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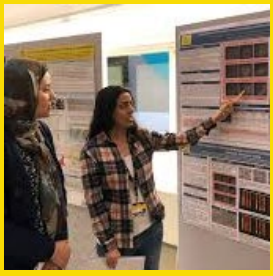






Vision Science Honours

Information Booklet 2023

Contents

Why do Vision Science Honours?

Vision Science Honours involves a full-time research project (with supervision) in the School of Optometry & Vision Science. This runs over 3 terms (with no coursework) and involves developing a research hypothesis, aims and project, and undertaking the research and assessing and interpreting results, with supervision.

Vision Science Honours provides a practical, real-world learning experience in a research environment. Students join a SOVS research group and are guided through a project by experienced SOVS academics.

Honours is an opportunity to gain advanced training and knowledge in a specific area of vision science (laboratory-based, bioinformatics, sensory/virtual reality, clinical or public health techniques and applications) and build further skills that can significantly enhance learning and improve employability including:

- Critical thinking
- Time-management and planning
- Oral and written communication
- Data analytics and different software programs
- Experience with variety of information and communication technologies
- Collaboration with various researchers and stakeholders

Honours also provides an opportunity for further research study (for example, PhD)

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Assessments in Vision Science Honours

Assessments for Vision Science Honours are listed below, including marks and approximate timing for submission. Please note Honours can be started in T1, T2 or T3.

1. Literature review (15%)

In the first term, you will prepare a literature review on your project topic. This is to help you learn more about the research field, identify research questions and hypotheses, and further develop skills for critically assessing literature.

2. Review and Proposal Presentation (15%)

After preparing your literature review and research plan (with support from supervisors), you will present your proposed project (15 min talk + 5 min question time) to students and SOVS academics. The feedback can be used to further develop your research project.

3. Research Seminars Reflection (10%)

During the year, you will attend research seminars (e.g. Vaegan seminars at SOVS) and need to write a two-page reflection on three seminars attended by the end of third term. This can include comments on seminar content, style, area of research, communication etc

4. Thesis (45%)

At the end of Honours, a written thesis is submitted detailing the background, results and critical discussion of your research. This follows a typical format of Introduction, Methods, Results and Discussion chapters, plus references, tables and figures.

5. Final Research Presentation (15%)

After thesis submission you will present your research project (15 min talk + 5 min question time) to SOVS academics and students.

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Applying for Vision Science Honours

Confirm your eligibility

To apply for Vision Science Honours please note you will need:

- To have completed 3-year, full-time BVisSci or BSc (VisSci) (144UOC) or BAdvSci (VisSci, Internal Honours)
- A WAM of 65 (credit) or more (please enquire if less than 65 WAM for special entry)

Finding a supervisor

Before applying for Honours, you need a confirmed supervisor. This can be organised by:

- Contacting the Honours Deputy Coordinator, Dr Lisa Nivison-Smith (L.Nivisonsmith@unsw.edu.au) to discuss your interests and to help you find a supervisor
- Reviewing available Honours projects in this booklet and contacting supervisors directly
- Checking the SOVS website Research Groups and contacting researchers directly

Apply online (this does not mean you are enrolled)

Applications for Vision Science Honours (VISN4016) can be made for a T1, T2, or T3 start.
To apply:

1. Complete an "Intention to Undertake Honours" at www.unsw.edu.au/science/student-life-resources/honours-how-apply
2. Apply for VISN4106 via https://applyonline.unsw.edu.au

Note: You require a copy of your transcript and confirmation of a supervisor for the application

T1 2024 Honours applications are now open until Dec 1st
Note: late applications can be submitted – ask Dr Nivison-Smith for assistance

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2024 Honours Projects*

**new projects can also be negotiated individually with supervisors*

Research Area: Anterior Eye

Dr Simin Masoudi

- The antimicrobial efficacy of human tear lipid
- The relationship between physical activity and dry eye in pre-, -peri, and post-menopausal women

A. Prof Nicole Carnt

- Risk factors for microbial keratitis in orthokeratology contact lens wearers in Australia
- Can high dose vitamin supplements that mitigate glaucoma be measured in tears and/or blood?

Prof. Fiona Stapleton

- Comparison of Non-invasive Dry Eye Assessment Techniques

Prof. Isabelle Jalbert

- What advice should be given to contact lens wearers during smoky periods?
- Should we recommend air purifiers to manage dry eye disease?

Research Area: Posterior Eye

Dr Matt Trinh

- Linking Retinal Integrity with Physiology, Non-ocular Pathology, and Pharmaceutical Drugs (PPP)
- Charting the course of geographic atrophy using a new high-density topographical OCT analysis

Dr Daisy Shu

- Decoding the pathogenesis of neovascular AMD through transcriptomic fingerprinting

Dr Lisa Nivison-Smith

- How do patients actually use their Amsler grid?
- Can a novel choroid high-density analysis be used to predict macular degeneration?
- Can a simple hand grip exercise improve imaging of retinal blood vessels?

A.Prof Michele Madigan

- Exploring Glucose Metabolism in the Macular Choroid: A Quest for Novel Treatment Targets in Retinal Diseases

Research Area: Vision Science

Dr Revathy Mani

- Comparison of Objective and Subjective Near Gradient Accommodation Convergence/ Accommodation ratio in emmetropes and myopes

Research Area: Public Health

Prof Lisa Keay

- Digital Divide: Analyzing needs and barriers faced by older Australians with vision impairments

The antimicrobial efficacy of human tear lipid

Supervisors:

Dr Simin Masoudi, Prof. Mark Willcox

Multidrug-resistant (MDR) infection is one of the most pressing issues in global public health which needs to be addressed urgently. A few promising approaches such as the use of synthetic cationic antimicrobial polymers, nanoparticles, anti-virulence compounds, and phage therapy have been tested to combat this global health challenge. Even though some of these approaches have strong potential to treat MDR infections locally in the future (e.g., topically treat skin or applied on the contact surfaces of medical devices), many still suffer from low to moderate biocompatibility and multiple aspects are required to be addressed before their systemic administration. Certain lipids in the human body have been recognized as broad-spectrum antimicrobe agents. One important potential benefit of innate antimicrobial lipids is that they do not induce damage to cells, therefore, decreasing the likelihood of side effects The lipid layer is the most superficial layer in the human tear film and is the first barrier between the eye and the environment. The meibum, an oily secretion of Meibomian glands, is the primary source of the tear film lipids, though, cell membranes and lipid-binding proteins may also contribute to the production of the tear lipids. This study aims to evaluate the antimicrobial efficacy of some of the synthetic tear lipids as well as human meibum lipids against Gram-positive and Gram-negative bacteria in vitro. By conducting this research, you will become familiar with laboratory techniques to assess the antimicrobial efficacy of compounds, preparation of ethics documents/approval, human meibum sample collection, collection of data in the clinic and laboratory and their analysis as well as scientific writing.

Contact

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The relationship between physical activity and dry eye in pre-, -peri, and post-menopausal women

Supervisors:

Dr Simin Masoudi, Dr Mandy Hagstrom

Dry eye syndrome is a multifactorial disorder of the tear film and ocular surface due to tear deficiency or excessive tear evaporation. This condition is more common in females, particularly menopausal and postmenopausal age groups. This is thought to result from sex hormone changes however, the relationship between the systemic level of the hormones and dry eye remains unclear.

The effects of physical activity on the tear film are unclear. One study observed an increase in tear film osmolarity following a maximal aerobic exercise session, indicating heightened tear evaporation after exercise. Conversely, a different study found that exercise improved tear film stability in individuals with dry eyes. Furthermore, the levels of certain inflammatory mediators decreased after exercise, while their concentrations remained unaffected in patients with dry eyes. The long-term effects of exercise as an intervention have only been studied in a small number of participants, which poses challenges in reaching definitive conclusions. Additionally, the relationship between dry eye in menopausal women and physical activity remains largely unexplored.

This study explores the relationship between symptoms of dry eye and subjective eye comfort with physical activity and sedentary behaviour in a large cohort of pre-, -peri, and post-menopausal women. We will assess menopause symptom severity via the Menopause Rating Scale (MRS) and dry eye with different instruments including the Ocular Surface Disease Index (OSDI), and the Dry Eye Quality of life Score (DEQS). The International Physical Activity Questionnaire Short Form (IPAQ-SF) will also be used to calculate the level of physical activity in metabolic equivalent units per week (MET, min/week). In addition, a custom-built questionnaire will be utilised to determine the type and volume of activity undertaken (i.e. resistance training, running, sport).

Contact

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Can taking high dose vitamin supplements to mitigate glaucoma be measured in the tears and/or the blood?

Supervisors:

Scientia A/Prof Nicole Carnt, , Dr Flora Hui, Dr Simin Masoudi, A/Prof Andrew White

Glaucoma is a group of eye conditions that damage the nerves connecting the eye to the brain. Glaucoma is the leading cause of blindness in industrialised nations and 50% remains undiagnosed. With the increased aging of the population in many countries, glaucoma is projected to be an increased global social and economic burden. Recent studies suggest that high dose vitamin supplementation may lower the risk of glaucoma and the progression of disease. Our group has developed a mass spectrometry method of analysis of low concentrations of vitamins in the tears. This study will investigate whether high dose vitamin supplementation can be measured in tears and whether this is reflected also in the blood to assess bioavailability. This research will assist in determining whether measurement of tear vitamins can be used as biomarkers in patients with glaucoma and assess the likelihood of progression to glaucoma. The results of this research might help with developing a device that can have a widespread clinical application in measuring the level of vitamins in tears and helps with preventive treatment before any permanent damage has caused irreversible visual loss.

Contact

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UNSW SYDNEY

Risk factors for microbial keratitis in orthokeratology contact lens wearers in Australia

Supervisors:

Scientia A/Prof Nicole Carnt, Dr Kathleen Watt, Dr Brett Drury, Dr Con Petsoglou

The effects of myopia include poorer outcomes of refractive surgery and greater reliance on refractive correction with the long term complications including vision loss due to myopic maculopathy and retinal detachment. Slowing myopia progression significantly reduces these complications. The most effective method of slowing the progression of myopia is the use of contact lenses in children as young as 6 years of. age. A popular contact lens modality effective in slowing myopia is orthokeratology, where large reverse curve rigid contact lenses are worn overnight to reshape the corneal epithelium to neutralise the myopia during the day in a way that delivers light to the retina in such a way that it slows myopia. However, there have been worrying cases of a rare but severe form of corneal infection (microbial keratitis) in children wearing orthokeratology lenses, where 50% of cases result in permanent vision loss. In this project you will work with Ophthalmologists, Dr Brett Drury at Gold Coast Hospital, Dr Con Petsoglou at Sydney Eye Hospital, microbial keratitis epidemiologist, A/Prof Nicole Carnt and Dr Kathleen Watt, an orthokeratology and myopia expert to determine risk factors that are driving these cases of microbial keratitis in order to develop safer guidelines for myopia control.

Contact

Scientia A/Prof Nicole Carnt

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UNSW SYDNEY

Comparison of Non-invasive Dry Eye Assessment Techniques

Supervisors:

Prof Fiona Stapleton, Ms Judy Nam

Dry eye is defined as a "multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles" (TFOS, DEWSII). This implies that the diagnosis of dry eye is complex and requires a multi-faceted approach to assess the tear film using different diagnostic modalities. There is an established suite of commonly utilised diagnostic tests for dry eye that are considered the gold standard. However due to its limitations, there has been an advent of novel non-invasive ocular surface analysing techniques.

This study will be examining the capacity of these non-invasive techniques in its ability to predict dry eye disease; by comparing the measurements of the tear film from these novel methods to gold-standard tests in healthy and dry eye subjects.

Contact

Prof Fiona Stapleton

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UNSW SYDNEY

What advice should be given to contact lens wearers during smoky periods?

Supervisors:

Prof Isabelle Jalbert, A/Prof Michele Madigan, Ms Suki Jaiswal

The eye is constantly exposed to ambient air and because of that, eye symptoms are one of the most common complaints reported during periods of poor air quality. Catastrophic bushfire events such as Black Summer in 2019-2020 released toxic particles and gases into the atmosphere, exposing people near and far to the hazardous air pollution. This includes the ~680,000 or ~15% of Australians who wear contact lenses, although very little is known about how smoke interacts with these lenses. Our pilot data suggests that particulate matter from smoke can deposit on contact lenses and disrupt their surface.

The evidence for whether contact lenses should be worn during periods of reduced air quality is lacking. Contact lenses may act as a barrier protecting the cornea from particles. Alternatively, contact lenses may potentiate the toxic effects of air pollution through adsorption of particles (ARVO abstract, 2023) and subsequent 'leakage' into the tear film.

This study will evaluate the effects of air pollution exposure on worn and unworn contact lenses using high magnification microscopy. The study will also investigate whether short term wear of contact lenses can protect the ocular surface from the impacts of pollution.

Contact

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UNSW SYDNEY

Should we recommend air purifiers to manage dry eye disease?

Supervisors:

Prof Isabelle Jalbert, Dr Kath Watt, Ms Suki Jaiswal

The prevalence and impact of dry eye disease appears to be increasing globally, in part due to increases in risk factors such as screen and mask usage, and exposure to polluted air. The recent TFOS Lifestyle Report on the impact of environmental conditions on the ocular surface (2023) concluded that both dry air (lack of humidity) and air pollution are associated with dry eye disease. Those with existing disease (e.g., asthma, dry eye) are at increased risk of reporting complaints during periods of poor air quality.

The COVID-19 pandemic helped fuel an increased understanding of the importance of indoor clean air. Air purifiers are increasingly used to filter indoor air and can remove 99.9% of pollutants including virus, allergens, and PM2.5. Whilst associations between dry eye and climate-related and pollution factors are increasingly demonstrated in large population studies, evidence is lacking for whether interventions to improve the air quality can improve dry eye signs and symptoms.

This study will investigate whether the routine use of air purifiers modulates signs and symptoms of dry eye disease.

Contact

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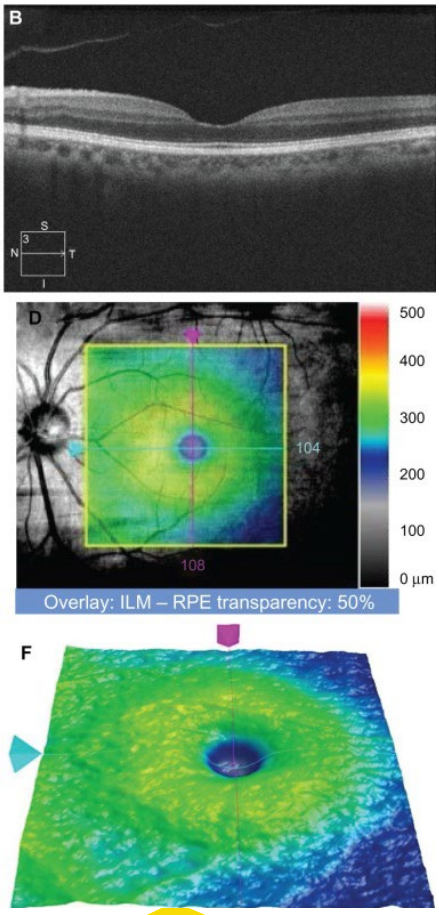
UNSW SYDNEY

Linking Retinal Integrity with Physiology, Non-ocular Pathology, and Pharmaceutical Drugs (PPP)

Supervisors:

Dr Matt Trinh, Dr Angelica Ly, Dr Lisa Nivison-Smith



The PPP project aims to improve the precision of clinical measures of retinal integrity, such as OCT retinal nerve fibre layer and total macular thickness, and colour fundus photography vessel diameters, by exploring relationships with non-ocular factors such as natural physiology, systemic disease, and medication use. This project is designed as a retrospective, translational study. Students will learn how to organise and quantitatively analyse large amounts of patient data from the Centre for Eye Health.

Contact

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UNSW SYDNEY

Charting the course of geographic atrophy using a new high-density topographical OCT analysis

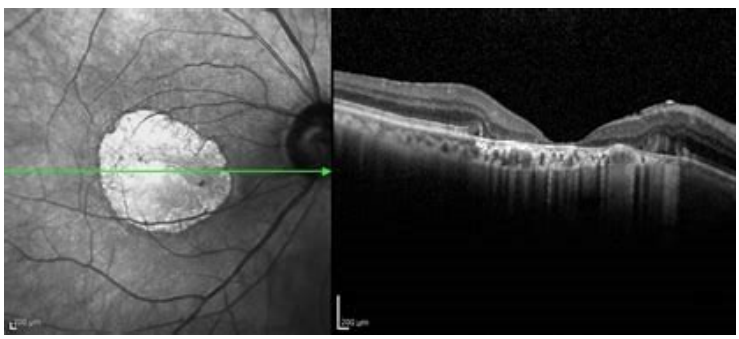
Supervisors:

Dr Matt Trinh, Dr Lisa Nivison-Smith

Geographic atrophy causes vision loss in 90% of age-related macular degeneration. However current measures of geographic atrophy are coarse and binary meaning there is limited information for us to better understand of the pathobiology of disease and develop new treatments.

We recently established a method of characterising subtle, topographical changes in specific retinal layers. This method generates high-density, topographical maps that could improve clinical interpretation and in-depth research investigation.

This project will involve applying this method to patients with signs of geographic atrophy and comparing the sensitivity of this method to the established binary measures. The results of this study will then be used to determine if this tool could be helpful in research and clinical care of AMD.



Contact

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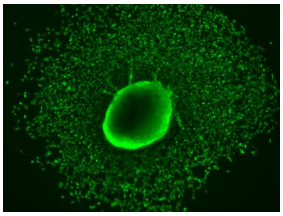
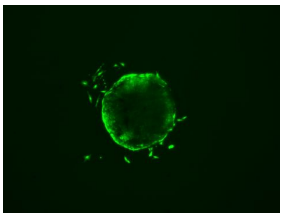
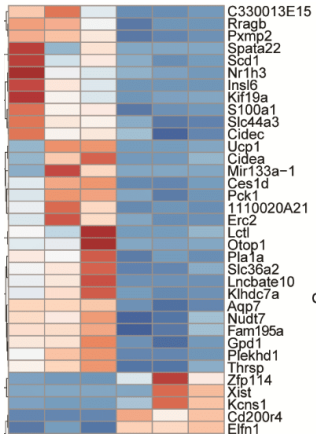
Decoding the pathogenesis of neovascular AMD through transcriptomic fingerprinting

Supervisors:

Dr Daisy Shu, A.Prof Michele Madigan







Age-related macular degeneration (AMD) is the leading cause of blindness among the elderly, encompassing two primary forms: dry and wet AMD. Wet AMD, characterized by the formation of abnormal blood vessels in the retina/choroid (angiogenesis), poses a substantial challenge due to limited understanding of the underlying mechanisms. This project will unravel the intricate web of molecular factors involved in wet AMD, shedding light on the role of angiogenesis, fibrosis, and inflammation in driving AMD progression. To achieve this, primary human retinal endothelial cells have been treated with pathogenic cytokines known to be pivotal in AMD progression. Notably, vascular endothelial growth factor (VEGF), the foremost angiogenic stimulus, will be compared to other key AMD cytokines including transforming growth factors (TGF-beta 1 and 2), which induce fibrosis as well as pro-inflammatory cytokines (tumour necrosis factor-alpha and interleukin-6) to elucidate how inflammation impacts gene expression patterns.

This project is inherently computational biology-oriented. Participants will receive training in cutting-edge data analysis techniques using R and coding, gaining proficiency in bioinformatics. Importantly, the experimental phase has concluded, with the samples already undergoing sequencing, laying the groundwork for comprehensive data analysis. There is also the opportunities for students to have hands-on wet lab training by testing key gene targets in the lab on the protein level using in vitro models. We seek enthusiastic Honours students with a passion for uncovering disease pathogenesis through the lens of computational biology. By delving into the transcriptomic landscape and dissecting gene expression patterns, we aim to advance our understanding of the intricate molecular processes underlying wet AMD. Ultimately, this research promises to contribute valuable insights that may inform future therapeutic strategies for this debilitating disease. Join us in this exciting journey to decode the mysteries of neovascular AMD pathogenesis.

Contact

Dr Daisy Shu

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UNSW SYDNEY

How do patients actually use their Amsler grid?

Supervisors:

Dr Lisa Nivison-Smith, Prof. Isabelle Jalbert

The Amsler grid is a low-cost, paper-based tool that is widely used by patients with early age-related macular degeneration (AMD) to monitor their vision at home. The goal is to assist patients in detecting changes associated with late-stage AMD so they seek intervention more rapidly. This is critical as treatment has the greatest success of restoring vision when administered early.

Only 55% of patients use their Amsler grid on a regular basis. Attempts to improve compliance such as education, behavioural training or reminder systems have had limited success. A possible reason for this is lack of engagement with patients to determine why they do not use the Amsler grid. This project will address this by performing focus groups and interviews with patients to explore the barriers of Amsler grid use and possible solutions. The student will be involved in patient recruitment, focus group and interview co-ordination, transcription and thematic analysis. The results of this study will then be used to develop meaningful interventions to improve Amsler grid use to potentially improve detection and treatment of late stage AMD.

Contact

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UNSW SYDNEY

Can a simple hand grip exercise improve imaging of retinal blood vessels?

Supervisors:

Dr Lisa Nivison-Smith, Dr Matt Trinh

Optical coherence tomography angiography, or OCTA, is a revolutionary, non-invasive method to view retinal blood vessels. OCTA however is prone to image artefacts which make it difficult to identify true disease changes.

This project determines if a simple (one-minute) in-office hand grip test can improve images of retinal blood vessels using OCTA. The project involves assessing images of individuals before and after the hand grip test to see if image quality is improved. If proven, these results could have a major impact on clinical practice and patient outcomes by enhancing the usefulness of OCTA in a simple, cost-efficient manner.

Contact

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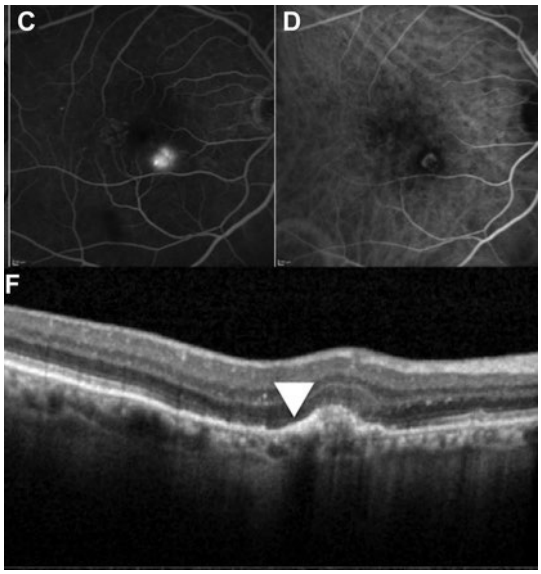
Can a novel choroid high-density analysis be used to predict macular degeneration?

Supervisors:

Dr Lisa Nivison-Smith, Dr Matt Trinh



Macular neovascularisation is a major reason for vision loss in age-related macular degeneration (AMD) and several clinical trials show that preventing vision loss hinges on treatment the disease early. Thus, tools to predict which patients are at highest risk of developing macular neovascularization and ensure they are monitored closely are desperately needed.

Our research team has developed a novel, high density analysis tool that can indicate subtle changes in the size and shape of blood vessels of the choroid. As macular neovascularization originates from the choroid, this tool may detect the disease early and help facilitate treatment.

This project will involve applying our tool to a population of AMD patients to test this hypothesis. The results of this study will then be used to determine if this tool can be translated into clinical practice.

Contact

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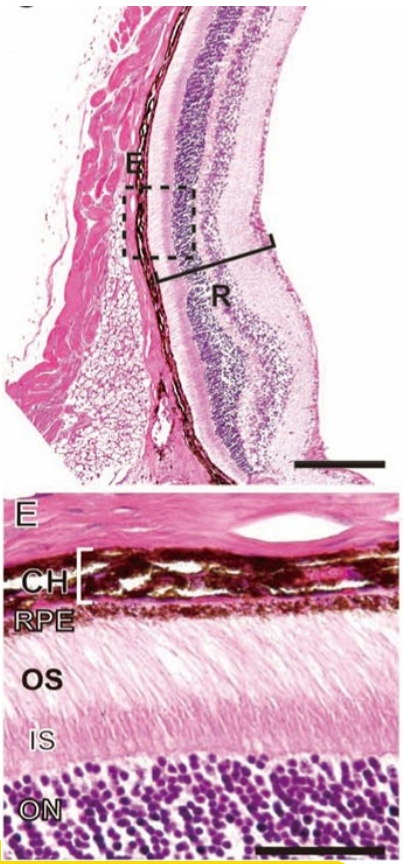
UNSW SYDNEY

Exploring Glucose Metabolism in the Macular Choroid: A Quest for Novel Treatment Targets in Retinal Diseases

Supervisors:

A.Prof Michele Madigan and Dr Ling Zhu

The macular and peripheral regions of the choroid—the vascular layer nestled between the retina and the sclera—differ significantly in their structural and metabolic attributes. Specifically, the macular choroid is denser and thicker, reflecting its role in catering to the high metabolic demands of the macula, the central portion of the retina responsible for detailed vision. Conversely, the peripheral choroid is thinner and less vascular. These anatomical variations have far-reaching implications for retinal diseases like Age-related Macular Degeneration (AMD) and Central Serous Chorioretinopathy (CSC), where choroidal changes can be critical indicators of disease onset or progression. To delve deeper into these dynamics, we are thrilled to offer a one-year Honors project titled 'Exploring Glucose Metabolism in the Macular Choroid: A Quest for Novel Treatment Targets in Retinal Diseases.' The research will be conducted primarily at Sydney University in the Biomedical Building at Australia Technology Park (near Redfern Station).



The project aims to investigate the glucose metabolism specific to the macular choroid, with the goal of uncovering novel avenues for treating retinal diseases. Participants will gain invaluable experience in cutting-edge metabolic analysis techniques, contributing to a more comprehensive understanding of retinal pathophysiology and the development of targeted treatment options. No prior wet-lab experience is required, with support from a research team of hands-on laboratory supervisors, and experienced research assistants.

Contact

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UNSW SYDNEY

Comparison of Objective and Subjective Near Gradient Accommodation Convergence/ Accommodation ratio in emmetropes and myopes

Supervisors:

Dr Revathy Mani, Dr Nayuta Yoshioka, Rebecca Dang, Amanda Lea, A. Prof Sieu Khuu

AC/A measure signifies the relationship between accommodation and vergence mechanisms. Assessment of the AC/A ratio plays an important role in the diagnosis and management of non-strabismic and strabismic anomalies and in prescribing addition lenses. Clinically Gradient AC/A is measured by the Cover Test, Modified Thorington method or using the Howell card. These methods are based on ocular alignment measured by an examiner or by a subjective response from patients based on the eye's position. However, such approaches are highly subjective, and no study has measured ocular alignment as an indicator of AC/A using more objective methods. Previous studies have measured accommodative response using an autorefractometer but not ocular alignment. This study aims to measure ocular alignment and accommodative response objectively using an eye-tracking and auto refractometer for the measurement of AC/A. This project will enable students to understand the dynamics of accommodation and vergence while using subjective and objective evaluation of AC/A ratio.

Contact

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UNSW SYDNEY

Digital Divide: Analyzing needs and barriers faced by older Australians with vision impairments

Supervisors:

Prof Lisa Keay and Dr Sheela Kumaran

Digital inclusion wears-off with age and drops to a significant low in those over 65 years of age (Australian Digital Inclusion Index =48). Compared to younger counterparts, older people face significant challenges accessing online government, health and business services, connecting socially and being safe online. These challenges are more prominent for people with vision impairments, impacting their mental wellbeing and overall quality of life. Using a mixed methods study design, employing surveys and qualitative research, this study will assess the digital skills and knowledge, confidence, social connectedness, loneliness, online safety concerns and barriers to digital inclusion of old people with vision impairments. This is an exciting opportunity for students interested in low vision and equity to understand the impacts of vision impairment (VI) beyond clinical implications. The student will be part of a larger team working towards improving digital inclusion for older Australians with VI, including partners at Macquarie University. Full scope research experience will be gained from ethics application, conduct data collection and analysis including NVivo qualitative software, survey tools such as REDCap/ Qualtrics and quantitative statistical packages (R, SPSS).

Note this project includes a $5k stipend for the successful candidate

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