WESTERN SYDNEY UNIVERSITY

School of Medicine

Summer Scholarship Research Program 2021

Project Lists

Project 1: Slicing out microRNA components of your meal

Supervisor(s): Anand Hardikar - a.hardikar@westernsydney.edu.au
Principal Supervisor

Mugdha Joglekar - m.joglekar@westernsydney.edu.au
Second Supervisor

Project Description

We and others have demonstrated that non-coding RNA molecules (such as microRNAs) are important for normal human physiology. Intriguingly, microRNAs, which were first identified in plants (and present in genomes of every farm animal) are being consumed as food. These exogenous microRNAs enter our bodies via our diet and some of these exogenous RNAs are known to retain bioactivity even after their passage through the stomach. Several miRNAs may reach the intestines and exert a regulatory effect on gut cells. Through this study, an engaging student will have the possibility to embark on a novel/newly emerging aspect of obesity research. The project will specifically involve analysing microRNAs from food components in obesogenic ("cafeteria diets") that have been shown to cause obesity in mice. Assessment of microRNAs using real-time PCR will be compared with those from normal diets and correlated to physiological measurements (oral glucose tolerance, fasting glucose/insulin) and changes in other biochemical and molecular measurements in normal vs obese mice. This project will highlight if xenomiRs that we consume through our foods influence glucose-insulin metabolism.

Project Aims

This project aims to understand:

1. If microRNAs within obesogenic diets are different from those in healthy diets
2. The proportion of dietary microRNAs that are successfully retained through the stomach.
3. Molecular pathways targeted by the identified microRNAs and their relevance to the development of obesity and diabetes.

Project Methods

The selected candidates will be trained in molecular biology techniques and will be trained to profile gene expression changes, microRNA profiles and DNA/RNA technologies. At the end of their training, they should expect to be skilled in understanding and carrying out several basic and at least 1-2 skilled procedures that are used in molecular biomarker analysis. They will also be trained in data analytical tools (including using R software, excel and prism) to perform statistical analysis. This project will provide the opportunity to gain significant expertise in molecular and data analytical techniques.

Opportunity for Skill Development

This project will provide an opportunity to learn molecular biology techniques and acquire cell biology skills. Students will learn about the basics of PCR and TaqMan chemistry for real time profiling of PCR. They will get to use different statistical analyses. Apart from their own experimentation and results, the selected candidate will have the opportunity to discuss research articles through weekly journal club, review and analyse data through weekly data meetings receive guidance and support to complete their final report as well as contribute to any scholarly publications that they could help produce through their work.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No specific prerequisites.

Project 2: Uptake of oral glucose tolerance testing for gestational diabetes during the 2020 COVID-19 first wave

Supervisor(s): David Simmons - Da.Simmons@westernsydney.edu.au
Principal Supervisor

Jincy Immanuel - J.Varghese@westernsydney.edu.au
Second Supervisor

Project Description

Our research team have an NHMRC grant (APP1104231) to conduct a multicentre randomized controlled trial on treatment of booking gestational diabetes mellitus (GDM) (Trial registration: ACTRN12616000924459; ethics approved by the South Western Sydney Local Health District Ethics committee (reference 15/LPOOL/551). Recruitment for the study has been ongoing since May 2017. The trial involves pregnant women with risk factors for diabetes to undergo an oral glucose tolerance test (OGTT) before 20 weeks of gestation and a repeat OGTT at 24–28 weeks' gestation if early GTT is negative or the positive results are randomly assigned to a deferred treatment group. Although a 2-hour OGTT is the gold standard method for diagnosing GDM, during the COVID-19 pandemic the guidelines for GDM diagnosis were temporarily modified according to social distancing advice to reduce the risk of exposure associated with laboratory visits/contact time. For laboratories that are unable to comply with the social distancing rules, the 2-hour OGTT was replaced with the following:

i. Offer HbA1c and/or random plasma glucose testing early in pregnancy to women with risk factors for GDM
ii. No early testing for women with previous GDM but consider them for GDM management and home blood glucose monitoring starting at 24–28 weeks' gestation
iii. Fasting blood glucose testing for all women at 24–28 weeks and proceed to OGTT only if fasting glucose is between 4.7 and 5.0 mmol/L

Although the trial recruitment was temporarily suspended during the COVID-19 pandemic, the new changes in guidelines affected the uptake of the 24–28-week OGTT among women recruited prior to the pandemic. It is currently unknown whether these women have undergone alternative testing or no testing at all.

The objectives of this study are to investigate participants' uptake of 24–28-week OGTT during the COVID-19 lockdown period and to explore the factors that contributed to women's noncompliance with glucose testing.

Project Aims

To evaluate the impact of the 2020 COVID-19 lockdown on the uptake of OGTT for GDM.

Project Methods

The study cohort will be drawn from the participants enrolled in the Treatment of Booking Gestational diabetes Mellitus trial (n=3,300). Women who had completed the booking OGTT and were instructed to have a repeat GTT at 24–28 weeks during the period from May 2017 to August 2020 will be eligible. The following patients will be excluded: withdrawn, unblinded results at booking, and pregnancies ending in miscarriage, stillbirth, termination of pregnancy, or early induction of labour at 24 weeks. The uptake of 24–28-week GTT and frequencies of missed OGTT will be compared between before and after the COVID-19 first wave (May 2017 to February 2020 vs. March 2020 to August 2020). The uptake of the OGTT will be confirmed through medical record review and by accessing pathology lab database. Women with missing 24–28-week OGTT will be further followed up with a phone call/email/text message to explore the reasons associated for not undertaking an OGTT. A short questionnaire will be used to identify the reasons for the failure to complete the recommended OGTT/glucose testing.

Opportunity for Skill Development

The summer scholar is expected to gain skills in:

- Quantitative and qualitative data collection
- Descriptive statistics
- Qualitative data analysis
- Report and journal article writing
- Working as part of a wider research team

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Excel and Word. Students are also expected to have basic clinical knowledge of diabetes in pregnancy and preferably have an interest in research on diabetes in pregnancy.

Project 3: Effect of COVID-19 in the reported prevalence of GDM at Campbelltown Hospital

Supervisor(s): David Simmons - Da.Simmons@westernsydney.edu.au
Principal Supervisor

Jincy Immanuel - J.Varghese@westernsydney.edu.au
Second Supervisor

Project Description

Hyperglycaemia in pregnancy (HIP) is a growing epidemic, affecting one in 6 pregnancies worldwide. In Australia, 13% of live births are affected by HIP, of which 97% are caused by gestational diabetes mellitus (GDM). The adoption of the International Association of Diabetes and Pregnancy Study Groups criteria, along with change in demographics of the population, has significantly increased the prevalence of GDM in Australia. According to the recent South Western Sydney (SWS) diabetes monograph published by Western Sydney University, the prevalence of GDM in SWS has nearly tripled in the last decade from 2010 to 2018, from 9.9% to 26%, higher than the national average.

The diabetes in pregnancy clinic at Campbelltown Hospital provides care for women with hyperglycaemia before, during, and after pregnancy. As part of the continuous quality improvement initiative, a GDM audit has been set up in the diabetes in pregnancy clinic and repeat GDM audits are now part of the clinic practice. The audit provides an opportunity to evaluate a particular change in clinical practice and re-establish goals of GDM care. During the 2020 COVID-19 pandemic the guidelines for GDM diagnosis were temporarily modified according to social distancing recommendations in order to reduce the risk of exposure associated with laboratory visits/contact time, For laboratories that are unable to comply with the social distancing rules, the 2-hour OGTT was replaced with the following:

i. Offer HbA1c and/or random plasma glucose testing early in pregnancy to women with risk factors for GDM
ii. No early testing for women with previous GDM but consider them for GDM management and home blood glucose monitoring starting at 24–28 weeks gestation
iii. Fasting blood glucose testing for all women at 24–28 weeks and proceed to OGTT only if fasting glucose is between 4.7 and 5.0 mmol/L

This alternative screening protocol raised concern that many GDM cases may go undiagnosed, causing potential lifelong consequences to both the mothers and the babies. As part of an ongoing audit, this project is intended to investigate the change in GDM prevalence at Campbelltown Hospital during the COVID-19 pandemic compared with years before COVID-19 and to evaluate the effect of the COVID-19 lockdown on GDM treatment and pregnancy outcomes.

Project Aims

To compare the prevalence of GDM in Campbelltown Hospital during the 2020 COVID-19 pandemic with previous years and to assess the change in GDM management and pregnancy outcomes during the COVID-19 lockdown.

Project Methods

A retrospective audit will be conducted on all GDM-diagnosed women who attended the antenatal diabetes clinic at Campbelltown Hospital between 2020 and 2021. Data will be collected using a structured data collection form that includes a review of women's obstetric history, laboratory results, hyperglycaemia management, and pregnancy outcomes. All women diagnosed with GDM during the COVID-19 pandemic (March 2020 to February 2021) and reference period (previous years) will be included in the analysis. The prevalence of GDM and the pregnancy outcomes between pre-COVID and COVID lockdown periods will be compared.

Opportunity for Skill Development

The summer scholar is expected to gain skills in:

- Quantitative data collection
- Descriptive statistics
- Report and journal article writing
- Working as part of a wider research team

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Excel and Word. Students are also expected to have basic clinical knowledge of diabetes in pregnancy and preferably have an interest in research on diabetes in pregnancy.

Project 4: Evaluation of the performance of blood glucose meters during pregnancy

Supervisor(s): David Simmons - Da.Simmons@westernsydney.edu.au
Principal Supervisor

Jincy Immanuel - J.Varghese@westernsydney.edu.au
Second Supervisor

Project Description

Many regulatory-approved blood glucose meters do not meet quality specifications in real-life situations, especially during pregnancy, when meter accuracy can be particularly influenced by a change in the hematocrit level. The majority of meters display a positive bias in the pregnant population. Few published studies have researched this topic in the last 10 years in spite of changes in meter and strip technology. This study will evaluate the performance of five commercially available blood glucose meters in pregnant women, with a primary focus on the effect of low hematocrit on the glucose meter reading. One hundred and three pregnant women with any type of hyperglycemia (i.e., type 1 diabetes, type 2 diabetes, or gestational diabetes) will be recruited to measure glucose across the physiological range of values. Participants will be aged above 18 years and will attend the hospital pregnancy clinic. The consenting women will undergo venous laboratory and capillary meter blood sampling. Venous blood will be collected for plasma glucose measurement, hematocrit, HbA1c and iron studies, and finger sticks will be used simultaneously for glucose meter measurements. In addition to capillary blood, venous blood will also be used to study the accuracy of its usage with glucose meters. Other relevant clinical information will be assessed using medical records. The meter values of both capillary and venous blood samples will be compared against the concurrent laboratory glucose values.

Project Aims

The specific objectives of the study are

i. To determine the accuracy of blood glucose meters by comparing meter values against the concurrent laboratory plasma results;
ii. To determine the effects of hematocrit changes on the accuracy of blood glucose meters;
iii. To assess whether the glucose meters meet the recent ISO 15197:2013 quality specifications for analytical and clinical accuracies; and
iv. To identify factors (e.g., room temperature, serum iron level) that can influence the accuracy of glucose meters in pregnancy.

Project Methods

Consecutive pregnant women after 12 weeks' gestation will be recruited from the Diabetes in Pregnancy clinic at Campbelltown Hospital. After providing informed consent, eligible women will complete questionnaires and undergo contemporaneous venous and capillary blood sampling. Venous blood will be collected for laboratory plasma glucose measurement, hematocrit, HbA1c and iron studies. Capillary blood glucose from the same sample will be measured by 5 glucose meter systems in random order using an electronic randomizer. Other relevant clinical information will be assessed using medical records.

The student will assist the study team with recruitment and data collection. The specific role responsibilities include explaining the study to potential participants, obtaining informed consent, and assisting participants with completing study questionnaires. The student will also collect venous blood samples, perform finger stick sampling, and assist the study team in collecting patient information from medical records.

Opportunity for Skill Development

The summer scholar is expected to gain skills in:

- Study recruitment
- Quantitative data collection
- Venous and capillary blood sampling
- Working as part of a wider research team

Students are required to have the following skills/meet the following pre-requisite(s) to apply

The student is expected to have basic knowledge and skills in venous and capillary blood sampling and specimen handling. The student is also expected to have basic clinical knowledge of infection control guidelines, diabetes in pregnancy and preferably have an interest in research on diabetes in pregnancy.

Project 5: Relationship between Obesity and Food Consumption: Comparative analysis of the Crossroads and Crossroads II studies in Victoria

Supervisor(s): David Simmons - Da.Simmons@westernsydney.edu.au
Principal Supervisor

Uchechukwu Levi Osuagwu
Second Supervisor - L.Osuagwu@westernsydney.edu.au

Project Description

Diabetes prevalence is increasing globally every year, with one in 11 adults currently suffering from the disease. With diabetes complications accounting for 1.5 million deaths every year globally and a projected prevalence to rise by more than 66% by 2045 following the current trend, it is becoming increasingly important to urgently address the causes. In Australia, it was estimated that 1.2 million people were living with this disease in 2018, based upon self- reported data. As this burden of disease grows, the cost to the nations' health care system, as well as to the individuals affected, increases significantly. In 2016, $2.7 billion of Australian health care spending was attributed to Diabetes alone. There are many factors that significantly increase the risk of Type 2 Diabetes occurring, these often stemming from diet and lifestyle choices. However, it is believed that in rural or remote areas, the incidence of metabolic disorders is higher due to the accessibility of health care, aging populations and poor health behaviours. This often goes hand in hand with low socio-economic status.

Victoria, in the south-eastern corner of Australia, is currently home to 6.66 million people and is the second most densely populated state in Australia. In 2018 the Australian Bureau of Statistics reported that 31.8% of Victorian residents were obese, citing a steady growth in combined overweight and obesity prevalence of the state from 63.3% in 2015 to 68.3% in 2018, with residents of disadvantaged areas being disproportionately affected. The Goulburn Valley, which encompasses the Shepparton region of rural Victoria, is an economically and culturally diverse community with a population of 129,971 people recorded in the 2016 Census. Located north of Melbourne, the region is rich in primary industries with 13% of its workforce in farming and agriculture, 32% of which are dairy cattle farms. In 2001 the region was identified as having a gross shortage of medical and health professionals, which was believed to be a contributing factor to a higher-than-average standardised mortality rate for the state of Victoria.

The Crossroads undiagnosed disease study (CUDS), established in 2001, was designed to surface much needed data in relation to general health, diabetes prevalence and the health services utilization. The study collated data from a survey which was sent to 10,000 households within the Goulburn Valley region of Victoria. The region chosen for its poor health outcomes and limited health resources at the time. The Crossroads II study was initiated in 2017 and followed the same protocol as CUDS as a 15 year follow up nested study. The data set obtained was used to identify health trends, monitor utilized health resources and track diabetes prevalence.

Since the publication of the Crossroads studies, its data has served as the foundation to many new studies hypothesizing the causes and contributing factors of the high diabetes prevalence in the rural community. One study of which investigated how the availability of takeaway and restaurant options impacted on the prevalence of adult obesity in rural Victorian communities. The results of the study returned no relationship between obesity prevalence and takeaway consumption in this setting. This suggests that the dietary behaviours of the community that are influencing obesity prevalence, and its subsequent health complications, are existing in food consumption within the home.

Project Aims

The study aims to:

1. Investigate the relationship between obesity and food consumption against the Crossroads studies data in rural Victoria.
2. Using a comparative analysis of the 15 years between the two data sets, the study will explore emerging trends that the Crossroads studies highlight to determine any possible relationship between the choices in food consumption and obesity prevalence within the community.

Project Methods

This is a retrospective study involving the use of two datasets obtained 15 years apart. Student will be expected to study the data, understand basic statistics and with help from our team analyse the data set to produce a report for publication

Opportunity for Skill Development

The student will have the opportunity to learn and develop a number of research skills including:

- Data cleaning and quantitative analysis skills
- Teamwork and collaboration skills
- Report and journal article writing
- Literature review skills

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Microsoft office and Excel and preferably have an interest in diabetes. Experience using any statistical software is important. Students should have excellent writing skills to be able to produce a publishable report.

Project 6: Diabetes Monograph from Gestational Diabetes Mellitus workshop – Focus on Tongan GDM Taskforce

Supervisor(s): David Simmons - Da.Simmons@westernsydney.edu.au
Principal Supervisor

Uchechukwu Levi Osuagwu
Second Supervisor - L.Osuagwu@westernsydney.edu.au

Project Description

Non-Communicable Diseases including diabetes have been the leading cause of mortality and morbidity in Tonga for many years. Over the past decade, diabetes has remained a significant and growing global public health issue, accounting for an estimated 1.5 million deaths and 925.8 disability-adjusted life years (DALYs) per 100,000 population in 2015 1-3. In Tonga, Diabetes and obesity are major public health problems, predicting a substantial risk from hyperglycaemia in pregnancy (HIP) including gestational diabetes (GDM) and diabetes in pregnancy (DIP). Tonga provides free antenatal care, which is attended by 98% of women. The Ministry of Health in partnership with Western Sydney University introduced systematic screening for GDM in 2016 across the main island of Tongatapu and very recently into the outer islands funding by the International diabetes Federation. Prior to this time, a lot of resources have been spent fighting the negative impacts from a continuum of care perspective, ranging from actions at the: health in all policy level, prevention, curative, rehabilitation and at the palliative care level. Through the GDM taskforce, Guidelines for Management of Diabetes in Pregnancy in Tonga was provided based on sound scientific evidence and has wide scope of focus, with the potential to significantly benefit not only the mother with Gestational Diabetes, but other members of the family too.

Diabetes is associated with so many behavioural risk factors that lead to obesity and susceptibility to develop diabetes. When diabetes affects a vulnerable group such as a pregnant mother, it poses a formidable medical challenge since clinical management is a complex exercise that needs to be managed and overseen by expert medical personnel. It involves effective collaborations between various clinical and public health disciplines that is based on clear understanding of how small risks, if not managed well, incrementally add up to major disability or even loss of life, to a mother or baby. This will lead to long lasting, devastating impacts, on a young family's future.

As part of the programme, Western Sydney University Researchers led by Prof David Simmons provided upskill of Tongan Health care workers through annual workshop organised by the GDM taskforce. These workshops, which ran for three days per year, provided an opportunity to upskill workers, assess progress of the universal screening and ensure that management follows international guidelines. Prior to COVID-19, there has been two workshops (2018 and 2019) and that for 2020 was postponed due to the pandemic. Following each workshop, participant feedbacks were collected and analysed, discussions between the local HCPs and the visiting WSU team members were documented, and through that, a final report was produced. The report outlines the consensus and actions to be taken. In addition to the feedback, diabetes knowledge testing was also conducted in 2019 workshop.

Project Aims

The aim of this project is to produce a monograph from the GDM training workshop reports of 2018 and 2019 showing the outcomes of training and process of implementation of the universal screening for GDM in Tonga. In addition, the project will assess the level of diabetes knowledge of the Tongan health care practitioners (HCPs).

1. To describe the process and outcomes from Staff GDM training workshops in Tonga
2. To describe the baseline diabetes knowledge of attending health care practitioners (HCPs) in Tonga
3. To produce the first diabetes monograph that will inform government of the outcome of the GDM taskforce workshops over 2 years

Project Methods

Student will conduct a literature review including relevant articles on gestational diabetes across the Pacific region as well as knowledge of diabetes among health care workers working in the pacific region. The report produced for submission to World Diabetes Federation will be converted into a monograph during the study period to highlight the outcomes of the workshops held over the last 3 years. The report will also include additional information obtained from literature review showing the nature of screening for GDM in the Pacific region. For the monograph, the student will work closely with the communication team at Western for a design of monograph.

For assessing the diabetes knowledge level of health care workers in Tonga, student will work on data already collected during the workshops. The change in knowlwdge level before and after the 2019 workshop will also be analysed. This is a retrospective study involving the use of datasets. Student will be expected to study the data, understand basic statistics and with help from our team analyse the data set to produce a report for publication

Opportunity for Skill Development

The student will have the opportunity to learn and develop a number of research skills including:

- Data entry and quantitative analysis skills
- Teamwork and collaboration skills
- Report and journal article writing
- Literature review skills

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students are expected to have basic knowledge in use of Microsoft office and Excel and preferably have an interest in diabetes. Experience using any statistical software is an advantage. Students should have excellent writing skills to be able to produce a publishable report.

Project 7: Neuroticism, self-esteem, and fear of negative evaluation in eating disorders

Supervisor(s): Katarina Prnjak - katarinaprnjak@gmail.com
Principal Supervisor

Deborah Mitchison - deborah.mitchison@westernsydney.edu.au
Second Supervisor

Project Description

Eating disorders are serious illnesses that affect individuals at the neurobiological, cognitive, emotional, physical and social level, and have elevated mortality rates. Early eating disorders identification and intervention increase likelihood for better outcomes in the treatment. Research shows that more than 90% of individuals with an eating disorder also have at least one co-occurring psychiatric disorder. Eating disorders are often comorbid with social anxiety disorder, and fear of negative evaluation has been identified as a common vulnerability for both disorders. Fear of negative evaluation has been conceptualized as anxiety around negative evaluations by others, and in eating disorders this fear may be centred around one's weight and/or shape. Indeed, studies show that fear of negative evaluation is prospectively associated with eating disorder symptoms, body dissatisfaction and feelings of fatness. Moreover, low self-esteem and high neuroticism are also implicated into eating disorder psychopathology. For instance, low self-esteem was shown to be prospectively linked to body dissatisfaction, and to mediate a relationship between interpersonal problems and eating disorder symptoms. In addition, increase in self-esteem (but not in neuroticism) was found among those with better treatment outcomes. Collectively, existing work in the field of eating disorders suggest that each of these constructs play an important role in eating disorder development, but it isn't clear what is the relative contribution of fear of negative evaluation alongside self-esteem and neuroticism as no research has examined their associations simultaneously.

Project Aims

- To inspect associations between fear of negative evaluation, self-esteem, and neuroticism and eating disorder symptoms in female and male university students
- To determine whether fear of negative evaluation has a unique contribution to meeting criteria for an eating disorder, over and above self-esteem and neuroticism

Project Methods

This research question can be answered with data collected online, in a survey format, among Australian university students. This is planned for July and August 2021. This data collection is part of a larger project that aims to inspect preliminary psychometric properties of the new body image questionnaire. The student will not directly participate in data collection, but they will be involved in preparation of dataset for this specific study, in planning and running statistical analyses, and subsequently in reporting on results.

Opportunity for Skill Development

The student will acquire knowledge about eating disorders and other important concepts in the field of clinical psychology as well as understanding how specific sociodemographic and individual characteristics (and their interaction) represent a vulnerability for eating disorder development. The student will also gain insight into how data in this field can be described, analysed and reported, as well as experience in using statistical software for data restructuring, running statistical analyses, and creating tables and figures as part of the final report. The student will obtain experience in interpreting research findings that will arise from this study, present them in scientifically sound and understandable way for a wider audience, and be able to think about how such findings may have implications for individuals at risk for an eating disorder, and broader community. Additionally, if interested in obtaining experience in publishing a manuscript in a scientific journal, the student will also be guided and provided support along this way (from initial writing of a manuscript until its publication).

Students are required to have the following skills/meet the following pre-requisite(s) to apply

BSc or MSc in health-related discipline (psychology, medicine, public health) is required. Knowledge about elementary statistical concepts and methods is required, as well as basic knowledge and/or experience with regression-type data analyses. Familiarity with some statistical software (SPSS, R, Mplus) is beneficial, but not required provided that the student has sufficient time and interest to learn about this. Familiarity with eating disorder literature is considered beneficial, but not necessary.

Project 8: Pilot program for cultural strength in Aboriginal, Maori, and Pasifica children

Supervisor(s): Aunty Kerrie Doyle - Auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Michelle Foster
Second Supervisor, External Partnership, **Ngaramura Indigenous Corporation**

Project Description

Ngaramura is an Indigenous Corporation consisting of 9 Indigenous board members forming, in 2021. Ngaramura was founded on the vision to improve the outcomes for Aboriginal, Maori and Pacific Islander children, families, and communities initially in the Southwest Sydney area. Ngaramura are passionate in developing a culturally strong, therapeutic program for Aboriginal primary school students in years 5, 6 and the first year of high school. These 3 years have specifically been selected to focus on all aspects of Indigenous wellbeing as an early intervention initiative towards adolescence.

Project Aims

Project outcomes will encompass;

- Building and/or strengthen healthy minds, bodies and spirit
- Develop culturally appropriate strategies to heal and thrive
- Ensure culturally strong relationships are formed with culturally appropriate people and services
- Build on strengths to promote strong identities

The first step will be a review of current cultural strength-based programs and strategies aimed at creating an evidenced based program. If you are interested in kids in out of home care, then please consider this program.

Project Methods

Desk-top research; grey literature; possible discussion with other services (as provided by Prof Doyle) to create evidence-based interventions designed to inform programs for implementation in schools.

Opportunity for Skill Development

Student will gain experience in working with Indigenous people and experts in the field of youth at risk of being placed in out of home care. I will teach excel skills, and other skills as appropriate.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No predetermined skills are required – we can upskill the student/s, but they need to be genuinely interested in working with Indigenous people, Indigenous communities, and be able to take coaching from the experts we have facilitating their learning. Student must sign confidentiality agreements as required by industry partner.

Project 9: Reviewing best practice in Drug & Alcohol services for Indigenous clients

Supervisor(s): Aunty Kerrie Doyle - Auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Prakash Poudel
Second Supervisor, External Partner, **Drug and Alcohol Department SWSLHD**

Brahm Marjadi - b.marjadi@westernsydney.edu.au
Third Supervisor

Project Description

The Translational Health Research Institute (THRI) is partnering with South West Sydney Local Health District (SWSLHD) Drugs & Alcohol Services to review the engagement with and service delivery to Aboriginal and Torres Strait Islander communities. This summer scholarship project will review the literature on best practices in Drug & Alcohol services for Indigenous clients in Australia and globally. The academic literature will be reviewed using a scoping approach, focusing on the context and evidence of success. The outcome of this review will directly inform the needs and gaps analysis of the larger project and forms the basis for recommendations for improvement. Throughout the project, the scholarship recipient will be jointly supervised by Western academics and SWSLHD expert through regular meetings. The recipient will learn about the context of SWSLHD Drugs & Alcohol Services in which the scoping review's findings will be used, thus connecting the desktop work with practical applications. In return, the joint THRI-SWSLHD team will obtain the summary of relevant literature which will inform the direction of the larger project.

Project Aims

The project will dovetail into a larger project between WSU and the LHD. The summer scholar will be tasked with a literature review of other D&A services with Indigenous clients to determine best practice in these services.

Project Methods

Desk-top research; grey literature; possible discussion with other services (as provided by Prof Doyle)

Opportunity for Skill Development

Student will gain experience in working with Indigenous people and experts in the field of Drug and Alcohol. Will teach excel skills, and other skills as appropriate.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No predetermined skills are required – we can upskill the student/s, but they need to be genuinely interested in working with Indigenous people, Indigenous communities, and be able to take coaching from the experts we have facilitating their learning.

Project 10: Caring for Community: measuring the capacity for carers in Indigenous families

Supervisor(s): Aunty Kerrie Doyle - Auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Robert Doyle - Rob.doyle@westernsydney.edu.au
Second Supervisor

Project Description

There continues to be an urgent unmet need to measure, support, and acknowledge the important role care givers play within Indigenous communities. Access to aged care services in Australia is determined by need, rather than age, however, Indigenous people are under-represented in aged care services. We will investigate the level of unmet need in Indigenous families in Macarthur, and if possible, the Indigenous communities in Bathurst.

Project Aims

This project aims to identify and measure the level of caring responsibilities in Indigenous communities.

Project Methods

This is a qualitative project based on the Yerin Dilly Bag indigenist framework for Interviewing Indigenous people about the amount of caring for family members that occurs in Indigenous communities. We aim to gather evidence to demonstrate unmet needs in communities that will translate into policies for increasing support mechanisms to keep Indigenous communities safe at home.

Opportunity for Skill Development

Student will gain experience in working with Indigenous people and experts in the field of indigenist research. I will teach skills as appropriate.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No predetermined skills are required – we can upskill the student/s, but they need to be genuinely interested in working with Indigenous people, Indigenous communities, and be able to take coaching from the experts we have facilitating their learning.

Project 11: Validation of cir-miRNA candidate biomarkers for locally advanced rectal cancer

Supervisor(s): Kevin Spring - k.spring@westernsydney.edu.au
Principal Supervisor

Stephanie Lim - stephanie.lim@health.nsw.gov.au
Second Supervisor

Project Description

Background:

In colorectal cancer, multiple studies have addressed the predictive and prognostic value of circulating tumour cells (CTCs) in the early as well as in the metastatic setting. There is much less work focusing on locally advanced rectal cancers treated with trimodality therapy, i.e. concurrent chemoradiotherapy, surgery followed by adjuvant chemotherapy. The majority of studies in this area have focused on circulating free tumour DNA/RNA, the presence of which has been found to correlate with inferior outcomes. MicroRNA (miRNA) are small non-coding RNAs which may also have prognostic and predictive value as they are involved in rectal cancer pathogenesis. The rectal cancer microRNAome differs from colon cancer and miRNAs has been reported to be important in determination of radiosensitivity of rectal cancers to chemoradiotherapy in biopsy specimens and also in surgical specimens. Thus, it is clear miRNAs could act as a potential biomarker of response to treatment in locally advanced rectal cancer.

Rationale for study:

The dynamic change in circulating miRNA (cir-miRNA) profile of locally advanced rectal cancer, across the course of treatment and including multiple different specimen types (tumour, serum, CTC) has not been described. To establish cir-miRNA as a reliable predictive and prognostic marker would allow us to tailor and modify treatments in locally advanced rectal cancers depending on response to trimodality therapy, which follows a standard protocol. Rectal cancers are recognised as being heterogeneous and differing in their molecular biology and aggressiveness, and hence some cancers will be over-treated, and some will not be adequately treated with the current regimen.

Project Aims

The overall aim of the rectal cancer study is to investigate the miRNA expression pattern and their predictive and prognostic value in locally advanced rectal cancer treated with neoadjuvant chemoradiotherapy, surgery and adjuvant chemotherapy.

The summer vacation specific project aims are to:

1. Review the miRNA profiling previous performed and select the most promising candidate that display differential expression.
2. Perform independent validation of individual miRNA taken across treatment.
3. Develop a miRNA signature and assess it predictive and prognostic value.

Project Methods

The methodology used for this project will involve the extraction of miRNA from up to 332 stored samples from 52 patient samples and 20 healthy controls. Once extracted these samples will be prepared for single well quantitative RT-PCR, for the relative expression analysis of approximately 10 identified cir-miRNA. Statistical analysis will be performed for the all candidates and assessed for differential expression.

Opportunity for Skill Development

This project will provide the student with a broad range of laboratory based molecular techniques, including patient sample handling, nucleic acid extraction and quantification, experimental design and preparation of assays and running of qRT-PCR reactions. They will also develop data analysis and statistical skills that will be needed to determine the differential expression and confirmation of selected miRNA expression.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

The candidate would preferably have some basic laboratory skills.

Project 12: Identifying synergistic drug combinations with c2 (a novel investigational drug) as a novel anticancer therapy

Supervisor(s): Kieran Scott - kieran.scott@westernsydney.edu.au
Principal Supervisor

Alex Hunter
Second Supervisor, External Partner, **Filamon Pty Ltd**

Shadma Fatima – s.fatima@westernsydney.edu.au
Third Supervisor

Project Description

Clinical, animal and cell-based studies provide evidence that omega-6 arachidonic acid (AA) pathway is activated and plays an important role in inflammation and tumorigenesis of prostate cancer (PCa). A secreted phospholipase A2, also known as hGIIA, is a key player in regulation of the AA lipid mediator pathway and plays an important role in production of number of pro-inflammatory metabolites. hGIIA function and its metabolic products are an important pharmacological target as a therapy for many inflammatory diseases and cancers. Identifying new strategies to target hGIIA can help for preventing or treating cancer. Currently, no potent and safe hGIIA inhibitor has been approved for clinical use for any indication. We have synthesized a novel anti-inflammatory drug which works by binding vimentin and inhibiting hGIIA function. Our novel experimental medicine (c2) was shown to be safe and orally absorbed in a world-first clinical trial in men with advanced prostate cancer (PLA001, CT-2017-CTN-04166-1). Our mouse xenograft data confirms that c2 significantly slows the growth of prostate tumours. We are now working towards identifying synergistic combinations of c2 with other drugs that are more potent than c2 alone. We know that vimentin is an important marker for various cancers, and we would like to test c2 with available vimentin inhibitors. The results may identify a novel highly potent anti-cancer therapy.

Project Aims

This project is aimed to identify and validate novel drugs which can work in combination with c2 via the hGIIA-vimentin axis as a potential therapy for treating resistant cancers.

Traditional de-novo drug design is a complex expensive process, and approximately takes 15 years and billions of dollars for a drug to reach to the patients. To reduce this lengthy procedure for compounds like c2, we propose to exploit contemporary systems-based computational drug repositioning—an emerging innovative strategy where existing clinically approved medicines are redeployed for new indications—to systematically test marketed drugs for their similarity to c2 on a number of levels. Our key focus is to find one, or a combination of, highly efficacious and potent c2-mechanism-based drugs, as a potential therapy for treating PCa. Briefly, a pharmacophore modelling method has been employed to guide the selection of drugs output from our high-throughput virtual screening. The shortlisted candidates will be screened robustly on PCa cell lines for their efficacy and potency. To determine the mechanism of action of the most potent drug combinations, changes in the gene expression patterns and lipid profiles of the cell lines/tumour tissues before and after the treatment will be analysed employing high throughput lipidomics and whole RNA transcriptomics. Furthermore, if this project is successful, the best two drugs will be used to check their potency on patient derived 3D tumoroids spheroids tissues or CTCs in subsequent studies.

Project Methods

The specific aims of the project are as follows

Aim 1. Identification of drugs which can function like c2 individually as well as can work synergistically with c2.

Hypothesis: Using pharmacophore modelling and literature search a group of lead drug candidates will be identified that can potentially work similar to and synergistically with c2 (via their ability to bind and block vimentin) and inhibit inflammatory and oncogenic signals. Outcome: The traditional lead selection process may be considerably shortened by selecting approved drugs with potential anti-inflammatory and anticancer properties.

Aim 2. Confirming the efficacy and potency of identified drugs to inhibit cancer cell proliferation

Hypothesis: That blocking hGIIA/vimentin protein-protein interaction is a major means to achieve regression of PCa cells. Outcome: Drugs identified from Aim 1 will be ranked and will be screen using our established in vitro drug protein interaction assay. Based on the ability to inhibit the hGIIA and vimentin interaction the individual drugs or drugs in combination with c2 will be assessed for inhibiting the growth of cancer cells in vitro and further tested for their in efficacy on 3D speroids. If time permits transcriptomic and lipidomic signatures will be identified for assessing their mechanism of action and their impact on cancer progression pathways.

Opportunity for Skill Development

The student will gain expertise in understanding of drug structure, functions and how to design assays essential to identify the mechanism of action of a drug. Particularly he/she will gain skills in Enzyme-Linked ImmunoSorbent Assay (ELISA) and understanding and handling of antibodies to detect the presence of specific biomolecules (i.e. peptides, proteins, and hormones) in a complex sample. Today, ELISA is used in many fields, including medical diagnostics, forensic science, and in quality control of foods thus can provide a skill which have wide applicability latter.

Cell culturing skills and cell proliferation assays are crucial for any life science-based research or experiments, this project will give the student a proficient-level capability in all the techniques required for making cell culture media and all the assays required to maintain and culture the cancer cells.

In addition, the student will be trained for writing scientific literature and reports, they will be closely looked after in the lab setting and will surely get a positive experience which may be beneficial for deciding their next steps in their career.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No specific prerequisites.

Project 13: Mechanism of dopamine release from dopaminergic amacrine cells in the retina

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

David Harman - d.harman@westernsydney.edu.au
Second Supervisor

Project Description

Dopamine is one of the most influential neuromodulators in the mammalian central nervous system (CNS). Pathologies involving its release and action underlie many disorders including Parkinson's disease, ADHD and schizophrenia. However, the mechanism that governs dopamine release is poorly understood. Dopaminergic amacrine cells (DACs) of the retina release dopamine in response to light stimulation. Over recent years, the electrical inputs to dopaminergic amacrine cells (DACs) have been defined in great detail, showing that all three photoreceptor classes: rods, cones and melanopsin-containing retinal ganglion cells (mRGCs), provide substantial input to these cells. Conversely however, measurement of dopamine release in response to light does not correlate with these results as mRGCs input alone does not drive dopamine release. Release of dopamine from midbrain neurons has recently been shown to display similar characteristics where spiking alone is not enough to explain the release of dopamine. This suggest that dopamine can be released from the process of these neurons independent of cell firing, a process that is not widely described in the CNS. The retina represents an ideal model to study the function of dopaminergic cells of the central nervous system (CNS) in general given the well-defined and accessible nature of the tissue. In this project we will examine directly the relationship between photoreceptor activation and dopamine release using ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS). Students will learn LC-MS techniques and analyse retinae for dopamine and other neuromodulators

Project Aims

- Construction of a standard curve to accurately measure dopamine and DOPAC in water.
- Measurement of dopamine/DOPAC in retinal samples by UHPLC-MS/MS

Project Methods

Ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS).

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, UHPLC-MS/MS and data analysis/statistics

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science and/or chemistry.

Project 14: Mechanism of adenosine release in the mammalian retina

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

David Harman - d.harman@westernsydney.edu.au
Second Supervisor

Project Description

Dopamine is one of the most influential neuromodulators in the mammalian central nervous system (CNS). Pathologies involving its release and action underlie many disorders including Parkinson's disease, ADHD and schizophrenia. Adenosine is a similar neuromodulator often has the opposite effects to dopamine, however, it is not understood how these two neuromodulators work together within the CNS. Dopamine has been shown to be released in the mammalian retina in response to light, whereas adenosine is thought to be released in response to dark. The retina represents an ideal model to study the function of dopamine and adenosine in the CNS in general given the well-defined and accessible nature of the tissue. In this project we will examine directly the relationship between photoreceptor activation and adenosine release using ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS). Students will learn LC-MS techniques and analyse retinae for dopamine and other neuromodulators

Project Aims

- Construction of a standard curve to accurately measure dopamine and DOPAC in water.
- Measurement of dopamine/DOPAC in retinal samples by UHPLC-MS/MS

Project Methods

Ultra-high-performance liquid chromatography and tandem mass spectrometry (UHPLC-MS/MS).

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, UHPLC-MS/MS and data analysis/statistics

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science and/or chemistry.

Project 15: Labelling of melanopsin retinal ganglion cells by viral vectors

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

John Morley - j.morley@westernsydney.edu.au
Second Supervisor

Project Description

Rods and cones are the well-known photoreceptors in the retina, the pigments of which can transform photons into electrical signals. These electrical potentials are then relayed to the bipolar cells and subsequently to the ganglion cells that exit via the optic disc. The optic nerve then carries information for the brain to process. Studies have shown that the melanopsin-expressing intrinsically photoreceptive retinal ganglion cells (ipRGCs) in the inner retina can modulate the firing rate of visual signals from the photoreceptors and the downstream retinal output neurons (RGCs) according to the ambient irradiance/illumination, allowing enhanced signal transfer or energy saving in various conditions, in addition to its regulatory function for circadian rhythm and pupil light reflex. This project will investigate novel ways to selectively activate these ipRGCs using "chemogenetics". This strategy involves the selective expression of Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) in ipRGCs by viral-vector delivery. These receptors are coupled to a fluorescent tag (mCherry) which allows the efficiency of viral delivery and expression to be evaluated. This project will involve staining of retinal tissue with immunohistochemistry followed by quantification of mCherry ipRGC-expressing cells using epi-fluorescence microscopy.

Project Aims

- Immunohistochemistry of mouse retinae, staining for melanopsin.
- Take images using a the MBF stereological microscope.

Project Methods

Immunohistochemistry and microscopy.

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, immunohistochemistry, microscopy, and data analysis/statistics.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science and/or chemistry.

Project 16: Development of dopaminergic cells in the mammalian retina

Supervisor(s): Morven Cameron - m.cameron@westernsydney.edu.au
Principal Supervisor

John Morley - j.morley@westernsydney.edu.au
Second Supervisor

Project Description

Dopamine is one of the most influential neuromodulators in the mammalian central nervous system (CNS). Pathologies involving its release and action underlie many disorders including Parkinson's disease, ADHD and schizophrenia. However, the mechanism that governs dopamine release is poorly understood. Dopaminergic amacrine cells of the retina release dopamine in response to light stimulation. These cells signal light-adaptation of the retina and rearrange neuronal circuits. However, dopaminergic cells are present in the retina immediately following birth in mice, well before eye-opening. It is thought that dopamine release is important for correct circuit development in the adult retina. This project will examine the morphology of dopaminergic cells in the retinae of mice at a variety of postnatal ages from P1 – P21. Further, we will examine the location of light sensitive melanopsin-containing retinal ganglion cells to determine if light information is able to reach these dopaminergic cells before rods and cones are functional. Students will learn immunohistochemistry using fluorescent-labelled antibodies and will take images of these stained retinae using a confocal microscope.

Project Aims

- Immunohistochemistry of early postnatal mouse retinae, staining for tyrosine hydroxylase and melanopsin.
- Take images using a confocal microscope.

Project Methods

Immunohistochemistry and confocal microscopy.

Opportunity for Skill Development

Acquisition of both general and specific lab skills: pipetting, dilutions, making up solutions, experiment planning and randomization, immunohistochemistry, confocal microscopy, and data analysis/statistics.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Some background in biological science and/or chemistry.

Project 17: To profile transcript changes in gut cells following exposure to short chain fatty acids

Supervisor(s): Mugdha Joglekar - m.joglekar@westernsydney.edu.au
Principal Supervisor

Anand Hardikar - a.hardikar@westernsydney.edu.au
Second Supervisor

Project Description

Short-chain fatty acids (SCFAs) are bacterial metabolites produced during the fermentation of non-digestible starch. SCFAs are present in large abundance in our gut and are altered during insulin resistance and progression to type 2 diabetes. The link between altered SCFAs and reduced insulin secretion is unclear. Similarly, the effect of these SCFAs on gut cell transcriptome and epigenome is not completely deciphered. We hypothesize that SCFAs alter gut cell gene expression through epigenetic mechanisms that impacts insulin secretion, changing the lifelong risk of type 2 diabetes. Through this project we aim to understand the effects of SCFAs on incretin gene regulation in gut cells. This work will generate new knowledge that will help in revealing the factors amenable to target for diabetes treatment.

Project Aims

To understand the effect of altering butyrate concentrations on RNA expression in gut cells

Project Methods

This project involves two major methods

1. Cell culture: Gut cell lines will be expanded, maintained under aseptic conditions. They will be exposed to two different concentrations of SCFAs (acetate, propionate and butyrate) which will be altered at a regular interval. Cells will be harvested for gene expression studies.
2. Real time PCR: RNA will be quantified, and different incretin hormones will be measured using real time PCR. Data will be normalised and analysed using appropriate statistical tests.

Opportunity for Skill Development

This project involves two major techniques, namely human cell culture and real time PCR. Students will learn to grow, monitor, and count human gut cells under aseptic conditions. They will also learn about the basics of real-time PCR and TaqMan chemistry for real time profiling of PCR. They will get to learn and use different biostatistical analyses. Apart from their own experimentation and results, students will be able to read scholarly articles, review and discuss these at weekly lab meetings and journal club meetings. They will be helped/guided to analyse, interpret and draft their final report and contribute to any scholarly work that they are able to produce.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

There is no pre-requisite to have any special skills. Enrolled students will be trained in the required wet-lab and dry-lab/analytical techniques.

Project 18: Quality Equity and Systems Transformation in Primary Health Care: Developing and testing a tool to measure quality in Australian General Practice

Supervisor(s): Phyllis Lau - Phyllis.lau@westernsydney.edu.au
Principal Supervisor

Samantha Ryan - Samantha.Ryan@westernsydney.edu.au
Second Supervisor

Project Description

Health systems with high performing primary health care (PHC) have been found to deliver more equitable health outcomes with greater cost-effectiveness.1 Australia, like other countries, requires high-quality primary healthcare (PHC) to address rising healthcare costs.2,3 Additionally, inequitable health outcomes impact on populations, including Aboriginal and Torres Strait Islander peoples, culturally and linguistically diverse (CALD) populations and those in prison.4 In Australia, PHC is delivered in settings including general practices, community health centres, Aboriginal community-controlled health services and allied health practices. High quality care is not always achieved.5 Currently, in Australian general practice, funding rewards throughput rather than quality. Australia is amongst OECD countries with the highest proportion of PHC funding paid as fee-for-service (90%), and there is no agreement on what constitutes high quality PHC.4 Hence there is a need for a validated Australian model of quality PHC.

In partnership with primary health networks (PHNs) in western Sydney, we have developed a suite of indicators and measures of high quality Australian general practice. This project will use the Delphi technique to achieve consensus on the relevance and feasibility of these indicators amongst PHC experts. The aim is to develop the first comprehensive, evidence-based, professionally endorsed tool for analysing and reporting across all components of high-quality general practice in Australia.

Project Aims

The aim of this study is to develop a tool for analysing and reporting across all components of high-quality general practice in Australia.

Project Methods

This study will use a Delphi Survey to achieve consensus in the primary health care sector. The Delphi Survey will be conducted between September and November 2021 to solicit opinions and reach consensus on a core set of relevant and feasible high-quality performance indicators and measures from a suite of indicators and measures previously developed by the researchers in partnership with primary health networks (PHNs) in Western Sydney. Participants of the survey will include general practice principals, GP (general practitioner) contractors, practice nurses and managers and key PHN staff who are familiar with the context of Australian general practice. A total of 80 to 184 participants will be recruited.

Participants will be asked to rate each indicator and measure for relevance and feasibility and to provide comments for each subgroup of indicators in three rounds of the online Delphi Survey. Each indicator (average score of its measures) and measure will require a minimum of 70% agreement in both relevance and feasibility to achieve consensus.

The student will be involved in the data analysis process described below.

Quantitative data: Participant's demographics and their ratings on the indicators and measures will be analysed descriptively using the Microsoft Excel software. The aggregate results of the participant's responses will be analysed for means, medians, standard deviations, interquartile ranges and agreement percentages.

Qualitative data: Participants' responses in the text boxes will be analysed thematically. They will be imported into the NVivo analysis software and coded using a mix of inductive and deductive approaches. Patterns will then be identified from the codes and grouped to elicit themes. The research team will separately and collectively analyse the data and resolve any differences in interpretation.

Opportunity for Skill Development

The student will have the opportunity to understand the Delphi methodology which is a technique used to arrive at a group opinion or consensus by surveying a panel of participants. The technique is particularly useful because of its flexibility and ability to offer anonymity to participants. The Delphi technique is often used to develop health care guidelines and practice pathways.

The student will also have the opportunity to be involved in qualitative thematic analysis with the aid of the NVivo software. This is a skill set that will be useful later on in the students' professional career and development.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

There are no essential requirements other than what are listed in the guidelines. This project will suit a medical, nursing or other health science student with an interest in quality primary health care practice in Australia.

Project 19: Phytochemicals - an alternative therapy for glioblastoma?

Supervisor(s): Shadma Fatima - s.fatima@westernsydney.edu.au
Principal Supervisor

David Harman - d.harman@westernsydney.edu.au
Second Supervisor

Kieran F Scott - Kieran.scott@westernsydney.edu.au
Third Supervisor

Project Description

Glioblastoma (GBM) is the most common and malignant primary brain tumour in adults. Even after complex and painful treatment involving surgery, radiation and chemotherapy with temozolomide (TMZ), the survival rates for these patients remains poor. Hence identifying novel compounds for the treatment of this disease is an utmost priority. Phytochemicals are bioactive, non-nutrient plant chemicals which have been reported to be effective against many diseases including cancer. With their reduced side-effect profile and ability to cross the Blood brain barrier, phytochemicals can offer significant potential to improve current glioblastoma treatment options. Resveratol (RSVl) and Thymoquinone (TMQ) are phytochemicals that have been studied as a potential treatment in GBM. However, their potential to treat GBM in combination have never been studied before. In this project we aim to identify the GBM killing potential of Resveratol and thymoquinone on its own as well as in combination. We hypothesize that combination therapy using thymoquinine and Resveratol can not only enhance the anti-cancer activity in comparison to their individual action but may also reduce the incidences of GBM reoccurrence.

Project Aims

The main aim of this study is to investigate whether TMQand RSVL can inhibit the proliferation of TMZ resistant Glioblastoma (GBM) cells.

1. To determine the IC50 and to investigate the effects of RSVL and TMQ alone and in combination on the survival of T98G GBM cells using MTT assay post 72 and 96 hrs.
2. To determine the effectiveness of the compounds in inhibiting GBM sphere formation.
3. To elucidate the mechanism of action of TMQ and RSVL combinations using Mass Spectrometry-Based Quantitative Proteomics.

Project Methods

1. Grow colonies of GBM cell lines in suitable media.
2. Treat each colony with a suitable concentration range of Resveratol, Thymoquinone and temozolomide for 72 and 96 hrs.
3. Perform cell viability assay, determine IC50.
4. For sphere formation assays: T98G and U251 cells will be cultured in a nonadherent flask for forming shperes and then will be treated with the drugs at IC50 concentrations. Upon formation of ≈200 μm diameter spheres in control groups (2–4 weeks), the total number of spheres will be manually counted within each of the culture wells.
5. For proteomics assays harvest cells from treated and untreated paired experiments, remove lipids and extract proteins

6. Digest proteins with the enzyme trypsin
7. Analyse resulting peptides using LC-MS/MS
8. Using bioinformatics software, process the raw data such that proteins whose concentration changes most significantly are discovered in each cell line
9. If time permits, relate such potential biomarkers to biochemical pathways in order to gain insight into the drugs mode of action

Opportunity for Skill Development

The Student will learn essential skills in research techniques such as GBM cell culturing, drug treatments, cell cytotoxicity, cell proliferation assays, protein isolation and quantification. This project will also give an understanding and hands on skills on LCMS based protein identification and high throughput analysis by Progenesis software. Enhancement of student's scientific communication and writing skills, literature review and project report writing and presentation skills.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students should be proficient in scientific communication and literature search. They should have interest in alternative medicine and drug discovery for brain cancers

Project 20: microRNA-mRNA associations in human tissue

Supervisor(s): Wilson Wong - w.wong@westernsydney.edu.au
Principal Supervisor

Anand Hardikar - a.hardikar@westernsydney.edu.au
Second Supervisor

Project Description

Pancreatic islet transplantation is the only approved cell-based clinical therapy for treatment of type 1 Diabetes (T1D) in Australia, Canada and a few other countries in the European Union. Islet transplantation, however, has been limited by the availability of cadaveric pancreas donors and islet isolation yield. Cells known to naturally produce (pro-)insulin transcript have been explored as an alternate source, as they show potential to differentiate into islet-like insulin-producing cells. In order to improve the efficiency of differentiation to islet-like cells, the molecular associations involved in regulating key pancreatic islet genes and also the impact of donor clinical characteristics needs to be explored at a molecular level.

For the past decade protein non-coding (nc-)RNAs, such as micro (mi-)RNAs, have been shown to post-transcriptionally regulate gene expression. MicroRNAs, which are 18-22 nucleotide long RNA molecules, are now well-recognised to be involved in different cellular process and are essential for cell development, homeostasis and differentiation. We have generated a large dataset of microRNA and mRNA gene expression in human cell and tissue samples from different donors (Wong et al, iScience, 2021). We have already identified key microRNAs that are associated with (pro)-insulin transcription in insulin-producing cells.

Glucagon and Somatostatin are two of the three major pancreatic islet cell hormones and microRNA regulators that help guide their development/differentiation remain to be fully elucidated. This study will use machine learning approaches in identifying microRNA regulators of Glucagon and Somatostatin gene transcription in a large human tissue bank. The identification of microRNA regulators of these endocrine pancreatic hormones in human islets and the donor characteristics (such as sex, age, BMI) that are associated with miRNA expression will help improve our understanding in developing protocols for generating islet-like cells in vitro.

This project aims to (1) To apply machine learning algorithms in assessing miRNA regulators of glucagon and somatostatin gene expression; and (2) To identify islet donor clinical characteristics associated with islet microRNA and mRNA expression. This project will pave way for improving the differentiation approaches in making cells to become more islet-like hormone producing cells for cell-based therapy (to treat diabetes) and also serve as an important resource to understand the underlying mechanisms between donor clinical characteristics and molecular expression profiles in human islet cell biology.

Project Aims

The specific aims of this project are:

1. To apply machine learning algorithms in assessing miRNA regulators of glucagon and somatostatin gene expression.
2. To identify islet donor clinical characteristics associated with islet microRNA and mRNA expression.

Project Methods

The selected candidate will be trained using microRNA qPCR software (Thermo Fisher Connect/Quantstudio) to extract and interpret the human gallbladder transcriptome data. Candidate will then be trained to use other data analytical tools (such as R software, MS-Excel and GraphPad Prism) to perform ML and biostatistical analysis. This project will provide the opportunity to gain significant training and expertise in data analytics and RNA biology.

Opportunity for Skill Development

The student in this project will learn and then perform data extraction and analyses from large sets of biological data. The student will be trained using microRNA qPCR software (Thermo Fisher Connect/Quantstudio) to extract and interpret the human islet transcriptome (mRNA/miRNA) data. Candidate will then use other data analytical tools (R software, excel and prism) to perform statistical analyses. This project will provide the opportunity to gain significant training and expertise in data analytics and RNA biology.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

No particular requirements listed here is required for the student in this role.

Project 21: Targeting neuronal hyperexcitability during neurodegeneration

Supervisor(s): Yossi Buskila - y.buskila@westernsydney.edu.au
Principal Supervisor

Project Description

Neurodegenerative diseases (ND) are a group of chronic, progressive disorders characterized by the gradual loss of neurons in discrete areas of the brain. One of the early characteristics of several neurodegenerative diseases such as Alzheimer's disease (AD) and amyotrophic lateral sclerosis (ALS) is neuronal hyperexcitability, which is an abnormal and exaggerated response of neurons to an excitatory stimulus. Although, the cause of the neuronal hyperexcitability during neurodegeneration is still unknown, it has been suggested that it plays a major role in neuronal loss. Recently, several reports indicated that astrocytes, which are the most abundant subtype of glial cells in the brain, playing a key role in neurodegenerative disorders such as AD and ALS, suggesting they are involved in the pathogenesis of neurodegeneration. The overarching aim of this proposal is to study the impact of astrocytes on neuronal hyperexcitability prior and during neurodegeneration. Specifically, we will investigate the mechanisms by which astrocytes interact with neurons, including astrocytic potassium clearance and its effect on the biophysiological properties of neurons in mice models for AD and ALS. The student will help in the analysis of electrophysiological recordings from both neurons and astrocytes.

Project Aims

The overarching aim of this proposal is to study the impact of astrocytes on neuronal hyperexcitability prior and during neurodegeneration. To this aim, we will characterise the electrophysiological profile of neurons and astrocytes in animal models for AD and ALS. The specific aims of this project are:

1. To investigate the functional activity of astrocytes in different brain regions associated with ND in mice models for AD and ALS.
2. To identify the impact of neuromodulators on astrocytic potassium clearance process during neurodegeneration.
3. To study the role of astrocytic energy metabolism in astrocytic potassium clearance in different brain regions during neurodegeneration.

Project Methods

To achieve this project aims, we will preform multiple electrophysiological recording from mice models for ALS and AD. The student will get to be involved in all procedures of these recordings, including surgery and acquisition of data, and will help in the analysis of these electrophysiological recordings using dedicated software (pClamp) and custom built Matlab code.

Opportunity for Skill Development

Following the completion of this project, the student will develop wet lab skills (including preparation of solutions; preparation of brain slices and electrophysiological recordings) as well as Matlab programming skills to facilitate data analysis.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Programming in Matlab

Project 21A: Gamblification/gamification: the lie of the loot box

Supervisor(s): Aunty Kerrie Doyle - Auntykerrie.doyle@westernsydney.edu.au
Principal Supervisor

Robert Doyle - Rob.doyle@westernsydney.edu.au
Second Supervisor

Project Description

The lockdown periods for COVID have created increased demand on mental health services, and on unhealthy methods of stress management. One of the stress management common in communities is gambling. While this is considered an adult issue, literature suggests that people as young as 10 have become addicted to the games where they buy a loot box in a scheme similar to a lottery. Other countries have legislated against this practice, but Australia has not. This project will consider a literature review of gamblication and gamification addiction – as recognised by the DMS – and consider if it is a problem to Indigenous youth. Our community partner – Bathurst Young Mob – have requested this research.

Project Aims

The aim of this research project is to provide a literature review of the prevalence of addiction to gaming and gambling. Review and indigenisation of the current resources to help parents and families with children with gaming issues will also be an outcome.

Project Methods

Desktop review of white and grey literature; if possible, engagement with community groups to pilot resources.

Opportunity for Skill Development

Students will gain experience in literature reviews, researching in Indigenous communities, and indigenising resources.

Students are required to have the following skills/meet the following pre-requisite(s) to apply

Students should have a good sense of humour, and some knowledge of video games.