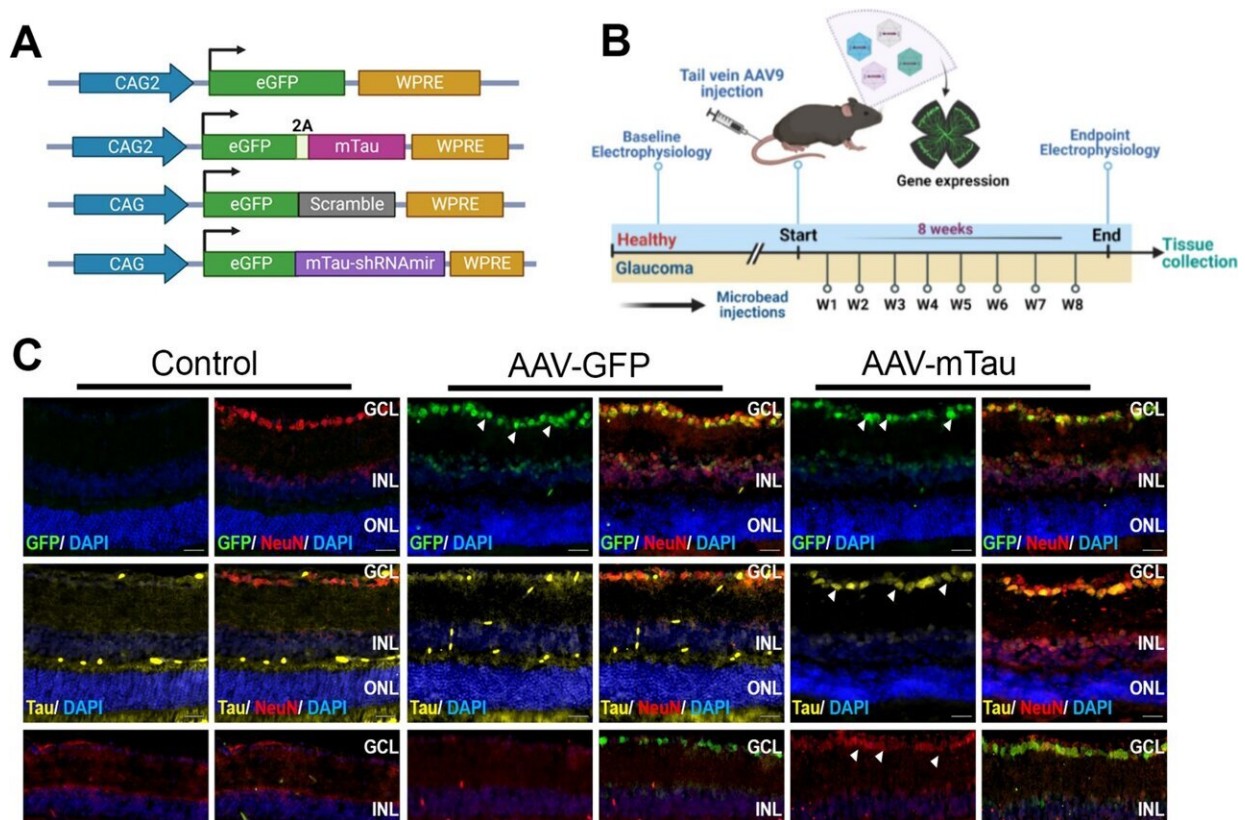


# Gene therapy discovery triggers hope for glaucoma patients

July 23 2024, by Georgia Gowing



Modulation of tau expression in C57BL/6 mice retinas. Credit: *Acta Neuropathologica Communications* (2024). DOI: 10.1186/s40478-024-01804-0

The protein tau is essential to the function of cells in the brain and central nervous system, but when over-produced under certain

conditions, it forms tangles that clog the cells' internal structures. These tangles have also been found in Alzheimer's disease patients.

Tau is also present in [neuronal cells](#) in the retina, and research led by Macquarie University's Vision Science Group has found that altered tau is likely to have a significant role in the development of [glaucoma](#).

About 300,000 Australians are estimated to be living with glaucoma, which may result in irreversible blindness over 10 to 15 years if left untreated.

Like Alzheimer's, it becomes more common with age. About 1 in 8 people aged 80 and older are affected, but many people are unaware they have it.

One of the signs of the disease is rising pressure inside the eyeball, and current treatments focus on reducing this pressure, either using eyedrops or with surgery.

However, not all glaucoma is associated with high eye pressure, and even in those cases that are, the topical pressure-lowering treatments only successfully control progression in about 50% of cases over a 10-year period, indicating other factors are also at play.

The Vision Science Group's [latest study](#), published in the journal *Acta Neuropathologica Communications*, brought together expertise from leading labs around the world, including Deakin University, Cedars-Sinai Institute and Harvard University in the U.S., and Linköping University in Sweden, enabling the team to delve deep into the molecular mechanisms underlying glaucoma.

Research leader, Associate Professor Vivek Gupta, says using novel gene therapy, they were able to manipulate tau levels in the retinas of mice.

"We have shown that tau is vital to maintaining retinal integrity, but it is a delicate balance," says Associate Professor Gupta.

"There is what you might call a 'Goldilocks' zone, where tau levels are just right, and that promotes optimal retinal health.

"When we over-produced tau, we observed inner retinal degeneration, but when there was too little tau, that was also detrimental.

"Switching off the over-production and knocking the tau down to healthy levels provided protection against the degenerative changes associated with glaucoma.

"This protective effect was evident in both the structural preservation of retina cells and their function. While it was not able to restore lost vision, it did stop the retinal degeneration from worsening.

"These findings highlight the critical role of tau protein in retinal health, and suggest that targeting tau could be a promising therapeutic strategy for glaucoma, particularly when administered early."

## **Potential for treating multiple diseases**

The "switch" the team developed is a gene therapy carried by a viral vector, which has the unique ability to cross both the hard-to-penetrate blood–brain and blood–retinal barriers.

The brain and retina need a special biological environment to function properly. While these barriers help maintain normal conditions and protect them from harmful pathogens and molecules in the bloodstream, it also makes it challenging to deliver medical treatments to these areas.

Based on a type of naturally occurring virus not known to cause serious

diseases in humans, therapies using what is known as an AAV-based vector are already being used to treat other retinal diseases.

The paper's lead author, Dr. Kanishka Pushpita Maha Thananthirige, says the team's aim is to develop a gene therapy to use in conjunction with treatments that lower interocular pressure after glaucoma is diagnosed.

"This kind of [gene therapy](#) that controls tau production can be designed to target neurons in the brain and [central nervous system](#), as well as those in the retina.

"With altered, or pathogenic, tau often present in the neurons of patients with Alzheimer's disease, there is good potential that it could also be beneficial in treating these and other neurodegenerative diseases."

The next step will involve further testing in animal models, with human clinical trials still several years in the future.

**More information:** Kanishka Pushpitha Maha Thananthirige et al, Tau modulation through AAV9 therapy augments Akt/Erk survival signalling in glaucoma mitigating the retinal degenerative phenotype, *Acta Neuropathologica Communications* (2024). [DOI: 10.1186/s40478-024-01804-0](#)

*This content was originally published on The Macquarie University [Lighthouse](#).*

Provided by Macquarie University

Citation: Gene therapy discovery triggers hope for glaucoma patients (2024, July 23) retrieved 23 July 2024 from <https://medicalxpress.com/news/2024-07-gene-therapy-discovery-triggers->

[glaucoma.html](#)

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.