## Autumn 2024 Hope in sight®

## Tom helps us write a NeW chapter

The right focus on eye health

Investigating glaucoma from all angles

CENTRE FOR

Eye Research Australia

**World Glaucoma Week** 10-16 March 2024

Visionary Autumn 2024

## Throwing light on glaucoma

One of the biggest challenges for treating glaucoma is detecting the disease before the eye is harmed.

This is why it's called the 'silent thief of sight' – it can cause irreversible damage before noticeable vision loss occurs.

World Glaucoma Week (10-16 March 2024)
is when the eye health community comes together to throw a spotlight on the disease and raise awareness of how early detection and treatment can save sight.

But even with all the progress we've made, we still need new ways to spot and treat the disease for the many people who go on to lose their vision.

In this edition of *Visionary*, we share how we're using new scanning technology to try and identify biomarkers – signs in the body we use to find and monitor diseases – to detect sight-threatening glaucoma earlier and test new treatments more efficiently.

We also explain how a digital education model could help people newly diagnosed with glaucoma better understand the



disease and the importance of taking their medication.

You'll also find out how tiny structures that control blood flow within the eye are offering clues towards a whole new way of treating the condition.

CERA's glaucoma research has progressed to this point thanks to the many people who have supported us on this mission, like Tom who participates in clinical studies and Heather who has chosen to leave a gift in her will to fund research.

If you would like to join them, please support our Glaucoma Appeal. Every donation brings us closer to our shared goal of a world free from vision loss and blindness.

Kind regards,

Keitu Martin

**Professor Keith Martin** Managing Director Centre for Eye Research Australia

#### **Centre for Eye Research Australia**

+61 3 9929 8360 cera@cera.org.au cera.org.au



- (f) CERA.eye
- 🛞 EyeResearchAus
- Centre for Eye Research Australia (CERA)





Giving back: Tom Valenta is a passionate supporter of research.

Photo: Ben Jones

## Writing a new chapter

#### Tom Valenta has witnessed incredible progress in glaucoma research in less than two decades – and is doing his part to keep up the momentum.

ournalist, public relations consultant and author Tom Valenta was diagnosed with glaucoma in 2011.

The now 77-year-old was no stranger to the degenerative disease – he watched his mum's eyesight diminish from it.

"There was virtually no treatment for glaucoma in those days," says Tom.

"In the last decade of her life, she became close to totally blind.

"Her peripheral vision was always impacted.

"But towards the end, I'd have to stand in a particular place so she could see it was me."

Glaucoma affects the optic nerve connecting the eye and the brain.

If left untreated, it can lead to permanent vision loss.

Around 300,000 Australians have glaucoma – but about half of these people don't know it.

The slow progression of glaucoma means that many people with the disease don't notice any symptoms until their vision loss is advanced.

Because of Tom's family history of glaucoma, he had his eyes checked regularly for many years.

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This meant it was caught early enough for treatment to be effective.

Tom manages his glaucoma with prescription eye drops.

Not only has this stopped his vision declining, but Tom says his eyesight has actually improved in recent years due to a change in medication.

"I am now no longer short-sighted and don't need glasses for driving or watching sport.

"It's the good news story in all of this."

#### New treatments, better outcomes

Tom spends his time caring for his six grandchildren, keeping fit and pursuing his interest in writing and photography.

While no longer working professionally, his love of writing has seen him publish 13 books – with another on the way.

The impact of glaucoma on Tom's vision is vastly different to his mother's – largely

due to advances in medical research and treatment over the past few decades.

"I believe I lead a very normal life," Tom says.

"I'm not constrained or restricted in any way. I just read with level one glasses – a very easy, simple thing.

"I'm not at all impacted the way my mother was."

Tom says he's grateful for the researchers who have worked towards better treatments and experiences for people with glaucoma.

"Had there not been any treatment for me, there's no doubt my glaucoma would have progressed," he says.

#### **Giving back**

Just as CERA researchers are working to extend knowledge of glaucoma and other eye diseases, Tom is using his non-fiction writing to build awareness and understanding of health and social issues.

#### Helping research: Tom Valenta with with optometrist and researcher Dr Flora Hui.

This commitment to giving back has driven Tom to participate in three clinical trials with CERA since 2017.

These studies are essential to advance our understanding of glaucoma and find new treatments – and it's volunteers like Tom who make them possible.

"The more we participate, the better the chances of improved medications for glaucoma, or even possibly a cure at some stage," Tom says.

"They've got a fabulous team at CERA.

"Everyone I've dealt with impresses me with their dedication, their professionalism, and their capacity to explain what they're doing and why they're doing it."

Tom says he's optimistic about the future of glaucoma research, based on the significant progress he's seen in the field since he was diagnosed 12 years ago.

He hopes his contribution can keep progressing this vital research.

"I hope that future generations will be free of glaucoma."

#### **Research impact**

Dr Flora Hui is a clinician scientist at CERA who researches innovative ways to improve outcomes for people who don't respond to current glaucoma treatments.

Her previous research determined that nicotinamide – a type of vitamin B3 – has the potential to boost the health of the cells that are affected in glaucoma.

She is currently undertaking a longer-term trial to see if the supplement could be used in standard clinical care to help slow vision loss in glaucoma.

Dr Hui says that people like Tom who participate in clinical research make a remarkable and invaluable contribution to science.

"It would be impossible for us to find new and improved treatments for vision loss without people like Tom being so generous with their time," she says.

She is also thankful to everyone who donates to research.

"All of the researchers at CERA are deeply grateful to the hundreds of people who contribute to make our achievements possible."

#### **World Glaucoma Week Appeal**

- → Help our research team find life-changing therapies so more people with glaucoma can see clearly.
- → You can donate on the form enclosed with this edition of Visionary, or online at cera.org.au/appeals/glaucoma-appeal

**Photo: Anna Carlile** 

### Global search for missing glaucoma link

International glaucoma experts have joined forces to investigate blood flow in the eye – which could be the key to unlocking new treatments.

ERA's Head of Visual Neovascular Research Dr Luis Alarcon-Martinez is bringing international collaborators together to investigate blood flow in the retina, thanks to a five-year grant from Foundation Fighting Blindness Canada.

Together they're aiming to gain a deeper understanding of how the retina, optic nerve and brain are impacted in glaucoma.

The most common known cause of glaucoma is too much pressure inside the eye causing damage to the optic nerve.

However, there are also many people who do not experience high eye pressure that still develop the condition. Dr Alarcon-Martinez says it's vital to decrease eye pressure, but "we know we are missing something very important about the disease."

He believes that mechanisms controlling blood flow through our light-sensing nerve cells may hold the key to unlocking this mystery.

"Nerve cells are always getting or using some levels of energy, which is why blood flow is so important to the retina, the optic nerve and the brain," says Dr Alarcon-Martinez.

"If you stop blood flow, the nerve cells will die."

#### Looking deeper: Dr Luis Alarcon-Martinez is searching for new treatment pathways for glaucoma.

Dr Alarcon-Martinez is working with Professor Adriana Di Polo from the University of Montreal, who is a global leader in understanding the mechanisms behind glaucoma.

CERA Managing Director Professor Keith Martin will also contribute to the study, and Professor Bang Bui from the University of Melbourne is bringing his invaluable knowledge of living glaucoma models.

"We hope this study lays the groundwork for new treatments aiming to improve blood flow – supplementing current treatments that lower eye pressure," says Dr Alarcon-Martinez.

#### **Communication is key**

The team will look deep behind the eye using Dr Alarcon-Martinez's pioneering two-photon microscopy setup – an advanced imaging technique allowing researchers to see living tissue at a scale not possible with other microscopes.

Dr Alarcon-Martinez and Professor Di Polo previously used two-photon microscopy to discover formerly unseen structures that communicate to regulate blood flow between cells in the retina, optic nerve and brain.

"We are now seeing the importance of this process to diseases, including glaucoma," says Dr Alarcon-Martinez.

The light-sensing retina at the back of the eye is made up of many nerve cells, which are constantly using energy to send signals through the optic nerve to our brain. "Most cells in our body can store energy for whenever needed, but nerve cells don't have this ability," says Dr Alarcon-Martinez.

Instead they constantly 'ask' blood vessels for oxygen and nutrients, which every cell needs to produce energy.

Pericytes are a type of cell that wraps around the blood vessels and controls the amount of blood passing through them.

By looking at a living organism, Dr Alarcon-Martinez and his team discovered pericytes project very thin tubes called nanotubes.

"Nanotubes send signals between blood vessels to lead blood flow to where energy is needed most," says Dr Alarcon-Martinez

Dr Alarcon-Martinez says this communication is disrupted if nanotubes are broken.

#### Huge potential

The team will use a pre-clinical model of glaucoma developed by Professor Bui to investigate how this communication is affected by the disease – comparing the results with healthy living organisms.

"We'll be looking at single axons and blood vessels with the aim of detecting how well single nerve cells are working – hoping to see if we can prevent, predict or even give a score of the state of the glaucoma," says Dr Alarcon-Martinez.

The team's findings will also give valuable insights to other CERA research looking at new ways of treating glaucoma, such as Professor Martin's work into developing a gene therapy to prevent optic nerve damage.

## Seeing glaucoma from all angles

#### A new 3D eye model aims to give patients a clearer insight into their glaucoma and encourage them to stick with their treatment.

hile current treatments for glaucoma are effective at stopping or slowing vision loss for many, a large number of people stop their treatments within several months of receiving their management plan.

Associate Professor Elaine Chong, CERA Senior Research Fellow and Head of Ophthalmology at the Royal Melbourne Hospital, says that arming patients with a better understanding of glaucoma is key to ensuring treatments are started early and taken regularly.

"When patients have a better understanding of what will happen if their condition deteriorates, they will be more motivated to take control of their treatment," says Associate Professor Chong. This led Associate Professor Chong and ophthalmology registrar Dr Joos Meyer to work with a team of designers and artists to develop One Right Eye: a 3D eye model quite literally modelled on a person's right eye.

"In One Right Eye, you can actually see the damage caused to the optic nerve in glaucoma, which would otherwise be extremely hard to understand," she says.

She says the model will also be a better way of working for ophthalmologists "because a picture tells 1000 words."

#### How it works

Associate Professor Chong says explaining a complex eye condition like glaucoma to

#### Zooming in: Associate Professor Elaine Chong visualising glaucoma with One Right Eye.

"Most patients really appreciate having a visual explanation of their condition rather than just a discussion." – Associate Professor Chong

a patient without a visual aid is extremely difficult – especially during a short consultation.

"In glaucoma, nerves become sick and eventually die, and you need to be able to visually demonstrate to patients how it happens and why you need to monitor it."

While physical eye models exist in some clinics, they are quite small and parts are often missing.

Associate Professor Chong says people with visual problems can look at the 3D model on an iPad or a computer in a lot more detail.

"It's easier to understand because you can rotate the eye to see it from different angles and split the eye to see inside and zoom into a larger format."

#### Increasing understanding

The software also allows clinicians to visually demonstrate the potential damage caused by cataracts, diabetic retinopathy and age-related macular degeneration.

The clinician selects the relevant condition in the program and then, using the 3D eye model, they can zoom in and out of the affected area to give the patient a visual understanding of the disease's potential effects. The team is currently running a trial of One Right Eye in clinics to assess patient satisfaction.

"Most patients really appreciate having a visual explanation of their condition rather than just a discussion," says Associate Professor Chong.

The team is using feedback to refine the model and add features that can further improve patients' understanding of eye disease.

New features will allow patients to see what happens during procedures such as visual field tests and OCT scans that check for eye diseases like glaucoma.

"For example, the patient will be able to see where an OCT scan is actually scanning on the eye – and how it relates to their condition," says Dr Meyer.

Another feature in development will show patients a 3D view of how their vision may change and deteriorate over time.

After further refinements, the team hopes to roll out One Right Eye more widely into clinics.

This project is supported by CERA's Innovation Fund and a Telematics Trust grant. Visionary Autumn 2024

## Predicting glaucoma progression

Photo: Anna Carlile

#### The combined power of imaging and AI could identify people at risk of losing vision from glaucoma quickly – and who may benefit from new treatments.

laucoma treatments such as eye drops, laser treatment and surgery can help preserve many people's sight, yet around one in three people still become blind in at least one eye within 20 years of being diagnosed with the condition.

"Predicting who will not respond well to routine treatment is one of the biggest challenges in managing glaucoma," says Associate Professor Zhichao Wu, Head of Clinical Biomarkers Research at CERA.

Many new glaucoma treatments are being developed that aim to prevent damage in the eye before it occurs.

When these treatments eventually become available, clinicians will need better

ways of identifying who is most at risk of losing vision quickly, as well as better methods of monitoring the effectiveness of these treatments.

Associate Professor Wu is working with CERA's Ophthalmic Neuroscience team to use advanced imaging techniques in conjunction with AI to find signs – known as biomarkers – of cells that are sick and most likely to degenerate.

#### **Identifying high-risk patients**

Biomarkers are indicators of our body's different processes, which can be used for diagnosing conditions, predicting worsening of disease and assessing the effectiveness of treatments.

#### Early detection: Associate Professor Zhichao Wu is looking for new glaucoma biomarkers.

Associate Professor Wu says there are not yet any known biomarkers that can accurately predict glaucoma progression.

In the first part of the study, Associate Professor Wu, alongside Professor Peter van Wijngaarden and Dr Xavier Hadoux from the Ophthalmic Neuroscience Unit, is focusing on the potential of hyperspectral imaging.

A hyperspectral camera, developed at CERA, takes images of the retina with a multicoloured flash, enabling the team to see how the cells reflect light and find previously unseen signs of injury.

"The objective is detecting cells that appear sick, as these sick cells are usually the ones that will go on to die in glaucoma, causing progressive loss of vision," says Associate Professor Wu.

"And that might give us a biomarker of the prediction for progression."

#### Tracking glaucoma's progress

With the use of AI, Associate Professor Wu says they aim to eventually produce a two-dimensional picture of the back of the eye.

"We're hoping for a heatmap of these sick cells to give an idea of how at risk patients are of progressing and where that damage will occur. "Because not all damage is equal – damage closer to the center of your vision matters more for our daily activities."

Once these high-risk patients are identified, clinicians will need a way of closely monitoring the effectiveness of their treatments.

However, the current method of tracking glaucoma progression can take years to pick up any vision loss.

"On average, it takes six years of doing visual field tests every six months to detect even moderate rates of visual field progression – and that's shocking," says Associate Professor Wu.

"In the second part of our study, we aim to compress this timeframe from six years to six months by picking up that change much sooner."

Associate Professor Wu is using widefield optical coherence tomography (OCT) imaging combined with AI techniques, informed by knowledge of human anatomy and glaucoma to better distinguish between disease progression and healthy ageing.

"With this method, we aim to do a much better job of detecting glaucoma progression than is possible with visual field tests."

This important study is following people with glaucoma over two years and is close to its halfway mark.

Associate Professor Wu and his team sincerely appreciate the commitment of research participants.

"We're very thankful to the people that give up their time to help us gain insights into this disease." Visionary Autumn 2024

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## Looking for glaucoma in the clinic

A study of one million patient records shows routine use of OCT scanners in optometry could boost glaucoma detection and reduce undiagnosed cases.

ptometry clinics that routinely used optical coherence tomography (OCT) scanners as part of their regular eye tests were 34 per cent more likely to refer patients for a specialist glaucoma assessment, according to new research which examines the results of almost a million people.

The research, published in the *Journal* of *Glaucoma*, found that routinely including OCT scans in optometry eye tests could boost glaucoma detection rates and reduce the high rate of undiagnosed cases in the community.

The research was conducted by a team from CERA, including Honorary Principal Investigator for Health Services Research Peter Larsen, and staff from the optometry chain Specsavers. Larsen began his research role at CERA after stepping down from his previous executive role as Group Eye Director at Specsavers.

The study compared specialist glaucoma referrals from those practices which routinely used OCT scanners in their eye examinations to those who did not.

It is believed to be the first large-scale investigation of the impact of routine OCT scanning on glaucoma detection rates.

#### **Glaucoma and OCT**

"Diagnosing glaucoma is challenging due to the insidious nature of the disease which has few symptoms in its early stages," Larsen says. In focus:
 OCT scanners
 can see the
 optic nerve.

"This is compounded by the fact that elevated eye pressure – a key risk factor for the disease – is not present in many people, including most of those with undiagnosed glaucoma."

OCT is a powerful imaging technique which enables eye care professionals to view a patient's optic nerve and retina with great precision.

It is widely used by ophthalmologists who treat people with glaucoma and is increasingly common among optometrists.

Larsen said the study results show that routinely including OCT in optometry eye testing – rather than using it as an 'on-indication' test when other signs of the disease are present – could significantly reduce the burden of undiagnosed glaucoma in the community.

"Conventional approaches to glaucoma detection in optometry were formulated before the widespread availability of OCT," he says.

"This study shows that routine adoption by optometrists could ultimately lead to earlier treatment and better visual outcomes."

#### Analysing eye data

Larsen's research examined the de-identified records of almost 994,000 patients who visited 195 Specsavers practices in 2019.

The study found 10,475 patients, or 1.1 per cent of those who had an eye test, were referred to an ophthalmologists for a glaucoma assessment.

It also found that:

- Practices which incorporated an OCT test in routine eye testing were more likely to refer patients to an ophthalmologist for a glaucoma assessment (1.1 per cent) compared to those that did not (0.8 per cent)
- → The proportion of patients referred by practices that routinely used OCT was similar to the estimated prevalence of glaucoma in the Australian population (1.4-1.6 per cent of all patients and 2-3 per cent of patients over 50 per cent)
- → More than two thirds of patients referred (68 per cent) had normal intra-ocular pressure in both eyes, meaning that they might have been missed if eye pressure was used as the basis for referral.

The study also received ophthalmologist feedback for 318 of the referred patients. Of these:

- → 41 per cent were diagnosed with glaucoma
- → 38 per cent were considered to be glaucoma suspects
- $\rightarrow$  21 per cent showed no signs of glaucoma.

While the rates of those who were shown not to have glaucoma were lower than some previous studies on glaucoma referrals from optometry, Mr Larsen says more research was needed to determine the false positive rate.

The research was the result of a collaboration between the Centre for Eye Research Australia, Specsavers Australia New Zealand, University of Melbourne and University of Western Australia.

## **Championing vision**

Heather Herbert's lifelong love of sport has inspired her to leave a gift in her will to vision research.

eather's passion for sports has kept her active throughout her life.

"I'd play anything with a ball – tennis, basketball, netball, squash. I'm a fairly well-rounded sportswoman," she says.

Now in her late 70s, golf is her preferred game. But she still enjoys the excitement of watching a variety of live sports, especially football as an avid Geelong supporter.

It was through the AFL that Heather first heard about Tyler Fishlock – a young eye cancer survivor who was taken under the wing of the Richmond Football Club.

"He had to have both his eyes removed, and he was only about eight at the time," says Heather.

She recalls being deeply moved by Tyler's story and the profound impact vision loss can have, particularly on young people.

"It's one of the main reasons I got interested in eye research," she says.

#### **Making a difference**

Heather has experienced several eye conditions herself, including glaucoma, for many years. This has compelled her to help others facing potential vision loss.

Introduced to CERA's work by her former ophthalmologist, Associate Professor Anne Brooks AM, Heather began donating in 2019 and has since included a bequest to CERA in her will.

She hopes her legacy gift can contribute to lasting change for those affected by vision loss and blindness.



↑ Lasting change: Heather Herbert is inspired to have an impact.

"If I can afford to do it and my family doesn't need the money, it's best to donate it to something useful. Every bit helps," Heather explains.

#### Maintaining precious vision

Heather has benefited from advances in eye research, such as laser therapy, cataract surgery and corneal transplants, which have helped preserve her vision so she can keep doing what she loves.

"My eyesight is clear but it's not perfect. I can keep driving though, which is the main aim of the game," says Heather.

She now encourages her three children in their 50s to have regular eye checks and hopes her 12-year-old granddaughter will do the same in future.

"You've got to do the right thing by your eyes because vision is so precious," she says.

# Be a star that shines on

By leaving a gift in your will, no matter the size, your generosity helps protect future generations from vision loss and blindness.

For more information Visit **cera.org.au/shine** Email **giftsinwills@cera.org.au** Call **1300 737 757** 







# Help us write a new chapter for glaucoma



World Glaucoma Week 10-16 March 2024

#### Donate to our Glaucoma Appeal today

Help future generations be free from glaucoma

Donate at cera.org.au/appeals/glaucoma-appeal

