GLAUCOMA
RESEARCH FOUNDATION

GLEAMS

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RESTORING VISION IN GLAUCOMA: MORE THAN MEETS THE EYE

NEW STRATEGIES ARE NEEDED TO RETHINK HOW WE TREAT GLAUCOMA TO DO MORE THAN JUST MANAGE EYE PRESSURE — TO ACTUALLY RESTORE VISION BY PROMOTING THE SURVIVAL OF RETINAL GANGLION CELLS AND THEIR AXONS.

When most of us talk about glaucoma, we talk about pressure in the eye: how high, how low, how many drops each day, etc. And for good reason — glaucoma is about sensitivity to eye pressure. Clinically, the goal is to manage pressure to stabilize vision. While eye pressure relates to structures in the front of the eye that regulate fluid flow, sensitivity to pressure relates to the back of the eye. There, stress from glaucoma affects the retina and optic nerve, which collect visual information and transmit it to the brain. Specialized neurons called retinal ganglion cells provide long cable-like axons that form the optic nerve. In glaucoma, sensitivity to eye pressure causes these axons to degenerate, followed by death of the ganglion cells themselves. As more and more ganglion cells die, abnormalities that may not be apparent to the patient can be detected on tests such as the visual field examination, and eventually, noticeable vision loss can occur. Ganglion cell death is permanent, for now. At Glaucoma Research Foundation, our goal is to change that.

The retina and optic nerve are part of the central nervous system, like the brain and spinal cord. When they are damaged beyond a certain extent, central nervous system structures do not regenerate. The same limitation applies to the retina and optic nerve. Thus, new strategies are needed to rethink how we treat glaucoma to do more than just manage eye pressure – to actually restore vision by promoting the survival of retinal ganglion cells and their axons. Glaucoma Research Foundation has had a longstanding interest in supporting research that focuses on *neuroprotection*: strategies that help struggling ganglion cells become less susceptible to glaucoma and prevent degeneration. Agents that are neuroprotective would be most beneficial for patients newly diagnosed with early glaucoma. At the other end of the spectrum, new research shows promise for *neuroregeneration*: strategies that either help dying ganglion cells sprout new axons or replace lost ganglion cells altogether. These therapies, which include stem cell transplantation, work around the natural limitations of the central nervous system to repopulate the optic nerve. They would benefit those who already have significant vision loss from glaucoma.

Glaucoma Research Foundation is committed to helping develop both protective and regenerative strategies through the Catalyst for a Cure and Shaffer Grant research programs. To this end, GRF is hosting another Catalyst Meeting this spring. By partnering with BrightFocus Foundation, this virtual meeting will bring together thought leaders not only in glaucoma, but also Alzheimer's disease. Goals include finding common elements in the mechanistic undertones of neurodegeneration and identifying barriers to regenerating new neural tissue. By learning from one another, scientists across different domains of neuroscience can help accelerate the search for the next generation of innovative treatments.

David J. Calkins, PhD *is Assistant Vice President for Research at Vanderbilt University Medical Center and Chair of the Glaucoma Research Foundation Research Committee and the Catalyst for a Cure Advisory Board.*

Vision Restoration Explained

The Catalyst for a Cure Vision Restoration research team is exploring and developing novel strategies to protect, repair, and replace lost retinal nerve cells and help them reconnect with the visual brain.

HOW THE EYE WORKS

The eye focuses light onto a tissue in the back of the eyeball called the retina. There are about a million optic nerve cells lining the retina. Each optic nerve cell has a long fiber that connects a point on the retina to a corresponding point on the brain. The optic nerve is a collection of about a million of these fibers. Light information is processed by the retina and then transmitted via the optic nerve to the brain where we experience vision.

WHAT HAPPENS IN GLAUCOMA?

In glaucoma there is damage to the optic nerve head, often caused by increased pressure inside the eye, which leads to degeneration of the fiber of the optic nerve cell, and eventually, death of the optic nerve cell. Once those optic nerve cells die, that point on the retina is no longer connected to the brain, and that disconnected area forms a visual field defect. As the disease progresses, more and more nerve cells become disconnected, leading to vision loss.

HOW CAN VISION BE RESTORED?

Current glaucoma treatments focus on preserving vision, but we have no current treatments to restore vision. The Catalyst for a Cure researchers are pursuing two major goals that are both necessary for vision restoration: 1) Developing a strategy for optic nerve cell transplantation, and 2) Developing neuroprotective therapies for glaucoma. Transplanted optic nerve cells need to survive, to regenerate, and to connect to the correct area of the brain in order for vision to be restored.

NEXT STEPS

The researchers are working to develop therapies that will improve the function of injured-but-not-yet-dead optic nerve cells, improve the survival of transplanted optic nerve cells, and halt the progression of vision loss from glaucoma. They have already identified several exciting options to improve optic nerve cell survival. The researchers are now working on improving optic nerve cell transplantation and planning next steps to translate these techniques to the clinic.

Derek Welsbie, MD, PhD is an Assistant Professor of Ophthalmology at the Shiley Eye Institute, University of California, San Diego and a principal investigator in the Catalyst for a Cure Vision Restoration Initiative.

Q&A Will I go blind?

One of the most frequent questions we get from patients with glaucoma is "Will I go blind?"

Robert L. Stamper, MD
is a Distinguished Professor of Clinical Ophthalmology and Director Emeritus of the Glaucoma Service at University of California, San Francisco.

Glaucoma is indeed a potentially blinding disease. Worldwide, it is the second most common cause for irreversible blindness. However, with early diagnosis and modern treatment, blindness is very uncommon.

Q What does blindness mean?
A Blindness means different things to different people. To the average person, blindness means the absence of all vision. However, the U.S. government defines blindness as severe loss of vision which limits mobility and other activities. The official definition is visual acuity in the better of the two eyes that cannot be corrected by lenses to better than 20/200 or loss of peripheral vision to less than 20 degrees. While "legal" blindness certainly restricts visual capability, it is far from the total blackness that most people imagine.

Q What are the actual chances that a patient with glaucoma will reach "legal" blindness?
A In general, from the best data in developed countries of the world, the risk of reaching that level of visual loss with a diagnosis of glaucoma is about 5%. In many of those people, the visual loss is compounded by the added presence of other eye conditions such as macular degeneration. Each person's actual risk will depend on how far advanced the glaucoma is when first diagnosed. The more advanced the glaucoma, the greater the risk. Therefore, it is critical to get regular eye examinations before symptoms appear so that, if glaucoma does develop, it is caught early when treatment is most effective at preventing vision loss. Of course, regular follow up and adherence to prescribed treatment are also critical in slowing or stopping progression. New and improved treatments should make severe vision loss even less likely. Although some eyes seem to be resistant to all modalities of treatment, for the vast majority of patients with glaucoma, adherence to treatment and appropriate monitoring will keep them from becoming blind by any definition.

IN APPRECIATION

We are grateful for the generous and loyal support from all our donors. Following is a listing of recent contributions and pledges at the $1,000 level and above; including members of The Catalyst Circle and institutional donors. Please note these are new contributions and pledges received between November 1, 2020 and February 28, 2021 and will not reflect a donor's cumulative giving for the year.

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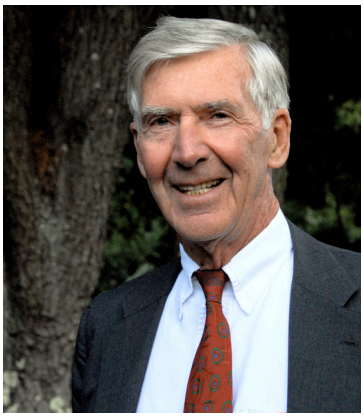
JOHN HETHERINGTON, JR., MD (in memory)



On December 31st, 2020, John Hetherington, Jr., MD, passed away at the age of 90. Dr. Hetherington was one of the founding physicians of Glaucoma Research Foundation and dedicated his career to advancing the field of glaucoma. His research accomplishments were extensive and impressive, shaping the way glaucoma is treated today. His profound impact extended far beyond his investigations and clinical expertise, to the deep compassion and care he had for his patients and their families. "Dr. Hetherington was an extraordinary clinician who greatly influenced patient care and research in glaucoma for over 50 years. His dedication and empathy to his patients was extraordinary," said Andrew G. Iwach, MD, Board Chair of Glaucoma Research Foundation. "He will be greatly missed by so many."

A special tribute fund has been established to support our Shaffer Grants for Innovative Glaucoma Research. Memorial donations can be made online at *www.glaucoma.org/hetherington.*

INSPIRED FUNDRAISING — THE LEA FAMILY

Chris and Heather Lea gave birth to Demi, their first child, in the midst of the pandemic. Three months later, they learned that their baby girl had congenital glaucoma in both eyes. Demi underwent three micro surgeries and finally, with drains opened in both eyes, she stabilized with no signs of vision loss.

After their stressful experience, the couple decided to raise money for glaucoma research and awareness. That's when they discovered Glaucoma Research Foundation. "We want parents to be more aware and get their kids tested, and GRF is a great place to get educated and connect with other parents."

They posted Demi's story on Facebook with an initial goal of $500. "And in the end," says Chris, "we got close to $10,000—that's when we realized we could make a real difference. And we were surprised by how many people reached out to us with their stories. That really helped us feel connected."

As they watch Demi grow, Chris and Heather hope she will live a normal life. In the meantime, they plan to keep spreading the word about congenital glaucoma and supporting GRF.

To start your own fundraiser for GRF, visit **glaucoma.funraise.org**

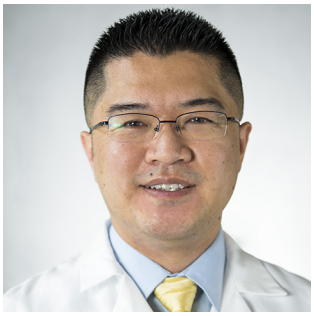
2021 RESEARCH GRANTS

The 2021 Shaffer Grants for Innovative Glaucoma Research are made possible through generous philanthropic support including leadership gifts from the Frank Stein and Paul S. May Grants for Innovative Glaucoma Research, the Harvey DuBiner MD Memorial Fund, Bob and Birdie Feldman and Giving Tuesday contributions, Molly and David Pyott, Richard and Carolyn Sloane, the Dr. Henry A. Sutro Family Grant for Research, Dr. James and Elizabeth Wise, and The Dr. Miriam Yelsky Memorial Research Grant. Glaucoma Research Foundation grants to explore new ideas are in the amount of $50,000 each. Below are the 2021 recipients.

Ta Chen Chang, MD
Bascom Palmer Eye Institute
PROJECT:
Genetic Studies of Open Angle Glaucoma in Haitian Community

Qi N. Cui, MD, PhD
Stellar-Chance Laboratories, University of Pennsylvania
PROJECT:
Evaluating the Glucagon-like Peptide 1 Receptor (GLP-1R) as a Therapeutic Target in Glaucoma

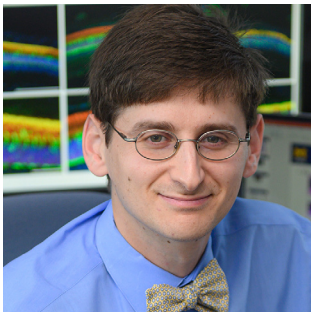
Luca Della Santina, PhD, PharmD
University of California, San Francisco
PROJECT:
Excitatory – Inhibitory Balance in Glaucoma



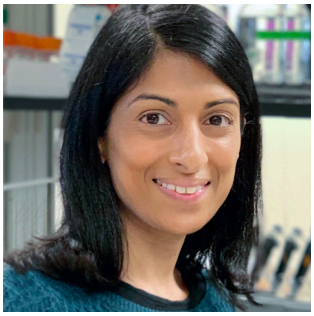
Jiun Do, MD, PhD
Shiley Eye Institute, University of California, San Diego
PROJECT:
Optic Nerve Relays for the Restoration of Visual Function

John Fingert, MD, PhD, FARVO
Carver College of Medicine, University of Iowa
PROJECT:
Single Cell Transcriptome Analysis of Glaucoma

Jason Meyer, PhD
Indiana University School of Medicine
PROJECT:
Complement Pathway-mediated Neurotoxicity of Reactive Astrocytes in a Stem Cell Model of Glaucoma



Lev Prasov, MD, PhD
Kellogg Eye Institute, University of Michigan
PROJECT:
Elucidating the Role of a Novel Closure Associated Gene in Eye Development and Disease



Teresa Puthussery, BOptom, PhD
UC Berkeley School of Optometry
PROJECT:
A Novel Approach to Assess Selective Ganglion Cell Vulnerability in Glaucoma

Steven Roth, MD, FARVO
College of Medicine, University of Illinois
PROJECT:
Novel Slow-release Exosome Formulations for Glaucoma

GLAUCOMA RESEARCH FOUNDATION

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THIRD ANNUAL

GLAUCOMA PATIENT SUMMIT

JUNE 26, 2021

The third annual Glaucoma Patient Summit will be presented as a virtual event on Saturday, June 26, 2021.

Learn more on our website: glaucoma.org/summit

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