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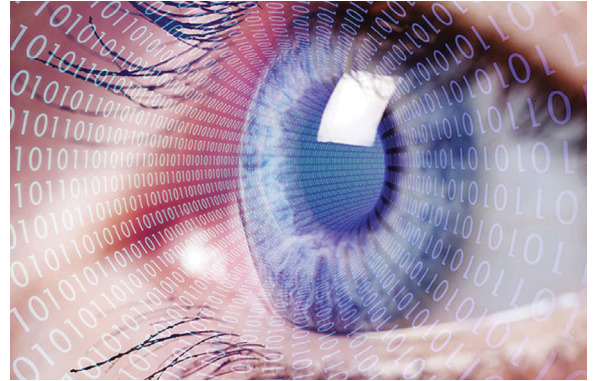
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Glaucoma and Corneal Thickness

Most cases of glaucoma are the result of a number of inherited and environmental risk factors, including gene mutations, diabetes, eye injury, and high blood pressure. Now, research funded by National Glaucoma Research has illuminated another risk factor—corneal thickness.



The cornea is the clear outer surface of the eye. The thinner the cornea, the higher the risk of developing glaucoma. Thinner corneas, which are an inherited trait linked to early eye development, are also associated with an increased severity of visual field loss and a more rapid progression of the disease. Corneal thickness influences the measurement of intraocular pressure (IOP); however, the effect is small, and the risk of glaucoma is independent of the confounding effect on IOP measurement.

There are likely other genetic connections between corneal thickness and glaucoma risk, but many clinicians believe the effect is due to corneal thickness affecting IOP measurements. People with thinner corneas have actual IOP higher than the measured IOP. The difference between measured versus actual IOP is what contributes to the increased risk of glaucoma.

There is also the possibility that thinner corneas indicate a thinner, more flexible sclera, and this difference in scleral stiffness may increase the retinal ganglion cells' susceptibility to injury. There is no question that corneal thickness affects one's likelihood of developing glaucoma and that this trait is genetic. But corneal thickness is just one of the factors in a complex interaction between genetics and environment that contributes to overall glaucoma risk.



President's Corner

I'm encouraged by the continual advance of science and by the research you help us facilitate every day. Each discovery scientists make today can lead to more breakthroughs tomorrow.

In this issue of National Glaucoma Research Report, you'll learn about other critical research you help fund, including advances in our understanding of how misfolded proteins can lead to glaucoma, and how a better understanding of the glymphatic system could one day lead to new treatments for glaucoma beyond lowering intraocular pressure.

Thank you for your continuing support of National Glaucoma Research. Because of you, top scientific minds can conduct the research that will change and improve the lives of people with glaucoma.

Stacy Pagos Haller
President

Identifying New Risk Factors and Treatments for Glaucoma

Piezo channels are protein formations that serve as biomechanical sensors and one of the ways cells can sense changes that cause pressure fluctuations and shearing stress. They are present in many of our organs, including the skin and lungs. While it's believed that Piezo channels are also located in the eye, it's still unknown where they are and what role they may play.

Michael Reber, PhD, at University Health Network (Canada), is using funding from National Glaucoma Research to investigate this channel. His goal is threefold. First, Dr. Reber and his team will confirm the presence of Piezo channels in the retinas of eyes with glaucoma. Second, they will utilize specific drugs to modulate the Piezo channels to assess the effect of these channels on retinal cell death and loss of vision. Third, they will study how Piezo channels mediate the effect of intraocular pressure (IOP) in the retina.

Dr. Reber's team believes that locating the Piezo channel in the eye could lead to the identification and use of existing drugs to help regulate the channel to reduce IOP and help prevent retinal cell death.



A better understanding of the Piezo channel could lead to new approaches for treating and preventing glaucoma.

SPOTLIGHT ON ... Raquel Lieberman, PhD

New Antibodies Help Uncover Myocilin's Role in Glaucoma

Raquel Lieberman, PhD, and her colleagues at the Georgia Institute of Technology in Atlanta have developed antibodies that can detect myocilin, a protein that, when misfolded, is involved in the formation of glaucoma.

Myocilin is normally present throughout the body and especially in the trabecular meshwork (TM) tissue of the eye. However, as is the case with many proteins, genetic miscoding can lead to mutated forms of myocilin that misfold into an abnormal shape.

Thanks to a National Glaucoma Research grant, Dr. Lieberman and her team were among the first to map the normal three-dimensional structure of the myocilin protein. Now, numerous

mutations have been discovered in the myocilin gene, and these are believed to account for approximately three to five percent of primary open-angle glaucoma, the most common type, worldwide.

The researchers also engineered three types of a protein—called an antibody—that can recognize and bind to different versions of myocilin. They hope the availability of these antibodies will allow their group and others to gain further understanding of myocilin's role in glaucoma, including when misfolding problems start and how that causes damage to the TM. Their results could bring about new ways to diagnose and treat glaucoma.



Raquel Lieberman, PhD

Dr. Lieberman's research could help doctors diagnose glaucoma sooner and discover new ways to treat it.

Top Five Questions to Ask Your Eye Doctor

More than 3 million Americans have glaucoma. By 2050, it's estimated this number will double to 6 million. Therefore, it's likely that you or someone you know could be affected, which is why regular, comprehensive eye exams are so important.

It can be helpful to prepare a list of questions before a visit to your eye doctor, who can then help you manage your vision health. Here are some questions you can ask:

- **What tests will you be doing today, and do they include a dilated eye exam to check for diseases such as glaucoma and macular degeneration?**
- **Is there anything about my medical or family history that puts me at higher risk for eye disease?**
- **Are there symptoms to watch for and ways to monitor my eye health?**
- **How often do you recommend I return for a comprehensive eye exam?**
- **Are there lifestyle changes that might lower my risk?**

For other tips and resources to help individuals living with glaucoma, visit brightfocus.org/NGRinfo.

New York Strip with Mushroom Sauce



Mushrooms are full of vitamin D, which is critical for eye health!

Ingredients

- 2 New York strip steaks, about 4 ounces each
- 1 teaspoon margarine
- 3 garlic cloves, chopped
- 2 ounces shiitake mushrooms, sliced
- 2 ounces button mushrooms
- 1/4 teaspoon thyme
- 1/4 teaspoon rosemary
- Salt and Pepper

Instructions

1. Salt and pepper raw steaks to taste. Grill or broil steaks until they reach desired doneness. For medium-rare, heat to 145 °F; for well-done, heat to 170 °F.
2. Heat margarine in a small saucepan on medium heat. Add mushrooms, thyme, rosemary, and garlic.
3. Sauté until mushrooms become tender. Remove from heat source and then stir for another minute. Top steaks with sauce and serve.

Makes two servings.



Researching the Glymphatic System to Treat Glaucoma

Recently, a new hypothesis emerged that suggests that the glymphatic system (brain waste clearance system) could be involved in the development of glaucoma. And yet, its exact role remains largely unexplored, partly due to limited imaging methods to help monitor the glymphatic system and the associated structural and functional changes in the visual system.

Thanks to a grant from National Glaucoma Research, Kevin Chan, PhD, at the New York University School of Medicine, is using advanced magnetic resonance imaging techniques in several studies to detect whether changes in eye pressure, brain pressure, and water channel function may be related to the

glymphatic system and cerebrospinal fluid dynamics along the optic nerve, and whether there are any corresponding visual system impairments.

Currently, the only clinically proven glaucoma intervention is lowering intraocular pressure. However, glaucoma may continue to progress in some patients even after lowering their intraocular pressure to normal levels, which indicates that other undetermined factors may be contributing to the disease. The results of Dr. Chan's study will not only provide new insights into the brain and eyes, but they're also likely to suggest new strategies for targeting glaucoma treatment beyond lowering eye pressure.

Gifts of Securities

Gifts of readily marketable securities that have appreciated provide an excellent means of benefiting National Glaucoma Research while improving your tax picture. When you give such securities (rather than selling them and donating the proceeds), these gifts will be credited at the full fair market value based on the average of the high and low quoted selling price on the day you relinquish control of the asset to National Glaucoma Research. When you are making your charitable contribution this year, consider the benefits of gifting appreciated stock.

1. The satisfaction of knowing your money is invested in a cause that's important to you.
2. Capital gains taxes on the stock are avoided.
3. You will be eligible to receive an income tax charitable deduction for the full fair market value of the stock at the time of the gift.

Please feel free to contact Charlie Thomas at 301-556-9397 or cthomas@brightfocus.org. For more information regarding the gifting of securities, go to brightfocus.org/securities.

Thank you for supporting National Glaucoma Research!

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Please share this newsletter with someone who might be interested in learning more about some of the latest advancements in research to diagnose, prevent, treat, and cure glaucoma. This newsletter is published by National Glaucoma Research, a program of BrightFocus Foundation®, a nonprofit organization located at 22512 Gateway Center Drive, Clarksburg, Maryland 20871, 301-948-3244, brightfocus.org.

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