CENTRE FOR
Eye Research
Australia

Hope in sight®

Annual Review 2022

See the future

Our story

Vision is precious and no one should ever lose the gift of sight.

We're deeply committed to conducting eye research with real-life impact and finding ways to prevent people from going blind.

As an international leader in eye research, we use our world-class knowledge and expertise to achieve better treatments and faster diagnosis of eye disease.

Our goal is to prevent vision loss – and ultimately, find cures to restore sight. As true innovators, our scientists are on the brink of new discoveries every day.

With your support we can continue this world-leading research and accomplish scientific breakthroughs previously deemed unattainable.

Our aim is to offer hope to people affected by vision loss and protect the sight of everyone in need.

With CERA, there's hope in sight.

CENTRE FOR
Eye Research
Australia

← **COVER: New mother Catherine Carnovale, pictured with daughter Netta, has type 1 diabetes. She is hopeful new research will help more women living with the disease preserve their sight during pregnancy so they can watch their children grow.**

THE UNIVERSITY OF MELBOURNE

the royal victorian
eye and ear
hospital

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↑ VENTURE team: (from left) Researchers Fleur O'Hare, Dr Thomas Edwards, Parker Truong, Sachinee Jayasuriya, Associate Professor Heather Mack, Dr Ceecee Britten-Jones and Associate Professor Lauren Ayton.

Chair and Managing Director's message

Rapid advances in technology and scientific discovery are transforming the way we diagnose and treat eye disease.

Telehealth and artificial intelligence are showing real potential to increase access to eye care and prevent blindness.

Genomics, powerful new imaging technologies and the utilisation of big data mean that causes of blindness, once considered to be a mystery, are now closer to being understood.

Accelerating progress in gene and cell therapies is providing new hope of treatments for eye diseases that until very recently were considered incurable.

Reaching this point has taken a concerted effort from global researchers in medical research institutes, universities, health services and industry through decades of work.

Vital support

In 2022, the Centre for Eye Research Australia continued advancing research to find new and better ways to save sight.

Innovation is the key to tackling eye disease. But the early stages of research, when a scientist has a bold new idea, are the hardest to get off the ground.

Philanthropy plays a vital role. The support of individual donors, forward-thinking philanthropists, trusts and foundations provides the conditions for successful innovation.

In 2022, two major studies demonstrated the great impact of a philanthropic gift to CERA. This research, part of a national collaboration, identified hundreds of new gene variants associated with glaucoma and age-related macular degeneration.

This research would not have been possible without the incredible generosity of Peter Clemenger AO and his late wife Joan Clemenger AO. Together they donated a robot which automated the development of the IPSC stem cells used in genetic modelling.

Fostering innovation

The stem cell robot was also critical in the early research of our Cellular Reprogramming Unit, whose work underpins our newest start-up company, Mirugen.

Mirugen is developing a gene therapy to 'switch on sight' by restoring photoreceptors at the back of the eye, with potential to treat conditions ranging from retinitis pigmentosa to age-related macular degeneration.

Start-ups like Mirugen are an important part of our strategy at CERA, helping us move our research from the lab to the clinic.

In 2022, we strengthened our partnership with the Royal Victorian Eye and Ear Hospital through a new joint research strategy titled *Innovation for Exceptional Care*.

The strategy aims to build our reputation as a leading clinical trials centre and give patients access to cutting-edge treatments, including new gene therapy trials.

It builds on the strong collaboration between the hospital's Ocular Genetics Clinic and our VENTURE study to link patients with suitable research opportunities.

Clinical research

The past year has seen a strong rebound of clinical research activity – reflecting global growth of ophthalmic research and Australia's reputation for high-quality clinical trials.

In 2022, 60 clinical research projects involving 2300 participants were conducted at CERA. Forty of these involved an intervention or investigational treatment – and we are seeing strong future demand from industry.

The international standing of our Macular Research Unit, led by Professor Robyn Guymer AM, has been central to bringing many of these trials to Australia.

In 2022, the Macular Research Unit celebrated its 25th anniversary, providing an opportunity to reflect on how far the treatment of AMD has progressed, thanks to research.

When the team was first formed in 1997, AMD was considered untreatable. Fast forward a quarter of a century and there are now effective treatments for wet AMD with many potential treatments for dry AMD on the horizon – illustrating the enormous impact of macular research.

Bright future

While we are celebrating our more established scientists – another bright spot last year was the influx of talented students.

In 2022, we hosted 25 higher degree researchers and 28 visiting students. We're proud to support the next generation of eye research leaders.

Impactful medical research is a team effort. We are incredibly grateful to our colleagues at the Eye and Ear Hospital, University of Melbourne, and our partners in other research institutes and industry, for being part of a collaborative research ecosystem.

Thank you to the Victorian and Australian governments for their ongoing funding and to the many individual philanthropists, trusts and foundations who support our work.

Finally, thank you to all CERA staff for their commitment and dedication to transforming the lives of people with vision loss.

Our collective efforts move us closer to a world free from vision loss and blindness.

Olivia Hilton
Chair

Professor Keith Martin
Managing Director

2022 snapshot

255

RESEARCH PUBLICATIONS

$6.21m

IN GOVERNMENT GRANTS

Clinical research

2300

PARTICIPANTS

60

PROJECTS

40

INVOLVING AN INTERVENTION OR INVESTIGATIONAL TREATMENT

$3.55m

IN DONATIONS AND BEQUESTS

FOUNDED **MIRUGEN** - CERA'S GENE THERAPY START-UP

MACULAR RESEARCH UNIT CELEBRATES

25 years

DR FLORA HUI

Superstar of STEM

$1.64m

IN PHILANTHROPIC GRANTS

6

Australian Vision Research Grants

Innovation for Exceptional Care

JOINT RESEARCH STRATEGY CERA AND THE EYE AND EAR HOSPITAL

DR LISA ZHU WINS RAMACIOTTI FOUNDATION'S HEALTH INVESTMENT GRANT

Lions Eye Donation Service

COORDINATED CORNEAL DONATIONS FROM 278 DONORS

FOR...

463

CORNEAL TRANSPLANTS

AND...

262

SCLERA SURGERIES

Sky's the limit

"If research can reduce the uncertainty for another family in the future, that will make a huge difference."
– Ronelle, Sam's mum

Sam is (almost) 11. He loves designing and building things. He thinks that when he grows up, he might be an engineer.

"My favourite subject at school is STEM," says Sam. "We are designing rockets and then we are going to print them out on a 3D printer.

"We are going to go out on the school oval, then you add bi-carb soda and vinegar, shake it up and it goes really high into the sky."

Like a rocket, Sam leaps high in to the sky in another of his favourite hobbies, trampolining.

For all his life, Sam has lived with low vision and photophobia which causes intense eye discomfort in bright light. He relies on special glasses with a coloured filter to see.

"When Sam was a baby, he literally would not open his eyes outside," says his mother, Ronelle. "And when he learned to crawl he would avoid any brightly lit areas of the house.

"It wasn't until he was about four or five that he was able to see clouds for the first time – because the light wasn't so bright, and he was able to see the contrast. He was amazed."

Sam also experienced nystagmus – rapid involuntary movement of the eyes – but doctors weren't able to provide a diagnosis or tell if his vision problems would get worse.

Continued on Page 8

← **Growing up: Sam is a happy, active 10-year-old.**

"I was worried Sam's vision loss was progressive and wanted to know how to prepare for the future," says Ronelle.

Sam's father Dave recalls the frustration of trying to find support for an undiagnosed condition.

"It is hard to access services when you can't put a name on something," he says.

Decade to diagnosis

It took nearly 10 years for Sam's family to get an answer.

Sam is part of VENTURE, a collaboration between CERA and the University of Melbourne which aims to improve understanding of inherited retinal diseases (IRDs) and give more people the opportunity to take part in research.

It was thought Sam may have had a very rare IRD known as achromatopsia.

It was through his involvement with VENTURE that Sam's family underwent genetic testing which identified the genes associated with X-linked congenital stationary night blindness.

And after travelling overseas in search of answers, Ronelle and Dave are reassured that studies like VENTURE are now happening in Australia.

"There aren't any treatment options, or gene therapy trials, for the condition Sam has," says Ronelle.

"But if research can reduce the uncertainty for another family in the future, that will make a huge difference. So, if another child has a condition like Sam's they won't have to wait 10 years to get an answer."

High hopes

In recent years, Sam's vision has been stable. After years of navigating the world with low vision – he's resilient and optimistic.

He's proud of the skills he's developed at school, at play and on the trampoline, including perfecting a double front flip and an ability to scale impressive heights at the trampoline park.

"At Bounce there were three levels to jump from. Some of the other kids were a bit scared but I just went straight up to the top one."

What is VENTURE?

IRDs are the most common cause of legal blindness in working-aged Australians.

The Victorian Evolution of Inherited Retinal Diseases Natural History Registry (VENTURE) is compiling groups of potential participants for the current wave of emerging IRD treatments for IRDs.

VENTURE is led by Associate Professor Lauren Ayton and Dr Tom Edwards, and includes a team of more than 20 specialists.

"About 250 patients have already registered," says Associate Professor Ayton.

"More than two-thirds now have a genetic diagnosis, so we know what genes cause their condition and can offer them access to new clinical trials and treatments."

VENTURE is supported by the National Health and Medical Research Council, Retina Australia, the CASS Foundation and the Choroideremia Research Foundation (USA).

↑ Reaching up: Sam's special glasses enable him to practise his jumping skills outdoors.

A shared vision

A new joint research strategy aims to maximise the benefits of having a world-class hospital and medical research institute under the same roof.

CERA and The Royal Victorian Eye and Ear Hospital have forged a new research strategy which will strengthen collaboration and bring the benefits of research to clinical care.

The four-year strategy *Innovation for Exceptional Care* outlines a joint vision of integrating research across all clinical specialties and roles throughout the hospital.

"The strategic location of three world-leading organisations – the Eye and Ear, CERA and the University of Melbourne – in the one location creates an unparalleled opportunity for innovation in eye care research," says CERA Managing Director Professor Keith Martin.

"It fosters the kind of translational research that CERA is committed to with laboratory-based discovery scientists working side by side with clinician-researchers to make a difference for people living with vision loss."

It also aims to apply the latest research innovations to improve care and efficiencies across the hospital and build on the success of existing collaborations. This includes the partnership between CERA's retinal gene therapy researchers and the hospital's Ocular Genetics Clinic.

Dr Jonathan Ruddle leads the Ocular Genetics Clinic, which includes ophthalmologists, geneticists and genetic counsellors who support patients and families living with genetic eye disease.

Having such close ties between the two organisations improves outcomes.

Maximising opportunities

CERA's Head of Retinal Gene Therapy Research Dr Tom Edwards says cooperation between the Ocular Genetics Clinic and CERA maximises opportunities for patients, clinicians and researchers.

Dr Edwards, along with Associate Professor Lauren Ayton, is also one of the leads of the VENTURE Study – a collaboration between CERA and the University of Melbourne that is a registry and natural history study of people living with inherited retinal diseases (IRD).

"Patients who are referred to the Ocular Genetics Clinic will often also be referred to the VENTURE study if they express an interest in getting involved in research," says Dr Edwards.

Likewise, people who come into the VENTURE study may be referred to the Ocular Genetics Clinic.

"Patients lacked a single point of access for a genetic diagnosis, genetic counselling and research opportunities like our ongoing natural history study," says Dr Edwards.

With new potential treatments for IRDs on the horizon, having access to current and future research opportunities is comforting for patients.

"Their reactions have all been very positive, and we all feel like we're having a good impact," says Dr Edwards.

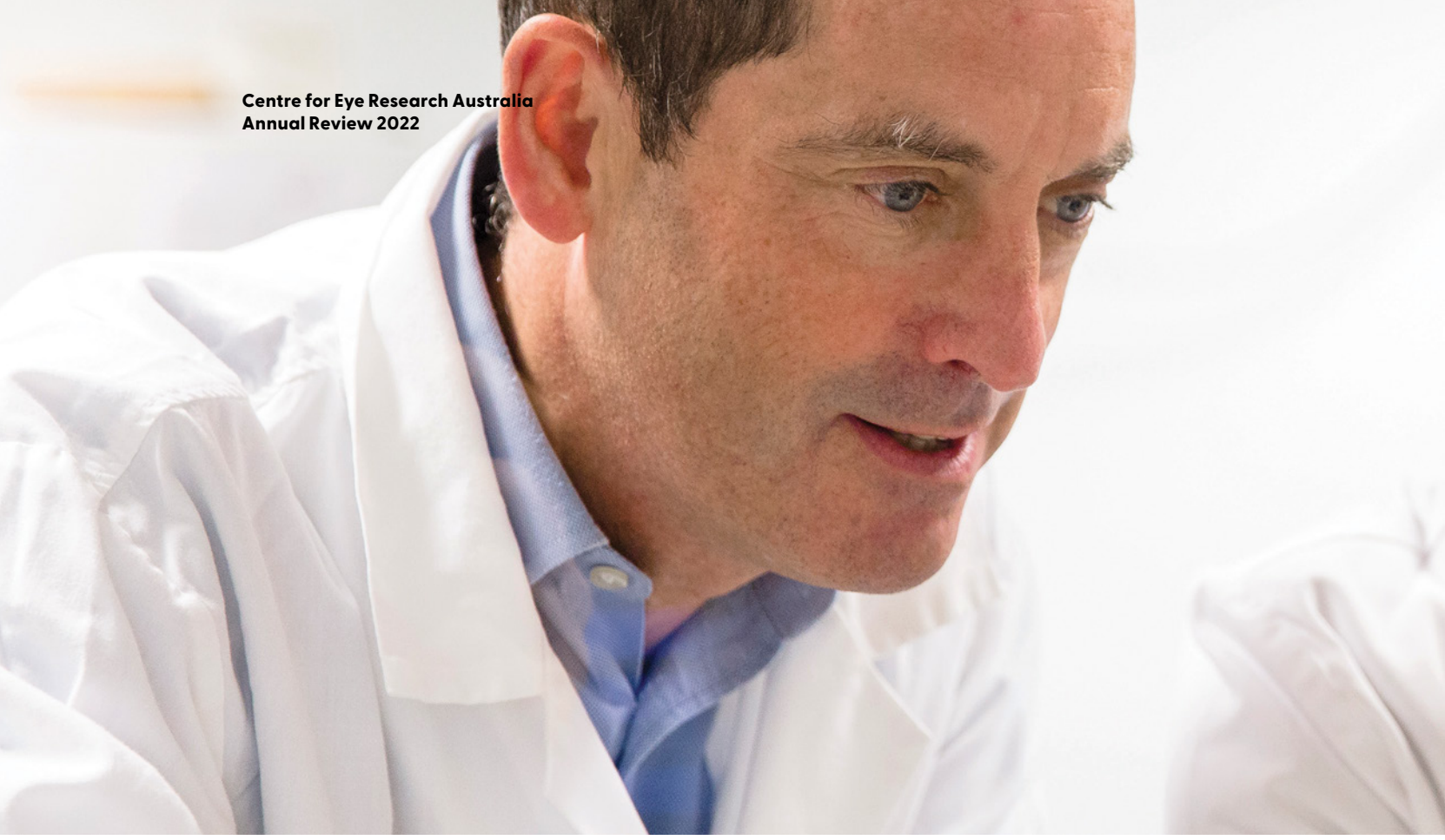
"We've been very lucky to have ophthalmology fellow and CERA colleagues Dr Doron Hickey, orthoptist and new clinic coordinator Lisa Kearns and Associate Professor Fred Chen from the Lions Eye Institute in Perth join Alex Hewitt, Jon Ruddle and myself in the clinic," says Dr Edwards.

"And while it is primarily a service for Victorians, interstate collaborations really position it as a genetic service for all comers."

Dr Edwards says working so closely together creates many opportunities.

"Many people in the clinic wear both a hospital hat and a CERA hat, which really helps collaboration."

↑ **Working together: Dr Tom Edwards, Dr Jonathan Ruddle and Associate Professor Lauren Ayton.**



New view of gene therapy

CERA's newest start-up company is taking a novel approach to gene therapy, aiming to 'switch on sight' by restoring light-sensing cells.

More than 190 million people worldwide have retinal diseases where death of photoreceptors – cells at the back of the eye that sense light – leads to vision loss and blindness.

Currently there is no way to restore lost vision after photoreceptors die, but CERA's newest start-up company Mirugen is aiming to regenerate the lost cells to preserve and restore visual function.

CERA's Principal Investigator, Cellular Reprogramming, Associate Professor Raymond Wong is leading Mirugen's research efforts.

Mirugen comes from the Japanese word '*Miru*' for 'view' and gen for 'gene therapy'.

It acknowledges the Japanese origins of Nobel Prize-winning cellular reprogramming research – which has now been adopted by research teams around the world.

"Cellular reprogramming is a technology which allows you to control genes to determine how cells behave," Associate Professor Wong says.

The process uses engineered genes to turn Müller glia cells in the retina into new photoreceptor cells to replace those lost in disease.

In chicken and fish, Müller glia cells can mobilise and repair the retina.

"This ability has been lost or suppressed in mammals including humans," Associate Professor Wong says.

"We're working to unlock this regenerative ability.

"Many diseases with damaged photoreceptors could potentially benefit from this, including age-related macular degeneration, retinitis pigmentosa and Stargardt's disease."

Start-up strategy

Mirugen is the third start-up company to be incubated at CERA – following ophthalmic referral platform Oculo (2015) and Enlighten Imaging (2019), which is developing a simple eye scan to detect the early signs of Alzheimer's disease and a variety of other conditions.

Mirugen is also one of the first biotechnology start-ups to receive seed funding from Australia's biotech incubator CUREator, which is backed by the Australian Federal Government's Medical Research Future Fund.

It will be based at CERA and part of a collaborative environment which includes researchers from the University of Melbourne's Department of Surgery and The Royal Victorian Eye and Ear Hospital.

Mirugen Director and CERA Managing Director Professor Keith Martin says developing start-up companies is an important part of CERA's strategy.

"The unique environment which sees lab-based research occur alongside clinical research provides a direct runway for taking promising pre-clinical research like Mirugen's through to clinical trial," says Professor Martin.

↑ **Fresh perspective: Professor Keith Martin and Associate Professor Raymond Wong are taking a new approach to gene therapy.**

Innovation times four

CERA's Innovation Fund is supporting a new round of blue-sky research ideas.

Four inventive new ideas to transform eye care have received a kick-start from the CERA Innovation Fund.

In 2022, Associate Professor Elaine Chong, Dr Sandy Hung, Associate Professor Guei-Sheung Rick Liu and Dr Jennifer Fan Gaskin received funding for research projects that are taking a new approach to tackling eye disease.

From developing eye drops to replacing eye injections to a virtual eye model to educate patients about eye disease – each project is taking a novel approach to addressing long-standing challenges.

CERA Business Development Manager Dr Shereen Tan says the Innovation Fund aims to support research at critical stages, giving scientists support to gather the data or evidence they need to be competitive in government schemes or attract industry investment for their research.

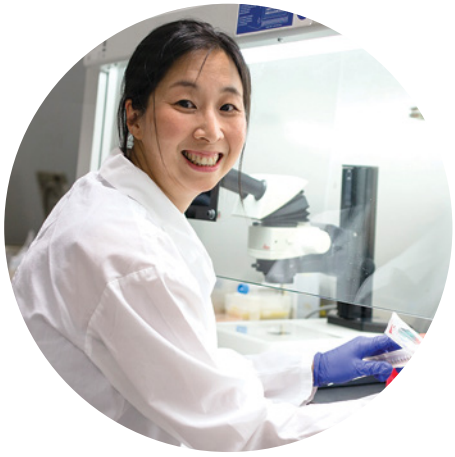
"The Innovation Fund supports researchers who want to take their ideas from the lab to the clinic to improve patient care – with extra funding for patent applications, pre-seed funding for start-ups and other early operating costs for companies incubated at CERA," says Dr Tan.

The Innovation Fund was established in 2017 from the generous philanthropic support of the estate of the late Ruth Chitty.

The fund was bolstered in 2021 when CERA added proceeds from the sale of its first spin-out company, Oculo, to create a dedicated, sustainable pool of funding to support innovative vision research into the future.

← **Supporting innovation: Dr Jennifer Fan Gaskin (left).**

↑ New approach: (from left) Dr Sandy Hung, Associate Professor Elaine Chong and Associate Professor Guei-Sheung (Rick) Liu.



Associate Professor Guei-Sheung (Rick) Liu
Head of Genetic Engineering

To ease the burden of frequent eye injections, CERA's Head of Genetic Engineering Associate Professor Guei-Sheung (Rick) Liu is investigating the development of a new gene therapy that could be delivered as a long-lasting injection, or via an eye drop.

"People with age-related macular degeneration or diabetic retinopathy have abnormal blood vessels growing in their retina, the light-sensitive layer of nerve tissue at the back of the eye," explains Associate Professor Liu.

"These new blood vessels are not very strong and can leak – causing damage to the retina that will eventually lead to vision loss.

"But the regular injections required to stop this abnormal growth are invasive and expensive to both patients and the healthcare system."

Associate Professor Liu's research involves changing a protein involved in blood vessel formation.

Dr Sandy Hung
Research Fellow, Clinical Genetics

Gene therapies are offering new hope for people living with inherited retinal disease.

In clinical trials, the most common way to deliver retinal gene therapies is using a virus known as AAV.

The AAV vector is a safe virus which enables the correct gene copies to be introduced into cells.

However, as Dr Hung explains, up to two thirds of the genes associated with IRDs are too large to fit into one AAV vector.

"Trying to get larger genes into the retina with an AAV vector is like trying to get a group of people to a destination in a taxi when you need a bus," she says.

Dr Hung aims to develop delivery systems large enough to carry bigger genes that can effectively target retinal cells. Initially the research will target the light-sensing photoreceptors.

"This will help us develop more treatments for IRDs," she says.

Associate Professor Elaine Chong
Senior Research Fellow, Corneal Research

Anatomical eye models can help clinicians describe eye conditions to patients, but they are expensive, fragile and often unavailable in many hospitals and clinics.

This is a scenario Associate Professor Elaine Chong is all too familiar with.

"When explaining a condition like cataract or glaucoma to patients, you're often trying to provide them with a conceptual understanding of something that is difficult to explain with words alone," she says.

This often results in confusion for the patient and frustration for the clinician.

To provide patients with a better understanding, Associate Professor Chong and co-founder Dr Joos Meyer, an ophthalmology trainee, developed a virtual 3D eye model.

An initial grant from Telematics Trust led to Associate Professor Chong and Dr Meyer working with a team of designers and artists to develop One Right Eye, modelled on a human right eye.

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

Dr Jennifer Fan Gaskin
Principal Investigator, Ocular Fibrosis

The use of anti-VEGF injections have revolutionised how wet age-related macular degeneration is treated.

However, many who receive these regular injections continue to lose their vision, with one contributing factor being scarring in the retina.

"Scarring is a source of disease for almost every part of the eye," says Dr Fan Gaskin.

"We want to try and go straight to the source to stop it."

Working alongside Associate Professor Guei-Sheung (Rick) Liu and Professor Robyn Guymer AM, Dr Fan Gaskin is conducting research to develop a gene therapy to this end.

She is aiming to disrupt the process that causes scarring to prevent the buildup of tissue that threatens sight.

"This process would require only a one-time injection, while providing a long-term effect," says Dr Fan Gaskin.

Visionary support

Over 20 years Peter Clemenger AO has helped bring ground-breaking research to life. His philanthropic support is now helping write the next chapter in CERA's history.

From founding one of the country's leading advertising agencies to helping establish Melbourne as a home for international events, Peter Clemenger AO has left an indelible mark on the city.

The Joan and Peter Clemenger Foundation can also be credited for supporting CERA's development as a world-leading research institute.

"I think it's nice to be involved and help, in a small way, with organisations that are benefiting other people," says Peter.

"And this one happens to be pretty damned important."

The Clemenger Foundation helped support infrastructure that was critical to CERA's induced pluripotent stem cell (IPS) research.

He is now making a significant contribution to CERA's future.

Personal journey

Peter's support of CERA is personal. When he was four, he lost vision in his left eye after his brother accidentally struck him with a spade.

"This has given me more than a passing sympathy for people with eye problems," says Peter.

His late wife Joan Clemenger AO, who passed away in early 2022, had age-related macular degeneration and was a patient of CERA Deputy Director Professor Robyn Guymer AM.

"Joan received injections every two or three months for around 20 years," says Peter.

"It's been a long-lasting bond between our family and the Centre for Eye Research Australia."

Peter's support purchased a stem cell robot able to automate labour-intensive parts of generating induced pluripotent stem cells – and accelerate the volume of work that could be done.

The device played a foundational role in research published by CERA's Principal Investigator, Clinical Genetics, Professor Alex Hewitt in 2022, which identified unique genetic signatures of age-related macular degeneration and glaucoma.

"We have been building a program of stem cell studies to model disease at a very large scale," says Professor Hewitt.

"This work is the culmination of contributions from many research teams around Australia, and we are grateful for our close collaborations, particularly with Professor Alice Pébay, who is based at the University of Melbourne and Professor Joseph Powell from the Garvan Institute of Medical Research."

Ongoing support

Looking ahead, Peter has committed to supporting CERA through a multi-year gift towards the organisation's future growth.

He says that supporting such a world-leading institution right here in Melbourne is an important choice.

"We're happy to support CERA as one of the foremost eye research institutions in the world," says Peter.

"And the fact that CERA is so highly regarded in the world and is contributing so much to research gives us great confidence to continue supporting various activities."

CERA Managing Director Professor Keith Martin says philanthropic contributions such as Peter's have a tremendous impact.

"Peter has already had a remarkable impact on our research, and we're very grateful for his ongoing support.

"We're all excited about what his support will allow us to achieve."

And Peter takes great pride in the support he is able to give.

"I was taught at a very young age that giving is better than receiving," says Peter.

"And although our trust has been wound up, I plan to continue supporting various organisations while I'm still alive.

"Among those is CERA – long may it continue."

↑ **Supporting CERA: (from left) Dr Tom Edwards, Associate Professor Guei-Sheung (Rick) Liu, Layal El Wazan, Associate Professor Raymond Wong, Research Orthoptist Lisa Kearns, Peter Clemenger AO and Professor Keith Martin.**

Macular milestone

Our Macular Research Unit has celebrated its 25th anniversary and a quarter-century of advances in the diagnosis and treatment of age-related macular degeneration.

In 1997, age-related macular degeneration (AMD) was a poorly understood condition, with little hope of saving the sight of people diagnosed with the disease.

But over the past 25 years our understanding has improved significantly, and treatments to slow the progression of wet AMD are now widely used.

Just recently in the United States the world’s first treatment for dry AMD was approved – with more options on the horizon.

Professor Robyn Guymer AM and the Macular Research Unit have played a critical role in the global research effort that has led to many advances in the treatment of AMD.

In 2022, the team celebrated its silver anniversary, their achievements along the way, and looked forward to further progress.

To commemorate this important milestone, two long-serving team members, research nurse Melinda Cain and Associate Professor Chi Luu, shared their memories of working in the Macular Research Unit.

Continued on Page 22

← **Celebrating 25 years: Members of the Macular Research Unit: (from left) Dr Emily Glover, Professor Robyn Guymer AM, Jan Terheyden (visiting researcher), Dr Carla Abbott, Erin Gee, Associate Professor Chi Luu, Emily Caruso, Lauren Hodgson, Associate Professor Zhichao Wu and Nikita Thomas.**

From page 21

Professor Guymer established CERA's Macular Research Unit in 1997 following a fellowship at Moorfields Eye Hospital in London.

AMD affects the macula – the central part of the retina located at the back of the eye – and results in blurred central vision. At the time, AMD was only recently identified as an inherited disease, and the Macular Research Unit's primary aim was to find the genes associated with the condition to learn more about how it could potentially be treated.

Research nurse Melinda Cain, who has been a member of the unit from the very first day, joined Professor Guymer to identify people living with the condition across Victoria and interstate.

Visiting families

"We would meet up once a week, drive in a station wagon for sometimes up to three hours to see family members with the condition," says Melinda.

"The people we visited in their homes were always welcoming – we performed a quick vision test, a small genetic blood sample and a photo of the back of the eye using a portable fundus camera Robyn received a small grant for."

The years undertaking this research have contributed critical data that helped point towards the mechanisms that cause retinal disease.

It also established the Macular Research Unit as a group that could contribute well-classified clinical cases for genetic analysis.

"Our team grew, and we focused on clinical trials," says Melinda.

"Our team has been involved in multiple clinical trials that have led to the approval of several new drugs that are now used to treat this debilitating condition."

Melinda says being part of the transformation of CERA has been amazing.

"In the early days we conducted large epidemiological studies involving questionnaires and took retinal photos to work out the prevalence of eye disease in the community," she says.

"Then we moved to a basic science focus employing different types of scientists, all experts in their fields, working alongside us to advance our understanding of the biological mechanisms involved in eye disease.

"An exciting multi-disciplinary team has evolved at CERA, and I am pleased to have been a part of it working with Robyn and the team."

Advancing technology

Throughout the unit's existence, improvements in technology have transformed the kind of research that can be undertaken.

Associate Professor Chi Luu, Deputy Head of Macular Research, first started with Professor Guymer's interventional laser study in the late 1990s as a PhD student.

He later returned to join the unit and work on the bionic eye project, as well as to conduct studies on visual function in AMD.

"In the last 20 years we have seen development of better imaging tools that let

us see very fine structures in the retina," says Associate Professor Luu.

"That is where we can learn more about the structural changes in the eye."

Improved imaging has underpinned several of the Macular Research Unit's achievements.

As part of his PhD, Dr Zhichao Wu – now Head of CERA's Clinical Biomarkers Research Unit – identified the specific changes that could be seen as part of cell death using an imaging technique called Optical Coherence Tomography (OCT).

The team has also conducted trials for AMD treatments, including intravitreal injections into the eye and laser treatments.

Identifying risk factors, disease progression and treatments for early-stage AMD to prevent vision loss is central to CERA's ongoing research.

The next steps are looking to improve how to preserve sight more effectively.

Synergy study

The Synergy High Risk AMD Study – a joint project led by CERA, the University of Melbourne and WEHI – is investigating genes and risk factors that contribute to some people having a particularly high chance of losing their vision.

There is also ongoing work towards investigating if laser technologies have the capability to slow disease progression.

"More importantly, there's still nothing out there to stop progression from early asymptomatic stages to vision-threatening late AMD," says Associate Professor Luu.

"The research into new treatments for early stages of AMD to prevent vision loss is particularly exciting."

↑ **Lasting collaboration: Professor Robyn Guymer AM and research nurse Melinda Cain have seen many changes in research together.**

Laser focus on AMD

A new study is investigating if laser treatment can halt the progress of age-related macular degeneration.

Most research into age-related macular degeneration (AMD) has focused on late-stage disease, when substantial cell damage has occurred and vision is at risk.

However, new research into a laser treatment at CERA is investigating ways of intervening during the intermediate stages of the disease to stop macular cells from dying.

The outcome could be a game-changer for the treatment of AMD.

"Age-related macular degeneration has early, intermediate and late stages, and most of the major research is focused on the late stage where vision is already threatened," explains Professor Robyn Guymer AM, CERA's Head of Macular Research.

"We are much more interested in trying to stop people getting there in the first place."

AMD affects cells in the macula – the central part of the retina at the back of the eye that provides the sharp central vision needed to read, drive and recognise faces.

About one in seven people with the earlier stages of AMD will progress to the late forms of the disease – dry AMD or wet AMD. This is when serious central vision loss can occur.

There is an effective treatment for wet AMD if it's started early enough, but complications that threaten vision in wet AMD are often detected too late.

In 2022, Professor Guymer and her team embarked on the LIANA study, using an Australian-made 2RT laser from NovaEye, which aims to slow the progression of intermediate AMD in people who have the earliest signs of cell death.

The study builds on the promising results of the earlier LEAD study, which used the same 2RT laser and was conducted by Professor Guymer from 2012-2018.

"In the LIANA study, we're essentially trying to identify people who have the very first signs of cell death and aiming to stop further cells from dying," says Professor Guymer.

As the 2RT laser delivers a very short and targeted pulse of energy, the team can effectively target a crucial layer of cells without damaging surrounding tissue.

Measuring cell death

However, these patients don't have noticeable signs of vision loss, so determining the trial's success is quite a challenge.

"Even if we can stop the disease from progressing – how do we know if the patient actually sees differently?" says Professor Guymer.

Rather than using traditional eye tests to measuring changes in vision, Associate Professor Zhichao Wu, Head of Clinical Biomarkers Research, is using a more sophisticated technique called

microperimetry and trying new ways to test the function of the affected area.

"With microperimetry, we can perform a targeted and detailed assessment of regions with the beginning of cell death," says Associate Professor Wu.

The technique involves projecting light onto different points of the patient's retina to get a detailed 'map' of the macula's sensitivity to light.

"This will allow us to determine if the laser can not only prevent cell death, but also preserve visual function with an unprecedented level of precision," he says.

Once complete, the LIANA study's results will help inform a larger international study, to be led by Professor Guymer and her team in the near future, to further investigate the 2RT laser's impact.

"Hopefully, we can slow down the disease's progression and, as a result, have the first effective treatment for intermediate AMD," says Professor Guymer.

↑ **Supporting research: Clinical trial coordinator Nikita Thomas with Sandy Kahn, who is helping find new treatments for AMD by taking part in a clinical study.**

Putting research in the frame

Optometrists are playing a vital role in helping their patients get involved in research.

As researchers shift their focus to stopping vision loss before it progresses, optometrists have become a valuable partner in identifying patients to take part in research.

Studies investigating ways of halting vision loss often need participants who show the early signs of disease, but are not experiencing advanced symptoms.

"Optometrists are the best people to find these early-disease patients," says Dr Emily Glover, optometrist and clinical trial coordinator in CERA's Macular Research Unit.

"They're hands-on with these conditions on a daily basis."

New pathways

Dr Glover is leading a new initiative to make it easier for optometrists to link their patients with clinical research at CERA.

She says that while traditionally many study participants have been directed to research by their ophthalmologist or when visiting a hospital, by the time they are seeing these specialists their condition has usually progressed.

"Patients with early age-related macular degeneration (AMD) generally have good vision at the disease's earliest stages – and are more likely to be visiting an optometrist," she says.

Dr Glover is visiting community optometry practices around Victoria to inform them of the studies underway, as well as provide materials which enable optometrists to help their patients register interest in research.

This includes a registration pad, which optometrists fill out so their patients have the most accurate, up-to-date information about their vision if they are interested in participating in research.

She says it's a positive experience for everyone involved.

"For patients, they have information about research to act on, and for optometrists, they have another way they can help patients manage their health care," she says.

"For us, we're able to continue our research."

The Australian College of Optometry (ACO) in Carlton is one of around 30 practices now directing patients to research.

"Research plays a valuable role in shaping our understanding of eye diseases, informing best practice and developing newer and more effective treatments which will ultimately benefit our patients," says Janelle Scully, Lead Optometrist Ocular Disease Services at the ACO.

"It is exciting to know that important research is happening right here in Melbourne and that our patients can be involved."

↑ Wider net: Dr Mina You, from the Australian College of Optometry, explains the registration pad to a potential research participant.

United focus

A collaboration utilising innovative technology and clinical research has the potential to transform care for people with glaucoma.

One of the biggest challenges of caring for people with glaucoma is knowing who is at the highest risk of losing vision.

"Despite treatment, one in three people still go blind from glaucoma in at least one eye within 20 years of diagnosis," says Associate Professor Zhichao Wu, Head of Clinical Biomarkers Research at CERA.

"There is a real need for us to find better ways of identifying those who are at a higher risk of progressing quickly, so we can monitor them more closely and intensify treatments if needed."

Associate Professor Wu is leading a research study where hyperspectral imaging developed at CERA is being used to potentially identify new biomarkers – signs of disease that can be identified and measured – of glaucoma progression risk.

The collaboration between clinical research and technology developers has the potential to change how the disease is treated.

Hyperspectral imaging

Enlighten Imaging, a start-up incubated at CERA, developed the hyperspectral camera that is now part of the study.

The team, which includes CERA Deputy Director Associate Professor Peter van Wijngaarden and Senior Research Fellow Dr Xavier Hadoux, developed an imaging technology similar to that used by satellites to capture images of space.

"Instead of using a single flash of white light to capture an image, their camera takes many multi-coloured photographs from across the light spectrum at once to provide a new view of the eye," says Associate Professor van Wijngaarden.

It has previously been trialled to detect signs of Alzheimer's disease and reveal new insights into diabetic eye disease.

"There is an urgent need for new ways to monitor glaucoma and there are some well-known parallels between glaucoma and Alzheimer's disease," says Associate Professor van Wijngaarden.

"This is a promising avenue for research."

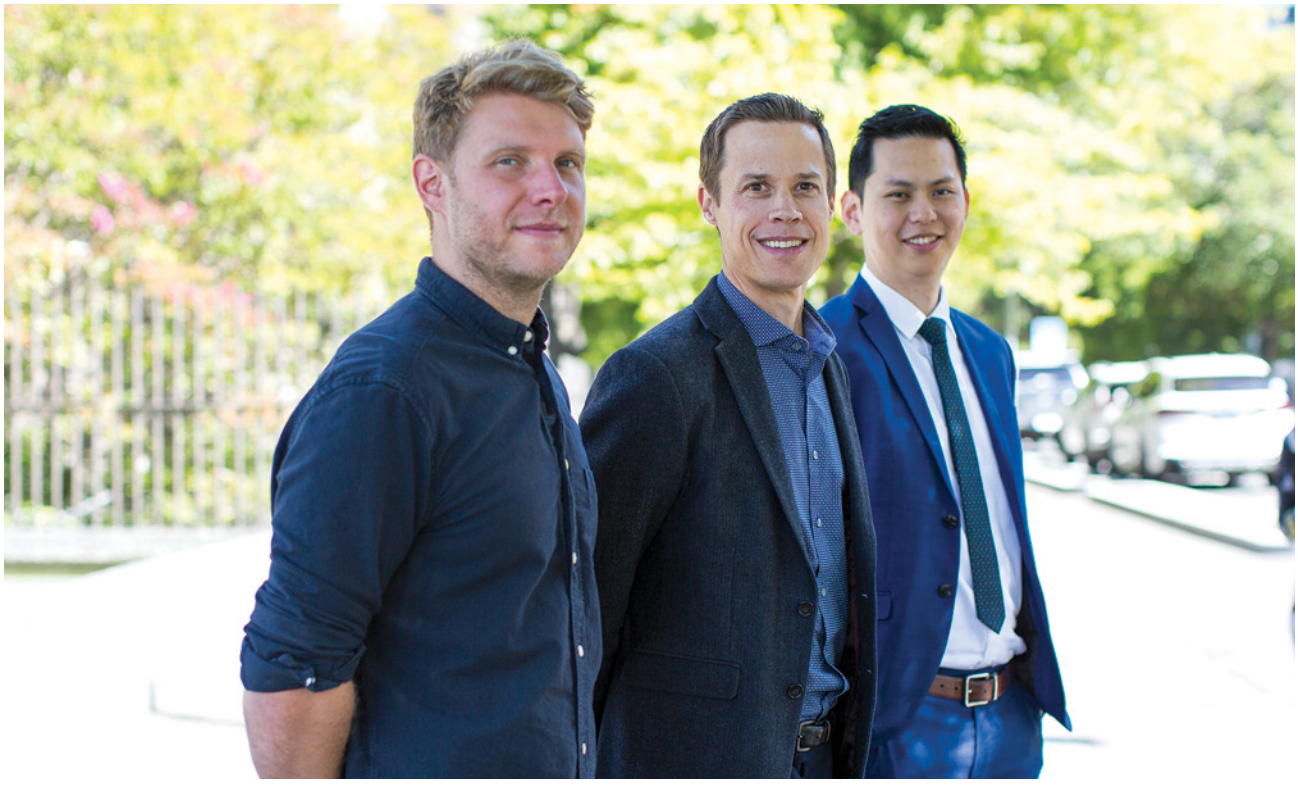
New signs of diseases

Glaucoma damages the optic nerve which sends visual information to the brain.

The comprehensive eye examinations for glaucoma patients do little to help predict who is likely to lose their vision more quickly.

However, the hyperspectral camera could provide a new dimension to current eye tests.

"Cells damaged by glaucoma are sick and fighting to survive for some time before



they are irreversibly lost," says Associate Professor Wu.

"We're investigating if it's possible to use hyperspectral imaging to detect the subtle changes in the way these cells appear when they're sick.

"If we can do this through a simple eye test, we may be able to better predict who is at highest risk of losing vision from glaucoma."

If the research proves successful, it could enable more personalised care for patients and give those with glaucoma the best chance of protecting their sight.

Close collaborations

Having both clinical and technological expertise in the same building at CERA has some special benefits.

"We are developing this state-of-the-art technology in a lab which is right next to patients in the clinic," says Associate Professor van Wijngaarden.

"This enables us to quickly respond to results and feedback from trials – it's a unique environment to work in."

↑ **Shared vision: (from left) Dr Xavier Hadoux, Associate Professor Peter van Wijngaarden and Associate Professor Zhichao Wu are working together to improve glaucoma detection.**

OCT-A opens a new window

A 3D image-capturing device, purchased with philanthropic support, brings new possibilities for eye research.

A new state-of-the-art OCT-A machine is helping CERA's researchers magnify the potential of their research.

Purchased in 2022, with generous funding from the Ian Potter Foundation matched by another of CERA's committed supporters, the imaging machine now takes pride of place in our research clinic.

"The eye is special because it can act as a window to the entire body," says CERA Managing Director Professor Keith Martin.

"Imaging devices like this open a world of new opportunities for us to understand diseases, and we're already making use of this transformative piece of equipment every day in the clinic."

Chairman of the Ian Potter Foundation Charles Goode AC says the Board of Governors was pleased to provide funding towards the acquisition of the OCT-A.

"The Ian Potter Foundation has a long association with the Centre for Eye Research Australia having awarded 20 grants (totalling over $400,000) since 2002 in support of research which aims to improve eye health for all Australians," he says.

"The OCT-A will enable CERA and collaborators in eye research to image retinal blood vessels in unprecedented detail using non-invasive methods, reducing the need for intravenous injection."

OCT-A devices use cutting-edge technology to capture a highly detailed, three-dimensional image of the tiny blood vessels within the eye to see how blood is flowing.

The other way to capture this information is by injecting a dye into a person's bloodstream to watch how it flows through their vessels.

However, this is a slow, invasive process that comes with the risk of an allergic reaction. The new machine makes taking part in research faster, easier and more comfortable for participants.

New insights

Changes in blood flow to the retina have been associated with age-related macular degeneration, glaucoma, Alzheimer's disease, diabetic retinopathy and some inherited retinal diseases.

Research teams across CERA investigating these conditions can now easily capture this information, accelerating research efforts while improving the experience of research participants.

"The generous contribution of the Ian Potter Foundation to this equipment, as well as all their support over the years, will have a huge impact on our research program," says Professor Martin.

"We are incredibly grateful for their contribution to our work."

↑ New window: Ian Potter Foundation Senior Program Manager Dr Alberto Furlan celebrates the launch of the new machine with Professor Robyn Guymer AM.

Precious vision

For new mum Catherine Carnovale, nothing is more precious than gazing at the face of her newborn daughter Netta.

Catherine has lived with type 1 diabetes since she was six and was diagnosed with diabetic eye disease in 2021.

She knew she would need to prioritise her diabetes management and eye care during pregnancy to protect her vision for the future – because some women with diabetes are at higher risk of eye complications during pregnancy.

“I spoke to my care team a year before falling pregnant to understand what I needed to do to support a healthy pregnancy,” says Catherine.

“While my diabetes control was always good, it needed to be stellar to give me the best chance of avoiding complications.”

One important change during her pregnancy was more frequent eye screening – from every two years to every three months – to make sure any changes were caught early.

“I think of protecting my health, including my eye health, as self-care,” she says. “The incentive to be in good health to see my daughter grow up feels like the biggest reward imaginable.”

Continued on Page 34

← **Family support: (from left) Catherine Carnovale, daughter Netta and husband Jason Sankovic.**

From page 33

People with diabetes can have abnormally high blood sugar levels, which damage the small blood vessels in the retina and cause an eye condition called diabetic retinopathy.

Diabetic retinopathy can cause vision loss, most commonly from diabetic macular oedema that affects our ability to recognise faces.

Regular eye checks can catch diabetic retinopathy early, which offers the best chance of preserving sight.

"For women with diabetes, eye screening during pregnancy is particularly important because risk factors for diabetic retinopathy like high blood pressure and high blood sugar levels are even harder to control during pregnancy," says Associate Professor Lyndell Lim, Head of Clinical Trials Research at CERA.

New data

A lot has changed about the way we understand and treat diabetes in the three decades since Catherine was diagnosed.

"In the early days, my parents helped me manage my condition by injecting insulin multiple times a day," she says.

"Fast forward 30 years and I now use an insulin pump with continuous glucose monitoring, together with my gorgeous assistance dog Beadie who is trained to detect hypoglycaemia."

The demographics of pregnant women with diabetes has also changed in this time – from mostly women with type 1 diabetes, to an increasing number with type 2.

It was this shift that prompted Associate Professor Lim to investigate the prevalence of diabetic retinopathy in pregnant women in 2022 and update the Australian data that was over 40 years old.

"We set out to see whether diabetic retinopathy in pregnancy still takes off in modern times when there's better treatment, control and screening, and also how it affects a different diabetes population, where 50 per cent have type 2 diabetes," says Associate Professor Lim.

Diabetic retinopathy risk

The study found that about one in four pregnant women with diabetes had diabetic retinopathy. Nearly one in nine participants had a sight-threatening form of the disease, which persisted for a year postpartum.

"Our research shows that in 2022, there is still a significant proportion of Australian women who have or develop diabetic retinopathy during pregnancy, and for some women this could lead to devastating vision loss," says Associate Professor Lim.

"Importantly, we also found diabetic retinopathy in women with type 2 diabetes. And the disease progressed in some of these participants. There has been no other Australasian research that's shown this.

"These findings indicate that we need to keep getting the message out to women with diabetes that it's crucial to be screened for diabetic retinopathy during pregnancy, regardless of whether they have type 1 or type 2.

"However, we also saw that more than one in 10 women were unable to come in for an eye check as part of our research.

"There are clearly barriers to screening we need to address, and this will be the focus of upcoming research."

The future of diabetes eye care

In a follow-up paper, to be published in 2023, Associate Professor Lim has shown that the risk of developing diabetic retinopathy in pregnancy is different for women with type 1 versus type 2 diabetes.

This could change how we screen for diabetic retinopathy in future, as the current clinical guidelines do not differentiate between type of diabetes.

Regular eye screening during pregnancy has preserved Catherine's vision and she is grateful for the future impact Associate Professor Lim's research could have on the pre-natal care of women with diabetes.

With improved screening and early treatment, there is hope that new mothers with diabetes will not have to face losing their sight from diabetic retinopathy in future.

As Catherine puts it: "A parent not being able to see their child when they are born or as they grow is heartbreaking.

"It's amazing to think that research at CERA could bring us closer to a world where that is less likely to happen."

↑ **A perfect vision: Netta sleeping peacefully in Catherine's arms.**

AI ambitions

CERA research is harnessing the power of artificial intelligence and retinal scans to improve health outcomes.

Dr Lisa Zhuoting Zhu is researching artificial intelligence's (AI) potential to predict life expectancy, conduct rapid disease screening and improve chronic disease management.

As we age, our risk of illness and death increases. However, as Dr Zhu explains, our individual ageing process – our biological age – could more accurately predict future disease and mortality than how long we have lived.

However, measuring biological age can be costly, invasive and time-consuming.

But now a new research collaboration between Dr Zhu, CERA's Principal Investigator, Ophthalmic Epidemiology, Professor Mingguang He and Professor Zongyuan Ge, Head of Monash Medical AI, is investigating a better way to determine biological age – using a simple eye scan.

"From a clinical perspective, the retina at the back of the eye is a window to our health," says Dr Zhu.

"We know retinal bleeding and retinal diseases are closely related to systemic diseases like cardiovascular disease, as well as future mortality."

The research team has trained AI technology to calculate biological age by assessing an image of the retina for changes indicating the rate of ageing – something a health professional can't do by sight alone.

Dr Zhu and colleagues have shown that the difference between an individual's biological and chronological age – the 'retinal age gap' – can predict life expectancy.

In 2022, they progressed this research further, demonstrating that a person's retinal age gap can also predict the risk of specific age-related diseases.

"Support from the National Health and Medical Research Council allowed me to refine the AI algorithm and apply the retinal age concept clinically," says Dr Zhu.

"I found a one-year increase in retinal age gap was associated with greater risk of cardiovascular diseases like heart attack and stroke, as well as Parkinson's disease."

Rewarding innovation

Dr Zhu was awarded a prestigious Victoria Fellowship in recognition of the clinical and commercial potential of the retinal age project.

This will allow her to expand her research internationally, including in the United States, where she will work with AI company, Ascertain.

"Ascertain has more than 80 hospital networks, so this visit will help determine whether we can implement the retinal age project in the US. And with their big datasets, we can refine the algorithm and improve our technology."

An AI-powered eye scan that can identify people at high risk of accelerated ageing could transform how we screen and treat age-related diseases.

"We want to trial this technology in GP clinics to determine the feasibility of implementing it into current practice," says Dr Zhu.

"There is huge clinical potential if the tool is satisfactory for both physicians and patients. For example, a higher retinal age gap indicating accelerated ageing might prompt a patient to quit smoking or do more exercise.

"For existing chronic diseases, a higher retinal age gap may require more intensive management."

Alongside her research on ageing, Dr Zhu is trialling an AI-driven smart camera designed to rapidly screen people in emergency departments who may have a life-threatening headache.

"With support from a Ramaciotti Foundation Grant, we conducted a pilot study that worked through the clinical workflow in a research setting," says Dr Zhu.

"We are now ready to trial it in more locations in 2023."

↑ **AI research team: Dr Lisa Zhuoting Zhu, PhD student Zhen Yu and Dr Alice Chen.**

Focus on the optic nerve

New research is developing a model to investigate how genetic faults cause vision loss in glaucoma and other optic nerve diseases.

Our vision relies on the correct functioning of the 1.2 million retinal ganglion cells that make up our optic nerve and transfer visual information from the eye to the brain.

In glaucoma, these cells are damaged – interrupting the transmission of information and leading to vision loss.

Current glaucoma therapies can effectively reduce eye pressure to slow vision loss, but they don't work for everyone – and none revive retinal ganglion cells and restore sight.

"Studying retinal ganglion cells is key to further understanding of glaucoma and developing new treatments," says Dr Sushma Anand, Research Fellow in CERA's Mitochondria and Neurodegeneration Research Unit.

With support from the CASS Foundation, Dr Anand is researching the role faulty mitochondria – the tiny powerpacks that provide energy to our cells – play in retinal ganglion cell damage that occurs in glaucoma and other optic nerve diseases like in Leber Hereditary Optic Neuropathy (LHON).

"Understanding why mitochondria stop working is the first step to understand how we keep them healthy," says Dr Anand.

Cell models

Dr Anand says she has developed a new method to grow cells in the lab that closely resemble those lost in glaucoma and other diseases of the optic nerve.

Using a technique called 'direct reprogramming', Dr Anand introduces specific genes to transform cells from one type into another.

She takes human skin cells called fibroblasts and introduces various genes to encourage them to transform into nerve-like cells or neurons.

The relatively fast process takes between 15 and 21 days, so Dr Anand has already completed several tests and has validated and standardised her method.

"The insights gained from this project will open the door to further understanding of these diseases and eventually for testing treatments," she says.

The next step is developing cell models that include the genetic mistakes known to cause glaucoma and other optic nerve diseases like LHON.

"If this cellular disease model is successful, we will test if repurposing FDA-approved drugs can block retinal ganglion cell death and potentially prevent or reverse vision loss," says Dr Anand.

Dr Anand says she is grateful for the philanthropic support.

"The CASS Foundation grant has enabled us to think of the bigger picture."

↑ Growing cells: Dr Sushma Anand is investigating the genetic causes of optic nerve diseases.

STEM superstar

Dr Flora Hui is a rising star in glaucoma research – and she's using her platform to make science accessible to everyone.

Growing up in the 80s and 90s, CERA Research Fellow Dr Flora Hui didn't see a lot of people who looked like her in science, technology, engineering and maths (STEM) careers.

"The closest I got was seeing female Asian doctors, but nothing in science or research," she says.

"So it was never a career that I thought about when I was younger.

"That's what now motivates me to become more visible in the public sphere – so people can see that having a career in STEM is open to everyone."

In 2022, Dr Hui got the chance to fulfil this role when she was one of 60 participants selected for the national Superstars of STEM program run by Science and Technology Australia.

The program aims to raise the media profile of women and non-binary people in STEM.

"I feel very honoured to be selected as the program is highly competitive and people apply from all around Australia," says Dr Hui.

In the two-year program, Dr Hui will build her skills in public speaking, working with the media and communicating with influence.

She will also have opportunities to share her story in schools, workplaces and the media.

"I'm really looking forward to putting these skills to use – talking to kids and getting them excited about a potential STEM career," she says.

In 2022, Dr Hui was also selected for the ABC's TOP 5 Science media residency program, which equips early-career researchers with the skills to communicate in the mainstream media.

"The program was fantastic. I not only got to see how the ABC works and write articles for them, but I also met fantastic people who have taught me a lot about presenting on radio and TV," she says.

"It's already leading to more media opportunities."

The program has given her a platform to share her research with a non-academic audience and help make science communication more accessible to the public.

"I think there are lots of benefits to hearing from researchers like myself, to learn about the importance of the work we do in Australia and why research is so critical," she says.

Advancing glaucoma research

Alongside her social advocacy work, Dr Hui has continued to progress her research to prevent blindness from glaucoma.

Following a six-month clinical trial in Australia that showed the potential of nicotinamide (a form of vitamin B3) to slow down vision loss in glaucoma, Dr Hui is now

conducting an international two-year trial to determine if these changes can be sustained long term.

"This study is going to be the world's first clinical trial to test if nicotinamide can protect the nerve cells in the optic nerve, which is what gets damaged in glaucoma," says Dr Hui.

"The great thing about nicotinamide is that it's already commercially available.

"If we do find that it's useful, it can be incorporated into clinical care very quickly."

Dr Hui has partnered with research teams in Singapore, Sweden and the UK to form an international collaboration that will allow four big clinical trials to run concurrently around the world.

If the trial is successful, Dr Hui says that nicotinamide could fill an important gap in the way we currently treat glaucoma.

"We haven't had any new therapies that don't work on eye pressure," she says.

"The problem is, when these therapies aren't working in a patient, we run out of options for them as all our current treatments target the same thing.

"The idea of these new therapies, including nicotinamide, is to find what else we can do to prevent people from losing their sight. It's really exciting to be a part of."

↑ **Future leader: Dr Flora Hui wants more young women to consider a career in STEM.**

The next generation

Meet the vision research leaders of the future.

In 2022, an increasing number of University of Melbourne students chose to undertake their studies at CERA.

In total, 25 higher degree researchers and 28 visiting students across bachelor, honours and masters level students joined CERA’s student group.

“In the past five years the cohort has roughly doubled,” says Research Education Lead Associate Professor Ian Trounce.

“It’s been rewarding to see so many students come through CERA as part of their journey.”

Many students are from the University of Melbourne Medical School Surgery in Ophthalmology cohort, which is co-located within CERA, while others come from other departments including engineering, materials science, optometry and population health.

Associate Professor Trounce says CERA offers a unique experience with lab work located near clinical research.

“Even just walking through the Eye and Ear Hospital every day students are exposed to the issues that people living with vision impairment experience,” he says.

← **Learning journey: (From left) Aaron Lee, Student coordinator Helen Zhang, Sanil Joseph, Daniel Urrutia-Cabrera, Jesse Gardner-Russell, Jamie Montenegro, Associate Professor Ian Trounce, Layal El Wazan, Zach Wang, Bridget Toussaint and Wenyi Hu.**

A bright future for vision research

University of Melbourne students are building the future of vision science at CERA.

Coming from a diverse array of backgrounds and fields, students at all stages of their education are making a valuable contribution to our collective knowledge of eye disease.

Three of our students – all of whom have taken different paths to becoming involved in eye research – explain why they have chosen to undertake their research degree at CERA.

Jesse Gardner-Russell, Visual Neurovascular Research

Jesse Gardner-Russell is a graduate researcher, working alongside Head of Visual Neurovascular Research Dr Luis Alarcon-Martinez, studying the connection between the brain and blood vessels in the eye.

He was the 2022 Valedictorian of the University of Melbourne's Faculty of Science and is also President and Board Chair of the University of Melbourne Graduate Student Association.

His journey has taken him from information technology to studying stem cell therapies to molecular biology, and then to CERA.

Since joining in 2022, he says that he has been supported in juggling his advocacy work with the Graduate Student Association.

"The support I've received at CERA has been very positive – I've found it's still possible to have a work-life balance," he says.

"This has afforded me a unique learning experience not just in research but also in processes, people and governance – which are all essential skills for a career in science."

Layal El Wazan,
Genetic Engineering Research

Layal El Wazan is president of the recently formed Ophthalmic Research Biomedical Society (ORBS) for CERA Graduate Students, and a recipient of the Medicine, Dentistry & Health Sciences John Landman PhD scholarship.

She has been interested in genetics since she first learned about them in Year 9.

"It all just made sense to me, and I thought 'there has to be more to this," Layal says.

She met Associate Professor Raymond Wong at an information night in 2017, and since then has done her masters degree, worked as a research assistant, and has now started her PhD in genetic engineering all at CERA.

"At CERA it's been great to have been given opportunities to try different things," says Layal.

"It's a trusting community who work together very closely which gives you the chance to gain so many new experiences."

Dr Jamie Montenegro,
Corneal Research

After studying and practising medicine in Mexico like many other members of his family, Dr Jamie Montenegro came to the University of Melbourne to study a Master of Biomedical Engineering.

However, he wanted to do something more hands on with patients.

"I found Dr Karl Brown's project on building engineered corneal tissue and wanted to bring my engineering and medicine skills together," Dr Montenegro says.

"I wanted to find something more in line with my principles, and research lets me feel like I'm treating more than one person at a time."

He says that the support he has received at CERA is helping him through his work.

"I've been here for one year - and being exposed to support resources and opportunities to join groups and committees is great to have extra on top of my work," says Dr Montenegro.

"The student community at CERA is also really supportive through tough times in both my research life and personal life."

A legacy of sight

Jenny Turnbull's glaucoma diagnosis inspired her to leave a lasting legacy.

In her own words, Jenny Turnbull has a 'blessed life' and isn't letting glaucoma get in the way of that. Fortunately, her glaucoma was diagnosed early, and treatment has slowed its progress – but for many this isn't the case.

Jenny says she's leaving a gift to CERA in her will to leave a legacy that might benefit future generations.

Jenny grew up in a happy household in Oakleigh and, after completing her teaching certificate, she left home aged 18.

"I was posted to Merino – a far-flung country town in the Western District," she says.

After a few years abroad, Jenny arrived back in Melbourne where she worked as a vocational counsellor.

"I really enjoyed helping people get back into the workforce and worked in rehabilitation until I retired," she says.

Diagnosis no barrier

Just before retirement, a visit to the optometrist led to Jenny's glaucoma diagnosis. Reflecting on her mother's diagnosis years earlier, she began donating to CERA.

"I thought my family could get it in the future, and I could give something towards research," says Jenny.

Now 85, her glaucoma has progressed, but it hasn't stopped Jenny from doing what she loves.

"I enjoy theatre, being down at the beach and appreciating things through sight," Jenny says.

Since meeting her friend Janet Cliff 44 years ago, Jenny says her life has been busier than ever.

"If anything comes up, there's two of you to do it – like volunteering at the Sydney Olympics and the Melbourne Commonwealth Games."

A lasting legacy

They also regularly attend CERA's community forums to hear about the latest in eye research.

"CERA are transparent and keep you informed – it's exciting how quickly they're moving with things," she says.

Jenny and Janet made a joint decision to update their wills and leave a gift to advance eye research.

"Any donation, small or large, will be very welcome because what they discover through research will help a lot of people," Jenny says.

Gift in Wills Lead Bron Sugden says CERA is deeply grateful to Jenny and Janet for having the foresight to remember CERA in their wills.

"People like Jenny and Janet are enabling exciting research breakthroughs that will transform the treatment and diagnosis of eye diseases, long into the future," Bron says.

↑ Gift in will: Jenny Turnbull and Janet Cliff are helping future generations.

Saving sight – on motorbikes

The Lions Eye Donation Service restores sight to thousands through corneal transplants, with Bloodbikes driving their impact.

The Lions Eye Donation Service (LEDS) has a team of donor coordinators who manage the entire donation service for Victoria, as well as providing tissue to other parts of Australia and New Zealand.

"They discuss consent with donor families, perform recovery of the eye, then bring the valuable gift back to LEDS to evaluate, preserve and then prepare the cornea for transplant," says LEDS Quality Manager Bronwyn Cohen.

It's a service they've been providing for 30 years, but in 2022 it was time for a rethink, when donor coordinators like Prue Armstrong were finding themselves increasingly driving all over Victoria to drop off donor tissue at hospitals.

The team wanted to focus their time on the crucial donor coordination work and Bronwyn looked for a medical transport service that could help ease the burden while increasing the number of vital tissue deliveries.

Enter Bloodbikes. "It's saved so much of our coordinators' time, and they can be here doing what they do best," Bronwyn says. "We're increasing the size of the team that saves sight."

Here to help

Bloodbikes are a group of volunteer motorcyclists who transport blood and medical supplies, free of charge, to help free up funds for health services.

Inspired by the Bloodbikes UK and Ireland, Peter Davis founded the Australian organisation in Brisbane in 2019.

Now they have more than 500 volunteers across Australia making thousands of trips for over 50 healthcare providers, including LEDS.

Rob Chrisomalidis is the Victorian Coordinator of Bloodbikes Australia. When he became a volunteer four years ago, no one was using their services in Victoria.

"Now, we've got over 70 qualified volunteers who pay for their own fuel and bike maintenance and only want the satisfaction of helping," he says.

"Some weeks we do up to six deliveries for LEDS. They might be small in size but are big in what they accomplish."

And he and his team always have the recipient in mind: "I can't imagine the feeling of waking up from an operation and being able to see better – it's life changing."

In safe hands

Professor Mark Daniell, Head of Corneal Research at CERA and Head of Corneal Service at the Royal Victorian Eye and Ear Hospital, says eye and tissue donation is "a priceless gift that makes a lasting impact."

"With the Bloodbikes on board, I know this precious cargo is always in safe hands on the homeward stretch towards potentially sight-saving surgery."

↑ Precious cargo: Prue Armstrong hands donor tissue to Rob Chrisomalidis.

Lead researchers

Dr Luis Alarcon-Martinez
Visual Neurovascular Research
BSc, MSc, PhD

Associate Professor Penny Allen
Bionic Eye Project
MBBS, FRANZCO

Associate Professor Lauren Ayton
VENTURE Study
BOptom PhD FAAO FACO GCOT

Associate Professor Michael Coote (until October 2022)
Surgical Glaucoma Research
MBBS, MS, FRANZCO, FRACS

Professor Mingguang He
Ophthalmic Epidemiology at the University of Melbourne
MD, PhD, FRANZCO

Professor Alex Hewitt
Clinical Genetics
BMedSci (Hons), MBBS, PhD

Dr Nathan Kerr
Glaucoma Surgical Trials
MBChB, MD, FRANZCO

Peter Larsen
Health Services Research (Honorary)
BSc (Optometry)

Professor Keith Martin
Glaucoma Research
MA, BM, BCh, DM, MRCP, FRCOphth, FRANZCO, FARVO, ALCM

Dr Rod O'Day
Ocular Oncology (Honorary)
MBBS, LLB, BSc, FRANZCO

Associate Professor Ian Trounce
Mitochondria and Neurodegeneration
BSc, PhD

Associate Professor Peter van Wijngaarden
Ophthalmic Neuroscience
MBBS, PhD, FRANZCO

Professor Mark Daniell
Corneal Research
MBBS. MS, FRANZCO, FRACS

Dr Thomas Edwards
Retinal Gene Therapy Research
MBBS, PhD, FRANZCO

Dr Jennifer Fan Gaskin
Ocular Fibrosis Research
MBChb, MD, FRANZCO

Professor Robyn Guymer AM
Macular Research
MBBS, PhD, FRANZCO, FAHMS

Associate Professor Lyndell Lim
Uveitis Research
MBBS, DMedSci, FRANZCO

Associate Professor Guei-Sheung (Rick) Liu
Genetic Engineering Research
BMedSci, PhD

Dr Isabel Lopez Sanchez
Mitochondrial Biology and Disease
BSc, PhD

Associate Professor Chi Luu
Macular Research
BOrth (Hons), Grad Dip (Epi and Biostats). PhD, FARVO

Associate Professor Raymond Wong
Cellular Reprogramming
B. Biomed Sci (Hons), PhD

Associate Professor Zhichao Wu
Clinical Biomarkers
BAppSc(Optom), PhD, FAAO

Dr Lisa Zhuoting Zhu
Ophthalmic Epidemiology
Md, PhD

For more details about our researchers visit cera.org.au

Our Board

We extend the deepest appreciation to our Board members who give their time and expertise to provide strategic direction and governance to CERA.

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BBus (Mkt) (Hons)

Simon Brewin
Royal Victorian Eye and Ear Hospital
BBus, Grad Dip HSM, MBL, GAICD

Professor Andrew Cuthbertson AO
BMedSci, MBBS, PhD, FAA, FTSE, FAHMS

Suwanee Dharmalingam
B. Comm (Accounting and Finance) LLB (UNSW)

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BA, LLB (Hons)

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University of Melbourne representative
MBBS, PhD, FRACP, FAHMS

Alternate Directors

Llewellyn Prain
BA (Hons) LLB (Hons) GAICD (for Simon Brewin)

Professor Jenny Wilson-Berka
BSc (Hons) PhD (for Professor John Prins)

Associate Professor Peter van Wijngaarden
MBBS (Hons), PhD, FRANZCO (for Professor Keith Martin)

CERA acknowledges the generous support of the Macquarie Group Foundation of $10,000 under its staff non-profit support policy in recognition of the Board service provided by employee Suwanee Dharmalingam.

CERA Executive team

Leah Borsboom
Chief Operating Officer
and Company Secretary
LLB (Hons), GAICD

Tena Cheng (on leave in 2022)
Head of Commercialisation
and Legal
LLB, BSc

Fiona George
Head of Finance
B Bus (Acc), CPA, GAICD

Professor Robyn Guymer AM
Deputy Director
Head of Macular Research
Professor of Surgery (Ophthalmology)
University of Melbourne
MBBS, PhD, FRANZCO, FAHMS

Associate Professor Lyndell Lim
Head of Clinical Trials Research
Principal Research Fellow
(Ophthalmology), University
of Melbourne
MBBS, DMedSci, FRANZCO

Rowan Neilson
Head of Commercialisation
and Legal
B Sc/LLB (Hons)

Professor Keith Martin
CERA Managing Director,
Head of Glaucoma Research
Ringland Anderson Professor
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**MA, BM, BCh, DM, MRCP, FRCOphth,
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Janine Sim-Jones
Head of Communication,
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BA (Journ) GradDipPR

**Associate Professor
Peter van Wijngaarden**
Deputy Director
Principal Investigator
Ophthalmic Neuroscience
Associate Professor Surgery
(Ophthalmology), University of
Melbourne
MBBS, PhD, FRANZCO

Abridged financials

CONSOLIDATED STATEMENT OF FINANCIAL POSITION

as at 31 December 2022

	2022 $'000	2021 $'000
ASSETS		
CURRENT ASSETS		
Cash and cash equivalents	1,962	865
Trade and other receivables	1,381	1,498
Other assets	212	253
TOTAL CURRENT ASSETS	**3,555**	**2,616**
NON-CURRENT ASSETS		
Financial assets	30,893	33,306
Property, plant and equipment	1,599	744
Trade and other receivables	207	417
Right-of-use assets	139	218
TOTAL NON-CURRENT ASSETS	**32,838**	**34,685**
TOTAL ASSETS	**36,393**	**37,301**
LIABILITIES		
CURRENT LIABILITIES		
Trade and other payables	3,589	2,590
Employee benefits	2,276	1,949
Lease liability	252	230
TOTAL CURRENT LIABILITIES	**6,117**	**4,769**
NON-CURRENT LIABILITIES		
Employee benefits	158	178
Lease liability	-	25
TOTAL NON-CURRENT LIABILITIES	**158**	**203**
TOTAL LIABILITIES	**6,275**	**4,972**
NET ASSETS	**30,118**	**32,329**
EQUITY		
Reserves	17,774	16,694
Retained earnings	12,344	15,635
TOTAL EQUITY	**30,118**	**32,329**

CONSOLIDATED STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME

for the year ended 31 December 2022

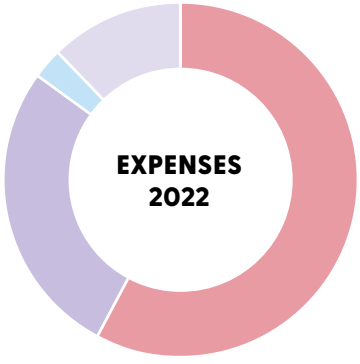
	2022 $'000	2021 $'000
REVENUE		
Federal and State Government grants	6,211	5,932
Clinical Trials and contract research	6,279	5,976
Donations and bequests	3,555	2,357
Philanthropic and other grants	1,641	1,957
Government subsidies*	-	445
Investment and other income	2,321	7,932
TOTAL REVENUE	**20,007**	**24,599**
EXPENSES		
Research expenses	(12,879)	(11,698)
Research support expenses	(5,965)	(4,824)
Occupancy expenses	(15)	(299)
Depreciation	(661)	(429)
Finance expenses	(2,698)	(189)
TOTAL EXPENSES	**(22,218)**	**(17,439)**
NET SURPLUS/(DEFICIT)	**(2,211)**	**7,160**

These abridged audited Financial Statements have been extracted from the full audited Financial Statements for CERA and its controlled entity. The full audited Financial Statements can be extracted from the ACNC (Australian Charities and Not-for-profits Commission) website.

CERA operates as a not-for-profit organisation. Accordingly, accumulated surpluses are held as reserves to suport future research projects and operations.

** Commonwealth Government JobKeeper and Cash Flow boost payments.*

31% Federal and State Government grants
31% Clinical Trials and contract research
18% Donations and bequests
8% Philanthropic and other grants
12% Investment and other income
0% Government subsidies*



58% Research expenses
27% Research support expenses
3% Depreciation
12% Finance expenses
0% Occupancy expenses

Supporters and acknowledgements

The support of these generous people and organisations enabled us to keep advancing our work towards a world free from vision loss and blindness. We are grateful for the many generous contributions to our research made by individual donors, along with the support of philanthropic trusts and foundations, industry, government and our member organisations.

Major gifts ($10 000+)

Noel Alpins AM

Rita Andre

Ainslie Cummins

Professor Andrew Cuthbertson AO

Renate Daniell

Robyn Ellis

Craig Kimberley OAM and Connie Kimberley

Peter Lemon

Janet McKenzie

Andrew G Michelmore and Janet Hailes Michelmore AO

Loris Peggie

Margaret S Ross AM

Trusts and Foundations ($10 000+)

The Alcon Foundation

Australian Vision Research (previously known as ORIA)

The Betty Brenda Spinks Charitable Trust – B.B.S. Trust as managed by Equity Trustees

Bright Focus Foundation

CASS Foundation

Centre for Eye Research Australia Foundation

DHB Foundation (managed by Equity Trustees)

Fred Hollows Foundation

Glaucoma Australia

GRAS Foundation

Gwenneth Nancy Head Foundation

Harold Mitchell Trust

Ian Potter Foundation

Joan and Peter Clemenger Trust

Lionel and Yvonne Spencer Trust

Lions Ride for Sight - Lions District 201V3

Macular Disease Foundation Australia

Marjorie M Kingston Charitable Trust

Mito Foundation

Myra Stoicesco Charitable Trust

National Foundation for Medical Research and Innovation (NFMRI)

Peggy and Leslie Cranbourne Foundation

Perth Eye Foundation

Ramaciotti Foundation

Retina Australia

Ruth Marie Sampson Foundation

Sir Edward 'Weary' Dunlop Medical Research Foundation

Teacher's Health Foundation

Telematics Trust

Victorian Lions Foundation

The Yulgilbar Foundation

Bequests ($10 000+)

Estate of June Bethel Ashton

Estate of Joan Barlow

Estate of James Andrew W Johnstone

Estate of Arthur Gordon Loveday

Estate of Elizabeth Frances Maxwell

Estate of Wilma Caroline Morrison

Estate of Harold Raymond Muir

Estate of Jaqueline Winifred Stephens

Estate of Florence Ann Watts

Corporate supporters

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Eye Bank Association of America

Royal Victorian Eye & Ear Hospital

We gratefully acknowledge the Royal Victorian Eye & Ear Hospital for facilitating support from the following donors for our research:

H&L Hecht Trust

Endowments

We gratefully acknowledge the support of the University of Melbourne in the ongoing management and direction of the following endowed funds to support our research:

Annemarie Mankiewicz – Zelkin Fellowship Fund

Dorothy Adele Edols Research Fund (managed by Perpetual Ltd)

Floris J & H Dallas Wiseman Charitable Trust

Hazel Jean Eastham Bequest

Hector Maclean Fund

Louisa Jean de Bretteville Bequest

Maurice Cantlon Memorial Fund

The Mavis and Ivan Rowe Prize for Retinal Diseases Research

Noel Curphey Fund

Ringland Anderson Chair of Ophthalmology Fund

Winifred Hallam Monds Bequest

Government

Department of Industry, Innovation and Science

National Health and Medical Research Council

Medical Research Future Fund

Victorian Government Operational Infrastructure Support Fund

Victorian Medical Research Accelerator Fund

Members

Diabetes Victoria

Glaucoma Australia

National Health and Medical Research Council

Royal Australian and New Zealand College of Ophthalmologists (RANZCO)

Royal Victorian Eye & Ear Hospital

University of Melbourne

The Victorian Lions Foundation

Vision Australia

Partnerships and Associations

Aikenhead Centre for Medical Discovery

Association of Australian Medical Research Institutes (AAMRI)

CCRM Australia

International Agency for the Prevention of Blindness

Medical Research Commercialisation Fund

MedTech Actuator

Melbourne Academic Centre for Health

St Vincent's Hospital Melbourne

World Health Organisation

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In memoriam

CERA extends its deepest sympathies to the family of the late Jacqueline Crock. We are grateful for Jacqueline's support of CERA and extend our heartfelt condolences to the Crock family on their loss.

About the photography in this report

CERA's research and clinical trials operate under strict COVID-safe guidelines. All images in this report were taken under the restrictions that were in place at the time.

↑ Better together: (From left) Associate Professor Guei-Sheung Rick Liu, Research Orthoptist Lisa Kearns, Associate Professor Raymond Wong, Peter Clemenger AO, Dr Tom Edwards, Layal El Wazan, Professor Keith Martin.

How you can support us

Donate

With your support, we can continue our world-leading research and accomplish scientific breakthroughs previously deemed unattainable.

Please visit cera.org.au/donate

Leave a bequest

Make a gift in your will and leave a lasting legacy.

Partnership and funding opportunities

As true innovators, our scientists are on the brink of new discoveries every day. For a confidential discussion about how you can partner with our researchers to help them discover new ways to prevent vision loss contact Ryan McCarthy, Senior Manager Philanthropy on rmccarthy@cera.org.au or +61 9929 8796.

Register for a clinical trial

Be part of clinical research by registering at cera.org.au/take-part-in-research

Stay in touch

Visit our website cera.org.au to receive our biannual supporter magazine *Visionary* or monthly e-newsletter *Eye-News*.

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