School of Science and Health
Summer Scholarship Research Program 2017
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Project 56: Unconventional Anti-Cancer Platinum Compounds

Supervisor(s): Professor Janice Aldrich-Wright (Principal Supervisor)  
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Project Description

Platinum complexes remain major components of cancer chemotherapy and their successful use in combination with molecularly targeted agents has led to the expectation that they will continue to be used for decades to come. A recent and particularly exciting example is the effectiveness of those cytotoxic agents that bind to DNA, when used in conjunction with the exciting new checkpoint inhibitors that modify the immune response. These existing and expanding uses of cytotoxic agents provide motivation for the development of new, less toxic agents. The most effective way of reducing the toxicity and increasing the efficacy of cytotoxic agents is to deliver them selectively to cancer cells and much work is underway on this approach. Critical to the effectiveness of this approach are (i) the degree of selectivity, (ii) the amount of cytotoxic agent that can be delivered to the cancer cell, and (iii) the potency of the cytotoxic agent that is able to be delivered.

The platinum complexes currently are not being particularly cytotoxic, having IC_{50} values that are typically in the low micromolar range. Platinum complexes unique to WSU have IC_{50} values in the low nanomolar range. These include the [Pt(diamine)(diamine)]^{2+} series developed by Aldrich-Wright (Pt^{IV}-1). Therefore, targeted platinum complexes are worthy of investigation because of the potential of high efficacy of the platinum moiety when delivered into the cell, but also have a number of important advantages over other cytotoxic agents for the investigation of selective targeting methods: (i) they can be converted to the inert platinum(IV) oxidation state (Pt^{IV}-2) which limits off-target effects on route to the cancer cell, (ii) the platinum(IV) state allows for the addition of the targeting group in such a way that it is lost on reduction, releasing the active cytotoxic platinum(II) agent in an unmodified form.

Project Aims

1. Prepare and characterise platinum (II) complex/es precursor.
2. Prepare and characterise platinum (IV) complex/es precursors.
3. Prepare and characterise platinum (IV) complex/es with added inhibitor.

Project Methods

1. Using published methods synthesize platinum (II) complex/es and learn to characterise it using spectroscopic techniques.
2. Using published methods oxidize the platinum (II) complex/es to obtain the platinum (IV) complex/es and characterise it using spectroscopic techniques.
3. Adapting published methods insert the inhibitor into the complex/es and characterise it using spectroscopic techniques.
4. Effectively communicate the results through a written report and verbal presentation.
Opportunity for Skill Development

1. Student will learn to plan effectively synthesize inorganic complex/es
2. Student will gain experience in wet laboratory skills.
3. Student will hone their skills at reviewing relevant literature.
4. Student will gain experience in communicating the results through preparation of a written report and verbal presentation to peers and teachers.

Students are required to have the following skills/meet the following pre-requisite(s) to apply
Keen to undertake research, chemistry background essential.
**Project 57: Views and Attitudes of Older Australians about Self-Care Complementary Medicines (CMs)**

**Supervisor(s):**  
Dr Mike Armour (Principal Supervisor)  
Dr Gisselle Gallego (Second Supervisor)

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**Project Description**

**Background and rationale**

There is growing evidence that older Australian’s are high users of complementary medicines (CM’s). Fifty eight percent of people aged over 65 years have used one of 17 common CM modalities in the previous 12 months, and 65% of these had visited a CM provider. Self-medication of CM is common including the use of over the counter vitamins, mineral supplements and herbal products.

There is growing evidence that older Australian’s are high users of CMs. Fifty eight percent of people aged over 65 years have used one of 17 common CM modalities in the previous 12 months, and 65% of these had visited a CM provider. The Australian Longitudinal Study of Ageing, an ongoing prospective study of the older population, demonstrated the prevalence of CM use to have increased over time among older Australians ranging from 17% in 2000-01 to 35% in the 2003-04 periods. Data from this longitudinal survey indicates celery, garlic and ginkgo biloba are the most common herbal medicines used, and cod liver oil the most popular nutritional supplement. Other common CM includes multi-vitamins, echinacea, ginseng, St. John’s wort and glucosamine.

Little is known about how information is used and how and why older Australians make decisions about CM treatment, and how research evidence influences individual decision making. Perceived benefits from treatment can be based on individual values, beliefs and expectations, and individuals are known to make decisions based on limited anecdotal information. The term evidence has several meanings, many researchers and health care providers explain evidence is based on the findings from scientific studies, and embrace the definition of evidence based research and evidence based practice, and recognise a hierarchy of evidence. However individuals using CM seek information from multiple sources (friends/families, the internet, print material) and frequently believe that non research based information provides proof of an effect equivalent to scientific evidence. This can complicate the decision making process with individuals unclear which information to use to guide their use of CM.

This qualitative study was conducted after the completion of a randomised controlled trial (RCT) that aimed to determine the effectiveness of an educational intervention directed at older people to improve self-advice, increase health literacy, decision making efficacy, awareness and understanding of self-care.

**Project Aims**

The aim of this study was to explore older adults’ perceptions of risk and attitudes towards CM on completion of an education intervention.

**Project Methods**

This qualitative study has been conducted after the completion of an RCT that aimed to test the effectiveness of an educational intervention to improve CM health literacy and decision making about supporting self-advice and decision making among older Australians. While the RCT evaluated the effectiveness of the education intervention it did not provide an insight into the perceptions of risks, attitudes and health seeking behaviours. Twenty interviews have been conducted and are currently being transcribed. Preliminary data analysis of the interviews is...
currently being conducted by CI Gallego. The student will be involved in the data analysis and literature synthesis.

During the 8 week scholarship the supervisors will be accessible to the student. The supervisory arrangement will ensure the student has access to supervisors, feels confident to work independently on tasks, and to have access to the necessary resources to complete their work in a timely manner.

The steps and time frame are detailed below:

1. Familiarise themselves with the qualitative data collected and alongside the supervisors conduct some preliminary data analysis.
2. Alongside the supervisors completed the data analysis
3. Produce draft evidence summaries to participants and other stakeholders.
4. Draft a report for circulation to stakeholders, and prepare an academic paper for submission to a journal.

Week
1: orientation to the project
2-3: preliminary data analysis along supervisor.
3-4: data analysis
5-6: preparation of two page summary
7-8: drafting of preliminary results and discussion

Opportunity for Skill Development
Outcomes from this scholarship for the student will include skill development in relation to research literacy and qualitative research. These will include conducting literature searches, developing critical appraisal skills, communication in relation to writing and presentation skills. They will also have the potential to extend their knowledge base around complementary medicines and therapies.

The skills developed will be of benefit to their ongoing studies, in addition to skills that can be further developed in pathways regarding Honours or a higher research degree. The student will be part of an experienced and multidisciplinary team collaborating across two different universities.

Students are required to have the following skills/meet the following pre-requisite(s) to apply
The study will be of interest to students in health science, medicine and nursing in years 2-5. Knowledge of how to search the literature, good writing skills, attention to detail, interest in complementary medicines and or health literacy would be advantageous.
**Project 58: Dental Health of Elderly in Australian Residential Care Facilities**

**Supervisor(s):**
- Dr Amit Arora (Principal Supervisor)
- Dr Narendar Manohar (Principal Supervisor)
- Dr Ajesh George (Second Supervisor)

**Supervisor(s) contact information:**
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**Project Description**

Australians have one of the highest life expectancies in the world. According to Australian Bureau of Statistics, there are approximately 2,687,000 people aged 65 years and above residing in Australia (Masoe, Blinkhorn, Taylor & Blinhorn, 2014) and to support such ageing population around 185,482 residential aged-care facilities are in function (Chrisopoulos, Beckwith, & Harford, 2011). One aspect of high life expectancy is that such individuals retain their natural teeth longer, thus requiring constant assessments and advanced treatments. These services are costly and a burden on the health services sector. The geriatric population, particularly those at nursing homes are prone to complex oral diseases due to frail immunity. Additionally, physical limitations and intake of prescribed medications impact their oral health as well as reduce their ability to maintain good oral hygiene. The cost of treatment and affordability also play an important role for receiving treatment (Masoe et al., 2014).

Health assessment is an important element of admission to a residential care facility because it initiates interventions and evaluate progress (Evans, 2001). Appropriate oral health assessment in elderly requires proper education and knowledge; while the use of effective assessment tools assist in undertaking assessments more efficiently. However, a prerequisite to the usage of such tools is the knowledge and education level of nursing staff since they are generally involved in screening and maintaining adequate oral health of elderly residents. Residential care facilities in Australia suffer from shortage of trained nurses who can perform adequate dental assessments; this may be due to either a lack of training, complicated instruments or self-rapport (Saliba, Moimaz, Marques, & Prado, 2007).

According to local reports, the oral hygiene and oral health care status of elderly people residing in long-term care facilities is poor (Zenthofer, Rammelsberg, Cabrera, Schroder, & Hassel, 2014). Hence, there is a need of well-trained carers who can identify oral diseases and define the best method of cleaning (Chalmers, King, Spencer, Wright, & Carter, 2005). This project will investigate the oral health status of elderly population residing in residential care facilities of Australian and which assessment tools are being utilised for the aforementioned purpose.

**Project Aims**

- To determine the oral health status of elderly population residing in Residential Care facilities of Australia.
- To highlight the recommendations and guidelines for assessing oral health status of elderly population.
- To provide insight on current assessment practices globally and in Australia.
Project Methods
This project will be based on the methodological framework described by Arksey and O’Malley (2005) for conducting scoping reviews. The student will be supervised and assisted to conduct literature search of related articles, published from 2000 to 2016 using the following databases: Cochrane Library, MEDLINE, PUBMED, Science Direct, CINAHL, Health Reference Centre Academic, Health Collection and Health and Medical Collection. The student will learn to identify relevant key terms and which databases will contain the types of studies being sought; will also be informed how to search keywords using MeSH or EMTREE subject terms. The student will be taught how to perform a grey literature search using multiple online databases with a focus on current practice standards and guidelines.

Opportunity for Skill Development
The student will acquire knowledge of oral health status of elderly in residential care facilities and related assessment tools. The student will develop research skills including access to databases, literature search, and critical appraisal of articles. He/she will experience working collaboratively and professionally with a strong team.

This project would suit (but is not limited to) a student in health sciences, medicine and nursing or psychology who is interested in gaining skills required for further study in research degree programs (Masters/PhD). If the student is interested in pursuing a further degree (e.g. honours, MRes, PhD) in this area, they will also have the opportunity to develop a research proposal under the guidance of the supervisors. The student may also have an opportunity to be a co-author on the peer-reviewed publication resulting from this work.

Students are required to have the following skills/meet the following pre-requisite(s) to apply
Students should be in their second or third year of study and have some experience with conducting literature searches. The student should have excellent interpersonal and organisational skills and strong critical thinking and writing abilities.
Project 59: Population Genetics and Diversification in the Rocket Frog (Litoria Nasuta)

Supervisor: Dr Renee Catullo (Principal Supervisor)

Supervisor contact information: r.catullo@westernsydney.edu.au

Project Description
Rocket frogs (Litoria) are currently considered to consist of a few widespread species that cross the monsoon tropics of Australia. Preliminary genetic data suggests that these “widespread” species are actually many narrowly distributed species, and an unknown number of frog species remain undescribed. This project is a subset of a larger project investigating distribution patterns and endemism of frogs in Australia’s northern tropical regions. This research project will focus on one particular species, the Rocket Frog (Litoria nasuta), a super pointy, super speedy frog species. The student will analyse data to help determine genetic structure across the species, identify the possibility of undescribed species, and clarify the species distributions. These data will help uncover the true diversity of frogs in northern Australia, crucial for conservation of frogs, and land use planning in the northern Australian development region.

To do this, the student will analyse genomic data of Rocket Frogs from Broome to Sydney. The results of this analysis will allow the student to choose whether to conduct further investigations of ecological differences between populations, or assess the morphological differences between possible species. Based on the results, there may be the opportunity to be involved in the description of new frog species in Australia.

Project Aims
- Use genomic data to determine the likely number and distribution of species in the Rocket Frog
- Describe the spatial distribution and evolutionary relationships between genetic groups
- Assess the ecological differences between genetic groups OR assess morphological differences between genetic groups

Project Methods
The student will use existing genomic data to identify spatial patterns of genetic diversity within the Rocket Frog. They will use/modify an existing bioinformatics pipeline to conduct quality control of the genomic data. They will then use these data to conduct analyses in programs such as STRUCTURE to identify the number of populations, assign each individual to populations, and identify hybrid individuals. Using the identified populations, they will then estimate phylogenetic relationships between populations and conduct formal species delimitation tests. The student will directly run and interpret the analyses, under substantial supervision.

At this point in the project, the student will have completed enough analyses for a scientific publication, and could begin writing the methods and results. However, if motivated and with sufficient time, they will have the ability to do further analyses which would increase publication impact. This includes assessing ecological differences between populations, or complete morphological assessments of frog specimens, to determine how different the populations may be.
Opportunity for Skill Development

These include:

1. Managing and handling large-volume datasets;
2. Computation-based data curation, where manual inspection of data is not possible;
3. Modifying existing code and/or writing new code for bioinformatic analysis;
4. Experience in quality control of genomic data;
5. Applied experience with phylogenomic and population demographic software;
6. Experience writing for scientific publication; and
7. Experience with project planning and management, time management, and working collaboratively.

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

N/A
Project 60: Determining the Molecular Details of DNA UV Damage Recognition by the Human Single-Stranded DNA Binding Protein 2

Supervisor (s): Dr Roland Gamsjaeger (Principal Supervisor)  
Dr Liza Cubeddu (Second Supervisor)

Supervisor(s) contact information: r.gamsjaeger@westernsydney.edu.au  
l.cubeddu@westernsydney.edu.au

Project Description
An effective DNA damage response is crucial for the maintenance of genetic integrity and cellular survival. One of the major DNA damage repair pathways in human cells is Nucleotide Excision Repair (NER). It is responsible for repairing damage mainly caused by ultraviolet radiation and chemical mutagens. Single-stranded DNA binding (SSB) proteins have long been known to be involved in DNA repair mechanisms. We recently discovered two putative SSBs in humans, hSSB1 and hSSB2.

Our preliminary data indicate that hSSB2 is upregulated when cells are exposed to UV radiation. Furthermore, when hSSB2 is knocked-down in cells that are exposed to increasing doses of UV damage, there is a significant decrease in the survival rate. We have also shown that hSSB2 is able to bind specifically to cyclobutane pyrimidine dimers (CPD), a product that originates from the absorption of ultraviolet light. In summary, these data point to a likely role for hSSB2 in the NER pathway. The overall aim is to discover how hSSB2 acts in the cellular response to UV-induced DNA damage.

This project will specifically look at the molecular details of how hSSB2 interacts with CPDs in the context of UV damage. We will determine which residues are critical for recognition of CPD by testing point mutants of hSSB2 in binding experiments.

CIs Gamsjaeger and Cubeddu are both applicants of a current World Wide Cancer UK grant (start 2018) that will determine the molecular details of hSSB1 function in oxidative DNA damage repair. Cubeddu was also a CI on a NHMRC grant (ending 2016) to understand the role of hSSB1 as the cellular sensor of oxidised DNA. This Summer Scholarship project contributes to the aims of both of these grants and will generate data for subsequent high impact research publications and future competitive research grants.

Project Aims
• Expression and purification of hSSB2 mutant constructs
• Testing of binding to CPD using Biolayer Interferometry (BLI)

Project Methods
• Recombinant Protein Expression and Purification techniques – Similar protein mutants have been expressed and purified in the laboratory. Affinity and size exclusion chromatography purification techniques will be utilized in the lab by the student under the CIs supervision.
• Biophysical methods – BLI will be carried out using in-house machine with support from the CIs. The student will learn how to use the machine and do some basic analysis.
Opportunity for Skill Development

- Student will develop a wide range of laboratory skills using cutting edge equipment.
- Student will learn how to work independently and as part of a team.
- Skills relevant to further research studies such as Masters, PhD will be acquired.

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

- Student is expected to be pro-active and diligent.
- Student is required to have basic molecular biology and protein knowledge.
- Student should have completed Functional Proteins and Genes as well as Molecular Biology.
- A final year student is desirable due to the high-level equipment being used and the potential to carry out further research studies (Masters).
Project 61: Effect of Oxygen on Contractility of the Human Heart During Exercise

Supervisor: Associate Professor Simon Green (Principal Supervisor)

Supervisor contact information: simon.green@westernsydney.edu.au

Project Description
Simon Green is principal supervisor of the PhD candidate, Lauren Rispen, whose PhD project is focused on the effect of arterial hypoxaemia (low blood oxygen) on function of the healthy human heart. In this project we have developed a novel and safe testing protocol which involves a single breath of nitrogen that induces a rapid but brief hypoxaemia which lasts for 20-30 s. We have tested the effect of brief hypoxaemia on the pumping power (contractility) of the heart at rest and we are currently analysing these responses. The magnitude of this effect is likely to be influenced by how hard the heart is pumping and, to explore this over the next summer, we propose to incorporate exercise into our new protocol and test the effect of hypoxaemia on heart contractility during exercise.

We want to introduce a summer research student to this new experiment and our broader interests in exercise and cardiovascular research. The focus of this summer project will be on teaching the summer research student some of the basic aspects of our research and enabling them to contribute directly to the collection and analysis of ‘pilot’ data required for a larger experiment. A challenging aspect of this research project relates to the optimisation of exercise conditions and performance of the nitrogen-breathing manoeuvre during exercise. The research student will learn and contribute directly to solving problems inherent in this challenge. Over the eight week period the research student will learn the following: 1) basic research housekeeping skills (e.g., log book observations); 2) use and calibration of equipment (exercise machine, ECG, gas analysers); 3) use of research software and analysis of data; 4) design and execution of an experiment; and 5) interpretation and presentation of recorded data. The number of research participants that the summer student helps test will be kept small (e.g., n = 2-4) so that the student can experience these above-mentioned aspects of research and complete their presentation within the required period.

Project Aims
1. Development of an exercise protocol to assess effect of hypoxemia on cardiac contractility.
2. Test the effect of hypoxemia on contractility of the heart during exercise (i.e. a ‘pilot’ experiment).

Project Methods
Aim 1: Development of the exercise protocol will require the summer research student to become familiar with the exercise device, its nuances (e.g., unusual positioning of subject), its process of calibration and interaction with a PC-based data acquisition system. The student will then learn how to measure and induce hypoxaemia at rest before implementing the same procedure during exercise. This requires the student to learn how to use the necessary cardiorespiratory equipment and switch a research participant between the breathing of normal air and nitrogen (see below). Finally, the student will need to demonstrate the feasibility of the experimental protocol by testing it with a small number of participants.

Aim 2: Once the experimental protocol has been established, the student will recruit 2-4 participants and test each participant on three separate occasions. On the first occasion, the research student will familiarise a participant will the experimental procedures and ensure that the intensity of exercise and heart rate response to exercise have been optimised for the ensuing experiment.
On the second and third occasion, the research student will implement the experimental protocol. The protocol will be 70 minutes in duration and consist of eight periods of exercise (4 minutes long) preceded and interspersed with rest periods (4 minutes long). During each period a brief single-breath manoeuvre will be performed where the inspired air will either be room air or nitrogen and these gas conditions will be alternated between consecutive periods; at all other times of the experiment the participant will breathe room air. The single breath of nitrogen provides a short-lasting fall in arterial $O_2$ levels (hypoxaemia); whereas the single breath of room air acts as a control condition.

For the entire experiment, the participant will be connected to a cardiorespiratory system and several physiological variables related to breathing (i.e. ventilation, tidal volume, breathing frequency), heart function (i.e. ECG, heart rate and echocardiographic measurements) and exercise (power output) will be measured continuously. The research student will analyse all physiological responses, with the exception of analysis of echocardiographic measurements. Echocardiography and analysis of related measurements will be performed by the principal supervisor or Lauren Rispen (PhD student). The measurement of stroke volume, derived from echocardiography, is the primary measurement of heart contractility. This measurement is complicated and will be performed by the principal supervisor or Lauren Rispen. However, the research student will assist with and learn some aspects of this process.

**Opportunity for Skill Development**

As identified above, the research student will learn and contribute directly to solving problems inherent in this challenging research project. Over the eight week period the research student will learn the following: 1) basic research house-keeping skills (e.g., log book observations); 2) use and calibration of equipment (exercise machine, ECG, gas analysers); 3) use of research software and analysis of data; 4) design and execution of an experiment; and 5) interpretation and presentation of recorded data. In addition, the principal supervisor will provide the student with important basic readings in cardiovascular physiology (which is not taught at WSU) and facilitate a ‘journal club’ to facilitate the student’s reading and interpretation of scientific papers appropriate to the research problem.

This research experience has been designed to prepare the student for entry into an M Res program supervised by Simon Green (who does not have any M Res students at the moment). It is likely that the summer research student’s contribution to research outcomes will merit co-authorship of a future publication.

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

Students must be enrolled in the Sports and Exercise Science degree at WSU and have completed the 2nd year of this degree.
Project 62: **Intensity and Duration of Cognitive Rehabilitation for Healthy Older Adults and Older Adults with Mild Cognitive Impairment**

**Supervisor(s):** Associate Professor Karen Liu (Principal Supervisor)  
Nikki Tulliani (Second Supervisor)

**Supervisor(s) contact information:** karen.liu@westernsydney.edu.au  
n.tulliani@westernsydney.edu.au.

**Project Description**

The inability to retrieve encoded information (the first step and an important step in memory) is a contributing factor to the reduction in daily functional performance often associated with aging and in particularly in individuals with mild cognitive impairment (MCI).

Research focusing on the neural mechanisms of memory encoding in healthy older adults and the effectiveness of cognitive rehabilitation among individuals with MCI indicates that there are benefits associated with the use of memory encoding strategies. Further to this, computer-based programs present an opportunity to potentially enhance professional-led cognitive rehabilitation, and have shown promising results in improving cognition in individuals with mild cognitive impairments.

It has been shown that cognitive rehabilitation programs consisting of between six and 20 professional-led sessions to be the most cost-effective for research and for clinical purposes. In addition, it was shown those intervention periods greater than 12 weeks do not show a significant advantage over intervention lasting less than 12 weeks. Our team has developed a cognitive rehabilitation program with 12 professional-led sessions and 24 self-administered sessions. This project will adopt this developed computer-based cognitive rehabilitation program and be part of a bigger PhD project and will be a project of an upcoming occupational therapy honours student.

It is worthwhile to investigate if there is an optimal intervention intensity and duration for the maintenance of daily functional performance for older adults. With more knowledge on this topic, it could inform the bigger project on the optimal intervention intensity and duration for the cognitive rehabilitation. Further to this, this knowledge will support the clinical utility of the intervention and translation of the research into clinical practice.

**Project Aims**

The project aims to compare a shorter intervention duration with more frequent (more intense; daily sessions over 5 weeks) sessions and a longer intervention duration with less frequent (less intense; 3 weekly sessions over 12 weeks) sessions on:

- The acceptance
- The compliance
- The daily functional performance

in healthy older adults and older adults with mild cognitive impairment.
Project Methods
A total of 40 participants will be recruited from aged care facilities if they are aged 65 years or older, either healthy without previous major neurological or psychiatric illnesses or meeting the diagnostic criteria for amnesic-mild cognitive impairment.

The computer-based cognitive rehabilitation intervention will be administered to two groups of participants across two varying intervention intensities. The participants will be randomly allocated to either the ‘more intense’ cognitive rehabilitation group or the ‘less intense’ cognitive rehabilitation group. The compliance to the intervention of all participants will be recorded. After the completion of the intervention, participants will be asked to complete a survey asking for their acceptance of the intervention. Outcome measures on participants’ daily functional performance including daily task performance and cognitive functioning will be administered before and after the intervention. Descriptive statistics will be reported on all data collected. The acceptance, compliance and daily functioning performance will also be analysed and a comparison between the two groups will be completed.

The student will be involved in recruiting, liaising with and gaining written consent from all participants. Students will also be involved with monitoring the running of the interventions, collecting data, assisting in data entry and analysis. The project will result in a manuscript to be submitted for journal publication. The student will involve in the writing of the manuscript.

Opportunity for Skill Development
Skill development
The student will learn:
- the research design of a randomised controlled study,
- the recruitment, procedure of getting consent and engaging participants in research study,
- the input of data into a statistical package, analysis of the data set using basic quantitative analysis methods and its interpretation,
- to interact with older adults.

These skills are necessary for his/her further development in research (e.g. honours or HDR study) and health care service provision.

Research environment
The student will receive daily supervision/guidance from the supervisors. The student will be co-located with other occupational therapy HDR and honours students in building 21/24. Fortnightly meetings with this group will be held to share ideas and their research work if possible. The student in this program will also gain peer support during the process.

Other outcomes
Based on the findings in this project, the student is expected to participate in the writing of a manuscript for journal submission under the guidance of the supervisors. He/she will be the author of the manuscript. The results will also form part of a larger study investigating the use of computer-based cognitive rehabilitation in delaying the impact of memory loss for older adults with MCI.

Students are required to have the following skills/meet the following pre-requisite(s) to apply
There is no specific skill required. Students in their second or third year of their study who are interested in clinical research and working with older adults are welcome to join the project.
Project 63: Scoping Community-Based Diabetes, Obesity and Lifestyle Prevention Programs across the South Western Sydney District

Supervisor(s): Dr Freya MacMillan (Principal Supervisor)
Dr Kate McBride (Second Supervisor)

Supervisor(s) contact information: f.macmillan@westernsydney.edu.au
k.mcbride@westernsydney.edu.au.

Project description
We have a team of over 100 academics from several institutions (Western, UNSW, UTS) and clinicians and professionals (including from Sydney Children’s Network, St Vincent’s Hospital, the Garvan Institute, the Ingham institute and several local health districts), who are tackling diabetes, obesity and metabolism (DOMS) across Sydney. Our DOMS team formed and is funded through the Sydney Partnership for Health, Education, Research and Enterprise (SPHERE) scheme. Within DOMS we have three main project, one of which is a diabetes prevention focused stream of work, led by Dr MacMillan, who is also an executive member of DOMS.

Funding has been allocated for a scoping project to be undertaken to identify existing diabetes, obesity and lifestyle prevention programs across South Western Sydney. The student will work with our prevention working group and a research assistant employed on the prevention project to assist in the scoping of existing programs. This work will be essential for the next steps of our SPHERE DOMS, which will be to introduce new evidence-based programs building on what is already existing across the district and working well and filling gaps where existing programs are not currently available. The student will gain skills in community and stakeholder engagement as well as internet and other resource searching, to identify the required information. Additionally, the student will be welcomed to any SPHERE DOMS meetings and events, which will allow them to build networks with a wide variety of multi-disciplinary researchers, industry and community partners in the area of DOMS.

Project Aims
- To identify existing diabetes and obesity programs across the South Western Sydney region
- To identify strengths and gaps in community based programs based on the findings of the scoping search

Project Methods
The student will work alongside the research assistant to develop skills in scoping diabetes and obesity community-based lifestyle prevention programs that are currently being delivered across the South Western Sydney District. This will involve searching online websites, social media and hardcopy resources and collaborating with local organisations (including the primary health network and local health district, local councils and libraries etc) to identify any records they have of such programs.

Throughout this process the student will keep an electronic record of the details of all programs identified (e.g., what the program targets, who it targets, where it is delivered and when), which they will then ‘code’ as per the type of program to identify community assets (where programs are working well) and community needs (where there are gaps in prevention strategy approaches). Our SPHERE DOMS is particularly focused on Aboriginal and Torres Strait Islander and CALD young people aged 16-25 years and so the student will also code any programs that are specifically targeting these sub-groups of the population.
A map will be developed as a result of the scoping exercise, of the South Western Sydney area to highlight the pockets where programs are currently available and unavailable. This information will be used by our DOMS SPHERE to guide future intervention strategies. It is expected that there will be many programs within the area and that this will take up the bulk of the student's time. However, there is scope for the student to be involved in other activities, including collaborating with built environment and geography experts, to map built environment attributes related to lifestyle behaviours and food supply across the district, as well as mapping overweight, obesity and diabetes by Local Government Area, which has not previously been done across the area.

**Opportunity for Skill Development**

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

- Scoping and mapping skills
- Thematic coding skills to assist in the development of interventions
- Community engagement skills
- Stakeholder engagement skills
- Communication skills
- Teamwork and collaboration skills
- Report and journal article writing

**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, obesity and metabolism. Their communication skills should be of high quality and they should be confident in engaging with individuals outside of the university.
**Project 64: Why Do Some People Get Better After Hurting Their Back Whereas Others Do Not? Understanding the Role of Physical Activity**

**Supervisor(s):** Dr Siobhan Schabrun (Principal Supervisor)  
Dr Matthew Liston (Second Supervisor)

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**Project Description**
Persistent musculoskeletal pain is one of the most significant health issues in the developed world, with an economic burden second only to cancer. "Termed a ‘Western epidemic’, low back pain (LBP) is the most common form of persistent musculoskeletal pain and a leading cause of suffering, productivity loss and disability. Despite the enormity of the problem, most current therapies target generic symptoms, not underlying mechanisms, and have achieved limited success. Indeed, the Australian National Pain Summit recently concluded that ‘the management of pain in Australia is shockingly inadequate’. This assessment is not surprising given that we cannot predict who will get better after hurting their back and who will go on to develop long-term pain and disability.

Physical activity is thought to be a key factor influencing the development of long-term pain yet, few studies have examined physical activity over time in people who do, and do not recover, after an acute episode of low back pain. The BRAiN-u team is currently running a major longitudinal trial of people with acute LBP to determine which factors can predict recovery at 6 and 12 months after injury. The trial is National Health and Medical Research Council funded and includes 264 participants who have experienced an episode of acute low back pain in the last month. We make measures of neuroplasticity in the primary sensory and motor cortex, hormone changes (cortisol from saliva), genetics (from saliva and blood) as well as psychosocial factors (depression, anxiety etc) and pain and disability.

This data will be analysed and written-up as the results from this large trial. However, we have also captured data on physical activity that does not form part of the large trial and these data form the basis of this summer research project. The summer research student will use these data, already collected on 100 individuals, along with data on low back pain outcome (recovered or developed long-term pain), to examine how physical activity influences recovery. This is an exciting and novel question that should lead to a publication for the summer research student and is entirely feasible in the timeframe.

**Project Aims**
To determine whether physical activity predicts recovery (or not) after an acute episode of low back pain.
**Project Methods**
These data are already collected and thus, the summer research student will be involved in data entry, analysis, interpretation and write-up of findings. However, as the larger study is on-going there will be the opportunity to observe and contribute to data collection for not only the physical activity component of the study, but also measures of neuroplasticity, hormones, genetics, psychosocial factors and pain and disability. Thus, the summer research student will be exposed to a wide range of neurophysiological and clinical techniques (including collection of saliva and blood samples) and will have the opportunity to work within a large project team (that includes the supervisors and 3 PhD students). The summer research student will therefore have the opportunity to engage with all aspects of the running, data collection, analysis and write-up of a large research project.

**Opportunity for Skill Development**
With support from the project team, the summer research student will develop:

- An understanding of what researchers do and the various careers and pathways available in this line of work from honours to PhD to post-doc and beyond
- An understanding of large-scale prospective longitudinal trials in clinical populations
- Skills in collaborative research and working in large research teams
- An understanding of patient recruitment for large clinical trials
- An understanding of tests used to measure neuroplasticity, hormones, genetics, psychosocial factors as well as physical activity, pain and disability
- Skills in developing a research question and hypothesis
- Skills in rigorous data entry
- Skills in data visualization, analysis and basic statistics
- Skills in data interpretation
- Skills in writing and preparing a paper for publication

**Students are required to have the following skills/meet the following pre-requisite(s) to apply**
There are no restrictions. In general, this project would suit someone with an interest in healthcare (physio, medicine, OT, sports science etc) or physiology (neuroscience, physiology, biomedical science) but students with backgrounds in statistics, mathematics, engineering etc are also welcome to apply as we recognise the importance of a diverse range of skills in research. Provided the student is enthusiastic and willing to learn, we can provide all the training needed to see the project through to completion and ensure excellent outcomes are achieved.
Project 65: A Neurophysiological Phenotype for Psychosis: The Impact of Genetic Risk Factors for Schizophrenia and Bipolar Disorder on Cortical Activity in Humans

Supervisor
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Project Description
The CACNA1C gene has been identified as a susceptibility gene for psychosis. Individuals carrying the A allele resulting from a single nucleotide polymorphism (SNP) (rs1006737) within CACNA1C have a higher risk of schizophrenia and bipolar disorder. This increased risk is thought to result from dysfunction in voltage-dependent calcium channels caused by the susceptibility variant. Recent neuroimaging work has shown that A allele carriers have increased hippocampal/amygdala activity during emotional tasks. However, CACNA1C’s function remains largely unknown and its effect on electrophysiological cortical activity has not been explored.

Electroencephalograph (EEG) measures the electrical activity of the brain and can be used to quantify neuronal network integrity. EEG is an inexpensive and non-invasive way of detecting changes in brain function that may indicate disease risk (e.g., schizophrenia and bipolar disorder) or underlying pathophysiology (e.g., epilepsy). Identifying EEG biomarkers (intermediate phenotypes) of CACNA1C A allele carrier status may further our understanding of the impact of this SNP on neurological function, and elucidate neurophysiological biomarkers for psychosis risk.

We have an archival dataset from over 100 adults. Resting EEG activity (eyes open) was continuously recorded from 30 scalp sites for 4 minutes, and all participants provided a saliva sample for DNA extraction and analysis (genotyping has been completed). This project will involve a review of the literature and formulation of hypotheses, the collection of data from additional participants, the post-processing and analysis of archival EEG data, and the preparation of results for publication. That is, within the timeframe of this scholarship, the student will have the opportunity to gain experience in all aspects of the research process from study inception through to publication (opportunity for authorship), with the convenience of working on an archival dataset that will enable the student to have their own project and develop a deep understanding of their topic. Further opportunity for broader involvement in the dissemination of research findings is also available post-award (e.g., manuscript preparation and the presentation of findings at a national conference).

Project Aims
The overarching aim of this research project is to identify EEG biomarkers of CACNA1C A allele carrier status. This will be done by answering the following questions:

- What are the differences in EEG spectral band amplitudes between A carriers and non-carriers?
- What are the differences in EEG spectral band sources between A carriers and non-carriers?
- How are these differences associated with the proposed function of the CACNA1C polymorphism?
- What is the relationship between EEG spectral band amplitudes, CACNA1C A allele carrier status, and psychosis risk (as measured by the schizotypal personality questionnaire)?
It should be noted that we know from a preliminary analysis on a subset of these data that CACNA1C A allele carrier status was associated with a trend towards reduced slow-wave activity in hippocampal-cortical networks. This finding is consistent with the functional significance of the CACNA1C polymorphism. The student will have the exciting opportunity to test this hypothesis in a fully-powered sample of more than 100 adults.

**Project Methods**

As noted above, this project involves working with: 1) an archival dataset, and 2) the collection of new data; allowing students to have a well-rounded experience of working on an entire research project from start to finish in the short timeframe provided (see Figure 1 for timeline).

1. In the archival dataset, resting EEG activity (eyes open) was continuously recorded from 30 scalp sites at 1000 Hz for 4 minutes, and all participants provided a saliva sample for DNA extraction and analysis. The genotyping for CACNA1C rs1006737 polymorphism was performed using Sequenom MassARRAY® genotyping assay. The student will have the opportunity to work with this dataset and learn new skills in EEG data analysis methods including:
   - Use of software: Compumedics Neuroscan®, MATLAB (The Mathworks®), LORETA® and SPSS®
   - Pre- and post-processing: EOG-correction, re-referencing data, filtering, epoching, baseline-correction, artefact-rejection, down-sampling
   - Quantification of EEG data: Fast-Fourier transformation (FFT), frequency principal components analysis (PCA), low-resolution electromagnetic tomography (LORETA)
   - Statistical analyses: PCA, analysis of variance (ANOVA), and regression.

2. The collection of new data will involve interacting with participants and gaining informed consent, participating in screening procedures, preparing them for psychophysiological data collection, running experiments, preparing blood samples for genomic DNA extraction. The student will have the opportunity to learn the following data collection and extraction research methods:
   - Preparing participants for data collection: fitting EEG recording apparatus, fitting electro-oculogram (EOG) and skin conductance electrodes, and ensuring all standards are adhered to
   - Running psychophysiological experiments: providing instructions to participants, monitoring the acquisition of psychophysiological data, ensuring participants complete tasks correctly, using specialised EEG data acquisition software (Compumedics Neuroscan Acquire and STIM 2)
   - Preparing biological samples for genomic DNA extraction from newly recruited participants
   - The student will be part of the vibrant HEADBOX Lab team, so will also have the opportunity to gain clinical experience with neuropsychological assessment and semi-structured clinical interviews.

Figure 1. Timeline for student involvement in the 8 week project, and further post-award opportunities.
Opportunity for Skill Development

The student will develop skills spanning across a range of areas from the inception of a research project through to publication of findings in a peer-reviewed journal. Specific skill development includes:

- Literature review
- Generation of hypotheses
- Psychophysiological data collection
  - Obtaining consent from participants
  - Preparing participants and collecting their data (fitting EEG cap, EOG, ECG, and skin conductance electrodes, running experiments, and monitoring data acquisition)
  - Experience with neuropsychological assessment and semi-structured clinical interviews will also be acquired
- EEG data analysis
  - Pre- and post-processing of EEG data
  - Source analysis with LORETA
- Molecular biology techniques
  - Preparing biological samples for DNA extraction
- Statistics
  - Principal components analysis (PCA)
  - Analysis of variance (ANOVA)
  - Regression
- Reporting of research findings
  - Creation of figures and tables (opportunity for authorship on the manuscript)

Additional post-award opportunities:

- Further involvement in the publication process
  - Assisting with drafting and editing of manuscript
- Opportunity to present findings at a national conference
  - Australasian Society for Psychophysiology (ASP) annual conference

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

Students will gain more from this research project if they are at least in their second year of study (preferably third). Whilst there are no formal requirements and pre-requisites for this project, students will have a significant advantage if they have experience in one or more of the following areas:

- Neuroscience
- Psychology (particularly biological and/or cognitive psychology)
- Physiology
- Human genetics
- Statistics
- Computer science
- Electrical engineering
- Mathematics
- Physics

It should be noted that this is a multi-disciplinary project, so students with an interest in more than one of these areas are encouraged to apply.