20 YEARS OF IMPACT 2001–2021

Macular Disease Foundation AUSTRALIA

10

YEARS OF RESEARCH

Reflecting on the impact of investing into macular disease research

Contents

MDFA acknowledges the traditional custodians of country throughout Australia and their continuing connection to land, sea and community.

We pay our respects to them and their cultures, and to the Elders past, present and emerging.

Cover Image: Professor Bamini Gopinath

Photography: Michelle Hauschild

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Welcome

There have been substantial improvements in the prevention, diagnosis, and treatment of macular disease over the past decade.

The targeted investment of Macular Disease Foundation Australia's (MDFA) Research Grants Program and the innovative work of our funded researchers has been key to many of these advancements.

Identifying single causes of macular disease remains a principal challenge, and it is essential that we be vigilant in prevention and detection to identify disease at an early stage.

Although treatments for conditions such as wet (neovascular) age-related macular degeneration (wet AMD) continue to improve, it is imperative that we make advances through research into dry (atrophic) AMD, diabetic retinopathy, diabetic macular oedema and inherited retinal diseases.

As we continue to work together to develop a national research agenda to fast-track advancements in treatment and better outcomes for the macular disease community, we applaud the past decade of research and scientific leaders in this field. We also extend our sincerest thanks to our donors and bequestors for your foresight, generosity, and trust.

It is only through this collaborative approach we can continue to reduce the incidence and impact of macular disease in Australia.

Dee Hopkins,

Chief Executive Officer,
Macular Disease Foundation Australia

As an ophthalmologist and researcher, I have seen first-hand the devastating impact of vision loss.

We have come a long way over past decades, but despite our ability to salvage vision through anti-VEGF treatments, macular disease remains the leading cause of blindness and vision loss in this country. This can only be reversed through ongoing investment into transformative research.

It has been a reward to be involved with MDFA in my capacity as National Research Advisor. I have also been a recipient of the Research Grants Program, which is an essential investment to support scientific advancements in an under-funded chronic disease.

I look forward to the advancements in new injectable treatments, including some that can potentially block VEGF together with other key cytokine growth factors, as well as progress in gene therapy, stem cell research and genomics, plus vision restoration with visual prostheses, implants and the use of artificial intelligence. By harnessing big data and improving technological advances, we are transforming how we predict, prevent, diagnose and treat macular disease.

Our research future looks bright, and like you, I look forward to supporting the next generation of scientific leaders and advances in research.

Prof Paul Mitchell,

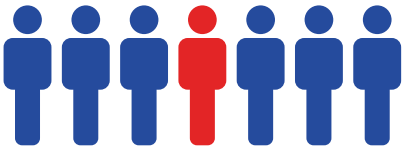
National Research Advisor,
Macular Disease Foundation Australia

Facts and figures

1.7 million Australians are at risk of, or living with, macular disease.

Macular Disease Foundation Australia's Research Grants Program is working towards a future where no one needlessly loses their sight to macular disease.

AGE-RELATED MACULAR DEGENERATION (AMD)



1 in 7

AUSTRALIANS OVER 50 HAVE SOME EVIDENCE OF AMD

50%

OF LEGAL BLINDNESS IN AUSTRALIA IS CAUSED BY AMD

1 in 4

PEOPLE WITH AMD ARE UNDIAGNOSED

DIABETIC EYE DISEASE

No. 1

DIABETIC RETINOPATHY IS THE LEADING CAUSE OF PREVENTABLE BLINDNESS IN WORKING-AGE AUSTRALIANS

1 in 3

PEOPLE OVER THE AGE OF 50 WITH DIABETES HAS DIABETIC RETINOPATHY

72,000

AUSTRALIANS LIVE WITH DIABETIC MACULAR OEDEMA (DMO), WHICH CAN OCCUR AT ANY STAGE OF DIABETIC RETINOPATHY

An internationally recognised research grants program

Over the past decade, MDFA has become **Australia's largest non-government source of funding** for macular disease research.

OUR RESEARCH GRANTS PROGRAM HAS SUPPORTED

$4.1 MILLION
ALREADY PROVIDED TO RESEARCH PROJECTS

$1 MILLION
10-YEAR ANNIVERSARY FUNDING ROUND IN 2021

$5.1 MILLION
TOTAL FUNDING BY MAY 2021

21 RESEARCH PROJECTS

18 AUSTRALIAN RESEARCHERS

8 NEW PROJECTS IN 2021

81

OUR RESEARCH GRANTS HAVE PRODUCED 81 PUBLICATIONS IN PEER-REVIEWED JOURNALS

2017 MDFA Research Grant recipients Professor Alice Pébay, A/Prof Fred Chen and Professor Erica Fletcher.

IN THE LAB

Professor Erica Fletcher

INSTITUTION: Department of Anatomy and Neuroscience, University of Melbourne

FUNDING YEAR: 2013

PROJECT: Purinergic receptors and early AMD: a novel mechanism and biomarker

TIMELINE: $400,000 over three years

FUNDING YEAR: 2017

PROJECT: Targeting monocyte phagocytosis to reduce progression of age-related macular degeneration

TIMELINE: $180,000 over two years

THE PROBLEM TO BE SOLVED

Currently, there is no way to predict who will develop age-related macular degeneration (AMD), nor stop the progression of the disease.

But MDFA funding has allowed Professor Erica Fletcher to take strides towards identifying people at risk and potentially developing a new treatment.

Researching the underlying mechanisms that lead to the development of AMD is personal to Prof Fletcher, whose great aunt lost vision to neovascular (wet) AMD late in her life.

Having seen first-hand the effect AMD has had on her loved ones, Prof Fletcher is acutely aware of the impact this condition has on people and also their families.

With a specific focus on the early stages of AMD and interrupting the disease's progression at that point, Prof Fletcher's goal is to prevent many of the changes that lead to vision-threatening forms of AMD.

"You cannot develop medicines or treatments for disease unless you first have undertaken fundamental research"

– Prof Erica Fletcher

Prof Fletcher's Department of Anatomy and Neuroscience at the University of Melbourne has undertaken several studies to better understand why AMD develops and progresses.

MDFA's Research Grants Program has supported two of these projects, which explored how waste disposal systems in the eyes malfunction during AMD.

The first – a $400,000 grant awarded in 2013 – determined that the signalling of immune cells via receptors called purinergic receptors influences the removal of debris as we age, predisposing people to the disease and its progression.

The second – a $180,000 grant awarded in 2017 – investigated whether the early stages of the disease occur because of defects in how cellular waste is removed.

Quantifying the phagocytosis (removal of waste) by monocytes (a type of white blood cell) in people with AMD compared to a healthy control group, Prof Fletcher found that monocytes are functionally abnormal early in the disease and that it is possible to generate therapies that enhance phagocytosis.

More work is needed to investigate whether targeting monocyte phagocytosis can reduce the development or progression of AMD, but this research could eventually help screen people at risk of AMD and develop new treatments for the condition.

One of the significant findings was that even though AMD is an eye disease, there are changes that occur in immune cells within the blood at a much earlier stage.

Prof Fletcher's research underlined how important systemic factors are to the development of macular disease.

Prof Fletcher's long-standing AMD research program has been recognised with the Nina Kondelos Award from the Australasian Neuroscience Society and the H Barry Collin Medal from Optometry Australia.

MDFA's funding also led to nine peer-reviewed publications appearing in leading biomedicine and ophthalmology journals like the American Journal of Pathology, Frontiers in Medicine, and Investigative Ophthalmology and Vision Science.

Prof Erica Fletcher and former Governor-General Peter Cosgrove. Photo: Jacquie Manning

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PEER-REVIEWED PUBLICATIONS

Prof Fletcher has received further National Health and Medical Research Council (NHMRC) funding to continue her research, and holds an NHMRC Development Grant to evaluate a novel way of reducing vision loss in those with wet AMD.

This additional government funding deepens our understanding of the disease, which is crucial to exploring treatments to reduce vision loss.

In the long term, Prof Fletcher hopes to develop tools that identify people at higher risk of progression, as well as treatments that stop the changes in the body that lead to macular disease.

Professor Damien Harkin

FUNDING YEAR: 2013

INSTITUTION: School of Biomedical Sciences, Queensland University of Technology

PROJECT: A novel tissue substitute for repairing the outer retina in patients with AMD

TIMELINE: $200,000 over three years

THE PROBLEM TO BE SOLVED

Professor Damien Harkin undertook a novel research project using a protein extracted from silk as a form of scaffold on which to grow new retinal tissue, with a view to replacing the damaged tissue that leads to vision loss in AMD patients.

The study not only achieved a better understanding of the feasibility of implanting cultured retinal pigment epithelium (RPE) cells into the retina, but unexpectedly discovered a new type of stem cell within the tissue that resides immediately behind the retina. This new stem cell may be used to reduce the scarring experienced by AMD patients.

Prof Harkin's MDFA-funded research attracted an additional $500,000 in NHMRC funding. It has also helped train a new generation of scientists to continue this and related projects well into the future. One of those young scientists is 2019 grant recipient Dr Audra Shadforth, who is building on Prof Harkin's work (right).

Dr Audra Shadforth

FUNDING YEAR: 2019

INSTITUTION: School of Environment and Science, Griffith University

PROJECT: Investigating the potential for scar-less wound healing in AMD

TIMELINE: $126,000 over three years

THE PROBLEM TO BE SOLVED

Dr Audra Shadforth's ongoing research project uses the new type of stem cell discovered in Prof Harkin's study to look at AMD from a new angle.

Current treatments for wet AMD focus on reducing the damage done by the growth and leaking of new blood vessels within and under the retina.

Although these treatments – anti-VEGF injections – can effectively stabilise and maintain vision, nearly half of eyes that receive these therapies develop blinding scars under the macula within two years of treatment.

Dr Shadforth's research aims to develop new treatment avenues that will reduce or eliminate this scarring and tissue damage in AMD patients. This investigatory project also hopes to reveal a new understanding of the role of the choroidal stroma – the supporting connective tissue that surrounds the choroidal blood vessels at the back of the eye – in the development of AMD.

Professor Alice Pébay

FUNDING YEAR: 2017

INSTITUTION: The Department of Surgery and the Department of Anatomy and Neuroscience, University of Melbourne

PROJECT: Modelling geographic atrophy using human pluripotent stem cells

TIMELINE: $300,000 over two years

THE PROBLEM TO BE SOLVED

The retinal pigment epithelium (RPE) is a layer of cells beneath the retina. When RPE cells die, so do the retinal cells above them, leading to patches of missing retina – or geographic atrophy (GA).

Professor Alice Pébay's MDFA-funded project explored the genetic pathways leading to GA using patients' own cells, creating a bank of stem cells that researchers across the globe can now access to investigate potential new treatments for GA, or dry AMD.

This collaboration between the University of Melbourne, the University of Tasmania, the Garvan Institute for Medical Research and the Centre for Eye Research Australia generated and used induced pluripotent stem cells (iPSCs) – cells that can become any type of cell in the body – from 60 AMD patients and 60 control individuals, and made them become retinal cells.

Prof Pébay's team then used this large iPSC cell bank to identify the genetic differences between the healthy cells and the disease cells, which can now be used to develop new targets for potential treatments of dry AMD.

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PEER-REVIEWED PUBLICATIONS

Prof Pébay was awarded an NHMRC Senior Research Fellowship in 2019, with a research program that includes the project funded by MDFA.

Along with her collaborators, Prof Pébay has also secured support from the Medical Research Future Fund's Stem Cell Therapies Mission and a 2021 grant from the Ophthalmic Research Institute of Australia. These projects will use the iPSC cell bank to screen for the impact of FDA-approved molecules on the formation of drusen-like deposits in a dish, and to assess the proteomic profile of the iPSC samples, respectively.

Prof Pébay's research shows how MDFA's initial investment can snowball into significant advancements in the field of macular research.

"MDFA is fundamental to the type of work we are doing around the country. Without this investment, much research on curing blindness would not happen in Australia. The research grants program is essential for us to do our work, and to do our work well"

– Prof Alice Pébay

Associate Professor Wilson Heriot

FUNDING YEAR: 2016

INSTITUTION: Department of Optometry and Vision Science, University of Melbourne

PROJECT: Plaquenil and chloroquine phototoxicity project

TIMELINE: $30,000 over one year

THE PROBLEM TO BE SOLVED

The anti-malarial drugs chloroquine and hydroxychloroquine are used to treat systemic autoimmune conditions like rheumatoid arthritis. However, long-term use of these agents is known to lead to macular degeneration.

Associate Professor Wilson Heriot studied the effect of these medications on the retinas of mice, showing that even after as little as four weeks, hydroxychloroquine treatment made the retina more sensitive to light, however this effect was not observed for chloroquine.

While some mild changes in the retina were observed, overall, no significant damage was noted. However even at low doses and very short light exposure, retinal metabolism was significantly altered.

This model will allow researchers to explore longer exposure to mimic patient exposure. If phototoxic damage is confirmed, macular damage may be eliminated with glasses adapted to counteract the retinal sensitivity by filtering specific colours.

Professor Steven Krilis

FUNDING YEAR: 2015

INSTITUTION: Infectious Diseases, Immunology and Sexual Health, St George Hospital, University of New South Wales

PROJECT: Novel mechanisms of complement control protein dysregulation contributing to AMD pathogenesis and progression: CFH and beta 2-Glycoprotein 1

TIMELINE: $400,000 over three years

THE PROBLEM TO BE SOLVED

We know genetics, age and environment can cause AMD, but how damage occurs is still not clear. Professor Steven Krilis examined the critical role that two proteins – CFH and B2GP1 – play in damaging the eye, leading to AMD.

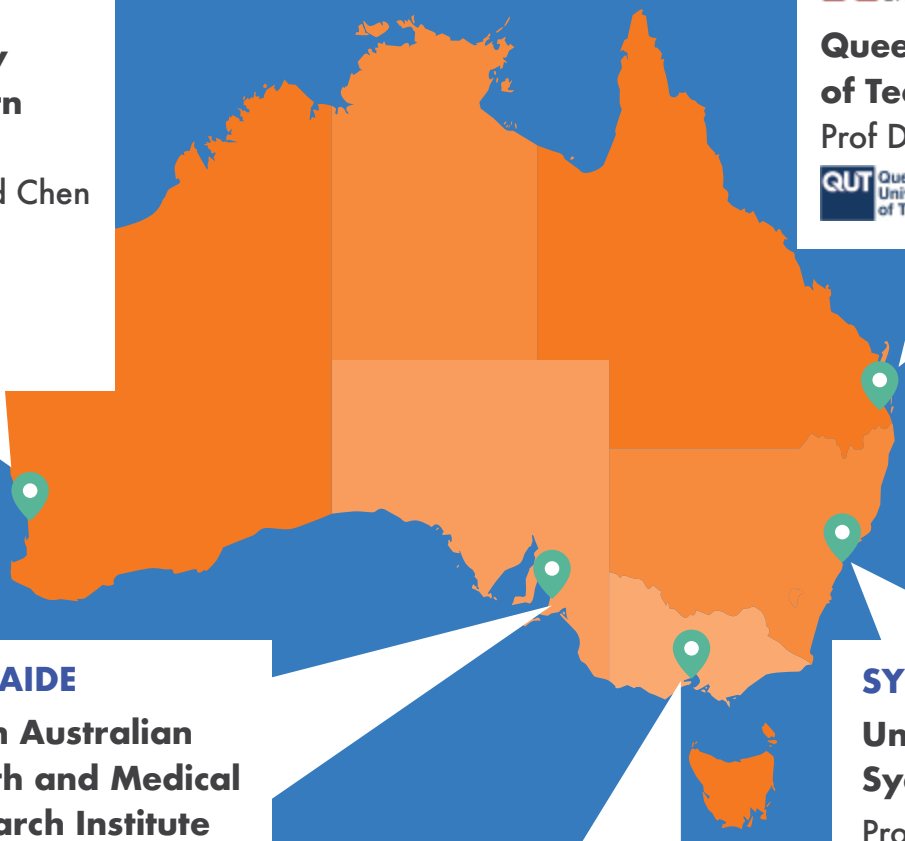
This project discovered that certain forms of CFH and B2GP1 protect the retina from damage, then developed a test to measure the amount of healthy and damaged forms of these proteins in the blood.

This new test could be used in AMD clinical trials to help identify patients with early AMD who may be at highest risk of disease progression.

Since completing this study, Prof Krilis was made a Member of the Order of Australia (AM) in 2019, and expanded his research portfolio into dementia, exploring the concept of the eye as an extension of the brain.

Where does our funding go?

MDFA's Research Grants Program has funded 18 world-leading researchers working at institutions across Australia.



PERTH

University of Western Australia
A/Prof Fred Chen

BRISBANE

Griffith University
Dr Audra Shadforth

Queensland University of Technology
Prof Damien Harkin

ADELAIDE

South Australian Health and Medical Research Institute
Prof Alex Brown

MELBOURNE

Centre for Eye Research Australia
Prof Robyn Guymer
A/Prof Chi Luu
Dr Zhichao Wu
Dr Liubov Robman

University of Melbourne
Prof Erica Fletcher
Prof Alice Pébay
A/Prof Wilson Heriot
A/Prof Laura Downie

SYDNEY

University of Sydney
Prof Paul Mitchell
Prof Mark Gillies
Prof Bamini Gopinath
A/Prof Gerald Liew

University of New South Wales
Prof Steven Krilis
A/Prof Isabelle Jalbert

DETECTING DISEASE

Professor Robyn Guymer

FUNDING YEAR: 2011

INSTITUTION: Centre for Eye Research Australia

PROJECT: Improved characterisation of high-risk phenotypes in early AMD, employing novel imaging and functional modalities

TIMELINE: $400,000 over three years

"This work has led the world in driving change in the way AMD is characterised"

– Prof Robyn Guymer

THE PROBLEM TO BE SOLVED

Despite one in seven Australians over 50 showing some signs of age-related macular degeneration, it's still difficult to pick up cases of AMD in its earliest stages before symptoms occur. It's also hard to predict which patients will progress to the more advanced forms of the disease.

Professor Robyn Guymer's MDFA-funded research helps solve these problems. Prof Guymer developed a new suite of state-of-the-art techniques to better describe early AMD, allowing people at high risk of disease progression to be counselled more appropriately and monitored more closely so that vision-threatening complications can be picked up more quickly.

An inaugural MDFA Research Grant recipient in 2011, Prof Guymer is an eminent figure in Australian and international AMD research – and this study has transformed the way the disease is characterised across the globe.

Prof Guymer's macular research unit at the Centre for Eye Research Australia (CERA) is considered a world leader in this intense field of research.

Through their grant, Prof Guymer's team characterised an early stage of atrophic AMD they called nascent geographic atrophy (nGA) – a term that is now used universally for the early stages of cell loss. This early potential biomarker of cell death can be seen on retinal imaging called optical coherence tomography (OCT) and is facilitating early-intervention trials.

The project also characterised the high-risk AMD phenotype reticular pseudodrsusen (RPD). Highlighting the importance of understanding RPD has led to clinicians learning how to recognise these deposits on standard imaging.

Prof Guymer and her team have led the world in better defining how intermediate AMD is characterised, so that progression to vision loss can be more accurately predicted.

This work has changed the lexicon of the disease by coining the term nascent geographic atrophy, which describes the earliest OCT changes that portend the development of atrophy in eyes with drusen.

Prof Guymer's MDFA grant contributed to a body of work that has earned a string of awards (below), membership of the international working group Classification of Atrophy Meeting (CAM) consensus committee, and global collaborations looking to develop artificial algorithms to detect nGA and RPD on retinal images, as well as to continue investigating the underlying cause of RPD.

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PEER-REVIEWED PUBLICATIONS

This research also produced 15 peer-reviewed publications in the field's highest impact publications: Investigative Ophthalmology and Visual Science (eight), Ophthalmology (four), JAMA Ophthalmology (one), Translational Vision Science and Technology (one), and the British Journal of Ophthalmology (one).

Prof Guymer's project also formed the basis of Dr Zhichao Wu's PhD thesis at the University of Melbourne, for which he was awarded the Dean's Award for Excellence. An optometrist and clinical researcher, Dr Wu has gone on to secure his own MDFA Research Grant to investigate novel imaging-based biomarkers of wet AMD development using OCT and artificial intelligence (see page 14).

Prof Guymer's accolades since receiving an MDFA grant

- NHMRC Principal Research Fellowship (2016)
- NHMRC Research Excellence Award (2016)
- NHMRC Elizabeth Blackburn Fellowship for top-ranked female research fellowship in clinical medicine and science (2016)
- RANZCO Norman McAlister Gregg Lecture and Medal (2018)
- Member of the Order of Australia (AM) in the Queen's Birthday Honours List (2018)
- NHMRC Synergy Grant (2019)
- Macula Society's W Richard Green Award and Lecture (2019)
- NHMRC Investigator Grant (2020)

Associate Professor Chi Luu

FUNDING YEAR: 2015

INSTITUTION: Centre for Eye Research Australia

PROJECT: Static and dynamic retinal function topography in early stages of AMD – a unique dark adapted chromatic perimeter

TIMELINE: $200,000 over two years

THE PROBLEM TO BE SOLVED

Difficulty seeing at night and being slow to adjust vision from light to dark environments are the most common visual symptoms of the early stages of AMD.

An MDFA grant enabled Associate Professor Chi Luu and co-investigator Professor Robyn Guymer to validate a new technology designed to test night vision and investigate how night vision is affected in early AMD.

A/Prof Luu developed a novel testing protocol that allows his team to assess night visual function from multiple locations in the retina. Traditionally, this type of testing can only be performed at one location.

The study found that eyes with AMD have reduced night vision – worse in eyes with reticular pseudodrusen (RPD), especially at the central retina.

A/Prof Luu's research sheds light on the pathophysiology of AMD and helps develop clinical tools for better characterising AMD and monitoring its progression.

Dr Zhichao Wu

FUNDING YEAR: 2019

INSTITUTION: Centre for Eye Research Australia

PROJECT: Novel prognostic imaging biomarkers for improved risk stratification in the early stages of AMD

TIMELINE: $240,000 over three years

THE PROBLEM TO BE SOLVED

Intravitreal eye injections can effectively treat wet AMD, but patients often lose vision because the disease is detected too late.

That's why Dr Zhichao Wu is investigating new imaging techniques to better identify people at risk of developing late-stage wet AMD, so they can be monitored more closely and receive sight-saving treatment as soon as they need it.

Dr Wu's project is using optical coherence tomography (OCT) and OCT angiography – imaging techniques that visualise the back of the eye three-dimensionally – to track 200 patients with intermediate AMD. They will then be followed up to see who develops wet AMD. Artificial intelligence will then exploit this rich source of information to extract novel imaging-based biomarkers that could help identify patients at high risk of progressing to late-stage wet AMD.

These new technologies could ultimately help save sight through earlier detection and treatment.

Associate Professor Gerald Liew

FUNDING YEAR: 2015

INSTITUTION: Centre for Vision Research, Department of Ophthalmology (Westmead Hospital), Westmead Institute for Medical Research, University of Sydney

PROJECT: Deciphering the metabolomic signature of age-related macular degeneration to discover pathogenic pathways

TIMELINE: $100,000 over one year

THE PROBLEM TO BE SOLVED

MDFA funding allowed Associate Professor Gerald Liew to study biomarkers in the blood that suggest a defect in mitochondrial function may be linked to neovascular (wet) AMD.

As the retina is the most metabolically active tissue in the body with a high concentration of mitochondria and lipids, A/Prof Liew assessed whether acylcarnitine concentrations – a marker of lipid and mitochondrial metabolism – differed between patients with wet AMD and controls.

This collaboration between the University of Sydney and the University of New South Wales found that people with wet AMD had reduced plasma levels of short-chain acetylcarnitine and increased plasma levels of long-chain dicarboxylic acylcarnitine – again highlighting the link between the nutrients we get from our diet and the development of AMD.

A/Prof Liew was thrilled with the final results because they suggested that mitochondria, the power stations of the cells, may not be working properly in AMD. Even better, the findings suggested a way to correct this defect, and potentially help treat the condition.

A/Prof Liew's team has published three peer-reviewed papers and is pursuing a project based on these findings, which may eventually lead to a preventative intervention for the disease. Preclinical studies are now being conducted with the hope of finding compounds that may help improve mitochondrial function in AMD, which may help prevent or treat the disease in future.

"MDFA fills an important gap. It's great to have an organisation laser-focused on macular diseases, which often get overlooked."

– A/Prof Gerald Liew

Image right: Associate Professor Gerald Liew

IMPROVING CARE

Associate Professor Laura Downie

FUNDING YEAR: 2015

INSTITUTION: Department of Optometry and Vision Sciences, University of Melbourne

PROJECT: Advancing eye care for people with age-related macular degeneration through integrating clinical research and its translation

TIMELINE: $100,000 over three years

THE PROBLEM TO BE SOLVED

A clinical audit helps healthcare practitioners discover the strengths and weaknesses of their current practices so they can then improve the care they provide their patients.

Optometrists play a key role in providing clinical care to people with AMD, particularly early in the disease journey when advice about lifestyle risk factors like diet and smoking can slow progression of the disease.

Although there are no formal requirements for clinical audit among Australian optometrists, there is a growing recognition of its value in improving practice – especially when it comes to sight-threatening conditions like AMD.

This lack of optometric audit tools is why MDFA awarded Associate Professor Laura Downie a research grant to develop an innovative auditing platform called the Macular Degeneration Clinical Care Audit Tool (MaD-CCAT) to assess the eye care received by people with AMD – work that can lead to immediate improvements in the quality of clinical care.

Using the MaD-CCAT, A/Prof Downie led a study that asked participants to audit their clinical records for patients with or at risk of AMD over a three-month period and identify areas for improvement. They were then required to audit their care of a new set of patients over another three-month period.

"The MaD-CCAT is, to our knowledge, the world's first primary care clinical audit tool for AMD of its type"
– A/Prof Laura Downie

Image left: Associate Professor Laura Downie and former Governor-General Peter Cosgrove

The project engaged 25 optometrists in five states across Australia, and analysed data from more than 600 unique AMD patient clinical records.

The study showed that the MaD-CCAT improved clinical record documentation and several aspects of care, particularly how often optometrists asked patients about modifiable risk factors like smoking (21% to 58%), diet (11% to 29%) and nutritional supplementation (20% to 51%).

Without a cure for AMD, reducing the risk of a person developing sight-threatening late-stage of the disease is critical. This research shows that the MaD-CCAT significantly enhances optometrists' knowledge and uptake of best practice AMD care.

Associate Professor Isabelle Jalbert

FUNDING YEAR: 2015

INSTITUTION: School of Optometry and Vision Science, University of New South Wales

PROJECT: Eyecare practitioners' and patients' perspectives on age-related macular degeneration: identifying barriers and facilitators to optimal AMD care

TIMELINE: $100,000 over two years

THE PROBLEM TO BE SOLVED

Evidence-based lifestyle changes that decrease the risk of AMD – such as quitting smoking, attending regular eye exams, and eating a macula-friendly diet full of oily fish and leafy greens – have been known for some time.

However, self-reported practices suggest that eyecare professionals' advice – and AMD patients' adherence to it – can be very poor.

Associate Professor Isabelle Jalbert asked why in this MDFA-funded study, which surveyed both patients and practitioners about the enablers and barriers to effective eye care.

A/Prof Jalbert learned the cost of care and a poor understanding of the nature and risk factors of AMD were major barriers to care, while optometrists and ophthalmologists could also improve their practices.

The study found the perspective of the patient and the practitioner frequently misaligned. While optometrists and ophthalmologists thought they were communicating clearly to their patients, the information that patients took away was confused or just wrong.

This project plus other funding has contributed to A/Prof Jalbert's iCareTrack program of research – an ongoing national collaboration that aims to measure and improve the delivery of care in optometry practices across Australia.

REDUCING THE RISK

Professor Mark Gillies

FUNDING YEAR: 2015

INSTITUTION: Save Sight Institute, University of Sydney

PROJECT: How to get the best outcomes of treatment of neovascular age-related macular degeneration with vascular endothelial growth factor inhibitors: real world evidence

TIMELINE: $400,000 over three years

> "I like the idea that if you can do something which improves outcomes, you can help potentially millions of people"
>
> – Prof Mark Gillies

THE PROBLEM TO BE SOLVED

Professor Mark Gillies' Fight Retinal Blindness! project is an online database tracking the treatment journey of thousands of patients living with retinal diseases – particularly people receiving anti-VEGF injections for wet AMD.

An MDFA Research Grant enabled Prof Gillies to expand this registry around the globe. Established in 2007, the FRB! project now gathers precious data from more than 500 practitioners spanning 23 countries across Europe, Asia, Africa and the Pacific – including 151 in Australia. Prof Gillies then uses this data to analyse the factors that make treatment more effective, thereby saving sight.

MDFA funding helped Prof Gillies to grow the FRB! project into the world's leading registry of high-quality data on the outcomes of treatment of macular disease and set international benchmarks for how the best outcomes for wet AMD can be achieved in real-word clinical practice.

When anti-VEGF agents first became available in 2006, clinical trials showed excellent results. However, these studies took place in ideal standardised conditions, and usually involved frequent injections over only two years.

On the other hand, Prof Gillies' observational study looks at what happens in the real world, where anti-VEGF injections can occur much less frequently over a much longer period.

By gathering data from thousands of people with AMD, diabetic retinopathy and other retinal conditions, the FRB! project enables Prof Gillies to analyse the long-term outcomes of anti-VEGF treatment in large and diverse groups of patients around the world.

This helps him then identify the variables that make therapy more successful, such as the type of anti-VEGF agent, the time between injections, and the clinical setting.

Prof Gillies' grant funding supported two projects. One examined the outcomes of wet AMD patients receiving anti-VEGF injections over the course of 10 years – the world's first analysis over such a long period.

Prof Gillies established that the treat-and-extend regimen – where the time between injections is extended as long as no new abnormal blood vessels form – appears to be the most efficient way to deliver an adequate number of injections. Eyes with good vision to start with were also more likely to complete 10 years of treatment.

The second project is comparing the effectiveness of the two leading anti-VEGF agents ranibizumab and aflibercept for diabetic macular oedema. The FRB! project has already shown that these two drugs deliver similar outcomes for wet AMD, despite the original suggestion that aflibercept was stronger and lasted longer than ranibizumab.

Analysis of this data began this year. Prof Gillies expects to find points of differentiation between the two drugs, which will help clinicians identify the best drug for specific patients.

The FRB! project also lets clinicians generate reports that graph their patients' visual acuity alongside their treatment pattern, charting their response to anti-VEGF injections. This helps the clinician conduct self-audits and compare their performance to other practitioners, as well as understand what works best for their individual patients.

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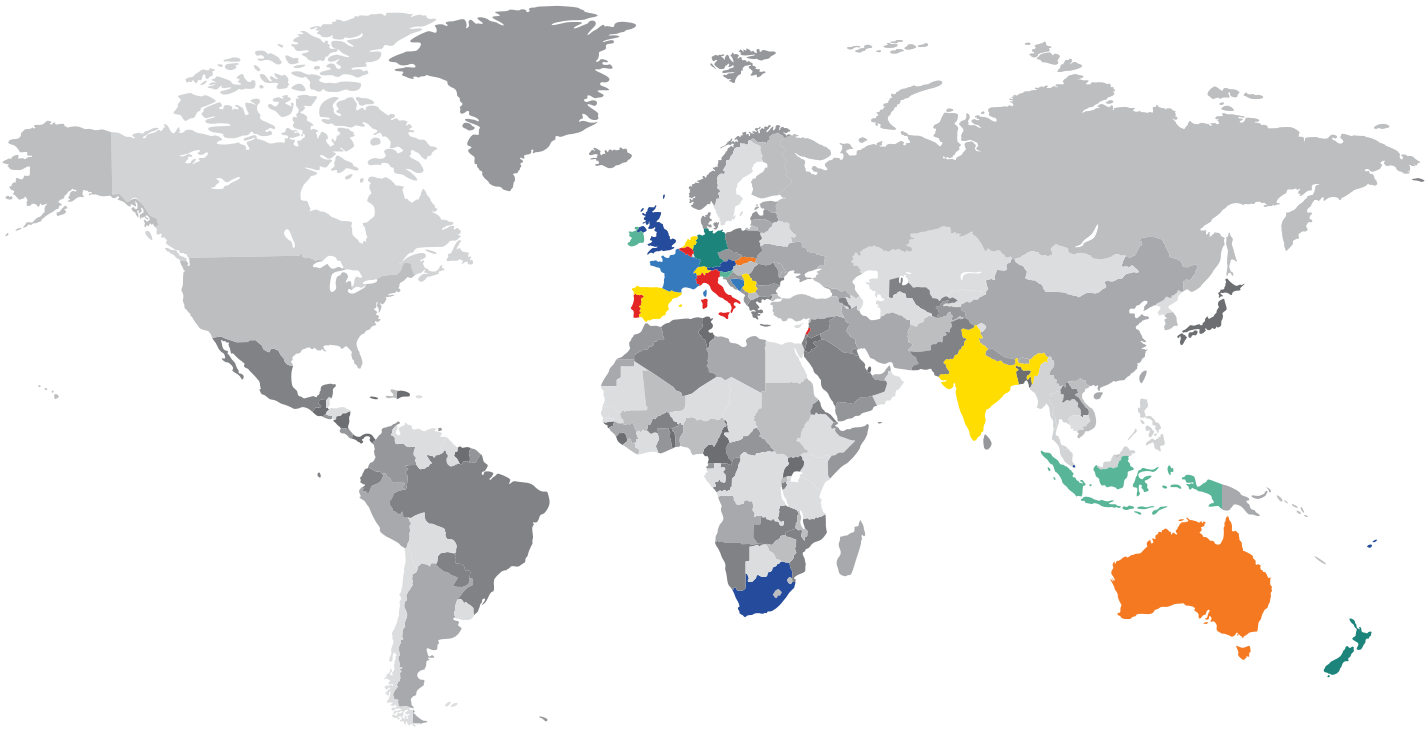
PEER-REVIEWED PUBLICATIONS

Prof Gillies' research has led to further funding from pharmaceutical companies Bayer and Novartis as well as the Singapore National Eye Centre, and will form the foundation of a major NHMRC application in 2021.

While the FRB! project has mainly focused on wet AMD to date, Prof Gillies now plans to examine other retinal conditions – specifically diabetic macular oedema and retinal vein occlusion – in even more locations around the world, particularly Europe.

WHERE IS THE FIGHT RETINAL BLINDNESS! REGISTRY NOW GATHERING DATA?



Professor Paul Mitchell

FUNDING YEAR: 2011

INSTITUTION: Centre for Vision Research, Westmead Institute for Medical Research, University of Sydney

PROJECT: Comparison of the risk factors, quality of life and utility value profile of a large age-related macular degeneration clinic patient sample with a population-based cohort

TIMELINE: $294,000 over three years

THE PROBLEM TO BE SOLVED

Professor Paul Mitchell is a world-renowned medical retinal specialist who was a worthy recipient of the Order of Australia in 2018.

That accolade is deserved recognition of his immense contribution to the fields of public health, ophthalmic epidemiology and clinical research, as well as his daily work at Sydney's Westmead Hospital and Sydney West Retina practice, which has saved the sight of countless thousands of Australians.

MDFA's National Research Advisor and a member of our Medical Committee since the Foundation's establishment in 2001, Prof Mitchell was also awarded one of MDFA's inaugural Research Grants a decade ago.

MDFA funding allowed Prof Mitchell to build upon his landmark Blue Mountains Eye Study (BMES), Australia's first large population-based study of AMD when it commenced in 1992. The BMES is globally recognised as one of the most

> "Research provides hope"
> – Prof Paul Mitchell

significant ophthalmic epidemiology studies ever conducted, yielding over 500 peer-reviewed publications in the world's top journals.

Prof Mitchell's MDFA project compared the diet and lifestyle of people with late-stage AMD to a similar-aged population with healthy eyes to better understand the modifiable risk factors for the condition. The results confirmed many of the findings from the BMES.

Prof Mitchell's research continues to inform MDFA's recommendations for the simple lifestyle changes to reduce the risk of AMD such as quitting smoking and changing your diet to include more oily fish and leafy green vegetables.

One member of Prof Mitchell's team, Prof Bamini Gopinath, has advanced this research with subsequent MDFA grants (below).

Professor Bamini Gopinath

INSTITUTION: Centre for Vision Research, Westmead Institute for Medical Research, University of Sydney

FUNDING YEAR: 2012 Blackmores Dr Paul Beaumont Research Fellowship

PROJECT: Targeted actions to identify modifiable nutritional and lifestyle factors for AMD among persons in the Blue Mountains Eye Study and other population studies

TIMELINE: $100,000 over two years

FUNDING YEAR: 2014 Blackmores Dr Paul Beaumont Research Fellowship

PROJECT: Establishing the dietary and lifestyle risk factor profile of a large cohort of clinic patients presenting with late AMD

TIMELINE: $100,000 over two years

FUNDING YEAR: 2016 NHMRC partnership

PROJECT: Caring for the carer: implementing a comprehensive support service model for family caregivers looking after persons with AMD

TIMELINE: $100,000 over three years

THE PROBLEM TO BE SOLVED

Professor Bamini Gopinath received two Blackmores Dr Paul Beaumont Research Fellowships to deepen our understanding of the links between lifestyle factors and macular disease. NHMRC and MDFA funding then supported a third project that aims to improve the wellbeing of people who care for family members living with AMD.

Prof Gopinath's first fellowship built on Prof Mitchell's Blue Mountains Eye Study, finding that adherence to smoking and dietary recommendations was poor among older adults with AMD, but uptake of antioxidant supplements increased significantly among those with late AMD over the 10-year study.

The second project provided further insight into the diet of people with the condition. These studies revealed new foods – such as oranges and dairy – that reduce the risk of AMD, and Prof Gopinath's globally unique research is now looking at novel antioxidants and their relation to wet AMD.

Prof Gopinath is completing a third study, co-funded by MDFA and the NHMRC, which hopes to enhance the welfare of carers for people with AMD through phone and mail support services.

Dr Liubov Robman

FUNDING YEAR: 2011 Blackmores Dr Paul Beaumont Research Fellowship

INSTITUTION: Centre for Eye Research Australia

PROJECT: Dietary patterns and risk of age-related macular degeneration

TIMELINE: $40,000 over one year

THE PROBLEM TO BE SOLVED

Dr Liubov Robman and her colleagues analysed data from more than 21,000 participants in the Melbourne Collaborative Cohort Study to investigate the role of nutrition in age-related macular degeneration.

Dr Robman was the inaugural recipient of the Blackmores Dr Paul Beaumont Research Fellowship, an award for studies on the dietary and lifestyle aspects of macular disease. Co-funded by MDFA and supplements company Blackmores, the fellowship was named in honour of MDFA's founding director Dr Paul Beaumont.

Research conducted because of the fellowship funding indicated that a diet high in steamed, grilled or canned fish, steamed or boiled chicken, nuts, muesli, boiled rice and vegetables like spinach, mushrooms, zucchini and broccoli – but low in red meat and white bread – is associated with a lower risk of advanced AMD. Dr Robman's findings validate MDFA's advice that a balanced diet rich in fish and leafy greens reduces the risk of AMD.

LAB TO CLINIC

Associate Professor Fred Chen

FUNDING YEAR: 2017

INSTITUTION: Centre for Ophthalmology and Visual Science incorporating Lions Eye Institute, University of Western Australia

PROJECT: Stargardt macular degeneration: finding new genetic mutations and preparing patients for clinical trials

TIMELINE: $120,000 over two years

THE PROBLEM TO BE SOLVED

Stargardt disease is the most common form of juvenile macular disease, with many children being diagnosed before they even leave primary school.

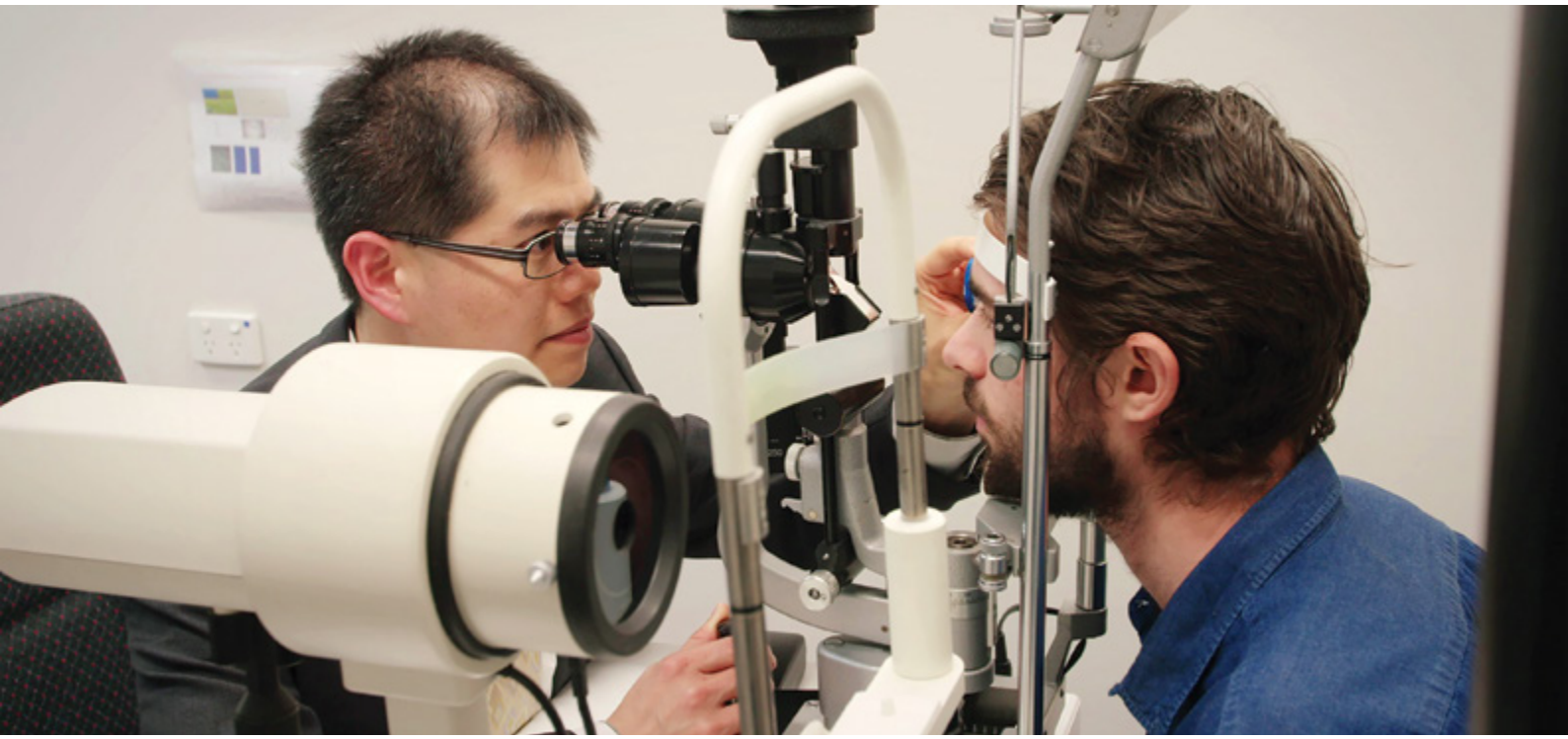
But despite its prevalence, this genetic disease often goes undiagnosed or is misdiagnosed.

Perth ophthalmologist and MDFA Research Grant recipient Associate Professor Fred Chen is working both to find treatments and to establish clinical pathways for patients.

Stargardt disease – also called Stargardt dystrophy or fundus flavimaculatus – is a genetic eye disease caused by more than 1000 different mutations, or faults, within a single gene called the ABCA4 gene. It affects one in every 10,000 people, and is the most common of the 250 types of inherited retinal diseases that blind 15,000 Australians.

MDFA funding allowed A/Prof Chen to examine the vast spectrum of Stargardt disease in more than 100 patients in his dedicated retinal dystrophy clinic at the Lions Eye Institute (LEI).

Some of these patients lost their vision when they were as young as seven, while others only noticed symptoms in their 70s, when the condition may masquerade as AMD. This extreme spectrum of disease manifestation is due to the large number and varied severities of mutations of the ABCA4 gene, which causes the condition.



Associate Professor Fred Chen and MDFA Patron Ita Buttrose AC OBE. Image: Jacquie Manning

As well as identifying several new mutations of this gene, A/Prof Chen's team used patients' own skin cells to study the effect of different genetic faults to develop personalised treatments for these mutations.

Through this project, A/Prof Chen and his team were able to grow miniature retina from skin cells. This will enable them to test and modify drugs using cells in the laboratory rather than using an animal model or risking patients' eyes in the early stages of the development.

Alongside collaborators at the Australian Inherited Retinal Diseases Registry, Genetic Services of WA and Murdoch University, A/Prof Chen has also established a streamlined clinical pathway for assessing and diagnosing these patients.

People living with Stargardt disease are sometimes undiagnosed or misdiagnosed, so this pathway helps to identify and manage them correctly. These patients can then receive genetic counselling so they and their family can better understand the disease, as well as be considered for clinical trials.

Following A/Prof Chen's MDFA project, LEI has been chosen as one of two clinical trial sites for Stargardt disease treatment in Australia, and in 2021, they are recruiting children with the condition for a clinical trial of a new drug that may prevent progression of the disease.

A/Prof Chen's team earned an NHMRC Ideas Grant in 2020 and a Bowen Foundation Grant in 2021 to continue this ground-breaking work, which gives hope for an effective treatment in future.

"My one wish as an ophthalmologist and researcher in macular disease is that one day I can tell my patients, who are affected by whatever form of macular degeneration, that we have the treatment to prevent them from going blind, or to restore their vision"

– A/Prof Fred Chen

INDIGENOUS HEALTH

Professor Alex Brown

FUNDING YEAR: 2019

INSTITUTION: Aboriginal Health Equity Theme, South Australian Health and Medical Research Institute (SAHMRI)

PROJECT: Defining the Risk and Epidemiology of Aboriginal Australian Macular Disease: the DREAM project

TIMELINE: $234,000 over three years

THE PROBLEM TO BE SOLVED

Indigenous Australians are five times more likely to lose their vision to diabetic eye disease than non-Indigenous Australians. The DREAM project aims to understand why.

With MDFA's backing, Professor Alex Brown has embarked on a large-scale longitudinal study of diabetes-related eye disease and other complications among Indigenous Australian communities.

The DREAM project will follow Aboriginal people across South Australia for five years to examine the social, psychological, environmental, behavioural, clinical, biological and metabolomic risk factors for diabetic retinopathy, including diabetic macular oedema.

Prof Brown's team is trying to identify the early markers, or predictors, of those who will develop eye disease to identify better targets for preventing such conditions in these communities.

Prof Brown hopes his findings will help develop better prevention and treatment strategies for Indigenous communities both here in Australia and around the world.

> "Without your support, we simply wouldn't be able to do this critical work in Aboriginal communities"
>
> – Prof Alex Brown

Looking to the future: Grant Family Fund

By including MDFA in her Will, Faye Grant's bequest is now supporting innovative 'blue sky' research in the field of macular disease – a lasting legacy to Faye and her dad Ronald.

When her beloved father Ron started losing his sight to AMD, Faye Grant became his primary carer, enriching his last years.

Faye's generosity of spirit continued after her death with a gift in her Will to support MDFA's research program.

Faye's bequest is now funding innovative research into macular disease through the Grant Family Fund, in memory of Faye and Ronald Grant.

The Grant Family Fund has become a key part of MDFA's Research Grants Program, supporting early-career Australian researchers working on creative projects that aim to shift existing paradigms in macular disease research.

Seed funding investments of up to $50,000 will be allocated every two years from May 2021, backing small to medium-scale one-year projects that show potential for future funding by granting bodies.

Ronald Grant lived with wet AMD for 15 years before he passed away in 2016, but regular eye injections saved his sight for most of that time. Faye took her dad to all his eye injection appointments and understood the value of this ground-breaking treatment.

When Faye passed away aged 59 in 2019, she left a bequest to MDFA, although there were no instructions on how to invest it.

"In discussing it with MDFA, we thought that the research fund was the best way to use Faye's bequest," says Faye's sister Janette Forrester.

"We thought that Faye would like to have the funds invested in that way."

Now, MDFA hopes the research sponsored by the Grant Family Fund will lead to medical breakthroughs that improve the eye health and change the lives of future generations.

A bequest to MDFA – big or small – is a meaningful way to leave an indelible mark on the macular disease community.

By including a gift to MDFA in your Will, you are joining a family of honoured supporters that we call Visionary Partners, whose support brings us closer to a future where no one unnecessarily loses their sight to macular disease.

If you'd like to learn more about becoming a Visionary Partner, please contact MDFA (1800 111 709, info@mdfoundation.com.au).

Acknowledgements

I sincerely thank all the researchers and their teams for producing this extremely high calibre and quality research work, which has made an enormous impact on the understanding and management of patients with macular disease.

It is encouraging to see that with the MDFA grants as a springboard, a number of the projects continue to attract funding from other avenues and achieve further research and publications.

It is a testament to the direction that MDFA is heading, guided by the expertise in the Board, the Medical Committee, and the Research Committee. Macular and retinal research is heading towards a bright future.

Lastly, I would like to thank MDFA CEO Dee Hopkins and her team for putting together this tremendous report that would make our donors proud.

A/Prof Anthony Kwan,

Research Committee Chair,
Macular Disease Foundation Australia

THANK YOU

MDFA's Research Grants Program would not have reached this 10-year milestone without the support of you, our community. Since 2011, MDFA has invested $4.1 million in 21 research projects with a further $1m to be committed in this year's round of funding.

This would not have been possible without your generosity, so thank you to every person who has donated towards this ground-breaking research.

MDFA would also like to acknowledge Blackmores and the Blackmore Foundation for sponsoring the Blackmores Dr Paul Beaumont Research Fellowship (2011, 2012 and 2014).

RESEARCH COMMITTEE

MDFA is very grateful to our National Researcher Advisor Professor Paul Mitchell, as well as the members of our Research Committee, for their voluntary contributions to the cause.

2021 Research Committee members

A/Prof Anthony Kwan (Chair)

A/Prof Peter van Wijngaarden

A/Prof Samantha Fraser-Bell

A/Prof Fred Chen

Ms Imelda Lynch (MDFA board member)

Ms Dee Hopkins (MDFA CEO)

Past Research Committee members

Mr Paul Rogan (inaugural Chair)

Ms Elizabeth Carr (inaugural member)

Dr Paul Beaumont (inaugural member)

Dr Jim Runciman (inaugural member)

Ms Suellen Tapsall (inaugural member)

Prof Nitin Verma (former Chair)

About MDFA

Macular Disease Foundation Australia (MDFA) is the national peak body for Australia's macular disease community.

Since 2001, MDFA has been committed to our purpose of reducing the incidence and impact of macular disease. We achieve this through four pillars of work.

OUR WORK FOCUS

Prevention and early detection	Supports and services	Advocacy	Research and data

IMPACT GOALS

To encourage people at risk of or living with macular disease to self-identify and take early action	To help people living with macular disease experience their best quality of life	To represent every person living with macular disease and lobby for fair treatment and support	To translate knowledge into better outcomes for people living with macular disease

In 2021, MDFA is celebrating its 20th year, as well as the 10th anniversary of the MDFA Research Grants Program.

MDFA has invested $4.1 million in 18 world-class Australian researchers since 2011, and is committing another $1 million in May 2021. We rely on your donations to support this crucial work.

DONATE TO MDFA

MDFA's Research Grants Program has taken great strides in the field of macular research over the past decade.

However, there is still so much to learn before we reach our goal of a future where no one needlessly loses their sight to macular disease.

If you would like to support this ground-breaking work by world-leading Australian researchers, please visit www.mdfoundation.com.au/donate or call 1800 111 709.

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