



**Gareth Thomas, PhD** (7/1/19 - 6/30/21)  
*Temple University, Philadelphia, PA*

### **Protecting Eye-Brain Connections in Glaucoma**

In glaucoma, there is damage to the eye-brain connection caused by activation of "executioner" proteins that cause the connections to degenerate, and loss of "survival" proteins that normally protect the connections. There is evidence that important executioner and survival proteins are modified with a sticky, fatty tag and this study will determine the importance of this "tagging" process for the damage seen in glaucoma.

[www.brightfocus.org/grant/G2019267](http://www.brightfocus.org/grant/G2019267)





**Philip Williams, PhD**

(9/1/20 - 8/31/22)

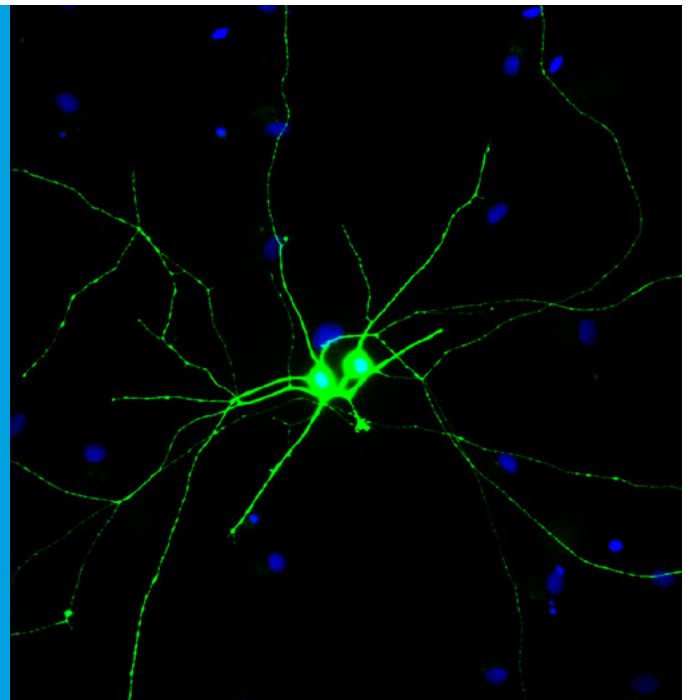
Washington University in Saint Louis, MO

## Direct Observation and Manipulation of Energy Regulation in RGCs During Glaucoma

Many RGCs die during the course of glaucoma, and yet some cells persist despite the harsh disease environment. This study will determine how these RGCs survive by directly observing their energy characteristics over the course of a disease in a model system. This information will be used to reprogram the energetic state of RGCs to attempt their rescue in conditions of glaucoma.

[www.brightfocus.org/grant/G2020255](http://www.brightfocus.org/grant/G2020255)

# Protecting and Regenerating the Optic Nerve



Unlike most cells in the body, which repair themselves, the nerve cells providing our vision don't regrow once damaged. National Glaucoma Research is supporting research into ways of protecting cells threatened by advancing glaucoma and regenerating those cells after vision loss. The biggest focus of these efforts is to replace and reconnect retinal ganglion cells (RGCs), nerve cells which make

up the optic nerve and carry visual signals over long tails (axons) extending from the eye to the brain. This is a sophisticated undertaking, given how RGCs are wired into the brain.

*Above: In early experiments aimed at restoring sight, lab-grown retinal ganglion cells (green) differentiate from human pluripotent stem cells. (Courtesy of Jason Meyer, PhD, Indiana University, Indianapolis)*



**Petr Baranov, MD, PhD**

(9/1/20 - 8/31/22)

*Schepens Eye Research Institute/Massachusetts Eye and Ear and Harvard Medical School, Boston*

### **Cell Replacement in Glaucoma: Making Mature RGCs**

This proposal aims to improve the adult donor stem cell-derived RGCs to make them differentiate to become closer to the “real” RGCs. That should significantly increase the transplantation success, leading to development of potential therapy.

[www.brightfocus.org/grant/G2020231](http://www.brightfocus.org/grant/G2020231)



**Jeffrey Boatright, PhD**

(9/1/20 - 8/31/22)

*Emory University, Atlanta, GA*

Co-Principal Investigator: Ying Li, MD, PhD

### **A Dietary Supplement in Treatment of Glaucoma**

Mitochondria are the energy factories of cells. The mitochondria of RGCs lose function with age, probably due to age-related loss of nicotinamide adenine dinucleotide (NAD<sup>+</sup>), an enzyme cofactor needed for energy production, making the cells more susceptible to damage. The goal of this study is to test whether systemic delivery of the NAD<sup>+</sup> precursor nicotinamide riboside, a dietary supplement, increases retinal NAD<sup>+</sup> and protects RGCs in glaucoma models.

[www.brightfocus.org/grant/G2020286](http://www.brightfocus.org/grant/G2020286)



**Kin-Sang Cho, PhD**

(9/1/20 - 8/31/22)

*Schepens Eye Research Institute/Massachusetts Eye and Ear and Harvard Medical School, Boston*

### **A Novel Use of Specialized Pro-Resolvin Mediators to Treat Glaucoma**

Microglial activation has been known as an early responsive immune cell in glaucoma disease among various immune cells. This proposal will investigate the role of docosahexaenoic acid (DHA)-derived anti-inflammatory pro-resolvins as mediators in suppressing microglial activation, promoting neuronal survival and vision in mouse models of glaucoma.

[www.brightfocus.org/grant/G2020333](http://www.brightfocus.org/grant/G2020333)



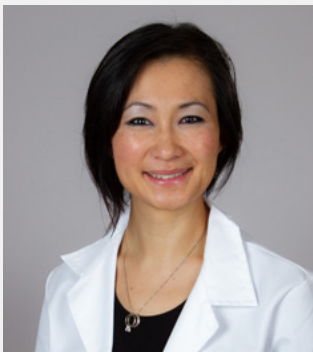
**Eldon Geisert, PhD**  
Emory University, Atlanta, GA

(7/1/19 - 6/30/21)

### **Making Optic Nerve Regeneration Faster**

For the adult optic nerve to regenerate in humans, the regenerating axons must travel a considerably longer distance. The goal of this study is to use a mouse model developed by this group that will make it possible to identify genes that increase the number of regenerating axons by at least four times and the distance the axons grow by at least three times.

[www.brightfocus.org/grant/G2019111](http://www.brightfocus.org/grant/G2019111)



**Kimberly Gokoffski, MD, PhD**  
University of Southern California Roski Eye Institute, Los Angeles

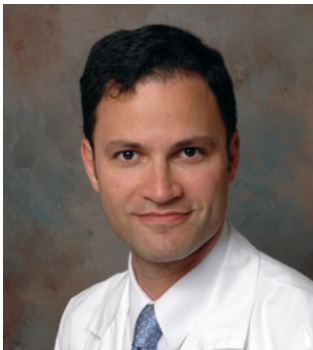
(9/1/20 - 8/31/22)

### **Using Electric Fields To Regenerate the Optic Nerve**

This project employs an innovative technology that uses electrical stimulation to direct neuron growth so that healthy neurons that have been injected into diseased eyes may form new connections with the brain and thereby restore vision.

[www.brightfocus.org/grant/G2020331](http://www.brightfocus.org/grant/G2020331)

*Recipient of the Dr. Douglas H. Johnson Award for Glaucoma Research.*



**Jeffrey Goldberg, MD, PhD**  
Stanford University, CA

(7/1/15 - 12/31/20)

### **Neuroregenerative Strategies in Glaucoma**

Dr. Goldberg is conducting a phase 2 clinical trial where he will implant into the eye a tiny device, called NT-501 encapsulated cell therapy (NT-501 ECT). The NT-501 ECT contains cells designed to deliver a steady stream of a growth factor, called ciliary neurotrophic factor (CNTF), to test whether it can protect against damage to the optic nerve, and, possibly, enhance visual function in patients with glaucoma.

[www.brightfocus.org/grant/C2015201](http://www.brightfocus.org/grant/C2015201)

*This clinical trial is made possible in part by support from the Barry Friedberg and Charlotte Moss Family Foundation.*



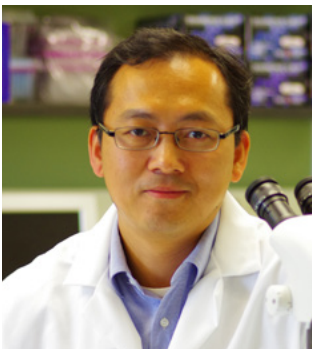
**Jeffrey Gross, PhD**  
*University of Pittsburgh, PA*

(9/1/20 - 8/31/22)

### **Identifying Factors that Protect Ganglion Cells from Death After Optic Nerve Injury**

Experiments in this proposal utilize the zebrafish as a model system, leveraging its unique biology whereby RGCs do not die when their axons are damaged, even in extreme cases when the optic nerve is completely severed. By understanding how zebrafish RGCs survive after axonal damage, this team will uncover novel modes of neuroprotection that could ultimately be translated into new targets for neuroprotection to preserve RGCs in glaucoma patients.

[www.brightfocus.org/grant/G2020277](http://www.brightfocus.org/grant/G2020277)



**Yang Hu, MD, PhD**  
*Stanford University, CA*

(7/1/18 - 6/30/21)

### **Studying Gene Regulation Networks in Retinal Ganglion Cells for Novel Neuroprotective Targets**

This study takes advantage of newly developed genetic tools to survey gene expression and epigenetic regulatory elements (heritable genetic changes that turn genes on or off) that are associated with RGCs at normal function, under disease, or after treatment. Through this effort, researchers in this study will create a comprehensive gene regulatory network blueprint to develop novel neuroprotectants for glaucoma.

[www.brightfocus.org/grant/G2018183](http://www.brightfocus.org/grant/G2018183)



**Richard Libby, PhD**  
*University of Rochester Medical Center, NY*

(9/1/20 - 8/31/22)

### **Defining the Importance of Extrinsic Signaling in Glaucoma Neurodegeneration**

This work explores the importance of extrinsic signalling in glaucomatous neurodegeneration. It builds on the work of many groups who have proposed that after an ocular hypertensive injury, glial cells (cells that support retinal neurons) transition from being helpful to being toxic to RGCs. Specifically, this study proposes to test the importance of three molecules thought to turn glial cells neurotoxic after a glaucomatous injury.

[www.brightfocus.org/grant/G2020095](http://www.brightfocus.org/grant/G2020095)

*Recipient of the Thomas R. Lee Award for Glaucoma Research.*



**Jason Meyer, PhD**  
*Indiana University, Indianapolis*

(9/1/20 - 8/31/22)

### **Astrocytes Regulate the Health and Degeneration of RGC in Glaucoma Neurodegeneration**

Astrocytes are known to play vital roles in the maintenance of RGCs, with these interactions adversely affected in glaucoma. The use of human pluripotent stem cells allows for the precise modeling of these interactions in a dish, providing the spatial and temporal resolution to closely examine how astrocyte function is changed in these cells as a result of glaucoma, as well as how these changes in astrocyte alter the health and function of RGCs as a whole.

[www.brightfocus.org/grant/G2020369](http://www.brightfocus.org/grant/G2020369)



**Jeff Mumm, PhD**  
*Wilmer Eye Institute, Johns Hopkins University, Baltimore, MD*

(9/1/20 - 8/31/22)

### **A Novel Model for Replacing Lost Cells and Restoring Vision in Glaucoma Patients**

Although humans do not normally regenerate lost RGCs, our eyes do retain a capacity to produce new neurons, suggesting an untapped potential for RGC regeneration. Unlike us, zebrafish have a natural ability to replace lost cells in the retina, including RGCs. By studying how zebrafish are able to naturally regenerate RGCs, we hope to 1) identify genes and pathways that are important for stimulating the eye's ability to repair itself and 2) apply this knowledge toward the development of transformative regenerative therapies for glaucoma patients.

[www.brightfocus.org/grant/G2020315](http://www.brightfocus.org/grant/G2020315)



**Robert W. Nickells, PhD**  
*University of Wisconsin-Madison*

(7/1/18 - 06/30/21)

### **A Study to Define the Link between Cell Adhesion and Retinal Ganglion Cell Death**

Cells living in a complex tissue are most healthy when they make and retain contacts with other cells, and to the extracellular environment. The goal of this research is to determine if loss of cell-to-cell, and/or cell-to-surface, contacts by RGCs stimulates the biological pathway leading to their death after damage to the optic nerve.

[www.brightfocus.org/grant/G2018166](http://www.brightfocus.org/grant/G2018166)





**Trent Watkins, PhD**

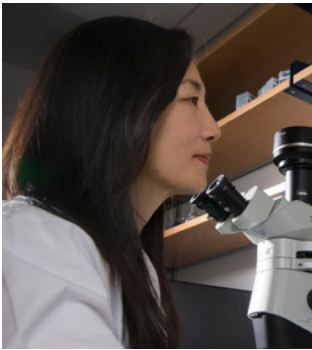
(7/1/19 - 6/30/21)

*Baylor College of Medicine, Houston, TX*

### **Stimulating the Natural Repair Programs of Ganglion Cells for the Preservation of Restoration of Vision**

This proposal aims to understand how the natural repair processes in the eye switch from providing hope for recovery to further contributing to the permanent loss of vision. Appropriate modulation of these processes may protect against neuronal loss and even contribute to the restoration of vision.

[www.brightfocus.org/grant/G2019332](http://www.brightfocus.org/grant/G2019332)



**Sarah Zhang, MD**

(7/1/19 - 6/30/21)

*State University of New York at Buffalo*

### **Targeting Inflammatory Cells to Treat Glaucoma**

The proposed research studies a novel protein that was recently identified as a key regulator of macrophages, a type of immune cell that are activated during glaucoma. Using genetic tools and animal models, the study will explore how this protein regulates macrophage activation and inflammation in the retina of glaucoma eyes. Furthermore, the study will develop a novel therapy using small vesicles secreted from bone marrow stem cells to manipulate macrophage behavior and protect retinal neurons in glaucoma.

[www.brightfocus.org/grant/G2019302](http://www.brightfocus.org/grant/G2019302)



**Siamak Yousefi, PhD**

(9/1/20 - 8/31/22)

*University of Tennessee, Memphis*

### **Identifying Which Retinal Ganglion Cell Types Die Earlier in Glaucoma**

This study aims to develop artificial intelligence (AI) approaches to identify RGC subtypes that are more susceptible to glaucoma-induced insult. Results from this study could advance our understanding of the genetic basis for glaucoma-induced RGC cell death and possible therapeutic interventions.

[www.brightfocus.org/grant/G2020374](http://www.brightfocus.org/grant/G2020374)



## Programs

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