2019
HONOURS AND HIGHER DEGREE BY RESEARCH OPPORTUNITIES

Faculty of Health and Medical Sciences

adelaide.edu.au
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Study with us and open the door to a range of rewarding career opportunities. Become a part of a community of alumni that includes Nobel Prize winners, pioneering researchers and world-renowned leaders in health. Our research programs are held in high regard, their quality and impact respected by peers and the community.

Studying Honours or a Higher Degree by Research can provide you with the skills and experience to pursue different career opportunities, particularly a career in research. Employers recognise that the research ability and broad range of transferable skills which University of Adelaide graduates possess equip them well for challenging and diverse roles in industry, government and business, as well as in research and academic organisations.

By undertaking a research degree with us, you will be involved in discovery, innovation and cutting-edge research. Our strong focus on addressing global challenges creates a highly stimulating setting for our postgraduate students interested in changing the world.
3 easy steps in applying for Honours

1. **Identify an area of interest**
   Discover current research opportunities in this publication, or browse our research areas on the [Faculty of Health and Medical Sciences website](#).

2. **Complete the relevant form**
   To initiate an expression of interest, download and complete the relevant form according to the instructions for the honours program you wish to undertake.

3. **Submit**
   Submit your completed expression of interest, a copy of your academic transcript, and any other additional documents required to [fhsresed@adelaide.edu.au](mailto:fhsresed@adelaide.edu.au).

**Further information**

The University offers scholarships to undergraduate students. These scholarships, as well as many others funded by industry and non-profit organisations, are available to potential and currently enrolled students.

Students enrolled in the Bachelor of Medicine and Bachelor of Surgery degree at the University of Adelaide will need to apply for a leave of absence and supply a banding letter. Students can request this by emailing [fhsassessment@adelaide.edu.au](mailto:fhsassessment@adelaide.edu.au).

**Are you currently studying at another university?**

If you are completing undergraduate studies at another institution, you will need to provide a copy of your academic transcript once your final results are available.

**Closing deadlines and next steps**

Once final results for the semester are available (in July or December), Honours coordinators will finalise their recommendations for honours projects. Successful students will then be emailed with instructions to submit a formal application for admission to the honours degree via a university internal transfer or, for external applicants, via SATAC.
APPLYING FOR A HIGHER DEGREE BY RESEARCH (HDR)

1. Determine what type of HDR you wish to apply for, and check the entry requirements.
   Information on the different degrees and their eligibility is available on the Degree Finder website at adelaide.edu.au/degree-finder
   Information on scholarships is available at adelaide.edu.au/scholarships

2. Secure a supervisor
   Before applying online, you need to secure the support of a supervisor and postgraduate coordinator with your proposed school. Note that this can take weeks or months, so ensure that you start this process well before any scholarship closing dates.
   To secure a supervisor email your initial inquiry to fhsresed@adelaide.edu.au. The Office of Research Development and Research Education can advise you on preparing the necessary documents, and liaise with the relevant postgraduate coordinator on your behalf. This is a highly competitive process, and we are aiming to help you present the strongest possible application to attract potential supervisors (note that each school has different internal processes, so students are discouraged from directly contacting supervisors).
   The postgraduate coordinator will assess your portfolio, and determine if your application is suitable for circulation to potential supervisors. Most successful applications typically demonstrate excellent academic transcripts, publications in respected international journals, high scoring English proficiency tests and a draft research proposal that fits well within the school’s research strengths.
   A list of postgraduate coordinators is available at adelaide.edu.au/graduatecentre/staff/postgraduate-coordinators/pgc-list

3. Refining your research topic and supervisor interview
   After circulating your portfolio to the academic staff within the school, supervisors who are interested in your portfolio will contact you directly. The supervisor will discuss your research topic with you, and will book a time to interview you (either in person or via Skype). If the supervisor then agrees to support your application, you will receive written confirmation to proceed with your application.

4. Apply online
   Having secured the support of your school, supervisor and postgraduate coordinator, the next step is to formally apply online through the Adelaide Graduate Centre at adelaide.edu.au/graduatecentre/admission
   Note that domestic and international scholarships have specific closing dates. You will be required to upload many of the documents that you have previously provided to the school, referee reports, and the written confirmation from your supervisors that they have agreed to support your project.

5. University ranking and award
   Scholarship applications undergo ranking and selection through a series of faculty and university selection panels. There is intense competition for scholarship places, so preparing a compelling application (per steps 1-3 above) is essential. The administration and admission of HDR students is managed through the Adelaide Graduate Centre adelaide.edu.au/graduatecentre/admission

Further information
Please direct all inquiries to fhsresed@adelaide.edu.au
In 2015, the University of Adelaide and our priority partners, Nagoya University (Japan) and the University of Freiburg (Germany) signed formal agreements to offer Joint PhD programs in the area of medical and biomedical research. In these programs, PhD students are enrolled in both the University of Adelaide and the respective partner university and will be supervised by experts from each university. At PhD completion, students will receive a jointly awarded PhD degree.

Students undertaking the joint PhD program will spend most of their candidature at the University of Adelaide and at least one year under academic supervision within the School of Medicine, Nagoya University or International Spemann Graduate School of Biology and Medicine at the Albert-Ludwigs-University/University of Freiburg. All instruction is undertaken in English.

For more information, visit:
health.adelaide.edu.au/our-research/honours-and-higher-degrees-by-research#higher-degrees-by-research
AGEING, FRAILTY AND MOBILITY
An increasing number of Australians are living for several decades beyond their retirement. As such, up to 4 million Australians are predicted to be impacted by frailty by 2050, making it a major personal, public, societal and economic health issue for our community.

Experts from geriatric medicine, general practice, nursing, pharmacy, orthopaedics and rehabilitation medicine, together with researchers in knowledge translation, health economics, epidemiology and demography are working together to identify the prevalence, impact and distribution of frailty in the community and developing health care interventions that are appropriate and translatable to patient care.

Furthermore, researchers are working collaboratively to explore the nature of ageing and frailty in order to develop and deliver models of care—benefiting individuals and our entire community.

Researchers across the faculty are focused on:

- identifying the associations and long-term impact of frailty on health outcomes such as resilience, quality of life, susceptibility to disease complications and disability
- examining the impact of medications on frailty to determine if frailty is a driver of susceptibility to adverse drug events
- understanding the community environment and its contribution to frailty to enable design of new environments that support healthy ageing
- developing and testing frailty health economics models
- developing and testing new interventions and technologies to support, treat and reverse frailty in older people
- identifying early predictors of frailty to evaluate early interventions to minimise or avoid the progression of the individual to frailty
- developing and assessing technologies in hospital to monitor movement and behaviours of elderly patients at high risk of falling to minimise these events.
The Clinical Autoimmunity and Inflammation Research Group undertakes research into the aetiology and outcomes of autoimmune diseases through the study of well-characterised patient cohorts. Studies of biological samples, paired with clinical data, aim to discover and validate novel biomarkers of disease. Associate Professor Proudman’s research focuses on recent onset rheumatoid arthritis and systemic sclerosis, with Dr Hissaria. Associate Professor Limaye’s research focus is inflammatory muscle disease with an emphasis on autoantibodies.

**Lead researchers:** Associate Professor Susanna Proudman, Associate Professor Vidya Limaye, Doctor Pravin Hissaria

**Email:** vidya.limaye@sa.gov.au

**Honours project opportunities**

**Recent onset rheumatoid arthritis**
Examination of the clinical and biochemical effects of fish oil in patients with rheumatoid arthritis. Models for predicting outcomes of treat-to target therapy including pharmacogenetics. Association with periodontal disease

**Project Supervisor:** Associate Professor Susanna Proudman

**Availability:** Semesters 1 and 2

**Systemic sclerosis**
Studies of complications such as calcinosis and gastrointestinal disease. Collaborative studies looking at the cellular mechanisms of fibrosis and vasculopathy, which are the principal pathophysiologic mechanisms responsible for disease manifestations such as pulmonary arterial hypertension.

**Project Supervisor:** Associate Professor Susanna Proudman

**Availability:** Semesters 1 and 2

**Inflammatory muscle disease**
Studies of the epidemiology, clinical, serological, and genetic features of inflammatory muscle disease, as well as the role of the innate immune system in myositis.

**Project Supervisor:** Associate Professor Vidya Limaye

**Availability:** Semesters 1 and 2

**ANCA-vasculitis**
The research group and in particular, Dr Hissaria, also has an interest in ANCA vasculitis. Research into the and immunopathogenetic mechanisms underlying this condition, its responses to immunosuppressive therapies, and the role of autoantibodies in this condition is being explored.

**Project Supervisor:** Doctor Pravin Hissaria

**Availability:** Semesters 1 and 2

**Higher Degree by Research project opportunities**
HDR projects may be available with this group, please contact the lead researcher(s) for more information.

**Research areas**
Ageing, Frailty and Mobility
Immunology and Infection
Environmental and Occupational Health Sciences: Occupational Health
Adelaide Health and Medical Sciences Building (AHMS), SA Health Citicentre Building, Roma Mitchell House, New Royal Adelaide Hospital, The Queen Elizabeth Hospital

We are interested in the nexus between the environment, society and human health. With diverse backgrounds in environmental and medical epidemiology, public health, occupational health, physiotherapy, infectious disease, social psychology and statistics, we employ an array of quantitative and qualitative methodologies and work closely with government and non-government stakeholders. We provide an empirical evidence base for strategic policy development and planning on public health issues and have close collaborative relationships with public health and infectious disease specialists in China. Current research projects include prevention of work-related musculoskeletal injuries in aged-care workers and heat and work injury.

Lead researcher: Dr Paul Rothmore
Email: paul.rothmore@adelaide.edu.au

Honours project opportunities

Ageing workers in the healthcare environment – a review of available information for healthcare design

Background: The ageing population and its workforce has created a dilemma for industries such as healthcare, where an ageing workforce is dealing with an ageing patient base. Given this context, the extent to which older workers are considered in the design of healthcare facilities needs to be examined. Healthcare facilities commonly base their design requirements on those specified in contemporary standards and guidelines. These sources of information need to be reviewed in order to establish whether adequate consideration is provided for the ageing population and workforce demographic.

Aim: To review recent literature to determine the current state of knowledge and level of awareness of ageing workforce factors in the design of healthcare facilities.

Methodology: Review of current Australian Bureau of Statistics (ABS) data to determine population and workforce data; Literature review examining: the physiological effects of ageing; the use of appropriate guidelines in the design of healthcare facilities; Review of existing healthcare design guidelines (e.g. Building Code of Australia; Australasian Health Facility Guidelines; Australian Standards) to determine any reference to factors relating to ageing workers and to the current needs of healthcare facilities.

Project Supervisors: Dr Paul Rothmore, Mr Peter Pollnitz (SA Health)
Availability: Semesters 1 and 2
Available for: Master of Public Health
Special requirements: Basic statistical knowledge; Knowledge of literature review methodology

The effectiveness of a healthcare design initiative – ceiling hoists – on hazard/incident reporting and staff satisfaction in SA Health

Background: Various initiatives have been implemented to decrease injury and improve staff satisfaction when lifting and moving patients in healthcare facilities. In the design of the nRAH overhead ceiling hoists were installed in every patient room to eliminate or minimise the need for mobile manual lifting devices.

Aims of the project:
• To compare the staff hazard/incident reporting trends and overall satisfaction prior to, and immediately following the transfer of services from the RAH to the n-RAH;
• To compare the staff hazard/incident reporting trends and overall satisfaction among staff at the Queen Elizabeth Hospital;
• To compare staff hazard/incident reporting trends and overall satisfaction of staff at the RAH/n-RAH with the Queen Elizabeth Hospital (where ceiling hoists have not been installed).

Project Supervisors: Dr Paul Rothmore, Ms Caz Saunders (SA Health)
Availability: Semesters 1 and 2
Available for: Honours
Special requirements: Good understanding of statistical tests and the use of appropriate statistical software; Knowledge of literature review methodology

Research areas: Ageing, Frailty and Mobility, Public Health, Musculoskeletal Health, Translational Health Outcomes

Forensic Science / CASR Research
University of Adelaide, North Terrace Campus

The Adelaide Centre for Forensic Research has a focus on accidental and inflicted trauma in infants and children, and also on many other aspects of paediatric forensic pathology, including sudden infant death syndrome, child safety issues and natural diseases that may be responsible for unexpected death in the young. Additional research has involved the characterization and dating of injuries, the analyses of various aspects of suicides and homicides, and the investigation of wildlife forensic issues.

Lead researcher: Professor Roger Byard, Associate Professor Corinna Van Den Heuvel
Email: corinna.vandenheuvel@adelaide.edu.au

Honours project opportunities

We will be offering a range of Honours projects within these topics so please contact the lead researcher(s) for more information.

Research areas: Ageing, Frailty and Mobility, Child and Adolescent Health
The presence of multiple chronic conditions (multimorbidity) is common in the older population, with 65% reporting three or more chronic conditions. Multimorbidity is associated with poor health outcomes including decreased quality of life, functional ability and increased hospitalisations, polypharmacy and complex medications regimens and mortality. The evidence-base for the therapeutic management and care of older people with multimorbidity is lacking, further adding to the complexity of caring for these patients. Our research centre aims to build the much needed evidence-base focusing on medication benefits and harms, reducing medication adverse events and patient-centred models of care to improve health outcomes for patients with multimorbidity.

**Lead researcher:** Professor Sepehr Shakib  
**Email:** sepehr.shakib@adelaide.edu.au

**Honours project opportunities**

**Relevance of Australian clinical guidelines to older patients with multimorbidity**

Clinical guidelines that provide treatment and management recommendations for clinicians generally focus on one chronic condition. In 2008 a review of Australian clinical guidelines showed that only one out of 17 guidelines for chronic conditions addressed multiple comorbid conditions. This proposed study will evaluate whether any improvements in addressing comorbidity in current chronic disease clinical guidelines have been made over the past decade in Australia and the extent of these changes.

**Project Supervisors:** Dr Gillian Caughey and Professor Sepehr Shakib  
**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**The opioid epidemic and multimorbidity: Utilisation of state-wide electronic health records to improve medication safety, reduce harm and improve efficiency of health care.**

The increasing prevalence of opioid use and subsequent adverse events associated with inappropriate use is a major public health issue for not only Australia but globally. The potential for harm in the older population with multimorbidity is increased due to the use of concomitant medicines that may increase the risk of harm, including respiratory depression and death. Acute pain is a common presentation for hospitalisation and also occurs commonly in hospital patients. This project will examine opioid use in the acute care setting to explore the demographics of the population receiving opioids, indication, and prevalence of concomitant medicines that are contraindicated with opioids and the rate of opioid-related hospital admissions. The prevalence of adverse outcomes associated with the use of these medications such as opioid induced ventilatory impairment, requirement for naloxone administration, readmission within 28 days and death will be examined as well as the incidence and potential predictors of opioid related hospital admissions.

**Project Supervisors:** Professor Sepehr Shakib and Dr Gillian Caughey  
**Availability:** Semesters 1 and 2

**Impact of national safety warnings on medicine utilisation in Australia.**

Adverse effects associated with medicines may not be identified in randomised clinical trials due to the studies generally conducted in younger people, with few comorbid conditions and short duration of follow-up. As a consequence when new medicines are used in clinical practice at the population level safety issues can be subsequently identified, months to years after the medicine is released on the market. In response to safety signals of potential adverse events and harm, Australia’s Therapeutic Goods Administration (TGA) provides continual monitoring and reporting of safety issues to healthcare providers and patients. Understanding the efficacy of these safety studies and announcements on subsequent utilisation of the specific medicines has not been evaluated. The aim of this study is to examine the impact of safety warnings on utilisation patterns of medicines before and after the safety warning in the Australian population using national prescribing data. Trends in the rate of dispensing of medicines of interest will be examined in a period before and after the safety warning / release.

**Project Supervisors:** Dr Gillian Caughey and Professor Sepehr Shakib  
**Availability:** Semesters 1 and 2

**Understanding competing health outcomes and patient preferences in multimorbidity**

Understanding patients’ preferences for treatment in the setting of multimorbidity is especially important because of multiple medication use and competing health outcomes. Incorporation of patient preferences in terms of benefits and harms of a patients’ overall treatment regimen and patient priorities for their health will help to optimise outcomes for these patients. This project will examine patient preferences for treatments in terms of global health outcomes rather than disease specific outcomes and how to best elicit and incorporate in care planning.

**Project Supervisors:** Dr Gillian Caughey and Professor Sepehr Shakib  
**Availability:** Semesters 1 and 2

**HDR project opportunities**

**Disentangling multimorbidity from polypharmacy as causes of adverse outcomes**

Patients with multimorbidity have a high treatment burden in terms of understanding and self-managing the multiple conditions, and managing polypharmacy and complex drug regimens. The benefits and harms of prescribing and deprescribing in patients with multimorbidity need to be examined. Efficacy and safety of medicines, including effects on mortality risk and patient centred-health outcomes, may differ in older adults with multimorbidity from results reported in randomised clinical trials which generally exclude patients with multimorbidity, that inform disease-specific guidelines. Strategies to determine medicine effects in those with multiple conditions are needed to minimize these potential harms (adverse outcomes) and burdens and to guide prescribing decisions that maximise benefits. Evaluating the effect of medication use on universal health outcomes such as survival, function, and symptom burden that are affected by most chronic conditions present and that are most important to patients too, could lay the foundation for an evidence-based approach to medication decision making for people with multimorbidity.

**Project Supervisors:** Dr Gillian Caughey and Professor Sepehr Shakib  
**Availability:** Semesters 1 and 2
Development and assessment of models of care for older patients with multimorbidity: Multidisciplinary and patient-centred care

There is increasing evidence from both Australia and International studies that multimorbidity, is becoming the norm rather than the exception, particularly in the older population. Multimorbidity is associated with poor health outcomes, including decreased quality of life, functional decline, as well as with increased healthcare utilisation including emergency admissions and health care costs.

The management and care of patients with multimorbidity is often complex, and frequently results in polypharmacy, multiple different healthcare providers involved in their care, leading to uncoordinated and disintegrated care, with increased potential for medication misadventure and adverse effects. Although evidence-based chronic disease programs exist for single conditions, that result in improved health outcomes, there is little evidence-base for the care of patients with multimorbidity. This project will examine the effect of patient-centred integrated model of care for patients with multimorbidity on both clinical and patient-centred health outcomes.

**Project Supervisors:** Professor Sepehr Shakib and Dr Gillian Caughey

**Availability:** Semesters 1 and 2

Impact of penicillin allergy de-labelling in clinical practice

Antimicrobial resistance is a major global public health issue, in part due to inappropriate use of available antibiotics. Antibiotics are one of the most frequently prescribed drugs and one of the most commonly reported causes of drug allergy. Whilst the reported prevalence of antibiotic allergy in patient medical records ranges from 5-16%, when patients are appropriately tested the vast majority of these patients (>95%) have a negative immunological assessment and are able to tolerate penicillins. Patients with a penicillin allergy label have higher rates of treatment failure, increased length of hospital stay and higher rates of readmission. The avoidance of penicillins also leads to more expensive and less effective second line antibiotic therapies used, potentially contributing to antibiotic resistance. Appropriate evaluation of patients with penicillin allergy label is required and should be a focus for de-labelling initiatives.

This research aims to improve the completeness of penicillin allergy documentation in patients’ electronic health records by conducting an intervention study focusing on de-labelling of patients with appropriate screening and testing and examination of drug utilisation and health outcomes.

**Project Supervisors:** Professor Sepehr Shakib, Dr Gillian Caughey and Dr William Smith

**Availability:** Semesters 1 and 2

Research areas

Ageing, Frailty and Mobility
Registry of Older South Australians (ROSA)

South Australian Health and Medical Research Institute (SAHMRI)

South Australia has one of the highest proportions of older people in the country (18% were over 65 and 2.6% were over 85 years old in 2016). This aging population places high demands on the aged care and health sectors and therefore there is a need to better coordinate and integrate information about people receiving aged care services in this state so that the needs of the people are aligned with the services they are receiving.

The Registry of Older South Australians (ROSA), is designed to monitor the health, service utilisation, medication use, mortality, and other outcomes of people receiving aged care services in South Australia. ROSA’s efficient model leverages existing information, bringing together diverse datasets collected by different organisations, to provide us with a whole picture of the ageing pathway. ROSA also has a “Living Lab” component, which will provide support and infrastructure for trialling innovative and emerging ideas to improve the health and wellbeing of older South Australians.

ROSA was developed by the Healthy Ageing Research Consortium, a cross-sectoral partnership of researchers, clinicians, aged care providers and consumer advocates from 13 organisations: SAHMRI, 3 universities (University of Adelaide, University of South Australia, and Flinders University), 5 industry partners, 2 consumer health advocacy groups, SA NT DataLink, and SA Health.

ROSA’s Core Research Team, led by Associate Professor Maria Inacio, is based at SAHMRI and includes postdoctoral researchers focusing on dementia, musculoskeletal conditions (Dr Tiffany Gill Senior Research Fellow & Postgraduate Coordinator), & health economics, as well as analytical and research management staff. All students will be supervised by one of ROSA’s University of Adelaide chief investigators, supported by a supervisory panel with the most relevant expertise drawn from ROSA’s partner organisations. The research team also encourage potential students to propose their own projects based on the ROSA data resource.

Lead researcher:
Associate Professor Maria Inacio
Email: maria.inacio@sahmri.com

Honours project opportunities

Changes in psychotropic medication use after entering permanent residential aged care in Australia

National and international guidelines for appropriate medication use in residential aged care recommend that psychotropic medications should not be used as first line treatment for changed behaviours in dementia due to the potential risks outweighing their potential benefits. Psychotropic medications (including antipsychotics, benzodiazepines and antidepressants) are associated with a high-risk of adverse events such as an increased risk of falls, cardiovascular complications and mortality. Despite recommendations, an estimated 61% of people living in Australian residential aged care facilities are regularly using psychotropic medications.

This project will examine if people are prescribed more psychotropic medications after entering residential aged care in Australia compared to when they were living at home. An analysis of trends of psychotropic medication use over time in residential aged care facilities will also be conducted to see if the use of psychotropics has decreased over time.

This project will be based at SAHMRI through the Registry of Older South Australians (ROSA). ROSA includes an historical national database (1997-2014) of the older population of Australia who accessed aged care services during this time. The database includes 2.9 million unique individuals with information from their aged care assessments linked with National Death Index data, Medicare data and Pharmaceutical data.

Project Supervisors: Professor Renuka Visvanathan, Associate Professor Maria Inacio, Dr Stephanie Harrison

Availability: Semesters 1 and 2
Available for: Honours and HDR

The effect of frailty on the utilisation of aged care services: A population based evaluation

Frailty is a state of increased vulnerability to mortality and is estimated to be prevalent in 18-49% of older Australians. While frailty is known to disproportionately affect the utilisation of health care services of people, less is understood regarding its effect on the utilisation of aged care services in Australia.

Using the Registry of Older South Australians (ROSA), this project will evaluate the effect of frailty on the utilisation of aged care services on the ROSA cohort from 2003 to 2014. It will describe how the cohort’s frailty has changed over the study period and evaluate how it affects the utilisation of specific types of aged care services. Frailty will be measured using the recently developed ROSA Frailty Index. Aged care service utilisation will be measured by the types of aged care services received by the study cohort (i.e. permanent residential aged care, home care packages, transition care, and respite care).

Understanding the epidemiology of aged care services in frail people will inform the preparation of the aged care system regarding resource allocation, workforce preparation, and policy development. This is needed as our population continues to age, increasing demand on our system.

Project Supervisors: Professor Renuka Visvanathan, Associate Professor Maria Inacio, Dr Jyoti Khadka, Professor Julie Ratcliffe

Availability: Semesters 1 and 2
Available for: Honours and HDR
The use of rheumatological medications by those with musculoskeletal conditions in aged care

This project aims to examine the use of rheumatological medications by those reporting a musculoskeletal condition as part of their aged care assessment. The data are obtained from the Registry of Older South Australians and include the Aged Care Assessment Team assessment, the Aged Care Funding Instrument and data from the Pharmaceutical Benefits Scheme. These data can be compared to those that have an assessment but are not admitted to permanent residential aged care, to determine if any differences exist.

**Project Supervisors:** Dr Tiffany Gill, Associate Professor Maria Inacio

**Availability:** Semesters 1 and 2

**Available for:** Honours and HDR

**Higher Degree by Research project opportunities**

Changes in psychotropic medication use after entering permanent residential aged care in Australia

Please see Honours project section

The effect of frailty on the utilisation of aged care services: A population based evaluation

Please see Honours project section

**Research areas**

Aging, Frailty and Mobility

Neuroscience, Behaviour and Brain Health

Translational Health Outcomes

Musculoskeletal Health

The ROSA Research Team at SAHMRI
The Adelaide Health Economics Group
Adelaide Health and Medical Sciences building (AHMS)

Lead researcher: Professor Jon Karnon
Email: jonathan.karnon@adelaide.edu.au

Honours project opportunities
Honours projects may be available in both semesters 1 and 2 with this group, please contact the lead researcher(s) for more information.

Higher Degree by Research project opportunities

Using longitudinal data to estimate the costs and consequences of frailty

Frailty is a state of increased vulnerability to functional decline, dependence and/or death arising from impairment of many body functions. Frailty is associated with increased risk of significant clinical events (e.g. fracture and depression) leading to hospitalisation and use of aged care services and loss of independence—a key component of quality of life in older people. It is expected that 4 million Australians will be frail by 2050. There is emerging evidence that frailty can be prevented, halted or reversed in some people. There is an urgent need to develop and evaluate interventions to prevent, delay and manage frailty with the potential for important benefits for older people and health services. To inform public funding decisions, where the overall budget situation is tight, it will be necessary to demonstrate that these interventions provide value for money.

For this project you will be part of the NHMRC Centre of Research Excellence in Frailty and Healthy Ageing at the University of Adelaide. The project will use major longitudinal datasets to assess the costs and health effects of frailty and to further develop a cost-effectiveness model to identify high-value interventions and programs targeted at prevention, delay or management of frailty.

Availability: Semesters 1 and 2

Research areas
Ageing, Frailty and Mobility
Child and Adolescent Health
CANCER BIOLOGY AND CLINICAL ONCOLOGY
Cancer is a general term for more than 100 diseases that are characterised by the abnormal growth of cells. Cancer affects a large portion of Australians, with one in two diagnosed by the age of 85.

Our cancer biology research seeks to understand the fundamental mechanisms by which cancers arise, progress and respond to treatment.

Clinical oncology consists of three primary disciplines: medical oncology (the treatment of cancer with medicine, including chemotherapy); surgical oncology (the surgical aspects of cancer, including biopsy, staging, and surgical resection of tumours); and radiation oncology (the treatment of cancer with therapeutic radiation).

Understanding the causes of cancer will enable the development of innovative approaches to treat both liquid cancers (leukaemia and myeloma) and solid cancers (breast, prostate, ovarian and gastrointestinal cancer).

Researchers across the faculty are focused on:
• identifying the molecular and cellular basis of cancer
• developing pre-clinical models that closely resemble human cancer
• understanding the mechanisms involved in cancer spread and resistance to chemotherapy
• identifying novel biomarkers for detection of cancer
• developing and evaluating new drugs to treat cancer.
Aquaporin Physiology and Drug Discovery Program

The University of Adelaide, North Terrace Campus

The water channels known as aquaporins (AQPs) are an ancient family found in all the kingdoms of life, from bacteria and plants to invertebrates and vertebrates, and play key roles in water balance and fluid homeostasis across cell membranes. The thirteen classes of human AQPs show tissue specific patterns of expression relevant for health and pathophysiological processes. Our goals are to define the molecular basis of the dual water and ion channel function of aquaporins, to understand the roles of AQPs in physiological systems, and to build a definitive portfolio of AQP antagonist and agonist compounds as tools for basic research and clinical innovation.

Aquaporins are currently being uncovered as essential components of rapid cell migration in wound healing and cancer metastasis, particularly in aggressive cancers such as glioblastoma and colon cancers. We have shown molecular knockdown or pharmacological blockade of AQP1 can slow or stop aggressive cancer cell movement. Our work over the past decade has challenged the original dogma that the archetypal channel AQP1 is rigid and constitutively open. We have shown that AQP1 is regulated by intracellular signals and serves as cGMP-gated ion channel as well as an osmotic water channel. Our focus on AQP pharmacology defined the first library of pharmacological agents in the world, based on arylsulfonamide scaffolds showing differential activities on the ion and the water pores.

We are now testing potentially powerful dual therapies for blocking cell migration. We are also defining pharmacological AQP modulators from traditional Chinese and Indian medicinal herbs, identifying the active chemical components and their molecular targets of action on AQP gating domains. Our findings offer exciting translational opportunities for clinical intervention in cancer metastasis, brain oedema, hydrocephalus, and other fluid transport disorders. Our drug agents are currently being tested in vivo in collaborative projects in Australia, Europe and the United States of America (USA).

Lead researcher: Professor Andrea Yool
Email: andrea.yool@adelaide.edu.au

Honours project opportunities
Aquaporin (AQP) channel upregulation is diagnostic of aggressive cancers such as glioblastoma, breast and colon cancer

Selective pharmacological modulators developed by our group are being used to evaluate the dependence of migration on water and cation channel activity in human cancer cell lines which natively express AQP1. New agents targeting migration and metastasis are of substantial interest in cancer therapy and other diseases.

Availability: Semesters 1 and 2
Special requirements: Nil

Discovery of new pharmacological blockers of cancer cell migration from traditional medicinal plants

Alternative herbal medicines from Chinese, Indian, and other cultures are investigated as sources of novel compounds for drug discovery. Methods including cell culture and microscopy are used to analyse the effects of medical herb extracts as tools for controlling cancer cell migration in vitro, and to identify candidate sources of new drug agents for aquaporin channels

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Molecular mechanisms of action and selectivity of pharmacological blockers of aquaporin channels as anticancer agents

Aquaporin channels localised at the leading edges of aggressive glioblastoma, colon and other cancer cells, and are essential for metastasis. This project focuses on the structure and function of mammalian aquaporins, their role in cancer cell migration, and the sites and molecular mechanisms of action of novel aquaporin drugs.

Availability: Semesters 1 and 2

Discovery and characterisation of pharmacological blockers of aquaporin channels for controlling colon cancer metastasis

Traditional medicinal plants are valuable sources of novel compounds for drug discovery. Methods including cell culture, live-cell imaging, confocal, and molecular biology are focused on the characterisation and mechanisms of action of new aquaporin agonists and antagonists, and testing the effects of the treatments on controlling cancer cell migration in vitro.

Availability: Semesters 1 and 2

Analysing the water and ion channel functions of aquaporin channels in the invasive pathology of glioblastoma

New AQP drugs that restrain cell migration hold promise for cancer therapy. Methods including molecular biology, protein expression systems, electrophysiology, and immunocytochemistry techniques are focused on the role of aquaporins and the discovery of new agonists and antagonists for controlling migration and thus the lethally invasive properties of glioblastoma cells in the brain.

Availability: Semesters 1 and 2

Research areas
Cancer Biology and Clinical Oncology
Neuroscience, Behaviour and Brain Health
The Cancer Treatment Toxicities Group is made up of four collaborative research laboratories: the Gastrointestinal Pathophysiology Lab (Lab Head Bowen), the Gut Microbiome Lab (Lab Head Gibson), the Clinical Pharmacogenomics Lab (Lab Head Coller) and the Mucositis Lab (Lab Head Keefe). The group’s broad research interest is in toxicity of cancer treatment, particularly of the gastrointestinal tract, and how it links to other toxicities such as pain and cognitive decline. The laboratory work investigates chemotherapy, radiotherapy and targeted therapy induced whole gut damage, and the efficacy of new agents in prevention and treatment. We also have ongoing patient studies looking to determine the risk factors associated with poor treatment outcomes and how to better predict side effects.

Lead researcher: Associate Professor Jo Bowen
Email: joanne.bowen@adelaide.edu.au

Honours project opportunities
Role of TLR4 on cancer treatment toxicities
Chemotherapy drugs used to treat cancer commonly cause damage to the normal gastrointestinal lining, leading to adverse symptoms such as intestinal inflammation and ulceration. There are currently no effective preventative strategies and a lack of understanding surrounding the mechanisms initiating damage. Recently, the innate immunity receptor, Toll-like Receptor 4 (TLR4), has been proposed to play a role in chemotherapy-induced gastrointestinal damage. As such, this project will investigate the effects of TLR4 gene deletion, both globally and restricted to the intestinal epithelium, on the development of gastrointestinal inflammation in response to chemotherapy.

This project will use TLR4 knockout mice treated with irinotecan to measure effects on intestinal damage. Research techniques include histological analysis, immunofluorescence, real time PCR and small animal handling. Results of this study will provide direct evidence of TLR4 signalling in mediating this important side effect of therapy.

Availability: Semesters 1 and 2
Special requirements: Nil

Gut microbiome composition as a predictive marker for cancer treatment outcomes
Patients with cancer are at high risk of microbiome dysbiosis (lack of bacterial diversity and/or overabundance of pathogenic species) due to frequent hospital visits, surgery, chemotherapy and radiation treatment, other medications (notably prophylactic antibiotics), changes in diet, and the presence of cancer itself. Having a diverse gut microbiota is considered protective against chemotherapy-induced bacteraemia, and pre-clinical work points to bacterial diversity as a key determinant of tumour response and intestinal inflammatory injury. Thus the objective of this project is to explore links between microbiota, inflammatory responses, and chemotherapy treatment. Research techniques include mouse models of colon cancer treated with chemotherapy, bacterial gene sequencing, and patients trials analysing longitudinal changes in microbiome following different cancer therapies.

Availability: Semesters 1 and 2
Special requirements: Nil

Targeting treatments to the inflamed gut using nanoparticles
A major limitation of delivering biological agents via the oral route is the destruction faced through the acid and enzyme rich environments of the stomach and small intestine. As such, conditions characterised by inflammation in the colon, such as radiation-induced colitis, are very difficult to manage. Through our industry collaboration, we are investigating the use of silica nanoparticles as new drug carrier systems, for the improved treatment of cancer therapy associated intestinal injury. We aim to demonstrate that neutralising antibodies loaded into particulate carriers are an effective approach to the treatment cancer therapy induced colitis.

Research techniques include mouse and rat models of colitis, live animal imaging, fluorescent microscopy, and mass spectrometer of circulating drug metabolites.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Role of TLR4 on cancer treatment toxicities
Please see Honours entry

Gut microbiome composition as a predictive marker for cancer treatment outcomes
Please see Honours entry

Targeting treatments to the inflamed gut using nanoparticles
Please see Honours entry

Research areas
Cancer Biology and Clinical Oncology
The treatment of chronic myeloid leukaemia (CML) has been one of the most remarkable cancer success stories this century. The improvement in 10 year survival for CML patients from 20% in the 1990s to over 80% today has been achieved through the clinical application of tyrosine kinase inhibitors (TKI) therapy targeting BCR-ABL1. However, despite the improvements in outcomes, around 30% of CML patients respond poorly to TKI therapy. Even among those patients who respond well, many will remain dependent on TKI therapy for life, leading to a massive cost burden, organ damage, and impairment of quality of life. The current focus of research in CML centres on the following issues:

1. Identification of patients at risk of failing frontline therapy, and working out whether these patients may benefit from novel anti-CML therapy. An inter-related question concerns patients who have suboptimal responses – can adding novel agents to TKI therapy further improve disease response?

2. Patients who have responded well to TKIs usually have undetectable circulating disease. Some patients in this groups can stop therapy without disease recurrence, whilst others experience rapid relapse. Identifying differences between these patients may hold the key to minimising the proportion of patients who need life long therapy.

**Lead researcher:** Professor Tim Hughes  
**Email:** tim.hughes@sahmri.com

**Honours project opportunities**

Investigation of signalling pathways involved in ABL001-mediated inhibition and study of resistance to combinations of the ABL001 and TKIs using BCR-ABL1+ cell-lines.

ABL001, or asciminib, is an allosteric inhibitor that has newly entered clinical development. It is designed to block the activity of BCR-ABL at its myristoyl pocket, a distance away from the ATP binding pocket where the TKIs bind. This project aims to understand the signalling pathways changes in BCR-ABL + cell lines and patient cells when combination therapy is given. Mechanistic understand will enhance our ability to predict whether patients are likely to respond to combination therapy, and ways to maximise synergism between these agents. We will also examine mechanisms of treatment resistance in vitro, in an attempt to predict emergent disease resistance mechanisms that may arise.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

Investigation of signalling pathways involved in ABL001-mediated inhibition and study of resistance to combinations of the ABL001 and TKIs using BCR-ABL1+ cell-lines

Please see Honours entry

Investigation of signalling pathways involved in ABL001-mediated inhibition and study of resistance to combinations of the ABL001 and TKIs using BCR-ABL1+ cell-lines

Please see Honours entry

**Research areas**

Cancer Biology and Clinical Oncology

**Monitoring of minimal residual disease on chronic myeloid leukaemia patients in a setting of treatment free remission**

For patients who have achieved deep molecular responses and have minimal residual disease after treatment, the new goal for clinicians today is to identify candidate patients that can safely cease TKI therapy achieving treatment free remission (TFR). It is estimated that approximately 50% of CML patients may be eligible to stop TKIs, however half of them experience molecular relapse, usually within 6 months, and have to restart therapy. CML is projected to become the most prevalent leukaemia by 2040, therefore it is critical to maximise the number of patients achieving TFR. However, unravelling the critical mediators of TFR is a major challenge.

The aim of the project will be to characterise the residual leukaemia population in TFR patients, and understand why some patients relapse and others don’t. One possible line of inquiry involves identifying the lineage of residual CML cells, through a highly sensitive DNA approach. This will involve a characterisation of the genomic breakpoint and the development of a patient-specific assay to monitor residual leukaemia on sorted cell populations.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil
The Dame Roma Mitchell Cancer Research Laboratories (DRMCRL) is a leading research centre in Australia with an integrated approach to breast and prostate cancer research that spans basic science to clinical translation.

The lab's research aims to improve disease outcomes for men with prostate cancer and women with breast cancer by understanding how sex hormones (such as testosterone, estrogen and progesterone) control tumour behaviour. This information is used to develop new drugs or treatment strategies that therapeutically manipulate sex hormone action. The DRMCRL has also pioneered the development of unique pre-clinical models of human breast and prostate cancers, especially ex vivo culture of human solid tumours, to facilitate translation of basic research into the clinic.

The DRMCRL comprises the Prostate and Breast Cancer Research groups, and employs more than 20 researchers. The Prostate Cancer Research programs have identified novel mechanisms of metastasis and resistance to current therapies, and are facilitating the development of a new type of drug to treat lethal prostate cancer.

Lead researcher: **Professor Wayne Tilley**

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**Research areas**

- Cancer Biology and Clinical Oncology
- Translational Health Outcomes
- Men’s Health
- Innovative Therapeutics
The Immunotherapy and GVL research group investigates the mechanisms of immunogenicity of haematological cancers, including effector immune responses against leukaemia-associated antigens such as WT1, proteinase 3, PRAME and BMI-1 in chronic myeloid leukaemia (CML) and multiple myeloma. We aim to ultimately enhance anti-leukaemia immune responses whether in the setting of allogeneic stem cell transplantation with the graft-versus-leukaemia (GVL) effect, or in an autologous setting targeting leukaemia-associated antigens. We are also developing chimeric antigen receptor (CAR) T cells targeting CD123 and IL1RAP which are expressed on leukaemia stem cells.

**Lead researcher:** Associate Professor Agnes Yong

**Email:** agnes.yong@sahmri.com

**HDR project opportunities**

**Characterisation of immune responses in chronic myeloid leukaemia patients in treatment-free remission**

Chronic myeloid leukaemia (CML) patients are treated with tyrosine kinase inhibitors (TKI), and the majority achieve good responses. Patients who have deep molecular responses can stop TKI treatment, and approximately 40% remain in treatment-free remission (TFR); however 60% will relapse and need to recommence TKI. We hypothesise that patients who remain in remission without TKI have favourable immune responses which prevent relapse. This project aims to study effector and suppressor immune responses in CML patients who cease TKI, and explore whether immunological parameters are predictive of TFR, in order to identify crucial effector pathways that could be targeted to maximise TFR achievement.

**Project Supervisor:** Associate Professor Agnes Yong

**Availability:** Semesters 1 and 2

**Research areas**

Cancer Biology and Clinical Oncology
Liver Metastasis Research Group
Basil Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Woodville

The Liver Metastasis Research Group investigates the molecular and cellular immune mechanisms that determine the capacity of a tissue to resist metastatic invasion. Our goal is to address the urgent medical needs of risk prediction, prevention, early detection, and treatment of liver metastases.

Being a small group with a clear translational research focus on the development of predictive and therapeutic biomarkers, we apply a straightforward bed-to-bench-and-back approach to determine the beneficial/detrimental functions of key immune mediators in cancer patients with distinctive disease progression patterns.

Inflammation is the very complex set of immune pathways underlying the normal acute response to injury and infection. However, unresolved chronic inflammation is a key driver of degenerative diseases and cancer. Therefore, protective adjustment of inflammation requires molecular and functional characterisation of the master regulators, which control the delicate balance between health and disease.

Lead researchers: Dr Ehud Hauben, Professor Guy Maddern
Email: ehud.hauben@adelaide.edu.au

Honours project opportunities

The nexus between metabolism, immunity, and liver metastasis

Liver metastasis is the leading cause of cancer-related death in bowel cancer patients. We do not know why in some patients the cancer spreads to the liver while others are cured by surgical removal of the tumour from the bowel. Our hypothesis is that liver resident cells either permit or resist invasion and growth of tumours based on the local capacity to effectively mount a protective immune response.

In Australia, metastatic colorectal cancer (mCRC) is the second most common cause of cancer-related death. Analysis of the South Australian Clinical Registry for mCRC revealed that 60% of mCRC patients suffer from spread of cancer to their liver.

Early onset of CRC and associated liver metastases in obese individuals is on the rise; however, our understanding of the role of metabolic pathways in regulating hepatic immune functions that allow or prevent liver metastasis remains very limited. Changes in liver composition may promote a favourable environment for tumour survival and growth. Therefore, strategies to limit fatty infiltration of the liver, to maintain hepatic immune function, to reduce damaging inflammatory and fibrotic processes, and to promote specific anti-cancer immune responses, can be developed as preventive therapeutic approaches for mCRC.

Project Supervisors: Dr Ehud Hauben and Professor Guy Maddern
Availability: Semesters 1 and 2
Special requirements: Nil

The response of liver-resident immune cell subsets to metastatic invasion

Metastasis is a complex process that relies on interactions between invasive circulating tumour cells and resident stromal cells that constitute the metastatic microenvironment. Tissue resident lymphocyte subsets and peripheral lymphocyte infiltrates can either prevent the metastatic process or support the invasion and growth of disseminated cancer cells. Primary liver cancer is initiated by chronic liver inflammation driven by hepatitis virus B or C infections, alcohol consumption, or non-alcoholic fatty liver disease. However, the link between liver disease and secondary hepatic malignancy remains controversial. The aim of this project is to determine the phenotype and function of T lymphocyte subsets and innate lymphoid cells in primary and secondary hepatic malignancy. Molecular characterisation of the role of specific lymphocyte subsets in liver metastasis can promote development of new strategies for risk prediction and prevention of metastatic progression.

Project Supervisors: Dr Ehud Hauben and Dr Kevin Fenix
Availability: Semesters 1 and 2
Special requirements: Nil

Development of targeted nanoparticles as preventative therapy for liver metastasis

The liver is the most common site for distant metastases from cancers arising in other organs. Secondary liver cancer (SLC) accounts for 95% of all hepatic malignancies, representing the second most common cause of cancer death worldwide (788,000 deaths in 2015). The majority of SLC cases are not amenable to surgical resection, resulting in a 5-year survival rate of about 11% in SLC patients. Healthy liver tissue is capable of activating local immunity against invading metastatic cells, while local immune dysfunction can render liver tissue susceptible to SLC. Nanovectors can be engineered to deliver therapeutic proteins that restore the local immune response against invading tumour cells. In particular, porous silicon nanovectors (pSiNVs), a new addition to the nanoparticle-based drug delivery vehicle field, combine biocompatibility, biodegradability, and high payload capacity. The use of pSiNVs for anticancer drug delivery was shown to overcome some of the challenges of conventional therapy. The aim of this proposal is to complete the preclinical development phase of a selected pSiNV - drug combination that will safely and effectively eliminate and prevent metastatic tumours spread and recurrence, through restoring antitumor immunity and intercepting tumour cell invasion and growth.

Project Supervisors: Dr Ehud Hauben and Professor Guy Maddern
Availability: Semesters 1 and 2
Special requirements: Nil
Development of predictive biomarkers of response to immunotherapy and radiotherapy in cancer patients

The future of cancer therapy lies in identifying subsets of patients who will benefit from particular therapies, using predictive biomarkers. These technologies offer hope of enhancing the value of cancer medicines and reducing their toxicity, cost and failure rates. Cancer immunotherapy is a therapeutic strategy designed to help the immune system destroy cancer cells, often by eliminating the effect of regulatory mechanisms (immune checkpoints) that control the capacity of our immune cells to attack other cells in our body. Programmed death 1 (PD-1) is a checkpoint protein on immune cells called T cells. Antibodies that block PD-1 protein improve survival in patients with advanced non-small-cell lung cancer (NSCLC). Lung cancer is the leading cause of cancer death: in 2017 there were 9021 deaths caused by lung cancer in Australia (AIHW 2017). This project aims to capitalise on the opportunity to analyse clinical samples from immunotherapy treated lung cancer patients. Our aim is to identify, validate and clinically develop novel biomarkers of response, toxicity and resistance following treatment of cancer patients with immunotherapy alone or combined with radiotherapy.

Project Supervisors: Dr Ehud Hauben and Professor Guy Maddern

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

The nexus between metabolism, immunity, and liver metastasis
Please see Honours entry

The response of liver-resident immune cell subsets to metastatic invasion
Please see Honours entry

Development of targeted nanoparticles as preventative therapy for liver metastasis
Please see Honours entry

Development of predictive biomarkers of response to immunotherapy and radiotherapy in cancer patients
Please see Honours entry

Research areas

Cancer Biology and Clinical Oncology
Immunology and Infection
Translational Health Outcomes
Innovative Therapeutics

More information

Acute Lymphoblastic Leukaemia (ALL) is the most common childhood cancer, and leading cause of non-traumatic death in children. For adolescents and young adults (AYA) with ALL the therapeutic outcomes are poor. Most older adults will die of their disease.

The recent wealth of genomic information has seen the emergence of new lesions known to confer high-risk, and other recurrent fusions and gene deletions for which the biological and clinical implications remain unclear. Further, recent studies have implicated the human microbiome in ALL development, treatment response and life-long comorbidities. The major challenge is to incorporate knowledge gained through Next Generation Sequencing (NGS) into clinical care and to systematically identify druggable targets and rational effective therapies to improve patient outcomes. To add to the complexity of therapeutic choice in ALL, immunotherapies (bi-specific T-cell engagers (BiTEs) and CAR-T cells), have shown efficacy in the relapsed/refractory setting, as a transplantation bridge. However, not all high-risk/relapsed ALL patients are eligible for immunotherapy, ~50% of patients experience severe hypersensitivity reactions, and the long-term clinical sequelae remains unknown. Our lab is the National Referral Centre for genomic screening of ALL cases across all age groups, as such we sequence a large number of patients and have identified a significant number of alterations and novel gene fusions for investigation.

All projects will involve a range of techniques which may include genomic sequencing, flow cytometry, cytokine measurement, molecular biology and cloning techniques including primer design, PCR Sanger sequencing, bacterial work and tissue culture. In addition we will be using other in vitro and in vivo (patient derived xenografts (PDX)/mouse avatars/germ free mice) models of ALL for some applications.

Lead researcher: Professor Deb White
Email: deborah.white@sahmri.com

Honours project opportunities

The cloning of novel full-length ALL gene-fusions
The cloning of novel full-length ALL gene-fusions from patient material into mammalian expression plasmids. This will allow in vitro characterisation of the down stream effects of these fusions, assessment of therapeutic responses and to investigate resistance to current targeted therapies.

Availability: Semesters 1 and 2
Special requirements: Nil

Establishment of a high sensitivity quantitative PCR
Establishment of a high sensitivity quantitative PCR assay to rapidly identify the presence of patient genomic lesions (minimal residual disease) throughout treatment to detect early relapse prior to morphological changes.

Availability: Semesters 1 and 2
Special requirements: Nil

Understanding the other factors which impact both disease initiation and therapeutic response
Understanding the other factors which impact both disease initiation and therapeutic response, in particular the effect of the immune system and environmental influences.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Cancer Biology and Clinical Oncology
Our laboratory studies the molecular and cellular basis for the development of the bone marrow cancer, multiple myeloma. Myeloma is characterised by the clonal proliferation of malignant plasma cells (an immune cell type that normally protects us against infection). Myeloma is the second most common blood cancer, with over 100,000 people diagnosed worldwide each year. Despite recent advances in treatment, myeloma remains almost universally fatal with a 10-year survival rate of approximately 17%. The main clinical manifestations of myeloma are the development of osteolytic bone lesions, bone pain, hypercalcaemia, renal insufficiency, suppressed immunoglobulin production and increased bone marrow (BM) angiogenesis (blood vessel formation). Most, if not all, cases of myeloma are preceded by a premalignant (asymptomatic) monoclonal gammopathy of uncertain significance (MGUS) stage. However, the intrinsic genetic factors which trigger the progression from this asymptomatic stage of the disease to overt malignant myeloma remains to be determined. Moreover, recent studies suggest that the bone marrow microenvironment plays a central role in disease progression.

Using state-of-the-art genomics, in vitro models of cancer development and pre-clinical models of disease, our laboratory is focused on identifying the key genes which are responsible for disease progression and the role played by the bone microenvironment in disease development and relapse. We believe that these approaches will enable us to identify new molecular markers of disease risk and to design drugs against novel therapeutic targets.

In addition to myeloma, our group also investigates how nutrient sensing pathways in the skeleton control bone mass and systemic glucose metabolism. Osteoblasts, the cells that form bone, have recently been shown to secrete factors that circulate in the blood stream and act on tissues remote to the bone to control metabolism and reproductive function. These remarkable developments in the fields of skeletal biology and endocrinology have important implications in the study of diseases which impact on skeletal health including osteoporosis and type 2 diabetes. Using sophisticated genetic models, our laboratory is studying the function of key insulin responsive pathways in osteoblasts in order to gain important insight into how the skeleton regulates global energy metabolism.

**Lead researcher:** Professor Andrew Zannettino  
**Email:** andrew.zannettino@adelaide.edu.au

**Honours project opportunities**

**Cancer cell dormancy in the bone marrow**

Multiple myeloma is an incurable cancer caused by the uncontrolled proliferation of antibody-secreting plasma cells. The plasma cells within the tumour masses of these bone marrow cancers can exist in one of two very different, yet interchangeable states. The majority of the tumour is made of rapidly proliferating cancer cells which can be killed by chemotherapeutics that target actively dividing cells. By contrast, buried within the tumour(s) are rare “dormant” cells, which are non-dividing and are refractory to these chemotherapeutics. These dormant cells provide a reservoir of cancer cells which are capable of switching to a proliferative state following activation of key intracellular pathways.

Our laboratory has been examining the role(s) that specific proteins controlling the dormancy/proliferation axis. The project will involve: mammalian cell culture, genetic modification of cells lines (both viral mediated transgenesis and CRISPR-Cas9 mediated gene editing), PCR, Western blotting, flow cytometry, in vitro proliferation and dormancy assays, as well as in vivo mouse models of multiple myeloma using bioluminescent imaging.

**Project Supervisor:** Dr Duncan Hewett  
**Availability:** Semester 1  
**Special requirements:** Nil

**The role of skeletal cells in myeloma disease progression**

Osteolytic bone disease occurs in 80-90% of Multiple Myeloma (MM) patients, leading to bone pain and increased risk of fractures. The basis for this bone disease is the uncoupling of the normal bone remodelling processes due to the release of numerous osteoclast (OC)-activating and osteoblast (OB)-supressing factors in the local microenvironment. This results in increased numbers/activity of the bone resorbing OC and a reduction in the numbers/activity of the bone forming OB, leading to the development of lesions. Understanding the interactions between the MM plasma cells and the microenvironment is the subject of ongoing research, in attempts to identify other possible treatment targets.

The aim of this project will be to investigate the role of OB and OC in the progression of MM and will focus on the disease relapse stage, where non-dividing/dormant MM plasma cells become activated and proliferate. It will examine whether manipulating the bone marrow microenvironment (including the OB and OC) will prevent the activation of the dormant cells and hence prevent or delay disease relapse. The project will use cell culture, in vivo mouse models, micro CT analysis, ELISAs, histology, real time PCR and Western blotting.

**Project Supervisor:** Dr Melissa Cantley  
**Availability:** Semester 1  
**Special requirements:** Nil

**The role of amino acid sensing by mTORC1 in skeletal development**

Bone loss is a significant problem in the aged, dramatically increasing the risk of fracture which is associated with significant morbidity, mortality and loss of independence. Currently, therapies to restore bone mass in the aged are limited. Gaining an understanding of the processes important in bone development may reveal therapeutic targets that promote bone. Our laboratory has investigated the role of mTORC1 in skeletal development. mTORC1 is a central signalling hub that plays a fundamental role in the regulation of cellular growth and metabolism. Loss of mTORC1 in bone causes an osteoporotic like phenotype suggesting activation of this pathway could be used to stimulate bone formation.

mTORC1 integrates a wide variety of signals including growth factors, energy levels and amino acids to control cell growth. However, the relative contributions of these inputs into the anabolic activity of mTORC1 in bone remains to be determined. The aim of this project is to investigate the role of amino acids in the anabolic activity of mTORC1 in the skeleton. This project will involve primary stromal cell isolation from transgenic mice, genetic manipulation using viral systems, RT-PCR, Western blotting, flow cytometry, differentiation assays and gene expression studies.

**Project Supervisor:** Dr Stephen Fitter  
**Availability:** Semester 1  
**Special requirements:** Nil

**HDR project opportunities**

**Cancer cell dormancy in the bone marrow**

Please see Honours entry

**Research areas**

Cancer Biology and Clinical Oncology  
Nutrition and Metabolic Health  
Musculoskeletal Health  
Ageing, Frailty and Mobility
Ovarian cancer is a devastating disease and the leading cause of death from gynaecological malignancies. It affects approximately 1 in 90 women in Australia with over 70% of patients presenting with advanced disease stage. Despite improvements in surgery and chemotherapy, ovarian cancer mortality rates have not changed dramatically over the last decade. To significantly improve ovarian cancer survival rates, identification of ovarian cancer biomarkers for early detection is essential, paired with improved molecularly targeted therapeutics.

The Reproductive Cancer Research Group seeks to understand the mechanisms involved in ovarian cancer spread, resistance to chemotherapy and the identification of novel biomarkers for early detection.

**Lead researcher:** Dr Carmela Ricciardelli

**Email:** carmela.ricciardelli@adelaide.edu.au

**Honours project opportunities**

### Targeting the hyaluronan signalling pathway to overcome chemo-resistance

Our recent studies have linked chemo-resistance with the production of the extracellular matrix component hyaluronan (HA). We have shown that HA can increase the expression of ABC transporters in ovarian cancer cell lines expressing the HA receptor, CD44, and thereby induce resistance to the chemotherapeutic drug, carboplatin. HA-CD44 interactions have been shown to activate several signalling pathways including the PI3K, MAPK and Rho K pathways. Genes of the PI3K/Akt cascade have also recently been shown to induce drug resistance to cisplatin. We plan to determine whether HA treatment activates these pathways in ovarian cancer cells and if specific inhibitors of these pathways can alter ovarian cancer sensitivity to carboplatin. This project will utilise a broad range of techniques including cell proliferation, western blotting, immunohistochemistry and qPCR.

**Project Supervisors:** Dr Carmela Ricciardelli and Dr Noor Lokman

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

### Versican as a target to inhibit cancer metastasis

Proteoglycans are major components of the extracellular and have been shown to regulate cell adhesion, cell signalling, apoptosis, migration and invasion. Increased expression of the chondroitin sulfate (CS) proteoglycan, versican in the peritumoral stromal matrix is associated with a poor outcome in many cancers, including breast and ovarian carcinoma. Although there is the accumulating in vivo evidence that versican is pivotal in promoting cancer cell metastasis in different cancer types, the means of preventing actions of versican in carcinomas have not been explored. This study will evaluate using in vitro and in vivo cancer models whether selective versican inhibition by versican siRNA, in addition to drugs known to inhibit versican synthesis; genistein, budesonide, formoterol and montelukast, can inhibit cancer invasive behaviour and block cancer metastasis.

**Project Supervisor:** Dr Carmela Ricciardelli

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

### Extracellular vesicles: Establishing methods for isolation and characterisation in blood of ovarian cancer patients

Extracellular vesicles (EVs) are nano-sized membrane-bound particles produced by virtually all cells in the body. They are found in all bodily fluids including the blood of ovarian cancer patients. EVs provide a major route of communication between different cell types throughout the body as they contain DNA, protein, RNA and lipid cargo characteristic of their cells of origin, which can be transferred to distant cells and affect their function. EVs are found in increasing numbers in the blood circulation under certain conditions, e.g. during normal pregnancy, and in cancer. The RNA and protein content of EVs have been characterised in studies of various commercially available cancer cell lines, including ovarian cancer cells but to date there have been limited studies characterising EVs from ovarian cancer patient blood samples.

Currently there is no consensus in the literature as to whether serum or plasma is the most appropriate blood sample for EV isolation and downstream analysis, although both have been used. This study will determine the most suitable EV isolation method for EVs from blood samples using nanoparticle tracking analysis (NTA). Isolated EVs will be further characterised and quantified by a fluorescent plasma membrane stain, then with fluorescent antibody labelling, with Qdots and antibodies against characteristic EV surface markers (CD63 and CD326). These studies will aid subsequent analysis of EVs to identify novel ovarian cancer biomarkers for diagnosis and monitoring disease progression.

**Project Supervisors:** Dr Carmela Ricciardelli and Dr Anne Macpherson

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

### Targeting the hyaluronan signalling pathway to overcome chemo-resistance

Please see Honours entry

### Extracellular vesicles: Identification of novel biomarkers and therapeutic targets for serous ovarian cancer

This study will examine the proteomic profile in EVs isolated from patients with diagnosed late stage serous ovarian cancer, compared to benign serous cystadenomas and healthy controls. Candidate proteins that are differentially expressed will be validated and further characterised in ovarian cancer patient cohorts and using functional assays (adhesion, migration and invasion assays).

**Project Supervisors:** Dr Carmela Ricciardelli and Professor Martin Oehler

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

### Reproductive Cancer Research Group

The University of Adelaide, North Terrace Campus

Ovarian cancer is a devastating disease and the leading cause of death from gynaecological malignancies. It affects approximately 1 in 90 women in Australia with over 70% of patients presenting with advanced disease stage. Despite improvements in surgery and chemotherapy, ovarian cancer mortality rates have not changed dramatically over the last decade. To significantly improve ovarian cancer survival rates, identification of ovarian cancer biomarkers for early detection is essential, paired with improved molecularly targeted therapeutics.

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**Lead researcher:** Dr Carmela Ricciardelli

**Email:** carmela.ricciardelli@adelaide.edu.au

**Honours project opportunities**

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**Project Supervisors:** Dr Carmela Ricciardelli and Dr Noor Lokman

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

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**Availability:** Semesters 1 and 2

**Special requirements:** Nil

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**Project Supervisors:** Dr Carmela Ricciardelli and Dr Anne Macpherson

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

### Targeting the hyaluronan signalling pathway to overcome chemo-resistance

Please see Honours entry

### Extracellular vesicles: Identification of novel biomarkers and therapeutic targets for serous ovarian cancer

This study will examine the proteomic profile in EVs isolated from patients with diagnosed late stage serous ovarian cancer, compared to benign serous cystadenomas and healthy controls. Candidate proteins that are differentially expressed will be validated and further characterised in ovarian cancer patient cohorts and using functional assays (adhesion, migration and invasion assays).

**Project Supervisors:** Dr Carmela Ricciardelli and Professor Martin Oehler

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

### Research areas

Cancer Biology and Clinical Oncology

Dr Carmela Ricciardelli
The Solid Tumour Group, incorporating the SAHMRI Colorectal Cancer Node, is headed by Professor Tim Price and works on a comprehensive program in colorectal and breast cancer spanning prevention, development and novel therapies. Themes include identification, development and clinical trial of new therapeutic agents for the treatment of colorectal cancer and breast cancer, development of new biomarkers of drug resistance and therapeutic targets, and mouse models of breast and colon cancer for efficacy testing of new drugs.

We have found that one in five young adults who develop colorectal cancer carries an inherited gene mutation which has predisposed them to this condition. Most of the young adults who carry the mutation have no characteristics which would have triggered genetic testing to be carried out. This suggests that all young patients with colorectal cancer should undergo genetic testing to identify such gene mutations as these may also be carried by other family members.

Prevention strategies for colorectal cancer can then be put into place by enrolling family members into surveillance colonoscopy programs. We have also found that a new type of drug derived from a plant used in herbal medicine has been shown to significantly inhibit the formation of new blood vessel networks. This process (angiogenesis) is necessary for the growth and metastasis of solid tumours such as colorectal or breast. We will be testing the efficacy of this new type of drug in animal models of cancer. This work is being undertaken by the Molecular Oncology Group in collaboration with Professor Andrea Yool, Adelaide Medical School.

**Lead researcher:** Professor Timothy Price

**Email:** timothy.price@sa.gov.au

**Honours project opportunities**

**Role of aquaporin 1 in tumour angiogenesis in colon or breast cancer (2 projects)**

Aquaporin (AQP) 1 is a water channel protein involved in cellular water flux, and implicated in migration, angiogenesis and metastasis in cancer. The drug discovery program in Professor Yool’s lab has identified several drugs that modulate aquaporin channel activity. We have found that several of these drugs are effective in vitro at reducing migration and invasion of colon cancer cells and preventing angiogenesis (tumour blood vessel formation). We aim to investigate the efficacy of these drugs in inhibiting angiogenesis in vitro and in halting metastasis in pre-clinical mouse models of human colon or breast cancer. Our hypothesis is that tumour cells that lack AQP1 activity are unable to respond to hypoxia which drives angiogenesis.

We will also establish a biobank of organoids cultured from metastatic breast biopsies for research work, in assessing the response to different novel therapeutic drugs in culture, and in characterising the mutational landscape and how that changes with developing resistance. A biobank of metastatic breast organoids is a much needed resource for future research which is currently lacking in this state. Techniques include cell culture, RNAi knockdown, RT-PCR, western blotting, functional assays of cell proliferation, invasion, migration, and angiogenesis and mouse models of human cancer.

**Project Supervisors:** Dr Jennifer Hardingham, Dr Amanda Townsend, Professor Timothy Price

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Determination of biomarkers to predict resistance in tumours from patients undergoing anti-angiogenesis therapy**

MicroRNA (miRNA) is a class of highly conserved, single-stranded, small RNAs that regulate gene expression at the post-transcriptional level by inhibiting the translation of protein from mRNA or by promoting the degradation of mRNA. Several endothelial-specific miRNAs have been implicated in the regulation of different aspects of angiogenesis, including migration and proliferation of endothelial cells. MicroRNA expression analysis will be used in correlative studies on archival tissue to identify biomarkers of resistance to bevacizumab (anti-VEGF monoclonal antibody). Techniques will include DNA and RNA/microRNA isolation from tissue blocks, running microRNA profiles, bioinformatics, and statistical analysis.

**Project Supervisors:** Dr Jennifer Hardingham, Professor Timothy Price, Dr Eric Smith

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Role of fibroblasts in mediating resistance to therapy**

Various cell types of mesodermal origin, including fibroblasts, pericytes, immune and endothelial cells, contribute to the stromal compartment of the tumour microenvironment. These cells are recruited and/or locally expanded from resident cells, and typically display activated phenotypes not found in normal tissue from which the tumour originated. These cells contribute to tumour development, progression and resistance to therapy. While the functional heterogeneity and disparate roles and effects of immune and vascular cells have been widely studied, knowledge about other mesenchymal cells including cancer-associated fibroblasts is poorly understood. This project will investigate the role of fibroblasts in mediating responses to colorectal cancer therapies, including radiotherapy, systemic chemotherapy and targeted therapies.

This project will involve: mammalian cell culture including cancer-fibroblast co-culture, PCR, western blot, immunofluorescence, flow cytometry, lentiviral-mediated modulation of gene expression, in vivo imaging in mouse models.

**Project Supervisors:** Dr Eric Smith, Dr Jennifer Hardingham

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Type 2 diabetes and early onset bowel cancer**

Colorectal cancer (CRC) incidence is rising among young adults, at a time when the rate of this condition is declining in the older patients in our population. The reason for the decline in older cases is population screening via stool testing and colonoscopy. However, the increase in the younger members of our population is unexplained. Recent work from our South Australian Young Onset CRC study (SAYO) has shown a significant association between young onset colorectal cancer (CRC) and personal and familial risk of type 2 diabetes (T2D). Though diabetes of all types affects 1 in 17 adults Australians (6%), less than 5% have T2D. This is a highly significant difference. Our finding is novel, and suggests that having a personal or first-degree family history of T2D may potentially identify a subset of young adults at increased risk for CRC. This project will extend our established studies, and allow us to sample different groups across the population of SA including rural and urban patients. It will also investigate a novel mecanistic basis for young onset CRC, and feasibility of discovering blood test markers to identify those young adults at highest risk.

**Project Supervisor:** Timothy Price

**Availability:** Semesters 1 and 2

**Special requirements:** Nil
Exploring the association between bowel cancer and type 2 diabetes

Colorectal cancer (CRC) incidence is rising among young adults, at a time when the rate of this condition is declining in the older patients in our population. The reason for the decline in older cases is population screening via stool testing and colonoscopy. However the increase in the younger members of our population is unexplained. Recent work from our South Australian Young Onset CRC study (SAYO) has shown a significant association between young onset colorectal cancer (CRC) and personal and familial risk of type 2 diabetes (T2D). Though diabetes of all types affects 1 in 17 adult Australians (6%), less than 5% have T2D. This project will investigate the association between colorectal cancer and type 2 diabetes from the perspective of a cohort of patients with type 2 diabetes assessing their familial risk for type 2 diabetes and personal and familial risk for bowel cancer and polyps. Variables to be assessed include age of onset of type 2 diabetes, number of relatives with type 2 diabetes, inheritance patterns, including parent-of-origin effects, and how these are related to bowel cancer and polyps.

Project Supervisor: Timothy Price
Availability: Semesters 1 and 2
Special requirements: Nil

Investigating the rise in prevalence of appendiceal cancers

Appendiceal cancer is a rare malignancy and has the potential to become an aggressive disease. Though rare the incidence of appendiceal cancer is increasing, and this observation is currently unexplained. Primary adenocarcinoma of the appendix is frequently diagnosed incidentally at histologic assessment of the surgical specimen following appendectomy for suspected or diagnosed appendicitis. This project will examine the demographics, medical history such as appendicitis, histology, and potential risk factors of developing appendiceal cancer. Family history of type 2 diabetes will also be explored. The project will involve patient interviews, and statistical analysis of results.

Project Supervisor: Timothy Price
Availability: Semesters 1 and 2

Genomic and epigenomic germline changes in early onset colorectal cancer

Colorectal cancer (CRC) incidence is rising among young adults, at a time when the rate of this condition is declining in the older patients in our population. The increase in the younger members of our population is unexplained. In this project we will look at germline genomic factors for the development of early onset bowel cancer. Procedures include whole exome sequencing (WES) analysis for rare deleterious mutations, and clusters of moderate risk alleles, SNP genotyping of blood DNA from young onset advanced colorectal cancer patients for known monogenic type 2 diabetes predispositions, known common risk loci for type 2 diabetes and CRC, and novel polygenic signatures in CRC-affected young adults.

Project Supervisor: Timothy Price
Availability: Semesters 1 and 2

Research areas
Cancer Biology and Clinical Oncology
CARDIAC, RESPIRATORY AND VASCULAR HEALTH
Healthy heart, lungs, arteries and veins are vital to overall good health. Despite being largely preventable, cardiovascular disease is one of Australia’s leading health problems, affecting one in six people and accounting for nearly 30% of deaths.

Our researchers conduct interdisciplinary research to understand the mechanisms which underlie the development of coronary heart disease, peripheral arterial disease, and vascular and heart rhythm disorders. Utilising the skills of physicians, bioengineers, research scientists and computational modelers, research is focused on translating biomedical discoveries to clinical practice.

Furthermore, researchers undertake clinical trials and epidemiological studies into cardiovascular disorders with the objective of improving health outcomes for patients.

Researchers across the faculty are focused on:

- understanding the molecular and cellular mechanisms underlying cardiac and vascular disorders including peripheral arterial disease, atherosclerosis and cardiac arrhythmias
- exploring the relationship between atrial fibrillation, blood clotting and stroke
- developing improved cardiovascular imaging and disease detection methods
- understanding the relationship between high density lipoproteins (HDL) and cardiovascular risk
- developing strategies to modify cardiovascular risk through the control of obesity and obesity-related conditions
- applying evidence-based medicine, recommendations and guidelines to target education and improve health outcomes for at risk cardiac patients
- developing new approaches to treat airway inflammation in asthma and chronic obstructive pulmonary disease (COPD)
- developing cell and gene therapy approaches for diseases affecting lung blood vessels (pulmonary hypertension) and lung transplant.
The Cardiovascular Pathophysiology and Therapeutics Group reflects the combined interests of members of The Queen Elizabeth Hospital’s (TQEH) cardiology and clinical pharmacology groups. This research collaboration has existed for over the past 20 years at TQEH.

We are mainly interested in developing a better understanding of the new’ cardiovascular epidemics of the 21st century, including atrial fibrillation, systolic hypertension, aortic valve disease, stress’ Tako-Tsubo’ syndrome and metabolic heart disease. We recognise that these conditions are responsible for impaired quality of life, as well as increased mortality rates. Therefore, we consider the development of effective treatment modalities as a major priority.

Lead researcher: Professor John D Horowitz
Email: john.horowitz@adelaide.edu.au

Honours project opportunities

Impaired platelet autacoidal signalling in patients with coronary vasospasm.

Angina pectoris is a common and debilitating problem in Western society, usually resulting from narrowings of coronary arteries. However, in a substantial minority of patients, spasm of the large or small coronary arteries is the cause of pain. While this condition can be treated symptomatically, there is no available cure, and many patients have poor quality of life because of frequent and recurrent episodes of pain. We are currently evaluating integrity of signalling pathways related to anti-aggregatory autacoids (e.g. nitric oxide and prostacyclin) in coronary spasm patients, with encouraging pilot results. These ongoing studies may lead to the development of better treatments for this condition.

Project Supervisors: Dr Y Chirkov, Dr TH Nguyen and Professor J Horowitz
Availability: Semesters 1 and 2
Special requirements: Nil

The “Resilient Heart” project: Towards better understanding of anthracycline-induced cardiac injury.

Chemotherapy-induced cardiotoxicity is an emerging cause of heart failure that could add millions more to the healthcare budget. Currently, there are over 400,000 cancer survivors in Australia and that number is expected to continuously increase. Given that virtually all of the drugs concerned are cardiac toxic, this advance has come at the cost of increased risk of symptomatic or fatal heart failure.

Doxorubicin, a member of the anthracycline family, is a well-known chemotherapeutic agent which is used in treatment of a wide variety of cancers. The successful use of doxorubicin has been hampered by toxicities such as hematopoietic suppression, nausea, vomiting, extravasation, and alopecia, yet the most feared side-effect is cardiotoxicity.

The planned study will utilize technology which is already established in our laboratory study to establish the determinants of extent of toxic effect of doxorubicin compared with those of other more recently developed antineoplastic drugs. The technology will utilize human myocardial cell grown in culture, and will quantitate the transition from complete cell viability through apoptosis to eventual necrosis. The results will help in the development of methods to develop cardiac-safe anticancer therapeutics.

Project Supervisors: Dr S Liu and Professor J Horowitz
Availability: Semesters 1 and 2

HDR project opportunities

Impact of B-type natriuretic peptide (BNP) on stabilisation and function of the myocardium

We have recently shown that BNP exerts important anti-inflammatory effects, by stabilising white blood cells and diminishing superoxide production. We wish to determine whether this results in limitation of inflammatory change within the heart, and whether this anti-inflammatory effect of BNP is lost in acute heart failure.

Project Supervisors: Dr S Liu, Dr Y Chirkov and Professor J Horowitz
Availability: Semesters 1 and 2

The heart in stress: tako-tsubo cardiomyopathy

Tako-Tsubo syndrome (TS) occurs mainly in ageing women as a dysfunctional, inflammatory response of the heart to adrenaline. We have partially characterised the chemical signal transduction pathway in TS, and now seek to evaluate potential therapeutic avenues, using intact animal models, essentially to characterize the impairment in post-receptor signalling.

Project Supervisors: Dr TH Nguyen and Professor J Horowitz
Availability: Semesters 1 and 2
Defects in physiological regulation of platelet aggregation: implications in the setting of potential coronary stenting

We are studying regulation of blood clot formation in patients with different cardiac conditions. Blood clots cause heart attacks and strokes. Clot formation can be prevented with special medications (e.g. clopidogrel or ticagrelor), which are used clinically to prevent thrombosis.

Our research is aiming to identify a reason for the frequently occurring less-than-expected response to these medications. We are focusing on platelets because the starting point for blood clot is platelet aggregation. Autacoids, naturally occurring within the organism (e.g. nitric oxide and prostacyclin) which are supposed to control the normal function of platelets, stop working properly in patients with cardio-vascular diseases. It turns out that the platelet adenylate cyclase system is particularly important in predicting responses to clopidogrel and related drugs, implying that defective adenylate cyclase signalling may be the basis for poor patient responses to this class of drugs. We are trying to work out what is going wrong with this regulation and how it could be restored.

**Project Supervisors:** Dr Y Chirkov and Professor J Horowitz

**Availability:** Semesters 1 and 2

**Research areas**

Cardiac, Respiratory and Vascular Health

Translational Health Outcomes

Innovative Therapeutics
The Basil Hetzel Institute for Translational Health Research offers a range of postgraduate and honours training opportunities each year for PhD, Masters and Honours students. Being part of The Queen Elizabeth Hospital, researchers can work closely with the hospital’s clinical divisions, and this has led to a focus on translational health research, an innovative 'bench to bedside' approach in which scientific discoveries can be quickly translated into improved patient care and treatment. The Clinical Pharmacology Unit is affiliated with the Discipline of Pharmacology of the University of Adelaide. It provides a clinical therapeutic drug monitoring service coupled with an active research program in the areas of heart disease, kidney transplantation and cancer. Through research in these fields we strive to provide a better understanding of drug action, metabolism and disposition in patients with varied genetic makeup in order to better use and tailor medications to each individual, and to develop new therapies.

Lead researcher: Associate Professor Benedetta Sallustio
Email: benedetta.sallustio@sa.gov.au

Honours project opportunities
Honours projects are available with this group; please contact the lead researcher(s) for more information.

HDR project opportunities

Metabolic treatments for heart disease and cancer
Altered cellular energy metabolism is an underlying feature of both heart disease and cancer. In heart disease, maladaptive changes in energy utilisation and storage contribute to a decline in myocardial function and structural remodelling. In cancer cells, changes in energy utilisation allow increased cell survival, replication and metastasis. In addition, a number of cancer chemotherapy agents cause myocardial damage. Therefore, it is possible that myocardial metabolic agents designed for treatment of heart disease, may also be useful adjunct therapy in cancer. PhD and honours projects are available in two broad research areas:
1. Investigating the efficacy of new myocardial metabolic agents in the treatment of heart failure and ischaemic heart disease.
2. Developing new therapies for chemotherapy-induced myocardial toxicity in cancer patients.

Availability: Semesters 1 and 2

Individualising transplantation therapy
The success of kidney transplantation depends largely on preventing rejection of the new organ, using a combination of immunosuppressant drugs. These drugs have narrow therapeutic indices and can cause renal, gastrointestinal or haematological toxicity. Due to significant variability in their elimination from the body, doses are currently individualised by targeting therapeutic concentrations in blood. Despite this, rejection and toxicity still occur. Our research focuses on understanding immunosuppressant distribution into lymphocytes (the mediators of rejection) and renal tissue (a major site of toxicity), as a means of better predicting individual risk of rejection and damage to the transplanted organ. Projects are available in two broad areas of research:
1. To investigate genetic variability in the pathways of immunosuppressant elimination in both kidney donors and recipients, to determine its impact on intra-renal and intralymphocyte exposure to immunosuppressants, and its association with rejection and long-term function of the transplanted kidney.

Availability: Semesters 1 and 2
Professor Lyle Palmer leads an interdisciplinary program aimed at investigating the genetic epidemiology of common, chronic disease. In particular, we are actively investigating the genetic determinants of obesity, growth in early life and childhood, and various chronic diseases – with a current focus on obstructive sleep apnea. This team is also active in the area of precision medicine, and together with clinical and engineering collaborators is leading a program of methodological and applied research in precision radiology. Members of the Unit also conduct methodological research in biostatistics and epidemiology. Current research projects include:

- The genetic epidemiology of obstructive sleep apnea
- The use of routinely collected radiologic images and linked health data to predict clinically important outcomes.

Lead researcher: Professor Lyle Palmer
Email: lyle.palmer@adelaide.edu.au

Project opportunities

Genetic epidemiology of obstructive sleep apnea
Investigate the genetic and/or epidemiological basis of obstructive sleep apnea using data from the Western Australian Sleep Health Study and potentially other international resources (available as part of the International Sleep Genetic Epidemiology Consortium).

Project Supervisor: Professor Lyle Palmer
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: Some skills in quantitative analysis and data manipulation will be necessary. Students will have completed epidemiological and/or biostatistics courses, as relevant to this project.

Observational epidemiology of common chronic diseases
Investigate epidemiological hypotheses related to various common chronic diseases (e.g., cancer, cardiovascular disease, respiratory disease) using observational data from an exceptional cohort study – the Ontario Health Study (OHS). The OHS is a population-based cohort of over 200,000 adults collected in Ontario, Canada, and is the largest cohort study ever undertaken in Canada.

Project Supervisors: Professor Lyle Palmer, Professor John Lynch
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: Some skills in quantitative analysis and data manipulation will be necessary. Students will have completed epidemiological and/or biostatistics courses, as relevant to this project.

Research areas
Cardiac, Respiratory and Vascular Health
Public Health
Men's Health
Nutrition and Metabolic Health
The Health Observatory
Basel Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Woodville, South Australian Health and Medical Research Institute (SAHMRI)

The Health Observatory is a specialist population research centre conducting a number of large scale representative population studies on health surveillance of chronic disease and related factors. The ultimate focus of the observatory is to contribute to positive ageing by improving population health across the life span. The work involves the tracking of population health to identify gaps/targets that can be better addressed through prevention strategies and/or better management of chronic conditions and conditions associated with ageing.

Lead researcher: Professor Robert Adams
Email: robert.adams@adelaide.edu.au

HDR project opportunities
Sleep medicine and sleep health

The Men: Androgens, Inflammation, Lifestyle and Environment Sleep Study (MAILES) is one of the largest and most detailed population-based studies of sleep in men in the world, including using home-based full sleep studies and extensive biomedical and psychosocial measures. This ongoing project, involves collaboration with researchers across the University of Adelaide, Flinders University and Sydney University. It has current National Health and Medical Research Council (NHMRC) funding to collect follow-up data to examine the longitudinal effects of sleep disorders and sleep disturbance in men on health outcomes, links to other diseases and ways to improve service delivery.

Some current projects include: the relationships between sleep disturbance, inflammation and chronic pain; the influence of dietary patterns on sleep apnea; the longitudinal effects of sleep apnea on health, and which moderating factors (e.g. obesity, diet, stress) influence these effects; and more.

Other projects involve analyses of a Sleep Health Foundation funded on-line study of sleep, to investigate relationships between insomnia phenotypes and help seeking behaviours and outcomes in addition to social patterns of sleep.

Project Supervisor: Professor Robert Adams
Availability: Semesters 1 and 2

Chronic disease and population health

The North West Adelaide Health Study (NWAHS) is a major South Australian chronic disease cohort study of over 4000 adults that has been in operation since 1999. NWAHS was formulated to provide much needed and unique representative, longitudinal data on chronic conditions and health-related risk factors in South Australia. The study’s focus is on chronic conditions (including bio-medically measured diabetes, asthma, chronic obstructive pulmonary disease, kidney health, sleep disorders and self-reported doctor-diagnosed arthritis, osteoporosis, cancer, mental health and cardiovascular disease), and modifiable health-related risk factors (such as smoking, alcohol, physical activity, overweight/obesity, cholesterol and blood pressure).

These variables are examined in relation to the demographic and socio-economic characteristics of participants (such as income, education, work, occupation, country of birth, and marital status). The study also collects information from participants about their health care service utilisation and medications, and links this information with data received from Medicare and the Pharmaceutical Benefits Scheme.

Data are also linked to SA-NT Datalink for hospital inpatient and outpatient data as well as the National Death Registry (including deaths related to cancer).

A number of projects are available examining the longitudinal time course of health and chronic conditions.

Availability: Semesters 1 and 2

Simulation modelling and systems design

Used to predict the implications of making significant changes to the existing health care system, such as with transforming health. The essence of this work is that health service redesign should be tested as rigorously as new treatments or medicines. This advocates acceleration of the redesign of care delivery to patients through well-controlled experiments. Unfortunately, the health service cannot wait until everything is in place and working properly before changes are made. Modelling and simulation makes coordinating this challenge possible. Simulation modelling provides a mechanism to better understand the flow of patients through the system, before changes are made. Currently available projects include looking at: management of acute and chronic patients at the Queen Elizabeth Hospital (funded by the Hospital Research Foundation), expansion and reconfiguration of emergency services at different hospitals, intensive care units, and cardiac care.

A simple visual example created by one of our partners can be seen at: youtube.com/P45WgRlc2sl

Availability: Semesters 1 and 2

Musculoskeletal medicine

A wide range of human clinical intervention studies in gout, giant cell arteritis and osteoarthritis are ongoing. In addition, NWAHS has the largest and most comprehensive data on musculoskeletal pain and disability and its impact in Australia. Data analysis is ongoing to support planning of services for musculoskeletal conditions as part of the health reform agenda. International collaborations exist looking at comparisons across countries of foot pain and associated disability.

Project Supervisor: Professor Catherine Hill
Availability: Semesters 1 and 2

Research areas
Cardiac, Respiratory and Vascular Health
Men’s Health
Musculoskeletal Health
Translational Health Outcomes
Men’s Health: Vascular and Brain Health program

University of Adelaide, North Terrace Campus, Adelaide Health and Medical Sciences Building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)

Our research aims to advance our understanding of cardiovascular disease, blood pressure, depression disorders including late onset depression, anxiety disorders, and dementia, and apply this understanding to reduce risk and improve screening and treatments.

Lead researcher: Dr Phillip Tully
Email: phillip.tully@adelaide.edu.au

Honours project opportunities

The association between blood pressure and its variability with brain outcomes

Elevated systolic blood pressure is the leading modifiable risk factor for death and disability globally, and a key factor in target organ damage especially in the brain. Unfortunately, treat-to-target randomised controlled trials for hypertension have not lead to a reduction in dementia suggesting there is still more to understand about blood pressure’s role in brain outcomes. Our group has several projects investigating blood pressure variability and brain outcomes, and students can pursue this topic by,

1) participating in prospective studies of blood pressure variability and cognitive function or depression,
2) participate in a large project analysing IPD from the variable brain consortium, or
3) perform an aggregate systematic review.

Project Supervisors: Dr Phillip Tully
Availability: Semesters 1 and 2
Special requirements: Nil

Sleep, stress and gastrointestinal symptoms

Work hours and shift work are linked with risk of gastrointestinal disorders including cancer, gastroesophageal reflux disease, colitis, and change in defecation routines. It remains largely unknown whether disturbances in gastrointestinal functioning are related to changes in dietary pattern, sleep and stress or occupational factors such as workload. The project aims are twofold and students may participate in one or both aspects: 1) to analyse shift work, occupational stress, sleep and diet in relation to gastroesophageal reflux disease, and 2) perform a systematic review of work hours and shift work in relation to gastrointestinal outcomes.

Project Supervisors: Dr Phillip Tully
Availability: Semester 1
Special requirements: Nil

Student health and well-being

Improving student health and welfare is an important pursuit for universities and the future workforce worldwide. Unfortunately, university students face increasing demands to balance their studies with work, sport and social lives, leading to compromised sleep, mental health and unhealthy coping strategies. This project aims to explore university student health and wellbeing using an ongoing survey of French university students (i-Share online at http://www.i-share.fr/). Potential projects include evaluating university students’ internet use, sleep, alcohol and tobacco use, academic stress, and factors relating to wellbeing and mental health.

Project Supervisors: Dr Phillip Tully
Availability: Semester 1
Special requirements: Nil
Molecular Physiology of Vascular Function Research Group

The objectives of our research group are to identify and investigate mechanisms and therapies for vasomotor disorders. The research involves investigation of vasospasm of large or small vessels and mechanisms contributing to vasodilatory septic shock. The research team is involved in both preclinical, basic research, and translational research using a three-pronged approach, which includes:

- Clinical characterization of vasomotor disorders
- Discovery of underlying molecular mechanisms
- Exploring novel therapies in basic & clinical studies.

Lead researcher: Dr David P Wilson
Email: david.p.wilson@adelaide.edu.au

Honours project opportunities

Heterogeneity in vascular tone and blood pressure regulation: exploring intrinsic and extrinsic variability.
**Project Supervisor:** Dr David P Wilson
**Availability:** Semesters 1 and 2
**Special requirements:** Nil

Exploring strategies to reduce vasopressor insensitivity in health and disease.
**Project Supervisor:** Dr David P Wilson
**Availability:** Semesters 1 and 2
**Special requirements:** Nil

Beyond receptor internalisation, exploring novel regulators of vasopressor sensitivity in blood vessels.
**Project Supervisor:** Dr David P Wilson
**Availability:** Semesters 1 and 2
**Special requirements:** Nil

HDR project opportunities

Heterogeneity in vascular tone and blood pressure regulation: exploring intrinsic and extrinsic variability.
Please see Honours entry

Exploring strategies to reduce vasopressor insensitivity in health and disease.
Please see Honours entry

Beyond receptor internalisation, exploring novel regulators of vasopressor sensitivity in blood vessels.
Please see Honours entry

Research areas

Cardiac, Respiratory and Vascular Health
Translational Health Outcomes
Our research group aims to improve outcomes for people with cardiovascular disease in northern Adelaide. Our main research themes include management of coronary heart disease, heart disorders during pregnancy, and heart disease in women. We are a passionate team of clinicians and scientists who have a strong focus on collaborative clinical research in a hospital setting. The diversity of our research strengths and methods means that there are many opportunities for students to explore and develop their own research interests.

Lead researcher: Associate Professor Margaret Arstall
Email: margaret.arstall@sa.gov.au

Honours project opportunities
Validation of a novel method to assess endothelial function

Endothelial function is an important factor to consider when evaluating overall cardiovascular health. Our research group has identified a simple, non-invasive method for assessing endothelial function. This project will involve validating our method in a range of populations and clinical settings.

Project Supervisor: Associate Professor Margaret Arstall
Availability: Semesters 1 and 2
Special requirements: Nil

Pregnancy and heart disease

Traditional risk factors for heart disease include hypertension, diabetes, smoking and obesity. There is clear evidence indicating that pregnancy complications should be counted as equally important risk factors, but they are not routinely considered by clinicians in risk assessments. This project seeks to explore the influence of pregnancy complications on future health of women who present to the Lyell McEwin Hospital with heart disease.

Project Supervisor: Associate Professor Margaret Arstall
Availability: Semesters 1 and 2
Special requirements: Nil

Cardiac Obstetric Registry of South Australia (COROSA)

COROSA is a collaboration between cardiology and obstetrics at the Lyell McEwin Hospital. We know that women with heart disease are more likely to have poor outcomes of pregnancy, but we have limited understanding of prevention and treatment techniques for these patients. Analysis of medical and demographic information about pregnant women who have heart disease may allow important advancements to be made towards improvement in patient care and outcomes. Projects can be tailored to suit interests of students.

Project Supervisors: Associate Professor Margaret Arstall, Dr Carr Men Chung
Availability: Semesters 1 and 2
Special requirements: Nil

Cardiovascular Assessment after Obstetric Complications: Follow-up for Education and Evaluation (COFFEE)

This study is an exciting partnership between cardiology and obstetrics based at the Lyell McEwin Hospital. Women who experience complications of pregnancy have an increased risk of developing future cardiovascular disease. The COFFEE program is the first Australian research-informed, clinical-based postpartum initiative for women who have had pregnancy complications. We have a variety of both clinic- and lab-based projects available with a strong emphasis on translatable clinical research.

Project Supervisors: Associate Professor Margaret Arstall, Professor Gus Dekker, Professor Claire Roberts
Availability: Semesters 1 and 2
Special requirements: Nil

Cardiovascular assessment in pregnancy with iron deficiency or iron deficiency anaemia

Approximately 25% of Australian women develop anaemia during pregnancy, primarily due to iron deficiency. Anaemic women may develop cardiovascular complications, in turn resulting in disorders such as preterm birth, low birth weight, perinatal mortality and postnatal depression. Many studies have demonstrated the effects of haemoglobin on cardiovascular and endothelial function; however, few have investigated how changes in iron-deficiency or iron-deficiency anaemia may affect the cardiovascular system. This study aims to investigate the effect of iron infusion with ferric carboxymaltose on the cardiovascular system in pregnant women.

Project Supervisors: Associate Professor Bernd Froessler, Associate Professor Margaret Arstall
Availability: Semesters 1 and 2
Special requirements: Nil

Surviving cardiac arrest in northern Adelaide

Only 1 in 10 people will survive after a cardiac arrest occurring outside of the hospital in northern Adelaide. In order to develop strategies to improve this high mortality rate, we have start an ongoing registry that offers the opportunity to explore each facet of the patient journey from arrest through to hospital discharge and beyond. Our projects mainly have a cardiology focus with input from hospital physicians and SAAS paramedics, but there is potential for broader collaborations with epidemiology, rehabilitation medicine, outcomes research and psychiatry. Small to medium projects can be adapted to suit the interests of summer research and honours students. Two broad PhD projects are available: firstly, a statewide study of physician-led decision-making for emergency cardiac catheterisation, including a trial of a treatment algorithm to improve survival; and secondly, a study of physical, mental and emotional outcomes after discharge with the opportunity to develop and trial an intervention to improve survivor and caregiver health status.

Project Supervisor: Associate Professor Margaret Arstall
Availability: Semesters 1 and 2
Special requirements: Nil

The role of rho-kinase in coronary spasm

Coronary spasm is a debilitating disease that can be associated with chest pain and poor quality of life. This project will investigate the underlying mechanisms of coronary spasm by characterising the expression of rho-kinase, a biomarker implicated in the pathogenesis of vasospasm.

Project Supervisors: Associate Professor Margaret Arstall, Dr Eng Lee Ooi
Availability: Semesters 1 and 2
Special requirements: Nil
HDR project opportunities

Cardiac Obstetric Registry of South Australia (COROSA)
Please see Honours entry

Cardiovascular Assessment after Obstetric Complications: Follow-up for Education and Evaluation (COFFEE)
Please see Honours entry

Cardiovascular assessment in pregnancy with iron deficiency or iron deficiency anaemia
Please see Honours entry

Surviving cardiac arrest in northern Adelaide
Please see Honours entry

Research areas

Cardiac, Respiratory and Vascular Health
Pregnancy and Birth

Northern Cardiovascular Research Group
Sleep disordered breathing in children is common, with as many as 10% of children reported to snore on a regular basis. The severity of sleep disordered breathing ranges from primary snoring, to the more severe obstructive sleep apnea and a reduction in blood oxygen levels and increase in carbon dioxide profile. Even a relatively mild condition has significant daytime effects on neurocognitive domains and behaviour.

The Paediatric Sleep Disorders Research group seeks to understand the impact of poor sleep on the health of the developing child. Our multidisciplinary team of researchers primarily focuses on the effects of sleep disordered breathing on neurocognition, cardiovascular development, and immune, metabolic and nervous system function. We are also one of the first groups to evaluate the effect that sleep disorder breathing (SDB) has on the oral microbiota in children. Our strong collaboration with the University of Adelaide’s, School of Dentistry has also allowed us to examine the contribution that dental/facial morphology plays in the onset of the disorder.

During 2016 the team focused on; assessing the effects SDB has on the physiology of the developing child, including evaluation of cardiovascular, autonomic nervous system and inflammatory response and changes in oral microbiota and dento/facial morphology; post-operative neurocognitive evaluation of children who had previously been assessed and treated with adenotonsillectomy.

**Lead researcher:** Professor Declan Kennedy

Email: declan.kennedy@adelaide.edu.au

**Honours project opportunities**

**Neurocognition, behaviour and sympathetic activity in children with sleep disordered breathing**

Sleep disordered breathing in childhood affects multiple pathways including the cardiovascular system, autonomic nervous system and neurocognition. This project looks at the impact of habitual snoring and sleep apnoea on the development of the autonomic nervous system and how it affects neurocognition and behaviour in children. The student will learn to perform neurocognitive tests, sleep studies (polysomnography) and pupillometry. The aim of the project is to determine if children with SDB and behavioural and neuropsychological processing issues have abnormal autonomic response.

**Project Supervisor:** Dr Anna Kontos

**Availability:** Semesters 1 and 2

**Special requirements:** A major in psychology is essential (and neuroscience preferred).

**Metabolism and vascular health in children with sleep disordered breathing**

Sleep disordered breathing (habitual snoring/sleep apnoes) in adults affects multiple pathways including the cardiovascular system, autonomic system and metabolism. Sleep disordered breathing is also common in children with as many as 10% of children reported to snore on a regular basis. Whether the same pathways are effected in children is less well understood. This project looks at the impact of habitual snoring and sleep apnoea on metabolism, autonomic function and vascular function in children with sleep disordered breathing. The student will learn to perform sleep studies, ELIZA assay testing (to measure metabolic markers) from samples and will assist in the Flow Mediated Dilatation procedure (vascular testing). The aim of the project is to determine if the pathological pathways identified in adults with SDB are also active in children with the disorder.

**Project Supervisor:** Dr Anna Kontos

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Research areas**

Cardiac, Respiratory and Vascular Health

Early Origins of Health

Neuroscience, Behaviour and Brain Health

Child and Adolescent Health
Postprandial Hypotension Group
Adelaide Health and Medical Sciences Building (AHMS)

Postprandial hypotension occurs in around 20% of the healthy elderly, and more than 40% of nursing home residents and patients with longstanding type 1 or 2 diabetes. This phenomenon is more common than orthostatic hypotension, and current management is suboptimal. Research by the CRE has shown that the magnitude of the fall in blood pressure is related to the rate of nutrient delivery from the stomach into the small intestine.

Lead researcher: Professor Karen Jones
Email: karen.jones@adelaide.edu.au

Honours project opportunities
Effect of exenatide once weekly on gastric emptying of, and the postprandial glycaemic and cardiovascular responses to, an oral glucose load in type 2 diabetes.

Glucagon-like peptide-1 (GLP-1) agonists are used widely in the management of type 2 diabetes (T2DM). They can be ‘short’ or ‘long-acting’. It is suggested that the postprandial glucose lowering effect of ‘short-acting’ agonists are related to their effect to slow stomach emptying. However, the effects of ‘long-acting’ drugs, on stomach emptying have only been measured with suboptimal techniques, rather than the ‘gold standard’, scintigraphy.

The rate of stomach emptying is a major determinant of the blood pressure (BP) response to a meal. Postprandial hypotension (PPH), a disorder characterised by a substantial fall in BP after meals, occurs frequently in T2DM (~30-40%), predisposes to falls, and increases mortality. There’s currently no satisfactory treatment. The magnitude of the fall in BP is dependent on the rate of stomach emptying - when emptying is more rapid, the fall in BP is greater. We have also shown that administration of GLP-1 prevents the fall in BP after a meal and that a ‘short-acting’ GLP-1 agonist has beneficial effects. The effects of ‘long-acting’ GLP-1 agonists on postprandial cardiovascular responses are not known.

The study will determine the effects of exenatide QW on stomach emptying, glycaemia and BP after oral glucose in T2DM.

Project Supervisor: Professor Karen Jones
Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities
Role of the gut in postprandial blood pressure regulation

Postprandial hypotension (PPH), defined as a fall in systolic blood pressure (BP) of 20 mmHg within two hours of a meal, is an important clinical condition. PPH is strongly associated with increased morbidity, particularly falls, and mortality. Those at greatest risk include ‘healthy’ older people, nursing home residents and patients with type 2 diabetes. Professor Jones’ group, which is part of the NHMRC CRE in Translating Nutritional Science to Good Health, is one of the few conducting research in PPH, and is recognised internationally.

Management of PPH is suboptimal. Previous studies have established that PPH should in the broadest sense, be regarded as a gastrointestinal disorder, which has major implications for effective management, in particular the interrelated gastrointestinal factors of meal volume and composition, gastric distension, the rate of delivery of nutrients into the small intestine and changes in gastrointestinal hormones and splanchnic blood flow to the regulation of postprandial BP.

The outcomes of the proposed studies in the PhD programme, conducted in the CRF of the AHMS building, will increase knowledge relating to mechanisms associated with PPH and have implications for the development of effective dietary and pharmacological management strategies.

Project Supervisor: Professor Karen Jones
Availability: Semesters 1 and 2

Research areas
Cardiac, Respiratory and Vascular Health
Ageing, Frailty and Mobility
Nutrition and Metabolic Health
The Primary Care and Health Services Research Group has experience in developing and conducting clinical trials, cross-sectional and longitudinal studies, analysing large data sets and informing health policy. It recruits general practices and patients for long-term studies and collaborates with interstate and international Universities.

We work with data from the National Prescribing Service (collected by MedicineInsight), which draws on 500 practices across Australia, with over 2000 GPs and more than 3.5 million patients of all ages. Through this partnership, we have been able to assess different preventive strategies in Australian general practice, including overweight/obesity in children and adolescents, cardiovascular risk among adults, chronic pain and musculoskeletal conditions, vitamin D testing, medication use, and vaccinations for respiratory conditions.

Furthermore, our work with the Australian Sentinel Practices Research Network (ASPREN) allows us to provide annual vaccine effectiveness estimates for influenza-like illness and other conditions seen in general practice. We also use National Prescribing Service data and information collected from population-based studies in South Australia (Health Omnibus Survey and North West Adelaide Health Study) in our epidemiological studies alongside qualitative research. Another significant area we research is the use of health-related quality of life as a subjective indicator of health status change, a secondary outcome of preventive health strategies, and a prognostic factor of complications among individuals with chronic conditions.

As a research group, we have successfully supervised masters and PhD students, academic GP registrars, and several honours. All projects developed by this group are suitable for candidates with a diverse background, including medicine, public health, psychology, nursing, health science, economy, or statistics.

In the last five years, the group has attracted over $15.4 million in NHMRC grant funding and over $4.2 million in small and other grants. The group is also associated with four Centres of Research Excellence.

Lead researcher: Professor Nigel Stocks

Email: nigel.stocks@adelaide.edu.au

Honours project opportunities

General Practice Epidemiology and Clinical Practice

The principal aim of this project is to explore any area of clinical general practice using the National Prescribing Service MedicineInsight database, which includes more than 500 practices across Australia, with over 2000 GPs, representing more than 3.5 million patients of all ages. Some of the topics investigated by the group using this dataset include the assessment of cardiovascular risk and preventive strategies in adults, prevention and management of overweight/obesity in children and adolescents, prevalence of musculoskeletal conditions and chronic pain, medication use for different conditions, vaccination for respiratory conditions. Basic quantitative skills (biostatistics and epidemiology) are recommended for candidates aiming to use this source of data, although close support will be provided by the research team to improve the student’s analytical skills.

Project Supervisors: Professor Nigel Stocks and Dr David Gonzalez

Availability: Semesters 1 and 2

Special requirements: Nil

Multimorbidity and quality of life

This project aims to use the health-related quality of life as a subjective indicator of health status change, a secondary outcome of preventive health strategies, and a prognostic factor of complications among individuals with chronic conditions. Different studies have been used to investigate this topic, including data from the North West Adelaide Health Study (a cohort of adults in Adelaide followed for more than 10 years), the ASPREE study (a randomised, double-blind, placebo-controlled trial including over 12,000 healthy individuals aged 70 years and over from Australia and the US), and the Health Omnibus Survey (population-based study including random samples of 3,000 adults from South Australia, data from 2015 and 2017 available).

All these studies include data regarding lifestyle (diet, physical activity, smoking, alcohol intake), use of preventive medication, anthropometric measurements, use of health services, diagnosis of chronic conditions (including cardiovascular, gastrointestinal, musculoskeletal, and mental health conditions, sleep problems), and sociodemographic characteristics of the participants. This project is recommended for candidates aiming to improve their analytical skills.

Project Supervisors: Professor Nigel Stocks and Dr David Gonzalez

Availability: Semesters 1 and 2

Special requirements: Nil

Preventative Health Care

One of the studies related to this research project aims at improving the quality of preventive and other care in general practice via targeted personalised automated pre-consultation education, information and advice to patients. In this research program, we are currently working with the GP author of the Doctors’ Control Panel software to develop and pilot unique strategies that present relevant information and advice to patients at a time when they can act on that advice immediately with a minimum of additional time, effort or cost.

Another study related to this project is examining the current management of sleep apnoea and insomnia in Australian General Practice. This work is being conducted in partnership with the Sleep Health Services Centre for Research Excellence and is using a mixed methods approach. Opportunities to contribute to both qualitative and quantitative orientated studies are available.

Project Supervisors: Dr Oliver Frank, Dr Elizabeth Hoon and Professor Nigel Stocks

Availability: Semesters 1 and 2

Special requirements: Nil

Dr David Gonzalez (left), Dr Elizabeth Hoon, and Dr Oliver Frank
HDR project opportunities

General Practice Epidemiology and Clinical Practice
Please see Honours entry.

Multimorbidity and quality of life
Please see Honours entry.

Preventative Health Care
Please see Honours entry.

Research areas
Cardiac, Respiratory and Vascular Health
Nutrition and Metabolic Health
Child and Adolescent Health
Ageing, Frailty and Mobility

More information
health.adelaide.edu.au/our-research/primary-care-and-health-services-research-group
The Translational Vascular Function Research Collaborative undertakes basic, clinical and epidemiological studies into cardiovascular disorders with the objective of improving the health outcomes of these patients. Currently the group focuses upon coronary heart disease and peripheral artery disease, although many principles are applicable to other vascular disorders.

We aim to conduct interdisciplinary research using a collaborative approach, with results being directly integrated into clinical practice. The research group includes both physicians and medical scientists located at the Basil Hetzel Institute, and the University of Adelaide’s medical school and teaching hospitals. The integrative nature of the group provides a unique opportunity to ensure that innovations are translated from bench to bedside to health outcome, as well as the reverse.

**Lead researcher:** Professor John Beltrame

**Email:** john.beltrame@adelaide.edu.au

### Honours project opportunities

**Coronary Angiogram Database of South Australia (CADOSA): Improving health outcomes in patients undergoing coronary angiography**

Coronary angiography is the clinical benchmark technique in the assessment of coronary artery disease with more than 6,000 performed in South Australia each year. Despite its diagnostic benefits in identifying the presence of coronary disease, its benefit to the patient has been less rigorously studied and will be the focus of this project. CADOSA is an internationally renowned clinical registry incorporating global links with organizations including the American College of Cardiology National Cardiovascular Data Registry and the International Consortium of Health Outcomes Measurement (ICHOM).

**Project Supervisors:** Professor John Beltrame and Dr Rosanna Tavella

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Vasomotor studies of patients with myocardial infarction and non-obstructive coronary arteries (MINOCA)**

Approximately 5-10% of patients who experience a myocardial infarct do not have significant coronary artery disease, prompting the clinical question of what is the underlying mechanism? This project will utilise invasive and non-invasive clinical techniques to elucidate potential mechanisms that may be responsible for the myocardial infarct.

**Project Supervisors:** Professor John Beltrame and Dr Rosanna Tavella

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

### Research areas

Cardiac, Respiratory and Vascular Health
Translational Health Outcomes
Our mission is to understand the factors that influence the natural history of atherosclerosis, the leading cause of death in our community. Using a range of experimental approaches, we undertake translational studies that aim to elucidate the molecular pathways that influence vascular risk, develop novel biomarkers for the assessment of cardiovascular risk and evaluate the impact of potentially protective therapies. Our studies span the spectrum from fundamental laboratory discovery through to clinical trials and ultimately studies to determine how novel treatments are applied in clinical practice. For further details see: sahmri.com

Lead researchers: Professor Stephen Nicholls, Dr Peter Psaltis, Dr Christina Bursill

Email: peter.psaltis@sahmri.com

Honours project opportunities

Do local stem cells in blood vessels contribute to the hardening of arteries in atherosclerosis?

Atherosclerosis is the main cause of heart attack and stroke, resulting in an enormous burden to patient morbidity, mortality and health care expenditure. Macrophages play an integral role in the formation of atherosclerotic plaque, that leads to arterial narrowing, plaque rupture and clot formation that result in arterial occlusion. For a long time, it has been thought that all macrophages in atherosclerotic arteries come from monocytes, that originate in bone marrow, circulate in blood and enter the artery wall to become macrophages.

Our group has discovered, for the first time, the existence of a new population of “stem” cells, called Adventitial Macrophage Progenitor Cells (AMPCs), that are present in the outer layer of arteries (adventitia), and can generate macrophages independently of circulating blood monocytes. We have found that these AMPCs are more abundant in atherosclerotic blood vessels. Current and future projects are focused on acquiring a better understanding of these AMPCs, including: where they come from in embryonic development, how they arrive in blood vessels, how they are regulated, and most importantly, what roles they play in normal and atherosclerotic blood vessels. This research is crucial to national and global health to improve preventive and treatment strategies of atherosclerosis.

Project Supervisor: Peter Psaltis

Availability: Semesters 1 and 2

Special requirements: Nil

Research areas
Cardiac, Respiratory and Vascular Health
Immunology and Infection
CHILD AND ADOLESCENT HEALTH
Research is ongoing to detect, prevent and treat the many chronic physical and mental disorders that originate in childhood, to improve the health of all children and adolescents.

Internationally, the Robinson Research Institute is known for achieving advances in childhood and adolescent mental health and diabetes. It is also recognised nationally as being at the forefront of immunisation research.

The Robinson Research Institute leads our child and adolescent health research, and an in-depth explanation of this research area is available on the Robinson Research Institute’s website.
Cystic Fibrosis Airway Research Group

Women’s and Children’s Hospital

Cystic fibrosis (CF) is the most common genetic disorder in the Caucasian population, and is caused by mutations in the CFTR gene. Lung disease is the primary cause of worsening health problems in young people with CF. It greatly affects their quality of life and is the overwhelming cause of early death, at an average age of around 40 years.

Our group is developing a gene therapy to correct CF airway disease. We utilise a lentiviral (LV) vector delivery system to study how to produce safe and effective gene delivery into airway cells in animal models. We use reporter genes such as LacZ, luciferase and GFP, as well as the therapeutic CFTR gene.

We also develop X-ray imaging based methods for determining how well our treatments work. We assess airway surface health at the SPring-8 Synchrotron in Japan, and perform imaging-based lung function assessment studies at the Australian Synchrotron in Melbourne.

In 2016-17 we established a CF rat colony in Adelaide to improve the testing of our genetic treatments for CF airway disease, with the first CF animals born in June 2017. This colony will now form the basis of many projects over the next few years.

We have a dedicated, state-of-the-art research laboratory at the WCH, used for plasmid and lentiviral vector production, molecular assays, histological processing, and cell culture work for developing, testing and measuring the effects of our gene and cell therapies in vivo.

Our 2019 Honours and HDR projects can be tailored to focus on any aspect of this work.

Lead researcher: Dr Martin Donnelley, Associate Professor David Parsons

Email: martin.donnelley@adelaide.edu.au

Honours project opportunities

CF rat therapeutic studies

In 2016-17 we used CRISPR/Cas9 gene editing to generate a breeding line of rats with the Phe508del CFTR mutation, which is the most common CF mutation in humans. CF rats with three genotypes have now been bred, with the first CF litters born around June 2017. The CF animals have now been characterised to understand how the disease manifests in this new model.

The proposed project will test the effects of airway gene therapy on the lung phenotype, and determine whether this novel treatment has the ability to alter the course of disease. This will be achieved with the use of tools such as PCR, histology, immunohistochemistry, and nasal potential difference assessment, as well as gene vector production.

Project Supervisors: Dr Martin Donnelley and Associate Professor David Parsons

Availability: Semesters 1 and 2

Special requirements: Nil

CF lung bacterial infections

In patients with CF the CFTR defect results in dehydration of the airway surface liquid and production of thick sticky mucus that blocks airways. This also means that clearance of inhaled particulates and pathogens is inhibited, enabling a cycle of persistent infection and inflammation to develop.

This project is designed to examine the effects of bacterial colonisation in the lungs of normal and CF rats. Lung infections with varying severity can be generated by depositing agar beads containing pathogens such as Pseudomonas Aeruginosa into the lungs.

The effects of performing gene vector delivery (including the use of LPC) in the presence of bacteria will also be assessed. Tools such as PCR, histology, immunohistochemistry, gene vector production, reporter gene delivery, etc. will be used.

Project Supervisors: Dr Martin Donnelley and Associate Professor David Parsons

Availability: Semesters 1 and 2

Special requirements: Nil

Effectiveness of repeat dosing

From our previous studies we know that the level of gene expression reduces over time as the lung cells are continually replaced. In humans, multiple doses might be required to increase gene expression levels over time.

This project will examine the effectiveness of redosing at different timepoints to examine whether a redosing protocol can be developed.

Project Supervisors: Dr Martin Donnelley and Associate Professor David Parsons

Availability: Semesters 1 and 2

Special requirements: Nil

Measurement of CF lung function and airway surface health

The ability to rapidly and accurately measure the effects of genetic or pharmaceutical therapies on airway surface health and lung function are very important. Changes in mucus clearance might occur relatively quickly, but are hard to measure in situ. Changes in lung function take much longer to be measurable, and their location within the lung cannot be identified. We have therefore developed a range of X-ray imaging technologies to quantify treatment efficacy.

At the SPring-8 synchrotron in Japan we can measure changes in the mucociliary transit behaviour of deposited tracking particles. At the imaging and medical beamline (IMBL) at the Australian Synchrotron we can use a technology called computed tomographic X-ray velocimetry to measure flow in each airway as it changes with mucus blockage or clearance.

This project is designed to examine the effects of genetic or pharmaceutical treatments on lung health. Depending on the expertise and skills of the applicant it could involve computer science techniques such as image processing algorithm development and image data analysis, or alternatively it could be based on gene vector production, animal handling and molecular assessments. Some travel may be involved.

Project Supervisors: Dr Martin Donnelley, Associate Professor David Parsons
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

CF rat therapeutic studies
Please see Honours entry

CF lung bacterial infections
Please see Honours entry

Effectiveness of repeat dosing
Please see Honours entry

Measurement of CF lung function and airway surface health
Please see Honours entry

Research areas

Child and Adolescent Health
Cardiac, Respiratory and Vascular Health
Innovative Therapeutics
Epidemiology and Biostatistics Unit: BetterStart
Adelaide Health and Medical Sciences Building (AHMS)

A large part of our research in the Unit is broadly focused on the health of women and children. Through the work of two of the School’s interdisciplinary research groups: the BetterStart group, led by Professor John Lynch, are trying to better understand how to ensure infants and children have the best start in life. Enhancing their health and development over the life course. The Life Course and Intergenerational Health Group (jointly with the Robinson Research Institute) led by Professor Vivienne Moore focuses on health of women and children and aims to understand how inequalities in health arise, through integrated social and biological pathways and to identify opportunities for change. Members of the Unit also conduct methodological research in biostatistics and epidemiology. Current research projects include:

- Position of women in public health initiatives and the popular media
- Health legacy for children born to women who are overweight or obese
- Role of modifiable structural factors in the health of families
- Gestational age and effects of pregnancy complications on children’s development
- Television marketing of unhealthy food and beverages to children in Australia
- Effects of poverty on cognitive ability
- Potentially preventable hospitalisations in children

Lead researcher: Professor John Lynch
Email: john.lynch@adelaide.edu.au

Honours project opportunities
Child care or preschool participation and Aboriginal children’s cognitive and socio–emotional outcomes at school entry

High quality child care has the potential to improve children’s health and development. This project will examine child care or preschool participation in Aboriginal and/or Torres Strait Islander children and the association between developmental outcomes at school entry.

Special requirements: Students will have completed epidemiological and/or biostatistics courses, as relevant to this project. Familiarity with statistical software packages such as STATA. Approval to access LSIC data.

Availability: Semesters 1 and 2
Available in: Honours; Master of Public Health
Special requirements: Nil

Smoking during pregnancy

Public awareness about the harms of smoking have led to declining rates of smoking. However, pregnancy can be a challenging time and some women find it difficult to quit smoking. This project involves surveying pregnant women about their attitudes to smoking in pregnancy and, if they smoke, gain a deeper understanding of the factors that might help them quit (e.g. counselling, social support, nicotine replacement therapy, incentives).

Special requirements: Students should have excellent communication skills and professionalism as they will be required to recruit women to the study. Some skills in designing surveys, data manipulation and quantitative analysis is also advantageous

The student must be willing to travel to and spend time in a hospital (antenatal) setting.

Project Supervisors: Associate Professor Lisa Smithers, Professor John Lynch
Availability: Semesters 1 and 2
Available in: Honours; Master of Public Health
Special requirements: Nil

Did a RCT involving carers of Aboriginal children alter what children eat and drink?

We conducted a randomised controlled trial (RCT) that aimed to reduce early childhood caries and improve children’s diets. Part of the intervention involved motivating carers to provide healthier foods and drinks to children. This project involves analysing nutrition and health-related data from the trial.

Project Supervisors: Associate Professor Lisa Smithers, Professor John Lynch, Professor Lisa Jamieson
Availability: Semesters 1 and 2
Available in: Honours; PhD (Mphil), Master of Public Health
Special requirements: Knowledge and experience of collecting dietary data (e.g. 24-hour recalls, food frequency questionnaires), and conducting nutrition analysis using software such as Foodworks would be advantageous. Strong quantitative analysis skills are essential and some experience with statistical software (e.g. stata) would also be beneficial.

Systematic review of interventions to reduce child maltreatment

Child maltreatment is associated with adverse outcomes for child health and development. As such, it is key to identify potential preventative interventions. This project will involve a literature review of studies evaluating interventions designed to reduce child maltreatment.

Availability: Semesters 1 and 2
Available in: Honours; Master of Public Health
Special requirements: Desirable to have skills in critical appraisal and a familiarity with searching online bibliographic databases.

Neonatal morbidity and child development and/or school achievement

Educational achievement is a strongly associated with later adult health outcomes and life chances. This project will describe patterns of neonatal morbidity (conditions experienced in the first month of life) and the association with children’s development at school entry and later school achievement.

Availability: Semesters 1 and 2
Available in: Honours; PhD (Mphil); Master of Public Health
Special requirements: Students will have completed epidemiological and/or biostatistics courses, as relevant to this project. Familiarity with statistical software packages such as STATA.
Child protection policy, practice, and investment

The number of children being notified to child protection, and the total number of notifications to child protection has risen substantially over the past decades. This project will involve identifying what changes in policy, practice and government spend and may correspond to peaks and troughs in trends.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Familiarity with statistical software packages such as STATA and searching online bibliographic database is desirable.

Public housing, child development and academic achievement

Using data from the South Australian Early Childhood Data Project this research project will involve exploring the association between public housing early in life and health, development and academic outcomes for children.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Familiarity with statistical software packages such as STATA is desirable.

Descriptive analyses of potentially preventable hospitalisations among children

This project will use linked hospital data to describe different types of Potentially Preventable Hospitalisations (PPHs) among children. Numerous definitions of PPH will be tested. This project can be expanded to include the nature of repeated hospitalisation, and demographic characteristics of children experiencing PPHs.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; PhD (MPhil); Master of Public Health  
**Special requirements:** Students will have completed epidemiological and/or biostatistics courses, as relevant to this project. Familiarity with statistical software packages such as STATA.

Trends in child protection contact

Using data from the South Australian Early Childhood Data Project this research project will involve exploring trends in child protection contacts in the last 30 years.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Familiarity with statistical software packages such as STATA is preferred.

What is insecure housing for children?

Using data from the South Australian Early Childhood Data Project this research project will involve defining what insecure housing is for children using public housing data.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Familiarity with statistical software packages such as STATA is preferred.

Parental time investments in children: examining trends over time?

This project will use the 1992, 1997 and 2006 Australian Time Use surveys to quantify how much time parents spend in different activities with their children, and whether this has changed over time and changed differentially by socioeconomic group.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Students will have completed epidemiological and/or biostatistics courses, as relevant to this project. Familiarity with statistical software packages such as STATA.

Understanding patterns of TV advertising to children

Television advertising influences the food preferences and diets of children. This project involves understanding patterns of TV advertising during children’s TV viewing hours using a large database of television advertising.

**Availability:** Semesters 1 and 2  
**Available in:** Honours; PhD (MPhil); Master of Public Health  
**Special requirements:** Students will have completed epidemiological and/or biostatistics courses, as relevant to this project. Familiarity with statistical software packages such as STATA.

The development of an instrument to measure nature-based play opportunities in school environments

There is evidence that engagement with nature is important for children’s health and development; however few studies have explored opportunities for nature-based play within school environments. Existing studies have primarily focused on traditional playground designs in which equipment is static and typically constructed of man-made materials structures, but may not have considered environments that include natural elements such as water, sand or mud, trees, changing topography, wood or stone. In this project, the student will develop a novel instrument to measure opportunities for exposure to natural environments within the school playground. The project will involve field work as observations of the school playground environment will inform the development of the measurement tool.

**Project Supervisor:** Dr Clare Hume  
**Availability:** Semesters 1 and 2  
**Available in:** Honours; Master of Public Health  
**Special requirements:** Nil
EARLY ORIGINS
OF HEALTH
The health trajectory of every child—including their metabolic, cardiovascular, immune and reproductive health, and neurological function—is profoundly influenced by their parents’ health and wellbeing prior to conception, throughout pregnancy, and during early postnatal life.

The Robinson Research Institute leads our research in the early origins of health and is well placed to tackle this challenge, having conducted some of the largest trials in the world investigating interventions in pregnant women and newborn infants to improve outcomes for the mother and child.

A more in-depth explanation of this research area is available on the Robinson Research Institute’s website.
EARLY ORIGINS OF HEALTH RESEARCH OPPORTUNITIES

Circadian Physiology Research Group
Adelaide Health and Medical Sciences building (AHMS)

Circadian rhythms are endogenous changes in physiology, behaviour and metabolism that oscillate with a period of approximately 24 hours. Circadian rhythms are established through a negative feedback loop involving a series of clock genes expressed within every cell of the body. The objective of our research is to determine how circadian rhythms regulate and interact with diverse physiological processes including metabolism, reproduction and behaviour, and the consequences of circadian disruption to health and wellbeing.

Lead researcher: Dr Tamara Varcoe
Email: tamara.varcoe@adelaide.edu.au

Honours project opportunities
Does shift work exposure during gestation affect pregnancy outcomes and the long term metabolic health of progeny?

This project, based within an NHMRC Project (APP1106674; Kennaway, Gatford & Varcoe 2016-2018), will use a large animal model to investigate the impact of simulated shift work exposure during gestation to the metabolic health of the progeny through until adulthood. Simulated shift work will involve controlling light exposure and food access of pregnant ewes at different stages of gestation. Lambs will be assessed at 12 months for body composition, glucose tolerance and insulin sensitivity. The student will experience a range of sampling and analytical techniques including: large animal surgery, radioimmunoassay, quantitative PCR and immunohistochemistry. The project will be jointly supervised by Dr Tamara Varcoe and Dr Kathy Gatford.

Project Supervisor: Dr Tamara Varcoe
Availability: Semesters 1 and 2
Special requirements: Nil

Sleep and melatonin during pregnancy: the implications for maternal metabolic health

This project will use sheep to investigate the impact of sleep restriction during pregnancy on maternal metabolic and cardiovascular health. Pregnant ewes will be sleep restricted for one week at early and late gestation. The impact upon maternal glucose tolerance and insulin sensitivity, and upon fetal growth and development will be assessed. The role of melatonin in mediating the impact of sleep on maternal and fetal health will be dissected. This project will be jointly supervised by Dr Tamara Varcoe and Dr Kathy Gatford.

Project Supervisor: Dr Tamara Varcoe
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Please see Honours entry

Sleep and melatonin during pregnancy: the implications for maternal metabolic health

Please see Honours entry

Research areas

Early Origins of Health
Fertility and Conception
Nutrition and Metabolic Health
Early Life Programming of Health and Disease

Adelaide Health and Medical Sciences building (AHMS)

The early environment — before and shortly after birth — influences an individual's risk of developing major non-communicable diseases including diabetes, cardiovascular disease, impaired neurological function and allergy. Importantly, the effects of adverse prenatal exposures are not always permanent or irreversible, opening the way for interventions during early life to improve outcomes.

The Early Origins of Health and Disease group seeks to optimise the life-long health of the next generation by understanding how early life exposures cause long-term changes in health. The goal is to develop interventions during pregnancy or in early postnatal life to improve health and reduce risks of non-communicable disease in the next generation. We are also interested in defining the developmental stages at which such intervention strategies are most effective.

Currently, we are developing methods and animal models to use in evaluating interventions to prevent intrauterine growth restriction (IUGR). We are also exploring how prenatal exposures affect risks of metabolic disease, neurodevelopmental function and immune function in later life. Programming of allergic diseases is a new focus for our group, and includes studies in preclinical models as well as evaluation of outcomes in human cohorts.

Lead researcher: Dr Kathy Gatford
Email: kathy.gatford@adelaide.edu.au

Honours project opportunities

Developmental programming of allergy
We have demonstrated in preclinical models that intrauterine growth restriction (IUGR) is protective against allergy in progeny, whilst maternal allergic asthma during pregnancy changes the fetal immune system in ways likely to increase allergy risk. We are in the process of evaluating data from human studies to determine whether IUGR and maternal allergy alter risk of allergic diseases in progeny, and in animal models plan to test whether improved control of asthma in the mother reduces the risk of allergic disease in progeny.

Honours and HDR projects are available to:
- assess the evidence for effects of maternal allergic diseases on risk of allergy in progeny in human studies (Honours)
- investigate the prenatal exposures that alter the risks of later allergy in human cohorts (HDR)
- investigate the impact of maternal asthma on postnatal immune system and allergy in a preclinical model. (This project will require off-site and after hours field work, HDR)
- investigate the epigenetic basis for long-term effects of prenatal exposures on postnatal immune function and allergy in our preclinical models (Honours or HDR)

Project Supervisor: Dr Kathy Gatford
Availability: Semesters 1 and 2
Special requirements: Nil

Preventing IUGR

In preclinical models, daily injections of the mother with growth hormone can improve placental function and fetal growth. We are currently investigating a dietary approach to increase maternal growth hormone, as a strategy to prevent IUGR that does not require injections.

Honours and HDR projects are available (some subject to pending funding) to:
- investigate sex-specific responses in our preclinical (mouse) model of IUGR (Honours or HDR)
- test placental and fetal responses to interventions in our preclinical model of IUGR (Honours or HDR)
- investigate effects of the hormone pathway downstream of our diet on growth and function of the human placenta (Honours or HDR)

Project Supervisors: Dr Kathy Gatford, Professor Claire Roberts, Associate Professor Beverly Muhlhauser
Availability: Semesters 1 and 2
Special requirements: Nil

Improving newborn survival in lambs

Newborn lambs often struggle to survive in a harsh environment, and poor survival is a problem particular in twin lambs, who are smaller and less resilient. In collaboration with colleagues in the School of Animal and Vet Sciences at Roseworthy and at SARDI, we are pursuing several dietary strategies to increase lamb energy stores and improve lamb temperature regulation at birth. Honours and HDR projects are available to evaluate one of the four intervention strategies, and the mechanisms that underlie their effects. (This project will require off-site and after hours field work).

Project Supervisors: Dr Kathy Gatford, Dr Will van Wettere, Dr Karen Kind
Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Early Origins of Health
Pregnancy and Birth

Dr Kathy Gatford investigates mechanisms for long-term health impacts of pregnancy complications and developing interventions to improve health of progeny.
Food and Nutrition Group
South Australian Health and Medical Research Institute (SAHMRI), Women’s and Children’s Hospital

The Food and Nutrition Research Group focuses on a number of areas of nutritional physiology, with a particular emphasis on understanding the role of nutritional exposures before birth and/or in early infancy on long term health outcomes. Associate Professor Muhlhausler has a particular interest in the role of maternal obesity/obesogenic diets on the future risk of obesity and type 2 diabetes in the child, and conducts both pre-clinical and clinical studies in this area.

**Lead researcher:** Associate Professor Beverly Muhlhausler

**Email:** beverly.muhlhausler@adelaide.edu.au

Honours project opportunities

**Maternal diet and breast milk composition**

Breast milk is made up of nutrients including fat and sugar. It also contains metabolic hormones. These hormones are known to be transferred from the breast milk to the baby and may play a role in regulating the infant’s appetite, growth and fat deposition. While there is evidence that breast milk hormones are altered in breast milk from obese vs normal weight women, we know very little about how they may be affected by the maternal diet.

The purpose of this study is to look at how improving dietary quality (reducing fat and sugar intake) during breastfeeding affects the levels of macronutrients and metabolic hormones in the milk. This research will help us to understand the effect of different dietary choices during breastfeeding on the composition of the breast milk and, in the future, may help inform dietary guidelines for breastfeeding women.

**Project Supervisors:** Associate Professor Bev Muhlhausler, Dr Merryn Netting, Professor Simon Langley-Evans (Uni Nottingham), Professor Donna Geddes (Uni Western Australia)

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

HDR project opportunities

**Maternal diet and breast milk composition**

Please see Honours entry

**Lactation as a window of opportunity for intervention**

Please see Honours entry

Research areas

Early Origins of Health
Nutrition and Metabolic Health

Lactation as a window of opportunity for intervention

Our previous studies have provided compelling evidence that cross-fostering rat pups from a mother fed a high-fat, high-sugar (“junk food”) diet during pregnancy, to a lean mother fed a nutritionally balanced (standard rat feed) diet after birth improves their long-term metabolic health. In the vast majority of cases, however, human infants are born to and fed by the same mother, and cross-fostering is not possible. Therefore, the aim of this study is to determine, using a rodent model, whether the same benefits for the metabolic health of the offspring can be achieved if the same rat mother is switched from a junk food diet during pregnancy to a control diet after they give birth. You will also determine the effect of the junk food diet on milk composition, and how this is changed when then rat is switched to a nutritionally balanced diet.

**Project Supervisors:** Associate Professor Bev Muhlhausler, Professor Simon Langley-Evans (Uni Nottingham), Professor Mary Wlodek (Uni Melbourne)

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

Understanding the impact of early postnatal growth restraint on long-term health outcomes

In clinical practice, it is not uncommon for infants of normal birth weight to undergo a period of poor growth before weaning, however the short and long-term consequences of this growth pattern are poorly understood. Our group has developed an animal model of prenatal growth restraint, in order to assess the long-term outcomes. In this study, you will utilise tissues collected in the course of the study in order to determine underlying mechanisms through which poor growth in the early infant period may impact on long term metabolic health.

**Project Supervisors:** Associate Professor Bev Muhlhausler, Dr Brian Symon

**Availability:** Semesters 1 and 2

**Special requirements:** Nil
FERTILITY AND CONCEPTION
Conception is the foundation event for each new life, with every child’s development, growth trajectory and health over the life course set in motion from the moment sperm and oocyte unite to form an embryo.

Our research in this area is led by the Robinson Research Institute, which is internationally recognised for its work in fertility and conception. A more in-depth explanation of this research area is available on the Robinson Research Institute’s website.
FERTILITY AND CONCEPTION RESEARCH OPPORTUNITIES

Early Development Group
University of Adelaide, North Terrace Campus

Accompanying oocyte maturation and fertilisation are dynamic molecular and biochemical processes that have a major impact on subsequent embryonic and fetal development, as well as adult health. The maturing oocyte and newly fertilised egg is extremely sensitive to the microenvironment within the maternal reproductive tract, and this is reflected in a process of ‘resetting’ of its epigenetic code. If the metabolic microenvironment surrounding the oocyte and embryo is altered as a result of IVF, diet and lifestyle factors, this will influence the epigenetic mechanisms that ultimately control the growth rate and development potential of the resulting foetus.

Our team explores the metabolic and epigenetic consequences of environmental stress (e.g. culture, oxygen, hyperlipidaemia, hyperglycaemia, etc) on the earliest stages of embryo development. With work spanning from the diet of dairy cows to the tightly regulated events of the transitioning chromatin of the maturing oocyte and early embryo, our well-rounded collaborative team is using multi-disciplinary approaches to answer questions on the micro- and nano-scale. Our major focus is to explain the direct mechanisms by which ‘environmental stress’ impacts early development, to develop new tools to measure the changes, and to successfully develop interventions to reduce the impact.

Lead researchers: Professor Jeremy Thompson, Dr Kylie Dunning, Dr Stephen Warren-Smith
Email: kylie.dunning@adelaide.edu.au

Honours project opportunities

Novel tools to assess embryo quality

Many women and their partners seek IVF to conceive a baby, yet most are unaware of the low success rates, particularly in women over 35. Success rates would likely be improved if the most developmentally competent embryo could be chosen in the laboratory prior to its transfer into the uterus. A potential tool to achieve this is the use of optical microfibers, whereby conventional optical fibers, which are 125 μm in diameter, are tapered down to dimensions of a several microns or less and thus can be inserted into the preimplantation embryo. These microfibers can be altered at the micro/nano- scale to measure biological parameters such as temperature, refractive index or different metabolic reactions.

In this project, the student will have an opportunity to work in a transdisciplinary team where in vitro embryo culture will be combined with these optical fibre sensors to develop techniques to perform intra-cellular measurements in embryos never before achieved. The student will work within the Centre for Nanoscale Biophotonics (CNBP), which is a transdisciplinary centre funded by the Australian Research Council. CNBP provides great access to both equipment and experts across disciplines such as reproductive biology, chemistry and physics.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

HDR projects may be available. Please contact the lead researcher(s) for more information.

Research areas
Fertility and Conception
Ovarian Cell Biology
Adelaide Health and Medical Sciences building (AHMS)

The Ovarian Cell Biology group is investigating the biological mechanisms by which somatic cells in the ovary nurture the oocyte and endow it with the capacity and essential components to form an embryo, and then trigger its timely release for fertilisation. Discovering this information is essential for understanding the foundations of reproduction and the earliest stages of embryogenesis.

For instance, using genetic and dietary mouse models of obesity, we have shown that the detrimental effects of obesity on female reproduction and embryo development commence with dramatic alterations in oocyte quality. We found that oocyte-complexes of obese mice contain high levels of lipid and mitochondrial dysfunction. Now, in collaboration with Fertility SA clinic, we are examining similar aspects of human oocyte biology. Our studies in mice also showed that obesity induced mitochondrial disturbance in oocytes persists into offspring tissues, a finding with major implications for understanding the transgenerational transmission of obesity. Most importantly, we discovered a class of compounds that when administered to obese female mice before conception, prevent the mitochondrial changes in oocytes and are developing this as a clinical therapeutic.

The vision of the Ovarian Cell Biology team is to discover the biological mechanisms by which ovarian cells act as the conduit between maternal physiological signals, the release of the egg and the healthy development of offspring. We use this knowledge to improve female reproductive health, generate new approaches to treat infertility and to optimise embryo growth in all pregnancies.

Lead researcher: Professor Rebecca Robker
Email: rebecca.robker@adelaide.edu.au

Honours project opportunities

Project 1
The research teams of Professor Rebecca Robker and Professor Darryl Russell are dedicated to understanding the cellular and molecular biology that regulates ovarian function.

All aspects of women’s health are dependent upon proper functioning of the ovary, which synthesises steroid hormones, undergoes dramatic tissue remodelling to release oocytes (eggs) and endows eggs with all of the building blocks that confer its pluripotency and capacity to form an embryo.

Available projects fall into a number of areas:

- Understanding how age and obesity alter cell functions in the ovary to cause poor egg quality and impaired embryo development.
- Discovering proteolytic mechanisms by which the cells surrounding the egg are able to propel it into the oviduct for fertilisation.
- Assessing how common contaminants in the environment disrupt cell signalling to result in infertility and/or defective embryo development.
- Characterising how steroid hormone receptors restructure DNA to regulate unique gene-sets depending on cellular context.
- Determining how the environment of the egg and embryo changes mitochondrial inheritance in offspring.

Project Supervisor: Professor Rebecca Robker
Availability: Semesters 1 and 2
Special requirements: Nil

Project 2
This research is important for:
1) elucidating the fundamental biology that controls the generation of new life
2) developing new therapies for infertility as well as new non-steroidal contraceptives
3) understanding how preconception events shape lifelong health trajectories.

Our teams are based in the state-of-the-art facilities at AHMS and use cutting edge techniques supported by a suite of advanced core facilities. Our experimental systems use unique mouse models and cell culture with analysis by high resolution confocal microscopy and high-content image analysis to interrogate these biological questions on a molecular level. We use timelapse video microscopy to monitor the earliest stages of embryo development and are able to then correlate these measures with later postnatal growth and health and molecular readouts using genome-wide sequencing, chromatin immunoprecipitation, lentiviral gene transfer, CRISPR/Cas9 gene editing, bioinformatics and cellular phenotyping methods in order to elucidate mechanisms of hormone action and cell signalling.

Each specific project is designed in consultation with prospective students according to their interests, expertise and skill levels. We encourage students to meet with us and discuss the possibilities.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
A number of exciting HDR opportunities are available within our group. Each project is designed in consultation with prospective students according to their interests, expertise and skill levels. We encourage students to meet with us and discuss the possibilities. Our trainees consistently go on to careers in diverse areas of biomedical research.

Research areas
Fertility and Conception
Early Origins of Health
Ovarian Cell Biology Group
Adelaide Health and Medical Sciences building (AHMS)

The Ovarian Cancer Cell Biology Group in the Robinson Research Institute is focused on understanding the mechanisms by which hormone signals and tissue structure interact to effect health and function of ovaries. The group seeks to harness this knowledge to improve reproductive health and advance treatments for infertility and cancer as well as identify new contraceptives.

We have characterised novel aspects of the molecular control of oocyte development and ovarian function and have demonstrated how environment and lifestyle stressors influence ovarian somatic cell function impacting oocyte and embryo health. The mechanisms by which oocytes and somatic cells communicate to promote healthy oocyte development and elicit protective responses to stress continue to be investigated. This is important for preventing infertility and promoting healthy development which can lead to infertility. Cancers of the reproductive organs are among the most common malignancies. We are also focused on understanding the causes and mechanisms of hormone regulation in reproductive cancers, seeking to develop new therapies to prevent the development and progression of cancers of reproductive organs.

Lead researcher: Professor Darryl Russell
Email: darryl.russell@adelaide.edu.au

Honours project opportunities

Discovery of new, safer contraceptives

The contraceptive pill is a medical technology that has transformed women’s health and empowerment. However, it is based on frequent high dose hormone treatments that can have off-target risks, meaning it is not safe for women with certain cardiovascular disease risk factors and may elevate risk of certain cancers. Importantly, access to birth control remains a vital unmet global health issue. The WHO has stated that due to a lack of safe, effective options for fertility control a global unmet need for contraceptive access for ~120 million couples, mean ~ 205 million pregnancies each year are unintended and ~4 million end in often unsafe abortion. Ovulation; the release of the oocyte (human egg) from the ovary is an ideal mechanism that can be targeted through a non-hormonal treatment to develop a new contraceptive. Our research group has developed a screening platform to identify new drugs with potential contraceptive activity by preventing ovulation. Research projects will apply molecular methods to investigate the mechanism of action of drugs identified in our drug screen. The results will uncover new insights into the mechanism of oocyte development and ovulation as well as validate the contraceptive potential, specificity and efficiency of these new candidate drugs.

Project Supervisors: Professor Darryl Russell, Professor Rebecca Robker
Availability: Semesters 1 and 2
Special requirements: Nil

Honours and PhD research projects are aimed at defining the mechanism of diverse PR action in normal cell and cancer contexts. Students will work with our team to identify specific interactions of PR with other gene regulatory proteins or RNA molecules. We use genomics methods in cancer cell lines and transgenic mouse models. Defining the mechanism of PR action is important in order to understand control of cell growth and function changes in cancers and how progesterone based drugs already in use such as the contraceptive pill or hormone replacement therapy (etc) influence breast and ovarian cancer risk.

Project Supervisor: Professor Darryl Russell
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Discovery of new, safer contraceptives

Please see Honours entry

Research areas

Fertility and Conception

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Project Supervisor: Professor Darryl Russell
Availability: Semesters 1 and 2
Special requirements: Nil

Discovery of new, safer contraceptives

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Project Supervisor: Professor Darryl Russell
Availability: Semesters 1 and 2
Special requirements: Nil

Discovery of new, safer contraceptives

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Availability: Semesters 1 and 2
Special requirements: Nil

Discovery of new, safer contraceptives

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Project Supervisor: Professor Darryl Russell
Availability: Semesters 1 and 2
Special requirements: Nil

Discovery of new, safer contraceptives

Please see Honours entry

Research areas

Fertility and Conception
**Ovarian Function**

*Adelaide Health and Medical Sciences building (AHMS)*

The ovary produces eggs and hormones, and these functions are dependent upon growth and development of follicles and corpora lutea within the ovary. Control of these processes is externally via hormones, or internally by growth factors and the extracellular matrix. In particular our laboratory focuses on the role of extracellular matrix in regulating ovarian function as this has previously been poorly investigated. We use molecular and cellular biology approaches. This area is important as extracellular matrix can be used to regulate ovarian cell function in vitro, as well as aid the understanding of normal reproductive function and ovarian diseases including infertility and hormone imbalances.

**Lead researcher:** Professor Ray Rodgers  
**Email:** ray.rodgers@adelaide.edu.au

**Honours project opportunities**

**Polycystic ovary syndrome**

Polycystic ovary syndrome (PCOS) is a chronic debilitating disorder that affects 12-18% of young women, with adverse downstream consequences on health and wellbeing. Women with PCOS have decreased fertility and signs and symptoms typical of hyperandrogenism [hirsutism (55-65%), acne (15-25%), central adiposity] as well as elevated risks of cardiometabolic outcomes. The attendant costs in Australia are one billion dollars per year.

The cause of PCOS is not known, so there is no specific treatment or preventative strategies available. We have now successfully discovered connections between (1) the fetal origin of PCOS (2) the genetic predisposition to developing PCOS and (3) the cardinal features of the PCOS ovary. We have a number of projects to offer on different aspects of the aetiology of PCOS.

**Project Supervisors:** Ray Rodgers, Katja Hummitzsch, Helen Irving-Rodgers  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Antioxidants in the ovary**

In a collaboration examining trace elements in ovaries using the Australian Synchrotron we recently found that selenium accumulates in granulosa cells as ovarian follicles approach ovulation (Ceko MJ et al Metallomics 2015, 7, 66-77). We identified the selenoprotein as glutathione peroxidase 1 (GPX1) and found that its expression was higher in the cumulus cells associated with oocytes that resulted in a successful pregnancy. GPX1 acts an antioxidant protecting cells against oxidant damage. The regulation of GPX1 in the follicle is unknown. We hypothesise that GPX1 expression is driven by production of reactive oxygen species, and in particular those generated by cytochrome P450 enzymes involved in production of oestradiol.

This project will examine the above hypothesis using bovine granulosa cells. Cells will be cultured and steroid hormone production induced in immature cells and conversely inhibited in mature cells and the effects on reactive oxygen species and GPX1 expression examined. The cells will be obtained from ovaries that we collect from an abattoir. This project will provide valuable information on the role of selenium and antioxidant proteins in follicle function.

**Project Supervisors:** Ray Rodgers, Katja Hummitzsch, Helen Irving-Rodgers, Hugh Harris  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

**Polycystic ovary syndrome**

Please see Honours entry  
**Antioxidants in the ovary**

Please see Honours entry

**Research areas**

Fertility and Conception  
Early Origins of Health

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**Fertility and Conception**
The Reproductive Biotechnology Group has an international reputation in the general areas of reproductive biology and the development of associated technologies for biomedical and agricultural applications. In collaboration with a number of university, institute and hospital research groups in Australia as well as overseas, current research is focused on developing organ, tissue and cell replacement therapies. This work is funded by various agencies including the Juvenile Diabetes Research Foundation, the National Health and Medical Research Council and industry. Honours, Master and PhD projects are available in a number of different areas offering students the possibility of working in some of medical science’s most exciting areas.

**Lead researcher:** Associate Professor Mark Nottle

**Email:** mark.nottle@adelaide.edu.au

**Honours project opportunities**

**Development of a new embryonic stem cell type for human cell therapies**

We have isolated a new embryonic stem cell type from an earlier stage in embryo development than that currently used. These cells have been extensively characterised and may have advantages in terms of the development of cell based therapies. Several projects are offered in this general area. These range from isolating our cell type in other species to the development of differentiation protocols for producing cell types for various treatments. Students will receive experience in a variety of areas from cell and molecular biology to embryology.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Improving human IVF outcomes**

We have pioneered the ability to mature pig oocyte or eggs in vitro to generate embryos for research applications. In collaboration with Hannah Brown and others from the Robinson Research Institute, current research is focused on extending this to other livestock species as well as to humans to overcome the need for patients to monitor their cycle and undergo hormonal stimulation during IVF. Projects will examine the effect of various hormones, growth factors and cytokines present in the prevoulatory follicle can have on in vitro oocyte maturation and embryo development following their addition to maturation media. Students will receive experience in a variety of areas from cell and molecular biology to embryology.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Development of a new embryonic stem cell type for human cell therapies**

Please see Honours entry

**Improving human IVF outcomes**

Please see Honours entry

**Research areas**

Fertility and Conception
Reproductive Immunology
Adelaide Health and Medical Sciences building (AHMS)

The female immune system supports survival and growth of the foetus, with immune system dysregulation leading to pregnancy disorders such as recurrent miscarriage and preterm birth. Seminal fluid, delivered to the female reproductive tract at coitus, provides signalling molecules which allow the female immune system to set up in preparation for pregnancy. We investigate how these signalling molecules influence cytokine expression and immune cell phenotypes in the uterus to understand how incorrect immune activation causes poor embryo growth, placental development and reproductive outcomes.

**Lead researcher:** Dr Kerrilyn Diener  
**Email:** kerrilyn.dienert@adelaide.edu.au

**Honours project opportunities**

**The male partner’s seminal fluid as a determinant of fertility and pregnancy health in women**

Seminal fluid is generally thought to have just one biological function—providing sperm to fertilise the oocyte at conception. Another less appreciated role of seminal fluid is to interact with the female reproductive tract, to influence fertility and fecundity. An expanding body of evidence shows this occurs in any species where intromission of male fluids occurs, including human. These changes have potentially critical consequences for fertility and pregnancy health in women. However, the molecular basis of seminal fluid priming in women is incompletely defined and its physiological significance for establishing immune tolerance and receptivity to pregnancy is unknown. This project will utilise:

- (a) a human seminal fluid biobank to investigate the association of various bioactive components of seminal fluid with fertility, and
- (b) in vitro and in vivo models of male-female signalling to assess the contribution of both human seminal plasma and sperm to the female reproductive tract immune environment. Techniques used include quantitative RT-PCR and cytokine immunoassay. These studies are essential to advance diagnosis and treatment of subfertility, and to tackle obstetric disorders that originate early in pregnancy.

**Project Supervisors:** Professor Sarah Robertson and Dr David Sharkey  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

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**Male to female sperm signalling: a new role for sperm in reproduction?**

When seminal fluid is delivered into the female reproductive tract at coitus, it interacts with epithelial cells lining the cervix and uterus to induce proinflammatory cytokines and chemokines. This inflammation-like response leads to the establishment of immune tolerance and receptivity to pregnancy. In addition to seminal plasma, our studies have recently shown that sperm play an important role in this process. However, we are yet to identify the specific mechanism that sperm utilises to induce these changes. Using bioinformatics analysis, we have been able to predict sperm signalling molecules including ligands for toll-like receptor 4 (TLR4).

This project will employ TLR4 null mutant mice to identify the contribution of TLR4 to sperm signalling. Techniques used will include quantitative PCR, cytokine immunoassay and flow cytometry. The findings from this study will help us understand the induction phase of the maternal immune response that allows successful pregnancy and may help us understand why some men have reduced fertility despite apparently normal sperm parameters.

**Project Supervisors:** Professor Sarah Robertson, Dr John Schjenken, Dr Lachlan Moldenhauer and Dr David Sharkey  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

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**T-regulatory (Treg) cell stability and plasticity in immune tolerance during early pregnancy**

To allow embryo implantation and successful pregnancy, the maternal immune system must become ‘tolerant’ to paternal transplantation antigens. Treg cells are now implicated as key cells mediating maternal immune tolerance. Discoveries in our laboratory show that semen plays an important role in establishing functional tolerance to male transplantation antigens during early pregnancy. We now seek to investigate the role of seminal factors in activating and expanding Treg cells in preparation for embryo implantation.

The aim of this project is to investigate the molecular events involved in activating Treg cells after mating. In particular the importance of seminal plasma TGFbeta and the role of male MHC antigens in semen will be investigated.

The project will employ cytokine null mutant mouse models and human samples, linked with state-of-the-art digital flow cytometry (FACS), and quantitative RT-PCR for the Treg fate-determining transcription factor Foxp3. The findings will help us understand the induction phase of the maternal immune response permitting successful pregnancy, and have broader relevance to the transmission of STDS and immunemediated pathologies linked with infertility.

**Project Supervisors:** Professor Sarah Robertson and Dr Lachlan Moldenhauer  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

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**MHC disparity and placental vascular supply**

MHC disparity between paternal and maternal genomes in pregnancy is beneficial to fetal growth and pregnancy success. This is linked with activation and expansion of maternal T cell populations which in a healthy pregnancy, are skewed towards T regulatory cells and immune tolerance. As well as inhibiting cytotoxic immunity towards the conceptus tissue, these T cells may help to promote placental development and robust access to the maternal blood supply. To investigate the role of T cells in placental development and transformation of maternal decidual vessels, this project will utilise mouse models of lymphocytedeficiency (SCID mice) and regulatory T cell deficiency (DEREG mice).
The project will employ a range of experimental strategies including immunohistochemistry and tissue morphometry to analyse placental vascular structure and physical interactions between endothelial cells and T cells, and quantitative RT-PCR for analysis of genes involved in vascular regulation. The results will provide new insight on the importance of T cells in the vascular adaptation required for optimal placental development and fetal growth. Problems with immune-regulated placental development underpin many common disorders of pregnancy including miscarriage, preeclampsia and poor fetal growth.

**Project Supervisors:** Professor Sarah Robertson, Dr Alison Care and Professor Claire Roberts

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

HDR projects may be available. Please contact the lead researcher(s) for more information

**Research areas**

Fertility and Conception
Pregnancy and Birth
Early Origins of Health
Bioinformatics enhances the Institute’s capability in next-generation sequencing and systems biology approaches to basic science and clinical research investigating human and animal reproduction and development. Bioinformatics strategies to design and analyse transcriptome, deep-sequencing, genome and proteome data sets are a powerful approach to generating fundamental knowledge on systems and processes in biology and disease. With the explosion in the amount of available public data from large, international projects such as BLUENPRINT, ENCODE and the Epigenomics Roadmap project, bioinformaticians are uniquely placed to develop novel research hypotheses and research tools that can translate to important health outcomes.

Currently our group is focused on a number of projects that aim to use biological data to characterise epigenomic effects on gene regulation across reproductive tissues. We are currently aiding in the computational analysis of a population of placenta and matched maternal plasma samples from normal and complicated pregnancies. To identify non-invasive mechanisms, to identify pregnancy complications such as Preeclampsia and Preterm Birth, as well as investigating the 3D chromosomal structure of T cell sub-populations that contribute to autoimmune disease.

**Lead researcher:** Dr Jimmy Breen

**Email:** jimmy.breen@adelaide.edu.au

**Honours project opportunities**

**Developing pathway and gene ontology enrichment workflows for medical researchers**

Currently, medical and biomedical researchers run sophisticated pathway enrichment analyses for their labs in proprietary software which is often extremely expensive and poorly updated. The reliance on paid software sources often prevent development of new tools that can be created from new datasets. In this project, we will develop a pathway enrichment analysis program for biomedical researchers using the Shiny app package ([shiny.rstudio.com/](http://shiny.rstudio.com/)) as part of the R programming language. Shiny is an interactive web application that allows a user to run R code developed by a bioinformatician. This project will be conducted with the help of both the Robinson Research Institute’s bioinformatics core-facility and the University of Adelaide’s Bioinformatics Hub.

**Project Supervisor:** Dr Jimmy Breen

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Identifying the effect of genetic variation on gene expression in placenta**

Pregnancy complications such as pre-eclampsia, small for gestational age and pre-term birth, have a major effect on the life of an infant post-pregnancy. Additional factors and clinical variables often explain a significant amount of variation in each disease (e.g. differences between sexes). One such variable, genetic background explains a significant amount of variation in disease susceptibility where we see much higher rates of these complications in different genetic backgrounds (e.g. Africans, Aboriginal Australians, East Asians) compared with Europeans. Unfortunately, data from whole-genome sequencing experiments can be extremely expensive, with low-coverage sequencing being more cost effective.

In this project, we will investigate the use of low-coverage genomic data (from in-house and public datasets) to identify population-specific characteristics of individual samples. We will also investigate previously identified single-nucleotide variants that have been associated with pregnancy complications, and create population-level allele-frequencies. This project will be conducted with the help of both the Robinson Research Institute’s bioinformatics core-facility and the University of Adelaide’s Bioinformatics Hub.

**Project Supervisor:** Dr Jimmy Breen

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Comprehensive profiling of enhancer transcription in the human placenta**

RNAseq, a high-throughput sequencing approach that quantifies the entire RNA component from a sample, has dramatically changed our understanding of how and when genes are expressed. Total RNA library preparation kits differ slightly from other approaches that quantify gene expression by allow the identification and quantification of all RNA species (including non-protein-coding) in the sample, rather than standard standard transcripts that contain poly-A tails. Among the non-coding transcriptional repertoire is the transcription of enhancer RNAs (eRNAs) that have recently been profiled in the FANTOM5 project (http://fantom.gsc.riken.jp/5/). Using in-house placenta RNAseq data, and publicly available datasets, we aim to comprehensively characterise eRNA transcription in placenta, and investigate whether different eRNAs are present at specific times of placental development. By identifying enhancer profiles through placental development, this research will aim to identify the precise regulatory mechanisms at play within the placenta, one of the most poorly understood, and highly influential, human organs.

**Project Supervisor:** Dr Jimmy Breen

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Identifying the effect of genetic variation on gene expression in placenta**

Please see Honours entry

**Comprehensive profiling of enhancer transcription in the human placenta**

Please see Honours entry

**Research areas**

**Fertility and Conception**

**Translational Health Outcomes**

**Pregnancy and Birth**

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**RRI Bioinformatics**

*Adelaide Health and Medical Sciences building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)*

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**Bioinformatics**

*Founded in 2014*

*SAHMRI is fully integrated with the University of Adelaide and Adelante Health & Medical Science building (AHMS)*

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**Adelaide Health and Medical Sciences building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)**

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**Special requirements:**

**Availability:**

**Project Supervisor:**

**Email:**

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**Lead researcher:** Dr Jimmy Breen

**Email:** jimmy.breen@adelaide.edu.au
IMMUNOLOGY AND INFECTION
Our immune system is at the front line for controlling infection from foreign pathogens, including bacteria and viruses. A healthy, functioning immune system is fundamental to our overall health and wellbeing.

Our research is focused on understanding how our body’s elaborate, innate and adaptive immune systems can distinguish foreign pathogens from self-tissue. Malfunction of the immune system can result in the development of autoimmune disorders including type 1 diabetes, inflammatory bowel disease, multiple sclerosis, psoriasis and rheumatoid arthritis.

Furthermore, inappropriate immune responses are also implicated in central nervous system diseases such as anxiety, depression, epilepsy and stroke and have been proposed to play a role in addictions and pain. Understanding immune responses, and how to control and modulate them is crucial to the successful treatment of patients requiring life-saving transplantation therapies. It is also critical for the development of safe and effective vaccines, which enable significant improvements worldwide in the health status of many communities.

Researchers across the faculty are focused on:

- developing new vaccines
- identifying novel targets in autoimmune diseases such as rheumatoid arthritis
- understanding the role of immune cells in neural tissue (glial cells) in normal healthy brains to elucidate their role in chronic pain, drug addiction and epilepsy and identifying new targets to treat these conditions
- developing immune interventions to prevent or modulate pathologies of pregnancy and graft rejection (in transplantation settings)
- conducting clinical trials to evaluate tolerability, safety and effectiveness of new agents to control infections in patients suffering chronic infections.
IMMUNOLOGY AND INFECTION RESEARCH OPPORTUNITIES

Chronic Inflammatory Lung Disease Laboratory
Royal Adelaide Hospital, Adelaide Health and Medical Sciences building (AHMS)

We are a multidisciplinary, internationally recognised research team. Clinically-based investigations in chronic lung diseases (CLD) including chronic obstructive pulmonary disease (COPD), severe asthma and childhood bronchiectasis include:

• Airway macrophage-targeted therapies: e.g. novel non-microbial antibiotics to overcome the problem of microbial resistance
• Understanding and overcoming steroid resistance
• Autophagy and its relationship with lung biometals: e.g. Zinc in CLD and in diseased blood vessels
• Investigation of the CD1b lipid antigen presentation pathway as a contributor to the autoimmune response in COPD
• E-cigarettes: effects on airway inflammation, function and emphysema development
• Potentially pathogenic bacteria that commonly colonise the airway in CLD: effects on airway macrophage dysfunction and inflammation
• Bacterial bronchitis and bronchiectasis in Indigenous children

Lead researcher: Professor Sandra Hodge
Email: sandra.hodge@adelaide.edu.au

Honours project opportunities

Epithelial cell-based models for asthma research

As a big burden to public health in Australia, asthma dictates more attention from research to improve our understanding of its mechanisms and novel approaches to its management. Important tools in asthma research are disease models which display certain features of it, using mostly mouse or sheep and being valuable but expensive. Our authors’ (and other’s) previous studies have identified bronchial epithelium as a key regulator of inflammasomes and other innate immunity responses in airway allergic inflammation, a key feature in allergic asthma subtypes. Allergens from house dust mite (HDM) have been shown as strong inducers of airway inflammation in asthma.

This project is aimed to develop simple and reproducible models using cell lines of human airway epithelium to imitate airway allergic inflammation. Commercially available cell lines 16HBE14o-, SV40 and BEAS-2B will be exposed to various doses of HDM-derived recombinant allergen Der p 1 and tested for inflammatory response by expression of markers of inflammation and oxidative stress.

Furthermore these readings will be used to test anti-inflammatory effects of substances including recently developed antibiotic-free macrolides and regulators of sphingolipid signalling. The student will gain research skills in cell culture, immunofluorescence and confocal microscopy and Western blot.

Availability: Semesters 1 and 2
Special requirements: Nil

Sphingolipid signalling regulates inflammation in cystic fibrosis (CF)

CS is a life-threatening disease affecting multiple organs of which the lung is the primary target. CS is characterized by chronic inflammation and increased susceptibility to infections. The disease is caused by mutations in the CFTR (Cystic fibrosis transmembrane conductance regulator) gene leading to abnormality of chloride channels in mucus and sweat producing cells.

Sphingolipids such as ceramides, sphingosine, and sphingosine-1-phosphate (S1P) are regulators of virtually every vital function of the cell. Importantly, while their effects as a rule are diametrically opposing to each other, these small bioactive molecules are readily degraded, de novo synthesised or convertible to each other catalysed by relevant enzymes. The final balanced effects of sphingolipids are defined by cell type-specific balance of expression and activity of such enzymes plus other proteins involved in their transport and ligation, often referred to as ‘sphingolipid rheostat’.

Previous studies have identified that an increase of ceramides may be the cause for increased cell death, inflammation and susceptibility to infections in the airway of CF patients and CFTR mutant mice [Teichgraber et al Nat Med 2008; Brodlie et al AJRCCM 2010; Becker et al BBRC 2010]. More recently, data pointing to a decreased signalling by S1P in CF has also been obtained [Xu et al AJRCMB 2013; Veltman et al AJPLCMP 2016; Malik et al PONE 2015; Tabarazaveh et al Cell Physiol Biochem 2017]. Thus, regulation of the sphingolipid signalling system may offer a whole array of novel pharmacologic targets in CF. A large gap in this field, however, remains whether and how individual components of the sphingolipid system may be involved.

In this study we test a hypothesis that inflammation in CF is associated with altered expression and localization of components of the sphingolipid signalling system. As a first step into dissecting such mechanisms, a mouse model of beta-epithelial Na+ channel (BeNaC) overexpression which reproduces a number of pathologic features of CF will be employed and analysed for parameters such as SPHKs (sphingosine kinases responsible for converting of sphingosine into S1P), S1PRs (S1P receptors), and Spns2 (Spinster homologue 2, responsible for S1P export), in parallel with inflammatory markers IL-1beta, IFN-gamma, and NFkB translocation.

Availability: Semesters 1 and 2
Special requirements: Nil
Exploiting increased autophagy as a new therapeutic approach for COPD

Autophagy is an important cellular responses to cell stress. Our preliminary studies show that increased autophagy is associated with COPD and smoking. This project will investigate the specific molecular mechanisms underlying the increased autophagy in response to cigarette smoke, including the causative role of autophagy in the cell death process, and evaluate the effects of therapies on autophagy and autophagy-associated apoptosis at the cellular, tissue and whole animal level and ex vivo in human COPD subjects. These studies will (a) advance our understanding of autophagy in COPD and (b) indicate novel therapeutic approaches with translational potential. Likely research methods include cell culture, westerns and microscopy.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

Steroid resistant cytotoxic/pre-inflammatory lymphocytes in the lung

Glucocorticosteroids are commonly used in management of chronic lung disease; however, steroid resistance is a major challenge and the reason for the steroid resistance is both poorly understood and a major limiting factor in treatment. We have identified changes in several mediators (glucocorticoid receptor, nuclear enzyme HDAC2 and cell membrane transport proteins including P-glycoprotein) in blood and airway lymphocytes in COPD patients and severe asthmatics. We have targeted these mediators with low doses of currently available pharmaceutical drugs (used to treat other diseases) to render these lymphocytes sensitive to glucocorticosteroids. We don’t know whether these steroid resistant lymphocytes invade the lung. We will collect lung tissue from COPD patients, extract lymphocytes and use flow cytometry and cell-stimulation to identify steroid resistant lymphocytes in the lung parenchyma. Likely methods include flow cytometry, westerns, and immunohistochemistry.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

Assessing the effects of e-cigarette mods on inflammation and macrophage function

Despite what their marketing campaigns say, whether e-cigarettes are safe and assist smoking cessation remains in doubt. Up to 24% of Australian 18-24 year olds have tried using e-cigarettes, with 27% of those vaping daily. Our published data shows that even non-nicotine containing E-liquids are damaging airway cells in a similar fashion to cigarette smoke, alters cell cytokine release, and affects macrophage phagocytic function. However, these studies were performed in a generation 2 e-cigarette. Data shows that those who switch from cigarettes to e-cigarettes prefer the third generation or tank/mod devices which have the ability to alter the temperature and voltage. We hypothesise that hotter temperatures and higher voltages may increase the toxicity of e-cigarette vapour on lung cells. This project will:

1. Test cell death and apoptosis in airway cells and macrophages
2. Test whether phagocytosis of bacteria and apoptotic airway cells by macrophages is decreased
3. Assess whether higher temperatures release metals from the heating coils.

Likely research methods include cell culture, kit based assays, ELISA, Flow cytometry, immunohistochemistry, ICP-MS and westerns.

**Availability:** Semesters 1 and 2

**Special requirements:** This project requires someone with a strong disposition given pushback from lobbying groups.

Sphingosine kinases (SPHK): novel therapeutic targets in COPD and lung cancer

COPD is a leading cause of death worldwide, and there are currently no effective therapies. We showed defective clearance of apoptotic cells by airway macrophages (effectorcytosis) as a contributor to chronic inflammation in COPD and identified SPHK as essential regulators of effectorcytosis. Effects of cigarette smoke on SPHK and effectorcytosis in macrophages were negated by Fingolimod, a clinically approved modulator of S1PRs. We will collect lung tissue obtained during lung lobectomy operations from COPD and lung cancer patients and assess whether SPHK are dislocated from their normal subcellular localisation, and have decreased enzyme activity as found in our cigarette smoke exposed cell culture models. We hope to identify potential therapy targets for this disease. Likely research methods include cell culture and immunohistochemistry.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil
Understanding the role of cigarette smoke induced oxidised lipids in COPD

COPD patients’ lungs do not continue to repair even after cessation unlike those who smoke without the disease. The reason for this remains unknown, but a growing body of evidence suggest an altered immune response may be at play. We have shown that there are increased apoptotic cells in the airways of COPD patients and that macrophages fail to effectively clear these, leading to a build up of material in the airway, including oxidised lipids. Our preliminary data shows that cigarette smoke oxidised lipids cause an increase in the expression of a lipid antigen presenting molecule called CD1b on macrophages, similar to increased levels seen in alveolar macrophages of COPD patients. It also hinders their phagocytic ability. This study will investigate this phenomenon further assessing whether T cells recognise oxidised lipid loaded CD1b and launch an immune response to lipids on airway cells causing ongoing damage after cessation of smoking. Likely research methods include cell culture, flow cytometry/sorting, PCR, westerns and ELISA.

Availability: Semesters 1 and 2

Special requirements: Nil

Investigating NTHi in the pathogenesis of COPD

Reprogramming and dysfunction of the airway epithelium are hypothesised to initiate COPD, a disease that is set to become the third leading cause of death by 2020. A major aspect of this is the colonisation of the airway epithelium by Nontypeable Haemophilus influenza, which is responsible for approximately 50% of all COPD exacerbations. To date there is no effective treatment for COPD or NTHi colonisations, and the manner in which this bacteria persists in the airways remains elusive. This project will investigate the mechanisms that NTHi employs, and though its secreted products (secretome), to invade and colonise the airway epithelium in the context of COPD. Specific aims will be to:

1. Characterise the NTHi secretome using proteomic techniques.
2. Infect and expose human epithelial cultures to NTHi and the secretome products (respectively) and characterise disease-related alterations to the epithelium that contribute to the pathogenesis of COPD.
3. Use therapeutics tailored to the targets identified in 1 and 2 and examine amelioration to the epithelium while treated with COPD related exposures, such as cigarette smoke. The candidate will gain a solid understanding of the immunological and cellular/molecular consequence of COPD and bacterial infection.

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

Epithelial cell-based models for asthma research
Please see Honours entry

Sphingolipid signalling regulates inflammation in cystic fibrosis (CF)
Please see Honours entry

The effect of non-typeable H. influenza (NTHi) on sphingosine-1 phosphate (S1P), and its therapeutic targeting in COPD
Please see Honours entry

Understanding and therapeutically targeting the migration of inflammatory/cytotoxic CD8+CD28null T-cells to the epithelium in chronic obstructive pulmonary disease
Please see Honours entry

Understanding the role of cigarette smoke induced oxidised lipids in COPD
Please see Honours entry

Research areas

Immunology and Infection
Indigenous and Disadvantaged Health
Child and Adolescent Health
Translational Health Outcomes
Molecular Immunology
Women’s and Children’s Hospital

Immunology and Infection

Autoimmune diseases have a genetic risk: GWAS have identified more than 200 regions containing genetic variations linked to autoimmune disease risk but how these variations contribute to disease has remained elusive. Critically, more than 80% of the disease linked variations identified in genome wide studies are not located in the coding regions of genes. Autoimmune diseases genetic risk affects CD4+T cell specific enhancers: Up to 60% of candidate autoimmune disease associated variants are localised to regulatory elements (enhancers) active in lymphoid cells. These variants may alter the expression of the genes normally controlled by enhancers in Treg and T conv cells. Discovering the target genes controlled by these enhancers will therefore pin-point the critical pathways disrupted in Treg and Tconv cells in autoimmune disease.

It is now clear that enhancers acting over large distances are critical for controlling the cell-type-specific transcription of target genes. Up to 50% of enhancer regions, and do not interact with the nearest gene(s), but interact with promoters hundreds to thousands of kilobases away via DNA looping. This project will use Chromatin Conformation Capture (3C, 4Cseq and Hi-C), reveal actual connectivity between regulatory elements containing genetic risk and their targets.

**Project Supervisors:** Tim Sadlon, Simon Barry

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Optimisation of chimeric antigen receptor immunotherapy: building a better CAR?**

CAR-T cells have demonstrated robust clinical activity against B-cell cancer, although they also cause B cell aplasia. However, it has been noted that “Perhaps the greatest challenge to the field of engineered T cell therapy is the identification of a ‘universal’ CAR-T, that is, a CAR-T cell that can attack a broad range of cancers, especially solid cancers. We have identified and tested a cancer target that we believe has the potential to meet this challenge. P2X7 is a human cell surface protein that, when functioning normally, controls programmed cell death in old or damaged cells. A dysfunctional version of P2X7, named nfP2X78, has been identified on cancer cells from a wide variety of tissues, including brain, prostate, breast, melanoma, bowel, ovary, cervix, lung, pancreas and stomach, while being completely absent on healthy cells. We propose that a CAR-T cell targeting nfP2X7 could attack a broad range of solid cancers and have little, if any, off-cancer damage. We have already generated prototype nfP2X7 targeted CAR-T cells and have data showing that these CAR-T cells can kill several solid cancer cell types in the laboratory, this project will develop and test new CAR-T constructs.

**Project Supervisors:** Simon Barry, Tim Sadlon, Veronika Bandara

**Availability:** Semesters 1 and 2

**Special requirements:** Nil
A comprehensive non coding transcriptome profile of human CD4 T cells in health and disease

T conventional cells (T conv) form part of the effector arm of the immune system, while regulatory T cells (Treg) are critical for immune suppression. Both are crucial for a well-balanced, responsive immune system. CD4+ T cells can be separated into Naive, Central memory and Effector memory phenotypes each with particular characteristics and functions. Subdivision into Th1, Th2, Th17, Th1/17, Th9 and Th22 subsets, allows the cells to exquisitely respond to particular environmental cues, allowing the immune response to be nimble and precise.

It is not surprising that to maintain this crucial immune balance, each Tconv subset will have a partner Treg subset to keep reactivity in check. microRNAs and other non-coding RNAs finely control the expression of many genes and have been shown to be crucial for the development, function and lineage fidelity of Treg and Tconv, but there is no comprehensive signature of miRs and other non-coding RNAs across the CD4+ lineage. We would like to develop and carefully characterise a library of the non-coding RNAs expressed in the subsets of Treg and Tconv cells. We can then use this library to identify target genes crucial for maintaining both immune reactivity and tolerance.

**Project Supervisors:** Simon Barry, Cheryl Brown, Chris Hope

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

- **Validation of Foxp3 regulated genes critical for treg function: novel targets for autoimmune therapy**
  - Please see Honours entry

- **Unravelling the chromatin interactome to map the genetic risk of type 1 diabetes**
  - Please see Honours entry

- **Optimisation of chimeric antigen receptor immunotherapy: building a better car?**
  - Please see Honours entry

- **A comprehensive non coding transcriptome profile of human CD4 T cells in health and disease**
  - Please see Honours entry

**Research areas**

- Immunology and Infection
- Child and Adolescent Health
- Translational Health Outcomes
- Fertility and Conception
Our group has developed a number of experimental vaccines for hepatitis C virus, HIV and Zika virus, and is constantly improving these vaccines with an aim to examine the safety and immunogenicity of an effective vaccine in clinical trials.

Lead researcher: Professor Eric Gowans
Email: eric.gowans@adelaide.edu.au

Honours project opportunities

Expanding the cell mediated immune responses to HIV

We have developed a novel HIV vaccine which encodes the conserved capsid protein, Gag. Vaccination of mice with this cytolytic DNA vaccine results in a robust cell mediated immune response to Gag as determined by enzyme linked immunospot (ELISpot) assay and by intracellular cytokine staining (ICS). This immune response provides a considerable level of protection against challenge with EcoHIV, a chimeric virus in which the HIV envelope proteins (Env) have been substituted with the Env proteins from murine leukaemia virus.

Challenge of vaccinated mice results in a significantly reduced viral load relative to unvaccinated controls. We now wish to introduce a number of additional HIV proteins into the vaccine, because one of the most effective experimental HIV vaccines included Gag, rev, nef, tat in the vaccine. Thus this project will involve DNA cloning, sequencing and protein expression, prior to vaccination of mice and analysis of the efficacy of the modified vaccine, as assessed by EcoHIV challenge.

Project Supervisor: Dr Branka Grubor-Bauk
Availability: Semesters 1 and 2
Special requirements: Nil

A multigenotypic, multiantigenic cytolytic DNA vaccine for HCV.

A vaccine designed to induce cell mediated immunity (CMI) to HCV has the potential to protect against infection. However, as the nucleotide sequence of the HCV genome varies by 35% between different genotypes, the production of a universal HCV vaccine represents a major challenge. A convenient way to overcome this difficulty is to generate a cocktail of DNA vaccines which will elicit CMI to each of the genotypes included in the cocktail. However, although we have developed such a cocktail, we have been unable to examine its immunogenicity because the reagents necessary to establish ELISpot and ICS are unavailable for genotypes 2 and 4.

Thus this project will generate DNA expression vectors for HCV genotype 2a and 4a non-structural (NS) proteins NS3 and NS5B, express and purify these proteins from mammalian cells, then establish ELISpot and ICS to examine the immune response in animals vaccinated with the cocktail or the individual genotype vaccine.

Project Supervisor: Dr Danushka Wijesundara
Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Immunology and Infection
INDIGENOUS AND DISADVANTAGED HEALTH
Closing the gap in health equality between Aboriginal, Torres Strait Islander people and other disadvantaged Australians is a national priority. Focused effort is required to understand and resolve the underlying basis for the inequalities of health care and health care outcomes across our most vulnerable Australian community members.

There are many factors impeding the availability and delivery of health care to ensure good health outcomes for Indigenous and disadvantaged groups in Australia. These include: physical access to services for rural and remote communities; cultural appropriateness of treatment; education on the maintenance of health; and financial restrictions.

Our researchers are investigating ways to overcome these barriers and provide an improved understanding of the health and health care amongst Indigenous and disadvantaged communities. This understanding is essential for the development and implementation of informed, effective public health policy.

Researchers across the faculty are focused on:

• reducing the burden of disease and health inequalities, arising from chronic dental diseases among Indigenous children
• monitoring and surveying Indigenous oral health and use of dental services
• working with Indigenous women to develop culturally-appropriate care in order to improve the outcomes for mothers and their babies
• working with the Indigenous community to use existing knowledge on best-practice chronic disease prevention and treatment to improve the coverage and appropriateness of health services and care
• conducting interventional clinical trials to provide evidence for optimal management of HIV/AIDS across high-, middle- and low-income communities.
The Australian Research Centre for Population Oral Health (ARCPOH) is Australia’s pre-eminent population oral health research body undertaking dental research and provides a broad range of dental and oral health statistics for Australia. ARCPOH was established at the University of Adelaide in 2001 to undertake research and research training in population oral health that is internationally recognised to be of the highest quality. In addition to the University, ARCPOH’s stakeholders include government agencies, dental organisations, and private corporations. Part of the Adelaide Dental School, the Centre is involved with the academic and research areas of social and preventive dentistry, oral epidemiology and geriatric dentistry.

Lead researcher: Professor Lisa Jamieson
Email: lisa.jamieson@adelaide.edu.au

Honours project opportunities
Honours projects may be available with this group, please contact the lead researcher(s) for more information.

HDR project opportunities
Investigating the role of discrimination experienced by Indigenous Australians on both self-rated and clinical markers of general health and oral health
All data collected; three data sets. Potential for at least three published journal articles and presentation at one international conference.
Availability: Semesters 1 and 2

Analysing outcomes of a randomised control trial that aimed to reduce progression of chronic kidney disease among Aboriginal Australians residing in Alice Springs, through a periodontal intervention
Potential for at least three published journal articles and presentation at one international conference. Also potential to spend time in Alice Springs with study team.
Availability: Semesters 1 and 2

Exploring the role of health states and utilities among Aboriginal Australians, using hypothetical models of oropharyngeal cancer and human papilloma virus
Potential for at least three published journal articles and presentation at one international conference. Also potential to spend time with study team travelling throughout South Australia to collect and collate data.
Availability: Semesters 1 and 2

Analysing the prevalence of, and risk factors for, oropharyngeal cancer cancer among Aboriginal Australians, and the attributable fraction related to human papilloma virus
Potential for at least three published journal articles and presentation at one international conference. Also potential to spend time with study team travelling throughout South Australia to collect and collate data.
Availability: Semesters 1 and 2

Research areas
Indigenous and Disadvantaged Health
Oral Health
Nutrition and Metabolic Health
Cardiac, Respiratory and Vascular Health
The Central Northern Adelaide Renal Transplant Service (CNARTS) and South Australian Health and Medical Research Institute (SAHMRI) is committed to providing quality clinical and culturally safe care for Aboriginal and Torres Strait Islander people. To do this, we are planning a series of research projects to build relationships between Indigenous patients, their family members and clinicians, provide opportunities for Indigenous patients and their families to provide feedback on services, and to support Indigenous people to be actively involved in decision making in research planning, policy creation, data governance and clinical guidelines.

Lead researcher: Dr Janet Kelly
Email: janet.kelly@adelaide.edu.au

Honours project opportunities

Improving Indigenous renal care

We invite an Honours student to work closely with the renal and transplant research teams to coordinate and analyse staff surveys and interviews, and to explore a range of patient feedback and Indigenous governance options. The findings of these studies will inform new national clinical guidelines and data management. There are also opportunities to work in the emerging field of patient journey mapping, which enables researchers to more accurately identify health care gaps and the most effective strategies to improve care for marginalised population groups.

This project is part of a much larger vision to improve renal care for Indigenous peoples nationally and internationally. As an Honours student, you will have an opportunity to work alongside leading clinicians and researchers, while being supported to develop your own research skills and interests.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Indigenous and Disadvantaged Health
Cardiac, Respiratory and Vascular Health
Surgical and Health Systems Innovation
INNOVATIVE THERAPEUTICS
Research in innovative therapeutics aims to identify new, economically sustainable therapeutic approaches that can deliver better outcomes for patients and the community.

From 2001 to 2014, health care expenditure in Australia doubled to $140 billion (9.5% GDP), and has since been increasing at a rate of 7.7% per annum. The various tiers of government fund 68% of these costs, 11.5% of which can be attributed to pharmaceuticals alone.

The development of new and cost-effective therapeutics is critical for sustaining and advancing the delivery of health care to the Australian community. Our research aims to produce novel therapeutic approaches to enhance efficacy and specificity; lower the side effects; provide greater safety; and reduced need for hospitalisation or other health services.

Researchers across the faculty are focused on:

• identifying novel targets for therapy to prevent metastasis and modulate the progression of cancers
• identifying new biomarkers to identify disease, predict disease trajectories and monitor response to treatment
• developing tissue regeneration technologies to address tissue injuries and disease
• developing cost-effective in vitro models to replace animal models for testing therapeutic efficacy
• developing rigorous clinical evaluation approaches of novel combinations of existing therapeutic agents, including development of novel modes of delivery.
INNOVATIVE THERAPEUTICS RESEARCH OPPORTUNITIES

Clinical Trials
Adelaide City (CMAX), Thebarton (CPR Pharmaservices; Bionomics)

Professors Rolan and Shakib are highly experienced clinical trial researchers in the commercial sector with close relationships with the partners who will host students for their Honours projects.

**Lead researcher:** Professor Paul Rolan  
**Email:** paul.rolan@adelaide.edu.au

Honours project opportunities

**Clinical research**
There are opportunities for Honours projects in clinical trials via a placement in industry. Placements are likely at CMAX, CPR Pharmaservices and Bionomics. These projects are most likely to be suitable for students who have completed the Clinical Trials Major of the Bachelor of Health and Medical Sciences or the Bachelor of Health and Medical Sciences (Advanced) degree and would like to pursue a career in this sector.

Students will be placed in a working environment where they will learn to carry out industry-relevant tasks. In addition, students will be allocated a research project which will be related to the field of work.

**Project Supervisor:** Professor Paul Rolan  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Research areas**
Innovative Therapeutics  
Translational Health Outcomes
**Genome Editing Laboratory**

South Australian Health and Medical Research Institute (SAHMRI)

CRISPR genome editing technology is transforming medicine, biology and agriculture. CRISPR enables targeted genetic modification of virtually any species with unprecedented efficiency. Given its potential, CRISPR is envisioned to be a game changer for therapeutic development, particularly for incurable genetic diseases.

The Genome Editing Laboratory led by Professor Paul Thomas uses state-of-the-art molecular genetic approaches to develop CRISPR technology to enhance human health. Our CRISPR innovation includes the development of strategies to eliminate entire chromosomes that could potentially be deployed for treatment of aneuploidy diseases. Our lab is expert in generating genetically modified mice using CRISPR to model human disease mutations with >60 mouse models to date. We are using these unique models to investigate the pathology of relatively common genetic diseases such as epilepsy and muscular dystrophy. We are also developing CRISPR genome editing approaches to cure genetic diseases by correcting disease-causing mutations in vivo. Finally, we are leading the world in the development of CRISPR gene drive in mice. This powerful technology has enormous potential for controlling invasive mouse populations that spread (zoonotic) disease, cause species extinction and loss of agricultural productivity.

**Lead researcher:** Professor Paul Thomas  
**Email:** paul.thomas@adelaide.edu.au

**Honours project opportunities**

**Developing CRISPR gene therapy for duchenne muscular dystrophy (DMD)**

The long term goal of this project is to develop innovative CRISPR gene therapy for Duchenne Muscular Dystrophy (DMD). DMD is a devastating muscle wasting disorder that affects 1:5,000 male births. Muscle weakness usually begins around the age of 4 and by age 12 most affected boys are in a wheelchair. DMD is caused by mutations in the X-linked DMD gene, which encodes the muscle protein Dystrophin. The first aim of this project is to use CRISPR to generate and characterise a DMD mutant mouse that models a common disease-causing mutation in affected boys. Once the preclinical model is established, we will deliver optimised CRISPR reagents to the muscle tissue to edit the defective gene and restore its function. If successful, we aim to translate our strategy into human patients. The approaches developed in this project could also potentially be applied to the development of CRISPR gene editing therapy for other inherited disorders.

**Project Supervisors:** Dr Fatwa Adikusuma and Professor Paul Thomas  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Understanding the pathological mechanism of PCDH19-girls clustering epilepsy**

Mutations in the X-linked PCDH19 gene are a leading cause of genetic epilepsy. PCDH19-Girls Clustering Epilepsy (PCDH19-GCE) has a unique form of X-linked inheritance as carrier (heterozygous) females are affected while carrier (hemizygous) males are not. Affected girls suffer from seizures of variable severity and some also have intellectual disability and/or autism. PCDH19 is a transmembrane protein that enables cells ‘stick together’ during brain development. Using CRISPR mouse models, we have recently shown that Pcdh19 heterozygous female mice have elevated brain activity and that the neurons cluster abnormally during development.

The aim of this project is understand how PCDH19 mutations cause epilepsy at the cellular and molecular level. We will firstly use fluorescence immunodetection methods to identify the neural subtypes that express PCDH19. Using conditional mouse models and cutting-edge in utero electroporation, we will delete Pcdh19 from specific neuronal cells and assess the impact on brain activity and development. Primary neuronal cultures of normal and mutant cells will also be used to determine PCDH19 function in synapse formation and neuronal activity.

Research techniques include mouse handling, PCR, cell culture, histology and immunofluorescence.

**Project Supervisors:** Dr Stefka Tasheva and Professor Paul Thomas  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Development of CRISPR gene drive technology in mice**

One of the most exciting applications of genome editing technology is the use of CRISPR gene drives to modify native or invasive pest populations to benefit human health, ecosystems or agriculture. For example, it may be possible to curb malaria by spreading a malarial resistance gene through mosquito populations that carry the disease-causing parasite. CRISPR gene drives are small DNA “cassettes” that encode CRISPR machinery (Cas9 and gRNAs) and are located at a specific position in the genome. Once activated, the gene drive element replicates itself ensuring that it is passed on to the next generation. While gene drives have recently been published in insects and yeast, they have not yet been developed in other species.

The aim of this project is to develop gene drive technology in mice. Using state-of-the-art molecular genetic approaches, we will develop transgenic mice carrying gene drive cassettes and determine the efficiency of gene drive replication and spread in cage trials. We will test a range of approaches including different endonuclease platforms (eg. SpCas9 versus Cpf1), target site strategies (eg. fertility and viability genes) and fluorescent reporters.

Research techniques include design and preparation of CRISPR reagents, mouse handling, fluorescence microscopy, PCR and sequencing.

**Project Supervisors:** Chandran Pfitzner and Paul Thomas  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

**Developing CRISPR gene therapy for duchenne muscular dystrophy (DMD)**

See Honours entry

**Understanding the pathological mechanism of PCDH19-girls clustering epilepsy**

See Honours entry

**Development of CRISPR gene drive technology in mice**

See Honours entry

**Research areas**

Innovative Therapeutics  
Neuroscience, Behaviour and Brain Health

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**Professor Paul Thomas**
Neuroprotection and Molecular Toxicology
University of Adelaide, North Terrace Campus

Our research focusses on developing innovative therapeutics targeting neuroprotection, with current applications targeting dementia. This includes local, national and international collaborations.

Lead researcher: Dr Scott Smid
Email: scott.smid@adelaide.edu.au

Honours project opportunities

Novel neuroactive phytochemicals from cannabis

Australians now have an approved pathway to access medical cannabis for the treatment of a range of health disorders. Research findings demonstrate neuroprotective effects of several compounds derived from cannabis, suggesting their potential in the treatment of Alzheimer’s and Parkinson’s disease. However, aside from THC and CBD we know very little about the effectiveness, safety and pharmacology of many of the 100 phytocannabinoids and over 400 other known phytochemicals in cannabis, including potential neurotoxicity. The project will screen a selection of phytocannabinoids for both neurotoxic and neuroprotective effects, using a combination of neuroanatomical, morphological, molecular and biochemical approaches. We will use cell imaging and morphometric analysis of neurons exposed to discrete phytochemicals preferentially expressed in cannabis to evaluate any intrinsic neurotoxicity, or effects on neurogenesis or differentiation indicative of neuroprotection. We will also determine if these compounds can inhibit neurotoxicity evoked by amyloid beta (Aβ) and β-synuclein exposure, which are hallmark neurotoxic proteins in Alzheimer’s and Parkinson’s disease respectively. This project will inform disease-modifying drug development urgently needed in the treatment of major forms of dementia.

Project Supervisor: Scott Smid
Availability: Semester 1
Special requirements: Nil

HDR project opportunities

Novel neuroactive phytochemicals from cannabis
Please see Honours entry.

Research areas
Innovative Therapeutics
Neuroscience, Behaviour and Brain Health
While the gap is narrowing, there remains a long-standing difference between the sexes in relation to risk factors for poor health and health outcomes, with males having five years less ‘healthy life’ than females.

The research area of men’s health focuses on the common and interrelated conditions that constitute the bulk of the disease burden in men, and have the most significant effects on wellbeing and quality of life, families and workforce participation. These include:

- prostate cancer
- diabetes and heart disease
- anxiety and depression
- urological disease
- sexual health
- reproductive health
- sleep health.

Our researchers are using an interdisciplinary approach to narrow the gap between male and female health. This comprises a network of basic scientists, public health, clinical, behavioural and social science researchers, health practitioners, educators, economists, consumers and expert advisors working together to share expertise and knowledge to advance men’s health.

Our research emphasises the biopsychosocial determinants of health across all our men’s health research and training programs. Our programs have a strong focus on:

- healthy male ageing
- clinical consequences of obesity
- health literacy
- preventative health and e-health measures
- vulnerable populations of men at greater risk
- innovation in screening, diagnostic and prognostic tools and therapies
- health economics
- healthy paternity.
The internet has the potential to be a powerful tool for health care and health promotion. Now more than ever, it is possible to reach those most at need and deliver personalised, comprehensive and on-going health support in a cost-effective way. Unfortunately, this potential is underutilised in men’s health with the vast majority of websites and apps offering ‘one-size-fits all’ information, and failing to incorporate evidence-based strategies to engage men and support decision-making or behaviour change.

This program aims to design and evaluate apps and websites to support healthy lifestyle changes and reduce psychological distress. Investigating what digital solutions work for who, and how best to present content based on the individual to enhance engagement and intervention impact. As well as developing new methods of capturing and understanding behaviour based on new digital data sources.

Lead researcher: Dr Camille Short
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Honours project opportunities
Designing an online exercise guidance tool for men with metastatic prostate cancer

Exercise is a recommended adjuvant treatment for men with metastatic prostate cancer. It reduces treatment toxicities, delays disease progression and possibly even increases survival. Despite this, many men with metastatic disease often miss out on exercise opportunities in lieu of expert guidance about the type and amount of exercise that is safe to perform. We have access to exercise prescription modules for men with metastatic prostate cancer that have been shown to be effective in a face to face setting. These modules will form the basis for the tailored exercise advice in an online tool. The project will involve conducting interviews with men, making educational videos, writing articles on behaviour change and the benefits of exercise and conducting a pilot evaluation of the developed tool. The student(s) will be involved in one or more of these tasks depending on their skill level, interest, discipline (degree) and the project needs at the time. The project is being conducted in collaboration with the Exercise Medicine Research Institute at the Edith Cowan University, Central Queensland University and the NHMRC Centre for Research Excellence in Prostate Cancer Survivorship. Multiple projects and scholarships available.

Availability: Semesters 1 and 2
Special requirements: Nil
Men’s Health: MAILES Longitudinal Male Ageing Study

The University of Adelaide, North Terrace Campus, Royal Adelaide Hospital, Basil Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Adelaide Health and Medical Sciences building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)

While the gap is narrowing, there remains a long-standing difference between the sexes in relation to risk factors for poor health and health outcomes, with males having five years less ‘healthy life’ than females. The research area of men’s health focuses on the common and interrelated conditions that constitute the bulk of the disease burden in men, and have the most significant effects on wellbeing and quality of life, families and workforce participation. These include:

- prostate cancer
- diabetes and heart disease
- anxiety and depression
- urological disease
- sexual health
- reproductive health
- sleep health.

Our researchers are using an interdisciplinary approach to narrow the gap between male and female health. This comprises a network of basic scientists, public health, clinical, behavioural and social science researchers, health practitioners, educators, economists, consumers and expert advisors working together to share expertise and knowledge to advance men’s health.

Our population health research emphasises the biopsychosocial determinants of health across all our men’s health research and training programs. Our programs have a strong focus on:

- healthy male ageing
- clinical consequences of obesity
- health literacy
- preventative health and digital health
- vulnerable populations of men at greater risk
- innovation in screening, diagnostic and prognostic tools and therapies
- health economics
- healthy paternity
- testosterone
- masculinity.

Lead researcher: Dr Sean Martin
Email: sean.martin@adelaide.edu.au

Honours project opportunities

Is urinary dysfunction a novel cause for depression in men: a prospective cohort study

Depression is recognised as being under-diagnosed in men, particularly middle-aged and elderly men. Recently, our group and others have demonstrated men with lower urinary tract symptoms (LUTS) are more likely to report depressive-type symptoms, however the nature of this relationship and the mechanisms involved remain unclear. LUTS, a cluster of conditions related to poor urinary function (such as increased frequency and/or urgency to void, increased night-time voiding among others) are known to be frequently raised and treated in the primary care setting. Given men appear reluctant to initiate discussions around mental health with their GPs, this project also has novel and important clinical implications for men with undiagnosed depression.

Using a longitudinal cohort of middle-aged to elderly community-based men with an extensive biopsychosocial dataset, this project aims to further examine the association between depression and LUTS in men. Specifically, we will be exploring novel mediators of the depression and LUTS association (e.g. systemic inflammation, stressful life events), which specific LUTS cluster with particular depressive symptoms (e.g. somatic vs affective symptoms), and whether the treatment of LUTS between clinic waves leads to decreases in depressive symptoms.

Project Supervisor: Dr Sean Martin
Availability: Semesters 1 and 2
Special requirements: Nil

The relationship between mental health and use of health care services in middle-aged to elderly men

Each year, approximately one in every five Australians will experience some form of mental illness (e.g. depression or anxiety). Despite this, many people remain undiagnosed, and consequently unable to benefit from an increasing array of treatment and support options. Men are commonly thought to use health services less frequently for depression and anxiety. However, our group has demonstrated that for middle-aged and older groups, the level of health care usage is comparable to that of age-matched women. This suggests efforts to better understand what factors drive men to use health care services (in combination with efforts made to increase uptake of available services) is vital to decrease the burden of mental illness in men.

Using a longitudinal cohort of middle-aged to elderly community-based men with an extensive biopsychosocial dataset, this project will examine the use of health care services in men with depression and anxiety. Specifically, we will examine how men with incident, recurring and undiagnosed depression/anxiety differ in their usage of health resources (GP and allied health usage, Medicare, PBS), when compared with men without depression. We will also identify other factors (demographic, lifestyle, and behavioural) that may act as mediating influences in this usage.

Project Supervisor: Dr Sean Martin
Availability: Semesters 1 and 2
Special requirements: Nil
The relationship between adverse childhood events and health and wellbeing in middle-aged to elderly men

There is now a well-established link between adverse childhood events (ACEs) and the development of common mental health disorders, such as anxiety and depression. Less is known however about whether such adverse events can also increase the risk of developing cardio-metabolic diseases (e.g. cardiovascular disease (CVD) and type 2 diabetes mellitus) in later life. Recent reviews of ACEs and subsequent disease risk have identified a need to examine these relationships in male, representative populations, given previous studies have focussed on female-dominant or exclusive samples [Wegman & Stetler (2009), Psychosomatic Medicine 71:805–812]. Important work by the CDC’s Adverse Childhood Experiences (ACE) Study has recently demonstrated that risk factors for poorer health outcomes (e.g. smoking, alcohol abuse, decreased physical activity, poor nutrition) tend to cluster in individuals who have experienced ACEs. However, it remains unclear whether these at-risk behaviours are directly related to ACEs or other psychosocial factors (later stressful life events, marital and workplace status, personality factors (e.g. mastery), mental health disorders etc), or whether ACEs independently raise the risk for the development of diseases such as CVD and T2DM.

Project Supervisor: Dr Sean Martin
Availability: Semesters 1 and 2
Special requirements: Nil

MAILES

The MAILES (Men Androgen Inflammation Lifestyle Environment and Stress) study is one of Australia’s largest and longest running studies on male health and wellbeing with ageing. Over time 2584 South Australian men aged 35 to 80 years have been assessed providing data that continues to improve our understanding of risk factors for, and early warning signs of, diabetes and poor heart and metabolic health, sexual health and mental health, and men’s use of health services. The following data is available for students to pursue topics of interest.

- Psychosocial: stress, socioeconomic status, life events and health outcomes
- Sleep: obstructive sleep apnoea prevalence, predictors and effects
- Sex steroids: testosterone measures, changes in testosterone with age, disease, and environmental exposure
- Diabetes and cardiovascular health: prevalence of diagnosed and undiagnosed and predictors
- Health service usage: use of prescription and non-prescription pharmaceuticals / supplements, health service utilisation and service preferences
- Mental health: depression and modifyable factors, anxiety prevalence and predictors, quality of life determinants
- Environmental: impact of environmental exposures on chronic disease
- Other: health literacy, fractures and body composition, injury, nutritional intake and alcohol projects

Project Supervisor: Dr Sean Martin
Availability: Semesters 1 and 2
Special requirements: Nil

Optimising the delivery of health services to better meet the needs and preferences of men

HDR project opportunities

Is urinary dysfunction a novel cause for depression in men: a prospective cohort study
See Honours entry

The relationship between mental health and use of health care services in middle-aged to elderly men
See Honours entry

The relationship between adverse childhood events and health and wellbeing in middle-aged to elderly men
See Honours entry

MAILES
See Honours entry

Research areas

Men’s Health
Nutrition and Metabolic Health
Cardiac, Respiratory and Vascular Health
Neuroscience, Behaviour and Brain Health

89 Men’s Health
The Prostate Cancer Research Group has established an internationally-recognised research program focused on targeting androgen signalling in prostate cancer, discovering innovative biomarkers of response to treatment, and developing new pre-clinical models of disease.

Prostate cancer is a major public health issue, killing approximately 3,300 men in Australia annually. While early stage cancers can be treated with surgery, advanced and metastatic cancers are treated with drugs which either prevent the synthesis of, or block the actions of, male hormones, which are known as androgens. Androgens, such as testosterone and dihydrotestosterone, are critical for normal prostate development and for the growth of prostate cancers. They bind to the androgen receptor (AR) protein which mediates their effects in prostate cells.

While drugs which target AR pathways are initially effective, patients eventually relapse and progress to an incurable stage of the disease. A confounding issue with prostate cancer treatment is the unreliable nature of the standard PSA (Prostate Specific Antigen) test for monitoring how tumours respond to prostate cancer drugs. Our research aims to develop robust diagnostic tests to better assess prostate cancer development, progression and response to treatment with existing prostate cancer drugs as well as new drugs undergoing clinical development.

**Lead researcher:** Professor Lisa Butler  
**Email:** lisa.butler@adelaide.edu.au

**Honours project opportunities**

**Importance of lipid metabolism in the response of prostate cancer cells to therapeutics**

We have shown that prostate cancer cells respond to current therapeutic drugs with characteristic changes in lipid metabolism. This project will determine whether these lipid changes are necessary for reduced proliferation or enhanced death of prostate cancer cells in response to these drug therapies. For this laboratory based project, you will be using a unique human prostate cancer tissue explant culture system to examine prostate cancer cell growth and lipid profiles. The role of specific lipid metabolism enzymes will also be examined using a range of prostate cancer cell line models and molecular biology techniques such as quantitative PCR, western blotting and assays for growth, apoptosis, invasion and migration. Scholarships available.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Defining biomarkers of response to novel prostate cancer drugs**

There is a critical need in cancer drug development for better ways to accurately predict which patients are likely to respond to new molecular targeted drugs. This project will characterise changes in expression of specific proteins in prostate cancer cells treated with developmental drugs. We have previously identified differential expression of several candidate proteins through proteomic screening. For this laboratory based project, you will be using prostate cancer cell lines as well as a unique human prostate cancer tissue explant culture system along with western blotting, immunohistochemistry and quantitative PCR to validate and characterise changes in these candidate genes and proteins. Tools such as siRNA will then be used to better define the role of these candidates in prostate cancer drug responses. Scholarships available.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil
MUSCULOSKELETAL HEALTH
Good musculoskeletal health is important at every stage of life and plays a vital role in keeping us on our feet. More than six million Australians (approximately 14% of the population) suffer from some kind of musculoskeletal condition, such as back pain, arthritis, osteoporosis and fractures.

Musculoskeletal health is a multidisciplinary area of research involving connective tissue biology (including bone, cartilage and muscle), diseases of connective tissue (including arthritis and osteoporosis), biomechanics and surgical/clinical interventions to treat traumatic bone injury and other conditions.

Researchers across the faculty are focused on:

- understating the cellular and molecular basis of normal and pathological bone turnover
- how to best repair fractures after traumatic injury with novel surgical approaches and post-operative management
- how to optimise the outcomes of joint replacement surgery in order to provide better and longer lasting outcomes for patients
- performing gait analysis and activity monitoring to evaluate the success of interventions across all musculoskeletal conditions
- developing better ways to manage spinal cord injury patients to improve their outcomes
- identifying links between bone cells and the molecules they produce and bone health.
Adelaide Paediatric Anatomy and Forensic Anthropology Research Group

University of Adelaide, North Terrace Campus

Lead researcher: Dr Nicolene Lottering
Email: nicolene.lottering@adelaide.edu.au

Honours project opportunities

Establishing normative multislice computed tomography (MSCT) standards for craniometric analyses of modern Australian children for early detection of craniofacial abnormalities

The primary aim of this study is to construct modern Australian specific standards using craniometric variables from head/neck computed tomography data of modern Australian children aged 3-10 years old. Specific skills in manual segmentation and 3D modelling of thin-slice data; trouble-shooting automated measurement protocols; and basics in non-linear statistics will be attained. In collaboration with the Australian Craniofacial Unit, this data will be used as a precursor for early detection of basi-scapular growth anomalies linked to sphenoid synostosis in South Australian Children.

Availability: Semesters 1 and 2
Special requirements: Nil

Changing epidemiology of nonsyndromic metopic craniosynostosis in Australian infants

Craniostenosis is characterised by untimely fusion of cranial sutures resulting in a variety of craniofacial deformities and neurological sequelae due to alteration in cranial volume and restriction of brain growth. This study aims to determine the incidence of metopic craniosynostosis in South Australian and Queensland children, using retrospective clinical MSCT data obtained from the Australian Craniofacial Unit and Lady Cilento Children’s Hospital. Risk factors, functional aspects and craniometric considerations correlated with synostosis will be explored using meta-data analyses, bayesian statistics and 3D CAD modelling.

Availability: Semesters 1 and 2
Special requirements: Nil

Development of new age estimation standards for improved human identification of Australian children

This project aims to develop Australian-specific ossification standards for age estimation; recalibrating the age of onset and complete epiphyseal fusion of the long bones in modern Australian children aged 5-20 years using 3D computed tomography scans. In conjunction with the Department of Medical Imaging and Nuclear Medicine at the Lady Cilento Children’s Hospital, Brisbane, you will obtain specific skills in medical imaging database management, image segmentation and 3D modelling of thin-slice data.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Temporal characterisation of ossification of the os coxa in modern Australian children: developing a multi-variable approach for accurate age estimation in forensic contexts

Using retrospective, thin-slice MSCT clinical data, this study aims to document the timing of the appearance and fusion of ossification centres of the bony pelvis in a sample of contemporary Australian male and female juvenile individuals. The primary outcome of this investigation strives to construct Australian specific age standards to facilitate age-estimation and reduce the subjective error in the development of biological profiles for unidentified juvenile remains. In addition, this study will utilise morphometric modelling and reverse engineering software capabilities in the assessment of paediatric skeletal age from the analysis of skeletal growth, to assist in the development of a novel, robust and quantitative multi-variable scoring system for juvenile age-estimation. Advanced bio-statistics skills will be acquired through a statistical collaboration/supervision with Griffith University.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Musculoskeletal Health
Child and Adolescent Health
Surgical and Health Systems Innovation
Bone and Joint – Osteoimmunology Group
University of Adelaide, North Terrace Campus

Lead researcher: Dr Tania Crotti
Email: tania.crotti@adelaide.edu.au

Honours project opportunities

Inhibiting pain and joint damage in rheumatoid arthritis (RA)

Rheumatoid arthritis is a chronic systemic destructive inflammatory disorder characterised by joint inflammation, synovial hyperplasia and associated destruction of bone and cartilage impacting on joint function. The pain associated with this joint destruction is one of the most debilitating symptoms reported by RA patients. There is a recognised decrease in the threshold of the sensory nervous system’s response to certain harmful or potentially harmful stimuli (hypernociception) that also impacts on joint function. Nociceptor sensitisation is considered to be a co-morbidity of RA and it may also be a significant problem when there is minimal disease activity or sustained remission. This study investigates the mechanism of hypernociception with concurrent joint destruction in a murine model of inflammatory arthritis. Further, we will assess the inhibition of a signalling pathway known to be involved in bone resorbing cells, inflammatory cells and hypernociception by a commercially available natural compound (Parthenolide). Analysis will include: Micro-CT: bone volume and soft tissue swelling; Immunohistochemistry/histopathology: HE and TRAP staining of paws; markers of activation in the brain and spinal cord.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Imaging pain in rheumatoid arthritis

Rheumatoid arthritis is a chronic systemic destructive inflammatory disorder characterised by joint inflammation, synovial hyperplasia and associated destruction of bone and cartilage impacting on joint function. Additionally, the pain associated with this joint destruction is one of the most debilitating symptoms reported by RA patients. There is a recognised decrease in the threshold of the sensory nervous system’s response to certain harmful or potentially harmful stimuli (hypernociception) that also impacts on joint function. Nociceptor sensitisation is considered to be a co-morbidity of RA and it may also be a significant problem when there is minimal disease activity or sustained remission. This study expands the field of knowledge greatly, as it investigates the mechanism of hypernociception with concurrent joint destruction in a murine model of inflammatory arthritis. Further, we will assess the activation of a signature of pain using hyperspectral imaging in conjunction with the Centre for Nanobiophotonics. This study could potentially guide treatment to address pain as well as disease.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Musculoskeletal Health
Neuroscience, Behaviour and Brain Health
Our group investigates ways of manipulating bone metabolism to treat bone pathologies based on our understanding of the mechanisms of bone loss in rheumatoid arthritis, periodontal disease and orthopaedic implant related bone loss. We have developed animal models for all of these diseases and in vitro cell culture assays to investigate these processes in detail. Human mesenchymal stem cells, osteoblasts, osteocytes and osteoclasts are routinely used during our investigations. We also have access to an array of unique therapeutic compounds (e.g. epigenetic regulators of cells) and novel biomaterials.

Lead researcher: Professor David Haynes
Email: david.haynes@adelaide.edu.au

Honours project opportunities

Topical administration of histone deacetylases for the treatment for periodontitis

Periodontal disease affects up to 90% of the adult population with almost half suffering from the destructive phenotype that causes alveolar bone destruction and tooth loss. We were the first to demonstrate the effectiveness of a novel therapeutic intervention in an experimental model of periodontitis. By targeting the epigenetic processes that regulate gene expression with inhibitors of Histone Deacetylases (HDACi), we see a vast improvement in the bone forming capacity of osteoblasts and suppression of bone destroying osteoclasts.

This study aims to utilise this therapeutic target with a new exciting oral topical delivery technique in our experimental periodontitis model. With completion of this study, we will be able to further our understanding of the role of HDAC’s in disease, and further the development of HDACi as novel therapeutic compounds for bone loss pathologies like periodontitis.

Project Supervisors: Dr Kent Algate, Dr Melissa Cantley, Professor David Haynes
Availability: Semester 1

Special requirements: Nil

Epigenetic regulation of mesenchymal stem cells to improve bone quality in disease

Mesenchymal stem cells are a fascinating class of cells that have the capacity to differentiate into a variety of cell types. This requires activating essential genes to induce their transition to their target phenotype. Recently, we identified Histone Deacetylases (HDACs; epigenetic regulators of gene expression) are involved with modulating mesenchymal stem cell development and differentiation into the osteogenic lineage. As such, we aim to explore the effectiveness of targeting specific HDACs to promote osteoblast formation from mesenchymal stem cells and increase bone formation as part of our NHMRC grant, highlighting the importance of HDACs in regulating stem cells to promote bone healing in disease.

Project Supervisors: Dr Kent Algate, Dr Danijela Menicanin, Professor David Haynes
Availability: Semester 1

Special requirements: Nil

Research areas
Musculoskeletal Health
Ageing, Frailty and Mobility
Oral Health
Innovative Therapeutics
The Centre for Orthopaedic and Trauma Research (COTR) was formed in 2012 and its members include orthopaedic surgeons, clinical researchers, and biomedical scientists and engineers. This diverse combination of researcher expertise enables the scientific study of highly clinically relevant topics pertaining to the human musculoskeletal system. The research aims to better understand bone and joint diseases and conditions, including osteoarthritis and joint replacement, pathological bone loss, infection, spinal conditions and fracture.

The COTR team of biomedical scientists and engineers and their laboratories are located in the new Adelaide Health and Medical Sciences building (AHMS) on North Terrace.

The Bone and Joint Research Group focus on understanding the pathobiology of osteoarthritis, osteoporosis, and other musculoskeletal conditions. The laboratory is internationally recognised for human tissue-level analyses, utilising a well-established human musculoskeletal tissue bank. The research involves a multidisciplinary approach utilising numerous tissue-level techniques: ranging from molecular to microstructural to clinical imaging.

**Lead researcher:** Dr Julia Kuliwaba
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**Honours project opportunities**

**TGF-beta as a critical factor in human osteoarthritis**

The aetiology of the painful degenerative joint disease osteoarthritis (OA) has so far been elusive, blocking the development of disease modifying treatments. Exciting recent research in mice has found that TGF-beta over-expression in the subchondral bone (beneath the cartilage) has a critical causal role in OA pathogenesis. The OA bone changes seen in mice closely resemble what we find in human OA bone in zones that display the most severe changes, which correspond to“bone marrow lesions” identified by magnetic resonance imaging (MRI).

This research project area will investigate the link between TGF-beta expression with structural, chemical compositional, cellular and molecular changes in human subchondral bone marrow lesions. The research involves the analysis of human knee and/or hip OA tissue specimens. This project will investigate TGF-beta as a candidate driver of human OA, which is an essential precursor to testing pharmacologic alteration of TGF-beta activity as a therapeutic strategy. Both HDR and Honours projects are available.

**Project Supervisors:** Dr Julia Kuliwaba, Professor David Findlay

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Clinical imaging and tissue-level phenotyping of human hip osteoarthritis**

In Australia, 1-in-4 individuals is at risk of developing symptomatic hip osteoarthritis (OA) in their lifetime. People with hip OA have significant pain and disability, which affects their quality of life. Clinical diagnosis of hip OA involves symptomatic and imaging findings; imaging characteristics include joint space narrowing, presence of osteophytes, subchondral bone cysts and bone marrow lesions (BMLs). A more painful and progressive subtype of hip OA is thought to be related to the formation of subchondral bone cysts, which may develop from BMLs that are often seen in pre-OA populations. The future development of preventive therapy and therapeutic approaches for OA depends on early prediction, detection and prognosis. Thus, it is essential to understand the relationship between subchondral bone cysts and BMLs in hip OA.

This Honours project will investigate the frequency and location of subchondral bone cysts and BMLs in hip OA patients using magnetic resonance imaging (MRI). The presence of these MRI features will be associated with OA progression, evaluated by cartilage volume loss, radiographic KL score and histopathological OARSI cartilage grade. Bone tissue changes will also be assessed in relation to cysts and BMLs by analysis of bone microarchitecture, bone remodelling and microdamage accumulation.

**Project Supervisors:** Dr Dzenita Muratovic, Dr Julia Kuliwaba

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Modic changes in the human lumbar spine: Is there a role for viral pathogens?**

Modic changes identified by magnetic resonance imaging (MRI) are associated with intervertebral disc degeneration and low back pain. The underlying cause(s) of the appearance and progression of Modic type changes in the human lumbar spine remain elusive.

This research project will investigate the aetiology of MRI-identified Modic type changes in the human lumbar spine; specifically exploring whether viral pathogens and/or other disc/subchondral bone pathology play a role in the appearance and progression of Modic type changes.

**Project Supervisors:** Dr Julia Kuliwaba, Associate Professor Jillian Clark, Professor Brian Freeman

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Compositional mapping of the cartilage-bone unit in human osteoarthritis: insight into disease pathobiology**

Osteoarthritis (OA) is a common painful degenerative disease of the joints, which constitutes a major and growing health problem for the ageing Australian population, and for which there are no effective therapies. Our recent research in human OA has shown the involvement of the bone under the cartilage, i.e. subchondral bone, in the development of OA. There is limited quantitative understanding of the matrix composition of the cartilage-bone unit in human OA. This project will utilise Fourier Transform InfraRed (FTIR) and Raman spectroscopic imaging to map region-specific changes in bone and cartilage matrix composition, eg. collagen organisation, proteoglycan and mineral distribution, for human tissue specimens. This project will use an available cohort of OA and non-OA tibial plateau specimens that has been characterised by MRI-imaging for the presence/absence of bone marrow lesions (BMLs) in the subchondral bone. BMLs are of clinical importance as they are associated with pain, predict disease progression, and may be useful as outcome measures for intervention strategies. This project will deliver new knowledge of the cartilage-bone matrix composition for human knee OA patients with/without subchondral BMLs and provide insight into the pathobiology of OA disease progression.

**Project Supervisors:** Dr Julia Kuliwaba, Professor David Findlay

**Availability:** Semesters 1 and 2

**Special requirements:** Nil
HDR project opportunities

**TGF-beta as a critical factor in human osteoarthritis**
Please see Honours entry.

**Modic changes in the human lumbar spine: Is there a role for viral pathogens?**
Please see Honours entry.

**Compositional mapping of the cartilage-bone unit in human osteoarthritis: insight into disease pathobiology**
Please see Honours entry.

**Research areas**
Musculoskeletal Health
Ageing, Frailty and Mobility

**More information**
The Centre for Orthopaedic and Trauma Research (COTR) was formed in 2012 and its members include orthopaedic surgeons, clinical researchers and biomedical scientists. This diverse combination of researcher expertise enables the scientific study of highly clinically relevant topics pertaining to the human musculoskeletal system. The research aims to better understand bone and joint diseases and conditions, including arthritis and joint replacement, pathological bone loss, infection, spinal conditions and fracture.

The Joint Replacement and Reconstruction Research Unit conducts research into a broad range of areas related to primary and complex revision hip and knee replacement as well as joint reconstruction for congenital joint disorders. The research opportunities include epidemiology using a joint replacement registry, clinical studies, basic bone biology and pathology, diagnostics, anatomy and surgical techniques, gait analysis and biomechanical testing.

Lead researcher: Professor Donald Howie
Email: donald.howie@adelaide.edu.au

Honours project opportunities

Optimising surgical techniques for joint replacement and reconstruction
Using cadaver specimens under the supervision of orthopaedic surgeons, the surgical technique used at revision total hip replacement will be improved to reduce the amount of soft tissue damage.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Identifying risk factors for complications after joint replacement surgery
This project uses our 30-year hip and knee replacement outcomes registry to investigate factors that influence longevity of the prosthesis.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Musculoskeletal Health
Surgical and Health Systems Innovation
Mesenchymal Stem Cell Laboratory
South Australian Health and Medical Research Institute (SAHMRI)

Postnatal mesenchymal stem cells (MSC) derived from connective tissues are capable of developing into multiple cell lineages (myelosupportive stroma, adipocytes, smooth muscle cells, myoblasts, ligament cells, chondrocytes and osteoblasts). Our Lab examines the transcriptional, epigenetic and signalling factors that regulate MSC self-renewal, proliferation, multi-differentiation and immune cell modulation. These molecular processes are being investigated as underlying mechanisms mediating tissue repair, inflammation, tumour cell development and aged related diseases.

Lead researcher: Professor Stan Gronthos
Email: stan.gronthos@adelaide.edu.au

Honours project opportunities

Pharmacological targeting of tyrosine kinase receptors and epigenetic modifying enzymes in mesenchymal stem cells to treat cranial bone conditions
The use of chemical inhibitors to modify bone cell differentiation by mesenchymal stem cells in the cranial sutures to treat craniosynostosis in children.

Project Supervisors: Professor Stan Gronthos, Dr Esther Camp, Professor Peter Anderson
Availability: Semester 1
Special requirements: Nil

Investigation of the importance of cell-cell communication and cross-talk between bone cells, blood cells and neural cells during skeletal development/repair
Investigating the role of the membrane bound contact dependent molecules, Eph/ephrin, to mediate cell-cell communication and function between bone cells, blood/immune cells and neural tissue, during development and tissue repair.

Project Supervisors: Professor Stan Gronthos, Dr Agnes Arthur
Availability: Semesters 1
Special requirements: Nil

Investigating the role of epigenetic modifiers to control mesenchymal stem cell self-renewal and cell fate determination in development and tissue repair
Investigation of the role of histone acetylation and methylation or DNA methylation in mesenchymal stem cell self-renewal and cell fate determination, in the context of skeletal stem cell ageing and bone disease.

Project Supervisors: Professor Stan Gronthos, Dr Dimitrios Cakouros
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Pharmacological targeting of tyrosine kinase receptors and epigenetic modifying enzymes in mesenchymal stem cells to treat cranial bone conditions
Please see Honours entry

Investigation of the importance of cell-cell communication and cross-talk between bone cells, blood cells and neural cells during skeletal development/repair
Please see Honours entry

Investigating the role of epigenetic modifiers to control mesenchymal stem cell self-renewal and cell fate determination in development and tissue repair
Please see Honours entry

Research areas
Musculoskeletal Health
Innovative Therapeutics
Oral Health
Cancer Biology and Clinical Oncology

More information
sahmri.com/our-research/themes/cancer/groups/mesenchymal-stem-cell-research-group

Professor Stan Gronthos

Mesenchymal Stem Cell Colony
A compendium of joint loading during activities of daily living

There are two main mechanical factors that are essential when attempting to understand the demands placed on a replaced joint:

1. the magnitude of the force passing through the joint; and
2. the frequency of a given force passing through the joint.

Whilst we can calculate the magnitude of load in laboratory conditions, this only gives partial insight into the mechanical environment the joint is subject to. We can quantify the frequency of different movement patterns in the real world using wrist-worn accelerometers, but these fail to provide a direct measure of the load passing through the joint.

This project will establish a compendium of joint loading for different activity types so that we can relate the frequency of a given movement in the real world to an approximation of the load passing through the joint. In some instances the information on the forces will be available from the literature, however, in others it will be necessary to measure this in our laboratory.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

A pilot randomised controlled trial for weight bearing after tibial plateau fracture

Fractures of the tibial plateau (or knee) have a massive impact on a person’s ability to participate in activities of daily living. Furthermore, they are five times more likely to require a knee replacement than their age-matched peer. Traditionally these injuries have been treated exceptionally conservatively with patients advised to avoid any weight bearing through the injured joint for up to 12 weeks. This has been shown to have a significant impact on mental health. However, our group has generated extensive data that demonstrate that the force (or weight) passing through a fracture is not related to a negative outcome. This has led us to believe that it might be more appropriate to prescribe immediate weight bearing as tolerated after surgery compared to the more traditional approach of partial or no weight bearing. To be sure of this we must run a pilot randomised control trial where weight bearing as tolerated is compared to partial weight bearing. This project will use a combination of biomechanical, imaging, clinical and patient reported outcomes to evaluate the effectiveness of weight bearing as tolerated in tibial plateau fracture management.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Musculoskeletal Health
Population Research Outcome Studies / The Health Observatory
Adelaide Health and Medical Sciences building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)

Population Research and Outcome Studies (PROS) provides information on health status, related risk factors, behaviours, determinants and satisfaction with health services among the South Australian population. PROS provides high quality population health information to contribute to the improvement of health and wellbeing outcomes of the South Australian population. The core business of PROS is the monitoring and surveillance of population health and chronic disease epidemiology. Epidemiology, the primary science of public health, is concerned with the monitoring and surveillance of the distribution and determinants of health and disease in human populations. Information obtained from population health surveys is used to inform policy, programs and health services that will promote the health and wellbeing of the South Australian population.

PROS has been involved with the North West Adelaide Health Study (NWAHS) since its inception in 1999. The NWAHS is a longitudinal cohort study based in the northern and western suburbs of Adelaide with nearly 20 years of longitudinal data collection.

Lead researcher: Dr Tiffany Gill
Email: tiffany.gill@adelaide.edu.au

Honours project opportunities
Back pain in the community
This project utilises data from the North West Adelaide Health Study, a cohort study in the north western suburbs of Adelaide. Data have been collected over a 20 year period, with data relating to back pain available over the past 15 years. Also available are covariates such as other chronic diseases, risk factors, quality of life, Medical Benefits Scheme, Pharmaceutical Benefits Scheme, biomedical and linkages to hospital admissions/ emergency and outpatient data. Originally, over 4000 participants were recruited to the study and in 2015, over 1500 took part in a postal survey. Back pain is a significant problem in the Australian population which impacts on quality of life and the ability to undertake work and leisure activities. The cost to the health system is significant and is predicted to increase over the coming years. Understanding the problem and then the implementation of strategies to address the issue are of paramount importance.

By using the data and examining those who
1) have back pain,
2) develop back pain over the period of the study, and
3) don’t develop back pain; we can understand the condition more fully and develop strategies to reduce the problem in the community.

Project Supervisors: Dr Tiffany Gill, Professor Catherine Hill
Availability: Semesters 1 and 2
Special requirements: Nil

Hand pain in the community
This project utilises data from the North West Adelaide Health Study with data relating to hand pain available over the past 15 years. Also available are covariates such as other chronic diseases, risk factors, quality of life, Medical Benefits Scheme, Pharmaceutical Benefits Scheme, biomedical and linkages to hospital admissions/ emergency and outpatient data. Originally, over 4000 participants were recruited to the study and in 2015, over 1500 took part in a postal survey. Hand pain impacts on quality of life and the ability to undertake work and leisure activities. The cost to the health system is unknown. Understanding the problem and then the implementation of strategies to address the issue are of paramount importance. By using the data and examining those who 1) have hand pain; 2) develop hand pain over the period of the study; and 3) don’t develop hand pain; we can understand the condition more fully and develop strategies to reduce the problem in the community.

Project Supervisors: Dr Tiffany Gill, Professor Catherine Hill
Availability: Semesters 1 and 2
Special requirements: Nil

The North West Adelaide health study
A range of other projects exist examining the musculoskeletal data from the NWAHS in conjunction with both measured and self-reported covariates.

Project Supervisors: Dr Tiffany Gill, Professor Catherine Hill
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Back pain in the community
Please see Honours entry
The North West Adelaide health study
Please see Honours entry

Research areas
Musculoskeletal Health
Translational Health Outcomes
Musculoskeletal conditions/rheumatic diseases are the most common chronic conditions in Australia, affecting a large sector of the population leading to chronic pain, disability, reduced quality of life, and in many cases, shortened life span. Disability associated with musculoskeletal diseases is universal across both developing and developed countries and monetary costs are high with respect to lost earnings, as well as direct health care costs. The Australian Institute of Health and Welfare (AIHW) estimates that 28% of Australians have arthritis and other musculoskeletal conditions, with an estimated health care expenditure of $5.7 billion in 2008-09. The Rheumatology Department strives to augment its clinical rheumatology services with research programs into the epidemiology, causation and complications of rheumatic diseases (bedside to bench), coupled with the evaluation of new generations of pharmaceutical agents for the treatment of arthritis (bench to bedside). These rheumatic diseases include gout's syndrome, giant cell arteritis, polymyalgia rheumatica, osteoarthritis, scleroderma, rheumatoid arthritis, ankylosing spondylitis, gout, and fibromyalgia.

Head of Department, Professor Catherine Hill, is both an epidemiologist and Rheumatologist. She is a Chief Investigator of the North West Adelaide Study (NWAHS), a longitudinal population health study, Chair of the Australian Rheumatology Association Database (ARAD), a longitudinal database of primarily Rheumatoid Arthritis patients, and a Chief Investigator of the Australian Arthritis and Autoimmune Biobank Collaborative (A3BC), a national, longitudinal biobank established in 2018.

**Lead researcher:** Professor Catherine Hill  
**Email:** catherine.hill@sa.gov.au

**Honours project opportunities**

**The relationship between socioeconomic status and medication use in rheumatoid arthritis patients.**

Different drugs are used in the treatment of rheumatoid arthritis (RA). Some are used to slow or stop the course of the disease and to inhibit structural damage (disease-modifying antirheumatic drugs, DMARDS). Others, such as non-steroidal anti-inflammatory drugs (NSAIDs) are used primarily to ease the symptoms of RA. Adjunct treatments, which should be used sparingly because they are associated with significant side effects, include glucocorticoids (steroids), which provide rapid control of disease activity, and flares, and opioids to manage pain. Effective treatment in RA with the DMARDS should negate the need for ongoing glucocorticoid or opioid use. In Australia, PBS funding of medications should ideally lead to equitable use of medications across groups of differing socioeconomic status (SES). However, other components of SES such as health literacy and lifestyle factors may mean that this is not the case.

The aim of this project is to determine the relationship between different types of medication use, pain, function and SES in RA. Data will be obtained from the Australian Rheumatology Association Database (ARAD), which is a longitudinal database with over 3000 RA patients. Socioeconomic status will be estimated using Socio-Economic Indexes for Areas (SEIFA) indexes developed by the Australian Bureau of Statistics.

**Project Supervisors:** Professor Catherine Hill, Dr Rachel Black, Sue Lester  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Research areas**

Musculoskeletal Health

**The association between dietary patterns and prevalence and incidence of joint pain in the North West Adelaide Health Study**

The relationship between diet and arthritis has not been well explored, particularly osteoarthritis. Both rheumatoid and osteoarthritis are associated with joint pain secondary to inflammation, which may be influenced by a number of dietary components such as long chain omega-3 fatty acids, antioxidant vitamins such as vitamin E and C, and polyphenols, including flavonoid antioxidants. Using data collected from the North West Adelaide Health Study, we would like to explore the relationship between prevalence and incidence of joint pain, and dietary patterns. We will be investigating three dietary patterns; a Mediterranean dietary pattern, an anti-inflammatory dietary pattern, and a general healthy eating dietary pattern based on dietary guidelines. A dietary pattern score will be developed from food frequency questionnaire data to establish compliance with each dietary pattern, and scores will be assessed for a cross-sectional, and longitudinal, relationship with joint pain. The results will add to our understanding of the relationship between nutrition and arthritis, enabling clinicians to tailor their advice around eating to patients and the general public.

**Project Supervisors:** Dr Courtney Davis, Sue Lester, Professor Catherine Hill  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Research areas**

Musculoskeletal Health
The Adelaide Spinal Research Group, within the Centre for Orthopaedic & Trauma Research (COTR), comprises clinicians, engineers and scientists, engaged in a multidisciplinary program of clinical, biomechanics and basic science research related to the normal, diseased, and injured spine and spinal cord. The broad aim of our research is to improve understanding of how the spine functions and is injured, and to devise and test solutions to prevent and repair injuries.

The projects listed below are representative of opportunities available within the group and are not exhaustive. Students are encouraged to contact Dr Claire Jones to discuss project availability or to propose subject areas of interest that are related to biomechanics or clinical research of the spine and spinal cord, or musculoskeletal research themes in general. Projects can be tailored to Honours, Masters or PhD levels.

**Lead researchers:** Dr Claire Jones, Professor Brian Freeman

**Email:** claire.jones@adelaide.edu.au

**Honours project opportunities**

**Investigating the acute response of the spinal cord and cerebrospinal fluid to trauma, in a pre-clinical model**

This project is seeking to develop, characterise and use a pre-clinical (large animal) model of spinal cord injury. The model will have specific utility to obtain serial measurements of pressure within the intrathecal space, as well as intra-operative (ultrasound) and serial measurements (MRI) of spinal cord morphology, oedema and haemorrhage, and cerebrospinal fluid (CSF) flow.

The ultimate aim of the research program is to investigate the effect of novel surgical interventions on these parameters, as well as on the functional recovery of the animals, and on histological markers of spinal cord damage. Student(s) will work within a dynamic multidisciplinary team of scientists, engineers and clinicians, and will be exposed to a wide variety of novel experimental techniques. Investigators associated with this study include: Dr Claire Jones, Dr Anna Leonard, and Professor Brian Freeman, members of the Spinal Research Group in the Centre for Orthopaedics and Trauma Research.

**Project Supervisors:** Dr Claire Jones, Dr Anna Leonard

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Investigating injury mechanisms and treatment pathways for cervical spine facet dislocation and fracture**

This project is seeking to understand the mechanisms by which facet dislocation and fracture occur in the cervical spine, and the patterns of clinical management and patient outcomes following such injuries. The study involves review, collation and analysis of clinical data, and data from US automotive injury databases, and may include cadaveric biomechanical modelling.

This project is suited to students with an interest in musculoskeletal injury and Orthopaedics. Student(s) will work within a dynamic multidisciplinary team of scientists, engineers and clinicians. Investigators associated with this study include: Dr Claire Jones and Professor Brian Freeman, members of the Spinal Research Group in the Centre for Orthopaedics and Trauma Research.

**Project Supervisors:** Dr Claire Jones and Professor Brian Freeman

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Changes in the rotator cuff tendon microstructure and mechanical response with maturation**

The aim of this project is to map the changes in microstructure and mechanical response of the sheep rotator cuff tendon during early maturation, with the goal of providing evidence for selection of age-appropriate animal specimens for human modelling. Animal models are frequently used to evaluate new and emerging surgical techniques for rotator cuff repair; however, very little data is available to validate these models. This study is led by Dr Claire Jones, member of the Centre for Orthopaedics and Trauma Research.

**Project Supervisor:** Dr Claire Jones

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Inter-species comparative investigation of meningeal composition and mechanical properties: implications for pressure and tissue injury**

The meninges are the protective tissue layers covering the brain and spinal cord which are integral in anchoring the tissues and providing protection. Variations in the way species respond to elevations in pressure (intracranial or intrathecal) may in part be a reflection of the meningeal composition. This project will examine the properties and composition of meningeal samples obtained overlying the cerebral hemispheres and of the spinal cord from a number of species. Students will work with a dynamic multi-disciplinary team of scientists, engineers and clinicians. Students will learn a wide variety of experimental techniques including: immunohistochemistry, western blot and ELISA, and mechanical testing and microscopy.

**Project Supervisors:** Associate Professor Renee Turner, Dr Anna Leonard, Dr Claire Jones

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Investigating the acute response of the spinal cord and cerebrospinal fluid to trauma, in a pre-clinical model**

Please see honours entry.

**Investigating injury mechanisms and treatment pathways for cervical spine facet dislocation and fracture**

Please see honours entry.

**Changes in the rotator cuff tendon microstructure and mechanical response with maturation**

Please see honours entry.

**Inter-species comparative investigation of meningeal composition and mechanical properties: implications for pressure and tissue injury**

Please see honours entry.

**Research areas**

Musculoskeletal Health
Neuroscience, Behaviour and Brain Health
Ageing, Frailty and Mobility
The Research Team at the Department of Orthopaedic Surgery, Women's and Children's Hospital (WCH) comprises orthopaedic surgeons, doctors-in-training, medical and research/higher degree students. It is supported by a Clinical Research Manager, Research Scientist and Research Assistant. The Department has a long track record of internationally recognised research activity and publications including basic science and clinical research investigating a range of paediatric musculoskeletal conditions.

Current areas of interest for the Research Team at the WCH Department of Orthopaedics include mechanisms of bone growth and repair, paediatric musculoskeletal infections, the management of congenital and developmental musculoskeletal deformities such as scoliosis and lower limb deformity and paediatric trauma.

Clinical Research aims to provide the benchmarks for clinical audit and quality management issues to be undertaken in a structured manner. The Department of Orthopaedic Surgery has a high clinical workload, which enhances the opportunities for organised clinical orthopaedic research.

Lead researcher: Associate Professor Peter Cundy, Associate Professor Nicole Williams
Email: nicole.williams01@adelaide.edu.au

Honours project opportunities
Outcomes in paediatric septic arthritis: a long term cohort study
Availability: Semesters 1 and 2
Special requirements: Nil

Optimising management and outcomes in paediatric spinal surgery
Availability: Semesters 1 and 2
Special requirements: Nil

Optimising detection and management of developmental dysplasia of the hip in South Australia
Availability: Semesters 1 and 2
Special requirements: Nil

Streamlining a pathway for paediatric fracture management
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Optimising management and outcomes in paediatric spinal surgery
Please see Honours entry.

Optimising detection and management of developmental dysplasia of the hip in South Australia
Please see Honours entry.

Rate of total hip replacement surgery in patients with a previous condition affecting the hip in childhood
This is a linkage study using the Australian Orthopaedic Association National Joint Replacement Registry.
Availability: Semesters 1 and 2
Special requirements: Nil
NEUROSCIENCE, BEHAVIOUR AND BRAIN HEALTH
## NEUROSCIENCE, BEHAVIOUR AND BRAIN HEALTH RESEARCH GROUPS

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The brain and spinal cord comprise the central nervous system of the body. Damage and disease of the brain or spinal cord can lead to developmental delay, intellectual or physical disability, loss of cognitive function and behavioural and psychological disorders.

Neuroscience is an interdisciplinary science that focuses on the study of neurochemistry and experimental psychology. It deals with the structure and normal function of the nervous system and brain that impact on behaviour, cognitive function and neurological dysfunction.

Our researchers investigate these areas with the aim of developing therapies and informing improved health service provision for individuals.

Researchers across the faculty are focused on:

- understanding the function of genes that cause neurodevelopmental disorders, such as intellectual disability and epilepsy
- investigating the causes of diseases of the brain, spine or nervous system (including Parkinson’s disease and Alzheimer’s disease) to inform diagnosis, prevention and treatment
- understanding the cellular and molecular basis of cognition, perception and neuropsychology
- developing therapies, and translating results into the treatment and prevention of neurological diseases
- understanding the health psychology, healthy development across the lifespan, and disability to inform and assess rehabilitation and health service delivery
- developing innovative biological computation technologies to enable large-scale epidemiological studies that can inform health care policy and service provision.
Dr Femke Buisman-Pijlman is a Behavioural Neuroscientist with a strong interest in the neurobiological basis of individual differences in behaviour and mental health. She works on the intersection between psychology, physiology and behaviour using a translational approach, using a range of methods from experimental psychology to genetics and analysis of birth cohort data. She has proposed a new theory about the effects of early life experiences on the developing oxytocin system and the impact this has on stress regulation and later drug use. Her career has been devoted to understanding how stress and adversity can impact on someone’s vulnerability to develop addiction and mental health issues and which factors can improve resilience.

Lead researcher: Dr Femke Buisman-Pijlman
Email: femke.buisman-pijlman@adelaide.edu.au

Honours project opportunities

The biological basis of susceptibility to addiction
Individual differences exist in susceptibility to develop addiction. We know that early life experiences and e.g. exposure to alcohol prenatally can impact on this, but what is the biological basis of this change? What is the role of oxytocin in this impact?

Project Supervisor: Dr Femke Buisman-Pijlman
Availability: Semester 1
Special requirements: Nil

Human-animal interactions
Human-animal interactions can have a positive impact on stress, cognition and mental health. This project will focus on identifying the impact of the interaction on the behaviour and physiology of both the animal and the human and test where we can use this impact best. This project will be run with Dr Susan Hazel in the School of Animal and Veterinary Science.

Project Supervisors: Dr Femke Buisman-Pijlman and Susan Hazel
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

The biological basis of susceptibility to addiction
Please see Honours entry

Human-animal interactions
Please see Honours entry

Research areas
Neuroscience, Behaviour and Brain Health
Early Origins of Health
Child and Adolescent Health
Biophenotypes for Personalised Psychiatry

Royal Adelaide Hospital, Basil Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Woodville, Adelaide Health and Medical Sciences building (AHMS), Lyell McEwin Hospital

Current diagnostic categories in mental illness are based largely on common symptomatology rather than an understanding of the underlying mechanisms of brain, cognitive and general day-to-day function. Illness and functional trajectories describe patterns of illness and impairment in individuals over time. This research group will apply probabilistic and growth mixture multivariate modelling techniques to various measures of patient history to identify and predict specific illness and functional trajectories in mood and psychotic disorders.

Lead researchers: Dr Scott Clark, Associate Professor Oliver Schubert, Professor Bernhard Baune

Email: scott.clark@adelaide.edu.au

Honours project opportunities

Multimodal prediction of the first psychotic episode

This study uses multimodal clinical, imaging and blood based biomarker data to predict the first psychotic episode with novel Bayesian, Machine Learning and trajectory modelling techniques in national and international cohorts of patients assessed at clinical high risk of psychosis.

Project Supervisors: Dr Scott Clark, Associate Professor Oliver Schubert

Availability: Semesters 1 and 2

Special requirements: Nil

Prediction of outcomes and treatment response in chronic psychosis

This study uses multimodal clinical and blood based biomarker data to predict medication response, cognition and outcomes in chronic psychosis with novel Bayesian and Machine Learning and trajectory modelling techniques in a large locally recruited sample of patients treated with depot antipsychotics or clozapine.

Project Supervisors: Dr Scott Clark, Associate Professor Oliver Schubert

Availability: Semesters 1 and 2

Special requirements: Nil

Prediction of outcomes and treatment response in mood disorders

This study uses multimodal clinical and blood based biomarker data to predict medication response, cognition and outcomes in chronic psychosis with novel Bayesian and Machine Learning and trajectory modelling techniques in a large locally recruited sample of patients treated and has a specific focus on response to lithium in bipolar disorder.

Project Supervisors: Associate Professor Oliver Schubert, Dr Scott Clark

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

Multimodal prediction of the first psychotic episode

Please see Honours entry

Prediction of outcomes and treatment response in chronic psychosis

Please see Honours entry
The Cognition, Ageing and Neurodegenerative Disease Laboratory (CANDL) focuses on the pathophysiological mechanisms underlying cognitive decline in healthy aging and in neurodegenerative diseases, including Alzheimer’s and Parkinson’s disease. The laboratory is particularly interested in the role of inflammation in this process. We are a translational neuroscience laboratory, with techniques ranging from cell culture to animal models of disease to clinical studies in individuals with neurodegenerative conditions. The laboratory currently maintains a number of productive collaborations both nationally and internationally, with multiple ongoing projects.

Lead researcher: Dr Lyndsey Collins-Praino  
Email: lyndsey.collins-praino@adelaide.edu.au

Honours project opportunities

**Alpha synuclein transmission and Parkinson’s disease**

Lewy bodies and neurites, consisting of intracellular aggregates of misfolded fibrillar alpha-synuclein, are a key pathological marker of Parkinson’s disease (PD). In addition to intracellular aggregates, however, a growing body of evidence suggests that extracellular alpha synuclein, released from neurons by exocytosis, is also capable of contributing to disease pathology. Most strikingly, extracellular alpha synuclein may play a key role in the spread of alpha synuclein pathology. Extracellular alpha synuclein can be taken up by neurons via endocytosis and interact with endogenous intracellular alpha synuclein, causing it to misfold. Thus, the targeted capture and clearance of extracellular alpha synuclein may be of great therapeutic benefit, halting or slowing disease progression and reducing intracellular inclusions. The current study will investigate brain mechanisms of alpha synuclein spread and trial a novel method for the capture of extracellular alpha synuclein. This study will involve cell culture and both in vitro and ex vivo molecular biology techniques.

**Project Supervisor:** Dr Lyndsey Collins-Praino  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Treating executive dysfunction in Parkinson’s disease**

In addition to the well-characterised motor impairments seen in Parkinson’s disease (PD), many patients also suffer from some degree of cognitive impairment. Within 20 years of diagnosis of PD, over 80% of patients meet criteria for diagnosis of Parkinson’s Disease Dementia (PD-D). While cognitive dysfunction in PD can be heterogeneous, individuals predominantly present with impairments in executive function, including judgment, decision making and attention. Currently, cognitive impairment in PD represents a significant unmet clinical need, since patient response to cholinesterase inhibitors, the only currently available treatment avenue, is variable and these compounds may actually worsen motor symptoms. Thus, the development of new treatment options is critical. One factor that has slowed the development of effective treatments to date is the limitations of preclinical testing batteries, as many of the current tests used for cognitive testing in rodents, such as maze tasks, are hippocampal dependent and don’t adequately evaluate the frontal lobe-dependent executive dysfunction seen in PD. The current study will evaluate a potential novel treatment strategy for PD, Fyn kinase inhibition, on a series of executive function specific tasks. This study will involve stereotactic surgery and behavioural testing in rodents.

**Project Supervisor:** Dr Lyndsey Collins-Praino  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Dementia and traumatic brain injury: Differential injury outcome comparison**

Traumatic brain injury (TBI) is the leading cause of death and disability in children and adolescents, with mild TBI and concussions accounting for 80-90% of these injuries. While the effects of these injuries are usually mild for most juveniles, a number go on to develop persistent post-concussion symptoms, including impulsivity, difficulty concentrating and paying attention and even memory impairment. While the brain mechanisms of these impairments are still unknown, they may be due to impairment in the maturation of the prefrontal cortex, particularly to abnormalities in dopaminergic function in the fronto-striatal circuitry. The current study will investigate how age at time of concussion impacts the maturation of this circuitry and how this is linked to behavioural measures of impulsivity, cognitive and neuropsychiatric function and motivation. This study will involve gene expression, biochemical and immunohistological analysis of archival rodent brain tissue.

**Project Supervisor:** Dr Lyndsey Collins-Praino  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

**Alpha synuclein transmission and Parkinson’s disease**

Please see Honours entry

**Juvenile concussion and dopamine function**

Please see Honours entry

**Research areas**

- Neuroscience, Behaviour and Brain Health
- Immunology and Infection
- Ageing, Frailty and Mobility
Cognition and Functioning in Psychiatry Research Group
Royal Adelaide Hospital, Basil Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Adelaide Health and Medical Sciences building (AHMS)

This research group investigates neuropsychological factors that influence the practical capacity of individuals with psychiatric disorders such as depression, anxiety or psychosis to function and perform on a daily basis. The research group undertakes projects that explore cognitive function, emotion and behaviour in psychiatric disorders with or without medical comorbidity. Another major focus of the group is the study of psychiatric interventions on neuropsychological measures of cognition and mood.

Lead researchers: Dr Scott Clark, Associate Professor Oliver Schubert, Dr Catherine Toben, Dr Catharine Jawahar, Professor Bernhard Baune

Email: scott.clark@adelaide.edu.au

Honours project opportunities

The Cognitive Function and Mood Study (CoFaMS)
This study investigates effects of depression and anxiety on a person’s mental status and cognitive capacity by analysing psychological, and functional genetic differences in a healthy cohort and those suffering from mood and anxiety disorders.

Project Supervisors: Associate Professor Oliver Schubert, Dr Scott Clark

Availability: Semesters 1 and 2

Special requirements: Nil

Cognitive and Functional Assessment of Psychosis Staging Study (CoFAPSS)
In current clinical practice it is impossible to predict individual course of psychotic illness or treatment response. This longitudinal study assesses patients at different stages of psychotic illness to develop accurate biomarkers of risk profile, transition between disease stages and potential for functional recovery.

Project Supervisors: Dr Scott Clark, Associate Professor Oliver Schubert

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

The Cognitive Function and Mood Study (CoFaMS)
Please see Honours entry

Cognitive and Functional Assessment of Psychosis Staging Study (CoFAPSS)
Please see Honours entry

Research areas
Neuroscience, Behaviour and Brain Health
Epidemiology and Health Services Research Group
Royal Adelaide Hospital, Adelaide Health and Medical Sciences building (AHMS), Lyell McEwin Hospital

The aim of this research group is to understand health care needs of people with mental health issues and to evaluate effectiveness and accessibility of services in addressing needs. This includes identifying predictors that can help understand successes and failures of health service interventions. The research group aims to develop evidence based service delivery approaches that can address unmet needs in a cost-effective, equitable and easily accessible manner. A focus of this group is on exploring the health service needs and evaluations for patients diagnosed with schizophrenia receiving treatment with the antipsychotic clozapine.

Lead researcher: Dr Scott Clark, Dr Oliver Schubert
Email: scott.clark@adelaide.edu.au

Honours project opportunities

Chronic Psychosis: morbidity, mortality and service use in South Australia

This study uses data linkage of existing information in public clinical services to provide a detailed understanding of treatment processes and outcomes in those with chronic psychosis treated with oral clozapine in comparison to long acting injectable (depot) antipsychotics. Goals include: the identification of local predictors of outcomes in chronic psychosis to inform the early safe use of clozapine over depot medication; the identification of optimal broad physical health monitoring protocols to reduce morbidity and mortality; the development of interventions designed to optimise the management of chronic psychosis that can be directly translated and implemented in local depot and clozapine clinics. Specific studies include clozapine induced myocarditis and trajectories of metabolic syndrome in clozapine treatment.

Project Supervisors: Dr Scott Clark, Dr Oliver Schubert
Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Neuroscience, Behaviour and Brain Health
Healthy Mothers, Babies and Children

The Healthy Mothers, Babies and Children Theme at the South Australian Health and Medical Research Institute has its headquarters at the Women’s and Children’s Hospital campus. The theme is expanding the already successful nutrition intervention trials which focus on enhancing cognitive outcomes, achieving optimal growth and preventing allergic disease in young children, with a particular attention to vulnerable and disadvantaged groups.

Lead researcher: Maria Makrides
Email: maria.makrides@sahmri.com

HDR project opportunities

The effect of childhood dietary patterns on cognitive and behavioural development

Diet supplies all the nutrients necessary for healthy development as well as for everyday functioning. Children have high nutritional requirements due to their rapid development, particularly of the brain.

This project involves exploring the dietary patterns of 500 children including traditional and contemporary home-prepared food, ready-prepared foods, and ‘discretionary’ or junk foods. Dietary patterns and estimated nutrient intake can then be linked to measures of child development including Intelligence Quotient (IQ), behaviour, language and academic abilities. Dietary patterns can also be linked to measures of obesity, insulin resistance and growth.

A background in nutrition or dietetics would be beneficial.

Project Supervisor: Dr Jacqueline Gould
Availability: Semesters 1 and 2

Research areas

Neuroscience, Behaviour and Brain Health
Early Origins of Health
Child and Adolescent Health
Nutrition and Metabolic Health
The research conducted in this laboratory investigates how the central nervous system coordinates the movement of our bodies and how it is reorganised as a consequence of exercise. The lab focuses on the area of fatigability and exercise intolerance in health, ageing and disease. The research involves the application of various novel and non-invasive electro-physiological techniques such as Transcranial Magnetic Stimulation (TMS), peripheral nerve stimulation, and electromyography (EMG) in experiments involving human subject.

Lead researcher: Dr Simran Sidhu
Email: simran.sidhu@adelaide.edu.au

Honours project opportunities

Brain areas that contribute to fatigue during locomotor exercise

There is now some evidence, although indirect, demonstrating that central fatigue is attributed to attenuation in neural drive from at or above the motor cortex (M1) region of the brain. This suggests that there are other important brain areas within and in association with M1 that feed activity-dependent inhibitory and excitatory neural signals into M1 output cells during fatiguing exercise. Differentially active brain areas are assumed to be significant constituents of the functional system governing human performance. The evidence, albeit from studies involving single joint exercise, suggests that in addition to the primary sensorimotor areas M1 and S1 (the somatosensory cortex) secondary and association cortices, including supplementary motor area (SMA), prefrontal cortex (PFC), insular cortex (IC) and cerebellum, play important roles in the development of fatigue during exercise. Information on the causative role can be obtained via direct manipulation of the activity in the cortical areas concerned, for example with the use of transcranial magnetic stimulation (TMS). The exact contribution from specific sensory and motor brain regions in the development of brain fatigue during locomotor exercise remains will be determined in these series of studies.

Availability: Semesters 1 and 2
Special requirements: Nil

Effects of neuromodulation on targeted brain areas during locomotor exercise performance

Transcranial direct current stimulation (tDCS) has been shown to produce sustained changes in human cortical excitability. This form of neuromodulation has the potential to attenuate the development of brain fatigue by moderating the manner in which a given brain area processes a stimulus. Application of tDCS on M1 for ten minutes prior to exercise increases time to task failure of a sustained isometric elbow flexion and improve locomotor exercise performance. Interestingly, when tDCS is applied on insular cortex before cycling exercise test, perceived exertion is reduced and performance is enhanced. However, the neural mechanisms underlying this effect remain unknown. Specifically, we need evidence on whether the increase in locomotor performance outcome is a consequence of tDCS mediated reduction in cortical inhibition.

Availability: Semesters 1 and 2
Special requirements: Nil

Impact of centrally driven locomotor fatigue on attentional cognitive performance

To perform accurate, goal-directed motor actions in everyday scenarios, our eyes and hands must interact, coordinate and implement with a low error rate. The performance of goal-directed movements requires the rapid deployment of attention. In particular, visual attention plays a key role in planning and executing goal-directed movements, since these movements are typically directed to visual targets. Recent work has shown that when we interact with objects in the environment, the profile of visual attention rises and falls at different times and locations relative to movement goals. It appears that blood lactate levels—a rudimentary marker of peripheral fatigue—are associated with a decline in cognitive processes, and prolonged aerobic exercise diminishes cognitive performance. If central fatigue does indeed have a detrimental effect on cognitive performance, then we can expect that application of a form of neuromodulation called transcranial direct current stimulation (tDCS) to increase excitability of neural circuitry in the areas contributing to central fatigue will also improve attentional performance. This phenomenon will be explored in these series of studies.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Effects of human locomotor fatigue on the brain and performance

Fatigue limits our ability to perform everyday tasks. We understand little about the brain areas involved in the development of fatigue during human locomotor movements, and the impact of centrally driven fatigue on movements that are vital for interaction with our environment. Having a comprehensive understanding of the neural mechanisms and interactions that occur between the components in the brain during locomotor exercise is critical to establish the anatomical sites of intervention that will result in the most effective functional outcomes. To improve human work productivity, both the neurophysiological and psychophysical aspects of fatigue must be addressed. In these series of studies, it will be determined how locomotor fatigue influences neural circuitry in specific brain areas and how this interacts with physical and cognitive performance.

Availability: Semesters 1 and 2

Age-related impact of fatigue on the brain

Age-related alterations in the neuromuscular system can predispose old adults to a different magnitude and mechanisms of neuromuscular fatigue. Recent evidence suggests that older adults are characterised by an increase in supraspinal (intrinsic of the brain) fatigue. Furthermore, due to changes in attentional demands and information processing capacities with ageing, it can be assumed that the consequences of brain fatigue on cognitive and motor function is higher in elderly people compared to young adults. Indeed, both exercise intolerance and impaired cognitive function not only impairs the elderly’s quality of life but also depicts a major source of morbidity. The aim of the current project is to elucidate these mechanisms via techniques and concepts that are at cutting edge of international research in integrative neuroscience. Specifically, the project will employ non-invasive brain stimulation techniques such as transcranial magnetic stimulation and novel motor skill learning and cognitive tasks during a fatiguing cycling exercise in older adults (>65 years) and young controls.

Availability: Semesters 1 and 2

Research areas

Neuroscience, Behaviour and Brain Health
Ageing, Frailty and Mobility
Our research seeks to understand human brain function through the identification of genes and characterisation of naturally occurring mutations implicated in various disorders of the brain. Intellectual disability describes significantly impaired cognitive functioning coupled with a deficit in adaptive behaviour with onset before age of 18, with as many as 1 in every 50 people in the world affected. There is a high co-morbidity of seizures with intellectual disability. Our research focuses on understanding the genetic causes of intellectual disability and seizures with an aim to provide a basis for rationale development of therapies.

Lead researcher: Associate Professor Cheryl Shoubridge
Email: cheryl.shoubridge@adelaide.edu.au

Honours project opportunities
Altered dosage of IQSEC2 disrupts neuronal response to synaptic signalling

Mutations in IQSEC2 lead to substantial limitation in intellectual functioning and adaptive behaviour in children, including speech disturbances, autistic traits and seizures. To better investigate the role of this gene, we have generated a novel mouse modelling the complete knockout (KO) of Iqsec2; which presents with frequent and recurrent seizures. Hippocampal neurons extracted from Iqsec2-KO embryos grown in culture display a morphological phenotype when compared to their healthy wild-type (WT) counterparts. This project will use this resource to investigate the role IQSEC2 and synaptic morphology and plasticity on the orchestration of the complex architecture required for normal cognition. Honours students are encouraged to remain with our research team to undertake a Ph.D.

Project Supervisor: Associate Professor Cheryl Shoubridge
Availability: Semester 1
Special requirements: Nil

Translating our understanding of the molecular mechanisms that underpin genetic causes of intellectual disability and infantile seizures to improve phenotypic outcomes.

Characterise molecular and cellular changes driving improvements to disease outcomes after postnatal 17B-estradiol treatment in mice modelling intellectual disability and seizures. We have mouse models to investigate functional impact of the two most frequent expanded polyalanine tract mutations in the ARX gene. Our ongoing work aims to establish the molecular mechanisms of disease associated with a range of expanded polyalanine tract mutations in ARX to begin to understand how these mutations underpin the intellectual disability with and without a broad spectrum of associated clinical symptoms in affected patients, including epilepsy. We are interested in more fundamental aspects of transcription factor regulating target genes and how these polyalanine tracts impact on this process contributing to disease. This project utilises a range of molecular cloning techniques, cell culture and cell based assays, protein studies as well as transcriptome wide expression analysis. Honours students are encouraged to remain with our research team to undertake a Ph.D.

Project Supervisor: Associate Professor Cheryl Shoubridge
Availability: Semester 1
Special requirements: Nil

Novel mechanisms regulating transcriptional activity of the intellectual disability and seizure gene, ARX.

Investigate the mechanisms by which different expanded polyalanine tract mutations disrupt the function of the ARX protein and contribute to the clinical severity. Our work aims to establish the molecular mechanisms of disease associated with a range of expanded polyalanine tract mutations to understand how these mutations underpin the intellectual disability with and without a broad spectrum of associated clinical symptoms in affected patients, including epilepsy. We are interested in more fundamental aspects of ARX biology and are currently investigating how this homeodomain transcription factor regulates target genes and how these polyalanine tracts impact on this process contributing to disease. This project utilises a range of molecular cloning techniques, cell culture and cell based assays, protein studies as well as transcriptome wide expression analysis. Honours students are encouraged to remain with our research team to undertake a Ph.D.

Project Supervisor: Associate Professor Cheryl Shoubridge
Availability: Semester 1
Special requirements: Nil

Research areas
Neuroscience, Behaviour and Brain Health
Child and Adolescent Health

The Intellectual Disability research team
Dr Ian Musgrave’s work focuses mainly on neurotoxicology with an emphasis on natural products. From the point of view of:

1) Natural products causing neurotoxicity (and other forms of toxicity such as hepatotoxicity)
   • Herbal medicine components and contaminants
   • Cyanobacterial toxins
   • Amyloids and other neurotoxic proteins in neurodegeneration

2) Natural products that can act as novel therapeutic agents in preventing neurotoxicity, specifically neurodegenerative diseases (e.g. Alzheimer’s and other amyloid disorders).

Lead researcher: Dr Ian Musgrave
Email: ian.musgrave@adelaide.edu.au

Honours project opportunities

New approaches of anti-amyloid therapies

Alzheimer’s disease (and other amyloidoses) therapy has concentrated on trying to prevent neuronal death. However, toxicity to axons and axonal connections is also important. This project will explore the ability of drugs to prevent amyloid toxicity to developing neurites in a tissue culture model as a novel therapeutic approach.

Availability: Semesters 1 and 2

Special requirements: Nil

Herbal Medicine toxicity through unappreciated drug herb interactions

Herbal medicines are widely thought of as being safe, yet they can have significant and often severe adverse effects through interacting with conventional drugs. Herbal medicine interaction with statins is one under-researched area. Herbal medicine interaction with statins will be explored in a tissue culture model.

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

HDR projects may be available with this group, please contact the lead researcher(s) for more information.

Research areas

Neuroscience, Behaviour and Brain Health
Innovative Therapeutics
Dr Sargeant’s research follows two themes. His team looks at how Alzheimer’s disease genetics influences the lysosomal system. The lysosomal system is critically important to neurological health and is responsible for clearing damaged organelles as well as unwanted or corrupted proteins. This research uses cell models and human data to identify how Alzheimer’s Disease-related genes influence the health of important recycling systems in the brain.

The other main theme of research in the Neurobiology Group aims to determine how to use nutrition to manipulate these same recycling systems in the brain. This work has focused primarily on mTOR and modifying amino acid concentrations to change how important Alzheimer’s Disease-related proteins are managed and removed in cells.

Lead researcher: Dr Tim Sargeant
Email: tim.sargeant@sahmri.com

Honours project opportunities
Can adjusting nutrients available to human neurons change the course of Alzheimer’s disease?

This project will examine how human neurons adapt to changing nutritional conditions, with an emphasis on Alzheimer’s disease. This disorder is caused by accumulation of molecules that stick together to form plaques and tangles in the brain. It is thought that plaques cause the tangles, which in turn drive most of the subsequent brain damage. The molecule that forms plaques is amyloid-beta, which comes from a larger molecule called amyloid precursor protein (APP). However, generation of amyloid-beta from APP does not need to occur. Instead, the neuron can destroy APP before this happens. The neuron can clear APP by sending it to the neuron’s recycling centres—lysosomes. Our research group has recently found that this process is enhanced when human cells are limited for nutrients. We therefore want to know how nutrient restriction affects entry of APP into lysosomes. To do this, we will study this process in human neurons. This study is important because it will characterise nutrient-responsive mechanisms that neurons use to limit the accumulation of toxic molecules that cause Alzheimer’s disease, and the mechanisms by which nutrition may influence disease onset.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
HDR projects may be available with this group, please contact the lead researcher(s) for more information.

Research areas
Neuroscience, Behaviour and Brain Health
Nutrition and Metabolic Health
Neurogenetics Group
Adelaide Health and Medical Sciences building (AHMS)

The Neurogenetics Group aims to understand the neurobiology of human brain function by studying major neurological disorders which are genetically determined. By identifying and characterising the mutations implicated in intellectual disability, epilepsy and cerebral palsy, a greater understanding of the role of specific genes and proteins in normal brain function can be discovered.

Identification of genes and understanding of molecular mechanisms leading to intellectual disabilities, autism and some epilepsies represents a challenge of significant medical importance. Led by Professor Jozef Gecz, the Neurogenetics Group seeks to further our understanding of human brain function through the identification of genes and characterisation of their naturally occurring mutations implicated in various disorders of the brain, intellectual disability and epilepsy in particular. With a broad range of state-of-the-art human genetics and genomics skills, our team has discovered or contributed to the discovery of more than 100 different genes. Many of these genes point to new and unexpected biological pathways essential for normal brain function (e.g. non-sense mediated mRNA decay, NMD).

The four key areas of our research focus are:

• genomics and bioinformatics
• molecular mechanisms of intellectual disability
• molecular neuroscience
• animal models

The Neurogenetics Group is complemented by a large number of national and international clinical and basic science collaborators.

Lead researcher: Professor Jozef Gecz
Email: jozef.gecz@adelaide.edu.au

Honours project opportunities

Investigating the role of TBL1XR1 mutations in neurodevelopmental disorders

The Neurogenetics research group aims to uncover the molecular mechanisms of early childhood neurodevelopmental disorders (NDDs) including epilepsy, intellectual disability and autism. Our recent research has uncovered that the PCDH19-NONO-estrogen receptor alpha (ERα) pathway contributes to the pathogenesis of girls clustering epilepsy and NDDs. Additionally, we also have preliminary data implicating TBL1XR1 (another co-regulator of ERα) in NDDs. TBL1XR1 is an F-box-like protein that plays an essential role in transcriptional regulation mediated by nuclear receptors. While the role of TBL1XR1 has been extensively studied in cancers, its role in neurodevelopment is not well understood. The aim of this Honours Project is to investigate the molecular mechanisms of TBL1XR1 mutations in NDDs by using a range of molecular, cellular and biochemical techniques including; RNA and protein expression analysis, in vitro functional assays and bioinformatics tools. These techniques will be utilised to examine naturally occurring human TBL1XR1 mutations and their involvement in NDDs.

This project will suit a passionate student interested in learning more about childhood disability. The student will be working in a large, highly productive, multidisciplinary research team providing opportunities to learn multiple skills with the potential for further research opportunities.

Availability: Semesters 1 and 2
Special requirements: Nil

Functional analysis of mutations causing BRAT1-associated neurodegenerative disorder

Mutations in the gene BRAT1 cause a progressive childhood neurodegenerative disorder characterised by microcephaly, intellectual disability and ataxia. Most patients also have seizures and dysmorphic features. The BRAT1 protein is required for the regulation of DNA damage pathways and is involved in control of the cell cycle. The loss of the protein in BRAT1-related disease is thought to cause increased neuronal death, leading to neurodegenerative disease. In severe cases, BRAT1-associated disease leads to death in infancy while less severely affected individuals survive into childhood. This highly variable disease severity is hypothesised to be due to differences in the functional effects of the causative BRAT1 mutations. In this project the functional effects of known disease-causing mutations in BRAT1 will be investigated using an in vitro cell based model. The project will involve the use of molecular biology techniques, protein analysis, cell culture and assays of cellular functions affected by BRAT1 mutations. This project will suit an enthusiastic student who is interested in pursuing a research career in neurogenetics. This is an opportunity to join a large multidisciplinary research team working on the causes of childhood neurological disorders.

Availability: Semesters 1 and 2
Special requirements: Nil

Investigations on the TREX-mediated nuclear mRNA export using mouse embryonic stem cell neuronal differentiation model

Animal and plant cells have developed sophisticated mechanisms to ensure competitive growth and survival. One such process is efficient mRNA export from the cell nucleus to the cytoplasm that is achieved via a highly-conserved TREX (Transcription-Export) complex. TREX contains the heterohexameric THO subcomplex (THOC1-3, THOC5-7) and UAP56, Aly, CIP29, PDIP3, SRR1, ZC11A, UIF and Chtop subunits. Recent studies show that the TREX complex plays diverse and critical roles in gene expression, 3mRNA processing, nuclear mRNA export, stress responses, mitotic progression and genome stability as well as developmental processes such as pluripotency maintenance and haematopoiesis. We and others have demonstrated that even slight perturbations in mRNA export by e.g. mutation or preferential cytoplasmic aggregation lead to neurodevelopmental disorders, neurodegeneration or cancer. Systematic investigations to define the role of TREX and functional contribution of its subunits to normal development and differentiation processes in different tissues have not been attempted. This project will use highly-regulated Tho/TREX subunit knockdown in in-vitro mESC differentiation model and tissue specific TREX composition to gain deeper insight into molecular pathways and cellular functions of the mRNA export process.

Availability: Semesters 1 and 2
Special requirements: Nil
Neurodevelopmental disorders (NDDs) are frequent (~1 in 30 children), and clinically and genetically heterogeneous, with 1000 genes already involved. They encompass intellectual disabilities (ID), epilepsies, autisms, and movement and behavioural disorders. Accumulating genetic evidence implicates multiple subunits (e.g., THOC2, THOC1, THOC5, THOC6) of the highly-conserved TREX (TRanscription-EXport) mRNA export complex in human disease and NDDs in particular. TREX exports capped, processed and mature mRNAs from the cell nucleus to the cytoplasm. Proper nuclear mRNA export is essential for efficient protein synthesis in all eukaryotic cells and therefore critical for normal development and function of multicellular organisms. We postulate that subtle perturbations in protein synthesis caused by defective TREX complex impact neural progenitor cell function and behaviour, particularly during early stages of development when brain is highly-susceptible to subtle changes in protein levels.

Availability: Semesters 1 and 2

Research areas

Neuroscience, Behaviour and Brain Health
Child and Adolescent Health
Neuromotor Plasticity and Development Research Group

The Neuromotor Plasticity and Developmental Group research interests encompass neuromotor development and neuroplasticity across the human lifespan, from prenatal and early postnatal factors influencing motor development, through to therapeutic uses of induced neuroplasticity in ageing and neuropathological disorders such as stroke and dystonia. The aim of the group’s research is to inform and develop therapeutic interventions to develop, maintain and rehabilitate human motor function.

Lead researcher: Professor Michael C Ridding
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Honours project opportunities

Cortical effective connectivity during cognitive control

The adaptive, goal-directed control of thoughts and behaviour is fundamental for everyday life. However, the neural mechanisms supporting these cognitive control processes are not fully understood. The recent combination of transcranial magnetic stimulation (TMS) and electroencephalography (EEG) has made it possible to measure how activation of a targeted cortical area propagates to the rest of the brain (i.e. effective connectivity), both at rest and during task performance.

This project will use TMS-EEG to explore the effective connectivity of different brain regions thought to play key roles in cognitive control. This novel study will provide important mechanistic insights into the brain processes that adaptively control human behaviour.

Availability: Semesters 1 and 2
Special requirements: Nil

Age differences in human prefrontal cortex stimulus response characteristics

The prefrontal cortex is a multimodal association brain region that supports higher cognitive function. It is among the most affected brain regions in age-related neurodegeneration, with deterioration of both grey and white matter. Transcranial magnetic stimulation (TMS) is a non-invasive and painless tool for studying the neurophysiological properties of the awake human brain, and when applied in combination with electroencephalography (EEG), can be used to provide novel insights into the excitability and connectivity of numerous brain regions, including the prefrontal cortex. This project will use TMS-EEG to investigate the stimulus-response characteristics of the ageing prefrontal cortex. The findings of this study will advance our understanding of how the brain changes with age.

Availability: Semesters 1 and 2
Special requirements: Nil

Does pain boost your brain?

In this study, we are interested to observe the dynamics of plasticity after a painful stimulus in healthy people. Plasticity is the intrinsic property of the central nervous system that enables us to adapt to new demands. Response to painful stimulation is accompanied by plasticity that influences the state of neuronal excitability from the periphery to the cortex. Indeed, acute painful stimulation can lead to reflex withdrawal and long-term learning about safety and avoidance, but very little is known about the relationship between the dynamic components of the plasticity response, pain, and subsequent outcomes in humans.

By using a direct, non-invasive, and subtle measure of cortical plasticity (transcranial magnetic stimulation (TMS) and electroencephalography (EEG)), this study will probe the plasticity characteristics of cortical areas associated with the cognitive components of a pain experience (i.e. prefrontal cortex). The aim of the study is to determine whether painful stimulation alters cortical network plasticity in the prefrontal cortex. It is plausible that persistent dysregulated or excessive plasticity in cognitive cortical areas might contribute to an overzealous response to noxious stimuli and lead to the formation of fear memories and even to the transition of acute to chronic pain.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

The neurophysiology of human cognitive ageing

Ageing is associated with a decline in cognitive performance, the profile of which can vary considerably between individuals. Cortical network connectivity and neuroplasticity are key factors supporting cognition, and there is growing evidence that these processes are also affected in the ageing brain. Transcranial magnetic stimulation (TMS) has long been a useful tool for non-invasively probing human neurobiology, although conventional measures have been limited to the motor cortex, thus limiting their relevance to cognitive ageing. The recent combination of TMS with electroencephalography (EEG) has provided exciting new possibilities for assessing neural function in non-motor areas, including those higher-order association brain regions that are important for cognition and are particularly vulnerable to the effects of ageing. This project will use cutting-edge TMS-EEG to investigate the role of cortical network connectivity and neuroplasticity in later life cognitive health. This work will provide novel insights into the mechanisms of successful cognitive ageing, and may have important implications for the early diagnosis and intervention of dementia.

The successful applicant will gain hands-on experience with state-of-the-art brain stimulation and recording techniques, and will have the opportunity to work with a world-class team of experts in human neurophysiological research.

Availability: Semesters 1 and 2

A TMS/EEG investigation of plasticity in people with chronic pain

Converging evidence from human experiments shows that chronic pain induces a complex reorganisation of structures and networks in the brain. Cortical plasticity is the intrinsic property of the central nervous system that enables reorganisation in response to changing demands. Changes at a local level (cortical network plasticity) may be the first in a series of neural circuit alterations that underpin maladaptive change and or susceptibility to a disorder. If so, indices of cortical plasticity in people with chronic pain may represent an objective correlate of an individual’s susceptibility to induced changes.

A direct and subtle measure of cortical network plasticity is possible using a technique that combines transcranial magnetic stimulation (TMS) and electroencephalography (EEG). This non-invasive technique is easily tolerated by people with pain. Comparing combined TMS-EEG measures between people with chronic pain and healthy controls promises to answer two very important questions: Do people with chronic pain differ in characteristics of cortical plasticity from healthy controls, and do patterns of altered cortical plasticity predict a response to treatment? You will have the chance to work with an internationally recognised team of experts using cutting edge technology during this exciting project.

Availability: Semesters 1 and 2

Research areas

Neuroscience, Behaviour and Brain Health
Ageing, Frailty and Mobility
Early Origins of Health
Men’s Health
Neuropharmacology of Drug Abuse
University of Adelaide, North Terrace Campus

Understanding how drugs of abuse interact with the cells in our body to cause their effects is fundamental to the development of strategies to deal with many of the social and health problems associated with these drugs. This requires understanding of the chemistry of the drugs, associated neuroscience and their neuropharmacology. We use a number of methods and techniques to pursue this understanding including in vivo radiotelemetry and micro-dialysis. The drugs currently under investigation include ecstasy and associated amphetamines.

Lead researcher: Dr Abdallah Salem
Email: abdallah.salem@adelaide.edu.au

Honours project opportunities

Microglial activation and MDMA-induced hyperthermia
The main MDMA-induced adverse effect is disruption of normal thermoregulation leading to life threatening hyperthermia which is exacerbated by high ambient temperature and linked to chronic neurotoxicity. Results obtained from our recent studies suggest an association between microglial activation and MDMA-induced hyperthermia. We have demonstrated that pre-treatment with minocycline, an antibiotic with glial attenuating properties, can significantly reduce the severity of MDMA-induced hyperthermia. The overall aim of this project is to extend our understanding of the underlying mechanisms leading to the disruption of normal thermoregulation and how minocycline reduces the hyperthermic response to MDMA.

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities
HDR projects may be available with this group, please contact the lead researcher(s) for more information.

Research areas
Neuroscience, Behaviour and Brain Health
Neurophysiology of Human Movement
University of Adelaide, North Terrace Campus

Have you ever been mesmerised by the skills of an Olympic athlete? Fascinated by the ability of the brain to change itself? Or wondered how the brain operates under extreme conditions? If so, then this research area is for you!

Research in this laboratory focuses on the neural mechanisms responsible for changes in human movement throughout the life span. We specialise in the use of brain stimulation techniques to painlessly and non-invasively measure and modify the brain’s control of skeletal muscles under diverse conditions, such as ageing, exercise, training and fatigue. The overall goal is to understand how the healthy nervous system functions to control movements in different situations, and how it may adapt in conditions involving neuromuscular injury or disease.

Lead researcher: Associate Professor John Semmler
Email: john.semmler@adelaide.edu.au

Honours project opportunities
Brain plasticity and motor function in older adults
There are huge variations in motor abilities later in life. As an example, the world record for running the 42-km marathon is a remarkable 2 hours and 36 minutes in the over 60 age category. For many of us, however, this is the age when motor function rapidly deteriorates, resulting in difficulties in performing everyday tasks such as fastening buttons, placing a key in a keyhole, or picking up a cup. One reason for this deterioration in motor function is a decline in plasticity in motor areas of the brain, but the specific mechanisms that contribute to this decline remain elusive.

Recent studies from our group show that specific brain circuits important for motor system plasticity are compromised in older adults. Do changes in these circuits contribute to impaired motor performance and learning in older adults? Can we modify plasticity and learning by strengthening these circuits in older adults? Several studies using brain stimulation and electroencephalography are planned to address these research questions. A better understanding of changes in brain function with advancing age may help to identify predictors of motor impairment, and optimise the design of programs aimed at rejuvenating brain function and movement quality in the elderly.

Project Supervisor: Associate Professor John Semmler
Availability: Semesters 1 and 2
Special requirements: Nil

Cortical mechanisms associated with age-related deficits in motor function
A degradation of motor function represents one of the most common deficits associated with the ageing process. These changes can impede the ability of older adults to care for themselves, and may significantly reduce their quality of life. Given the rapidly ageing population, it is crucial to develop a better understanding of these deficits and how they might be treated. Subsequently, this project will use advanced non-invasive brain stimulation techniques to characterise changes within the brain that may contribute to age-related reductions in motor function.

Project Supervisor: Dr George Opie
Availability: Semesters 1 and 2
Special requirements: Nil

Investigating the neurophysiological effects of mild traumatic brain injury
Mild traumatic brain injury (mTBI) is extremely common, affecting millions of people annually. In contrast to the common belief that these injuries are short-lived in nature, emerging evidence suggests that alterations within the brain may be present long after mTBI. The nature of these alterations, and how they contribute to long-term functional deficits associated with injury, is not well understood. Using advanced neurophysiological techniques, this study will attempt to identify specific mechanisms of brain injury in mTBI patients.

Project Supervisor: Dr George Opie
Availability: Semesters 1 and 2
Special requirements: Nil

Brain plasticity and motor function in older adults
Ageing is commonly associated with a reduced capacity to reorganise brain connections (i.e. plasticity), which may contribute to an age-related decline in cognitive, motor and other brain functions. Recent studies from our group show that it is possible to improve brain plasticity in older adults by priming the brain using transcranial magnetic stimulation (TMS). Furthermore, several studies in young subjects have shown that longer lasting changes in brain plasticity can be achieved with daily sessions of priming TMS. This project will examine if longer lasting changes in brain plasticity can be achieved in older adults by repeated TMS sessions over multiple days. A better understanding of changes in brain function and plasticity with advancing age will help to optimise the design of preventative programs aimed at rejuvenating motor and cognitive function in the elderly.

Availability: Semesters 1 and 2
Special requirements: Nil

Brain function and connectivity after eccentric muscle damage
Eccentric contractions are performed regularly in everyday lives, and are important considerations in sports medicine and science as they offer significant advantages for rehabilitation and training because of their potential to produce large forces with a low metabolic cost. However, the consequence of performing eccentric exercise is that it causes significant damage to muscle fibres, resulting in a loss of strength and soreness that can last many days. Along with the changes in the muscle, we have recently shown changes in motor cortex function after eccentric muscle damage, but whether there are more widespread cortical changes are unclear. Combining TMS with electroencephalography (TMS-EEG) provides a more direct measure of cortical excitatory and inhibitory function (i.e. measured from the brain rather than the muscle), and permits an assessment of interactions between multiple brain areas (i.e. functional connectivity). Therefore, the aim of this study is to use TMS-EEG to examine the changes in cortical excitability and functional connectivity after eccentric muscle damage. A greater understanding of the neural adaptations to eccentric exercise is necessary for refining interventions for injury prevention, injury treatment, and strength training.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Brain plasticity and motor function in older adults
Please see Honours entry
Cortical adaptations to strength and endurance training

It is now commonly accepted that the central nervous system possesses a remarkable ability to alter its structure and function in response to different types of motor training. In particular, strength and endurance training represent the extremes of physical activity, and are likely to elicit different neural adaptations due to the goal of maximising muscle strength or endurance. However, it is not known whether strength or endurance training influences the ability to reorganise cortical connections (i.e. plasticity) or if there are training specific changes in the interactions between multiple brain areas (functional connectivity) that relate to the ability to generate muscle strength or endurance.

The overall goal of these studies is to determine if strength and endurance training induce changes in cortical excitability, plasticity and connectivity that are specific to the motor experience. It is hypothesised that strength and endurance training will produce divergent effects on cortical excitability, plasticity and connectivity, which will be related to differences in muscle strength and endurance.

Availability: Semesters 1 and 2

Research areas
Neuroscience, Behaviour and Brain Health
Ageing, Frailty and Mobility

Associate Professor John Semmler
The Psychiatric and Medical Co-morbidities Research Group is built around the idea that physical and brain processes are interrelated in a bidirectional way. For example, heart disease is more frequently associated with depression and vice versa. Moreover, individuals with psychiatric disorders have a 25-30 years decreased life-expectancy than the general population due to a high degree of medical comorbidity. The group uses a range of methods providing for investigations of the molecular, functional, clinical, and epidemiological characteristics of psychiatric-medical co-morbidity.

**Lead researchers:** Associate Professor Oliver Schubert, Dr Scott Clark, Professor Bernhard Baune

**Email:** oliver.schubert@adelaide.edu.au

**Honours project opportunities**

**The clinical and cognitive effects of Hepatitis C Virus (HCV) treatment with a DAA medication in people with severe and enduring mental illness**

This is a placebo controlled multicentre study in collaboration with the Department of Medicine (Professor Mark Boyd), investigating the effects of a direct acting antiviral (DAA) drug for HCV on psychiatric symptoms and cognitive function in people with severe and enduring mental illness.

**Project Supervisors:** Associate Professor Oliver Schubert, Dr Scott Clark, Professor Bernhard Baune

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**The effects of iron deficiency and its treatment on mental health outcomes in pregnant mothers and their children**

This collaborative study (Associate Professor Bernhard Froessler, Department of Acute Care Medicine) investigating the role of iron deficiency and its treatment on mental health outcomes such as depression, anxiety, and neurocognition in pregnant women. Longitudinal assessments of mothers and babies have been conducted during pregnancy and in the first postpartum year.

**Project Supervisors:** Associate Professor Oliver Schubert, Dr Scott Clark, Professor Bernhard Baune

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**The clinical and cognitive effects of Hepatitis C Virus (HCV) treatment with a DAA medication in people with severe and enduring mental illness**

Please see Honours entry

**The effects of iron deficiency and its treatment on mental health outcomes in pregnant mothers and their children**

Please see Honours entry

**Research areas**

Neuroscience, Behaviour and Brain Health
The Biomarker and Pharmacogenetic Research Group has a clinical orientation towards identifying biological markers relevant to psychiatric disorders and pharmacoresponse with an emphasis on mood disorders, cognitive function, and psychosis. The specific emphasis has been developed in this research group by studying the pharmacogenetic response to antidepressants as well as to electroconvulsive therapies in treatment resistant depression, pharmacogenetics of response to lithium treatment in bipolar disorder and an extensive biomarker project in clozapine treated patients is under way.

**Lead researchers:** Dr Catherine Toben, Dr Catharine Jawahar, Dr Scott Clark, Professor Bernhard Baune  
**Email:** catherine.toben@adelaide.edu.au

**Honours project opportunities**

**Functional genomics of major depressive disorder (MDD)**

This study seeks to identify transcriptomic alterations in major depressive disorder (MDD) cases from a large locally recruited sample of participants exhibiting peripheral inflammation using next generation RNA sequencing technology.

**Project Supervisors:** Dr Catherine Toben, Dr Catharine Jawahar, Dr Scott Clark  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Transcranial Magnetic Stimulation and Electrophysiology in Mood and Psychosis Study**

This study seeks to identify electrophysiological signatures including resting state electroencephalography (EEG), Event Related Potentials (ERP) and Transcranial Magnetic Stimulation (TMS) induced plasticity associated with symptoms, cognition and general function in mood and psychotic illness for use as biomarkers of outcome.

**Project Supervisors:** Dr Scott Clark, Associate Professor Oliver Schubert  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Genomics of Electroconvulsive Therapy-International Consortium (GenECT-IC)**

This study seeks to identify genomic, clinical and cognitive signatures of treatment response in severe depression treated with electroconvulsive therapy (ECT).

**Project Supervisors:** Dr Scott Clark, Dr Oliver Schubert  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

**Transcranial Magnetic Stimulation and Electrophysiology in Mood and Psychosis Study**  
Please see Honours entry

**Genomics of Electroconvulsive Therapy-International Consortium (GenECT-IC)**  
Please see Honours entry

**Research areas**

Neuroscience, Behaviour and Brain Health
The spinal cord injury research group (SCIRG) is led by Dr Anna Leonard, a research active lecturer in the Adelaide Medical School and a division of the Translational Neuropathology Research Group, led by Associate Professor Renee Turner. The SCIRG is focused on understanding the secondary injury processes that occur post-SCI and how these can be targeted to improve outcome. We have recently developed a clinically relevant large animal model of SCI, the first in Australia, which allows us to investigate more clinically relevant outcome measures and potentially improve translation into the clinic. We also work with small animal models to help understand the secondary injury processes post-SCI, with a particular focus on inflammation, oedema and pressure.

Lead researcher: Dr Anna Leonard
Email: anna.leonard@adelaide.edu.au

Honours project opportunities

Investigating the acute response of the spinal cord and cerebrospinal fluid to trauma, in a pre-clinical model

This project is seeking to develop, characterise and use a pre-clinical (large animal) model of spinal cord injury. The model will have specific utility to obtain serial measurements of pressure within the intrathecal space, as well as intra-operative (ultrasound) and serial measurements (MRI) measurements of spinal cord morphology, oedema and haemorrhage, and cerebrospinal fluid (CSF) flow. The ultimate aim of the research program is to investigate the effect of novel surgical interventions on these parameters, as well as on the functional recovery of the animals, and on histological markers of spinal cord damage. Student(s) will work within a dynamic multidisciplinary team of scientists, engineers and clinicians, and will be exposed to a wide variety of novel experimental techniques. Investigators associated with this study include; Dr Claire Jones, Dr Anna Leonard, and Professor Brian Freeman, members of the Spinal Research Group in the Centre for Orthopaedics and Trauma Research.

Project Supervisors: Dr Anna Leonard, Dr Claire Jones, Professor Brian Freeman
Availability: Semester 1
Special requirements: Nil

Investigating the relationship between neuroinflammation and the development of cognitive deficits following traumatic spinal cord injury

A rarely investigated outcome of spinal cord injury in affected patients is the chronic effect on cognition. This project will investigate how traumatic injury to the spinal cord can result in neuroinflammation within the brain and subsequent cognitive deficits. This project will utilise a rodent model of SCI and involve a wide variety of experimental skills including animal surgery and care, western blots and immunohistochemistry. The ultimate aim of this study is to understand how neuroinflammation evolves within the brain post-SCI, what cognitive deficits develop and whether novel treatment using Fyn Kinase can help prevent neuroinflammation and improve outcome.

Project Supervisors: Dr Anna Leonard, Dr Lyndsey Collins-Praino
Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Neuroscience, Behaviour and Brain Health
Stroke and Trauma Research Group (Member of Translational Neuropathology Research Group)

University of Adelaide, North Terrace Campus, PIRL/SAHMRI Gilles Plains

We use pre-clinical models to investigate the complex mechanisms of injury and disease to develop new treatments for acute central nervous system injury, encompassing stroke and traumatic brain injury (TBI). We have a particular focus on translating research findings into the clinical setting.

Lead researcher: Associate Professor Renee Turner
Email: renee.turner@adelaide.edu.au

Honours project opportunities

Comparative study of meningeal composition across species: implications for pressure and tissue injury

The meninges are the protective tissue layer covering the brain and spinal cord which are integral in anchoring the tissues and providing protection. Variations in the way species respond to elevations in pressure (intracranial or intrathecal) may in part be a reflection of the meningeal composition. This project will examine the properties and composition of meningeal samples obtained overlying the hemispheres and the lumbar region of the spinal cord. Students will work with a dynamic multi-disciplinary team of scientists, engineers and clinicians. Students will be using a wide variety of experimental techniques including: immunohistochemistry, western blot and ELISA.

Project Supervisors: Associate Professor Renee Turner, Dr Anna Leonard and Dr Claire Jones
Availability: Semester 1
Special requirements: Nil

Identifying novel stroke biomarkers in a pre-clinical model

This project will take serum samples from a pre-clinical stroke model and clinical stroke patients to identify key injury biomarkers and determine their temporal profile following stroke. We seek to identify whether changes in injury markers correlate with both lesion size and stroke outcome. The goals of the study are to identify novel targets for treatment and to determine if such profiles align with the clinical situation. Students will work with a dynamic team of neuroscientists and clinicians whilst learning a number of experimental techniques including: ELISA and western blot.

Project Supervisors: Associate Professor Renee Turner, Dr Adam Wells and Dr Benjamin Reddi
Availability: Semester 1
Special requirements: Nil

Examining neurodegeneration following stroke

Early on following stroke the focus is on salvaging brain tissue in the penumbra and minimising the stroke infarct size to reduce disability. However, later on following stroke there is still the potential for further injury and loss of neurological function due to the development of neurodegeneration. This project will use serum samples, cerebrospinal fluid samples, fresh/fixed brain tissue and magnetic resonance imaging from a pre-clinical stroke model to examine whether changes in kinases and other key pathological markers known to be implicated in neurodegenerative disease occur. Students will learn a number of experimental techniques including: immunohistochemistry, western blot, ELISA and MRI analysis.

Project Supervisors: Associate Professor Renee Turner and Dr Lyndsey Collins-Praino
Availability: Semester 1
Special requirements: Nil
**Stroke Research Programme**

*South Australian Health and Medical Research Institute (SAHMRI)*

Stroke is by far the most common neurological disease and afflicts 60,000 Australians per annum. It is the second leading cause of death, and a significant number of people who survive a stroke are left with neurological disability. It remains the leading cause of adult disability in Australia.

The Stroke Research Program (SRP) is a unique collaboration between the SA Health and Medical Research Institute (SAHMRI), University of Adelaide and the Central Adelaide Local Health Network. There are 22 members of the SRP, including 13 scientists and nine clinical; with four Stroke Unit heads from all major Adelaide public hospitals. Over the last 16 years the SRP has trained 26 PhD students, three Masters students and 30 Honours students in various disciplines (26 with first-class honours), and four neurologists with a clinical and/or scientific interest in stroke medicine.

**Lead researchers:** Professor Simon Koblar, Associate Professor Anne Hamilton-Bruce

**Email:** simon.koblar@adelaide.edu.au

**Honours project opportunities**

**Dental pulp stem cell (DPSC) therapy for stroke**

Our research investigates brain repair following ischaemic stroke using adult human stem cells from teeth (DPSC). We have published that DPSC have therapeutic potential, however, it remains unknown how these stem cells mediate improvement following stroke, and the best treatment paradigm for DPSC administration. We are also investigating how we make these stem cells available at a human-grade for a clinical trial and if there are differences between young and older DPSC for autologous transplantation in humans.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Npas4 and stroke**

In 2004, we discovered a new brain specific gene encoding a transcription factor (Npas4) that is expressed specifically in the brain and following injury such as stroke. Exciting findings from our recent research demonstrated that Npas4 has a neuroprotective role in ischaemic stroke and, for the first time, that Npas4 is involved in modulating inflammation, an important contributor to the pathogenesis of stroke. In addition, we have shown that Npas4 also has an important role in neurogenesis (generation of new nerves), which is induced by stroke as a compensatory response to repair brain damage. Our laboratory aims to clarify how Npas4 expression modifies the brain’s response to stroke and improves neurological outcomes following stroke.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Clinical translation of stroke treatment**

We partner with the South Australian Academic Health Science and Translational Centre (AHSTC) to continuously enhance translation of research into health care. Stroke is an AHSTC priority and we participate in research to improve stroke unit services and expect the opportunity afforded by the opening of the new Royal Adelaide Hospital will assist us to implement clinical translation of stroke research.

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Proteomics of stroke and transient ischaemic attack (TIA)**

TIA is a common precursor and warning sign for an imminent ischaemic stroke. Correctly distinguishing TIA from benign mimic conditions such as complicated migraine or focal seizures is clinically problematic. There are currently no biochemical markers for TIA or stroke, making diagnosis of these conditions dependent on expensive and time-consuming imaging. This study explores the human plasma proteome for differentially expressed TIA- or stroke-sensitive plasma proteins that could be used as diagnostic biomarkers.

**Availability:** Semesters 1 and 2

**Research areas**

Neuroscience, Behaviour and Brain Health

**More information**

adelaide.edu.au/srp/
Visceral Pain Research Group
South Australian Health and Medical Research Institute (SAHMRI)

Our research focuses on chronic pain, with particular emphasis on Irritable Bowel Syndrome (IBS), Inflammatory Bowel Disease (IBD), and overactive bladder. We determine the mechanisms responsible for detecting painful events and how they change during acute and chronic pain. It is clear that certain mechanisms are reprogrammed during chronic pain, which fail to ‘reset’ back to normal. Overall, understanding how these mechanisms are changed is the first step in finding new therapeutic treatments for chronic pain.

Lead researcher: Associate Professor Stuart Brierley
Email: stuart.brierley@sahmri.com

Honours project opportunities

Ion channels: critical targets for the treatment of chronic abdominal pain.
This project will follow up on our recent Nature paper to investigate novel ion channels in sensory neurons, and how their function changes across acute and chronic pain models. We will also determine how ion channel expression is altered in tissue from human patients with chronic visceral pain.

Project Supervisor: Associate Professor Stuart Brierley
Availability: Semesters 1 and 2
Special requirements: Nil

Identifying molecular changes to spinal cord signalling in altered states of visceral pain
Internal organs (viscera) are innervated by sensory nerves that detect harmful events and signal into the spinal cord. Neurons in the spinal cord then relay this information into the brain where it is perceived as pain or discomfort. It is well established that the sensory nerves innervating visceral organs become hypersensitive upon inflammation and is the precursor to the development of chronic visceral pain conditions such as IBS.

Currently, there is little understanding of the changes occurring in the spinal cord pathways contributing to conditions of acute and chronic visceral pain.

This project will use laser micro-dissection to isolate neurons in the spinal cord to identify molecular changes in models of acute and chronic visceral pain. Spinal cord slice calcium imaging will then be used to validate molecular changes.

Project Supervisor: Dr Andrea Harrington
Availability: Semesters 1 and 2
Special requirements: Nil

Molecular mapping of brain regions processing visceral pain
It is unclear how signalling from the spinal cord into the brain is altered in states of chronic visceral pain, leading to abnormal pain perception. This is largely due to the fact that the brain regions activated by visceral pain are not well identified. This project uses molecular and anatomical approaches to map out the brain regions activated by painful visceral stimuli in health and identify how these changes in models of acute and chronic visceral pain.

Project Supervisor: Dr Andrea Harrington
Availability: Semesters 1 and 2
Special requirements: Nil

Mechanisms of visceral pain cross-talk
Patients with visceral pain conditions such as IBS often experience co-morbid dysfunction of adjacent visceral organs, contributing to chronic pelvic pain. The mechanisms underlying this visceral cross-talk are mediated by sensory neurons with overlapping sensory innervation. This project will investigate the role of the immune system in regulating neuronal hypersensitivity within these sensory pathways.

Project Supervisor: Dr Luke Grundy
Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Identifying molecular changes to spinal cord signalling in altered states of visceral pain
Please see Honours entry

Research areas

Neuroscience, Behaviour and Brain Health
Nutrition and Metabolic Health
Immunology and Infection
Translational Health Outcomes

Visceral Pain Research Group members
**Visual Physiology and Neurobotics Laboratory**

*University of Adelaide, North Terrace Campus*

The Visual Physiology and Neurobotics Laboratory (VPNL), study how the brain processes visual information. We investigate visual processing from behavioural, computational and physiological levels, with a multidisciplinary team covering fields of neuroethology, neurobiology, psychology, computer vision and engineering. Consider a human catching a ball, a dog leaping at a Frisbee or a dragonfly hunting prey amidst a swarm. Brains large and small have evolved the ability to predictively focus attention on a moving target, whilst ignoring distracters and background clutter. We use electrophysiological techniques to investigate how flying insects perform such visual tasks. Our most recent work suggests that insects use sophisticated mechanisms of attention similar to those in primates, to aid in the selection of one feature even in the presence of distracters (e.g. feeding in a swarm).

The physiological data obtained in our laboratory feeds into our robotics projects, as we implement neuronal processing onto an autonomous platform. This research involves computational modelling or hardware development, and is therefore suited to those with mathematical or engineering backgrounds. We work with collaborators in both Mechanical Engineering and Computer Vision on jointly supervised projects.

**Lead researcher:** Dr Steven Wiederman  
**Email:** steven.wiederman@adelaide.edu.au

### Honours project opportunities

**Modulation of early vision by higher-order processes**

The commonly accepted view is that photoreceptor and first order interneuron responses depend only on the intensity of the light source presented within their receptive field. That is, these early visual neurons represent changes in light in a feed-forward manner, passing this information to higher-stages of visual processing. However, in the fly’s visual system there are neurons that synapse back onto the retina and lamina layers and the functionality of this neuronal architecture is yet to be completely understood. This project will explore what is currently a hot topic in neuroscience—how early sensory neurons may be modulated by higher-order processes, such as expectation and attention.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

### HDR project opportunities

**Target-tracking neurons in the insect visual system**

Visual target detection against a cluttered, moving background is a challenging problem for any visual system, natural or artificial. We study a set of neurons from the brain of insects, which achieve this in spectacular fashion. Our most recent work suggests that the insects use sophisticated mechanisms of attention similar to those in primates, to aid in the selection of one feature even in the presence of distracters (e.g. feeding in a swarm). This project aims to explore physiological responses to single or multiple targets moving along natural trajectories, typical of pursuits in real-world environments. We will also explore how the electrophysiological properties of these neurons (e.g. their complex receptive fields) are matched to the underlying morphology of the neurons. This project is composed of several sub-projects, suited to students with different educational and work experiences (e.g. electrophysiological recording).

**Availability:** Semesters 1 and 2

**Neurobotics: active vision systems**

The physiological data obtained in our laboratory feeds into our robotics projects, as we implement neuronal processing onto an autonomous platform. This project involves computational modelling or hardware development, and is therefore suited to those with mathematical or engineering backgrounds. If desired, we have collaborators in both Mechanical Engineering and Computer Vision to establish jointly supervised projects.

**Availability:** Semesters 1 and 2

**Nanoscale biophotonics**

We are investigating the in vivo application of fluorescent nanoparticles for the purpose of recording neuronal function in behaving organisms. This project combines life and physical sciences as we explore properties of the nanoparticles, the tapering of optical fibres and their interaction with nervous tissue. This project is part of the ARC Centre for Nanoscale Bio Photonics and is in collaboration with the Institute for Photonics and Advanced Sensing (IPAS).

**Availability:** Semesters 1 and 2

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**Availability:** Semesters 1 and 2

**Research areas**

Neuroscience, Behaviour and Brain Health
NUTRITION AND METABOLIC HEALTH
The effects of nutrition quality and availability on metabolic processes not only play a significant role in the incidence of many serious illnesses, but can drastically influence our general health and wellbeing throughout our lives.

The links between nutrition, metabolism and human health are complex, and our researchers—from basic scientists, human physiologists, clinicians and population health specialists—are working to enhance our understanding of these links.

Our researchers are investigating the associations between diet and sleep, pregnancy, foetal growth and mortality, and serious illnesses such as coronary heart disease, stroke, hypertension, atherosclerosis, obesity, cancer, type 2 diabetes, osteoporosis, dental caries, gall bladder disease, dementia and nutritional anaemias.

Our overarching goal is to develop and validate innovative diets to promote health and wellbeing, and deliver improved health outcomes to the community in a range of areas.

Researchers across the faculty are focused on:

• determining the effects of modifying diet on metabolic health
• developing strategies to prevent and manage obesity and type 2 diabetes
• studying the molecular and cellular basis of appetite regulation
• understanding immune function and pain-sensing in the gut
• exploring how nutrition interacts with sleep patterns and metabolic disorders
• investigating metabolism in liver, muscle, fat tissue and bone tissue
• understanding nutrition in vulnerable populations such as the elderly, and determining the association between nutritional intake and chronic disease
• conducting studies longitudinal, large cohort studies to assess associations between diet and chronic diseases.
NUTRITION AND METABOLIC HEALTH RESEARCH OPPORTUNITIES

Gastrointestinal Function and Appetite Regulation

Adelaide Health and Medical Sciences building (AHMS)

Our research is focused on characterising the role of the upper gastrointestinal (GI) tract, particularly the role of dietary nutrients, in activating GI functions, including gut hormone release and stimulation of gut motor functions, in the regulation of appetite, gut symptoms, energy intake and blood glucose, in humans. The work has made major contributions to current understanding of mechanisms underlying disorders, including obesity and functional dyspepsia (both of which are highly prevalent conditions, i.e. with substantial health, economic and psychosocial implications) and shaped current concepts of how nutrients interact with GI function in the regulation of appetite and overeating on the one hand, and digestive symptoms associated with a lack of appetite on the other.

As examples, our research has established (i) key roles for specific GI motor and hormone functions in energy intake regulation in humans, (ii) that very small amounts of specific nutrients (e.g. certain fatty acids or amino acids), through their potent GI effects, have major appetite-suppressant and glucoregulatory effects, and, therefore, may have the potential to be developed into novel, nutrient-based therapeutic agents, (iii) that adaptive changes in GI function can occur to both high-energy diets and dietary restriction, discoveries that have wide-reaching implications for a better understanding of a range of intake-related disorders, including obesity, functional dyspepsia as well as anorexia nervosa, and (iv) a key role for dietary factors (including meal size and dietary nutrient composition) for symptoms in FD.

We offer projects at Honours and PhD levels on an ongoing basis.

Lead researcher: Professor Christine Feinle-Bisset
Email: christine.feinle@adelaide.edu.au

Honours project opportunities

Effects of dietary fatty acids on appetite regulation in health and obesity
Certain fatty acids that we have evaluated in our research have potent energy intake-suppressant effects. This project evaluates the relationship between the effects of these fatty acids on functions of the upper gut with appetite perceptions and energy intake in people that are normal-weight or obese, and also examines potential beneficial effects for blood glucose control.

Availability: Semesters 1 and 2
Special requirements: Nil

Effects of specific dietary amino acids on the regulation of appetite, energy intake and blood glucose control in health, obesity and type 2 diabetes
This project examines the recently discovered potent effects of specific amino acids on energy intake and/or blood glucose and underlying mechanisms, including the role of gut functions, circulating amino acids or centrally mediated effects, in people with normal weight or obesity and patients with type 2 diabetes.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Effects of dietary fatty acids on appetite regulation in health and obesity
Please see Honours entry

Effects of specific dietary amino acids on the regulation of appetite, energy intake and blood glucose control in health, obesity and type 2 diabetes
Please see Honours entry

Research areas

Nutrition and Metabolic Health

Role of novel plant-derived compounds on energy intake regulation
This project will characterise the effects of a novel plant-derived compound on energy intake in healthy humans, and the potential mechanisms (particularly gut hormones) that may be underlying these effects.

Availability: Semesters 1 and 2
Special requirements: Nil
Gastrointestinal Function in Diabetes Mellitus
Royal Adelaide Hospital, Adelaide Health and Medical Sciences building (AHMS)

Professor Chris Rayner’s major research interest concerns nutrient gut interactions, including the regulation of gastrointestinal motility, with an emphasis on the role of upper gut function in diabetes. His work seeks to develop an understanding of the mechanisms of nutrient sensing and incretin hormone release in the gut, and how these can be manipulated for therapeutic gain. He has developed the concept of protein preloads, taken in advance of meals, to initiate gut feedback mechanisms that will lower subsequent postprandial glycaemia in type 2 diabetes.

Lead researcher: Professor Chris Rayner
Email: chris.rayner@adelaide.edu.au

Honours and HDR project opportunities

Variety of projects available

Our group includes Professor Michael Horowitz, Professor Karen Jones, Dr Tongzhi Wu, Dr Liza Phillips, and Dr Chinmay Marathe. We form part of a NHMRC Centre of Research Excellence in Translating Nutritional Science to Good Health, and collaborate closely with Associate Professor Richard Young’s Intestinal Nutrient Sensing Group at SAHMRI.

We have established an international reputation in the area of gastrointestinal function in diabetes, and have a history of supervising higher degree students from a broad variety of clinical and scientific backgrounds. We have the capacity to measure gastric emptying with scintigraphy, ultrasound or breath tests, gastroduodenal pressure events with manometry, release of small intestinal hormones (e.g. GLP-1, GIP, CCK) by assays on plasma samples, gut sensations by validated visual analogue scores, and appetite and food intake by ad libitum buffet meals. Research projects include evaluation of dietary or drug interventions to control postprandial hyperglycaemia, or physiological studies seeking to understand the basis of disordered gastric or small intestinal function in diabetes.

Availability: Semesters 1 and 2
Special requirements: Nil

Research areas

Nutrition and Metabolic Health
Gastrointestinal Neuro-immune Interactions
South Australian Health and Medical Research Institute (SAHMRI)

Dr Patrick Hughes is interested in communication between the nervous and immune system, and particularly how this is relevant for gastrointestinal diseases. He collaborates with clinical gastroenterologists, immunologists and neuroscientists to investigate the effects immune mediators have on sensations from the gut, but also the effects neurotransmitters have on the immune system.

Lead researcher: Dr Patrick Hughes
Email: patrick.hughes@adelaide.edu.au

Honours project opportunities

Is naive and relapsing inflammation of the colon the same?
Inflammatory Bowel Disease is characterised by chronic inflammation that comes and goes over time. However, little is understood regarding how the type(s) of immune responses differ between acute and relapsing inflammation. This project uses cutting edge immune and nerve analysis (e.g. molecular biology, flow cytometry, electrophysiology) to understand the effects of repeated inflammation on immune and nerve responses.

Availability: Semesters 1 and 2
Special requirements: Nil

How do microbial products maintain immune and physiological homeostasis in the colon?
The microbiota is known to be altered in many diseases, but little is understood regarding the effects microbiota products have on colonic immune and nervous systems. This project combines studies using human samples with animal models of disease to understand how changes in microbiota composition affect the physiology of the intestinal tract.

Availability: Semesters 1 and 2
Special requirements: Nil

How does activation of the immune system contribute toward symptoms in irritable bowel syndrome?
Irritable Bowel Syndrome is characterised by symptoms of pain and altered motility that occur in the absence of overt pathophysiological changes. However recent evidence indicates that the immune system is altered in IBS consistent with a low grade inflammatory event. This project combines studies of human tissue with animal models to understand how immune changes lead to symptoms of pain and altered motility in IBS.

Availability: Semesters 1 and 2
Special requirements: Nil

Novel techniques for imaging colonic inflammation
In collaboration with MITRU at SAHMRI, we are using radiolabelled antibodies against immune markers to develop novel in-vivo techniques for imaging colonic inflammation.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Is naive and relapsing inflammation of the colon the same?
Please see Honours entry

How do microbial products maintain immune and physiological homeostasis in the colon?
Please see Honours entry

How does activation of the immune system contribute toward symptoms in irritable bowel syndrome?
Please see Honours entry

Novel techniques for imaging colonic inflammation
Please see Honours entry

Research areas
Nutrition and Metabolic Health
Immunology and Infection
Neuroscience, Behaviour and Brain Health
Innovative Therapeutics

135  Nutrition and Metabolic Health
Hypoglycaemia and the Gut

Adelaide Health and Medical Sciences building (AHMS)

Lead researcher: Dr Chinmay Marathe
Email: chinmay.marathe@adelaide.edu.au

Honours project opportunities

Hypoglycaemia and gastric emptying in diabetes

Hypoglycaemia, or low blood glucose, is a frequent and important complication of type 1 and insulin-treated type 2 diabetes. While hypoglycaemia can, generally, be self-treated (i.e. by eating or drinking carbohydrate) if symptoms are recognised promptly, a substantial number of people, particularly those who have had frequent episodes of hypoglycaemia do not experience adequate warning symptoms. This state is known as ‘impaired awareness of hypoglycaemia’ or IAH. Severe hypoglycaemia (defined as an event requiring the assistance of another person to actively treat hypoglycaemia) is particularly dangerous and may be fatal. The risk of severe hypoglycaemia is increased 3–6 fold in IAH. The gut is the largest endocrine organ in the body and plays a major role in blood glucose homeostasis. It is known that gastric emptying (the rate at which the stomach empties food into the small intestine) exhibits a wide inter-individual variation that impacts on post-meal blood glucose. Upper gastrointestinal symptoms and delayed gastric emptying are common in longstanding diabetes and associated with increased risk of hypoglycaemia. The proposed study will determine whether an increased frequency or impaired awareness of hypoglycaemia are associated with delayed gastric emptying. If this proves to be the case, it would have major implications for the management of hypoglycaemia.

Availability: Semesters 1 and 2

Special requirements: Nil

Research areas
Nutrition and Metabolic Health
**Intensive Care Research**

*Royal Adelaide Hospital, Adelaide Health and Medical Sciences building (AHMS)*

**Lead researcher:** Professor Marianne Chapman  
**Email:** marianne.chapman@sa.gov.au

**Honours project opportunities**

**Thiamine deficiency and mitochondrial dysfunction in sepsis: A pilot observational study of prevalence and outcomes in intensive care**

Recent evidence suggests that thiamine deficiency may be under recognised in critically ill patients, and associated an increase in mortality of up to 50%. The concept of metabolic resuscitation has recently become an area of interest in critical care research, particularly in relation to the management of sepsis. This pilot observational study will determine the association between thiamine deficiency and immune cell mitochondrial dysfunction in patients admitted to ICU with sepsis, and the potential role of thiamine supplementation in the treatment of sepsis-associated mitochondrial dysfunction. In addition, the researcher will conduct a prospective observational snapshot of the prevalence of thiamine deficiency in all patients admitted to ICU across a one month period, with a view to identifying point prevalence of thiamine deficiency in the ICU population. The findings of this study will be used to generate hypotheses and funding applications related to mitochondrial dysfunction and metabolic resuscitation in critical illness. The student undertaking this study will be expected to be involved in hypothesis generation, the application for future funding, and potentially involved in the conduct of future studies.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Enteral naloxone for the prevention of opioid-associated constipation in ventilated intensive care patients**

Constipation occurs commonly in Intensive Care Units (ICU), affecting up to 80% of patients, and can result in significant morbidity. The cause is likely to be multifactorial but probably relates at least in part to the administration of opioids for analgesia. The enteral administration of naloxone has been studied in ICU for the treatment of constipation, but not for prevention. Observational studies have reported encouraging improvements in bowel function, without an increase in pain. However, these studies have used intravenous (IV) formulations of naloxone, delivered enterally, which requires large volumes of IV preparations which are costly and impractical for ongoing regular enteral administration. An alternative to the enteral administration of IV formulations of naloxone is a combination opioid agonist/anatagonist therapy which has been shown to preserve bowel function in patients with chronic cancer pain. In this study, a commercially available enteral preparation of oxycodone/naloxone combination will be administered to ventilated patients who are receiving opioid therapy, and who have commenced enteral feeding, with a view to establishing whether oxycodone/naloxone administration results in decreased rates of constipation, and associated complications, in ventilated patients receiving IV opioids.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Resolution of elements influencing nutritional status after critical illness**

We are a dynamic and competitive group of ICU consultants, dietitians, nurses, scientists and PhD candidates based in Intensive Care at the Royal Adelaide Hospital. Led by Professor Chapman, ICU Research is a word-leader in nutrition, GI function and glucose metabolism in critical illness with an emphasis on clinically-focused, technically-challenging studies ranging from physiological studies to large NHMRC-funded clinical trials.

Nutrition delivery to critically ill patients is largely suboptimal, and patients experience significant muscle wasting leading to reduced functional capacity that persists well after hospital discharge. The proposed research project is a hands-on clinical study with the aim of determining the extent to which factors that affect nutritional status, including delayed gastric emptying, reduced glucose absorption, and hyper-catabolism, return to normal on the post-ICU ward in survivors of critical illness.

Our unit has successfully supervised seven medical students to First Class Honours, one who subsequently received a Rhodes Scholarship. All students have been first author on a high-impact publication and presented at major national or international meetings. Our program is particularly well-suited to students with an interest in acute care medicine, anaesthetics, endocrinology or gastroenterology.

**Project Supervisors:** Dr Lee-anne Chapple and Professor Marianne Chapman  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Heart rate variability as a predictor of elevated intracranial pressure in patients with traumatic brain injury**

Traumatic brain injury is a common condition that can lead to profound long-term disability and even death. Following severe head injury the brain swells inside the skull leading to high intracranial pressure. This high pressure limits the flow of arterial blood into the skull, reducing oxygen and glucose supply to the neurones and causes irreversible brain damage. It is crucial to identify elevated intracranial pressures so that urgent steps can be taken to reduce it. Currently, the only method of identifying the presence of elevated intracranial pressure is by the potentially dangerous technique of using catheters placed directly into the brain.

This project will involve the assessment of patients with traumatic brain injury in the Intensive Care Unit of the Royal Adelaide Hospital. The project aims to establish whether specific changes in neural modulation of heart rate, measured through the continuous electrocardiogram, can predict the development of elevated intracranial pressures without the need for invasive intracranial monitoring devices.

**Project Supervisor:** Dr Benjamin Reddi  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

HDR projects may be available with this group, please contact the lead researcher(s) for more information.

**Research areas**

Nutrition and Metabolic Health  
Immunology and Infection
The Intestinal Nutrient Sensing Group undertakes world-leading translational research on the intestinal sweet taste system. This system detects dietary sweet stimuli, and triggers a series of events, mediated by gut hormones, which coordinate the absorption and metabolism of glucose.

We have revealed regulation of this system by dietary and blood glucose, and dysregulation in people with diabetes, critical illness and obesity. We undertake clinical studies in the Royal Adelaide Hospital, and lab activities in SAHMRI Nutrition & Metabolism. We have expertise with genetic and disease models of disease, and in clinical research, to answer a range of research questions, including for 2018:

- Do artificial sweeteners disrupt control of blood glucose in human health and type 2 diabetes?
- Does blocking intestinal sweet taste receptors improve blood glucose control in patients with type 2 diabetes?

We collaborate widely, with active projects that engage cell biologists, microbiologists, clinicians and industry to extend our ability to deliver novel therapies for type 2 diabetes.

**Lead researcher:** Associate Professor Richard Young

**Email:** richard.young@adelaide.edu.au

**Honours project opportunities**

**Can blocking the sweet sensing ability of the gut improve blood glucose control for people with type 2 diabetes?**

Artificial sweeteners are widely consumed in the community. We have recently shown that their regular, high intake leads to faster entry of glucose to the blood, and impaired blood glucose control in healthy people in a clinical study. This change may explain how regular, high intake of artificial sweeteners increases the risk of developing type 2 diabetes.

We have also shown that people with type 2 diabetes may be at higher risk of worsening blood glucose control due to artificial sweeteners, as they already have a defect in this sensing and glucose uptake pathway.

This Honours and HDR project will investigate whether limiting the ability of the upper gut to detect sweet stimuli improves control of blood glucose levels in people with type 2 diabetes. This project will involve clinical research in the new RAH and anatomical and molecular experiments in SAHMRI.

**Project Supervisor:** Associate Professor Richard Young

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Friend or foe: How does the human gut respond to artificial sweeteners?**

In contrast to the view that artificial sweeteners are “nutritionally inert” we now know that they are detected in the gut in similar way to how sugars are recognised, and can impair control of blood glucose in healthy subjects. Artificial sweeteners may also alter blood glucose by changing the way gut bacteria are hosted or work, and how they communicate to the host.

This Honours or HDR project will examine basic mechanisms that signal the presence of artificial sweeteners in the human gut, and ways that sweeteners may change gut bacterial communities. This will involve research on gut function using ex vivo human tissues and measurement of signals released by artificial sweeteners, as well as experiments examining gut bacteria (metagenomics) in SAHMRI, and with collaborators.
Obesity and Metabolism Group
South Australian Health and Medical Research Institute (SAHMRI)

Associate Professor Leonie Heilbronn is Group Leader of the Obesity and Metabolism Group based within the Nutrition and Metabolism Theme at SAHMRI. Her research focus is to better understand the molecular and physiological basis of obesity and its co-morbidities, and in particular the role that insulin resistance plays in the aetiology of these conditions. Her research is at the interface between basic and clinical science, and she currently has research projects aimed at understanding mechanisms of insulin resistance in skeletal muscle and in adipose tissue utilising various environmental perturbations (e.g. overfeeding, calorie restriction, exercise, hyperbaric oxygen therapy). She is also keenly interested in the role of nutrition in healthy ageing and is a member of the Robinson Research Institute, where she also studies mechanism of insulin resistance in IVF.

Lead researcher: Leonie Heilbronn
Email: leonie.heilbronn@adelaide.edu.au

Honours project opportunities
Honours projects may be available. Please contact the lead researcher(s) for more information.

HDR project opportunities
Studying the role of fasting and time restricted feeding to reduce diabetes and cardiovascular risk in overweight humans and in mice
Availability: Semesters 1 and 2
Special requirements: Nil

Studying how altering circadian clocks and feeding out of phase impacts the risk of type 2 diabetes in humans and mice
Availability: Semesters 1 and 2
Special requirements: Nil

How overfeeding contributes to metabolic dysfunction in human obesity, with a particular focus on adipose tissue remodelling and skeletal muscle plasticity
Availability: Semesters 1 and 2
Special requirements: Nil

How hyperbaric oxygen therapy increases insulin sensitivity in obese individuals
Availability: Semesters 1 and 2
Special requirements: Nil

Research areas
Nutrition and Metabolic Health
Early Origins of Health
Translational Health Outcomes
Adelaide Health and Medical Sciences building (AHMS)

Lead researcher: Dr Tim Schultz
Email: tim.schultz@adelaide.edu.au

Honours project opportunities

Long term patient outcomes following implementation of an intervention to improve nutrition in hospital patients

This project will follow-up the outcomes of patients exposed to nutrition screening in a hospital setting to determine whether the intervention has a long term influence over outcomes like mortality, health service utilisation and patients' use of residential aged care.

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

Older people's perceptions and experiences of nutritional interventions for treating and preventing weight loss

A recently published umbrella review identified a lack of qualitative systematic reviews to help clinicians understand how to support older people to comply with interventions to treat and prevent weight loss. This project will conduct a systematic review as a Masters of Clinical Science. Further primary research could be conducted as part of a PhD.

Availability: Semesters 1 and 2

Research areas

Nutrition and Metabolic Health
Ageing, Frailty and Mobility
Translational Health Outcomes
Obesity is resistant to behavioural intervention, but to date, pharmacological approaches have had limited efficacy or unacceptable adverse effects. It is increasingly appreciated that the stomach plays an important role in appetite regulation. It is targeted in bariatric surgery and gastric vagal electrical stimulation to treat obesity. Our study of gastric vagal afferent (GVA) innervation has resulted in major contributions to our understanding of the role of these afferents in health and disease (e.g. obesity). These include: 1) Phenotypic specialisation of vagal sensory endings. Early work involved development of an in vitro preparation that enabled classification of vagal sensory endings. This nomenclature has been adopted worldwide and extended to other regions of the gut. 2) G-Protein Coupled Receptors (GPCRs) as modulators of gastro-oesophageal vagal afferent activity. Using pharmacological approaches we have demonstrated that GABAB receptor agonists inhibit peripheral gastro-oesophageal vagal afferent endings and thus GABAB receptors are potential target for gastro-oesophageal reflux disease. As a direct result of this work, GPCR modulation is now a major clinical target for many diseases. 3) Role of vagal afferents in food intake. Using innovative approaches we have demonstrated that satiety signals originating in the stomach can be modulated by appetite hormones including leptin and ghrelin. Together, these studies have highlighted the importance of the stomach in the regulation of food intake, the complex interplay between appetite hormones and vagal afferent activity and the changes that occur in high fat diet (HFD)-induced obesity.

Lead researcher: Professor Amanda Page
Email: amanda.page@adelaide.edu.au

Honours project opportunities

Novel new molecular targets for functional dyspepsia

Functional dyspepsia (FD) is a gastrointestinal disorder associated with recurrent bloating, early satiety (feelings of fullness), nausea and/or pain. There are two clinically distinct FD syndromes: 1) postprandial distress syndrome (PDS), where feelings of fullness occur early in the meal and there is persistent bloating after eating; and 2) epigastric pain syndrome.

Information about the amount and type of food eaten is sent from the gut to the hindbrain via specialised nerves called vagal afferents. Normally, these signals impact on our desire to eat and during a meal lead to the sensations of fullness and satiation that are intended to stop us eating. In FD, the vagal afferents appear to be oversensitive giving rise to heightened upper abdominal responses to gastric distension and the symptoms observed in PDS. Various ion channels mediate the conversion of mechanical stimuli (e.g. gastric distension) into a nerve action potential. The vagal afferents that carry signals from the stomach to the brain have a specialised ion channel called the transient receptor potential vanilloid 1 (TRPV1) channel. When this ion channel is activated the number of vagal afferent action potentials generated in response to distension of the stomach increase intensifying the satiety signal to the brain. Conversely, when this channel is deactivated the opposite occurs. This project will investigate the role of TRPV1 in the heightened sensitivity of vagal afferents to food related stimuli in an animal model of FD.

Availability: Semesters 1 and 2
Special requirements: Nil
ORAL HEALTH
Oral health is an essential component to a healthy life. Oral health is not only concerned with teeth, but the health of oral and related tissues that enables an individual to eat, speak and socialise without active disease, discomfort or embarrassment, and that contributes to general wellbeing.

Oral health research seeks to understand population and individual dental health to prevent or manage oral disease and to educate our community to maintain optimal oral health throughout their lives.

Our research spans a broad range of fields including: dental education; endodontics and pulp biology (stem cell research); periodontics; orthodontics; craniofacial biology; oral and maxillofacial surgery; forensic odontology; population oral health; and cancer treatment.

Our research activity also includes epidemiological studies focusing on the efficacy of population oral health interventions, oral health services and oral health policy analysis in relation to oral disease prevention and provision of optimal dental health services.

Researchers across the faculty are focused on:

- assessing intergenerational change in oral health in Australia
- monitoring of Indigenous oral health and the use of dental services
- performing population-based studies focusing on socioeconomic and psychosocial factors related to the use of dental services
- investigating patient-reported outcomes of dental care, such as oral health impact, health utility and quality of life.
Australian Research Centre for Population Oral Health

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.
Lead researcher: David Brennan
Email: david.brennan@adelaide.edu.au

Research areas
Oral Health

Craniocfacial Biology Research Group
University of Adelaide, North Terrace Campus, Adelaide Health and Medical Sciences building (AHMS)

Associate Professor Toby Hughes’ primary research interest is identifying genes associated with dental development and oral health. Other interests include genotype x genotype interactions associated with oral micro-flora, functional genomics of oral development, and epigenetic modulation of gene expression.

He is currently involved in a number of research projects with common underlying themes. One is modelling family data to establish the relative contributions of genes and environment to observed variation in features such as tooth size and spacing, cusp spacing, 3D surface morphology, arch shape, and occlusion. He has developed longitudinal models to identify common and unique genetic factors associated with the primary, mixed and permanent dentitions.

Another project is examining two closely related developmental events in Australian newborn twins—timing of emergence of the primary teeth and timing of colonisation of the oral cavity by Mutans streptococci, a primary agent in dental decay. Evidence suggests the prevalence of delayed tooth emergence is increasing in developed populations, presenting a smaller window of opportunity for colonisation and reducing the incidence of decay in primary teeth.

Both projects establish a baseline to develop models incorporating molecular data arising from the human genome project. We are planning to conduct genetic linkage and association analyses on data arising from both studies, to identify specific genes that contribute significantly to orofacial growth and development, and to oral health.

Lead researcher: Associate Professor Toby Hughes
Email: toby.hughes@adelaide.edu.au

Honours project opportunities
Epigenetics
Our group is interested in examining the role of DNA methylation in regulating dental development (missing and extra teeth; tooth size; dental anomalies) and disease risk (dental caries; systemic inflammatory conditions). Projects in this domain would suit students interested in genetics and epigenetics, with a particular interest in developing skills in bioinformatics and analysis/interpretation of whole-genome chip and sequencing-based approaches.

Availability: Semesters 1 and 2
Special requirements: Nil

The oral microbiome
We have a large ongoing collaboration with researchers in the US, Sydney and Melbourne examining the transmission, acquisition, proliferation and stabilisation of the oral microbiome, as well as examining its role in health and disease, both orally and systemically. Projects in this domain would suit a student interested in microbiology, with a particular interest in developing skills in bioinformatics and metagenomic sequencing.

Availability: Semesters 1 and 2
Special requirements: Nil

Craniofacial biology
Our group has a long track-record in collecting longitudinal growth records from large-scale national cohort studies, with an emphasis on craniofacial growth and development. Projects in this domain would suit a student interested in using novel methodologies (2D and 3D surface topography mapping; micro CT; geometric morphometrics) to describe normal human variation and disease states, with a particular interest in developing skills in biostatistics.

Availability: Semesters 1 and 2
Special requirements: Nil

Quantitative genetics
Our group has extensive phenotypic and genealogical records from many populations nationally and internationally, with a particular focus on longitudinal data from indigenous and twin cohorts in Australia. Projects in this domain would suit students interested in population/quantitative genetics, with a particular interest in developing skills in population genetics and associated analyses. The focus will be to parse out the relative influences of the genotype, and the shared and non-shared environments of individuals, on a range of craniofacial and whole-body phenotypes.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Epigenetics
Please see Honours entry

The oral microbiome
Please see Honours entry

Craniofacial biology
Please see Honours entry

Quantitative genetics
Please see Honours entry

Research areas
Oral Health
Early Origins of Health
Child and Adolescent Health
Translational Health Outcomes
Craniofacial Research Unit

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

Lead researcher: Professor Peter Anderson

Research areas
Oral Health

Dental Education Research Group
University of Adelaide, North Terrace Campus

Lead researcher: Associate Professor Tracey Winning
Email: tracey.winning@adelaide.edu.au

Honours project opportunities
Patient education in the internet age: what are practising clinicians experiences and challenges in using online health information for patient information and education?

This project aims to identify to what extent and how, general and specialist dentists in metropolitan and regional settings use online health information to communicate about oral health with their patients, and what issues or challenges may arise. Dental clinicians experiences of patients who source their own online health information and any challenges this may have presented for communication and patient education will also be investigated. This project will build on findings of a pilot undertaken with five dental clinicians and a related project with medical clinicians (Woodward-Kron et al. 2014). Recent research evidence shows that available health information on the internet presents both benefits and challenges for patients and their health professionals. Currently, only limited survey research focused on only some key issues has been undertaken in dentistry. A range of dental clinicians will be recruited to participate in a qualitative, interview based investigation. Interview data will be analysed in terms of contexts, purposes, resources, processes, and issues related to using online health information to inform and educate patients. Project outcomes will provide an evidence-base for a subsequent project developing continuing professional development and dental curriculum learning activities to address effective patient education in the internet age.

Availability: Semesters 1 and 2

Special requirements: Nil

Exploring the predictors of high achievement for Bachelor of Oral Health students at the University of Adelaide

Profile data, academic achievement and selection score data has been collected and was used to predict high achievement amongst cohorts from 2002-2009. The project will be expanded to include the more recent cohorts and note if there are any significant changes since the first study published in 2012. Tracking the performance of Bachelor of Oral Health students over the three years of their degree using demographic, profile data, prior learning, work experience, schooling is important to inform selection, curricula, and marketing of the program.

Project Supervisor: Dr Suzanne Gardner
Availability: Semesters 1 and 2

Special requirements: Nil

Exploring characteristics of oral health students and whether their socio demographic is representative of the general population

Data has been collected from Bachelor of Oral health student cohorts, University of Adelaide, from 2005-2017. Recent studies have reported on career aspirations of this group and intentions for further study. There is much more to explore including the level of dental anxiety and previous dental experiences of the students and how this may impact on their clinical performance.

Project Supervisor: Dr Suzanne Gardner
Availability: Semesters 1 and 2

Special requirements: Nil

Optimising the educational impact of longitudinal evaluations of performance in dental workplace-based settings: experiences and outcomes of feedback discussions.

This project will investigate the experiences and outcomes of final-year dental students feedback discussions with their clinical educators in hospital and community dental clinical practice settings. These discussions are part of longitudinal clinical evaluations students when they provide direct patient care. They aim to support students achieving required patient care standards by students identifying performance gaps and learning goals, and monitoring their performance longitudinally, using clinical educator feedback. However, these outcomes are dependent on students and dental educators perceptions and experiences of the purposes, identities, relationships and experiences of these discussions. Currently, there is only limited evidence of the educational impact of these feedback discussions, particularly in dental workplace based settings. Final year dental students and their clinical dental educators will be recruited to participate in a qualitative study involving both group and individual interviews. Interviews will focus on students and clinical educators experiences, particularly related to significant or memorable incidents of previous feedback discussions, including how these discussions helped students improve their performance. Data will be analysed thematically involving identification of recurrent patterns and themes.

Project outcomes will inform the design of core learning activities for students and clinical educators to optimise the educational impact of feedback discussions.

Availability: Semesters 1 and 2

Special requirements: Nil

Qualitative study of dentists attitudes toward the future of dentistry in Australia

A nationwide survey was conducted in 2013 and included a random sample of Australian practicing dentists. The purpose of the study was to explore the characteristics of the small proportion of dentists who orientated their practice towards disadvantaged groups. The survey included an open ended question which invited comment. The Honours project would be conducting a thematic analyses of this information to identify any significant recurring themes, impressions, or opinions of the respondents. A nationwide survey was conducted in 2013 and included a random sample of Australian practicing dentists. The purpose of the study was to explore the characteristics of the small proportion of dentists who orientated their practice towards disadvantaged groups. The survey included an open ended question which invited comment. The Honours project would be conducting a thematic analyses of this information to identify any significant recurring themes, impressions, or opinions of the respondents.

Project Supervisor: Dr Suzanne Gardner
Availability: Semesters 1 and 2

Special requirements: Nil
HDR project opportunities

Other HDR projects may be available with this group, please contact the lead researcher(s) for more information.

Job satisfaction of oral health practitioners and whether job satisfaction is linked to scope of practice as the terms of employment

Specific studies on job satisfaction have been conducted amongst Australian dentists therefore it is timely to compare whether findings are similar for oral health therapists.

Project Supervisor: Dr Suzanne Gardner
Availability: Semesters 1 and 2
Special requirements: Nil

Association between perceived workplace choices in early years of the Bachelor of Oral Health program and actual work placements after graduation

How closely do these aspirations align? The findings would be important for recruitment, workplace retention, and career promotion.

Project Supervisor: Dr Suzanne Gardner
Availability: Semesters 1 and 2

Research areas

Oral Health
Neuroscience, Behaviour and Brain Health
Indigenous and Disadvantaged Health
**Endodontics**

*The Adelaide Health and Medical Sciences building (AHMS)*

**Lead researcher:** Professor Giampiero Rossi-Fedele  
**Email:** giampiero.rossi-fedele@adelaide.edu.au

**Research project opportunities**  
Higher Degree by Research or Honours project opportunities may be available. Please contact the lead researcher(s) for more information.

**Research areas**  
Oral Health

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**Forensic Odontology**

**Research project opportunities**  
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

**Lead researcher:** Dr Denice Higgins  
**Email:** denice.higgins@adelaide.edu.au

**Research areas**  
Oral Health
Oral Epidemiology at the Australian Research Centre for Population Oral Health

Adelaide Health and Medical Sciences building (AHMS)

The Australian Research Centre for Population Oral Health (ARCPOH) is Australia’s pre-eminent population oral health research body undertaking dental research and provides a broad range of dental and oral health statistics for Australia.

ARCPOH was established at the University of Adelaide in 2001 to undertake research and research training in population oral health that is internationally recognised to be of the highest quality. In addition to the University, ARCPOH’s stakeholders include government agencies, dental organisations, and private corporations.

Oral Epidemiology is a main research strength of ARCPOH. A number of NHMRC-funded research projects are being conducted. The Study of Mothers’ and Infants’ Life Events Affecting Oral Health (SMILE) is described below. Being funded by two consecutive NHMRC Project Grants from 2013 to 2022, the study will follow a population-based sample of Australian children and their mothers from birth to the age of seven years.

Lead researcher: Associate Professor Loc Do
Email: loc.do@adelaide.edu.au

Honours project opportunities
Determinants of child oral health – a population-based birth cohort study

The SMILE study is a population-based birth cohort study established in 2013 in SA aiming to investigate socio-demographic and modifiable factors that influence the longitudinal development of child oral health from birth to school age. Over 2000 mother/child dyads had been recruited and followed. Questionnaire data have been collected at age 3, 6, 12 and 24 months. Clinical oral examinations and height and weight of children and mothers were conducted when children had turned 24 months. Data on socioeconomic status at area- and household levels are collected at multiple time points. Extensive data on diet, health behaviours and practice of mothers and children, physical activities, dental visiting patterns and measures of behaviours have been collected. Questionnaire and oral examination data will be conducted again when children turn five and seven years under the current NHMRC funding.

Multiple HDR and Honours projects may be available with this group, please contact the lead researcher(s) for more information.

Project Supervisors: Associate Professor Loc Do and Dr Diep Ha
Availability: Semesters 1 and 2
Special requirements: Nil

HD project opportunities
Determinants of child oral health – a population-based birth cohort study
Please see Honours entry.

Research areas
Oral Health
Child and Adolescent Health

Orthodontics

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

Lead researcher: Professor Craig Dreyer
Email: craig.dreyer@adelaide.edu.au

Research areas
Oral Health

Paedodontics

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

Lead researcher: Professor Sam Gue

Research areas
Oral Health

Prosthodontics

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

Lead researcher: Professor James Dudley
Email: james.dudley@adelaide.edu.au

Research areas
Oral Health

Tooth Wear and Dental Materials

Research project opportunities
Higher Degree by Research or Honours project opportunities may be available with this group. Please contact the lead researcher(s) for more information.

Lead researcher: Associate Professor John Kaidonis, Dr Sarbin Ranjitkar
Email: john.kaidonis@adelaide.edu.au, sarbin.ranjitkar@adelaide.edu.au

Research areas
Oral Health
Oral Health

Health.

There is also accumulating evidence showing an association between oral diseases and their impact on general human health. More recently our research has focused on the relationship between extra-oral diseases as a result of the migration of oral bacteria to niches not normally associated with colonisation. Oral diseases such as periodontitis allows oral bacteria to gain entry to the circulatory system where they can potentially migrate and infect other areas of the body. Diseases such as diabetes, cardiovascular disease, arthritis and adverse pregnancy outcomes are only a few of the pathologies linked to oral diseases.

We also investigate the development and removal of multi-species and axenic bacterial biofilms grown on natural substrates using 3D-printed flow cells. In particular we are investigating the effectiveness of D-amino acids in dispersing and inhibiting biofilm development using species of bacteria that contribute to dental caries. We have been successful in obtaining funding from the Australian Dental Research Foundation.

**Honours project opportunities**

**Disruption of multi-species endodontic biofilms using D-amino acids incorporated into polymer encapsulated particles**

The goal is to produce an endodontic medicament that contains an antimicrobial agent (calcium hydroxide) and a biofilm breaker (D-amino acids-DAAs) that will, in combination, disrupt and destroy the bacterial biofilm associated with disease. The work is based upon our previous in-vitro study.

Disruption of the biofilm will render bacteria more susceptible to killing by antimicrobial agents and this will be done by incorporating DAAs as biofilm breakers in polymer encapsulated nanoparticles (N-DAAs) into the calcium hydroxide paste. This should provide a sustained release of DAAs over a similar time period consistent with established clinical protocols.

We have published research that shows that E. faecalis promotes biofilm growth as part of the organisms coordinated stress response to sub-MIC levels of the endodontic irrigant, sodium hypochlorite. To counteract this, we propose the use of N-DAAs will disrupt biofilm growth and therefore reduce the organisms resistance to treatment, based on our previous in-vitro study.

**Project Supervisor:** Dr Peter Zilm  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**The development of ‘intelligent’ particles as a targeted antimicrobial and anti-biofilm delivery system for oral care**

Lifestyle and dietary changes can lead to the proliferation of particular pathogenic species which inhabit the mouth and lead to the development of significant oral diseases such as dental caries, periodontal disease and candidiasis. Their impact is significant when considering the effect on the quality of life of individuals and the cost to the community. There is also accumulating evidence showing an association between oral diseases and their impact on general human health.

We aim to provide a solution by developing a new generation of ‘intelligent’ antimicrobial and anti-biofilm particles specifically designed to improving oral health. At the end of this project, we expect to provide a working intelligent anti-biofilm/bacterial mouthwash that could be used for preclinical and clinical trials.

**Project Supervisor:** Dr Peter Zilm  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Is the dysbiosis of the gut microbiome and subsequent inflammation caused by changes in the gut metabolome of pregnant mice with periodontitis?**

Research in recent years has shown the gut microbiome to be a key to human health. Our research has shown that the gut microbiome is significantly altered at both the phylum and genus levels following induction of periodontitis by oral inoculation of P. nucleatum and P. gingivalis. Additionally, this modification was associated with a significant change at a physiological level, as detected by significantly increased inflammation of the gastrointestinal tract.

To better understand the link between periodontal disease, gut microbiome and increased inflammation in the GI tract, its pivotal to get a better understanding of the activity of the gut microbiome by identifying the metabolites produced. This will allow us to link changes at the physiological level, like increased inflammation of the gastrointestinal tract with observed in the gut microbiome.

**Hypothesis:** A dysbiosis in the gut microbiome as a result of P. nucleatum and P. gingivalis induced periodontitis in pregnant mice causes a change in the gut metabolome that maybe detrimental to the health of the mother and fetus.

**Project Supervisor:** Dr Peter Zilm  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**The effectiveness of D-amino acids at inhibiting and removing supra-gingival oral biofilms**

The goal of the research is to investigate the effectiveness of D-amino acids (DAAs) in dispersing and inhibiting biofilm development using species of bacteria that contribute to dental caries. DAAs may disperse biofilms of mixed and axenic cultures, as well as inhibit biofilm development. We aim to back up studies that claim DAAs disassemble the extracellular anchors of the biofilm structure by mis-incorporation into the peptide side chain of peptidoglycan, which ultimately breaks down the biofilm structure. We will also investigate if DAAs are toxic to epithelial cells in vitro, as a preliminary test in the safety of their use in the oral cavity. Our team has published work that shows DAAs have significance in the treatment of Enterococcus faecalis biofilms in the application of root canal treatment, by successfully showing these effects on supra-gingival biofilms using bacteria that contribute to dental caries, in static and flow cell conditions, further studies may see products developed which patients can use in their oral hygiene routine, or as a treatment during dental visits to maintain their oral health.

**Project Supervisor:** Dr Peter Zilm  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Azithromycin modulation of osteoclasts in an induced inflammatory environment in vitro**

Periodontal disease is initiated by the host immune response to bacterial infection of the subgingival tissue resulting in destruction of the tissues supporting the teeth and thought to result from the immune response and is driven by bacteria and their products. A key feature of chronic periodontal disease is alveolar bone loss resulting from increased formation and activity of osteoclasts, the cells responsible for bone resorption, driven by cytokines present in inflamed periodontal tissues.
Currently, the most common non-surgical treatment for periodontal disease is routine scaling and debridement. However, in some cases persistent inflammation and tissue damage remain, therefore, adjunctive therapy may be required and are required to target both the inflammation and bone loss associated with bacterial infection.

Our group is exploring the use of azithromycin (AZM, an antibiotic) in cases where conventional periodontal therapy is inadequate. Azithromycin (AZM) has bacteriostatic and immunomodulatory properties in addition to several advantages over alternative antibiotics. Our previous publications indicate that AZM inhibits cytokine production by gingival fibroblasts exposed to Porphyromonas gingivalis (periodontopathogen) lipopolysaccharide and under ‘normal conditions, AZM inhibits osteoclast differentiation and activity in vitro. Our current aims are to determine if AZM effects osteoclast development and function in an inflammatory environment.

**Project Supervisor:** Dr Tracy Fitzsimmons

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Benefits of omega-3 fatty acids and their derivatives in periodontitis and rheumatoid arthritis**

The relationship between periodontitis and rheumatoid arthritis (RA) has been a longstanding research topic within our group. Key features of both diseases include local and systemic inflammatory components and significant bone loss resulting from increased formation and activity of osteoclasts, the cells responsible for bone resorption.

RA patients are prescribed a number of medications to reduce pain and swelling of joints but in some cases, severity and disease progression continues. Fish oil is a source of omega-3 polyunsaturated fatty acids (PUFAs) and due to its anti-inflammatory effects is an adjunct treatment. In addition, other components of fish oil may be beneficial as they promote resolution of inflammation. Adjunctive omega-3 PUFAs reduce disease activity in RA patients (published data). Furthermore, our preliminary studies demonstrate a role for pro-resolving lipid mediators in modifying formation and activity of osteoclasts in vitro. Therefore, this project is aimed at increasing our knowledge of the benefits of fish oil and its derivatives in the management of both periodontitis, RA and other chronic disease states such as diabetes and cardiovascular disease, initially on osteoclast formation and activity and establishing if a relationship with inflammatory biomarkers exists.

**Project Supervisor:** Dr Tracy Fitzsimmons

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

- Disruption of multi-species endodontic biofilms using D-amino acids incorporated into polymer encapsulated particles
  
  Please see Honours entry

- The development of ‘intelligent’ particles as a targeted antimicrobial and anti-biofilm delivery system for oral care
  
  Please see Honours entry

- The effectiveness of D-amino acids at inhibiting and removing supra-gingival oral biofilms
  
  Please see Honours entry

- Benefits of omega-3 fatty acids and their derivatives in periodontitis and rheumatoid arthritis
  
  Please see Honours entry

**Research areas**

- Oral Health
- Musculoskeletal Health
- Pregnancy and Birth
- Immunology and Infection
PREGNANCY AND BIRTH
Most prospective mothers anticipate healthy and problem-free pregnancies. However, in reality complications are common, with a quarter of Australian pregnancies affected by one or more conditions that can have serious, lifelong health implications for the mother and her baby.

The most common conditions affecting Australian pregnancies are preeclampsia, preterm birth, foetal growth restriction and gestational diabetes. Their cost for individuals, families and communities is enormous, and can last a lifetime.

The Robinson Research Institute leads our research in pregnancy and birth and has an outstanding record of success in the area. This success relates to the cross-disciplinary capability and bench-to-bedside approach, which has led to major improvements in the health outcomes of mothers and babies. A more in-depth explanation of this research area is available on the Robinson Research Institute’s website.
The Central and Northern Adelaide Renal and Transplantation Service (CNARTS) Clinical Research Group (CRG) has an active research program encompassing basic laboratory research (Centre for Clinical and Experimental Transplantation), epidemiology of renal disease via the ANZDATA registry and participation in National and International multi-centre clinical trials via the Clinical Trials Unit. Led by Dr Shilpa Jesudason, the research group is currently pursuing mixed methodology research across a range of patient-centred themes, with the goal of evidence-based change to clinical practice and improvement of clinical care. Including:

- Quality of life for Patients with chronic kidney disease (CKD), Dialysis and Transplantation
- Gut health in patients with CKD, Dialysis and Transplantation
- Kidney disease and pregnancy outcomes
- ANZDATA registry and other population data analyses in pregnancy outcomes for kidney transplant recipients and women with kidney disease
- Epidemiological outcomes for patients with CKD, Dialysis and Transplantation
- Clinical transplantation
- Vasculitis and glomerulonephritis

**Lead researcher:** Dr Shilpa Jesudason

**Email:** shilpa.jesudason@sa.gov.au

**Honours project opportunities**

**Individualising transplantation therapy**

The success of kidney transplantation depends largely on preventing rejection of the new organ, using a combination of immunosuppressant drugs. These drugs have narrow therapeutic indices and can cause renal, gastrointestinal or haematological toxicity. Due to significant variability in their elimination from the body, doses are currently individualised by targeting therapeutic concentrations in blood. Despite this, rejection and toxicity still occur. Our research focuses on understanding immunosuppressant distribution into lymphocytes (the mediators of rejection) and renal tissue (a major site of toxicity), as a means of better predicting individual risk of rejection and damage to the transplanted organ.

**Project Supervisor:** Dr Shilpa Jesudason

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**ANZDATA registry and other population data analyses in pregnancy outcomes for kidney transplant recipients and women with kidney disease**

ANZDATA registry and other population data analyses in pregnancy outcomes for kidney transplant recipients and women with kidney disease.

The Central and Northern Adelaide Renal and Transplantation Service (CNARTS) is the largest renal unit in South Australia. We provide dialysis services to approximately 700 patients (around 100 receiving peritoneal dialysis and 600 receiving haemodialysis), support around 900 existing transplant recipients and perform 65-80 transplants per year.

**Project Supervisor:** Dr Shilpa Jesudason

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Individualising transplantation therapy**

Please see Honours entry

**Research areas**

Pregnancy and Birth

Translational Health Outcomes
Our research group is focused on improving health outcomes for individuals that require blood management as a part of peri-operative or peri-partum care. Patient Blood Management (PBM) improves patient outcomes by ensuring that the focus of the patient’s medical and surgical management is on optimising and conserving the patient’s own blood. The PBM group is led by Associate Professor Bernd Froessler who is a clinical affiliate of the University of Adelaide and the Robinson Research Institute based at the Lyell McEwin Hospital. Our team has a strong focus on patient-related outcomes linked to iron deficiency, iron infusion and general perioperative blood product management. Our growing laboratory has a multidisciplinary focus, giving students the opportunity to gain experience in scientific research that informs direct clinical outcomes.

The Protective Trial is a keystone project established by our group for the administration of variable doses of intravenous (IV) Ferric Carboxymaltose to iron deficient women during pregnancy and in the post-partum period. The development of iron deficiency and anaemia during pregnancy has been associated with serious pregnancy complications including cardiovascular disease, poor mental health, preterm birth and fetal growth restriction. Iron deficient women are also at greater risk of morbidity or mortality following post-partum haemorrhage. We understand that iron supplementation is protective in these scenarios, therefore our trial is investigating anaemia, quality of life and mental health outcomes during pregnancy and 12 months following delivery. This will provide insight into mechanisms and risk factors for iron deficiency, as well as trial an effective intervention to protect against adverse maternal, fetal and neonatal outcomes.

Lead researcher: Associate Professor Bernd Froessler
Email: bernd.froessler@adelaide.edu.au

Honours project opportunities
Iron metabolism in pregnancy
Iron deficiency affects up to 50% of pregnancies and is associated with serious complications including cardiovascular disease, maternal depression, preterm birth and fetal growth restriction. Intravenous (IV) iron offers an attractive approach for treating iron deficiency (ID). It is well-tolerated, efficacious and safe.

Currently, there is sparse understanding of the mechanisms of iron metabolism during pregnancy that may predispose women towards adverse health outcomes. Our group established the Protective Trial in 2015 to assess whether different doses of antenatal IV iron (ferric carboxymaltose) were successful in replenishing and sustaining iron stores in pregnant iron deficient women. As part of the trial, we established a biobank that captured maternal blood, placenta and cord blood samples over a 12 month follow-up period.

We seek to characterise iron metabolism in our sample to investigate biological determinants that could be predictors of poor health outcomes. The results of our trial will inform future management of iron deficiency in pregnancy and support reviews of IV iron administration. This Honours project will involve laboratory-based analysis of gene and protein expression in samples of maternal blood, cord blood and placenta. Project outcomes are negotiable in collaboration with the student’s interests and qualifications.

Project Supervisors: Associate Professor Bernd Froessler, Dr Natalie Aboustate
Availability: Semesters 1 and 2
Special requirements: Nil

Hypophosphatemia following iron Infusion in pregnancy
Hypophosphatemia is usually asymptomatic, but has been associated with anorexia, muscle weakness and osteomalacia. In severe cases, it may lead to respiratory and cardiac failure. Hypophosphatemia is characterised by low levels of Phosphate in the serum, often due to increased iFGF23 that reduces resorption of Phosphate by the renal system. Some have indicated a transient decrease in serum phosphate following FCM transfusion and there are concerns with its use in pregnancy. If hypophosphatemia occurs more significantly and persistently over time during pregnancy, it may expose the foetus and mother to additional stress during this vulnerable period of development- particularly where there are co-morbid disorders evident.

Through the Protective trial, we established a cohort of iron deficient women who received repeated FCM infusions over time. We intend to reassure the safety of IV FCM use through characterising phosphate system in these women’s blood and looking at pregnancy outcomes in association with phosphate. This project aims to understand the incidence of hypophosphatemia in this sample of women and how it affects delivery and health outcomes over time. This project will involve laboratory-based analyses of serum phosphate in biological samples and associated clinical case note review and analysis.

Project Supervisors: Associate Professor Bernd Froessler, Dr Peter Palm, Dr Natalie Aboustate
Availability: Semesters 1 and 2
Special requirements: Nil
The role of preoperative iron supplementation in neoadjuvant chemo radiotherapy response rates and perioperative morbidity and mortality in rectal cancer patients

Rectal malignancy is common (5,114 cases in 2011), with many of these patients developing iron deficiency (ID) and/or anaemia. Anaemia is associated with a worse prognosis and response to therapy in patients suffering from colorectal malignancy.

Iron supplementation in anaemic patients with malignancy has been shown to decrease transfusion rates and shorten patients' lengths of stay. Additionally, blood transfusions often result in poorer outcomes for patients suffering from colorectal malignancy, with growing evidence that patients with ID anaemia do not respond as well to adjunctive chemo radiotherapy. Despite this, iron replacement perioperatively remains sporadic. Improving the management of ID in colorectal cancer has resulted in a higher awareness of the benefits of iron, regular testing and replacement. It is also suspected that iron supplementation is associated with an improved response to chemoradiotherapy in patients with colorectal cancer.

This study seeks to compare two groups of patients: those with sporadic iron supplementation and those who were managed more uniformly (recruited over different time periods). We aim to assess the role of iron in response to adjunctive therapies. The project will involve examination of histopathological samples and clinical case note review to identify associated morbidity, length of stay and overall health outcomes.

**Project Supervisors:** Dr Elizabeth Murphy, Associate Professor Bernd Froessler, Dr Natalie Aboustate

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**Research areas**

- Pregnancy and Birth
- Translational Health Outcomes
- Surgical and Health Systems Innovation
- Cancer Biology and Clinical Oncology
Placental Development Laboratory
Adelaide Health and Medical Sciences building (AHMS), Lyell McEwin Hospital

The four main complications of pregnancy—preeclampsia, preterm birth, intrauterine growth restriction and gestational diabetes—affect 1 in 4 first pregnancies and are life threatening to the mother and/or baby in up to 6% of pregnancies.

Globally, more than 300,000 women die each year from complications of pregnancy and childbirth. Additionally, there are 15 million preterm births annually and this is considered the greatest factor contributing to the 6 million children who die before their fifth birthday. There are currently no screening tools in clinical practice to identify pregnant women at risk, largely because of a poor understanding of the pathogenesis of pregnancy complications and the complex inter-relationships in causal factors.

The Placental Development group have established pregnancy cohort databases and biobanks, and ex vivo, in vitro and animal models to investigate: the molecular profile of the placenta across gestation at the genome and epigenome levels; molecular mechanisms by which fetal sex impacts pregnancy outcome; and how micronutrients impact placental development and function in vivo and in vitro and pregnancy success.

In 2016, we filed a PCT patent application for our algorithms that predict a first-time mother’s risk of pregnancy complications early in her pregnancy. We identified molecular pathways in the placenta that are perturbed in pregnancy complications and demonstrated important effects of gene environment interactions on placental differentiation and function, and fetal growth. Our research program in human pregnancy and mouse models is revealing novel molecular mechanisms by which maternal micronutrient status impacts placental and fetal development and function.

Lead researcher: Professor Claire Roberts
Email: claire.roberts@adelaide.edu.au

Honours project opportunities
Molecular regulation of placental function in health and disease
Using RNA sequencing, we have identified a number of genes that are switched on in the human placenta during distinct stages of pregnancy. We believe disruptions to the expression of these genes can lead to common pregnancy complications such as preeclampsia, which can arise from abnormal placental development. We have constructed a biobank of human placental tissues from first trimester, second trimester and term pregnancies and from pregnancies complicated with common pregnancy complications.

The Honours student will utilise our placenta biobank to investigate the roles of a small number of genes and identify what placental cell types they are expressed within. Students will gain experience in quantitative PCR, immunohistochemistry, and primary cell culture. This project would suit a student interested in learning molecular techniques, and the outcomes of this research will help understand how the placenta changes at the molecular level throughout normal and complicated pregnancies.

Availability: Semesters 1 and 2
Special requirements: Nil

Postnatal health
The effects of adverse pregnancy outcomes and intrauterine environment on health of women and offspring are now well established. Women who develop preeclampsia, gestational diabetes, deliver small for gestational age (SGA) infants or deliver preterm are at increased risk of later life vascular diseases compared to women who have uncomplicated pregnancies. Emerging evidence suggests that children born of a complicated pregnancy may also be at increased risk. However, most evidence comes from retrospective studies. Identifying the prevalence of risk factors for vascular disease after pregnancy complications as well as after exposure to adverse intrauterine conditions will allow early targeted interventions to reduce the subsequent burden of vascular diseases. This project aims at following up women and children of a large pregnancy cohort to identify cardiovascular risk factors within a few years after delivery of the first child.

Availability: Semesters 1 and 2
Special requirements: Nil

Maternal diet quality and offspring telomere length
Telomeres are located at the ends of chromosomes and shorten with each cell division. In situations of high oxidative stress or inflammation, telomeres shorten even further. Increasing telomere shortening is associated with chronic diseases. There is increasing evidence that nutritional factors are associated with telomere length, thus poor quality and low micronutrient diets could potentially result in erosion of telomeres and contribute to chronic disease. However, there is little information about telomere length in pregnancy and infancy. Offspring exposed to adverse intrauterine exposures such as poor diet may have shorter telomeres at birth and during childhood, thus already placing them at greater risk for chronic disease in later life. The aim of this project is to determine whether maternal dietary quality is associated with telomere length in mum, baby and child. The student will gain experience in dietary questionnaires and quantitative real time PCR.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities
Molecular regulation of placental function in health and disease
Please see Honours entry.

Postnatal health
Please see Honours entry.

Research areas
Pregnancy and Birth
Early Origins of Health
Nutrition and Metabolic Health
Our research focuses on how communities respond to and participate in healthcare, with particular emphasis on public health issues. We aim to ensure that the views and experiences of community members, including citizens, patients, consumers and stakeholders, are included in health research, policy and service delivery. We use a variety of research methods, including qualitative, quantitative and deliberative methods often through an ethical lens or with a critical stance. We collaborate widely, with other staff of the School and more broadly with researchers, clinicians and policy makers in SAHMRI, the Women’s and Children’s Health Network, SA Health, Cancer Council Australia, the Northern Adelaide Local Health Network, as well as internationally in countries such as Myanmar, Indonesia and East Timor. Recent projects include:

• Review of maternal deaths in Indonesia
• Snakebite prevention in Myanmar
• Primary health care and chronic disease and risk management
• Counselling and psychotherapy
• Health care policy
• Health systems and services
• International health
• Community engagement (Indigenous and non-Indigenous)

Lead researcher: Associate Professor Afzal Mahmood
Email: afzal.mahmood@adelaide.edu.au

Honours project opportunities

Improving the health outcomes for pregnant women in Kutai Kartanegara District, East Kalimantan, Indonesia

Health Services Intervention Research in urban and rural areas aimed at improving the health outcomes for pregnant women and comparing the outcomes before and after introducing a spectrum of changes in 8 health centres catchment areas and at three hospitals. You will learn about the health system in a developing country, safe motherhood services and quality of care as a reason to stalled decline in maternal mortality.

Project Supervisors: Dr Afzal Mahmood, Professor Peng Bi
Available for: Honours, PhD (Mphil), Master of Public Health
Availability: Semesters 1 and 2

Special requirements:

Essential: At least a Credit average in epidemiology and biostatistics and ability to use SPSS.
Desirable: prior participation in quantitative study or data collection/entry, motivated (and have time) to travel and learn in cross-cultural setting

There may be funding available for one airfare to Indonesia. Note that: The student will need his/her own funding for living and accommodation for about 3 months in Indonesia (about $500 – $1000 a month).

Referrals from health centres to frontline hospital to teaching hospitals: Policy and effect of a pyramidal referral system on delays in accessing care and health outcomes for women and babies

The student will learn about health systems in developing countries, quality of care concepts particularly the concept of early and effective referral and coordinated care, health system policies that impact on access, timeliness and quality of care.

Project Supervisor: Dr Afzal Mahmood
Available for: Honours, PhD (Mphil), Master of Public Health
Availability: Semesters 1 and 2

Special requirements:

Good understanding of basic concepts of health system and of the concepts such as integrated care, social and system factors affecting access to care, determinants of health; access to care; motivated to travel and learn in cross-cultural setting.

There may be funding available for one airfare to Indonesia. Note that: The student will need his/her own funding for living and accommodation for about 3 months in Indonesia (about $500 – $1000 a month).

Research areas

Pregnancy and Birth
Public Health
SURGICAL AND HEALTH SYSTEMS INNOVATION
Surgical innovation, and indeed all innovation in the health system, significantly enhances the quality and length of life for many in our community, and enables health services to reach more of our community.

Our researchers are working to enhance the quality, effectiveness and sustainability of surgical and health systems innovation at all levels. Our research addresses the many challenges of bringing health innovations into practice, including validating the innovation, justifying the economics, influencing the policies and spreading the knowledge to implement these new approaches.

Using evidence-based assessment, researchers test the efficacy and safety of the innovation, model the costs of implementation, and finally garner the support of the health industry, health service providers, policymakers and the community to implement the innovation. This exciting and challenging field can yield highly rewarding results that benefit society for years to come.

Researchers across the faculty are focused on:

- developing and evaluating the efficacy of new therapeutics
- evaluating new, less invasive diagnostic technologies to lower patient risk, improve the patient experience and reduce health service costs
- performing large-scale, multi-centre clinical trials to rigorously assess treatments and predictive diagnostic tests
- performing longitudinal studies to monitor patient health status and quality of care to identify problems in the health system’s delivery of services
- performing long-term analysis of total-joint-replacement patients to analyse prosthetic failure, assessing the device, the biomaterials and methodology
- assessing the impacts of health policies and implementation of preventative health interventions.
Our group brings together engineers, clinicians, physicists and computer scientists to design and build novel imaging devices to explore the body, and then translate these devices into clinical usage. We have a particular focus on developing new optical imaging technologies, and have strong research programs in optical coherence tomography and fluorescence imaging. Much of our work involves our ‘imaging needle’ technology highly miniaturised optical imaging probes small enough to be encased within a needle, and we have active programs extending this work to brain cancer and lung disease.

We have a range of PhD and Masters projects, extending from theoretical developments in optical modelling, through hardware and software development, and to clinical translation. Most projects will focus on one of these aspects, but may involve aspects of all of them. Specific projects include:

- **3D printing of miniaturised optical lenses.**
- **Accurate quantification of brain cancer using intra-operative fluorescence by developing a mathematical model to correct for fluorescence attenuation.**
- **Development of high-speed imaging needles for intra-operative guidance.**
- **Development of image processing techniques for automatic quantification of blood flow using optical coherence tomography.**
- **Use of convolutional neural networks for segmentation of optical images.**

Our Honours projects are closely integrated with the work of our post-doctoral researchers. Your project will form a part of one of the larger research projects in the group, typically focused on optics hardware, software development, or clinical application of optical imaging. The PhD and Masters projects listed above give a good indication of the range of potential projects, but are adapted to a one-year Honours timeline. You are encouraged to come and talk to the head of the group, Professor Robert McLaughlin, to discuss the currently available topics.

**Lead researcher:** Professor Robert McLaughlin  
**Email:** robert.mclaughlin@adelaide.edu.au

**Honours project opportunities**

**3D printing of optical calibration objects for high resolution medical imaging**

Our group develops highly novel imaging scanners that scan the body using optical coherence tomography. When developing and using these scanners in medical trials, it is important to regularly acquire scans of standardised, calibration objects. Examining the scans of these calibration objects allows us to rapidly identify when there are problems with the scanner. In this project, the student will first gain a deep understanding of the physics underlying optical coherence tomography to understand which aspects of the scanner are important to characterise. The student will then design a set of calibration objects that will allow us to easily assess the quality of the scanner. To fabricate the calibration objects, the student will use our recently-purchased Form2 SLA 3D printer from FormLabs, USA.

**Project Supervisors:** Professor Robert McLaughlin, Dr Jiawen Li  
**Availability:** Semesters 1 and 2  
**Special requirements:** Applicants must have a strong background in optics and photonics, and practical experience in building optical setups.

**HDR project opportunities**

**Imaging and sensing of cellular signalling molecules via an optical fibre probe**

Previously, imaging and sensing devices have been limited to low resolution or the use of separate devices, which restricts our ability to study complex biological activities deep in a living organism. For the first time, we demonstrated that both imaging and sensing functions can be realized simultaneously via a single, optical fibre probe, with a diameter of 130 µm - comparable to that of a single strand of human hair. Such a probe will enable real-time image-guided sensing for cellular signalling molecules deep in body in vivo by a minimally-invasive approach.

In this project, the PhD/Masters student will first work with engineers in our group to develop a combined imaging+sensing fibre-optic probe that is targeted to measure a specific physiological process. There are several different physiological processes that may be chosen, depending upon the interest of the student. These include measuring H2O2 production by an embryo, a hallmark of embryonic stress; or real-time local measurement of cytokines, signalling molecules that control cell survival, growth, differentiation, etc. In the second half of the project, the PhD/Masters student will work with embryologists or immunologists to study the concentration and distribution of the cellular signalling molecule deep in live animals.

**Project Supervisors:** Professor Robert McLaughlin, Dr Jiawen Li  
**Availability:** Semesters 1 and 2

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**Bioengineering Imaging Group (Rodney Kirk, Jiawen Li, Bryden Quirk, Robert McLaughlin)**
Intelligent algorithms to detect blood flow with optical imaging

Optical coherence tomography (OCT) is a high resolution optical imaging technology, which is rapidly growing in importance in medical imaging. Our group has developed some of the world’s smallest medical imaging probes, capable of acquiring images deep within the body. One important use of this technology is to detect the presence of blood vessels during surgery. This project will develop sophisticated software algorithms to automatically detect blood vessels in OCT data. The project will require the student to gain a deep understanding of the physics underlying OCT imaging, and to implement algorithms in Matlab to detect blood vessels in real-world medical data.

Project Supervisors: Professor Robert McLaughlin, Dr Jiawen Li
Availability: Semesters 1 and 2

Special requirements: Applicants should have experience programming with Matlab, a strong background in mathematics and some familiarity with optics. Experience in other programming languages is also desirable.

Research areas
Surgical and Health Systems Innovation
ENT Surgery Research Group
University of Adelaide, North Terrace Campus

The Department of Otolaryngology, Head and Neck Surgery at The Queen Elizabeth Hospital is committed to excellence in translational research and education. Research in our department is focused mainly on understanding the pathogenesis of chronic rhinosinusitis (CRS), using a multidisciplinary approach, aimed at identifying new diagnostic/prognostic markers and treatment strategies to the benefit of our patients. Research projects cover all aspects of rhinological research from pathophysiological aspects of CRS to the identification and validation of new treatment strategies in vitro and in vivo, bringing research from bench to bedside.

Lead researchers: Professor Peter Wormald, Associate Professor Sarah Vreugde, Associate Professor Alkis Psaltis

Email: peterj.wormald@adelaide.edu.au, sarah.vreugde@adelaide.edu.au, alkis.psaltis@adelaide.edu.au

Honours project opportunities

A new treatment for invasive P. aeruginosa wound infections

P. aeruginosa is an opportunistic pathogen frequently responsible for severe infections in chronic wounds, lungs and sinuses. With the emerging threat of multidrug resistance, new treatments are urgently required. Our laboratory has identified a novel antimicrobial treatment that can kill multidrug resistant P. aeruginosa strains. We have shown that the treatment can eliminate bacteria from within mammalian cells, indicating its potential to kill invasive P. aeruginosa infections. This project will evaluate the potential of this new treatment to kill P. aeruginosa from within mammalian cells (epithelial cells and macrophages) in vitro and in vivo in an infected wound model.

Project Supervisors: Professor Peter Wormald, Associate Professor Sarah Vreugde, Associate Professor Alkis Psaltis

Availability: Semesters 1 and 2

Special requirements: Nil

Development of a new treatment for P. aeruginosa airway infections

Chronic Rhinosinusitis (CRS) is one of the most common manifestations in patients with Cystic Fibrosis (CF) accounting for significant morbidity and contributing to CF lung disease. There is an urgent need for the development of new treatments that are effective at eliminating infections with MDR pathogens. Bacteriophage (phage) is a virus that targets and kills one specific bacterial species, leaving the human mucosa and commensal species unaffected. Phage therapy has been considered in the West as early as the 1940’s, and has recently regained interest for its potential to treat MDR bacterial infections. However, phage’s suitability for therapeutic application is hindered by the existence and/or rapid emergence of Bacteriophage Insensitive Mutants (BIM) in the presence of phage. We have identified specific compounds that can re-sensitize S. aureus BIM to phage. This project will evaluate the potential of these compounds to resensitize P. aeruginosa BIM to phage and study their effect on modulating inflammation.

Project Supervisors: Professor Peter Wormald, Associate Professor Sarah Vreugde, Associate Professor Alkis Psaltis

Availability: Semesters 1 and 2

Special requirements: Nil

A new treatment for cystic fibrosis upper airway infection

Chronic Rhinosinusitis (CRS) is one of the most common manifestations in patients with Cystic Fibrosis (CF) accounting for significant morbidity and contributing to CF lung disease. We have recently identified a new treatment that is highly effective to kill antibiotic resistant S. aureus infections, frequently causing chronic relapsing infections in the CF airways. This project will develop the pharmaceutical delivery and formulation of this new product to the sinuses and test its safety and efficacy in a sheep model of sinusitis.

Project Supervisors: Professor Peter Wormald, Associate Professor Sarah Vreugde, Associate Professor Alkis Psaltis

Availability: Semesters 1 and 2

Special requirements: Nil

Research areas

Surgical and Health Systems Innovation
Immunology and Infection
Translational Health Outcomes
Innovative Therapeutics

More information
Machine learning in medicine: Precision medicine to improve clinical practice for glaucoma.

Glaucoma is the leading cause of irreversible blindness worldwide. The world's largest prospective study of glaucoma progression is based at Flinders University and led by Professor Jamie Craig. Data available includes extensive longitudinal clinical phenotyping, genetic data, and serial images of the eye. This project will focus on using deep learning techniques on eye images to better predict disease progression in glaucoma.

Project Supervisor: Professor Lyle Palmer
Available for: PhD (Mphil); Master of Public Health; Masters (MClinSc)
Availability: Semesters 1 and 2
Special requirements: Background in data analysis and data manipulation essential. Knowledge of programming desirable.

Machine learning in medicine: Using deep learning to predict chronic diseases from routinely collected CT images.

Investigate the use of radiological features from thoracic CT scans to predict important clinical outcomes such as mortality and chronic disease incidence. Datasets containing images and other data from over 100,000 adults is available.

Project Supervisors: Professor Lyle Palmer, Associate Professor Gustavo Carneiro, School of Computer Science
Available for: PhD (Mphil)
Availability: Semesters 1 and 2
Special requirements: Some skills in quantitative analysis and data manipulation will be necessary. Students will have completed epidemiological and/or biostatistics courses, as relevant to this project.

Machine learning in medicine: Systematic review of chronic disease prediction using radiomics

This project will involve a literature review of studies evaluating the use of radiologic images to predict chronic disease and related characteristics. This project would be suitable for a group of students.

Project Supervisors: Professor Lyle Palmer, Associate Professor Gustavo Carneiro, School of Computer Science
Available for: Honours, Master of Public Health, Masters (MClinSc)
Availability: Semesters 1 and 2
Special requirements: Students will have completed epidemiological and/or biostatistics courses, as relevant to this project.

Research areas
Surgical and Health Systems Innovation
Public Health
Translational Health Outcomes
Cardiac, Respiratory and Vascular Health
Oculoplastic Research Group
Royal Adelaide Hospital, Adelaide Health and Medical Sciences building (AHMS)

The Oculoplastic Department is an internationally recognised centre of excellence in the management of orbital, lacrimal and oculoplastic surgery and research. High quality research is conducted in the areas of lacrimal dysfunction and disease, orbital oncology and periocular malignancy and reconstruction.

**Lead researcher:** Professor Dinesh Selva

**Email:** dinesh.Selva@adelaide.edu.au

**Honours project opportunities**

**Lacrimal disease and dysfunction**

Students will be involved in a number of clinical and laboratory projects focusing on lacrimal dysfunction and disease. There will also be the opportunity to participate in outpatient and theatre activities, and involvement in charity activities with Sight For All.

**Project Supervisor:** Professor Dinesh Selva

**Availability:** Semesters 1 and 2

**Special requirements:** Nil

**HDR project opportunities**

**Lacrimal disease and dysfunction**

Please see Honours entry

**Research areas**

Surgical and Health Systems Innovation

Translational Health Outcomes
Honours project opportunities

Bioengineering and cell culture for the eye

Bioengineering involves the creation of replacement tissue using both artificial and biological material. There are many structures in and around the eye which are suitable for bioengineering studies, with huge potential benefits to patients suffering from various eye conditions.

This project focuses on different structures in and around the eye of increasing complexity, starting initially with eyelid and lacrimal gland tissue. We have already had success developing a bioengineered eyelid tissue substitute which is approaching the clinical trials stage, and have demonstrated proof of concept with the culture of lacrimal gland cells using biopsy-sized pieces of human lacrimal gland tissue.

The basic principle of tissue engineering involves the combination of a polymer scaffold with a stem cell or precursor cell population. This exciting project combines bioengineering and cell culture with clinical ophthalmology and has significant translational potential.

Project Supervisors: Professor Dinesh Selva, Dr Michelle Sun and Dr John Wood

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

Bioengineering and cell culture for the eye

Please see honours entry.

Research areas

Surgical and Health Systems Innovation

Innovative Therapeutics
Royal Adelaide Hospital Colorectal Unit

The RAH Colorectal Unit is the largest tertiary referral colorectal surgical unit in South Australia, performing approximately 300 major colorectal surgical procedures per annum.

The unit comprises six consultant surgeons (all of whom are CSSANZ members), one colorectal fellow, an advanced surgical trainee, a registered medical officer, three interns and two research fellows. The colorectal unit undertakes high volume major open and laparoscopic colorectal cancer surgery, complex inflammatory bowel disease cases, interventional colonoscopy and trans-anal endoscopic microsurgery. Robotic surgery is offered in highly selected cases, utilising facilities in the private sector. Research is an important part of the unit and planned for expansion, with specific interest in clinical research focusing on patient-centred outcomes.

Lead researcher: Associate Professor Tarik Sammour
Email: tarik.sammour@gmail.com

Research project opportunities

Robotics and surgeon reported outcomes

Robotic surgery has some perceived technical advantages over laparoscopy, and this is heavily promoted by industry and surgeons alike despite little evidence for patient benefit in the short and long term. However, there may be advantages in terms of surgeon’s fatigue and concentration due to better visualization and ergonomics. This project will investigate this by comparing surgeon reported outcomes after laparoscopic and robotic surgery to assess whether there are any surgeon-specific benefits to the technology.

Project Supervisor: Associate Professor Tarik Sammour
Availability: Semesters 1 and 2
Special requirements: Nil

Next generation Enhanced Recovery After Surgery (mERAS)

Enhanced Recovery After Surgery (ERAS) is a package of care which combined evidence based practices with a protocol of management to guide patients and staff during the peri-operative period. This has been shown to improve patient outcomes by reducing complications. However, most ERAS programs tend to stagnate and not advance with update evidence. In 2018, we implemented a “live document” electronic ERAS protocol which enabled rapid and continuous improvement and modification at the Royal Adelaide Hospital (mERAS). This project will seek to determine the impact of this implementation on patient care and measure any differences in post-operative recovery.

Project Supervisor: Associate Professor Tarik Sammour
Availability: Semesters 1 and 2
Special requirements: Nil
Surgical Evaluation Group

Basil Hetzel Institute for Translational Health Research, The Queen Elizabeth Hospital, Woodville

• Evidence based surgical appraisal
• Evaluation of hepatic surgical outcomes
• Minimally invasive surgery
• Development of techniques for liver tumour destruction
  (particularly minimally invasive techniques capable of destroying both primary and secondary liver tumours by the insertion of electrodes)

Lead researcher: Professor Guy Maddern
Email: guy.maddern@adelaide.edu.au

HDR project opportunities

The Laparoscopic Simulation Skills Program (LSSP)

Current access to surgical simulation training in Australia is limited and the best formal for delivery is yet to be established. Self-directed learning has the potential to limit the costs associated with simulation training, as well as improve access through increased flexibility of training times. The aim of the LSSP is to develop and assess the efficacy and feasibility of a self-directed simulation based training program, and to determine if a period of more formal (supervised) training is required.

Availability: Semesters 1 and 2

Coaching to enhance surgeons' non-technical skills

The concept of coaching for performance improvement is an accepted and well-established approach in fields such as sports, education, business and music. It has only been much more recently recognised that application of this model of learning, which is grounded in established learning and psychological concepts, may be of particular value when applied in health care settings. This project investigates whether surgical coaching is a potentially valuable tool to enhance surgeons' non-technical skills and whether it would be beneficial to develop a surgical coaching program for General Surgeons for the purpose of improving their ongoing professional development.

Availability: Semesters 1 and 2

The use of a novel gel to prevent adhesion formation post-abdominal surgery

Postoperative intra-abdominal adhesions are a major cause of morbidity and mortality and a heavy burden to health care resources. In 2016 and 2017, we investigated the effectiveness of novel recombinant human lubricin gel in preventing intra-abdominal adhesion in a rat model. In 2018, further studies will be complete to investigate toxicity and anti-adhesion properties in more significant operations.

Availability: Semesters 1 and 2

Developing novel diagnostic tools and preventative therapies for metastatic colorectal cancer

The majority of colorectal cancer (CRC) related deaths are attributable to liver metastasis—the most critical prognostic factor observed in CRC patients. However, there is no clinical test to predict metastatic risk and allow informed selection of preventive treatment regimen. The translational challenge, therefore, is to validate immune checkpoint biomarkers controlling metastasis. In collaboration with other groups at the BHI, we investigated the prognostic value of candidate protein biomarkers. HLA-G expression by tumour cells is an established mechanism to escape immune-mediated destruction. Our analysis demonstrated that soluble HLA-G is a differential prognostic marker of liver metastasis in CRC patients. We therefore propose that HLA-G secretion by different cell types is predictive of particular prognosis in sequential CRC disease stages. Our proteomic and lipidomic analysis of CRC patients’ tissue and blood samples identified additional proteins and lipids, which are candidate biomarkers of progression to liver metastasis. These candidates are currently being validated in a larger patient cohort.

Availability: Semesters 1 and 2

Research areas

Surgical and Health Systems Innovation
Cancer Biology and Clinical Oncology

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TRANSLATIONAL HEALTH OUTCOMES
TRANSLATIONAL HEALTH OUTCOMES RESEARCH GROUPS

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Translational health research applies basic scientific findings from laboratory and preclinical studies to enhance human health and wellbeing at the personal and community level—taking experimental findings ‘from bench to bedside’ through new treatments and improved health policy.

High quality preclinical, clinical and epidemiological research is the foundation stone of optimised health care provision that serves to improve the quality of life of patients who are managed in the health system. Effective translational research is crucial to the continued improvement and sustainability of the Australian health system, and requires significant engagement with industry and service sectors within government.

Our researchers are developing new and innovative ways to transfer new knowledge to health service professionals, to: change practice; improve skills; and influence policy and procedures system-wide.

Researchers across the faculty are focused on:

- undertaking population surveys to develop and test new interventions to improve the mental health of children and adolescents
- undertaking evidence-based practice development to manage at-risk populations for trauma and mental disorders across the lifespan
- elucidating genetic factors that may serve as new targets for therapy, or are predictive of responses to pharmaceutical treatments
- performing longitudinal studies of patients undergoing invasive procedures to review and improve standard practice in the health care system
- developing evidence-based assessments of novel surgical techniques and postoperative care to enhance skills and promote knowledge transfer to health service professionals.
Clinical Pharmacogenetics: Personalised Medicine
University of Adelaide, North Terrace Campus

The Clinical Pharmacogenomics group has an active research program focused on elucidating the genetic factors that contribute to an altered response to medicines and to adverse drug reactions. Pharmacogenomics is the study of variations in our genome (DNA and RNA) that alter our response to drugs. We aim to personalise medicine by studying DNA variations to better target a drug, or its dose, to improve health and prevent toxic reactions. The group investigates pharmacogenetic factors involved in pain therapeutics (acute and chronic postsurgical pain, cancer pain and opioids), cancer therapy (chronic myeloid leukaemia drugs), kidney transplantation (immunosuppressants), antidepressant drugs, HIV drugs and drugs to treat opioid addiction. Research involves human genetic factors that affect pharmacokinetics, metabolism, pharmacodynamics (receptors, signalling messengers) and immune markers of drug hypersensitivity reactions. The group also has a large research programme investigating pharmacogenomics of Aboriginal Australians, as discovery of interethnic differences in drug response (good and bad) and the genetic factors that contribute to such differences are of importance for drug and dosing guidelines. Translation of these genetic findings into clinical practice is called personalised or precision medicine and is an overarching theme of the group. The Clinical Pharmacogenomics group works on the development and implementation of clinical use of personalised medicine.

Research from this group incorporates the examination of genetic variants that impact on drug responses and those that impact on a person’s immune response to drugs. Studies include drug metabolism and response (cancer, addiction, solid-organ transplantation outcomes), neurogastroenterology and molecular toxicity (via a chemotherapy-induced model of mucositis), drug abuse and addiction (alcohol, opioid and behavioural), pain (chronic pain in spinal cord injury and fibromyalgia), Gulf-war illness and epilepsy.

Lead researcher: Professor Andrew Somogyi
Email: andrew.somogyi@adelaide.edu.au

Honours project opportunities

Pain genetics
Investigations into the genetic control of chronic persistent pain following surgery will allow us to identify those people who will require a different approach to post surgical pain including the use of nonopioids. Studies will require knowledge of pain mechanisms, immunology and epigenetics.

Availability: Semesters 1 and 2
Special requirements: Nil

HDR project opportunities

Genetic studies into treatment resistant depression
Two current NHMRC-funded clinical trials with ketamine as a new therapy are underway with collection of samples for biomarker analysis. Pharmacokinetic and pharmacogenetic analysis will allow for determining
a) responders versus non responders and
b) personalised dosing.

Availability: Semesters 1 and 2

Pharmacogenetic studies in Aboriginal Australians
We are conducting unique studies to identify whether personalised medicine for our First Peoples should be the same as Caucasians. Our initial studies indicate that a different personalised approach needs to be used in order that the medicines work better and don’t cause harm. This is funded by the NHMRC and involves pharmacogenetic testing of the most common drug receptors, metabolising enzymes and transporters in cohorts of Aboriginal Australians.

Availability: Semesters 1 and 2

Ancient DNA and pharmacogenetics
Genetic polymorphisms for drug receptors and metabolizing enzymes show enormous variability between different ethnicities leading to different drug dosages in specific populations. The evolution of these polymorphisms is not known. In collaboration with Professor Alan Cooper (Director Australian Centre for Ancient DNA), we are in a unique position to track the evolution of some of these polymorphisms as people migrated out of Africa. The project would be ideally suited to a student with an anthropology, pharmacology and genetics background.

Availability: Semesters 1 and 2

Pain genetics
Please see Honours entry

Pharmacogenetic studies in Papua New Guinea (PNG)
We are conducting translational studies for the treatment of HIV/AIDS and tuberculosis in PNG. The medicines that are used all have a genetic footprint. Variants in the genes that control the metabolism and transport of these medicines affect how well they work and their toxicity. These variants also have a very large interethnic variability. The project would be ideally suited for a candidate who has pharmacology and genetics as majors in undergraduate studies.

Availability: Semesters 1 and 2

Medicines safety in Papua New Guinea
PNG people have quite unique genetic profiles making them vulnerable to drug toxicity. Studies will determine which drugs for which diseases are better suited to treat their diseases than the uses of personalised precision medicine.

Availability: Semesters 1 and 2

Research areas
Translational Health Outcomes
Immunology and Infection
Neuroscience, Behaviour and Brain Health
Indigenous and Disadvantaged Health
Environmental and Occupational Health Sciences: Adelaide Exposure Science and Health

Adelaide Health and Medical Sciences building (AHMS), Adelaide Exposure Science and Health Laboratory, Thebarton

We are interested in the nexus between the environment, society and human health. We have diverse backgrounds in environmental and medical epidemiology, public health, exposure science, and statistics and we employ an array of quantitative and qualitative methodologies, working closely with government and non-government stakeholders. We provide an empirical evidence base for strategic policy development and planning on public health issues including environmental and occupational health. We work in the assessment and control of health hazards in workplaces and environment including hazardous chemical management. Current research projects include

• Heat and work injury
• Evaluating the dermal absorption of toxic chemicals
• Risk assessment of firefighter dermal exposure to toxic chemicals
• Cytotoxic drug surface contamination

Lead researcher: Professor Dino Pisaniello
Email: dino.pisaniello@adelaide.edu.au

Honours project opportunities

Creating a healthy visual working environment

We are part of the International Commission of Occupational Health – Scientific Committee on Work and Vision. This project is aligned with a program of work assessing visual tasks in the work environment, and the potential impact on health and productivity. It will explore the use of screens and other equipment in the workplace, as well as individual susceptibilities to eye health disturbance. The project will involve selected literature reviews and field work assessing the visual working environment. Field work will involve measurements in the occupational visual field, including luminance, and radiance for blue light hazards. Findings and recommendations will be communicated to an international audience. The multidisciplinary project would suit students with an interest in lighting, myopia, older workers, or circadian rhythm disruption and cancer risks for shift workers.

Project Supervisors: Dr Sharyn Gaskin, Professor Dino Pisaniello
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil)
Special requirements: Physiology/Public Health preferred

Mapping contaminated land sites and reproductive health outcomes

Following the Clovelly Park and military base soil contamination incidents, there is increasing public concern about health effects that might arise from contaminated land and groundwater, arising from past or current industrial activities. Exposures from indoor vapour intrusion can lead to a range of adverse health outcomes. It is now evident that the highest inhalation exposures can occur when people are asleep in their homes. There is evidence of increased foetal heart malformations in selected US populations. Heart defects constitute a significant proportion of birth defects. There is no information for Australia.

The project will explore data from birth defect (and related) registries and geocoded contaminated site databases, with the potential for field work.

Project Supervisors: Dr Len Turczynowicz, Professor Dino Pisaniello
Availability: Semesters 1 and 2
Available for: PhD (Mphil)
Special requirements: Public Health/Biostatistics preferred

Development of an analytical technique for MOCA in biological samples

4,4’-Methylene bis(2-chloroaniline) (MOCA) is a chemical used in manufacturing of polyurethane products. MOCA is classified as an A2, Suspected Human Carcinogen and has the potential to be absorbed through the skin. Health monitoring for MOCA is required under work health and safety laws. This project is laboratory based and will involve development of an analytical method for the detection of MOCA in biological samples. Occupational exposure to MOCA in industry is ideally assessed by biological monitoring to identify individuals with an absorbed dose.

Project Supervisors: Dr Leigh Thredgold, Dr Sharyn Gaskin
Availability: Semesters 1 and 2
Special requirements: Analytical chemistry

Emergency management of chemical exposure incidents affecting public health

Accidental or intentional toxic chemical releases may result in significant public health and psychological consequences. Management of exposed individuals during hazardous material (HAZMAT) incidents should be risk-based and supported by suitable scientific evidence base. The most serious hazard is from exposure to gases or vapours via the respiratory system. Dermal exposure, as an important secondary route of exposure, is still a concern most acutely for the unprotected public. This project is aligned with a program of work and involves selected literature reviews, the identification of knowledge gaps and the recommendation of a framework, protocols and experimental arrangements for subsequent work for a selected range of toxic gases that may be encountered in a HAZMAT scenario involving the public.

Project Supervisors: Dr Sharyn Gaskin, Professor Dino Pisaniello
Availability: Semesters 1 and 2
Available for: Honours; Master of Public Health

Special requirements: Some chemistry and/or toxicology preferred

Indoor air pollution from 3D printers

3D printers are becoming ubiquitous in schools, universities and industry (additive manufacturing). These printers are cost-effective for rapid and specialised fabrication. There is a wide variety of applications ranging from synthetic skin, medical implants and devices, architectural prototypes etc. Many different 3D systems exist and potentially emit toxic particles and vapours, especially in large scale or open printers. There is a need to understand the indoor air contaminant levels, especially in terms of time and space. The research findings will assist in the evaluation and design of ventilation systems and other forms of control. The project will entail a literature review and measurements in 3D printing labs in the University, and potentially in secondary schools.

Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health

Special requirements: Knowledge of literature review methods and basic chemistry (at least year 12).

Research areas

Translational Health Outcomes
Public Health
Cancer Biology and Clinical Oncology
Ageing, Frailty and Mobility
Environmental and Occupational Health Unit: Climate Change; Ecosystem Health and Infectious Disease Epidemiology

We are interested in the nexus between the environment, society and human health. With diverse backgrounds in environmental and medical epidemiology, public health, occupational health physiotherapy, infectious disease, social psychology and statistics, we employ an array of quantitative and qualitative methodologies and work closely with government and non-government stakeholders. We provide an empirical evidence base for strategic policy development and planning on public health issues and have close collaborative relationships with public health and infectious disease specialists in China. Current research projects include:

- Infectious disease in China as a consequence of climate change
- Health impacts of extreme heat and climate change in rural South Australia
- Food handling practices during hot weather

**Lead researcher:** Professor Peng Bi  
**Email:** peng.bi@adelaide.edu.au

**Honours project opportunities**

**Ambulance and ED visit costs of heatwaves and benefits of a heat health intervention**

Heatwaves are associated with a significant and preventable health burden in Australia, which will escalate with climate change. Public health warnings and interventions are being implemented to raise awareness and minimise the health impacts. However, there is currently no evidence of the cost effectiveness of these interventions, nor any comprehensive analysis of the cost of heatwaves to the health system. This project will address this evidence gap. With 1.5–3°C warming ‘locked in’ over the coming decades, it is imperative that cost-effective interventions to minimise the health impacts of heatwaves be adopted nationally. This project will:

1. Estimate annual heat-attributable hospital ED visits and Ambulance usage costs in Adelaide, and may project future costs under different scenarios of climatic and demographic change.
2. Conduct a cost analysis of a public health heatwave intervention implemented in Adelaide in 2014. Heatwave-attributable hospital ED and ambulance costs will be estimated for two comparable heatwaves: in 2009 (pre-intervention) and 2014 (post-intervention). The intervention costs will be estimated in consultation with the relevant agencies. The difference between the estimated intervention cost and the difference in the excess costs associated with the heat events in 2009/2014 will inform a cost analysis of the heatwave intervention.

**Project Supervisors:** Professor Peng Bi, Dr Susan Williams  
**Availability:** Semesters 1 and 2  
**Available for:** Honours; Master of Public Health  
**Special requirements:** Nil

**The impact of environmental exposure (heat) on stillbirths, preterm births, and birth defects**

Population groups vulnerable to the effects of high environmental temperature include pregnant women with the potential for adverse birth outcomes. Stillbirths, preterm births and birth defects are significant public health problems associated with mortality and lifelong disability. Preventing mortality and adverse birth outcomes is critical in reducing long term health effects and social and economic burden. This project will involve a systematic review in order to examine the evidence of the relationship between stillbirths, preterm births, birth defects and environmental exposure of high temperature.

**Project Supervisor:** Dr Adriana Milazzo  
**Availability:** Semester 1  
**Special requirements:** Students will have completed epidemiological courses, as relevant to this project. Familiarity with statistical software packages such as STATA may be relevant.

**Do Australian schools have a heatwave policy, and is there a need for a national one?**

This project will review school hot weather policies to assess the type of guidelines in place to protect students from outdoor extreme weather events. The information gathered will be used to assess the level of consistency among school guidelines, internationally, nationally and locally, and will provide recommendations for the need of a national school policy on heatwaves.

**Project Supervisors:** Dr Adriana Milazzo, Dr Alana Hansen  
**Availability:** Semester 1  
**Special requirements:** Qualitative and quantitative research skills.

**Research areas**

Translational Health Outcomes  
Public Health
Health Economics and Policy: Health Economics
Adelaide Health and Medical Sciences building (AHMS)

The Health Economics and Policy Unit focuses on key issues in developing evidence-based health policy, health system planning and health care resource allocation. Projects have large scale impact and our research generates the evidence and analyses needed to determine how health services and workforce ought to be planned, and whether governments ought to allow and reimburse the use of particular health interventions. This includes evidence on interventions’ comparative safety, effectiveness and cost effectiveness, and analyses of anticipated impacts and ethical implications.

We work across disciplines, with our academic backgrounds spanning public health, health economics, medicine, moral philosophy, psychology, epidemiology and biostatistics, pharmacy, health sciences, geography and social sciences. Current research projects include:

- Methodological projects concerning the development and use of evidence by policy makers
- Involving patients in health technology funding decisions in Australia
- Assessing personalised medicines in Australia
- The ethics of allocating intensive care resources
- Estimating the future workforce needs in Australian general practices
- Alcohol misuse primary care intervention referrals in young people
- Access to health services including unmet need

Lead researcher: Professor Jon Karnon
Email: jonathon.karnon@adelaide.edu.au

Honours project opportunities
Evidence-based decision making in primary health networks

In 2015 the Commonwealth established 31 geographically defined Primary Health Networks (PHNs) across Australia to increase the efficiency and effectiveness of medical services for patients and to improve coordination of care to ensure patients receive the right care in the right place at the right time. To achieve these aims, PHNs begin by developing a needs assessment for their geographical area to identify a set of key health priority areas. They then design services to meet these needs, commission these services to external partners and work with these partners to monitor and evaluate services for continued improvement.

As part of this research you will be working closely with the two South Australian (SA) PHNs – Adelaide PHN and County SA PHN to document and contribute to their current processes from needs assessment through to monitoring and evaluation. The specific activities to be undertaken will vary according to your own area of expertise and/or interest. This research will provide you with research experience in a university setting and practical experience working with local government health service providers and their key stakeholders.

Project Supervisors: Professor Jonathan Karnon, Dr Laura Edney, Ms Jodi Gray
Availability: Semesters 1 and 2
Available for: Honours; Master of Public Health; Masters (MClinSc)
Special requirements: Nil

Understanding community perceptions toward health care funding decisions

Healthcare systems are faced with allocating constrained health budgets across increasingly costly health interventions. Funding only health interventions that generate greater benefits than the opportunity cost of funding decisions is one way to contribute towards improving population health from a constrained budget.

Health funding decision makers have cited that a key barrier to the use of the average opportunity cost is the perceived negative community response. To date, limited research has examined community attitudes toward the use of the average opportunity cost to guide funding decisions. This may be due to the prior lack of evidence on the value of the average opportunity cost, and the complexities of communicating such concepts to the general public. It is unknown whether the community accept the use of the average opportunity cost to guide funding decisions.

We have developed a video to communicate these complex concepts and an online survey to collect individual responses on attitudes towards the use of the average opportunity cost to guide health funding decisions. Survey respondents further indicated whether they would be willing to discuss their responses in detail with a researcher to further explore their responses. This research project will involve conducting and analysing these qualitative interviews.

Project Supervisors: Professor Jonathan Karnon, Dr Laura Edney
Availability: Semesters 1 and 2
Available for: Honours; Master of Public Health; Masters (MClinSc)
Special requirements: Nil

Unmet clinical need: What is it and what can we do about it?

The public healthcare budget will never be large enough to meet all of the clinical needs of the population, but we need to describe the extent and distribution of unmet need so that policymakers can make informed decisions about where to allocate our scarce resources. Depending on the size, this research project will comprise one or more of the following activities: review the existing literature on unmet clinical need, identify and analyse relevant survey data, analyse hospital waiting list and activity data, interview stakeholders (GPs and hospital-based clinicians, managers, consumers, politicians) and design and conduct primary surveys to assess barriers and facilitators to reducing unmet need (e.g. workforce and other capacity constraints, organisational and political issues), review the literature and consider methodological issues around the cost-effectiveness analysis of reducing unmet clinical need (e.g. reducing waiting lists), undertake relevant cost-effectiveness analyses and develop implementation plans. The focus of the project may be broad (e.g. looking at unmet need across diseases or conditions across the healthcare system) or narrow (e.g. focussing on issues around unmet need for a particular disease or condition in a particular jurisdiction).

Project Supervisors: Professor Jonathan Karnon, Dr Hossein Afzali, Dr Laura Edney, Ms Jodi Gray, Ms Clara Pham
Availability: Semesters 1 and 2
Available for: PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: Health economics
Public and private healthcare spending as determinants of population health: Panel data evidence from Australia

Government healthcare expenditure aims to improve health outcomes and reduce inequity through the provision and allocation of health technologies and services. Increased healthcare expenditure should, all else being equal, translate to improved health outcomes. However, the empirical relationship between healthcare expenditure and population health is not well understood in Australia. This project will involve establishing a panel dataset across several decades by States and Territories, including information on healthcare expenditure, healthcare outcomes and additional covariates such as government spending in other areas, population size, lifestyle factors such as alcohol and cigarette consumption and health status variables such as diabetes prevalence. This dataset will allow empirical estimation of the relationship between healthcare expenditure and population health.

**Project Supervisors:** Dr Hossein Afzali, Dr Laura Edney

**Availability:** Semesters 1 and 2

**Available for:** Master of Public Health; Masters (MClinSc)

**Special requirements:** Experience with collating data from websites; some experience with data management; competency with statistical methods.

Comparing methods of health technology assessment in Australia: MSAC and PBAC

Public funding decisions for new healthcare technologies are made by two key committees in Australia, the Medical Services Advisory Committee (MSAC) and the Pharmaceutical Benefits Advisory Committee (PBAC). Differences in the methods and processes for evaluating new technologies by these two committees and how these may impact on healthcare efficiency and resource allocation have not previously been systematically investigated. This project will involve reviewing MSAC and PBAC guidelines and extracting key information such as remit and scope, process of assessment, methods of evaluation and appraisal of evidence into a database. Comparison of the similarities and differences between methods used can then be detailed. Any differences identified will be further explored with MSAC and PBAC members via survey or interview methodology.

**Project Supervisors:** Dr Laura Edney, Dr Hossein Afzali

**Availability:** Semesters 1 and 2

**Available for:** Master of Public Health; Masters (MClinSc)

**Special requirements:** Experience with extracting information from websites, interest in survey design or interview methodologies

**Research areas**

Translational Health Outcomes

Public Health
Health Economics and Policy: Health Technology Assessment

Adelaide Health and Medical Sciences building (AHMS)

The Health Economics and Policy Unit focuses on key issues in developing evidence-based health policy, health system planning and health care resource allocation. Projects have large scale impact and our research generates the evidence and analyses needed to determine how health services and workforces ought to be planned, and whether governments ought to allow and reimburse the use of particular health interventions. This includes evidence on interventions’ comparative safety, effectiveness and cost effectiveness, and analyses of anticipated impacts and ethical implications.

We work across disciplines, with our academic backgrounds spanning public health, health economics, medicine, moral philosophy, psychology, epidemiology and biostatistics, pharmacy, health sciences, geography and social sciences.

Current research projects include:

- Methodological projects concerning the development and use of evidence by policy makers
- Involving patients in health technology funding decisions in Australia
- Assessing personalised medicines in Australia
- The ethics of allocating intensive care resources
- Estimating the future workforce needs in Australian general practices
- Alcohol misuse primary care intervention referrals in young people
- Access to health services including unmet need

Lead researcher: Professor Tracy Merlin
Email: tracy.merlin@adelaide.edu.au

Honours project opportunities

GRADE: is the application of the method consistent with the aim?

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) working group began in the year 2000 as an informal collaboration of people with an interest in addressing the shortcomings of evidence grading systems in health care. The working group developed an approach to grading quality (or certainty) of evidence and strength of guideline recommendations based on that evidence. The aim was for the approach to be ‘common, sensible and transparent’. Many international organisations have provided input into the development of the GRADE approach which is now considered the standard in evidence synthesis. Evaluations of the GRADE approach have been limited to date. There are anecdotal concerns that when the approach is used by different organisations that the method is applied differently, and so that what may appear ‘common’ or ‘universal’ is in fact not common at all.

This research project would be aimed at determining whether the GRADE approach that has been developed, when applied in clinical practice guideline development and in health technology assessment, is in fact standardly applied by different organisations i.e. ‘common, sensible and transparent’.

Project Supervisor: Professor Tracy Merlin
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: Previous exposure to Health Technology Assessment would be an advantage but is not required.

Health technologies funded by SA Health: post-approval outcomes assessment

SA Health convenes a number of panels and committees that make recommendations on the clinical role and availability of new medicines and medical devices in the public health system. There is increasing interest within SA Health and among its clinicians to undertake evaluation work to see if the approval and funding of a medicine or device has resulted in the outcomes expected.

Under supervision, you will examine the data sources available to SA Health to answer key questions, such as the following. Were the indications for the new technology/medicine followed? Did the right cohort of patients receive the technology/medicine? Were the patients’ health outcomes as expected? Did this represent value for money? You will then collate and analyse the available data to answer these questions, and contribute to advice on future outcomes assessment.

There are multiple projects available. Projects are possible in cardiology, and other areas. Confidentiality arrangements would need to be in place, though publication would be possible with appropriate ethics approval.

Project Supervisors: Dr Drew Carter, Professor Tracy Merlin, Naomi Burgess, Director of Medicines and Technology Programs (MTP) and Out of Hospital Pharmacy Services, SA Health
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: Familiarity with health technology assessment is desirable but not required.

Assessing biomedical technologies to inform health policy decisions: what evidence is needed?

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) working group began in the year 2000 as an informal collaboration of people with an interest in addressing the shortcomings of evidence grading systems in health care. The working group developed an approach to grading quality (or certainty) of evidence and strength of guideline recommendations based on that evidence. The aim was for the approach to be ‘common, sensible and transparent’. Many international organisations have provided input into the development of the GRADE approach which is now considered the standard in evidence synthesis. Evaluations of the GRADE approach have been limited to date. There are anecdotal concerns that when the approach is used by different organisations that the method is applied differently, and so that what may appear ‘common’ or ‘universal’ is in fact not common at all.

This research project would be aimed at determining whether the GRADE approach that has been developed, when applied in clinical practice guideline development and in health technology assessment, is in fact standardly applied by different organisations i.e. ‘common, sensible and transparent’.

Project Supervisor: Professor Tracy Merlin
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (MClinSc)
Special requirements: One or more of: Epidemiological research methods, Introduction to biostatistics, Health Technology Assessment
Ethical principles guiding resource allocation in intensive care units

A shortage of beds or staff in intensive care units (ICUs) often leaves practitioners and administrators with difficult decisions regarding how limited resources should be allocated. For example, if the ICU is full but a new patient requires admission, what should happen? Should the least sick patient be discharged prematurely to make way for the new patient, if the new patient can benefit more? Or should the new patient be cared for outside of the ICU, perhaps being transferred to another hospital? In either case, someone will receive less than optimal care.

Formal guidance has been issued on the question of who this should be, namely by professional and government bodies, but consideration of what the main messages are or how consistent they are across the world is lacking. We are conducting a systematic review of recommendations regarding ICU admission and discharge. (The body of literature has been identified; full texts can now be reviewed, then data can be extracted and synthesised.) Our review will help decision makers – both in ICUs and at policy levels – by providing a global picture of the guidance offered. It will also help to advance debates about what the most ethical guidance is.

Project Supervisor: Dr Drew Carter

Availability: Semesters 1 and 2

Available for: Honours; PhD (MPhil); Master of Public Health; Masters (M ClinSc)

Special requirements: Familiarity with systematic reviews is preferred but not required

Research areas

Translational Health Outcomes

Public Health

Cardiac, Respiratory and Vascular Health

Surgical and Health Systems Innovation
Health Economics and Policy: Health Workforce

Adelaide Health and Medical Sciences building (AHMS)

The Health Economics and Policy Unite focuses on key issues in developing evidence-based health policy, health system planning and health care resource allocation. Projects have large scale impact and our research generates the evidence and analyses needed to determine how health services and workforces ought to be planned, and whether governments ought to allow and reimburse the use of particular health interventions. This includes evidence on interventions’ comparative safety, effectiveness and cost effectiveness, and analyses of anticipated impacts and ethical implications.

We work across disciplines, with our academic backgrounds spanning public health, health economics, medicine, moral philosophy, psychology, epidemiology and biostatistics, pharmacy, health sciences, geography and social sciences.

Current research projects include:

- Methodological projects concerning the development and use of evidence by policy makers
- Involving patients in health technology funding decisions in Australia
- Assessing personalised medicines in Australia
- The ethics of allocating intensive care resources
- Estimating the future workforce needs in Australian general practices
- Alcohol misuse primary care intervention referrals in young people
- Access to health services including unmet need

Lead researcher: Professor Caroline Laurence

Email: caroline.laurence@adelaide.edu.au

Honours project opportunities

Patterns and determinants of GP utilisation in Australia

In Australia there is an increasing demand for GPs services, with GP attendances rising by 42% between 20003 and 2014. In terms of cost and service provision this is unsustainable, but many of the policies implemented to address this rising demand are often broad brushed and inequitable. What is lacking is a better understanding of what drives this demand within the Australian population. This project is aimed at understanding the patterns and determinants of health care utilisation, focusing on primary care services. It will use panel data from the HILDA to determine which predisposing, enabling and need characteristics are determinants of utilisation of GP services.

Project Supervisors: Professor Caroline Laurence, Associate Professor Lynne Giles, Dr Elizabeth Hoon

Availability: Semesters 1 and 2

Available for: PhD (Mphil); Master of Public Health; Masters (MClinSc)

Special requirements: Introduction to Biostatistics or basic statistical course.

Research areas

Translational Health Outcomes

Public Health
The Knowledge Translation Group’s research program is focused on advancing implementation science in healthcare. This involves studying the methods, processes and roles that can be used to facilitate the implementation of research evidence into healthcare decision making and practice at a clinical, organisational and health system level.

**Lead researcher:** Professor Gill Harvey  
**Email:** gillian.harvey@adelaide.edu.au

### Research project opportunities

#### Translating research evidence into improved practice and patient care

This project will involve identifying a clinical topic where there is a known evidence-practice gap (for example, wound care, pre-operative fasting) and undertaking a practice-based case study to identify opportunities for improvement, assess readiness for change and develop a real-world implementation plan.

**Project Supervisor:** Gill Harvey  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

#### Facilitating evidence-based practice in acute hospital settings

Research in primary care settings suggests that employing practice facilitators to support the implementation of clinical guideline recommendations increases the uptake of evidence-based practice almost three-fold. This project will involve undertaking a similar systematic review of facilitation in acute hospital settings to evaluate the impact on clinical guideline implementation.

**Project Supervisor:** Gill Harvey  
**Availability:** Semesters 1 and 2

### Research areas

- Translational Health Outcomes
We are interested in improving how research evidence is used for health care decision-making at a clinical, organisational and health system level. The Knowledge Translation Group studies the methods, processes and roles that can be used to facilitate the ‘evidence-to-practice’ components of knowledge translation. We work with theories and frameworks that recognise the complex, dynamic and iterative process of implementing research, in particular, the ‘Promoting Action on Research Implementation in Health Services’ (PARIHS) framework (recently revised as the integrated or i-PARIHS framework). Our research areas include:

- Synthesising evidence of best practice. We undertake, and offer training in the methodology of, systematic reviewing of evidence relevant to nursing practice. This takes place within the Centre for Evidence-Based Practice South Australia (CEPSA), a Joanna Briggs Institute Centre of Excellence.
- Examining the evidence-practice gap to identify potential for improvement. Here we focus on current practices and compare to known best practice, for example, in relation to improving the coordination of care for older people living in the community.
- Implementing and evaluating the implementation of evidence into clinical practice. Ongoing research is focused on topics such as implementing evidence-based guidance for stroke rehabilitation and improving renal care for Aboriginal patients.
- Understanding processes of disinvestment and de-implementation to stop the use of practices that are known to be ineffective or potentially harmful, for example, in wound care.
- Examining key roles in the translational process. We are looking at facilitator roles and facilitation processes and how these can be developed and embedded within health service settings in an effective and cost-effective way.

**Lead researcher:** Dr Tim Schultz  
**Email:** tim.schultz@adelaide.edu.au

### Honours project opportunities

**How can nurses help to promote walking practice after stroke?**

In hospitals around the world, people with stroke are consistently very inactive. There is clear evidence that dose of walking is important with regard to recovery of walking function, so it is recommended in the Stroke Clinical Guidelines that people with difficulty walking should be given the opportunity to practise walking as much as possible. Observational studies conducted in Australian rehabilitation hospitals provide evidence that people with stroke spend most of their day sitting or lying in bed on the ward, so it is important to consider how nurses can contribute to walking recovery after stroke. In this study, we will use a model of facilitation (the integrated Promoting Action on Research Implementation in Health Services model, co-developed by a researcher currently working in Adelaide Nursing School) to work with nurses on one stroke rehabilitation ward to develop and test strategies to promote walking practise on the ward.

**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

### Research areas

- Translational Health Outcomes
- Cardiac, Respiratory and Vascular Health

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**Translation and psychometric testing of a tool to measure the context of Indonesian primary health care**

Understanding the context in which knowledge translation occurs is essential. This project will adapt an existing tool (Alberta Context Tool) to support the implementation of best practice in neonatal care for Indonesian primary health care nurses, midwives and doctors.

**Project Supervisor:** Dr Tim Schultz  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**Understanding nursing care and patient experience in single bedded rooms**

About 10% of patients are harmed in hospitals from their care. While single bedded rooms in hospitals offer advantages for patients such as greater privacy, and potentially less chance for infection, patient safety in single bedded rooms has been little studied. This study will address that gap, while also investigating how nurses provide care in single bedded rooms.

**Project Supervisor:** Dr Tim Schultz  
**Availability:** Semesters 1 and 2  
**Special requirements:** Nil

**HDR project opportunities**

**Developing and testing an arts-based knowledge translation intervention for people with stroke**

Stroke is a leading cause of adult disability in Australia, and the numbers of people living with stroke are increasing. People who have recently experienced a stroke report they lack appropriate information about what a stroke is, what a person with stroke should do to promote recovery, and how much to expect in terms of recovery. When information is provided, people with stroke report this is often difficult to understand.

The Australian Stroke Clinical Guidelines have been updated in 2017, providing a series of best practice recommendations to assist decision-making in the management of stroke. One recommendation is that all stroke survivors should be offered information tailored to meet their individual needs using relevant language and communication formats. Different forms of art have been to promote health literacy and change health-related behaviours. As such, developing an arts-based approach (such as a graphic novel) to interpret sections of the 2017 Stroke Clinical Guidelines offers a novel strategy to address the information needs of patients with stroke, by providing them up-to-date evidence about stroke using non-text-based media. This resource would be developed and evaluated through a program of research.

**Availability:** Semesters 1 and 2

**Models of care for home nursing of people with chronic illness**

There is increasing pressure on hospitals to deal with larger numbers of sicker patients. Providing care in the home is an option for some patients who are living with a chronic illness. This project will identify candidate conditions for home care nursing, develop, and potentially evaluate, new models of nursing care.

**Project Supervisors:** Dr Tim Schultz  
**Availability:** Semesters 1 and 2

**Research areas**

- Translational Health Outcomes
- Cardiac, Respiratory and Vascular Health
Our research focuses on how communities respond to and participate in healthcare, with particular emphasis on public health issues. We aim to ensure that the views and experiences of community members, including citizens, patients, consumers and stakeholders, are included in health research, policy and service delivery. We use a variety of research methods, including qualitative, quantitative and deliberative methods often through an ethical lens or with a critical stance. We collaborate widely, with other staff of the School and more broadly with researchers, clinicians and policy makers in SAHMRI, the Women’s and Children’s Health Network, SA Health, Cancer Council Australia, the Northern Adelaide Local Health Network, and others. Our research covers the following areas:

- Health promotion and public understanding of science
- Primary health care and chronic disease and risk management
- Counselling and psychotherapy
- Health care policy
- Health systems and services
- International health
- Community engagement (Indigenous and non-Indigenous)
- End of life care.

Lead researcher: Associate Professor Jaklin Eliott
Email: jaklin.eliott@adelaide.edu.au

Honours project opportunities

Ethics in the news

The media both shapes and reflects public opinion, sometimes drawing public attention to matters that have moral or ethical significance. This is often raised in the context of an alleged breach of some ethical code, or behaviour that appears to deviate from that expected of persons in the public arena. However, the invocation of an ethical lens can also serve other interests, and some ethicists have noted a ‘commodification of ethics.’ Little is known however about what issues or topics are deemed to have ethical import, and how these are depicted within the media. This project involves accessing, coding, and analysing print and/or online media reports that feature ‘ethics.’

Project Supervisor: Associate Professor Jaklin Eliott
Availability: Semesters 1 and 2
Available for: Honours; Master of Public Health; Masters (MClinSc)
Special requirements: Nil
Research areas
Translational Health Outcomes
Public Health

The prevalence and modalities of expressive therapists working in aged care in Australia

Utilising expressive and creative therapies in aged care settings in a growing area of practice. However, there is little information regarding an established or coherent approach to practice with this client group. Additionally there is limited data available regarding the number of ANZATA /ACATA / PACFA registered arts therapists that work with this population. This research could explore which creative modality individual counsellors utilise when working with aged-care clients, together with collating information about registered therapists who work in this field.

Project Supervisor: Associate Professor Jaklin Eliott
Availability: Semesters 1 and 2
Available for: Honours; Master of Public Health; Masters (MClinSc)
Special requirements: Nil
Research areas
Translational Health Outcomes
Public Health
Social and Behavioural Health Sciences
Unit: End of Life Care

Our research focuses on how communities respond to and participate in healthcare, with particular emphasis on public health issues. We aim to ensure that the views and experiences of community members, including citizens, patients, consumers and stakeholders, are included in health research, policy and service delivery. We use a variety of research methods, including qualitative, quantitative and deliberative methods often through an ethical lens or with a critical stance. We collaborate widely, with other staff of the School and more broadly with researchers, clinicians and policy makers in SAHMRI, the Women’s and Children’s Health Network, SA Health, Cancer Council Australia, the Northern Adelaide Local Health Network, and others. Our research covers the following areas:

- Health promotion and public understanding of science
- Primary health care and chronic disease and risk management
- Counselling and psychotherapy
- Health care policy
- Health systems and services
- International health
- Community engagement (Indigenous and non-Indigenous)
- End of life care

The End of Life Care group undertakes research with people nearing the end of their life and the systems that provide their care. A key current project is the NHMRC Partnership Project: Investigating the inclusion of vulnerable populations in Advance Care Planning: Developing complex and sensitive public policy

Lead researcher: Associate Professor Jaklin Elliott
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Honours project opportunities

Values and ethics in planning for end-of-life care for vulnerable Australian communities

This project is part of a larger study, funded by an NHMRC Partnership Grant APP1133407 in partnership with 10 community partners, including advocacy, clinical, government, and legal organisations. The study can be scaled according to the enrolled degree. The student will be part of a team examining how people talk about and understand the process of planning for end-of-life care, often called Advance Care Planning (ACP). The project will draw upon available data (generated during other phases of the larger study) to clarify ethical principles, values, and beliefs pertaining to what, how, when, and by whom sensitive topics (e.g. ACP) should be managed. The student will identify and analyse the ethical issues evident in policy and practice regarding ACP, particularly regarding vulnerable groups in South Australia. They could also analyse points of convergence and divergence between the ethical assumptions embedded in academic literature and policy documents relating to current legislation and clinical practice, and/or within community and healthcare professional views. Results would contribute to recommendations to enable development of recommendations for changes to policy and practice that will facilitate the provision of culturally safe, inclusive policies and practices that encompass the diverse views and values within the Australian population.

Project Supervisor: Associate Professor Jaklin Elliott
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health; Masters (M ClinSc)

Special requirements: Proficiency (evidenced by appropriate grades) with ethical theory, and/or sociology, and/or critical psychology is required.

Representations of medicalised death and dying in the Australian media

Media both reflects and shape public understanding about significant issues, and is known to be a source of health information for many. It is generally agreed that death is a feared event, and that death within Australia is medicalised, such that the majority of Australians still die within a medical setting, though many profess a wish not to do so. Recent legislative debate and change, and events within the medical setting, have seen a specific focus on medicalised death within Australia as well as elsewhere. This has included discussion on ‘medically assisted death’ and ‘euthanasia’ as well as deaths attributable to medical error. The student would undertake an analysis of articles referencing death in a medical setting, utilising descriptive statistics and qualitative analysis. Information about public and/or publically available perceptions of such deaths may assist in better provision of information about how most Australians die.

Project Supervisor: Associate Professor Jaklin Elliott
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil)
Special requirements: Familiarity with (evidenced by appropriate grades) public health, sociology, and/or critical psychology is preferred.

How do community members and healthcare professionals currently undertake advance care planning and apply the current South Australian law?

This project is part of a larger NHMRC Partnership project entitled: Including vulnerable populations in the development of policies and strategies in sensitive public policy areas. This project is part of Study 3 in the larger project which is investigating community members’ and health professionals’ understandings of advance care planning (ACP), particularly as enacted in Aboriginal and Torres Strait Islander peoples, people from CALD backgrounds and people with advanced chronic disease. Your role will be to identify and review and evaluate materials developed or used in these vulnerable populations in both community and acute health services in South Australia to guide and inform healthcare professionals and community members regarding ACP.

Project Supervisors: Professor Greg Crawford and Dr Teresa Burgess
Availability: Semesters 1 and 2
Available for: Honours; PhD (Mphil); Master of Public Health
Special requirements: Qualitative research skills.
Advance care planning (ACP) allows individuals to make plans for their future care, often in consultation with clinicians, family members, and important others. Despite development of legislation to improve implementation and uptake of ACP, problems remain, partly because of differences in interpretation of relevant legislation and policy. Such differences are heightened within vulnerable communities where cultural variation in practices and ways of thinking about individuals, families, health decision-making, and death must also be address. Drawing upon existing data, this project will examine the needs and expectations of defined vulnerable communities and healthcare providers regarding current legislation and policy, identifying points of congruence and divergence.

**Project Supervisors:** Professor Greg Crawford and Associate Professor Jaklin Eliott

**Availability:** Semesters 1 and 2

**Available for:** PhD (Mphil); Master of Public Health

**Special requirements:** Qualitative research skills.

**Research areas**

- Translational Health Outcomes
- Public Health
- Indigenous and Disadvantaged Health
Social and Behavioural Health Sciences Unit: SAHMRI Population Health Research Group

Adelaide Health and Medical Sciences building (AHMS), South Australian Health and Medical Research Institute (SAHMRI)

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- End of life care

Lead researcher: Associate Professor Caroline Miller

Email: caroline.miller@adelaide.edu.au

Honours project opportunities

Factors influencing compliance with smoke-free regulations in the Adelaide Biomedical Health Precinct

Smoke-free policies are an important means of protecting the community against harmful second-hand smoke in public areas and creating health promoting areas and supportive environments to maintain quit attempts. Smoker compliance with these policies can be variable throughout the day and by days of the week, so it is important to monitor compliance over time. This project will involve collection of observational data of tobacco smoking in the Adelaide biomedical health precinct, as well as analysis of factors which influence compliance with the area’s smoke-free regulations, such as staff/patient/visitor status, signage, weather conditions, degree of foot traffic etc. Recommendations will then be developed for improving policy compliance based on the results of the study and the existing literature in the area of smoke-free policies.

Nature of data: Quantitative observational data

Source of data: Observational data to be collected by the student around the Adelaide biomedical health precinct

Project Supervisors: Associate Professor Caroline Miller and Kim Martin

Availability: Semesters 1 and 2

Special requirements: Completed coursework on quantitative research methods and qualitative data analysis; Knowledge of health psychology and public health interventions; Interest in public health approaches to reduce harm from second-hand smoke.

Cocktail, Jägerbomb, beer, wine, mocktail, club soda... investigating drink choices among young adults

There is growing interest in policy approaches to address overconsumption of sugary drinks but one of the barriers to implementing change for policy makers is the uncertainty in how people will respond and whether there will be unintended consequences. For example, people who consume sugary drinks during social occasions may respond to incentives to reduce sugary drink consumption by switching to alcohol, or increasing alcohol consumption. Similarly, policies aimed at reducing alcohol consumption could result in increased sugary drink consumption. There is a need for further understanding on whether people consider substituting one drink type for another, the circumstances under which this may occur, and whether perceived health risk contributes to substitution behaviour. This could be explored via in-depth interviews with young adults who have high rates of sugary drink and alcohol consumption and who are exposed to multiple influences on beverage selection (e.g. social, advertising, availability).

Project Supervisors: Associate Professor Caroline Miller and Jo Dono

Availability: Semesters 1 and 2

Available for: Honours; Master of Public Health

Special requirements: Completed coursework on qualitative research methods and qualitative data analysis; Knowledge of health psychology and public health interventions; Interest in public health approaches to reducing consumption of unhealthy beverages.

Population exposure to alcohol consumption in the Australian reality show “Bachelor in Paradise”

Alcohol consumption is a widely accepted component of Australian culture, with high consumption per capita globally. Popular reality television shows in Australia anecdotally depict alcohol consumption on a regular basis. Exposure to imagery of alcohol consumption normalises and promote the consumption of alcohol in the community. A preliminary investigation revealed that viewership for Bachelor in Paradise was high and second only to the Commonwealth Games at one point. This project will involve 1. conducting a literature search on similar projects internationally and the effect of such placement 2. investigating reach and viewer profiles of the television show and then 3. coding 16 episodes of Bachelor in Paradise at 1 minute intervals for the presence or absence of alcohol. The student will then prepare a manuscript for publication in the peer-reviewed literature in collaboration with the research team.

Project Supervisors: Associate Professor Caroline Miller and Jacqueline Bowden

Availability: Semesters 1 and 2

Available for: Honours; Master of Public Health

Special requirements: Nil
Victorian Livelighter campaign evaluation: Analysis of a pre-post cohort design with a comparison state

In 2014, the Livelighter campaign was launched in Victoria for 6-weeks. The campaign consisted of three television advertisements (with supporting media) with the general aims of increasing awareness of health risks associated with being overweight, understanding the risks associated with poor lifestyle choices, supporting healthier lifestyle choices, and encouraging public debate regarding obesity and the need for community-level interventions.

A pre-post cohort design with South Australia as a comparison state was employed to evaluate the campaign. In both states, data were collected from 1000 participants at baseline, with follow up of over 700 participants for each state. The questionnaire was developed by the Centre for Behavioural Research in Cancer, Cancer Council Victoria, using pre-existing validated measures and specifically derived measures. The questionnaire assessed recall, beliefs, intentions, current behaviour and recent changes. An opportunity exists to apply research skills and behavioural theory to a real-world setting, in the evaluation of the first media wave of the Livelighter campaign in Victoria.

Project Supervisors: Associate Professor Caroline Miller and Dr Kerry Ettridge

Availability: Semesters 1 and 2

Special requirements: This project would be suitable for a student with high level statistical analysis skills and with coursework in psychology/behavioural science.

Australian media coverage of a tax on sugar-sweetened beverages

Sugar-sweetened beverages are gaining more attention in public health due to their contribution to obesity, limited nutritional value and associated health issues. Regulatory measures, such as imposing a tax increase on soft drinks, have been implemented in other countries; however, Australia has lagged behind other countries in its implementation of initiatives to curb consumption. The media can play an important role in influencing and reflecting public opinion and political decision makers. Understanding the Australian media portrayal of SSB regulatory measures will provide insight into the formation and progression of public opinion on this important health issue. This project would involve undertaking a media-content analysis regarding coverage and views towards regulatory measures aimed at reducing the consumption of SSBs, including but not limited to taxes.

Project Supervisors: Associate Professor Caroline Miller and Dr Kerry Ettridge

Availability: Semesters 1 and 2

Available for: Honours; Master of Public Health

Special requirements: Student skills required include: systematic literature searching, computer and database literacy, some statistical knowledge/ability and excellent written skills.

Knowledge of qualitative methods and qualitative data analysis, involving creating suitable coding structures/frames, coding data using NVivo software, and identifying and collating qualitative data into themes

Knowledge of and/or interest in obesity policy and sugary drinks

Research areas

Translational Health Outcomes

Public Health
Our laboratory is embedded within Genetics and Molecular Pathology in the state-wide pathology service, SA Pathology providing diagnostic services for patients with inborn errors of metabolism throughout Australia. These are single gene disorders resulting from defects in the biochemical pathways of the body. For a handful of these diseases treatments are available, and for others clinical trials are ongoing, but for the vast majority there is no clinically approved therapeutic pathway. Consequently, these diseases can have a devastating impact on the child and family representing a significant proportion of childhood disability and death. The laboratory’s primary research focus is to improve the diagnostic efficiency of these disorders and to investigate therapeutic strategies.

Lead researcher: Associate Professor Maria Fuller

Email: maria.fuller@adelaide.edu.au

Honours project opportunities

Understanding and exploring treatment approaches for inherited neurological disease

Neurological deficits in many untreatable inherited metabolic diseases manifest progressive neurological decline in infancy leading to premature death. The primary biochemical insult the accumulation of a metabolite compromises the normal metabolic state. How the cell responds to this metabolic defect involves a multitude of cellular processes and it is this complex interplay of largely unknown events that underlies disease pathophysiology. It has been known for 30 years that amongst these metabolic aberrations, transpires an abnormal accumulation of lipids within the brain. Lipids are crucial for brain function and temporal regulation highly important for neuronal development, therefore brain lipid homeostasis is tightly regulated. This project seeks first to define the extent of lipid dyshomeostasis within the brain of a mouse model and/or neuronal cultures (student choice) and second, manipulate lipid metabolism via pharmaceutical intervention using conventional drugs of lipid metabolism as a therapeutic tool.

Project Supervisor: Maria Fuller

Availability: Semesters 1 and 2

Special requirements: Nil

Biomarkers for monitoring therapeutic intervention

Gene therapy presents a simple principle to treat monogenic neurodegenerative diseases by replacement of the defective gene. The first-in-man gene therapy trial for the genetic disease known as Sanfilippo A syndrome is currently underway (abeonatherapeutics.com) and biochemical evaluations for all patients treated worldwide are being performed within our laboratory. This project will investigate additional biomarkers for this disease to chart individual patient response to the gene therapy. Additionally, biomarker discovery investigations will be undertaken for other disorders in anticipation for future gene therapy trials for these related conditions.

Project Supervisor: Maria Fuller

Availability: Semesters 1 and 2

Special requirements: Nil

HDR project opportunities

Targeting the brain lipidome as a therapeutic strategy

Inherited neurodegenerative disorders present throughout life, although disease burden is greatest in childhood. The diseases result in progressive loss of neurocognitive function and in the most aggressive forms inevitable decline to a dependent vegetative state and premature death. Current diagnostic pathways remain inadequate, with many patients not receiving a correct diagnosis and for others diagnosis is often delayed - stressful for both child and family. There are no cures and therapeutic intervention is limited to a small subset of cases. Using patient samples, cell and/or mouse models metabolism in the brain will be interrogated; identifying biomarkers for diagnosis and informing new therapeutics for disease treatment. This will also establish potential for extension of therapeutic and disease prophylactics to the wider spectrum of neurocognitive illnesses for which study models that faithfully recapitulate human disease are not clear.

Project Supervisor: Maria Fuller

Availability: Semesters 1 and 2

Special requirements: Nil

Research areas

Translational Health Outcomes
Innovative Therapeutics
Neuroscience, Behaviour and Brain Health

The Translational Medicine research group