

**Menzies Institute for Medical Research
Honours Projects 2019**

NEURODEGENERATIVE DISEASE AND BRAIN INJURY THEME

Project title: Inhibitory regulation of motor neurons: a new target mechanism for motor neuron disease?

Supervisor(s): Prof Tracey Dickson and Dr Rosie Clark

Project description: Amyotrophic lateral sclerosis (ALS) is the most common phenotype of motor neuron disease, and is a devastating neurodegenerative disease for which there is no effective treatment or cure. It involves the progressive loss of movement due to the dysfunction and loss of motor neurons, which universally results in paralysis and death, due to respiratory failure. ALS has a median survival of only three years from symptom onset, with only 4% of people living longer than ten years. There is new clinical, histological and electrophysiological evidence from our research team and others indicating that reduced inhibitory neuronal influences may be at the root of the disturbed glutamatergic transmission occurring in ALS. Through a combination of human and transgenic pathological investigations, performed in parallel with novel targeted in vitro experimental models we will address the novel hypothesis: 'Interneuron pathogenesis is a central mechanism of ALS'

Key techniques: immunohistochemistry, cell culture, immunocytochemistry, iPSC culture

Contact: Tracey.Dickson@utas.edu.au

Project Title: Discovering the targets of neural stem cell transcription factors

Supervisor(s): Dr Owen Marshall and Dr Caroline Delandre

Project Description: Neural development is a complex process in which neural stem cells (NSCs) give rise to a large number of highly specific neuronal lineages. A number of key transcription factors are known to be involved in this process, but little is known about their targets or their mode of action. One such family of transcription factors are the bHLH genes that respond to Notch signalling. These are vital for both NSC maintenance and for specifying a subset of neuronal lineages. This project aims to identify the genome-wide binding targets of these transcription factors in NSCs and immature neurons within the brain of the fruit fly, *Drosophila melanogaster*, using the Targeted DamID technique and next-generation sequencing. The results will be integrated with existing expression and epigenetics data to gain an understanding of how the brain develops.

Key Techniques: PCR, next-generation sequencing, immunohistochemistry, data analysis using R

Contact: owen.marshall@utas.edu.au

Project Title: Investigating the effect of modifying the timing of amyloid beta expression in a fly model of Alzheimer's disease

Supervisor(s): Dr Owen Marshall and Dr Caroline Delandre

Project Description: Dementia is now the second leading cause of death in Australia, with Alzheimer's disease (AD) being the most common type. Mouse AD models need several months before behavioural impairments can be observed making them very time-consuming and costly to study. A growing number of groups have turned to the fruit fly *Drosophila melanogaster* as a complementary approach to study the basics of AD in a rapid and cost-effective manner. Within a matter of weeks, expression of the human amyloid beta 42 (Abeta42) peptide (thought to form toxic aggregates in humans) in the fly brain causes amyloid deposits,

neurodegeneration, and memory decline as flies become older, reminiscent of symptoms seen in human patients. The current fly AD model expresses Abeta42 throughout the life cycle, while symptoms only appear in older flies. Is the gradual accumulation of Abeta42 important to lead to a disease state? Or could similar symptoms be triggered by expressing Abeta42 only at later stages? This project is set up to assess the effect of modifying the timing of Abeta42 expression on behaviour and the rate of neurodegeneration by using a simple locomotor assay and brain imaging.

Key Techniques: *Drosophila* genetics, dissection, immunohistochemistry, confocal imaging, behaviour

Contact: owen.marshall@utas.edu.au

Project Title: Identifying genes important for the function of the mushroom body, the *Drosophila* brain centre for memory

Supervisor(s): Dr Caroline Delandre and Dr Owen Marshall

Project Description: Understanding how memories are formed, stored, and later retrieved is one of the great challenges in neurobiology. With ~100 billion neurons in a single human brain, studying a complex process such as memory is an almost impossible task that is greatly helped by model organisms like the fruit fly *Drosophila melanogaster* (with “just” 10^5 neurons in the brain). Over the past five decades, research using this humble little insect has pushed the field forward by revealing some of the basic cellular and molecular mechanisms controlling memory, most of them conserved across the evolutionary tree. In the fly brain, memories are formed and stored in a central structure called the mushroom body (MB). By studying genome-wide epigenetic changes in the MB, we have recently identified a group of genes that are potentially important for MB function. The goal of this project is to test whether downregulation of these genes (via RNAi or mutants) will lead to changes in MB development and behaviour.

Key Techniques: *Drosophila* genetics, dissection, immunohistochemistry, confocal imaging, behaviour

Contact: caroline.delandre@utas.edu.au

Project Title: Studying the behaviour of induced pluripotent stem cell derived oligodendrocytes from people with Multiple Sclerosis

Supervisor(s): Kimberley Pitman and Kaylene Young

Project Description: Multiple Sclerosis (MS) is a disease in which immune cells invade the central nervous system, killing oligodendrocytes. However, it is unclear what causes MS and why the immune system attacks oligodendrocytes. The student undertaking this project will address this question by culturing induced pluripotent stem cells (iPSCs) derived from people with MS and healthy controls. The iPSCs will then be differentiated to generate immature and mature oligodendrocytes, distinguished by performing immunocytochemistry and fluorescent microscopy. They will next determine whether the oligodendrocytes from people with and without MS are inherently different by comparing their properties using electrophysiology and behavioural assays.

Key Techniques: Human stem cell culture, molecular biology, DNA sequencing, immunocytochemistry, light and confocal microscopy, electrophysiology, cellular assays.

Contact: Kimberley.pitman@utas.edu.au

PUBLIC HEALTH AND PRIMARY CARE THEME

Project Title: What influences the sale of healthy foods in Tasmanian primary school canteens?

Supervisor(s): Dr Kylie Smith

Project Description: Schools have continuous and intensive contact with children during an important time in the development of health behaviours. A fundamental component of the school setting is the school canteen, which can contribute a substantial proportion of children's daily nutrition in addition to influencing their perception of healthy eating. In Tasmania, the canteen accreditation program uses a traffic light system to classify food and beverages as Green (healthy), Amber (choose carefully) or Red (not recommended) based on their nutritional properties. It is not known what factors (eg proportion of healthy items on the menu, price, principal support, canteen facilities) have the greatest influence on the sale of healthy foods.

This project aims to:

- 1) identify the factors associated with the sale of healthy foods in Tasmanian primary school canteens.
- 2) test how effective different strategies are at increasing the sale of healthy foods.

This project is in collaboration with the Tasmanian School Canteen Association and dietitians from the Department of Health and Human Services.

Key Techniques: Epidemiology, public health.

Excellent communication skills and a driver's license are essential, as the student will be required to visit school canteens to collect the sales data.

To visit Tasmanian schools, the student will be required to have a Working with Vulnerable People Registration card. The cost of this registration can be covered by the project, however, the student cannot have a criminal history that would prevent them from obtaining this registration.

Contact: k.j.smith@utas.edu.au

Project Title: Is it pollen or is it fungi? Determining the cause of allergies in Tasmania

Supervisor(s): A/Prof Fay Johnston, Dr Penelope Jones, Dr Grant Williamson

Project description: Fungi are known to be a major trigger for allergies and asthma, yet across Australia a paucity of fungi-based studies means that we have very little understanding about their contribution to asthma and allergy symptoms at a population scale: in particular, how they compare to and/or interact with pollen and smoke as asthma and allergy triggers. This project will provide the first systematic analysis of the contribution of fungal spores to asthma and allergies by:

- 1) Counting the number of allergenic fungal spores on daily microscope slides (previously collected for pollen analysis by the 'AirRater' project); and
- 2) Building a model that tests associations between fungal spore abundance and asthma and allergy symptoms reported by users of the 'AirRater' app.

This will provide an important platform for understanding the role of fungi in asthma and allergies in Tasmania, and the degree to which they should be prioritised in clinical and public health settings.

Key techniques: The student will gain skills in both microscope identification and the statistical analysis of epidemiological data. Students will develop strong skills in quantitative analysis (using R) and an appreciation for the challenges and opportunities in utilising crowd-sourced symptom data: a rapidly emerging but challenging field. This project will suit students with an interest in epidemiology, public health, environmental health and/or biostatistics.

Contact: Fay.Johnston@utas.edu.au

Project Title: Is there an allergy 'hot spot' in Hobart? Comparing pollen allergen exposure on Hobart's eastern and western shores

Supervisor(s): A/Prof Fay Johnston, Dr Penelope Jones, Dr Grant Williamson

Project description: Pollen is a major cause of allergic disease with over 20% of the Tasmanian population suffering regularly from hay fever (allergic rhinitis). Understanding where and when people are exposed to pollen can help significantly in reducing the associated burden of disease. AirRater is a novel smartphone app and environmental monitoring system that is helping to map population exposure to pollen (as well as smoke and temperature extremes) across Tasmania. This includes monitoring atmospheric pollen levels at both Sandy Bay and Mornington, providing a unique opportunity to compare population exposure to allergenic pollen types on Hobart's eastern and western shores. This project will contribute towards this by analysing the pollen slides from Mornington to build a picture of eastern shore pollen exposure. You will then compare the data with those from Sandy Bay and use this to develop a basic spatial model of pollen variability across Hobart.

Key techniques: The project will involve the identification of pollen on microscope slides and statistical analysis of pollen, meteorological and land use data. Statistical analysis will be conducted using R. The project will suit a students with an interest in transdisciplinary approaches to public health, environmental health and/or epidemiology.

Contact: Fay.Johnston@utas.edu.au

Project Title: Do Tasmanian native plants cause allergies?

Supervisor(s): A/Prof Fay Johnston, Dr Penelope Jones, Dr Grant Williamson

Project description: Pollen is a major cause of allergic disease, with over 20% of the Tasmanian population suffering regularly from hay fever (allergic rhinitis). However, diagnosis and treatment of pollen allergies is limited by a lack of information about which pollen types are the most prevalent allergy triggers. In particular, almost nothing is known about the allergenicity of native pollen types and whether they should be considered as clinically-relevant. This project uses symptom data collected by the 'AirRater app' and other methods to test whether native pollen types should be considered as allergy triggers. This highly novel research will have the potential to significantly contribute to improved allergy treatment and diagnosis in Tasmania.

Key techniques: This project will utilise a mixture of epidemiological and immunological techniques. It will suit students with a background in public health, applied science, biostatistics, and/or immunology.

Contact: Fay.Johnston@utas.edu.au

Project Title: Evidence synthesis: effects of work-related stress, and of workplace-based stress-management interventions on employee's family members

Supervisor(s): Dr Fiona Cocker, Mrs Larissa Bartlett

Project Description: Conduct a systematic review of research literature addressing the flow-on effects of work-related stress, and of work-based stress management interventions on employee's family members (stress/emotional contagion). Key questions include how many studies are found for both aspects of this question, what populations and study designs were used and what effects were observed.

Key Techniques: Systematic literature review, possibly meta-analysis and the opportunity to draft a manuscript for submission to an academic journal. This project will suit students with an interest in mental health and occupational health.

Contact: Fiona.Cocker@utas.edu.au

Project Title: Understanding early childhood service use in Tasmania - the Tassie Kids Project

Supervisor(s): Dr Kim Jose and Dr Emily Hansen

Project Description: The Tassie Kids project is a NMHRC funded partnership project involving researchers from the Menzies and School of Social Sciences, UTAS and the Telethon Kids Institute, W.A. along with Tasmanian Government partners. The project is investigating what early childhood services (e.g. Launch into learning, Child health and parenting, Child and Family Centres) are valuable to Tasmanian families to support the health and wellbeing, education and care of their children. Using data linkage and qualitative (i.e. ethnographic methods) this project is examining how Tasmanian families are engaging with the early childhood service system and tracking the progress of Tasmanian children from birth to age five. There are a number of opportunities to work on topics across the different data sets and health and/or education service systems. Possible topics include the engagement of fathers in early childhood services, impact of family structure on service use and exploring geographic patterns of service use.

Key Techniques: Projects may be qualitative, quantitative or mixed methods in nature, with students involved in analysing existing data. Students will be able to apply principles of epidemiology and public health, will become proficient in analysing data using appropriate software packages and will gain experience in academic writing. This project will suit students with an interest in public health, child health and education, health services, epidemiology and social science.

Contact: kim.jose@utas.edu.au

Project Title: Validity and reliability of sedentary behaviour assessment tools used in primary care.

Supervisor(s): Prof Tania Winzenberg and Ms Aroub Lahham

Project Description: Sedentary behaviour (SB) is defined as a range of activities that result in an energy expenditure of 1.5 metabolic equivalent task or lower including sitting or lying. Prolonged SB was reported as an independent risk factor for major chronic disease and all-cause mortality. Despite this, Australian adults spend an average of 39 hours per week engaging in sedentary activities. Primary care is one of the vital environments to target health-related behavioural change. Published primary care guidelines strongly recommends that assessment of SB should be provided for all patients in general practice. Recommended assessment tools ranged from providing a brief inquiry about the amount of time spent in sitting to the use of activity monitors. As suggested tools to assess SB vary in content, duration, delivery and feasibility, this systematic review aimed to identify the tools used to assess the SB in primary care and describe their psychometric properties (measurement validity and reliability) will be of high value to clinical practice. Using findings from the systematic review, this project will also comprise a small pilot study to test the properties of a refined SB tool in primary care.

Key Techniques: As this project is exploratory in its nature, students will learn substantial skills in literature evaluation. Through the systematic review, writing skills of structured summary of results will also be gained. The pilot study is a great and rare opportunity to experience clinical trials development and management with close supervision.

Contact: aroub.lahham@utas.edu.au

Project Title: Understanding the perspectives of general practitioners regarding sedentary behaviour management in primary care: a qualitative study.

Supervisor(s): Prof Tania Winzenberg and Ms Aroub Lahham

Project Description: Sedentary behaviour (SB) is defined as a range of activities that result in an energy

expenditure of 1.5 metabolic equivalent task or lower including sitting or lying.

Recently, SB behaviour has shown associations with the incidence of major chronic disease and all-cause mortality risk. Despite this, Australian adults are increasingly sedentary.

Primary care is one of the vital environments to target health-related behavioural change amongst the general population. Additionally, GPs are the main health care providers for patients in Australia. However, understanding SB assessment and management in primary care is markedly poor. To date, it is unclear whether

GPs perceive the importance of addressing SB as recommended by published guidelines. Additionally, it is unknown whether GPs assess SB in their practice and provide appropriate management strategies when needed.

To address the evidence gap, this project will shed light on GPs' perspectives regarding the importance of SB assessment and management in primary care through an inductive qualitative design using semi-structured interviews with open-ended questions. The outcome of this study will be the first step to understanding current practice which is fundamental in developing effective strategies that are well-informed by GPs' perspectives to optimise SB management in primary care.

Key Techniques: As this project is qualitative in its nature, student will gain skills in conducting interviews with GPs through implementing qualitative methods to understand healthcare behaviour. Skills around interviews content appraisal will also be gained. This project will suit students who have interest in physical activity, sedentary behaviour and/or qualitative methods.

Contact: aroub.lahham@utas.edu.au

Project Title: Perspectives on current management for painful health conditions during pregnancy

Supervisor(s): Dr Amanda Neil, April Miller

Project Description: Chronic pain during pregnancy may be a result of a pre-existing maternal illness, a result of pregnancy related health conditions or a combination of these factors. Approximately 5% of Australian women who are pregnant also live with chronic pain during this period. Despite the potential impacts to mother and baby, little research is available on the management of chronic pain during pregnancy. This qualitative study seeks to identify the strengths and weaknesses of current pregnancy management strategies for women who are pregnant and live with painful health conditions from their own perspectives. It will involve recruiting women with chronic pain who are or have been pregnant, and conducting interviews to ascertain personal thoughts and experiences related to the management of their chronic pain during pregnancy.

Key Techniques: This study provides an opportunity for the student to obtain qualitative research skills related to an important public health issue. The student should be familiar with the Tasmanian healthcare system and be confident in their ability to speak to participants about their health. This study would suit an honours candidate interested in maternal and infant health, mental health, healthcare services or public health in general.

Contact: Amanda.Neil@utas.edu.au, April.Miller@utas.edu.au

Project Title: A national review of hospital policy and protocols on the clinical management of infants with neonatal abstinence syndrome

Supervisor(s): Dr Amanda Neil, April Miller

Project Description: Neonatal abstinence syndrome (NAS) is a condition in which an infant shows symptomatic signs of withdrawal from a substance or medication exposure which occurred in pregnancy. Infants with symptoms of NAS require monitoring in hospital following delivery for 5-7 days and may require pharmacological management for weeks in hospital until they are able to be safely weaned. Most hospitals which provide care for these infants have specific protocols in place which serve as guidelines for the

treatment they receive. The current gold standard practice guideline was developed by NSW Health in 2013, but how widely these practices have been implemented into hospitals providing care for these infants is not currently known. This study seeks to review the current policies in place related to the clinical management of infants with neonatal abstinence syndrome, to identify how closely individual hospital practice aligns with the current gold standard.

Key Techniques: This study will involve a systematic process of obtaining and reviewing current hospital policy across Australia. The honours candidate should have some familiarity with the Australian healthcare system, as well as an interest in infant health and the impacts of drug exposure in pregnancy.

Contact: Amanda.Neil@utas.edu.au, April.Miller@utas.edu.au

Project Title: A comparison of hospital admissions and emergency department presentations during pregnancy in Tasmania

Supervisor(s): Dr Amanda Neil, April Miller

Project Description: Pregnant women may seek medical attention in the emergency department for a variety of reasons, not all of which are pregnancy related. Recently, it has been suggested that frequent emergency department presentations during pregnancy are associated with subsequent hospitalisation for postnatal depression. This project seeks to describe hospital and emergency department utilisation by women during pregnancy in Tasmania to better understand the types of presentations and admissions which may be seen in this cohort of women. Whether or not an association is found between maternal mental health and frequency of presentations during pregnancy is of interest.

For this study the established Conception to Community (C2C) database will be used, containing both maternal and infant Tasmanian health system data from 2007-08 and 2008-09 respectively.

Key Techniques: Students will gain proficiency in the use of software used to analyse data and will have the opportunity to draft a manuscript for submission to an academic journal. This project will suit students with an interest in epidemiology, public health, psychology and maternal and infant health.

Contact: Amanda.Neil@utas.edu.au, April.Miller@utas.edu.au

Project Title: Health by Stealth: Increasing physical activity through public transport use

Supervisor(s): Verity Cleland

Project Description: Physical inactivity is a global public health problem, so establishing ways to increase participation is critical. Healthy transport options (walking, cycling, public transport) may represent an important opportunity for easily incorporating physical activity into everyday life. Understanding healthy transport behaviours, the barriers and facilitators of these, and what it might take to change travel behaviours will provide useful information for physical activity promotion strategies. There are opportunities for up to three Honours projects within this research area: 1) a qualitative project involving interviews and/or focus groups exploring why Tasmanians who catch the bus choose to or not to walk further than necessary to a bus stop; 2) a qualitative project involving interviews and/or focus groups with rural Tasmanians to explore their travel behaviours; and 3) a quantitative project involving analysis of National Health Survey data and/or data from a recent Tasmanian travel survey to establish factors associated with healthy transport options.

Key Techniques: Students with an interest in public/population health, epidemiology, health behaviour, psychology, geography, spatial sciences, transport, education, sports science or demography are encouraged to apply.

Contact: verity.cleland@utas.edu.au

Project Title: Physical activity promotion for rural adults: why are we missing the mark?

Supervisor(s): Verity Cleland

Project Description: Physical inactivity is a global public health problem, but even more so in rural areas. Understanding the reasons for these geographic disparities is important for informing strategies to redress them. There are opportunities for up to three Honours projects within this research area: 1) a qualitative project involving interviews and/or focus groups to understand rural adults' conceptualisation of "physical activity", and their reception of physical activity guidelines; 2) a qualitative project involving interviews to identify how rural service providers and policy-makers interpret and promote national physical activity guidelines; 3) a quantitative project involving analysis of data from the National Health Survey to establish the factors associated with physical activity among rural Australians.

Key Techniques: Students with an interest in public/population health, epidemiology, health behaviour, psychology, education, sports science or demography are encouraged to apply.

Contact: verity.cleland@utas.edu.au

Project Title: Is it pollen or is it fungi? Determining the cause of allergies in Tasmania

Supervisor(s): A/Prof Fay Johnston, Dr Penelope Jones, Dr Grant Williamson

Project description: Fungi are known to be a major trigger for allergies and asthma, yet across Australia a paucity of fungi-based studies means that we have very little understanding about their contribution to asthma and allergy symptoms at a population scale: in particular, how they compare to and/or interact with pollen and smoke as asthma and allergy triggers. This project will provide the first systematic analysis of the contribution of fungal spores to asthma and allergies by:

- 1) Counting the number of allergenic fungal spores on daily microscope slides (previously collected for pollen analysis by the 'AirRater' project); and
- 2) Building a model that tests associations between fungal spore abundance and asthma and allergy symptoms reported by users of the 'AirRater' app.

This will provide an important platform for understanding the role of fungi in asthma and allergies in Tasmania, and the degree to which they should be prioritised in clinical and public health settings.

Key techniques: The student will gain skills in both microscope identification and the statistical analysis of epidemiological data. Students will develop strong skills in quantitative analysis (using R) and an appreciation for the challenges and opportunities in utilising crowd-sourced symptom data: a rapidly emerging but challenging field. This project will suit students with an interest in epidemiology, public health, environmental health and/or biostatistics.

Contact: Fay.Johnston@utas.edu.au

Project Title: Is there an allergy 'hot spot' in Hobart? Comparing pollen allergen exposure on Hobart's eastern and western shores

Project description: Pollen is a major cause of allergic disease with over 20% of the Tasmanian population suffering regularly from hay fever (allergic rhinitis). Understanding where and when people are exposed to pollen can help significantly in reducing the associated burden of disease. AirRater is a novel smartphone app and environmental monitoring system that is helping to map population exposure to pollen (as well as smoke and temperature extremes) across Tasmania. This includes monitoring atmospheric pollen levels at both Sandy Bay and Mornington, providing a unique opportunity to compare population exposure to allergenic pollen types on Hobart's eastern and western shores. This project will contribute towards this by analysing the pollen slides from Mornington to build a picture of eastern shore pollen exposure. You will then compare the data with those from Sandy Bay and use this to develop a basic spatial model of pollen variability across Hobart.

Key techniques: The project will involve the identification of pollen on microscope slides and statistical analysis of pollen, meteorological and land use data. Statistical analysis will be conducted using R. The project will suit a students with an interest in transdisciplinary approaches to public health, environmental health and/or epidemiology.

Contact: Fay.Johnston@utas.edu.au

Project Title: Do Tasmanian native plants cause allergies?

Supervisor(s): A/Prof Fay Johnston, Dr Penelope Jones, Dr Grant Williamson

Project description: Pollen is a major cause of allergic disease, with over 20% of the Tasmanian population suffering regularly from hay fever (allergic rhinitis). However, diagnosis and treatment of pollen allergies is limited by a lack of information about which pollen types are the most prevalent allergy triggers. In particular, almost nothing is known about the allergenicity of native pollen types and whether they should be considered as clinically-relevant. This project uses symptom data collected by the 'AirRater app' and other methods to test whether native pollen types should be considered as allergy triggers. This highly novel research will have the potential to significantly contribute to improved allergy treatment and diagnosis in Tasmania.

Key techniques: This project will utilise a mixture of epidemiological and immunological techniques. It will suit students with a background in public health, applied science, biostatistics, and/or immunology.

Contact: Fay.Johnston@utas.edu.au

Project Title: What influences the sale of healthy foods in Tasmanian primary school canteens?

Supervisor(s): Dr Kylie Smith

Project Description: Schools have continuous and intensive contact with children during an important time in the development of health behaviours. A fundamental component of the school setting is the school canteen, which can contribute a substantial proportion of children's daily nutrition in addition to influencing their perception of healthy eating. In Tasmania, the canteen accreditation program uses a traffic light system to classify food and beverages as Green (healthy), Amber (choose carefully) or Red (not recommended) based on their nutritional properties. It is not known what factors (eg proportion of healthy items on the menu, price, principal support, canteen facilities) have the greatest influence on the sale of healthy foods.

This project aims to:

- 1) identify the factors associated with the sale of healthy foods in Tasmanian primary school canteens.
- 2) test how effective different strategies are at increasing the sale of healthy foods.

This project is in collaboration with the Tasmanian School Canteen Association and dietitians from the Department of Health and Human Services.

Key Techniques: Epidemiology, public health.

Excellent communication skills and a driver's license are essential, as the student will be required to visit school canteens to collect the sales data.

To visit Tasmanian schools, the student will be required to have a Working with Vulnerable People Registration card. The cost of this registration can be covered by the project, however, the student can not have a criminal history that would prevent them from obtaining this registration.

Contact: k.j.smith@utas.edu.au

Project title: Mitigation of apnoea in preterm infants

(* This project is for Honours starting in 2020 *)

Supervisor(s) contact details: Prof Peter Dargaville, Dr. Tim Gale

Project description:

Aim: To investigate the application of a range of therapeutic stimuli to curtail apnoea in preterm infants on non-invasive respiratory support.

Method: This project will be based in the Neonatal and Paediatric Intensive Care Unit at Royal Hobart Hospital. Studies will be conducted in preterm infants <32 weeks gestation who are receiving respiratory support with continuous positive airway pressure or nasal high flow. Several different forms of stimulation will be examined, all of which are either experienced by the infant at the bedside (tactile, acoustic, vibratory) and/or have been used in previous investigations of mitigation of apnoea (barotactic, olfactory, tactile). These stimuli will be applied a) in a stochastic (random) fashion, b) during a respiratory period identified by predictive software as a pre-apnoeic state, and c) at the onset of respiratory pause events. The stimulation device, built by a UTAS Engineering team, will be set up at the bedside by the Honours student, and its function monitored during repeated 2-4 hour studies. The different forms of stimulation, and the different modes of application, will be compared, and the optimal technique(s) for curtailing apnoea will be identified.

Key Techniques: Physiological and clinical data collection and analysis in an intensive care environment

Contact: peter.dargaville@ths.tas.gov.au or tim.gale@utas.edu.au

CARDIORESPIRATORY HEALTH AND DISEASES THEME

Project Title: Influence of upper arm cuff inflation on blood pressure

Supervisor(s): Dr Dean Picone, Dr Martin Schultz and Prof James Sharman

Project Description: Cardiovascular disease remains the number one cause of mortality and morbidity in Tasmania, Australia and globally. High blood pressure is the leading risk factor for cardiovascular disease. Blood pressure measurement via inflatable upper arm cuff is one of the most common clinical measurements. Accuracy of measurements is paramount to ensure appropriate diagnosis and management of high blood pressure.

Inflation of the blood pressure cuff during measurements could induce a reactive response such that the blood pressure reading is inaccurate. However, studies addressing this hypothesis are limited. The aim of this project is to determine whether recordings of intra-arterial (invasive) blood pressure (at the aorta and brachial artery) measured during cardiac catheterisation exhibit a reactive response to upper arm cuff inflations.

The project comprises part of an existing research program in collaboration with the Royal Hobart Hospital cardiology department. Participation will involve data collection at both RHH and at the Menzies Institute clinical research facilities, in addition to analysis of the existing human physiological data. Prospective candidates are encouraged to contact BP research group supervisors for more detail or to discuss other options for related research activities.

Key Techniques: Blood pressure measurement (automated devices, in-clinic and 24-hour), arterial stiffness, patient questionnaires

Contact: dean.picone@utas.edu.au OR martin.schultz@utas.edu.au OR james.sharman@utas.edu.au

Project title: Growth, temporal trends, and clinical impact of cardiovascular medications in Australia

Supervisors: Dr Ricardo Fonseca and Prof. James Sharman

Project Description: Population growth, higher life expectancy, new technologies, and growth of burden of chronic diseases, have contributed to the increase of the health expenditure in Australia. Cardiovascular disease remains associated with the highest level of mortality, burden of illness, and health care spending, and has been a primary contributor to the rise in health costs.

This study aims to determine the growth and regional differences in the use of the cardiovascular medications, and its impact on cardiovascular outcomes. The project will involve collection and analysis of data from Medicare statistics, Australian Bureau of Statistics (ABS) and ABS Health Survey, and Australian Workforce data.

Aims:

1. To understand the associations between the use of cardiovascular medications and cardiovascular mortality.
2. To determine the temporal trends and regional variation in the utilisation of different cardiovascular medicines in Australia.

Key techniques: This study would suit a student who is interested in the use of medical services and its economic and clinical impact. The student will learn how to collect and analyse data using statistical methods.

Contact: ricardo.fonseca@utas.edu.au or james.sharman@utas.edu.au

Project title: Association between long-term blood lipid trajectories and subclinical cardiovascular outcomes in mid-adulthood

Supervisor: Dr Costan Magnussen, Marie-Jeanne Buscot

Project description: Abnormal levels of blood lipid (dyslipidemia), is a major risk for atherosclerosis, a leading cause of cardiovascular disease worldwide. To assess pre-clinical vascular change, the presence of increased carotid intima-media thickness (cIMT) and coronary artery calcification (CAC), can be detected non-invasively and reliably by ultrasound. These two commonly used markers of structural atherosclerosis strongly correlate with the severity of coronary atherosclerotic lesions and with future cardiovascular events. Adverse serum lipid profiles in young adulthood are associated with adult atherosclerosis, but the condition is known to begin in childhood: Cross-sectional and longitudinal studies have shown that exposure to atherogenic blood lipid profiles in early life was associated with the development of atherosclerosis.

However, limited data allows linking long-term circulating lipid profiles to later cardiovascular disease endpoints and it remains poorly understood whether distinct blood lipid trajectories from childhood to adulthood predict different levels of cIMT or CAC, or whether a specific serum lipid pattern is more strongly associated with pre-clinical atherosclerosis than others.

The aim of this project will be to identify distinct lifecourse patterns of change in serum lipid levels in a large multi-wave cohort study, and to examine whether they predict subclinical cardiovascular outcomes (cIMT and CAC), while adjusting for potential time-varying confounders.

Key techniques: Key techniques will include Latent Class Growth Mixture Modelling (LCGM) and Poisson/logistic regression. An interest for biostatistics is essential. You will learn to code analyses in S-PLUS through the R software interface. In addition to normal Hons requirements, students will be expected to draft a manuscript for submission to a peer reviewed journal.

Contact: cmagnuss@utas.edu.au, m.buscot@utas.edu.au

Project title: Predictors of smoking cessation in younger adults

Supervisor(s): Dr Jing Tian, Dr Seana Gall

Project description: Young adulthood is a peak time when smokers attempt to quit. Understanding the factors that motivate younger smokers to quit, and the methods they typically use, can inform public health strategies to promote quit attempts. This project will use data from over 2,000 people aged 31 to 41 years collected as part of the Childhood Determinants of Adult Health (CDAH) study, to examine these aspects of smoking cessation.

Key techniques: This project will involve analysis of observational data from an existing prospective cohort study. Participants provided information on their smoking history, including attempts to quit, motivations for quitting and methods used to quit. Students will learn principles of epidemiology and public health, and will become proficient in analysing quantitative data using Stata software (note that statistics/analytic experience is not a pre-requisite). This project will suit students with an interest in epidemiology, public health, psychology/health behaviour, and/or biostatistics.

Contact: J.Tian@utas.edu.au

MUSCULOSKELETAL HEALTH AND DISEASE THEME

Project title: The association between dietary patterns with sarcopenia related outcomes in older adults (tasoac study).

Supervisor(s): Dr Feitong Wu, Prof Tania Winzenberg, Professor Graeme Jones

Project description: Sarcopenia, or the decline of skeletal muscle tissue with age, is one of the most important causes of functional decline and loss of independence in older adults. However, the longitudinal association of dietary pattern with sarcopenia is unclear.

Participants are from the Tasmanian Older Adult Cohort study, which is a prospective, population-based study that primarily aimed at examining the causes and progression of osteoarthritis. Participants aged 50 years and older were selected using sex-stratified random sampling from the electoral roll in southern Tasmania (population 229,000). A total of 1099 adults (response rate = 57%) consented to participate. Using this unique cohort, this project will describe the longitudinal association between dietary patterns with sarcopenia related outcomes, including muscle mass, muscle strength and quality.

Key techniques: Students will learn how to perform statistical analysis, interpret study results, prepare conference abstracts and presentations and prepare a scientific manuscript for publication. Statistical supervision and training will be provided.

Contact: Feitong.Wu@utas.edu.au

Project title: The association between dietary patterns with joint replacement in older adults (tasoac study).

Supervisor(s): Prof Tania Winzenberg, Dr Feitong Wu, Professor Graeme Jones

Project description: Joint replacement (JR) is an effective treatment for severe osteoarthritis (OA), which can reduce pain and restore function. There is a concurrent increase in the incidence of OA and the rates of JR, leading to substantial health burden. Diet plays an important role in one's health. However, the relationship between dietary pattern (an indicator of the overall diet) and the risk of joint replacement is poorly understood. Participants are from the Tasmanian Older Adult Cohort study, which is a prospective, population-based study that primarily aimed at examining the causes and progression of osteoarthritis. Participants aged 50 years and older were selected using sex-stratified random sampling from the electoral roll in southern Tasmania (population 229,000). A total of 1099 adults (response rate = 57%) consented to participate. The incidence of primary (first-time) knee and hip joint replacement between 1 March 2002 and 21 September 2016 were determined by data linkage to the Australian Orthopaedic Association National Joint Replacement Registry. Using this unique cohort, this project will describe the longitudinal association between dietary patterns with the incidence of knee and hip joint replacement.

Key techniques: Students will learn how to perform statistical analysis, interpret study results, prepare conference abstracts and presentations and prepare a scientific manuscript for publication. Statistical supervision and training will be provided.

Contact: Feitong.Wu@utas.edu.au

Project title: Childhood and adulthood determinants of knee joint health assessed using cartilage and joint degradation biomarkers.

Supervisor(s): Dr Benny Antony, Prof. Changhai Ding

Project description: Osteoarthritis (OA) is the most common joint disorder in adults around the world. OA mainly affects older populations; however, it is likely that factors in early life contribute towards the

development of OA in later life. There are no disease modifying treatments available for OA. Therefore, identifying the risk factors including early life risk factors is important for designing prevention programs.

Biomarkers such as serum cartilage oligomeric matrix protein (COMP), serum hyaluronan and serum matrix metalloproteinase 3 (MMP-3), urinary type II collagen C-telopeptide (CTX-II) mainly represents markers of cartilage degradation and osteophyte formation. These biomarkers have good predictive value for diagnosing early OA and are elevated in population of patient with subclinical OA (even before MRI shows early structural pathologies). Assessing cartilage degradation biomarkers from samples collected in existing child or birth cohort studies will be an ideal cost-effective outcome measure for exploring the association between childhood fitness, physical activity and obesity and adult knee joint health.

The aim of this project is to explore the effect of physical activity, fitness and fatness measured from childhood to adulthood over 32 years on serum cartilage and joint degradation biomarkers and change in knee pain measured in adulthood.

Key techniques: Students will learn how to perform statistical analysis, interpret study results, prepare conference abstracts and presentations and prepare a scientific manuscript for publication.

Contact: Benny.EathakkattuAntony@utas.edu.au

Project title: A randomised trial of curcuma longa for treating symptoms and effusion-synovitis of knee osteoarthritis (curkoa trial)

Supervisor(s): Dr Benny Antony, Prof Graeme Jones

Project description: Osteoarthritis is a common joint disorder for which there is no cure. Inflammation of the joint lining (synovitis and excess joint fluid) is now recognised as a key part of osteoarthritis that predicts the progression of the disease including total joint replacement. Curcuma longa (commonly known as the turmeric plant) has anti-inflammatory, cartilage and bone protective properties, and can potentially be used to treat osteoarthritis patients with an inflammatory form of osteoarthritis. Previous studies of Curcuma longa have been of dubious quality and did not select patients with knee swelling, which is a clinical indication of inflammation.

The aim of this study is to compare the efficacy of Curcuma longa vs. identical placebo to treat knee pain and excess joint fluid in 70 older adults with clinical knee osteoarthritis, significant knee pain and local inflammation (effusion) on MRI using a randomised, double-blind, placebo-controlled clinical trial over 12 weeks.

This will be the largest clinical trial of Curcuma longa and the first to investigate use in a targeted population using imaging outcomes of effusion-synovitis. If Curcuma longa can improve both symptoms and effusion-synovitis in osteoarthritis, it may slow OA progression. The proposed study represents an innovative approach to this and lends itself to easy implementation.

Key techniques: Students will learn how to perform statistical analysis, interpret study results, prepare conference abstracts and presentations and prepare a scientific manuscript for publication.

Contact: Benny.EathakkattuAntony@utas.edu.au

Project title: Do ligament and enthesis abnormalities predict pain?

Supervisor(s): Dr Laura Laslett, Dr Benny Antony

Project description: Knee pain is extremely common. One potential source of pain is abnormalities in ligaments and the point at which ligaments enter the bone (enthesis). There is little population-based data on these abnormalities, and even less in younger populations.

Key techniques: This project will involve viewing MRI scans to collect data on ligament abnormalities and using statistical techniques to investigate associations between these abnormalities and knee pain and disability. These scans will come from data that has already been collected on younger adults (20's and 30's).

Contact: Laura.Laslett@utas.edu.au

CANCER, GENETICS AND IMMUNOLOGY THEME

Project Title: Congenital Cataract

Supervisor(s): A/Prof Kathryn Burdon, Dr Jac Charlesworth, Dr Bennet McComish

Project Description: This inherited Mendelian disease affects children and can lead to lifelong visual impairment or blindness. Our research program aims to find the genetic variants that cause this disease. We are using whole exome and whole genome sequencing in families with the disease to identify segregating variants and testing the effects of mutations on gene function in model systems. An honours project could focus on the bioinformatic analysis of the genome data. Alternatively, a project could focus on functional testing of already identified variants to confirm their role.

Key Techniques: Bioinformatic analysis of high-throughput sequencing data including alignment, variant calling and analysis of structural variants; or molecular biology and cell culture techniques and zebrafish models (or a combination).

Contact: kathryn.burdon@utas.edu.au

Project Title: Keratoconus

Supervisor(s): A/Prof Kathryn Burdon, Dr Jac Charlesworth, Dr Bennet McComish

Project Description: This is a progressive disease of the cornea that affects young adults. It is a complex disease with a prevalence of around 1 in 2000. Our research program includes a genome-wide association study as well as sequencing in extended families and a population cohort. An honours project may focus on follow-up analysis of loci identified through our recent genome-wide association scan or and analysis of exome sequencing data. There are opportunities to focus on data analysis or on developing functional testing of identified variants in model systems.

Key Techniques: Bioinformatic and statistical analysis including fine mapping of association results and next-generation sequencing analysis; or molecular biology and cell culture techniques.

Contact: kathryn.burdon@utas.edu.au

Project Title: Diabetic retinopathy and macular edema

Supervisor(s): A/Prof Kathryn Burdon, Dr Jac Charlesworth, Dr Bennet McComish

Project Description: This group of diseases are complications of diabetes and are one of the most common causes of visual impairment in adults. Our research program is using genome-wide association analysis to identify risk loci for diabetic eye disease. We are also investigating the genetic and clinical risk factors that determine response to treatment. An honours project would involve continuing to recruit patients undergoing intraocular anti-VEGF injections for the treatment of macular edema and undertaking analysis of up to 2 years of follow-up data to determine the factors that predict treatment response, including genetic risk factors. This project would suit students with an interest in clinical research.

Key Techniques: Patient recruitment and data collection, SNP genotyping, statistics

Contact: kathryn.burdon@utas.edu.au

Project Title: Short tandem repeats in multiple sclerosis

Supervisor(s): Dr Bennet McComish, Dr Jac Charlesworth, A/Prof Kathryn Burdon

Project Description: Multiple sclerosis is a complex disease of the central nervous system that can interfere with the transmission of nerve impulses, and has a strong genetic component. We are currently investigating the involvement of short tandem repeat (STR) sequences in the disease. STRs are highly polymorphic variants that are ubiquitous in the human genome, and specific STR mutations are known to be involved in a number of other genetic diseases, including several neurological diseases with motor involvement. The project involves analysis of STR loci with prior evidence for involvement, and integration of novel data sources such as long-read sequencing and bioinformatics methods to more accurately characterise these repeats.

Key Techniques: Molecular biology techniques including STR genotyping; bioinformatic analysis of high-throughput and long-read sequencing data.

Contact: bennet.mccomish@utas.edu.au

Project title: Identification of devil facial tumour-associated antigens for vaccine development

Supervisor(s): Dr Andy Flies, Dr Bruce Lyons, Dr Amanda Patchett

Project description: The Tasmanian devil facial tumour (DFT) disease has been the primary driver for an 85% decline in wild devils. Recently a second type of transmissible tumour was discovered in wild devils and this second devil facial tumour (DFT2) thus far has proven to be 100% fatal. These two transmissible tumours offer a unique opportunity to learn how tumours avoid being killed by the immune system, and the knowledge we acquire from studying these transmissible tumours could help us to understand cancer and transplant rejection in other species, including humans. Efforts to develop a DFT vaccine have made steady progress, but have been hampered by the limited tools available for studying the devil immune system². The goal of this project will be to use recombinant antibody techniques to identify tumour-associated antigens that can be used for a DFT disease vaccine. Successful completion of the project will result in a better understanding of how cancer evades immune defences and will shed light on potential vaccine and immunotherapy pathways for the DFT diseases.

Key techniques: polymerase chain reaction (PCR), overlap-extension PCR, DNA purification, plasmid DNA construction, Gibson assembly cloning, bacterial transformation, DNA sequencing, cell culture, mammalian cell transfection, analysis of receptor-ligand interactions, flow cytometry, immunofluorescence.

Contact: andy.flies@utas.edu.au

Project title: Rapid de novo antibody generation using phage-assisted continuous evolution (PACE)

Supervisor(s): Dr Andy Flies, Prof Alex Hewitt

Project description: Development of tools such as monoclonal antibodies to study the immune system can be time consuming, costly, and technically challenging. Recently, a technique called phage-assisted continuous evolution (PACE) was developed to harness the rapid evolution of bacteriophages to produce novel biomolecules. We will use the PACE system to produce single-domain antibodies (sdAb, aka Nanobodies®). sdAbs are derived from the variable coding region of heavy-chain only antibodies from the camelid family (e.g. camels, llamas, alpaca). The initial aim is to reproduce a published sdAb that targets a key immune molecule to demonstrate our capacity to make sdAbs. The second aim is to produce a phage library containing heavy chain only variable regions. We can then allow the phages to compete for binding to target antigens and allow evolution to produce a high-affinity sdAb in a few weeks, as opposed to traditional monoclonal antibody methods that take 2-6 months to produce. The third and major aim of this project is to produce sdAbs that bind to specific isoforms of key immune molecules.

Key techniques: overlap-extension PCR, plasmid DNA construction, Gibson assembly cloning, DNA sequencing, phage-assisted continuous evolution (PACE), recombinant antibody production, flow cytometry.

Contact: andy.flies@utas.edu.au

Scholarships

Students studying honours at the College of Health and Medicine are eligible for a range of scholarships. Administered by the Scholarships Office, honours students may be eligible for scholarships awarded on the basis of academic achievement and/or financial need.

Many of these scholarships are made possible by generous donations from Tasmanian businesses and individuals. Scholarships recipients may be encouraged to engage with the donors throughout the period of support, which has proven in the past to be a great way to provide direct support and feedback for both students and donors.

Further information on the availability, eligibility and how to apply is provided at the [Scholarships and Bursaries](#) website.

A selection of the scholarships on offer include:

Medical Science Precinct Honours Scholarship (\$5000)

School of Medicine

Cancer Council Tasmania Evelyn Pederson Honours Scholarship (\$10000)

Dr Les Wescombe Honours Scholarship in Cystic Fibrosis (\$5000/\$10000)

Launceston Clinical School GP Honours Scholarship (\$10000)

Others pending

Menzies Institute for Medical Research

Diagnostic Service Honours Scholarship for Medical Research (\$5000)

Doctors Tasmania Scholarship in Primary Care Research (\$5000)

Heart Foundation / Menzies Institute for Medical Research Honours Scholarship (\$10000)

Moonah Navy Club Honours Scholarship in Medical Research (\$5000)

Tasmania Police Charity Trust Scholarship in Medical Research (\$5000)

Wicking Dementia Research and Education Centre

Wicking Centre Health Services Honours Scholarship in Dementia Care (\$5000)

Wicking Centre Neuroscience Honours Scholarship in Dementia Research (\$5000)

George Huizing Scholarship in Motor Neuron Disease/Frontotemporal Dementia Research (\$5000)

Rhonda Ewart Honours Scholarship in Dementia Care (\$5000)