

2022-2023
Hector MacLean Scholarship Projects



Project One: Multi-modal Retinal Imaging for Biomarker Discovery

Supervised by: A/Prof Peter van Wijngaarden and Dr Xavier Hadoux

Research Group: Ophthalmic Neuroscience

Project Summary: The Ophthalmic Neuroscience Unit specialises in multi-modal retinal imaging for biomarker discovery for a wide array of retinal and systemic diseases. The group has applied this approach to the detection of a retinal imaging biomarker of Alzheimer's disease. Another focus area for the unit is developing a way to predict the progression of geographic atrophy in age-related macular degeneration.

At present it is unclear which of the many millions of people world-wide with geographic atrophy will progress to sight-threatening stages of the disease. As novel therapies to slow the progression of this disease are in the advanced stages of development it is becoming urgent to develop biomarkers that will allow us to identify people who are at greatest risk and who stand to benefit most from these new therapies.

Working in conjunction with the CERA Macular Research Unit, the student will assist the team in annotating of retinal images from a range of different imaging devices. These annotations will then be used to train image analysis algorithms to detect biomarkers of atrophy progression. The student will have the unique opportunity to learn from leaders in the fields of retinal research and image analysis.

Experience in image analysis, computer programming and machine learning is advantageous, but not essential.



Project Two: Resolving corneal scarring with a novel factor

Supervised by: Prof Mark Daniell and Dr Gink Yang

Research Group: Corneal Research

Project Summary: Blindness due to corneal scarring is an unaddressed challenge affecting 10 million people worldwide. Corneal scarring remains a distressing issue for Australian indigenous communities, especially in children and the elderly with trichiasis.

The prolonged use of current clinical treatments such as corticosteroids delays wound healing and may contribute to poor visual outcomes resulting from endothelial cell loss or secondary glaucoma. Worldwide, corneal scarring remains a major complication following glaucoma filtration surgery, corneal refractive surgery, and corneal infections such as herpetic stromal keratitis. Focusing on the key mechanisms of corneal scarring, we have identified an anti-scarring factor that is shown to limit scarring following fibrosis induction in human corneal cells. The current project aims to further validate the efficacy of the factor in vitro.

Selection Criteria for the Corneal Research project:

Biotechnology or Biomedical science students who are interested in drug development and validation. The successful applicant will need laboratory experience in molecular biology and tissue culture; and be able to work independently.



Project Three: Australian Study of Keratoconus: A large scale multi-faceted approach to combat Keratoconus

Supervised by: Dr Srujana Sahebjada & Prof Mark Daniell

Research Group: Surgical (Cornea) Research Unit

Project Summary:

Australian Study of Keratoconus (ASK), one of the largest global projects of Keratoconus. Keratoconus is a common condition that affects the cornea that affects 1 in 84 young Australians. The aim of the projects is to better understand the underlying genetic causes, environmental risk factor, clinical characteristics, and treatment options of keratoconus to develop strategies that can halt the disease progression.

The project also aims at developing Artificial Intelligence algorithms to identify features that define early subclinical keratoconus that are currently refractory as well as identify a series of features that are involved in a) disease staging, as well as b) risk of progression of Keratoconus. The project involves collection of large datasets from clinical records and images and offers an exciting opportunity to conduct big data analysis and manuscript writing.

Students with backgrounds in bioinformatics, genetics, life science, biomedicines, molecular biology, biochemistry and physiology with computer science, statistics and applied mathematics, computer science and database software's, statistics or optometry and visual science are welcome to apply.

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Project Four: Understanding Stickler Syndromes in an Australian Context

Supervised by: Dr Rosie Dawkins

Research Group: Bionic Eye and Vitreoretinal Surgery



Project Summary: The Stickler Syndromes are collagenopathies which may result in a high rate of retinal detachment. There is now effective prevention available, however, access to genetic diagnosis, prophylactic surgery, and other medical care such as audiology and rheumatology can be disjointed. This project aims to address this gap. The successful applicant will work with the research unit to develop care pathways and clinical education materials. They will also investigate the local genetic changes, and outcomes for patients who have had prophylaxis, no prophylaxis, and/or detachment(s).

Timeline:

Four weeks in February 2023