BrightFocus® Foundation
Cure in Mind. Cure in Sight.

Current National Glaucoma Research Projects

Glaucoma is the second leading cause of blindness worldwide, according to the World Health Organization, affecting 60.5 million in 2010. As people live longer, this number may increase to almost 80 million by 2020. More than three million Americans are living 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 inception, National Glaucoma Research (NGR), a BrightFocus Foundation program, has awarded nearly $33 million to support research projects on the causes and potential prevention and treatment of this disease.

NGR funds investigator-initiated research topics, allowing us to invest in a wide range of scientific approaches to ending glaucoma. There are 36 research projects currently supported by NGR that fall into these broad categories:

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

Note: *The funding statistics and inclusion of research grants in this yearbook are based upon award offers and grants that were active as of July 1, 2018. Excerpts are from research profiles available at BrightFocus.org and may have been edited for clarity and space constraints. This information is accurate as of 2/11/2019.*

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, carrying 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 (i.e., elevated eye pressure or intraocular pressure (IOP) 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 how genetics, oxygen deprivation, changes in the retinal blood supply (microvasculature), and other factors that threaten the health of the optic nerve, as well as projects to develop new research models to test these theories. New understanding will lead to new therapies.

Rouzbeh Amini, PhD (7/1/18 - 6/30/20)
The University of Akron, OH
Co-Principal Investigator: Syril K. Dorairaj, MD

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

Jessica Cooke Bailey, PhD (7/1/18 - 6/30/20)
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

Douglas Gould, PhD (7/1/17 - 6/30/19)

University of California, San Francisco

Growth Factor Signaling in Eye Development

This project studies genes involved in normal eye development so that we may understand how defects lead to blindness from glaucoma and other diseases, and if there are ways to intervene and prevent vision loss.

www.brightfocus.org/grant/G2017218

F. Kent Hamra, PhD (7/1/18 - 6/30/20)

University of Texas Southwestern Medical Center, Dallas

Genetically Engineering a New Animal Model to Find Cures for Glaucoma

This 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

Shahid Husain, PhD (7/1/16 - 6/30/19)

Medical University of South Carolina, Charleston

Low Oxygen Mediated Proteins Play Pathological Role in Glaucoma

The studies in this project seek to reduce the up-regulation of neurotoxic proteins that is triggered by low oxygen levels, to slow/halt neuronal death in glaucoma.

www.brightfocus.org/grant/G2016157

Monica Jablonski, PhD (7/1/18 - 6/30/20)

The University of Tennessee Health Science Center, Memphis

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

Benjamin Sivyer, PhD (7/1/18 - 6/30/20)

Oregon Health and Science University, Portland

More Sensitive Methods for Studying the Onset of Glaucoma

This study aims to identify early changes in response to injury in an animal model of glaucoma. We hope our research will lead to earlier diagnostic detection of glaucoma, but more importantly, we aim to uncover retinal mechanisms that will allow us to slow or stop the progression of retinal ganglion cell degeneration following injury.

www.brightfocus.org/grant/G2018011

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

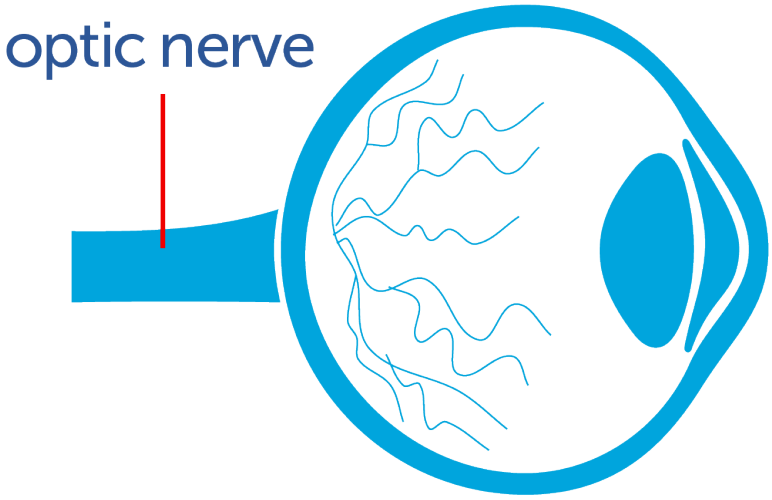
Linda Zangwill, PhD (7/1/17 - 6/30/19)

University of California, San Diego

The Role of Vascular Factors in Glaucoma

The goal is to investigate whether changes in the retinal blood supply (microvasculature) precede or follow the death of cells in a layer in the optic nerve head.

www.brightfocus.org/grant/G2017122



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, varies 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 use these new technologies to look at individual cells and nerve fibers (retinal ganglion cells are nearly transparent and very difficult to image); and changes to synapses, or connections between cells, and in the way the eye responds to light; as well as changes in blood vessels feeding the optic nerve. In addition, even newer imaging techniques are being explored for early detection of glaucoma.

Brad Fortune, OD, PhD (7/1/17 - 6/30/19)

Devers Eye Institute, Portland, OR

Can Imaging Reveal Early Stage Damage to Individual Optic Nerve Fibers?

This study seeks to determine whether a particular type of imaging is capable of reporting on the integrity of sub-microscopic structures within optic nerve fibers at an early stage of damage from glaucoma, preceding their complete degeneration and loss from the eye.

www.brightfocus.org/grant/G2017170

Recipient of the Thomas R. Lee Award for Glaucoma Research

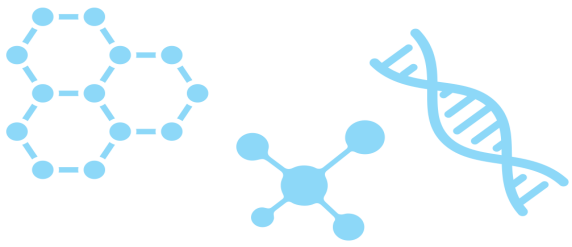
Esther G. Gonzalez, PhD (7/1/17 - 6/30/19)

Krembil Research Institute, Toronto, ON, Canada

Testing the Brain Structure Connecting Two Hemispheres in Glaucoma

This project plans to study the function of this brain structure in humans with glaucoma using a series of non-invasive tests.

www.brightfocus.org/grant/G2017093



Xiangrun Huang, PhD (7/1/18 - 6/30/20)

University of Miami, Miller School of Medicine, FL

Developing a New Imaging Method for Sensitive Detection of Early Glaucoma Damage

The proposed research will develop a new optical imaging method that detects abnormities of the light reflected by the nerve fibers. If successful, it can provide clinicians with a new means to sensitively detect early glaucomatous damage, opening an early therapeutic window for the prevention of vision loss.

www.brightfocus.org/grant/G2018148

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

Jason Porter, PhD (7/1/18 - 6/30/20)

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

Ethan Rossi, PhD (7/1/17 - 6/30/19)

University of Pittsburgh, PA

Imaging Individual Cells Affected by Glaucoma

The goal is to understand the earliest changes to the individual cells that form the optic nerve, the retinal ganglion cells, in patients with glaucoma.

www.brightfocus.org/grant/G2017082

Ji Yi, PhD (7/1/17 - 6/30/19)

Boston Medical Center, MA

A New Imaging Technique to Detect Early Markers of Glaucoma

The goal is to develop a new optical imaging technology to examine the eye, which is very sensitive to early glaucoma so that we can use it for early diagnosis.

www.brightfocus.org/grant/G2017077

Controlling Eye Pressure in New Ways

Elevated eye pressure or intraocular pressure (IOP) is present in most forms of glaucoma. This happens 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 (TM), which is the eye's main drainage channel. The TM offers a certain resistance to the outflow of aqueous humor that is needed to maintain a steady-state eye pressure. However, eye pressure can be affected by volume and by other factors such as TM 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 control the eye pressure, including cellular signaling through microRNAs (very small genetic sequences that can regulate gene expression), and are looking for newer ways to monitor and control eye pressure.

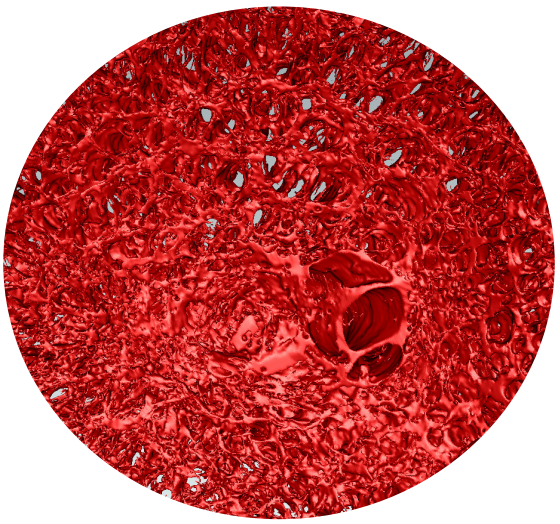
J. Crawford Downs, PhD (7/1/16 - 12/30/19)

University of Alabama at Birmingham

A Wireless System to Measure and Control Fluid Pressure Around the Optic Nerve

Investigators in this study have developed a new system to wirelessly measure and record the eye pressure continuously in research subjects. They now propose to extend that system to measure the pressure around the nerve exiting the eye, leading to new treatment approaches for glaucoma.

www.brightfocus.org/grant/G2016165



Courtesy of Dr. J. Crawford Downs' Lab
A high resolution, digital, three-dimensional reconstruction of the lamina cribrosa from a human donor eye, created using a custom-designed, automated, serial episcopic fluorescent image capture system in Dr. Downs' laboratory.

Rudolf Fuchshofer, PhD (7/1/16 - 6/30/19)

University of Regensburg, Germany

Identifying Underlying Pressure-Control Mechanisms in Glaucoma

The understanding of the functional role of microRNAs will be an important step toward restoring the balance of the outflow regulation to normal in the glaucomatous tissues and will lead to new therapies.

www.brightfocus.org/grant/G2016076

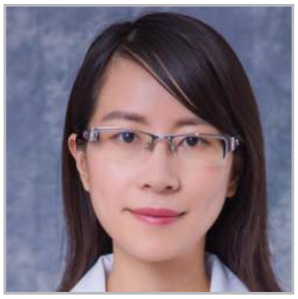
Krishnakumar Kizhatil, PhD (7/1/17 - 6/30/19)

The Jackson Laboratory, Bar Harbor, ME

Identifying Underlying Pressure-Control Mechanisms in Glaucoma

The objective is to determine how neuronal control regulates aqueous humor outflow and eye pressure.

www.brightfocus.org/grant/G2017152



Yuan Lei, PhD (7/1/18 - 6/30/20)

Eye and ENT Hospital of Fudan University, Shanghai, China

A Key MicroRNA that Controls Eye Pressure

TThe aim of this project is to understand the role of a very important microRNA in regulating eye pressure. This may be a very effective new way to treat elevated eye pressure in glaucoma.

www.brightfocus.org/grant/G2018112

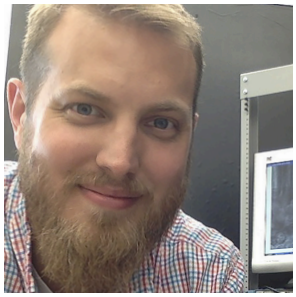
Yutao Liu, MD, PhD (7/1/16 - 6/30/19)

Augusta University Research Institute, Inc., GA

Identifying New Drug Targets to Lower Eye Pressure Via Outflow

The purpose of this project is to study how a short RNA molecule known as miR-182 may affect the outflow of aqueous humor.

www.brightfocus.org/grant/G2016023



Matthew Van Hook, PhD (7/1/17 - 6/30/19)

Truhlsen Eye Institute, University of Nebraska Medical Center, Omaha

Effects of Elevated Eye Pressure on Ganglion-Cell Photoreceptors

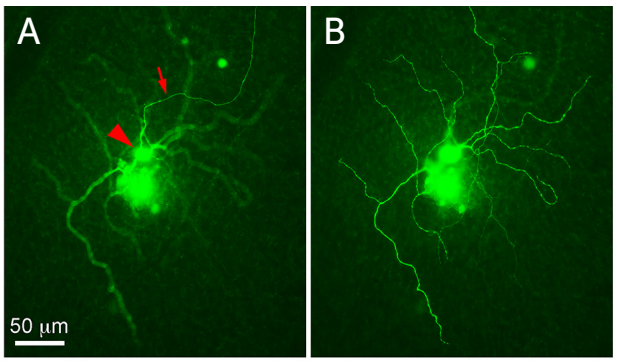
The goal of this project is to determine how the function of neurons in the retina that are responsible for resetting circadian rhythms (body's internal clock) and triggering constriction of the pupil are altered at early stages of glaucoma, before irreversible degeneration of retinal ganglion cells.

www.brightfocus.org/grant/G2017027

Courtesy of Dr. Matthew Van Hook's Lab
Image showing the structure of a fluorescent dye-labeled cell in animal model.

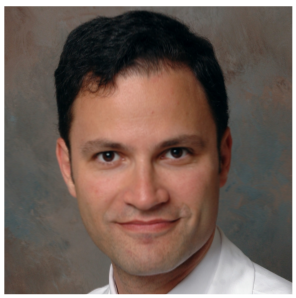
A) shows the cell body (arrowhead) and axon (long projections from the cell, arrow).

B) branching structure of cell extensions called dendrites is in focus.



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 "holy grail" 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.



Jeffrey Goldberg, MD, PhD (7/1/15 - 12/31/19)

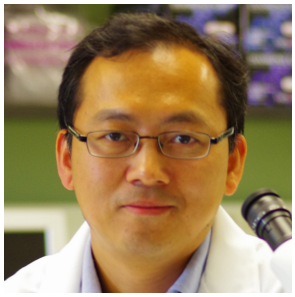
Stanford University, CA

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 damage to the optic nerve, and, possibly, enhance visual function in patients with glaucoma.

www.brightfocus.org/grant/C2015201

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



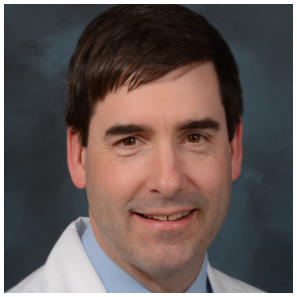
Yang Hu, MD, PhD (7/1/18 - 6/30/20)

Stanford University, CA

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



András Komáromy, DVM, PhD (7/1/17 - 6/30/19)

Michigan State University, East Lansing

Co-Principal Investigator: Bruce R. Ksander, PhD

A Gene Therapy Approach to Neuroprotection in Glaucoma

This research project will test a new form of treatment for glaucoma that uses gene therapy to protect retinal neurons and stop glaucoma from developing, even in the presence of elevated eye pressure.

www.brightfocus.org/grant/G2017185

Gillian McLellan, PhD (7/1/16 - 6/30/19)

University of Wisconsin-Madison

A New Treatment to Protect the Optic Nerve in Glaucoma

This research will test a promising new treatment strategy for glaucoma patients by repurposing an existing drug to block transforming growth factor-beta and preserve vision.

www.brightfocus.org/grant/G2016129

Robert W. Nickells, PhD (7/1/18 - 6/30/20)

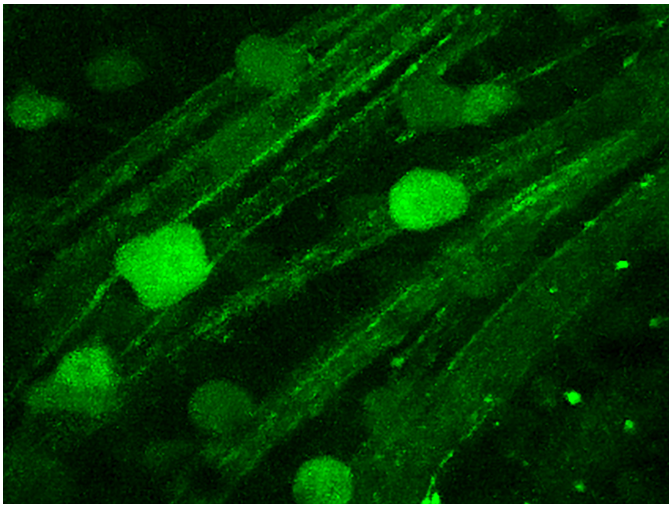
University of Wisconsin-Madison

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

Recipient of the Thomas R. Lee Award for Glaucoma Research



Courtesy of Dr. Robert W. Nickells' Lab
Retinal ganglion cells from a mouse expressing a protein called BAX fused to a green fluorescent protein for visualization.

When the nerve is damaged, such as in glaucoma, the BAX protein aggregates on the surfaces of mitochondria and stimulate biochemical changes that lead to ganglion cell death.

Ephraim F. Trakhtenberg, PhD (7/1/17 - 6/30/19)

University of Connecticut Health Center, Farmington

New Approach for Regenerating the Injured Optic Nerve

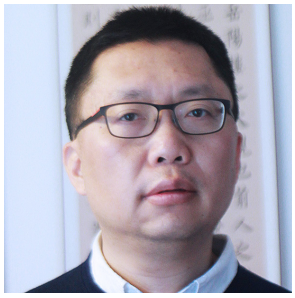
The goal is to identify novel biological regulators of the intrinsic ability of the retinal cells to regrow connections between the eye and the brain.

www.brightfocus.org/grant/G2017204

Derek Welsbie, MD, PhD (7/1/17 - 6/30/19)
University of California San Diego, La Jolla

Genome Editing to Inhibit Optic Nerve Cell Death in Glaucoma

This project will develop a novel neuroprotective strategy that directly interferes with the cell death process in retinal ganglion cells that is triggered in glaucoma.
www.brightfocus.org/grant/G2017212
Recipient of the Dr. Douglas H. Johnson for Glaucoma Research



Fengquan Zhou, PhD (7/1/17 - 6/30/19)
Johns Hopkins University, Baltimore, MD

A New Approach to Optic Nerve Regeneration

The proposed study will open a new avenue for identifying novel genes and pathways that can be manipulated to promote optic nerve regeneration.
www.brightfocus.org/grant/G2017037

New Ways to Predict Progression and Treating Glaucoma

Numerous therapies exist to lower eye pressure effectively; however, the bulk of them (eye drops 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. 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 (TM) (a spongy tissue that drains fluids from the eye). In addition, computerized algorithms are being designed by some groups to analyze an assortment of biometric data to better predict and track a patient's risk of progression to vision loss.

Suchismita Acharya, PhD (7/1/18 - 6/30/20)
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

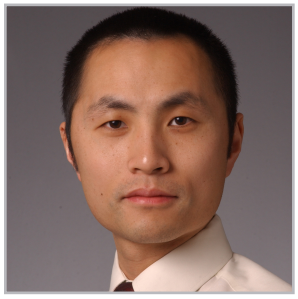
Tobias Elze, PhD (7/1/17- 6/30/19)

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

Computational Investigation of Glaucoma Progression

The aim of this project is to investigate the spatial configuration of glaucomatous visual field (side vision) defects by a combination of mathematical algorithms and clinical expertise in order to identify patterns of disease progression.

www.brightfocus.org/grant/G2017111



Weiming Mao, PhD (7/1/17- 6/30/19)

Eugene and Marilyn Glick Eye Institute, Indiana University, Indianapolis

CRISPR Interference for Glaucoma

Our study aims to use a novel technology called CRISPR interference to correct abnormal protein modifications, with the hope of thus restoring function to the trabecular meshwork tissue.

www.brightfocus.org/grant/G2017151

Biji Mathew, PhD (7/1/18- 6/30/20)

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

Gulab Zode, PhD (7/1/17- 6/30/19)

University of North Texas Health Science Center, Fort Worth

Novel Treatment for Steroid and Myocilin Glaucoma

This study will test whether inhibition of molecules via a new type of drug known as an integrated stress response inhibitor (ISRIB) lowers eye pressure in mice and cultured trabecular meshwork cells.

www.brightfocus.org/grant/G2017199

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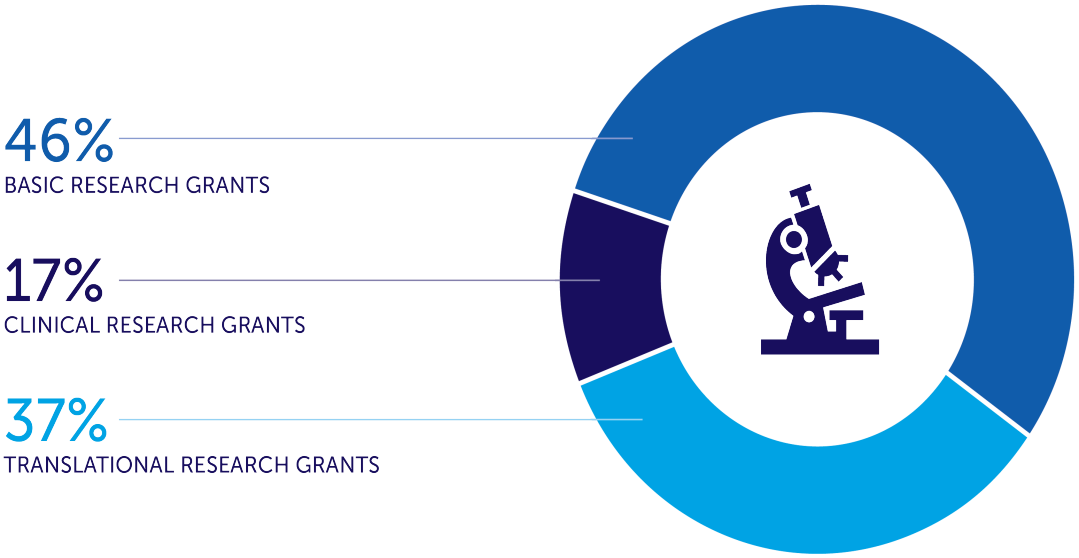
BrightFocus Grants at a Glance



Basic - Research that aims to better understand how a disease happens, and to obtain new ideas of how to stop the disease.

Clinical - Research involving volunteer participants to test the safety and effectiveness of drugs, devices, or other treatment candidates.

Translational - Research to move findings from the lab bench to the "bedside" by testing potential treatments.

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