Glaucoma Research Society of Canada Awarded $374,874 in Grants to 16 Research Projects in 2023

Study on Improving Gene Therapy of Retinal Ganglion Cells Wins Mel Mitzel Research Excellence Award

Glaucoma damages the eye's retinal ganglion cells (RGCs) leading to irreversible loss of visual field and potentially blindness.

Scientists are exploring gene therapy of RGCs as a treatment option using adeno-associated viral vectors, which are able to carry genes to targeted cells in the eye.

Researchers will test three different promoters (which act like switches) to activate the therapy genes in the targeted cells of mice to determine which promoter works the best and lasts the longest.

By studying these different promoters, researchers hope to improve how gene therapy is used to treat glaucoma and other eye diseases in the future.

Aliénor Jamet & Dr. Balwantray C. Chauhan, Dalhousie University, Halifax, NS

Studying How Anxiety Affects Visual Field Testing Results

Visual field tests are commonly used to diagnose glaucoma, but they can cause discomfort and anxiety for patients, which might affect the results.

Researchers hope to find better ways to make the tests more accurate and less stressful for patients.

In this study researchers will compare the physiological responses (e.g. blood pressure) during the test and responses to questionnaires about anxiety in groups of glaucoma patients and control groups.

Dr. Brennan Eadie & Hailey Burns, Nova Scotia Health Authority, Halifax, NS

Prevalence of Glaucoma in Canada

Canada lacks data on glaucoma prevalence. This limits our ability to understand the burden glaucoma has nationally, and also impacts Canadian health-related vision policy and planning. Further, Canada is often excluded from international vision research projects requiring prevalence data.

Researchers for this project will study information from eye exams and questionnaire responses to generate original glaucoma specific knowledge on the prevalence of glaucoma in Canada. They will also generate information on glaucoma risks for Canadians and derive other valuable information such as the use of glaucoma eye drops.

This data will allow Canadian researchers and policy analysts to understand glaucoma and its risk factors. It will also help fill the knowledge gap between Canada and other countries regarding glaucoma.

Dr. Yaping Jin, Dr. Yvonne Buys & Dr. Ziad Butty, University of Toronto, Toronto, ON

Examining the Visual Effects of Laser Iridotomy

This team aims to review and analyze all previous studies of the relationship between the location of Laser Peripheral Iridotomy (LPI) and a visual phenomenon called dysphotopsia (visual effects described as halos, lines, and ghost images).

They expect that the combined analysis could reveal significant insights that individual studies might not have captured. This could lead to a better overall understanding of LPI location and dysphotopsia.

Michael Balas & Dr. David Mathew, University Health Network, Toronto, ON

The Impact of Size and Sex on Outflow Pathways of the Eye

Glaucoma is linked to factors like age and eye pressure. For this project, researchers will explore drainage pathways in the eyes to determine if they are affected by the size of the eye or the person's sex.

They will use various sized tracers (tracking compounds) developed in the laboratory and non-invasive imaging to track the drainage process in both male and female mice.

By comparing different tracers and sexes, researchers hope to better understand how drainage pathways work and whether it could lead to new treatments for glaucoma in humans.

Dr. Yeni Yücel & Dr. Neeru Gupta, Unity Health Toronto, St. Michael's Hospital, Toronto, ON

Understanding How MIGS Affects IOP Fluctuations

Microinvasive glaucoma surgery (MIGS) is a treatment to reduce high intraocular pressure (IOP).

However, follow-up testing may not always show accurate results. IOP fluctuates, and testing IOP during doctor's visits can miss spikes. 24-hour home monitoring devices may produce more accurate results.

This study will use 24-hour home monitoring systems to measure IOP before and after the surgeries to better understand how MIGS affects IOP fluctuation.

The results of this study could lead to a better understanding of baseline risk factors associated with MIGS outcomes and have the potential to dramatically improve surgical outcomes and overall patient satisfaction.

Dr. Ike Ahmed, Dr. Matthew B. Schlenker, Dr. Irfan N. Kherani, Dr. Mike Yang, & Dr. Anastasiya Vinokurtseva, University of Toronto, Toronto, ON

Gaze Behavior When Analyzing Visual Fields

Glaucoma often progresses from a patient's peripheral vision to their central vision. A common diagnostic test is visual perimetry, where patients click a button when they see lights in their field of vision. An ophthalmologist then analyzes test results to determine if there is glaucoma damage.

Previous studies show that ophthalmology residents are twice as likely to incorrectly analyze test results when compared with experienced ophthalmologists' analyses.

This study will compare the evaluations of visual field test results made by glaucoma professionals and ophthalmology residents to try to determine why residents are currently not providing more accurate analyses. It also aims to determine the optimal analysis of a visual field report.

Rodolfo Bonatti, Dr. Lesya Shuba & Dr. Brennan Eadie, Dalhousie University, Halifax, NS

Protecting Eyes Using PEA Molecule

Glaucoma damages the optic nerve and retinal ganglion cells (RGCs) of the eye, potentially leading to blindness. Current treatments target eye pressure, but some patients still lose vision.

A molecule called Palmitoylethanolamide (PEA) shows promise in protecting eyes and is already used in some countries in Europe, but some details are lacking.

This team seeks to determine if they can increase PEA and other related molecules, using mice as test subjects. The study will also look at how age and disease affect these molecules.

This research could lead to new treatments to reduce inflammation, contribute to cell survival, and prevent nerve loss, thus protecting eyesight.

Dr. Melanie Kelly, Dalhousie University, Halifax, NS

Improving Tissue Healing After Glaucoma Surgery

Some glaucoma surgeries to reduce eye pressure can be less successful due to abnormal tissue healing. The goal of this research project is to improve the success of glaucoma surgeries by studying the effects of a number of different compounds.

Researchers will use a special 3D model they developed to mimic the eye's tissue and fluid flow. They will use human cells in the model and simulate conditions of real surgeries to examine the structure and changes in the cells after using different compounds.

The team anticipates finding a compound that could improve tissue healing. This study could help make glaucoma surgery safer and more successful.

Dr. Cindy Hutnik, Dr. James Armstrong, Dr. Anastasiya Vinokurtseva & Richard Zhang, Lawson Health Research Institute, London, ON

Studying the Gene Pathways in Eyes with Glaucoma

The intraocular eye pressure (IOP) associated with both primary open angle glaucoma (POAG) and pseudoexfoliation glaucoma (PXFG) can be linked to issues with the trabecular meshwork (TM). This project aims to understand molecular changes of the TM in patients with POAG and PXFG by determining if the genes in the TM are different in patients with these forms of glaucoma. Researchers will collect TM samples during glaucoma surgeries to be examined at Duke University using advanced techniques for studying genes.

Researchers hypothesize that the gene patterns in eyes with PXFG will differ from those with POAG and also with those of non-glaucoma eyes. They are optimistic that results can lead to improved glaucoma treatments.

Dr. Brennan Eadie, Dr. Changseok Lee & Dr. Emma-Lee Rhyno, Nova Scotia Health Authority, Halifax, NS

Optic Nerve and CSF Changes in Pseudoexfoliation Glaucoma

This study will use advanced MRI scans to examine changes in the optic nerve and cerebrospinal fluid (CSF) in people with pseudoexfoliation glaucoma (PFXG).

Researchers believe that the buildup of abnormal proteins in patients with this condition might affect the flow of CSF around the optic nerve, leading to damage.

The team plans to use specialized MRI techniques on both glaucoma patients and a control group, then compare the results to better understand how the disease affects the optic nerve and CSF movement.

This study could provide valuable insights into the causes of optic nerve damage in PFXG patients and lead to better treatments.

Dr. Neeru Gupta & Dr. Yeni Yücel, Unity Health Toronto, St. Michael's Hospital, Toronto, ON

Regeneration of the Trabecular Meshwork via Stem Cell Activation

Damage caused by high intraocular pressure (IOP) can lead to irreversible blindness.

A recent treatment discovery involves injecting certain protein factors (TMRPs) into the eyes following laser treatment to activate stem cells with the ability to reduce IOP.

For this project, the team will use a different type of laser than has been used in the procedure before to perform the test in rats. Researchers will focus on changes in stem cells and IOP following the test.

If the laser and TMRPs work successfully together to lower IOP, it could lead to better treatments for glaucoma in the future and help prevent eye damage that leads to vision loss.

Dr. Mark Lesk & Dr. Denis Claude Roy, University of Montreal, Montreal, QC.

Two Studies Examining the Impact of Meditation and of Breathing Exercises on Improving Quality of Life of Glaucoma Patients

This team is continuing with research started during the pandemic with two new projects funded this year. Researchers will conduct a 12-week pilot study for both projects.

Glaucoma patients are susceptible to having lower quality of life partly due to the added stress that can come with vision loss. Earlier studies have proven that both meditation and breathing exercises can reduce stress and improve the overall well-being for many glaucoma patients.

The first project will compare a group doing meditation with a group getting the usual care, and measure stress, quality of life, and future outlook using questionnaires.

The second project will compare glaucoma patients who receive the breathing intervention with those who receive the usual care. They will measure the effects on mental health, stress levels, and future outlook using questionnaires.

If effective, this could lead to better care for glaucoma patients and improve their mental and physical well-being.

Dr. Monali Malvankar & Dr. Cindy Hutnik, Lawson Health Research Institute, London, ON

A New Role for Histamine in Optic Nerve Regeneration

Glaucoma can lead to blindness when retinal ganglion cells (RGCs) in the eye are damaged. In an attempt to restore vision, researchers are exploring ways to regenerate RGCs.

A substance called Zymosan has shown promise in promoting regeneration, but with negative side effects that outweigh the benefits, preventing its use in humans. This study aims to better understand how Zymosan works and if it can be used to develop a safe treatment for glaucoma. Previously, the team found that mast cells play a role in Zymosan's effects and that histamine, a chemical produced by mast cells, helps RGCs regenerate.

This project will study if the histamine and its receptors can aid RGC regeneration and test if blocking histamine with drugs harms RGC regeneration. The study could lead to safer and better treatments for glaucoma and potentially help restore vision.

Dr. Philippe Monnier, University Health Network, Toronto, ON

RENEWAL: Studying Associated Glaucoma Gene Using Zebrafish

This renewal project has already received two grants from the Glaucoma Research Society of Canada in 2016 and 2019 to study glaucoma using zebrafish. Zebrafish make an excellent model to study glaucoma as their eyes are highly similar to that of humans, and certain mutations in genes can be easily produced in the researcher's laboratory.

The 2016 study looked at a gene called FOXC1 and the gene GMDS was the focus of the 2019 renewal – both uncovered links with glaucoma.

This second renewal in 2023 will focus on the zebrafish version of the GMDS gene that has been associated with primary open angle glaucoma (POAG) risk in human populations. The researcher hopes to further explore the relationship between the gene and glaucoma in the fish to help doctors better understand and treat glaucoma in humans.

Dr. Curtis French, Memorial University of Newfoundland, St. John's, NL

ATTENTION RESEARCHERS:

GRSC's online research portal will open on October 16th for submissions to the 2024 grant campaign.

www.glaucomaresearch.ca