Retina Australia Research Grants 2022

We are pleased to announce that that 2022 recipients of the Retina Australia medical research grants are Associate Professor Penny Allen (Centre for Eye Research Australia, Melbourne), Dr Rabab Rashwan (Lions Eye Institute, Perth), Associate Professor Guei-Sheung (Rick) Liu (Centre for Eye Research Australia, Melbourne). These grants have a combined total value of $120,000.

Improving real-world mobility and assessing long-term safety outcomes with a retinal prosthesis ("Bionic Eye")

Lead: Associate Professor Penelope Allen - Centre for Eye Research Australia

Research Team: Dr Janine Walker, Dr Matthew Petoe, Professor Nick Barnes, Dr Carla Abbott

Project Description:

Participants with end-stage retinitis pigmentosa (inherited retinal disease) were implanted with a second-generation Australian bionic eye (retinal prosthesis) in 2018 as part of a clinical trial. The clinical trial finished in December 2020 and showed the device has an unsurpassed safety profile, with no serious adverse events and good stability over 3 years. Furthermore, laboratory-based measures showed that using an intensity-based method of visual processing (turning a stream of images from a camera into a series of flashing lights for the recipient to interpret) improves orientation and mobility, functional vision, and activities of daily living for recipients.

However, the team has now designed a promising cutting-edge visual processing strategy based on advanced depth processing algorithms with potential for further breakthrough visual improvements, especially in a real-world setting with varying levels of colour contrast. They have an extraordinary opportunity to measure visual outcomes with this advanced vision processing method in an extension study with three participants already implanted with a bionic eye in both a controlled laboratory environment (obstacle avoidance task) as well as in a real-world environment (novel outdoor streetscape protocol). The outcomes are critical to optimising the visual processing strategy and to establish the real-world efficacy of the unique Australian bionic eye. The team will also monitor the long-term safety of the device out to 4 years after implantation as a secondary outcome to check the device does not impact adversely on eye health and to check the long-term device functionality.

Neuroprotective effect of SAHA in Retinitis Pigmentosa. Do time and frequency matter?

Lead: Dr Rabab Rashwan - Lions Eye Institute Perth

Research Team: Miss Annie Miller, Dr Livia Carvalho

Project Description:

Retinitis pigmentosa (RP) is a genetic, blinding retinal disorder that affects approximately 2 million people worldwide. RP involves the death of the photoreceptor cells (rods and cones) that turn light signals into vision. RP begins with the death of rod photoreceptors, causing night blindness. As the disease progresses, the cone photoreceptors also degenerate, which causes the loss of central, fine and daylight vision leading to complete blindness in some people. RP has been proven to be caused by mutations in over 90 genes, targeting all causative genes being a challenge for treatment development.

For this reason, this project will focus on the development of a broad treatment approach that can be used on RP patients regardless of the underlying mutation causing the disease. Other studies showed that a molecule called histone deacetylase (HDAC) to be increased in the retina of many RP mouse models. In the present study, the team will investigate the effect of an FDA-approved HDAC inhibitor (SAHA) to protect photoreceptor cells, especially cones, from degeneration in two mouse models of RP with two different mutations. The intraocular administration of SAHA will be for the first time tested at the early and late stages of the disease to achieve the best results on photoreceptor survival and function. Additionally, multiple treatments and the long-term safety profile of SAHA will be examined, which is essential for clinical translation. The ultimate impact of this study is the development of gene-independent treatment strategies that preserve visual acuity and daylight vision in RP patients and several different types of vision loss, benefiting a more comprehensive range of patients.

RNA base editing strategies as potential therapeutic of inherited retinal dystrophies

Lead: Associate Professor Guei-Sheung (Rick) Liu - Centre for Eye Research Australia

Research Team: Associate Professor Bang Bui, Dr Thomas Edwards

Project Description:

Inherited retinal degenerations (IRDs) are significant contributors to global vision impairment and blindness, with no cure to date. Gene therapy by supplementation is restricted to certain forms of IRDs and therefore alternative therapeutic approaches are required. Specific mutations underlying these conditions have been identified, although efficient strategies to target these mutations have not been developed. Recently, CRISPR-based editing has allowed targeted modification of single bases using adenosine and cytosine deaminases without causing sequence breaks. Compact CRISPR/Cas enzymes that target RNA have also been demonstrated to perform efficient and specific base editing. Their compact size allows delivery using a single viral vector which is the delivery

method of choice. These enzymes (Cas13X) do not require a flanking sequence which permits targeting of any locus within the transcriptome, while ensuring safety as the genome is not altered.

In addition, a novel CRISPR-inspired RNA targeting system (CIRTS) has been developed, which is smaller than all known CRISPR/Cas systems and able to perform efficient base editing. The team will compare these two established compact RNA base editors to investigate their potential in correcting point mutations present in the retina efficiently and specifically. Successful demonstration of ocular RNA base editing using these systems would provide a novel therapeutic approach against IRDs, one that is efficient, safe, cost-effective and provides long-term treatment.