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Macular Disease Foundation Australia awards $1 million to eight exciting research projects

Macular Disease Foundation Australia (MDFA) has awarded more than $1 million in research funding to eight promising projects, in a ceremony marking 10 years of significant advances in the search for a cure to Australia's leading cause of blindness.

The grants were presented to eight cutting-edge Australian researchers who are working to reduce the incidence and impact of macular disease by His Excellency the Honourable David Hurley, Governor-General of Australia, at Admiralty House in Sydney.

This funding will support projects examining gene therapies, using novel imaging techniques, improving patients' quality of life, and creating a macula in retinal organoids that could potentially help treat age-related macular degeneration (AMD) and other macular conditions.

Celebrating MDFA's 20th anniversary and a decade of the MDFA Research Grants Program, this $1m investment brings MDFA's total commitment to $5.1m since 2011. MDFA is now Australia's largest source of research funding in the field of macular disease outside of government.

MDFA awarded six research grants worth a total of $935,000. An additional $90,000 will fund two new early-career researchers undertaking innovative 'blue sky' research into macular disease and is only possible as a result of a generous bequest made in memory of the late Faye Grant.

MDFA CEO Dee Hopkins says MDFA did not expect to finance eight projects when applications opened last October, but this round of funding is testament to the depth of talent among young Australian researchers.

"This announcement underlines the sheer volume of gifted researchers – particularly early-career researchers – that Australia is producing," Ms Hopkins says. MDFA is proud to play its part in supporting and funding these rising stars.

"All eight of these projects show great promise, but I'm particularly excited by the applications from younger researchers that aim to shift existing paradigms in macular disease research.

"MDFA funding is crucial and often snowballs into much larger investments from the NHMRC and other funding bodies, not to mention significant advancements in treatment and better outcomes for the macular disease community."

MDFA awarded grants to researchers investigating potential gene therapies for AMD as well as use of innovative imaging techniques that could help improve our understanding on the causes of AMD and develop novel treatment strategies.

One project will use human eye cells to create disease models in the laboratory and explore the possibility of blocking the actions of molecules known as cytokines to treat macular oedema.

MDFA Research Grants are also funding a pilot diet, exercise and social interaction program designed to boost the mental and physical wellbeing of people living with AMD, plus a study to measure AMD patients' quality of life – including the financial burden of the disease.

The Grant Family Fund is supporting projects that create a macula-containing organoid that will then be used as perfect models for macular degeneration, as well as manipulating genes to provide novel insights into the pathogenesis of AMD and potentially contribute to the development of a new treatments for AMD.

Applications were subject to a rigorous assessment process based on NHMRC criteria to ensure that successful applicants meet the highest standards.

MDFA Research Grants

Researcher: A/Prof Chi Luu

Institution: Centre for Eye Research Australia

Project title: Relationships between choriocapillaris endothelial function, photoreceptor health and AMD phenotypes.

Abnormal regulation of blood supply to the retina in the back of the eye is thought to contribute to the development and progression of AMD. Assessing this regulation has not been possible in the past due to the lack of a clinical tool to visualise and image the dynamic (vasodilation and constriction) properties of tiny blood vessels at the specific site in the retina relevant to AMD (called choriocapillaris). We have recently developed a novel imaging technique to non-invasively capture the dynamic properties of the choriocapillaris. In this research project, we will use this innovative imaging technique to examine the dynamic properties of the choriocapillaris in eyes with early stages of AMD to investigate the regulation of blood supply at the choriocapillaris in this disease. This research will improve our understanding on the causes of AMD and help developing novel treatment strategies for AMD.

Researcher: Prof Justine Smith

Institution: Flinders University

Project title: Targeting inflammatory cytokines in macular oedema.

The macula is the part of the retina that is responsible for reading and driving vision. In a wide range of common and rare eye diseases – from diabetic eye disease to retinitis pigmentosa – fluid collects in the macula and causes vision loss. This condition is known as macular oedema. Treatments for macular oedema are best administered directly to the eye. However, present treatments have limitations, including lack of effectiveness across different diseases and eye complications. Macular oedema occurs because there is disruption of the many natural mechanisms that keep the tissue dehydrated. Our work focuses on molecules known as cytokines that disrupt these mechanisms. We will use human eye cells to create disease models in the laboratory and explore the possibility of blocking the actions of cytokines to treat macular oedema. Drugs that block cytokines are already being prescribed for other diseases, and they could be repurposed for macular oedema.

Researcher: A/Prof Matthew Simunovic

Institution: Save Sight Institute, University of Sydney

Project title: Optogenetic restoration of vision in macular degeneration with high-sensitivity Type I and Type II opsins.

Age-related and early-onset forms of macular degeneration result in blindness due to the loss of the light-detecting cone and rod cells of the macula, as well as the underlying layer of pigmented cells which supports them. However, the nerve cells which normally relay information from the rods and cones to the brain persist. We aim to restore vision in age-related and early-onset macular degeneration by making these surviving relay (a.k.a. retinal ganglion) cells light-sensitive, thereby effectively bypassing

the diseased layers of the retina. This will be achieved through gene therapy, which will use a non-disease-causing virus injected into the eye to introduce the genetic code for light-sensitive proteins into retinal ganglion cells. This approach can be considered a biological equivalent of the bionic retina, and it has been termed “optogenetics”: it offers the hope of central vision restoration to those with advanced vision loss from macular degeneration.

Researcher: Ms Diana Tang

Institution: Macquarie University

Project title: The development, implementation and evaluation of an online Movement, Interaction and Nutrition for Greater Lifestyles in the Elderly (MINGLE) program for people with age-related macular degeneration.

The ‘Movement, Interaction and Nutrition for Greater Lifestyles in the Elderly’ (MINGLE) program aims to improve the mental and physical wellbeing of people with AMD through social interaction to reduce loneliness; exercise to improve physical health, including balance; and nutrition education to improve knowledge and dietary practices in an accessible and COVID-safe online platform. Improving mental and physical wellbeing is important for overall health as poor diet, physical inactivity, depression and loneliness can increase the risk of many health conditions such as obesity, heart disease and dementia. Poor diet and physical inactivity can also increase the risk of worsening AMD. Therefore, this study, led by an accredited practising dietitian and a physical education specialist, will specifically target people living with AMD to develop and test the preliminary efficacy of the MINGLE program.

Researcher: Dr Sheela Kumaran

Institution: University of NSW

Project title: Measuring the breadth and the depth of the quality-of-life impacts caused by age-related macular degeneration.

This research is focused on developing a smart questionnaire (item banks) that can precisely and comprehensively measure the quality-of-life (QoL) impacts posed by AMD. The questionnaire is built on solid foundation of patient experiences. An elaborate bank comprising 302 questions covering eight diverse QoL aspects (activity limitations, symptoms, mobility, emotional wellbeing, health concerns, social impact, convenience and economic impact) have been created. This study aims to calibrate these items on measurement scales using advanced psychometric analysis. Upon calibration, these can be administered using a computer algorithm that uses fewer items (relevant to the individual’s ability) to measure the impacts reliably. The secondary aim of this project is to estimate the costs associated with AMD and thereby the financial burden of the disease using a cost diary (a record of costs filled by individuals).

Researcher: Dr Yvette Wooff

Institution: Australian National University

Project title: Treat yourself! The use of therapeutically-loaded extracellular vesicles as a novel gene therapy for the treatment of age-related macular degeneration.

Cells have a language that researchers are only now starting to understand. In order to maintain tissue health, cells communicate by transferring molecular cargo using small cell-to-cell delivery vehicles called extracellular vesicles (EV). The loss of EV communication has been correlated with increased retinal cell death as we age. We believe that replenishing EV and their cargo will restore the communication channels required for maintaining retinal health and slow the progression of retinal degenerations,

including AMD. To investigate this, we will profile EV from healthy and diseased retinas and supplement the degenerating retina with essential retinal EV cargo. We will load and deliver this essential cargo using EV derived from stem cells to reduce the risk of immune attack. This work will identify a therapeutic profile of essential EV cargo required for retinal health and help develop EV-based gene therapies for the treatment of AMD.

Grant Family Fund

Researcher: Dr Ting Zhang

Institution: Save Sight Institute, University of Sydney

Project title: Activating endogenous phosphoglycerate dehydrogenase (PHGDH) to treat age-related macular degeneration with the help of a Müller cell-specific lipid nanocarrier.

What causes AMD is not clear. Evidence suggests that oxidative and mitochondrial stress in retinal Müller cells is related to the occurrence and development of AMD. Serine synthesis pathway plays a crucial role in maintaining oxidative balance and mitochondrial function in Müller cells, which are the supporting cells for photoreceptors. Errors of serine metabolic pathway make the macula more vulnerable to stress than the peripheral retina. This project aims to increase the phosphoglycerate dehydrogenase (PHGDH), an important enzyme in serine synthesis pathway in Müller cells to combat oxidative and mitochondrial stress. The CRISPR gene manipulation system will be used to activate PHGDH, which will be delivered by Müller cell-targeting lipid nanoparticles. The findings will provide novel insights into understanding the role of serine synthesis in the pathogenesis of AMD and contribute to the development of a new treatment for AMD.

Researcher: Dr Anai Gonzalez-Cordero

Institution: University of Sydney

Project title: Creating a macula in retinal organoids.

The loss of the light-sensing photoreceptor cells in the eye is the leading cause of blindness. Particularly important for macular degeneration is the loss of the cone photoreceptors responsible for central vision in the macula of the human eye. In the laboratory, we use patients' own blood cells or skin cells to create stem cells, which can form 'mini-organs' in the dish containing photoreceptor cells. These organoids can be used as a model of blindness diseases and for testing the efficacy of potential therapies. One caveat is that these organoids do not form a macular structure. This study aims to address this problem and create a macula-containing organoid that will then be used as perfect models for macular degeneration. Importantly, the macular tissue can be used as a source of cells for replacement therapies to ameliorate sight loss of millions of people.

About Macula Disease Foundation Australia (MDFA)

MDFA is the peak national body representing the voice of the macular disease community. It is committed to reducing the incidence and impact of macular disease, the leading cause of blindness and severe vision loss in Australia. It provides a range of information and support services via its National Helpline 1800 111 709 and website www.mdfoundation.com.au.

About MDFA's Research Grants Program

MDFA's Research Grants Program was launched in 2011. Over the past decade, MDFA has invested $5.1 million in world-class Australian researchers – the largest non-government source of research funds for macular disease in Australia. Including this 2021 round of funding, MDFA Research Grants have supported 29 projects by 25 different researchers.

In 2021, MDFA also launched the Grant Family Fund, which provides grants to early-career researchers for innovative and creative 'blue sky' projects in the field of macular disease. The Grant Family Fund is a biennial grant opportunity made possible by a generous bequest from the estate of the late Faye Grant.

About macular disease

Macular disease covers a range of painless conditions that affect the central retina (the macula) at the back of the eye. The most common are age-related macular degeneration (AMD) and diabetic retinopathy (DR), including diabetic macular oedema (DMO). AMD accounts for 50 per cent of blindness in Australia. One in seven (approximately 1.4 million) Australians over the age of 50 have some evidence of AMD.

Contact MDFA

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