Across the Research Spectrum

Expanding Our Innovative 360° Approach

2022 National Glaucoma Research Projects

BrightFocus® Foundation | **National Glaucoma Research**

National Glaucoma Research

We're Funding
60 Projects
Worldwide This Year.

Inside

Glaucoma, a group of eye diseases that can damage the optic nerve and result in vision loss and blindness, has gained a reputation as the silent thief of sight.

It has very few symptoms and will steadily damage sight, beginning with the peripheral vision needed for navigating safely and driving, if left untreated.

Glaucoma is the most common cause of irreversible blindness in the United States and worldwide.
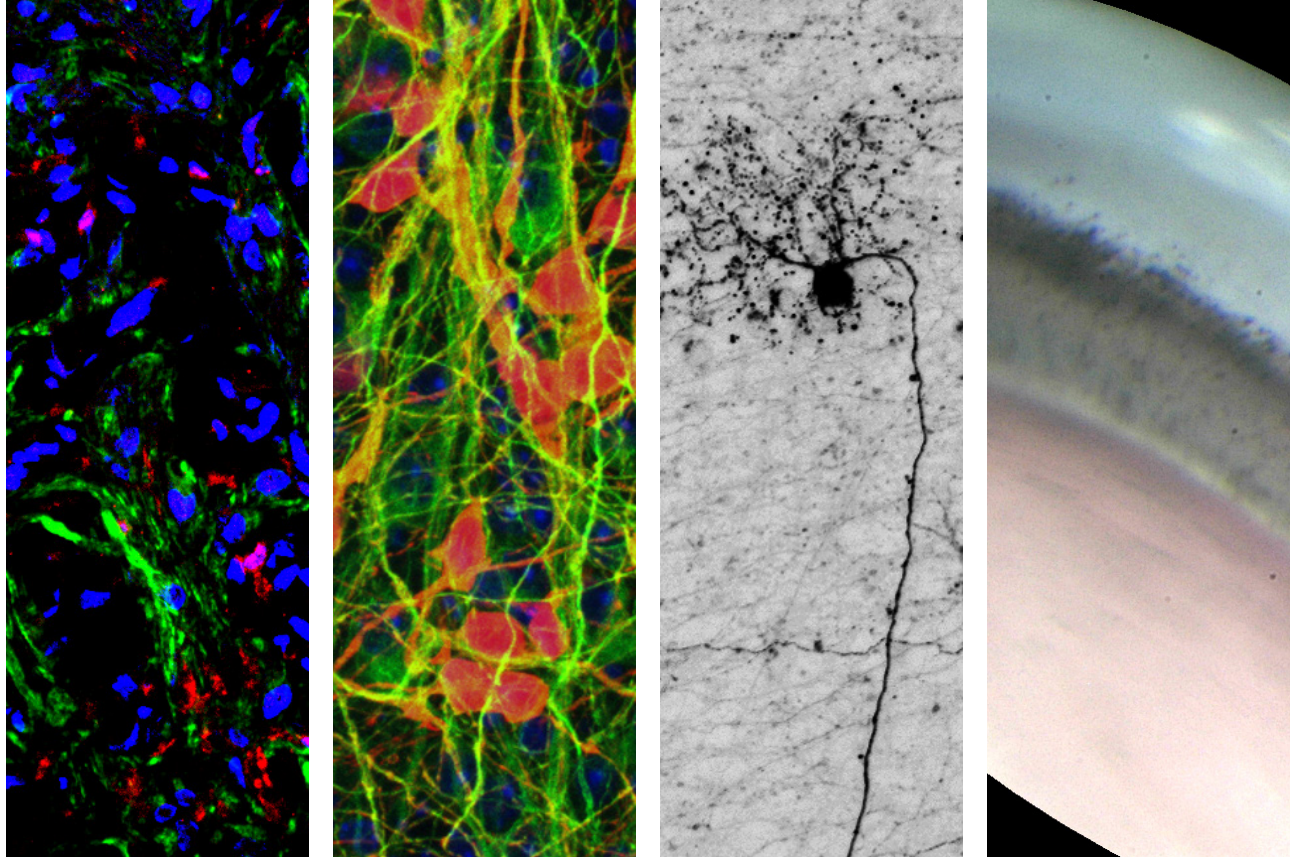
Left to right: Page 9, Page 18, Page 24, Page 4.

An estimated 80 million people in the world today have glaucoma, with 111 million projected to have it by 2040.

In the United States, where the disease disproportionately affects and is a leading cause of blindness among African American and Latino communities, more than three million people live with glaucoma.

There is currently no clear, widely accepted understanding of the causes of glaucoma. BrightFocus Foundation, through its National Glaucoma Research (NGR) program, is one of the world's leading nonprofit funders of glaucoma research, having supported nearly $47 million in scientific grants exploring the root causes of and prevention strategies and treatments to end glaucoma.

Our glaucoma researchers are advancing newer imaging techniques and strategies for early detection, exploring exercise to slow vision loss, and finding new ways to control eye pressure—taking a 360-degree approach to ending this disease.

As of July 15, 2022, we have awarded 60 glaucoma research projects around the globe.

Cover: *The flow of blood and oxygen delivery is being studied in glaucoma. This model shows oxygen levels surrounding the optic nerve. Photo courtesy of Yi Hua, PhD, University of Pittsburgh.*

Note: *Co-principal investigator and fellowship mentor institutions are listed if different from the PI.*

Controlling Eye Pressure in New Ways
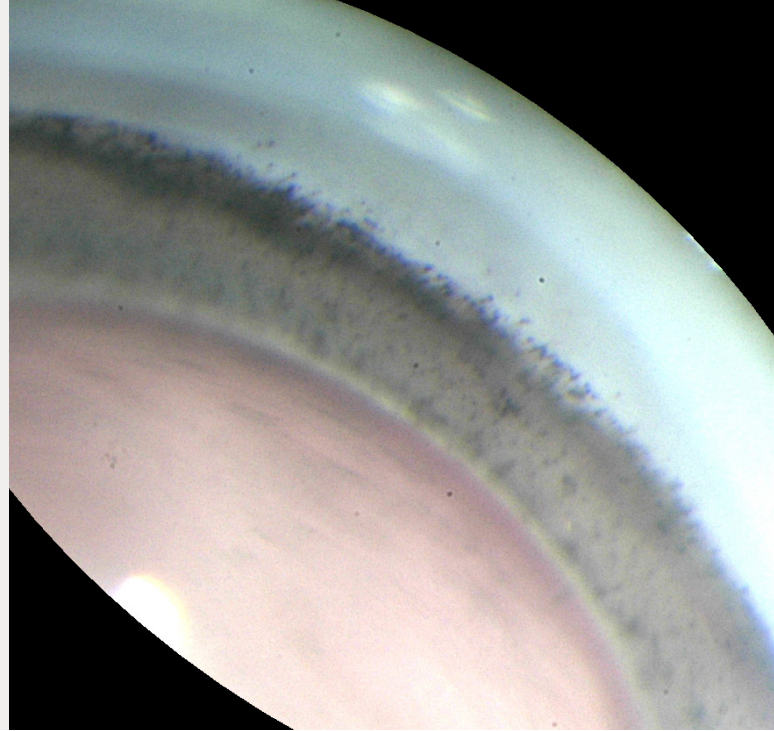
Elevated eye pressure, or intraocular pressure (IOP), exists in most forms of glaucoma and can occur when aqueous humor, the fluid that constantly bathes the front of the eye, cannot drain properly.

Normally aqueous humor drains through a spongy tissue known as the trabecular meshwork and flows into Schlemm's canal (SC), a ring-like passageway that then delivers it to the blood stream.

Blockages and other forms of resistance to the outflow of aqueous humor can raise eye pressure.

In addition, eye pressure can be affected by fluid volume and other factors such as trabecular meshwork stiffness, which is reported to be 20 times higher in glaucoma than in healthy eyes.

With critical NGR funding, grantees are unraveling novel mechanisms that regulate eye pressure and are exploring new ways to decrease stiffness and control eye pressure.

Above: Image of mouse eye-drainage tissues injected with pigment, which also acts like a tracer of outflow. Photo courtesy of Michael G. Anderson, PhD, University of Iowa.

The Role of Podosomes in Regulating Eye Pressure

Michael G. Anderson, PhD | 7/1/22 – 6/30/24
University of Iowa

This study will test the role of podosomes, small fingerlike protrusions of cells, and their effect on eye pressure. This work will lead to important information about the cell biology of glaucoma, perhaps identifying the precise molecular location of outflow resistance, and may point to compounds altering podosomes as potential new glaucoma therapies.

www.brightfocus.org/grant/G2022017S
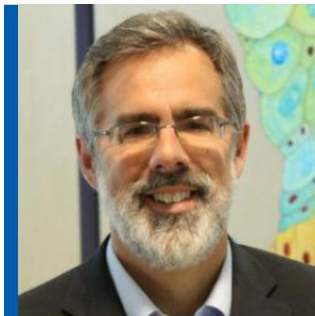
Next-Generation Glaucoma Drugs to Selectively Release the Pressure-Building Block in Schlemm's Canal

C. Ross Ethier, PhD | 3/31/21 – 2/29/24
Georgia Tech Research Corporation

We now understand that endothelial cells of the inner wall of Schlemm's canal (SC) play a key role in homeostatic control mechanisms that maintain IOP within a target range. The long-term goal of this project is to develop novel therapies that directly target SC cells to improve IOP control. These targeted therapies will be highly effective due to their specificity and will thus greatly benefit glaucoma patients.

www.brightfocus.org/grant/CG2020001

Part A of Joint Research Award for a collaborative interinstitutional grant.

The Role of Thrombospondin-1 in Regulating Eye Pressure

Haiyan Gong, MD, PhD | 7/1/19 – 7/30/22
Boston University

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 preventive measures for glaucoma.

www.brightfocus.org/grant/G2019295

Study of Segmental Aqueous Outflow in Uveal Drainage Pathway

Haiyan Gong, MD, PhD | 7/1/22 – 6/30/24
Boston University | Co-Principal Investigator: Carol Toris, PhD, University of Nebraska Medical Center

Uveal outflow, one of two routes for fluid drainage from the eye, plays a role in maintaining normal pressure inside the eye (IOP). Prostaglandin analogue drugs lower IOP in glaucoma by increasing uveal outflow. Recent studies by this group have found that uveal outflow is segmental, or nonuniform, around the eye, though it is unclear what factors regulate it. This study aims to further investigate segmental uveal outflow and the factors that may regulate it.

www.brightfocus.org/grant/G2022013S

Novel Gene-Therapy Approach for Glaucoma

Simon John, PhD | 3/31/21 – 2/29/24
Columbia University | Co-Principal Investigator: Krish Kizhatil, PhD, The Jackson Laboratory

The project aims to develop and test resources for Schlemm's canal–specific targeting and expression of genes for gene therapy. Successful development of this targeted therapy will help control eye pressure more effectively and provide better treatment options for glaucoma patients.

www.brightfocus.org/grant/CG2020004

Part D of Joint Research Award for a collaborative interinstitutional grant.

Developing New Drugs to Lower Eye Pressure in Glaucoma

Darryl Overby, PhD | 3/31/21 – 2/29/24
Imperial College London (UK)
Co-Principal Investigator: Joseph M. Sherwood, PhD

Our research has identified a particular cell type (Schlemm's canal cells) that regulates eye pressure by controlling the drainage of aqueous humor from the eye. In this project, we will develop and apply novel screening technologies to identify new drugs to lower eye pressure by improving aqueous humor drainage across Schlemm's canal cells.

www.brightfocus.org/grant/CG2020003

Part C of Joint Research Award for a collaborative interinstitutional grant.

Small Molecular Compounds for Glaucoma Therapy

Chan Young Park, PhD | 7/1/19 – 3/31/23
Harvard T.H. Chan School of Public Health

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 remodilins, a new drug, to see if it can make those stiffened tissues go back to a softer state.

www.brightfocus.org/grant/G2019179

Potential Role for New Sensors of Elevated Eye Pressure in Models of Glaucoma

Michael Reber, PhD | 7/1/21 – 6/30/23
University Health Network (CANADA)

This study looks into a new set of pressure sensor molecules discovered in 2010. In mammals, the Piezo1 and 2 receptors expressed by retinal ganglion cells (RGCs) are sensing eye pressure. In this project, researchers want to investigate further Piezo1 and 2 receptors' role in sensing eye pressure in an animal model of glaucoma using pharmacological and genetic approaches and measure the effect on RGC death.

www.brightfocus.org/grant/G2021014S

Mechanisms Controlling Aqueous Humor Drainage in Mice

Ester Reina-Torres, PhD | 7/1/21 – 6/30/23
Imperial College of Science, Technology and Medicine (UK)
Fellowship Mentors: Darryl Overby, PhD & William Daniel Stamer, PhD, Duke University

This project will help us understand aqueous humor drainage better, which would help us develop more effective drugs to lower eye pressure and treat glaucoma.

www.brightfocus.org/grant/G2021004F
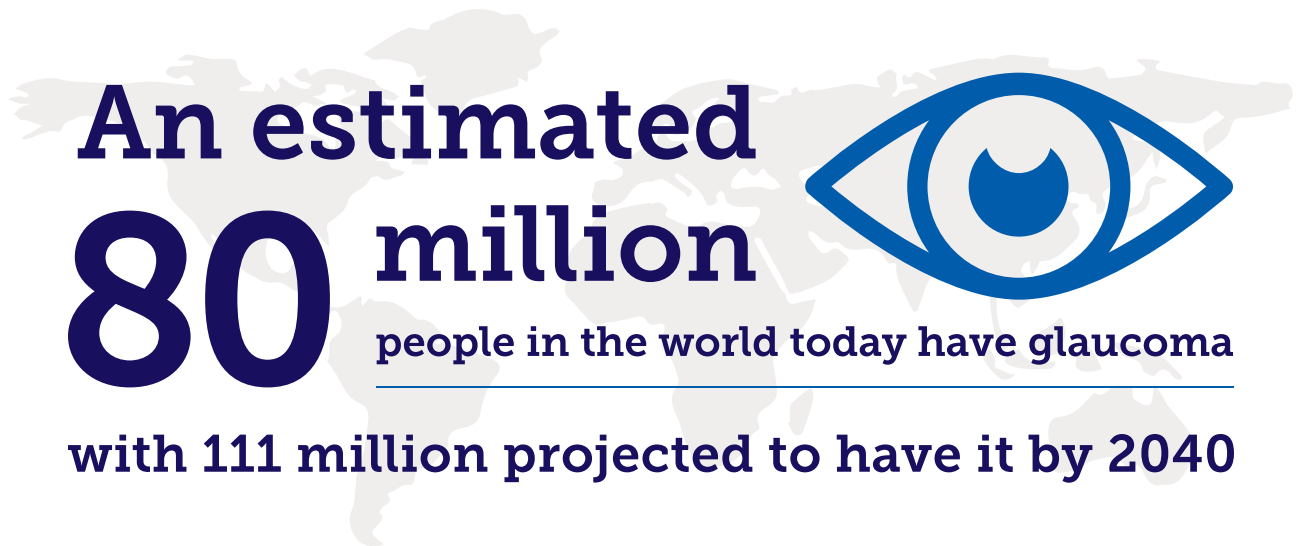
Next-Generation Glaucoma Drug Development

W. Daniel Stamer, PhD | 3/31/21 – 2/29/24
Duke University

For the project, we will screen candidate adeno-associated viruses and engineered promoters cloned into lentiviruses obtained from collaborators in human Schlemm's canal cells in vitro and anterior segments ex vivo for selective tropism to/activity in trabecular meshwork versus Schlemm's canal.
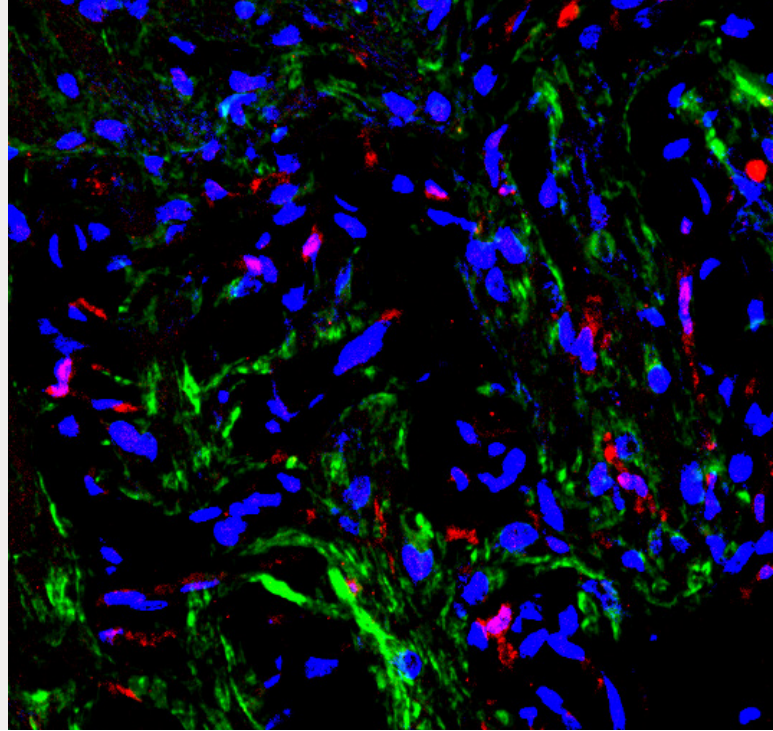
www.brightfocus.org/grant/CG2020002

Part B of Joint Research Award for a collaborative interinstitutional grant.

An estimated
80 million

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with 111 million projected to have it by 2040

Understanding 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. Other factors may also lead to glaucoma.

NGR is funding studies on genetics—including racial disparities in incidence and onset, more sensitive methods to study disease onset, and projects to develop new research models—to promote better understanding of glaucoma, which will lead to new therapies.

Above: The optic nerve head section from a glaucoma eye of a nonhuman primate. Photo courtesy of Hongli Yang, PhD, Good Samaritan Foundation, Legacy Health System.

Detecting Iris Stiffening and Its Significance in Certain Types of Glaucoma

Rouzbeh Amini, PhD | 7/1/18 – 12/31/22
Northeastern University | Co-Principal Investigator: Syril K. Dorairaj, MD, Mayo Clinic Jacksonville

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

Mechanisms of Angle Development and Glaucoma

Revathi Balasubramanian, PhD | 7/1/21 – 6/30/23
Columbia University Irving Medical Center

In several cases of glaucoma and especially early-onset glaucoma, drainage structures that regulate eye pressure are affected. To address this, we need to understand the genetics of drainage structure development. We have developed a mouse model of early-onset glaucoma. Using this newly developed mouse model of early-onset glaucoma and modern imaging methods, researchers will determine how drainage structures develop and the mechanism through which abnormalities in drainage tissue contribute to glaucoma.

www.brightfocus.org/grant/G2021007S

Genetics of Glaucoma in Africa

Kathryn Burdon, PhD | 9/1/20 – 8/31/23
University of Tasmania (AUSTRALIA) | Co-Principal Investigator: Girum Gessesse, MD, St. Paul's Hospital Millennium Medical College (ETHIOPIA)

This study will investigate the 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 around the world.

www.brightfocus.org/grant/G2020293

Deciphering the Local Effect of Glaucoma Risk Factors on Axonal Mitochondria

Romain Cartoni, PhD | 7/1/21 – 6/30/23
Duke University Medical Center

Mitochondria, an intracellular organelle responsible for key cellular processes such as energy production and programmed cell death regulation, are impaired in retinal ganglion cells (RGCs) affected by glaucoma. This study will uncover regulators of mitochondrial functions involved in glaucomatous conditions that may constitute novel therapeutic targets.

www.brightfocus.org/grant/G2021008S

A recipient of the Thomas R. Lee Award for Glaucoma Research.

Regulation of APBB2 Gene Expression and How It Influences Risk for Glaucoma

John Fingert, MD, PhD | 9/1/20 – 8/31/22
University of Iowa

Researchers in this study have identified a new gene (APBB2) 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 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

Artificial Intelligence Approaches to Better Understand Genetic Contributions

Puya Gharahkhani, PhD | 7/1/21 – 6/30/23
The Council of the Queensland Institute of Medical Research (AUSTRALIA) | Co-Principal Investigators: Stuart MacGregor, PhD & Alex W. Hewitt, PhD, Menzies Research Institute Tasmania; Maciej Trzaskowski, PhD, Max Kelsen; David Mackey, MD, University of Tasmania; Jamie E. Craig, PhD, Flinders Medical Centre

In this study, researchers propose applying artificial intelligence (AI) approaches to identify the genes contributing to optic nerve damage and any trends in nerve damage over time. They will investigate whether these genes are targeted by existing approved drugs (used for the treatment of the other diseases), as this provides an avenue to develop novel accessible treatments for glaucoma blindness aimed at preventing optic nerve damage.

www.brightfocus.org/grant/G2021009S

Genetically Engineering a New Animal Model to Find Cures for Glaucoma

F. Kent Hamra, PhD | 7/1/18 – 6/30/24
University of Texas Southwestern Medical Center

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

The Genetics of Glaucoma in Individuals of Caucasian and African Ancestry

Michael Hauser, PhD | 3/2/21 – 2/28/23
Duke University Medical Center

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 the 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

Determine the Genetic Element on Human Chromosome 9 That Increases the Risk for Glaucoma

Gareth Howell, PhD | 9/1/20 – 8/31/23
The Jackson Laboratory

Human genetic studies show glaucoma is caused by a combination of genetic risk factors. However, few specific genetic 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
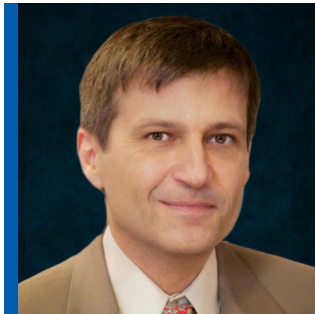
A Possible Link Between Glaucoma and Alzheimer's Disease

Nick Marsh-Armstrong, PhD | 7/1/22 – 6/30/24
University of California, Davis

This proposal will use live imaging of the optic nerve in models to determine whether an agent believed to be central to Alzheimer's disease might be released from axons together with mitochondria (the energy powerhouse of cells). If its release is linked to that of mitochondria, it would have profound implications for both Alzheimer's disease and glaucoma.

www.brightfocus.org/grant/G2022016S
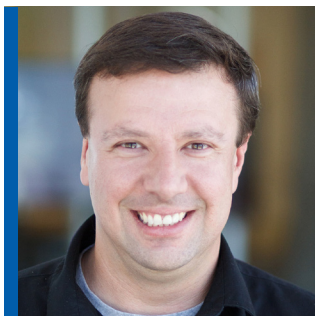
Human Stem Cell Modeling of the APBB2 Risk Variant for Glaucoma

Jason Meyer, PhD | 7/1/22 – 6/30/24
Indiana University School of Medicine in Indianapolis

African Americans are at a significantly higher risk for glaucoma compared to other ethnicities. Recently, a variant in the APBB2 gene was identified to be significantly associated with glaucoma in African Americans, representing a novel opportunity to explore the degeneration of retinal ganglion cells (RGCs) associated with this increased risk. The overall goals of this application focus upon the use of human-induced pluripotent stem cells, as well as CRISPR/Cas9 gene editing, as an in vitro model to study the effects of this gene variant on RGCs and identify how it may lead to glaucomatous neurodegeneration.

www.brightfocus.org/grant/G2022014S

Mapping Scleral Fibroblasts and Their Significance in Glaucoma

Ian Pitha, MD, PhD | 7/1/21 – 6/30/23
Johns Hopkins University School of Medicine

Damage to the nerve cells occurs because the pressure within the eye pinches the nerve at the optic nerve head. Intraocular pressure reduction alleviates this pinching and allows the cell to function properly. Thus, this proposal aims to better understand how the wall of the eye remodels in glaucoma and test an approach to prevent the nerve cells' pinching by altering this process.

www.brightfocus.org/grant/G2021013S

Investigating Risk Factors for Primary Open-Angle Glaucoma in African Descendants

Alberta Thiadens, MD, PhD | 9/1/20 – 12/31/23
Erasmus Medical Center, Rotterdam (THE NETHERLANDS)
Co-Principal Investigator: Caroline C.W. Klaver, MD, PhD

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

www.brightfocus.org/grant/G2020116

Understanding Alterations in an Early Experimental Glaucoma Model

Hongli Yang, PhD | 7/1/22 – 6/30/24
Good Samaritan Foundation, Legacy Health System
Co-Principal Investigator: Priya Chaudhary, PhD

This proposal's goal is to identify the cellular and molecular alterations underlying structural change in an experimental model. Overall, this project will inform and enhance the interpretation of human optical coherence tomography (OCT) imaging, advance our understanding of pathophysiologic mechanisms in glaucoma, and provide guidance to improve therapeutic options before glaucomatous damage becomes permanent and untreatable.

www.brightfocus.org/grant/G2022008S

Imaging & Exploring the Eye-Brain Connection
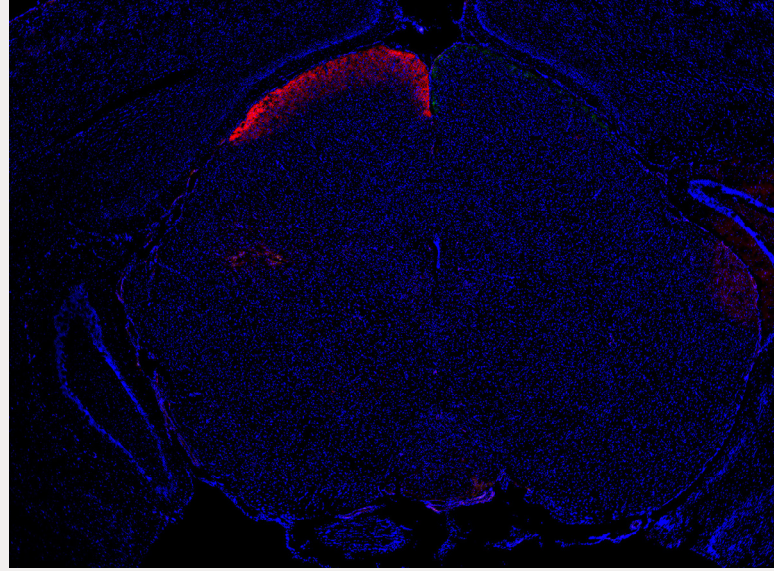
Eye changes associated with glaucoma contribute to tiny blind spots, known as visual field defects, which can advance to vision loss and blindness.

The speed and probability at which this progression 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 precede glaucoma.

NGR grantees are developing and leveraging new technologies to look at individual retinal ganglion cells (RGCs) of the eye and their nerve fibers that carry light signals to the brain—which is 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 contributions of cerebrospinal fluid and other mechanisms are also being explored to better understand the eye-brain connection, which may result in earlier detection and new ways to treat glaucoma.

Above: Glaucoma may alter key parts of the brain that are involved in the sleep-wake cycle. Photo courtesy of Ji Won Bang, PhD, NYU Grossman School of Medicine.

Association Between Glaucoma and Sleep Disorders

Ji Won Bang, PhD | 7/1/21 – 6/30/23
Columbia University Irving Medical Center | Fellowship Mentors: Kevin C. Chan, PhD, Joel Schuman, MD & Yuka Sasaki, PhD, Brown University

This study will use multimodal brain neuroimaging, clinical ophthalmic assessments, and sleep quality assessments in early-stage and advanced-stage glaucoma patients and healthy subjects. The outcomes should provide a mechanistic account of the high incidence of sleep disorders in glaucoma and could lead to therapeutic advancements benefiting millions of people.

www.brightfocus.org/grant/G2021001F

Improved Imaging of the Outflow Pathway in the Living Human Eye

Alessandra Carmichael-Martins, PhD | 7/1/22 – 6/30/24
Indiana University Bloomington
Fellowship Mentor: Stephen Burns, PhD

This proposal will enable researchers and clinicians to achieve three-dimensional images of the drainage structures in the living human eye at cellular-level resolution, allowing a deeper understanding of changes within the trabecular meshwork associated with age, glaucoma, and treatment.

www.brightfocus.org/grant/G2022001F

A Novel Tool for Seeing Neuron Cells in Eyes with Glaucoma

Yali Jia, PhD | 9/1/20 – 8/31/23
Oregon Health & Science University
Co-Principal Investigator: Shaohua Pi, PhD

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 to help understand the nature of the disease.

www.brightfocus.org/grant/G2020168

Increased Pressure in the Eye Affects the Neuronal Communications in the Brain

Prabhavathi Maddineni, PhD | 7/1/22 – 6/30/24
University of North Texas Health Science Center at Fort Worth
Fellowship Mentor: Gulab Zode, PhD

Since the optic nerve is the part of central nervous system and is connected to the brain, pressure-induced optic nerve damage may also damage surrounding cells and neurons in the brain. This proposal aims to study how neurons in the brain communicate with each other in response to pressure-induced damage.

www.brightfocus.org/grant/G2022004F

Direct Observation and Manipulation of Energy Regulation in RGCs During Glaucoma

Philip Williams, PhD | 9/1/20 – 8/31/22
Washington University in St. Louis

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

Predicting Outcomes & Other Treatment Innovations
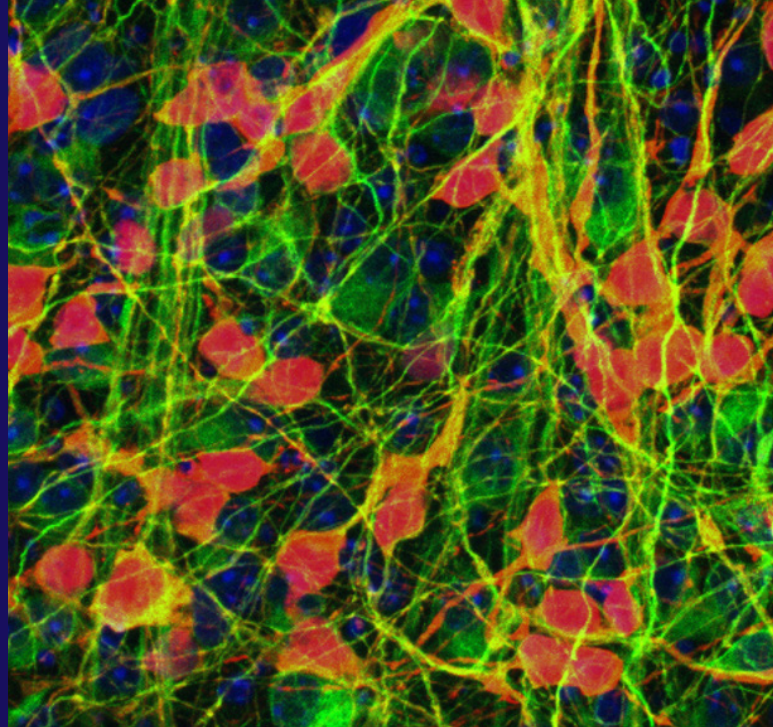
Approved treatments for glaucoma primarily focus on lowering eye pressure. Numerous therapies lower eye pressure effectively, but require skill and consistency to achieve results (eyedrops) or present recognizable risks (surgery).

More reliable treatments and new therapies to address the underlying causes of glaucoma (besides intraocular pressure) are needed.

NGR grantees are working to develop drugs that will lower eye pressure and protect against nerve cell injury and death, as well as genome-editing approaches to restore the function of trabecular meshwork, a spongy tissue that drains fluids from the eye.

Additional therapies include advancing stem-cell transplantation, promoting lifestyle interventions, and identifying strategies to communicate genetic testing with at-risk individuals.

Above: The Johnson Laboratory induces human pluripotent stem cells to become retinal ganglion cells (RGCs), shown in red. They have developed methods that enable donor human RGCs to integrate into the retina of a recipient eye following transplantation, where they intermingle with the recipient's own RGCs, shown in green. Photo courtesy of Thomas V. Johnson III, MD, PhD, Wilmer Eye Institute, Johns Hopkins University School of Medicine.
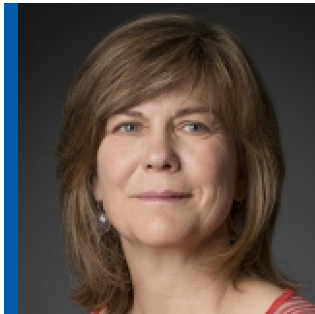
Preventing Vision Loss by Predicting and Treating Exfoliation Syndrome Earlier in Patients

Karen Curtin, PhD | 9/1/20 – 8/31/23
University of Utah | Co-Principal Investigator: Barbara M. Wirostko, MD

By 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

The Biomechanical Phenotype of Normal-Tension Glaucoma

Michael Girard, PhD | 10/1/21 – 9/30/23
Singapore Eye Research Institute, Singapore National Eye Centre (SINGAPORE) | Co-Principal Investigators: Aung Tin, MBBS, PhD & Monisha E. Nongpiur, MBBS, PhD

To understand why some patients with normal eye pressure develop glaucoma, this study proposes engineering and artificial intelligence tools to fully assess and understand the robustness of the optic nerve head (ONH) in a given patient. Our goal is to establish whether ONH robustness can help us predict who is at risk of developing future glaucoma damage. If successful, we will be able to provide earlier treatment in the eyes that are deemed mechanically unstable.

www.brightfocus.org/grant/G2021010S

Blood Flow and Oxygen Delivery in the Back of the Eye

Yi Hua, PhD | 7/1/21 – 6/30/23
University of Pittsburgh | Fellowship Mentor: Ian Sigal, PhD

This study will test if elevated eye pressure deforms the microvessels that supply blood, nutrients, and oxygen to the lamina region at the back of the eye to support the nerve cells. The long-term goal is to understand axon death mechanisms in glaucoma and help develop novel diagnostic and therapeutic agents for clinical glaucoma treatment.

www.brightfocus.org/grant/G2021003F

Integrated Machine Learning Analysis of Biomarkers for Glaucoma Therapy

Pirro Hysi, MD, PhD | 7/1/21 – 6/30/24
King's College London (UK)

The purpose of this project is to identify highly variable and modifiable molecular changes that participate in mechanisms causing primary open-angle glaucoma as immediate targets of novel treatments. This project will identify modifiable changes of metabolism, or chemical modifications of the DNA, that lead to glaucoma. This project will use powerful machine learning to stack millions of data points acquired through high-throughput platforms ("omics") in a very large number of individuals to identify robust signals of epigenetic and metabolic changes that together modulate the glaucoma risk.

www.brightfocus.org/grant/G2021011S
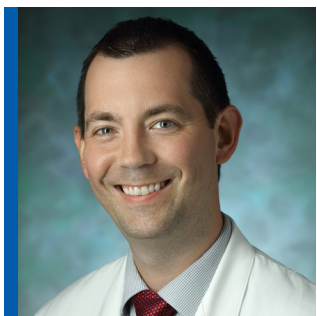
New Tools for Leveraging Regenerative Medicine to Restore Sight in Glaucoma

Thomas V. Johnson III, MD, PhD | 7/1/22 – 6/30/24
Wilmer Eye Institute, Johns Hopkins University School of Medicine

To help usher stem cell transplantation as a new approach toward treating glaucoma, this study proposes to develop a novel, sensitive, rapid experimental tool that labels successful integration of transplanted neurons in the retinas of recipient eyes and to rigorously validate the experimental framework using multiple complementary techniques that include high-resolution, three-dimensional microscopy and measurements of electrical responses to light.

www.brightfocus.org/grant/G2022005S

A recipient of the Dr. Douglas H. Johnson Award for Glaucoma Research.

Can Progression of Glaucoma Be Slowed by Regular Exercise?

Andras Komáromy, DVM, PhD | 7/1/22 – 6/30/24
Michigan State University

In models with naturally occurring glaucoma, this study will determine if regular, moderate-intensity exercise can slow glaucoma disease progression. Exercise would provide an easy, low-cost, beneficial therapy avenue for glaucoma patients.

www.brightfocus.org/grant/G2022007S

Cellular-Scale Imaging in the Living Eye to Study Glaucoma Pathophysiology

Kazuhiro Kurokawa, PhD | 7/1/22 – 6/30/24
Good Samaritan Foundation, Legacy Health System

New ways are needed for detecting damage earlier, at a point when treatment could preserve vision, and even restore the health of the eye and optic nerve before irreversible damage occurs. This study aims to construct and test a new, advanced multifunctional imaging system capable of revealing astounding details in the living eye as small as single cells to transform the future of clinical testing for glaucoma.

www.brightfocus.org/grant/G2022006S

Insights into a Naturally Occurring Glaucoma Model

Amanda Melin, PhD | 3/1/21 – 2/28/23
University of Calgary (CANADA)
Co-Principal Investigator: James Higham, PhD, New York University

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 hold great promise to guide genetic-screening panels used in the 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

Investigating the Mechanical Behavior of the Optic Nerve Head in Glaucoma

Thao Nguyen, PhD | 7/1/21 – 6/30/23
Johns Hopkins University
Co-Principal Investigator: Harry A. Quigley, MD

This study aims to investigate the mechanical behavior of the optic head in glaucoma patients and determine how it may be altered by glaucoma damage.

www.brightfocus.org/grant/G2021012S

Cell-to-Cell Communication in Health and Disease

Michael Risner, PhD | 7/1/22 – 6/30/24
Vanderbilt University Medical Center
Co-Principal Investigator: David Calkins, PhD

This proposal aims to understand the metabolic interaction between healthy and stressed cells in the context of cell transplantation for the treatment of glaucoma.

www.brightfocus.org/grant/G2022011S

Investigating Autophagy in Nitric Oxide Production to Control Eye Pressure

Myoungsup Sim, PhD | 7/1/22 – 6/30/24
Duke University School of Medicine

Several studies have shown that nitric oxide (NO) lowers eye pressure. However, most of the NO-based drugs have failed to be approved by the FDA due to challenges related to the delivery of NO, suggesting that regulation of the cells' own NO production could represent a better strategy for glaucoma treatment. Here, we seek to investigate how to regulate endogenous NO production to improve the current NO-based glaucoma therapy.

www.brightfocus.org/grant/G2022010S

Developing Communication Strategies for Genetic Risk Testing in Glaucoma

Emmanuelle Souzeau, PhD | 7/1/22 – 6/30/24
The Flinders University of South Australia (AUSTRALIA)
Fellowship Mentor: Jamie E. Craig, DPhil, FRANZCO

The recent development of polygenic risk scores (PRS) for glaucoma makes genetic testing an ideal strategy to identify at-risk individuals who can benefit from early management to reduce preventable blindness. However, the current lack in reporting strategies to efficiently communicate PRS to patients impedes the implementation of testing in clinical practice. This proposal aims to develop the first patient-friendly reports and assess delivery methods for risk communication of PRS for glaucoma, which will ultimately benefit at-risk individuals globally.

www.brightfocus.org/grant/G2022002F

A recipient of the Thomas R. Lee Award for Glaucoma Research.

Predicting and Detecting Glaucoma Progression with New Imaging

Zhichao Wu, PhD | 1/1/23 – 12/31/24
Centre for Eye Research (AUSTRALIA)
Co-Principal Investigators: Xavier Hadoux, PhD, Peter van Wijngaarden, MBBS, PhD, Flora Hui, PhD & Keith Martin, DM, FRANZCO

The goal of this project is to address the urgent need for more effective tools to predict and detect progression to prevent irreversible vision loss from glaucoma.

www.brightfocus.org/grant/G2021016S

Validation of Novel OCT-Based Imaging Tools for Noninvasive Monitoring

**Robert Zawadzki, PhD** | 7/1/21 – 6/30/23
University of California, Davis
Co-Principal Investigator: Pengfei Zhang, PhD

Novel treatments focused on restoring vision in glaucoma, using gene or stem cell therapies, would benefit from developing cellular resolution in vivo imaging tools that could offer sensitivity and specificity beyond current clinical tests. To achieve that, we propose developing and validating novel structural and functional extension of optical coherence tomography (OCT), so-called temporal speckle analysis OCT (TSA-OCT), for basic science research.

www.brightfocus.org/grant/G2021017S

A recipient of the Dr. Douglas H. Johnson Award for Glaucoma Research.

Protecting & Regenerating the Optic Nerve
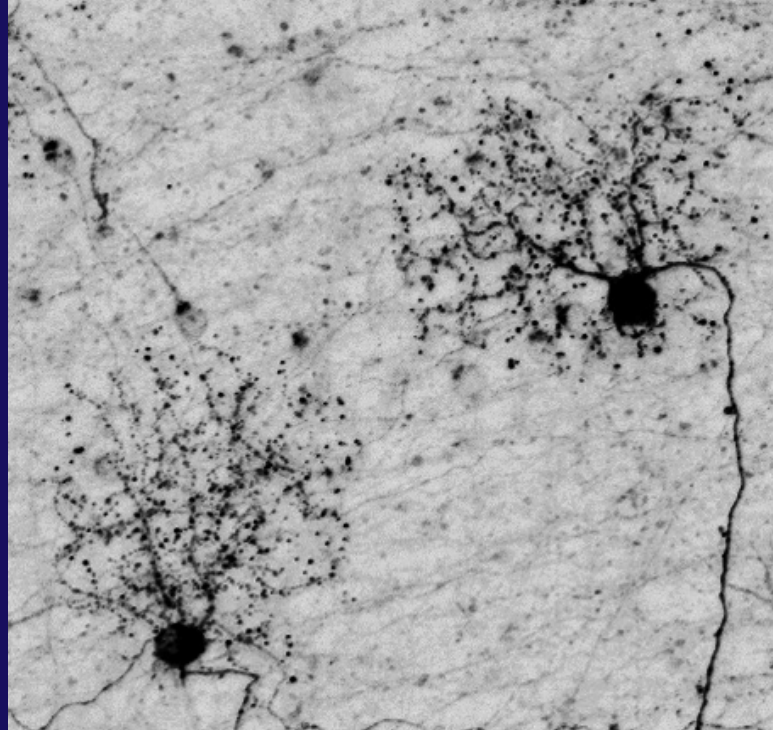
Unlike most cells in the body, which repair themselves, the nerve cells providing our vision don't regrow once they've been damaged.

NGR is supporting research into ways of protecting cells threatened by advancing glaucoma and regenerating those cells after vision loss.

The main focus of these efforts is to replace and reconnect retinal ganglion cells (RGCs), the nerve cells that make up the optic nerve and carry visual signals over axons, long threadlike tails extending from the eye to the brain.

This is a sophisticated undertaking, given how RGCs are wired into the brain.

Another focus is to develop neuroprotective drugs and therapies that will help nourish and support fragile RGCs to ensure their long-term viability.

Above: Retinal ganglion cells of zebrafish are being studied for their ability to regenerate. Photo courtesy of Matthew B. Veldman, PhD, Medical College of Wisconsin.

Cell Replacement in Glaucoma: Making Mature RGCs

Petr Baranov, MD, PhD | 9/1/20 – 8/31/22
Schepens Eye Research Institute, Massachusetts Eye and Ear, Harvard Medical School

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

A Dietary Supplement in the Treatment of Glaucoma

Jeffrey Boatright, PhD | 9/1/20 – 8/31/23
Emory University | Co-Principal Investigator: Ying Li, MD, PhD

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+), 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+ precursor nicotinamide riboside, a dietary supplement, increases retinal NAD+ and protects RGCs in glaucoma models.

www.brightfocus.org/grant/G2020286

A Novel Use of Specialized Pro-Resolving Mediators (SPMs) to Treat Glaucoma

Kin-Sang Cho, PhD | 9/1/20 – 8/31/23
Schepens Eye Research Institute, Massachusetts Eye and Ear, Harvard Medical School

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

www.brightfocus.org/grant/G2020333

Preserving the Eye's Vision by Neuroprotecting Retinal Cells

Marco Feligioni, PhD | 7/1/22 – 6/30/24
Fondazione EBRI Rita Levi-Montalcini (ITALY)

Neuroprotection is an unmet medical need. This project aims to investigate the properties of a new drug to protect against degeneration of retinal ganglion cells.

www.brightfocus.org/grant/G2022015S

Using Electric Fields to Regenerate the Optic Nerve

Kimberly Gokoffski, MD, PhD | 9/1/20 – 8/31/23
University of Southern California Roski Eye Institute

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

A recipient of the Dr. Douglas H. Johnson Award for Glaucoma Research.

Neuroprotection and Neuroenhancement in Glaucoma

Jeffrey Goldberg, MD, PhD | 5/1/22 – 4/30/25
Stanford University

The goal of this project is to evaluate safety and proof of concept for whether ciliary neurotrophic factor (CNTF) can enhance vision or protect against vision loss in glaucoma.

www.brightfocus.org/grant/CG2022001

The Role of Reactive Astrocytes in Glaucomatous Axonal

Cátia Gomes, PhD | 7/1/22 – 6/30/24
Indiana University Bloomington | Fellowship Mentor: Jason Meyer, PhD, Indiana University School of Medicine in Indianapolis

Reactive astrocytes are closely associated with RGCs in the optic nerve head, where the initial insult to RGC axons occurs. In this study, RGCs and astrocytes will be differentiated from human pluripotent stem cells, and microfluidic platforms will be used to study the effect of toxic insults from astrocytes on RGC axons. Identifying reactive astrocyte-induced axonal degeneration pathways will allow for the development of novel therapeutic strategies.

www.brightfocus.org/grant/G2022003F
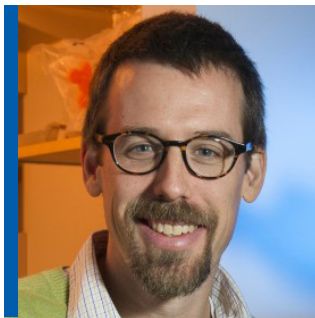
Identifying Factors That Protect Ganglion Cells from Death After Optic Nerve Injury

Jeffrey Gross, PhD | 9/1/20 – 8/31/22
University of Pittsburgh

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

Defining the Importance of Extrinsic Signaling in Glaucoma Neurodegeneration

Richard Libby, PhD | 9/1/20 – 8/31/23
University of Rochester Medical Center

This work explores the importance of extrinsic signaling in glaucomatous neurodegeneration. It builds on the work of many groups that 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

A recipient of the Thomas R. Lee Award for Glaucoma Research.

Astrocytes Regulate the Health and Degeneration of RGC in Glaucoma Neurodegeneration

Jason Meyer, PhD | 9/1/20 – 8/31/22
Indiana University School of Medicine in Indianapolis

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 astrocytes alter the health and function of RGCs as a whole.

www.brightfocus.org/grant/G2020369

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

Jeff Mumm, PhD | 9/1/20 – 2/28/23
Wilmer Eye Institute, Johns Hopkins University

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

A Study to Define the Link Between Cell Adhesion and Retinal Ganglion Cell Death

Robert W. Nickells, PhD | 7/1/18 – 5/31/23
University of Wisconsin–Madison

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

Investigating Optic Nerve Head Remodeling in Glaucoma

Babak Naghizadeh Safa, PhD | 7/1/21 – 6/30/23
Georgia Tech Research Corporation
Fellowship Mentor: Christopher Ross Ethier, PhD

In this project, researchers will (1) provide the most accurate characterization of the mechanical properties and mechanobiology of the optic nerve head, the primary site of damage in glaucomatous optic neuropathy, and (2) develop a physiologically appropriate ex vivo 3D culture model to study the mechanobiological response of ONH cells, thought to drive characteristic changes in glaucoma. This system will eventually form the basis of a high-throughput drug discovery system, accelerating the development of future treatments for glaucoma.

www.brightfocus.org/grant/G2021005F

New Genes to Prevent Cell Death in Glaucoma

Matthew B. Veldman, PhD | 7/1/21 – 6/30/23
Medical College of Wisconsin

The current project uses loss-of-function studies in zebrafish and gain-of-function studies in mammalian cells to test the neuroprotective ability of four candidate genes identified in zebrafish. The goal of this study is to understand the basic biology of injury resilience and optic nerve regeneration in the zebrafish and apply that knowledge to mammalian models of glaucoma with the long-term hopes of identifying new avenues for therapeutic development in patients.

www.brightfocus.org/grant/G2021015S
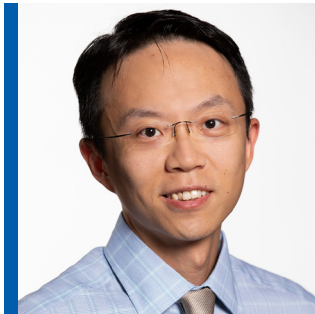
Hunting for Genes Controlling Optic Nerve Regeneration

Jiaxing Wang, PhD | 7/1/22 – 6/30/24
Emory University

This study is looking for genes that could modulate optic nerve regeneration to save vision. This group has found a model with enhanced regeneration response that is carrying such gene and are working to identify it. Once identified, the gene will be tested to see how it alters the regeneration response. This may lead to a clinical intervention for the treatment of blindness due to optic nerve damage.

www.brightfocus.org/grant/G2022012S
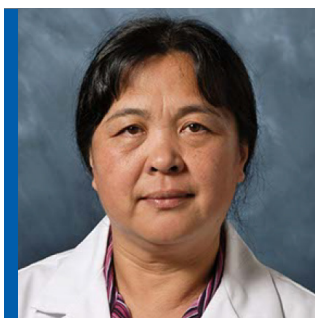
Combined Stem Cell and Trophic Factor Therapy for Glaucoma

Shaomei Wang, MD, PhD | 7/1/22 – 6/30/24
Cedars-Sinai Medical Center

The novel approach of this study is to deliver a combined stem cell and gene therapy close to the site of disease to protect RGCs from secondary degeneration in a model of glaucoma.

www.brightfocus.org/grant/G2022009S

Identifying Which Retinal Ganglion Cell Types Die Earlier in Glaucoma

Siamak Yousefi, PhD | 9/1/20 – 8/31/23
University of Tennessee Health Science Center

This study aims to develop artificial intelligence 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

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