

### NHMRC Grant Application Round 2015

### Eye research funding results

Total number of eye health projects funded: 23

Total funding for eye health research projects: \$12,820,708

### Implications of retinal neurodegeneration in Alzheimer's disease

Dr Mojtaba Golzan, Macquarie University

Funding grant: \$602,213

Recent research has shown that 'early signs' of Alzheimer 's disease (AD) can be detected in the eyes. The research focus is to determine which particular changes in the retina are associated with AD. This project will also investigate if blocking the production of beta amyloids (proteins produced in AD) in the eye will indeed help reduce their load in the brain and hence delay the onset of AD. Results from this research may be used for early diagnosis and future medicinal studies that target the eye in AD.

### Molecular Profiling of Blinding Diseases

Associate Professor Alex Hewitt, University of Tasmania

Funding grant: \$463,652

Understanding the molecular mechanisms underlying blinding diseases will allow for the development of new therapies. This research project aims to uncover further genetic associations for eye disease, as well as interrogate patient-specific cell lines to elucidate specific signatures of disease development.

#### Improving bionic device safety and performance with conductive hydrogels

Dr Rylie Green, University of New South Wales

Funding grant: \$419,180

Bionic devices are being developed to treat a variety of neural disorders including blindness. Conductive hydrogels (CHs) are a new soft material developed by the CI to improve device performance and safety. This project will explore CH technologies with an aim of producing flexible organic electronics for high resolution devices, such as the bionic eye. Collaboration will be sought through industry, academia and clinical researchers to accelerate technology translation from bench to bedside.

### Pathways to treatment in blinding genetic retinal eye diseases

Associate Professor Robyn Jamieson, University of Sydney

Funding grant: \$556,956

Blinding eye diseases with genetic contributing factors affecting the retina or lightsensing part of the eye, damage the vision of millions of people worldwide. The vision impairment is irreversible, untreatable, and worsens with age. In this project, technological breakthroughs in genome correction and sequencing will be used, in combination with stem cell and mouse model applications, to develop pathways to treatment of these currently incurable diseases.

### Cultivated corneal endothelial cell implants for restoring vision

Associate Professor Damien Harkin, Queensland University of Technology

Funding grant: \$886,032

Thousands of Australians each year receive a corneal tissue transplant from the eyes of a deceased organ donor. In the majority of cases these transplants are performed to restore structure and function to the most posterior layer of the cornea - the corneal endothelium. The reliance upon donor tissue, however, presents significant logistical and safety issues. The goal of this project is to develop improved strategies for treating diseases of the corneal endothelium using cultivated tissue implants.

### Novel Photoreceptor Bioenergetics: Basic Science and Clinical Translation

Professor Robert Casson, University of Adelaide

Funding grant: \$701,088

This project will investigate how the light-sensitive cells in the eye (the photoreceptors) use energy and make special pigments that convert light to electrical signals. Novel treatments that enhance the energy supply of the photoreceptors in individuals with age-related macular degeneration will be tested.

### A non-cytotoxic approach to reduce ocular fibrosis following surgery in glaucoma

Dr Hitesh Peshavariya, Centre for Eye Research Australia

Funding grant: \$586,979

Glaucoma surgery often leads to scar formation and blindness. A novel protein (NADPH oxidase 4; Nox4) which promotes scar formation in the eye has been identified. Lack of Nox4 in a mouse models reduces scar formation. It has been demonstrated that a 'repurposed' drug which is currently used to treat lung diseases can also block Nox4 in the eye. This project aims to determine whether this drug can be used as a novel therapy for vision loss after glaucoma surgery.

#### Retinal Ganglion Cell Bioenergetics with Clinical Translation

Professor Robert Casson, University of Adelaide

Funding grant: \$725,913

Glaucoma is an eye disease where elevated pressure within the eye damages the sensitive nerve of sight at the back of the eye. The only current treatment is to lower the pressure in the eye with either drops, laser or surgery. Why the pressure damages the nerve of sight is unclear but there is evidence that it results in a reduced blood flow to the nerve. This starves the nerve of nutrients. A new treatment that supplies nutrients to the nerve and protects vision has been developed.

### Investigation of the role of PI3-kinase in the regulation of angiogenesis

Professor Christina Mitchell, Monash University

Funding grant: \$837,660

The formation of blood vessels is critical for the development of embryos, but also after birth in processes such as wound healing. However, the uncontrolled formation of new blood vessels is also a feature of many human diseases such as cancer, and eye diseases that lead to blindness in adults or in premature infants. This project proposes to identify new regulators of blood vessel development, in order to improve current treatment therapies for these debilitating diseases.

### Gene Identification for Keratoconus - a Blinding Eye Disease

Associate Professor Kathryn Burdon, University of Tasmania

Funding grant: \$912,880

Keratoconus is a common eye disease where the cornea at the front of the eye progressively becomes thinner and bulges out, resulting in severe visual impairment in young people. This project is investigating the genetic causes of keratoconus in a large collection of Australian patients. The project aims to be better able to predict who will develop the disease and treat them earlier, as well as be able to target treatments to the causes of disease.

### Neuro-feedback for improved efficacy of retinal prostheses

Professor Michael Ibbotson, University of Melbourne

Funding grant: \$653,655

Bionic eyes offer the possibility to return sight to the blind. Existing retinal implants are effective at delivering basic visual percepts, namely brief spots of light. The project is working on building the second generation of bionic eyes that include the ability to both stimulate the visual system (the retina) and record its response. By recording the evoked responses, stimulation can be adjusted and optimized to restore a persistent high spatial resolution sense of vision to the blind.

### Clinical trial of a suprachoroidal visual prosthesis for the profoundly vision impaired

Professor Gregg Suaning, University of New South Wales

Funding grant: \$1,098,802

After 15 years designing a bionic eye, device called the Phoenix99 has been created and shown in short term animal tests that it is both safe to implant but also that it potentially performs better than any other device in the world. This project will complete longer term animal testing of the device and then commence a small human clinical trial to demonstrate the benefits of the technology - specifically that it is able to help blind people navigate without assistance.

### Novel ways of treating angiogenesis in the eye

Professor Erica Fletcher, University of Melbourne

Funding grant: \$366,300

Abnormal growth of blood vessels is a central feature of number of blinding conditions of the eye. Although there are treatments available that reduce the sudden loss of vision in a majority of people with advanced age related macular degeneration, about 20 per cent fail to respond and half gradually loose vision. This project will determine the effectiveness of treating vascular diseases of the retina with a novel therapy that is quite different to that currently available.

### Novel Clinical Biomarkers of Glaucoma Management

Dr Zhichao Wu, Centre for Eye Research Australia

Funding grant: \$366,252

Glaucoma is a leading cause of irreversible blindness, and its management is hindered by the lack of effective clinical measures of the disease. This project seeks to develop new clinical tests to take the 'guesswork' out of its management - measures that can correctly identify those at high-risk of progression, accurately determine treatment efficacy and sensitively detect disease progression, thus preventing the irreversible loss of vision from this disease.

# Improving visual outcomes in patients with Diabetic Macular Oedema undergoing Cataract Surgery: A prospective randomised clinical trial (the DiMECat Trial)

Dr Lyndell Lim, Centre for Eye Research Australia

Funding grant: \$187,322

Cataract and diabetic retinopathy are the leading causes of visual loss in patients with diabetes, but unfortunately, cataract surgery in these patients often results in a loss of vision, rather than an improvement. The purpose of this study is to improve the visual outcomes in this group of patients, through the use of new, injected medicines that are given at the time of cataract surgery, thereby potentially changing current medical practice.

## Diabetic Retinopathy Screening in Australia: Referral for, access to and outcomes of DR Screening in type II diabetes mellitus

Dr Robert Finger, Centre for Eye Research Australia

Funding grant: \$329,644

Diabetic retinopathy (DR) screening is readily available, but referral for DR screening as well as its uptake by patients is currently suboptimal. This project will investigate referral pathways and patient- and provider-related barriers to DR screening referral and uptake with the aim to develop an intervention to improve these. In the long term this will lead to better vision, better quality of life and fewer costs associated with ocular complications and blindness in persons with diabetes.

### Stem Cell Bioinformatics for Eye Research: Mapping an integrative network model of glaucoma

Miss Seyhan Yazar, University of Western Australia

Funding grant: \$335,292

Biology has become data-driven, with a huge amount of data available but not enough researchers with bioinformatics skills to analyse it. By studying genetic architecture of eye cells generated from induced pluripotent stem cells of individuals with and without glaucoma, this project aims to contribute to a better understanding of the underlying causes of glaucoma and equip myself with new bioinformatics skills to utilise in future eye research in Australia.

### Assessing the biogeography of the ocular microbiota and the impact of antibiotic prophylaxis

Mr Jran Ozkan, University of New South Wales

Funding grant: \$314,644

Using DNA sequencing, recent studies have identified a diverse community of bacteria on the eye, once believed to be sparsely populated by microbes. This project will identify what is the resident bacteria of the eye and where these bacteria reside on the eye. Also, after cataract surgery some individuals experience dry eye problems. This project will investigate if antibiotic therapy, necessary to prevent infection, disrupts the microbial communities on the eye leading to development of dry eye

### Clinical Trials and registries to prevent blindness for Macular Disease

Professor Mark Gillies, University of Sydney

Funding grant: \$467,961

Injection of drugs into the eye is an unprecedented breakthrough in the treatment of macular diseases, however many questions must be addressed for our patients with diabetic retinopathy and macular degeneration to reap the full benefits. This project will conduct clinical trials, such as testing a new laser that has never been used in the retina and track 'real world' outcomes of treatment of retinal disease in a large group of Australians.

Age-related macular degeneration - novel biomarkers, outcome measures, world first clinical interventions and uncovering pathological mechanisms in early disease

Professor Robyn Guymer, Centre for Eye Research Australia

Funding grant: \$561,362

Age-related macular degeneration (AMD) is a leading cause of visual loss and there is urgent need for an early intervention to slow progression to vision loss. This project will trial a novel laser treatment to slow progression of disease, identify retinal changes that signal progression and use basic science to investigate mechanisms induced by the laser.

### Age-related macular degeneration: A cause and a cure

Professor Robyn Guymer, Centre for Eye Research Australia

Funding grant: \$828,300

Age-related macular degeneration (AMD) is a leading cause of vision loss and there is urgent need for an intervention to slow disease progression. AMD is characterised by debris accumulation in the retina and I will investigate if loss of function in cells that should clear this debris is a critical step in the development of AMD. I will trial a novel laser intervention to slow progression of disease and use basic science techniques to investigate the mechanisms of action of the laser.

### New approaches to regenerative healing in heart and retinal eye disease

Professor Gregory Dusting, Centre for Eye Research Australia

Funding grant: \$150,660

Loss of vision due to damage to the retina is on the rise in the elderly. Currently this is treated by frequent injections directly into the eye, but this is very costly and does not always improve vision, yet can have serious side effects. This project will test recently discovered potential treatments for retinal blindness at the bench and in lab animals. This project will also grow human heart tissue from stem cells to repair injured hearts.

### Molecular Profiling to identify therapeutic targets for blinding diseases

Associate Professor Alex Hewitt, University of Tasmania

Funding grant: \$467,961

Understanding the molecular mechanisms underlying blinding diseases will allow for the development of new therapies. This project aims to enhance the synergy between current research and clinical practice, and uncover further genetic associations for eye disease, as well as interrogate patient-specific cell lines to elucidate specific signatures of disease development.