Research Projects and Information for ProspectiveStudents 2021

School of Medicine

Honours, MPhil and PhD
V.4, 21 October 2020

Deakin University CRICOS Code: 00113B

Table of Contents

Contents

An overview of the Honours program H413

The Honours program in the School of Medicine is designed to build upon the skills and knowledge obtained from the completion of a three-year undergraduate degree. The program aims to provide students with the opportunity to pursue an independent investigative research project in the areas of health and medicine along with relevant course work. This will enable students to expand their depth of knowledge in their chosen research area and provide a suitable qualification for entry into a higher degree by research program (Masters or PhD).

The School of Medicine program is a Type A Honours Degree, leading to award of a Bachelor of Health and Medical Sciences (Honours) (course code H413). This program, which comprises both coursework units and a research thesis, is undertaken over one year full-time. Each student is allocated a primary research supervisor and in some circumstances a co-supervisor.

Entry requirements

Applicants must have completed an accredited undergraduate degree in the broad area of health and medical science (of at least three years length) in a discipline related to the area of their research project. Applicants will require a mid-credit (>65%) average for the third year or equivalent of undergraduate study to be eligible for selection.*

Doctor of Medicine (H911) students who do not meet the above requirement and wish to apply will require a minimum GAMSAT score of 60 and have successfully completed a minimum of 8 credit points of the Doctor of Medicine course. Entry into H413 for Doctor of Medicine (H911) students will be available at the end of the first, second or third year of the course and will be a competitive process.

*Entry will also be determined by the availability of supervisors and resources.

Course Structure of H413

The course comprises three Units, worth a total of eight credit points to be taken over one year of full-time study. The requirements include: an independent research project/thesis worth four credit points conducted under the supervision of the nominated supervisor for that project, a two-credit point unit in research methods, and a two credit point unit in developing research skills in health and medical sciences. The course will be structured in the following way:

HMH401: Developing Research Skills	2 credit points (Trimester 1)
HBS400: Research Methods	2 credit points (Trimester 1)
HMH402: Honours Research Project	4 credit points (Trimester 2)

HMH401: This Unit will provide you with a thorough understanding of your research field through the generation of a research proposal whilst at the same time helping you to develop skills essential to research, including online literature searching, presentation skills and critical analysis of literature. Assessment involves the development of a research

proposal, the completion of a literature review and an oral presentation of the research findings prior to submission of the thesis.

HBS400: This is a Faculty-wide Unit comprised of a series of modules, in which the students must complete a required number of modules. Students select modules that are the most relevant to their project and in areas in which they require support. All modules are completed and assessed in Trimester 1.

HMH402: This Unit involves the implementation of the research project. While the enrolment is in Trimester 2, students will actually commence their research project in Trimester 1. The assessment for this Unit is writing up the research in a thesis format that includes a literature review, research methodologies, research results and a discussion of the findings. The literature review (which is undertaken as part of HMH401) will be only assessed in relation to the relevance to the project and the hypothesis and aims.

- Developing Research Skills Trimester 1 2 credit points
- Research Methods Trimester 1 2 credit points
- Research Project/Thesis Trimester 2 4 credit points

The Honours year is an exciting year because it provides the first real opportunity to get a feel for research and students develop a wide range of research and problem-solving skills. However, students should be aware that this year is a challenging and demanding year, involving at least 35 hours per week of study and/or research work.

Honours Awards

Each year, enrolled students can apply to the School of Medicine for merit-based awards to the value of $1,000 and $2,000.

Contact details

For further information, please contact the Honours Course Director:

Assoc Prof Jeffrey Craig
Phone: (03)5227 6455
Email: jeffrey.craig@deakin.edu.au

Applying for Honours

To apply for Honours in the School of Medicine please follow the steps below:

1. Select and preference four research projects

Examine the list of research projects that the school is offering for 2021. For those projects that you are interested in, you must personally contact the named supervisor to discuss the proposed project. The supervisors contact details are provided together with the project description. This will enable you to gauge whether the research project aligns with your career goals and enables the supervisor to establish whether you have the appropriate academic background to undertake and complete the research project. As most projects are chosen by more than one student, **we strongly recommend that you select four research projects, listing your most preferred project first**.

2. Complete the project preference form

Please complete the online project preference form. This form is mandatory as part of your application for this course, and must be submitted before the closing date for applications.

3. Submit an on-line application

All prospective honours students MUST also apply directly to Deakin University. Submit an online application at http://applicantportal.deakin.edu.au/connect/webconnect. Closing dates for applications is **25 October, 2020**.

- You will need to register as a user in order to apply. Select the 'Register' link to activate a username and password to gain entry to the online application. NOTE: Current Deakin students – your Deakin username and password will not gain you access to the online application.
- Complete all of the questions on the online application. NOTE: referee details are not required.
- Complete the final step ONLY if your undergraduate studies were NOT undertaken at Deakin University. This final step requires applicants to upload scanned and certified copies of their University academic transcript(s).

4. Project allocation

Students will be allocated a project based on a combination of student preferences, supervisor's student preferences and a mid-credit (>65%) average for the 3rd year or equivalent of undergraduate study. Successful candidates will be advised of their offer during mid-November to mid-December 2020. Please note that we are not always able to allocate a project to every applicant.

The projects on offer within the School of Medicine reflect the expertise and research that is currently undertaken by the prospective supervisors at Deakin and at our affiliate institutes. It must be noted that due to the nature of research, the focus and direction of a research group may change over time and the final project may not necessarily be exactly as described.

Please refer to the website for any further information on Honours in the School of Medicine: http://www.deakin.edu.au/medicine/research .

An overview of the Master of Philosophy program H800

The Master of Philosophy (MPhil) course is an elite intensive postgraduate research degree, providing students with the opportunity to pursue an independent investigative research project along with specialised coursework that is designed to provide skills in research design, the interpretation and communication of research and an understanding of research integrity.

The MPhil will suit students who are inquisitive, analytical and interested in pursuing higher coursework skills and further research in the health and medical sciences field. The MPhil is specifically designed to provide students from diverse undergraduate backgrounds with an opportunity to expand their knowledge base and become an independent researcher with specialised technical, critical thinking, communication and cognitive skills. These skills are highly sought by many employers, with the course providing students with a dedicated pathway into both national and international PhD programs or into careers, both local and globally, within academia, industry, medical research as well as government and non-government scientific agencies.

The MPhil course comprises both coursework units and research under the guidance of a supervisor, culminating in a research thesis. The program is undertaken over 18 months-two years full-time (or full-time equivalent).

Entry requirements

Applicants must have successfully completed one of the following to be eligible for selection*:

- Bachelor degree with a distinction average (70%) for the third year or equivalent in the same discipline as the proposed research thesis.

  OR

- Coursework Master's degree with a minimum credit average (65%) in the same discipline as the proposed research thesis.

  OR

- Completion of the pre-clinical component of the Bachelor of Medicine Bachelor of Surgery (or equivalent degree) at the postgraduate level.

International Students must also possess an overall IELTS score of 7 with no band less than 6.5 (Band C or equivalent)

*Entry will also be determined by the availability of supervisors and resources.

Course structure of H800

HMH812 Research Thesis. Students will work continuously on their research project over an 18-month to two-year period of full-time study (~36 hrs/week). Students are eligible for four weeks of leave each year. It is possible to enrol part-time at 0.5 FTE.

In addition, students need to complete 4 credit points of research training coursework units within the first year (FTE) of the course.

HMH810 Research Communication (2 credit points) – Available Trimester 1 or Trimester 2.

HMH811 Research Interpretation and Integrity (1 credit point) – Available Trimester 1.

And one of:

HMH800 Research Design (1 credit point) – Available Trimester 1 or 2
or
HSH746 Biostatistics 1 (1 credit point) – Available Trimester 1.
or
HSH715 Qualitative Health Research (1 credit point) – Available Trimester 1

The Trimester in which the coursework will be undertaken will be determined by the enrolment date and after consultation with the Course Director.

HMH800: In this unit, students will learn how to design a research project, how to formulate a research hypothesis and develop aims along with appropriate study design to test the hypothesis. The unit places a strong emphasis on developing the student's understanding of various statistical tests by which to analyse research data, including relevant software. It will also emphasise appropriate professional practice in the workplace and compliance with regulatory authorities.

HMH810: This Unit will engage students to learn and develop communication skills that are fundamental for a career in research, but which will also have broad application in careers other than research. The topics that will be covered include developing effective written and verbal communication skills to interpret and transmit a body of knowledge in the discipline of medical research to specialist and non-specialist audiences, and will incorporate how social media can be used to communicate research and build a researcher's profile. It will include written presentations of a literature review and the research project as well as a verbal presentation of the research proposal.

HMH811: This unit will teach students the philosophies, ethics and principles of research integrity. It will also provide students with the skills to be able to critically analyse literature in their discipline for their strengths and weaknesses.

HSH746: This is an introductory unit on biostatistics. In this unit, students will explore the philosophical basis of statistical thought, examine fundamental statistical concepts and methods and explore their application in a variety of health settings. The delivery of the Unit is designed to facilitate the syntheses of the basic components of learning through practical exercises, statistical computing labs and the application of biostatistical techniques to realistic health-related data. The main topic areas covered will include descriptive statistics, hypothesis testing, confidence intervals, comparison of means, inference on proportions, contingency tables, correlation and basic regression concepts.

HSH715: This unit aims to introduce students to the qualitative health research. Students will explore the types of research questions that can be answered using qualitative methods. Students will develop skills in identifying researchable questions from theories, their practices and observations; designing, planning and conducting qualitative health research; and qualitative data analysis techniques.

Contact details

For further information, please contact the MPhil Course Director:
Prof Tania de Koning-Ward
Phone: (03)5227 2923
Email: taniad@deakin.edu.au
Please refer to the website for any further information on MPhil in the School of Medicine: http://www.deakin.edu.au/medicine/research .

Course Fees

If you are a successful applicant for research degree candidature, and you are an Australian citizen, permanent resident or New Zealand citizen, you will not pay any tuition fees.

You also do not need to pay the University's Student Services and Amenities Fee (SSAF).

For all other applicants, course fees apply. Please refer to **www.deakin.edu.au/courses/fees**

Applying for MPhil

The application process requires all prospective MPhil students to:

Examine the research disciplines or research projects on offer in the School of Medicine. For projects/topics that you are interested in, it is mandatory that you contact the named supervisor to discuss the proposed project. This will enable you to gauge whether the research project aligns with your career goals and enables the supervisor to establish whether you have the appropriate academic background to undertake and complete the research project. The supervisor needs to confirm that they agree to take you on as a student.

As this is a Higher Degree by Research, an online application needs to be submitted directly to Deakin University using the following link: **www.deakin.edu.au/research/become-a-research-student/how-to-apply-research-degrees .**

Note that the application form requires an applicant to provide a one-page outline of their proposed research program and this needs to be undertaken in consultation with the supervisor. More information for international students can be obtained from **www.deakin.edu.au/international-students .**

Enrolment dates: Note that the processes for accepting enrolment are different to undergraduate courses and the time can be lengthy (can take up to 8 weeks). For international students, the process will be even lengthier due to VISA applications, etc. Whilst students can enrol for candidature and thus commence the research component at any time, it is recommended that students are ready to commence in either the beginning of February or beginning of July to allow sufficient time for orientation and safety training and commencement of coursework in either Trimester 1 or 2. Accordingly, it is requested that **applications are submitted either by:**

- **End November** for commencement in February the following year, with coursework beginning in Trimester 1.

- **Beginning of May** for commencement in July the same year, with coursework beginning in Trimester 2 of that year.

An overview of the Doctor of Philosophy H960/H961

The key to entry (besides meeting entry qualifications) into a PhD Xtra or Master's by Research program is the support of a School of Medicine staff member to supervise you. It is essential, therefore, that you discuss your application for one of the listed projects with the relevant supervisor(s) prior to applying. Note the application form requires an applicant to provide a one-page outline of their proposed research program.

Applying for PhD

Applications for candidature are accepted at **any time**; however, for applicants seeking scholarships please note the appropriate closing dates shown below. With the support of a supervisor, submit an application.

The application and scholarship can be found at: http://www.deakin.edu.au/research/become-a-research-student/how-to-apply-research-degrees and http://www.deakin.edu.au/courses/scholarships/find-a-scholarship/rtp-and-duprs . Applications from domestic scholarships close at the end of **October** each year.

Additional information for International applicants can be found at:
http://www.deakin.edu.au/research/become-a-research-student/international-research-students.

Applications for scholarships from International students close at the end of **July** each year.

Abbreviations

CMMR	Centre for Molecular & Medical Research
COCPH:	Centre for Organisational Change in Person-Centred Healthcare
CPHR	Centre for Public Health Research
CREM	Centre for Rural Emergency Medicine
DRH	Deakin Rural Health
GCEID	Geelong Centre for Emerging Infectious Diseases
IMPACT	Centre for Innovation in Mental and Physical Health and Clinical Treatment
NCFH	National Centre for Farmer Health
SOMERG	School of Medicine Education Research Group

Cancer

Project reference: 1688

Zebrafish cancer models to understand the mechanism of cancer progression

Supervisors: Amardeep Dhillon, Faiza Basheer

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

The development and progression of cancers involves multiple cellular interactions and complex physiological changes that cannot be faithfully replicated in vitro. It is only using a comparable in vivo and genetically tractable model that we can effectively explore and establish causal relationships between candidate genes/therapeutic targets and the development of tumours. Whilst mouse models of human cancer have significantly contributed to our understanding of the disease, they are costly and not easily amenable for in vivo non-invasive visualization of tumours. To overcome these challenges, researchers have recently generated optically clear zebrafish cancer models, which facilitate in vivo tracking of tumour cells in real time with advanced imaging and cutting-edge genome editing capabilities. Thus, these models can significantly help in defining mechanisms that drive continued tumour growth, metastasis, and therapy responses.

Research question:

What are the key genes and pathways controlling tumour invasion and metastasis? This project aims to uncover genes and pathways regulating tumour growth and metastasis using two zebrafish models. The first involves studying how human cancer cells with specific genetic profiles behave when transplanted into immune-deficient zebrafish. The second model involves genetically manipulating candidate cancer-enriched genes and/or therapeutic targets to understand their roles during tumourigenesis.

Techniques, methods, analyses and day to day activities:

Techniques to be used in this project will include molecular biology (cloning, quantitative PCR), cell biology (cell culture, transfection), histology, fluorescence and confocal microscopy, protein analysis (western blotting), and zebrafish handling and dissection. This involves use of zebrafish genetic cancer models and zebrafish xenotransplantation models.

Contact supervisor: Assoc. Prof. Amardeep Dhillon (School of Medicine): amardeep.dhillon@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1665

Investigating cancer progression and targeted therapeutics in 3D functional microenvironments

Supervisors: Rasika Samarasinghe, Richard Williams, Sarah Shigdar

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Childhood solid cancers are the highest cause of mortality in kids between the ages of 0-14 years, with an estimated 125,000 children being diagnosed annually. Various different chemotherapeutics and biologic agents have been tested, with over 150 clinical trials conducted in the past decade, however very few of these trials have shown any therapeutic benefit in children, especially on those with brain and other solid tumours. The 5-year survival rate for these cancers are less than 17% which hasn't changed for the past 30 years. A major cause for this low survival is the inability of conventional therapies to target invasive and migratory cancer cells which are the primary cause for progression and metastasis of cancers.

Research question:

This study aims to establish a paediatric cancer model in an enhanced 3D microenvironment of functional biomaterials that help promote cancer cell growth and invasion. It also aims to evaluate the molecular mechanisms regulated in these 3D microenvironments and identify potential targeted therapies, such as aptamers, as alternative therapies for these paediatric cancers.

Techniques, methods, analyses and day to day activities:

This project will include cellular techniques such as cell culturing, cell viability, cytotoxicity and confocal microscopy to determine cellular activity of cancer cells in 3D microenvironments and molecular bioassays such as real-time PCR to determine regulation of signalling pathways.

Contact supervisor: Dr. Rasika Samarasinghe (School of Medicine): r.samarasinghe@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1662

Understanding metabolic alterations in childhood cancers

Supervisors: Rasika Samarasinghe, Sean McGee

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Childhood brain and spinal cord tumours (CBSCT) are the leading cause of mortality in children, accounting to 1/3 of all cancer related deaths. Over 4000 cases of CBST are diagnosed each year and despite therapeutic advances, the overall survival is 14.6 months with a 34% 5-year survival. Due to the early onset of these tumours, it is suggested that a single genetic mutation is insufficient to drive malignant transformation and additional mechanisms, other than the traditional genetic and oncogenic modifications within the tumours cells are therefore likely to be involved. Deregulated cellular metabolism is a key characteristic of cancer with mounting evidence showing altered metabolism associated with neoplastic transformation, progression and chemo-resistance. Further, cancer cells have shown to undergo cell cycle arrest and cell death when altered metabolism in not maintained, hence understanding these mechanisms can help elucidate the initiation of these aggressive CBSCTs.

Research question:

This study aims to explore the metabolic profile of CBSC cells, with the hope of identifying aberrant metabolic pathways that are crucial for the progression and metastasis of CBSCTs. It also aims at exploiting these altered metabolic pathways as novel therapeutic targets for CBSCT. It is hypothesised that deregulated metabolic pathways are up-regulated in CBSC cancer cells as compared to control cells and that these mechanisms are crucial for the growth and progression of CBSC.

Techniques, methods, analyses and day to day activities:

Metabolic profiling will be determined using Seahorse extracellular flux analysis, real-time PCR, western blotting and flow cytometry will be used to determine molecular pathways and cell-based assay use to evaluate cell proliferation, invasion and metastasis.

Contact supervisor: Dr. Rasika Samarasinghe (School of Medicine): r.samarasinghe@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1656

Understanding the molecular regulation and functions of a tumour-enriched transcription factor

Supervisors: Amardeep Dhillon, JetPhey Lim, Syeda Ameen

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

The malignant transformation of cells requires changes in gene expression caused by dysregulation of networks of DNA-binding proteins known as transcription factors, which activate or repress genes by interacting with other proteins, including histone modifying enzymes, chromatin remodellers and RNA polymerases. We interested in understanding the biology and mechanism of gene regulation by a family of transcription factors known as Activator Protein-1 (AP-1). Aberrant AP-1 function is implicated in the pathogenesis of many human diseases, including cancer. We and others have previously identified the AP-1 protein Fos Related Antigen-1 (FRA1) as a key regulator of gene expression programs facilitating the spread multiple cancers, including colon, lung, pancreas, breast, bladder, thyroid, and skin. Importantly, these studies also found FRA1 to be enriched in cancer cells but not their normal counterparts, underscoring its potential as a cancer-specific therapeutic target.

Research question:

Research question: How does FRA1 promote cancer progression and how can we disrupt its actions in cancer cells?

To identify strategies to disrupt its actions in cancer cells, this project aims to use biochemical, cell biological and proteomic approaches to characterize the composition of FRA1 complexes isolated from cancer cell lines, and to identify molecular pathways that are dysregulated in cancer cells in which FRA1 is overexpressed.

Techniques, methods, analyses and day to day activities:

Experimental approaches that will be used during this project include molecular biology (cloning, chromatin immunoprecipitation, qPCR), cell biology (cell culture, gene expression/knockdown, phenotypic assays) and protein analysis (proteomics, immunoprecipitation, western blotting).

Contact supervisor: Assoc. Prof. Amardeep Dhillon (School of Medicine): amardeep.dhillon@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1642

Identification of metabolic vulnerabilities in cancer

Supervisor: Sean McGee

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

All cancer cells reprogram their metabolism to support their rapid proliferation and growth and this metabolic reprogramming has also been linked to resistance to cancer treatments. While it has been known for some time that cancer cells increase glycolysis to provide energy, it is becoming apparent that oxidative metabolism has an equally important role by providing metabolites for lipid, protein and nucleotide synthesis and for balancing redox state. This raises the possibility that inhibitors of various metabolic pathways could be used to prevent cancer progression and enhance sensitivity to existing treatments. Using our expertise in metabolic profiling, we have developed an approach to identify metabolic vulnerabilities in cancer cells that could be exploited therapeutically.

Research question:

This project will profile the metabolism of breast, prostate, brain and liver cancer cells to identify metabolic vulnerabilities, which will be targeted to kill cancer cells. The cellular mechanisms involved will also be examined using a number of different molecular analyses. This project will increase our understanding of how cancer cells reprogram their cell metabolism to proliferate and survive and could also reveal new treatment approaches for cancer.

Techniques, methods, analyses and day to day activities:

The project will involve cell culture, real time analysis of metabolic flux using extracellular flux analysis and real time profiling of cell proliferation using impedance scanning. Molecular analyses including gene expression profiling using real time RT-PCR, intracellular signalling determination using western blotting will also be performed.

Contact supervisor: Prof. Sean McGee (School of Medicine): sean.mcgee@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1636

Crossing the blood brain barrier for drug delivery

Supervisors: Sarah Shigdar, Rasika Samarasinghe

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Due to the importance of the brain in regulating physiological functions of the human body, its environment is separated from the circulatory system to avoid invasion of pathogens via a physical barrier called the blood-brain barrier (BBB). While this barrier is protective against toxic substances circulating in our blood, it complicates delivery of therapeutics from the circulatory system and into the brain tissue to treat pathologies. In order to deliver drugs across the BBB into the brain, we have generated a number of aptamers, or chemical antibodies, that can bind to receptors on the BBB and carry a cargo into the brain. This project will characterise these aptamers using an in vitro model of the blood brain barrier.

Research question:

Aptamers are an emerging field of novel agents that can be considered superior to conventional therapeutic agents due to their capacity to bind to their target in a highly specific and sensitive manner. The central hypothesis of this research is that DNA aptamers generated against biomarkers present on the BBB could be internalised and transcytosed into the brain.

Techniques, methods, analyses and day to day activities:

This project will use flow cytometry, confocal microscopy, molecular biology techniques and cell culture. Aptamers will be generated using molecular biology techniques. Binding affinities and rate of internalisation will be assessed using flow cytometry and confocal microscopy

Contact supervisor: Dr. Sarah Shigdar (School of Medicine): sarah.shigdar@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1635

Developing targeted therapeutics for treatment of melanoma

Supervisors: Sarah Shigdar, Rasika Samarasinghe

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Melanoma is considered a dangerous cancer due to its likelihood to metastasize, with approximately 40% of patients developing metastases to distant organs, especially the brain. With a mean survival time of 9.2 months and a 5-year survival rate of 5-19% after the onset of distant metastasis, the prognosis for metastatic melanoma patients is very poor. Conventional therapies, such as chemotherapy and radiotherapy, are very toxic to patients due to their off-target effects, and generally cannot eradicate tumours due to a build-up of resistance to the treatments. Effective new therapies are urgently required to overcome these obstacles. Aptamers, also known as chemical antibodies, are a novel therapy that binds to targets with high specificity and affinity. Aptamer-mediated drug delivery allows for a superior concentration of drug to be delivered to target cells, reducing off-target effects, overcoming drug resistance and reducing the dose administered to patients.

Research question:

This project aims to develop aptamer-drug conjugates to target melanoma cells through binding to cell surface proteins. Aptamers generated against a biomarker and further truncations will be characterised. Binding affinities and rate of internalisation will be assessed using flow cytometry and confocal microscopy.

Techniques, methods, analyses and day to day activities:

This project will use flow cytometry, confocal microscopy, molecular biology techniques and cell culture. Aptamers will be generated using molecular biology techniques. Binding affinities and rate of internalisation will be assessed using flow cytometry and confocal microscopy

Contact supervisor: Dr. Sarah Shigdar (School of Medicine): sarah.shigdar@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1602

Development of chemical antibody (aptamer)-based liquid biopsy

Supervisor: Wei Duan

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

There is hardly a cure for most major diseases, such as cancer, due to our inability of detect these diseases at early stages. We aim at developing novel DNA aptamer (chemical antibody)-based diagnostics using only several ml of blood via liquid biopsies, involving minimally invasive analysis of circulating tumour-derived material. Extracellular vesicles (exosomes) are new tumour constituents with promising potential at each stage of cancer management. Thus, we are working on novel strategies of using exosomes for early cancer diagnosis, monitoring disease progression and response to treatment in real-time. This represents a new direction for precision oncology to overcome current limitations associated with tissue biopsies. The project will focus on the isolation of cancer-derived extracellular vesicles/exosomes using carefully designed DNA aptamer to detect circulating cancer-derived exosomes with high sensitivity and specificity

Research question:

Whether we can develop novel aptamers that are superior than the monoclonal antibodies to be used as a 21st century new weapon for dearly diagnosis of cancer and to guide effective treatment.
Can we also explore the therapeutic use of exosomes and use them for personalized medicine that is based on modifying endogenous exosomes to the specific patient's needs and then to re-implant them as a therapy measure.
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Techniques, methods, analyses and day to day activities:

Human Cell culture, isolation of extracellular vesicles, nanoparticle tracking analysis, flow cytometry, isothermal titration calorimetry, determination of dissociate constant, K-on rates, K-off rates, fluorescence microscopy, aptamer-cell or aptamer-exosome binding assays,

Contact supervisor: Prof. Wei Duan (School of Medicine): wduan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

Clinical Practice

Project reference: 1699

Antimicrobial stewardship and optimising the management of infections

Supervisors: Kevin Mc Namara, David Kong

Location: Waurn Ponds Campus

Research centre: DRH

Project background:

Antimicrobial resistance is a global threat to human health, with the World Health Organization listing it as a priority issue of our time. Antimicrobial resistance has impact on patient's morbidity and mortality, and costs of delivering healthcare. Inappropriate use of antimicrobials is associated with the emergence of resistance. Thus, antimicrobials should be used and prescribed appropriately. The project will be undertaken in collaboration with investigators based at Ballarat Health Services, and will generate essential data to facilitate the safe, optimal and cost-effective use of antimicrobials.

Research question:

This PhD project will focus on antimicrobial stewardship in hospital- and/or community-based healthcare, and/or rural/regional settings. Research aims will be to develop and test new multidisciplinary approaches to clinical management and prevention of microbial infections in health settings.

Techniques, methods, analyses and day to day activities:

The student will work with the clinical team to evaluate current or novel approaches to clinical management and prevention of microbial infections in health settings, from a multidisciplinary perspective. It may be possible for the student to be located in Ballarat.

Contact supervisor: Assoc. Prof. Kevin Mc Namara (School of Medicine): kevin.mcnamara@deakin.edu.au

Suitable for: MPhil, PhD

Project reference: 1698

Optimising medication safety in a rural/regional referral hospital

Supervisors: Kevin Mc Namara, David Kong

Location: Waurn Ponds Campus

Research centre: DRH

Project background:

It has been suggested that medication errors or adverse drug events are responsible for about 140,000 hospital admissions in Australia and is estimated to cost the Australian healthcare system in the region of $380 million annually. Indeed, medication errors have an impact on patient morbidity, mortality and healthcare resource consumption. Accordingly, it is pivotal that efforts are made to minimise the occurrence of medication errors and optimise patient safety. This project will generate much needed data to facilitate and support the safe and optimal use of medications in regional community and/or hospital settings.

Research question:

This project will focus on reducing the risk of medication errors and improving patient safety in the hospital setting, primarily at Ballarat Health Services (BHS), which is the only regional hospital for the Grampians region of Victoria. BHS serves a population of approximately 240,000.

Techniques, methods, analyses and day to day activities:

Opportunities exist for students to gain skills in qualitative and quantitative research methodologies. There may also be opportunities to develop pharmacoeconomic models related to medication errors. This project will generate much needed data to facilitate and support the safe and optimal use of medications in the community and/or hospital settings.

Contact supervisor: Assoc. Prof. Kevin Mc Namara (School of Medicine): kevin.mcnamara@deakin.edu.au

Suitable for: MPhil, PhD

Project reference: 1661

Can N-acetyl cysteine be effective as a monotherapy in psychiatry?

Supervisors: Olivia Dean, Alyna Turner

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Adjunctive N-acetyl cysteine (NAC) has been shown to be effective in a variety of psychiatric disorders. The subgroups of patients who may benefit need to be explored to provide more tailored therapeutic options and better outcomes for people undergoing psychiatric treatment. This project will explore pooled data to determine the utility of NAC as a monotherapy. While not being proposed for treatment in this way, understanding if NAC can be useful in those not currently undergoing pharmacological treatment will be important to inform clinical practice and future drug discovery.

Research question:

Can N-acetyl cysteine be effective as a monotherapy in psychiatry? While not proposed as a single therapy, the benefits of NAC in those not taking a pharmacotherapy is important to understand. Do participants taking NAC without a primary pharmacotherapy respond differently to those who took it adjunctive to pharmacotherapy.

Techniques, methods, analyses and day to day activities:

This project will access data collected from several trial of N-acetyl cysteine for bipolar disorder, major depressive disorder, schizophrenia and autism. The student will create and analyse a dataset to determine if NAC was effective as a treatment in those not currently undergoing pharmacotherapy. Factors including individual treatments, age, sex and diagnosis will be explored in the context of NAC adjunctive treatment.

Contact supervisor: Assoc. Prof. Olivia Dean (School of Medicine): o.dean@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1660

Exploring duration of illness as a factor in symptom change in randomised controlled trials

Supervisors: Olivia Dean, Melanie Ashton

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Duration of illness has impacts on treatment outcomes. The longer a person experiences a psychiatric illness the more likely they will have residual symptoms after an episode. However, the impact that duration of illness has specifically on the benefits of adjunctive therapies has not been well explored. Our team has a collection of data from completed adjunctive trials investigating major mental illness. This project will utilise data from several randomised controlled trials to determine if the length of illness impacts on treatment outcomes in those studies.

Research question:

Does duration of illness impact on treatment outcomes of adjunctive therapies in major mental illness? This project hypothesises that individuals with longer duration of illness will be less likely to respond to adjunctive treatment when exploring pooled data of several serious mental illnesses.

Techniques, methods, analyses and day to day activities:

The project will explore several trials of adjunctive novel therapies for psychiatric disorders including minocycline, n-acetyl cysteine, rosuvastatin and aspirin. These agents were used in trials for bipolar disorder, major depressive disorder and schizophrenia. Using duration of illness as the exploratory factor, the project will explore statistical modelling to determine the impact on treatment outcomes.

Contact supervisor: Assoc. Prof. Olivia Dean (School of Medicine): o.dean@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1659

Exploring qualitative outcomes in a study of adjunctive mangosteen pericarp for schizophrenia

Supervisors: Olivia Dean, Alyna Turner

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Mangosteen pericarp was investigated as an adjunctive treatment for people with schizophrenia. While the primary analysis of the trial was negative, it's important to maximise data and the participant's experience. Our team has used this approach previously to successfully explore qualitative outcomes from randomised controlled psychiatric trials. We aim to explore qualitative data outcomes to determine signals of efficacy that may have been missed by validated quantitative scales. Data has been collected on the participant's experience using case notes collected during trial interviews.

Research question:

Were there qualitative factors that may provide further understanding of the potential benefit of mangosteen pericarp within the context of a negative quantitative randomised controlled adjunctive clinical trial? Using analysis of themes, any subjective benefits experienced by the participants during the clinical trial not captured by traditional rating scales may be uncovered. This exploratory approach allows for a bias-free exploration of the data.

Techniques, methods, analyses and day to day activities:

The student will analyse data collected from a randomised controlled trial of mangosteen pericarp as a treatment for schizophrenia. These data are captured in REDCap and will be exported into NVIVO for analysis. The data will be explored for themes and differences between groups.

Contact supervisor: Assoc. Prof. Olivia Dean (School of Medicine): o.dean@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1657

IBS and concurrent mental health disorder: Characterising dietary intake and testing a new approach

Supervisors: Heidi Staudacher, Antonina Mikocka-Walus, Felice Jacka

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The close bi-directional relationship between the gut and the brain helps to explain the common overlap of mental health and gastrointestinal symptoms. There are numerous potential factors that impact on food choice in this population including prescribed therapeutic dietary approaches, the risk of gut symptom exacerbation and reduced motivation and fatigue. This project involves characterising the dietary intake of individuals with IBS and concurrent anxiety or depression based on 3-day food records, as well as contributing to other aspects of a randomised controlled trial that tests a novel approach in this group. A potential limitation relating to measuring clinical endpoints in this population is that tools widely used to measure anxiety and depressive symptoms have not been confirmed as valid in IBS. This project will also include a study of the psychometric properties, including construct validity and reliability of the hospital anxiety and depression scale in IBS.

Research question:

This research aims to 1) characterise the energy and nutrient intake and diet quality in people with IBS and concurrent mental health disorder, 2) test a dietary approach that has yet to be evaluated in IBS, and 3) evaluate the psychometric properties of a common mental health screening tool in IBS.

Techniques, methods, analyses and day to day activities:

Techniques, methods, analyses and day to day activities:
The student will interact with the multidisciplinary research team who have set up and are running the randomised controlled trial. Tasks will include extraction and coding of food record and questionnaire data, data cleaning, statistical analysis and interpretation using appropriate statistical procedures in consultation with biostatistician.

Contact supervisor: Dr. Heidi Staudacher (School of Medicine): heidi.staudacher@deakin.edu.au

Suitable for: PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1630

The gut-brain connection in depression

Supervisors: Heidi Staudacher, Antonina Mikocka-Walus

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The close bi-directional relationship between the gut and the brain is now widely accepted and helps to explain the common overlap of mental health and gastrointestinal (GI) symptoms. While the prevalence of anxiety and depression has been well reported for individuals with diagnosed GI disorders like irritable bowel syndrome, the prevalence and severity of individual GI symptoms in those with mental health disorders, such as depression, is less well known. This project will be conducted as part of a large global m-health randomised controlled trial testing the Mediterranean diet in people with self-reported depressive symptoms.

Research question:

What is the prevalence and nature of GI symptoms in people with depression?

Aim: To determine overall prevalence of GI symptoms in individuals with depression and to investigate associations between GI and psychological symptoms

Hypothesis
GI symptom severity is positively associated with depressive symptom severity

Techniques, methods, analyses and day to day activities:

The student will interact with the multidisciplinary research team running the global mHealth randomised controlled trial. Tasks will include extraction and coding of questionnaire data, data cleaning, statistical analysis using appropriate statistical procedures in consultation with biostatistician, interpretation, manuscript preparation

Contact supervisor: Dr. Heidi Staudacher (School of Medicine): heidi.staudacher@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1610

Psychological symptoms in patients receiving treatment for anorexia nervosa: The ReGut Study

Supervisor: Tetyana Rocks

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Emerging evidence has identified the importance of the gut microbiome in several aspects of human health, including weight regulation, appetite, gut function, mood and anxiety, and behaviour, all of which are often compromised in individuals with anorexia nervosa. A key focus of inpatient rehabilitation programs for anorexia nervosa is weight restoration achieved through high-energy diets. However, it is unclear what impact current nutritional rehabilitation approaches may have on the gut microbiome.

Research question:

The Recovering Gut (ReGut) Study aims to understand the potential role of the gut microbiome in anorexia nervosa, as well as changes that may occur to the gut microbiome and related symptoms (e.g. weight regulation, gut function, mood and anxiety) during treatment. The proposed honours project will further explore a range of psychological outcomes including self-esteem, clinical impairment, stress, depression and anxiety in participants recruited for The ReGut Study.

Techniques, methods, analyses and day to day activities:

This honours project involves examining psychological symptoms at admission to an inpatient eating disorder unit in patients with a diagnosis of anorexia nervosa. The honours project will also assess changes in these symptoms during the treatment. The student will be supported to conduct statistical analysis on the available data, with the expectation of producing a publishable manuscript. The student will also have opportunities to participate in data collection for The ReGut Study.

Contact supervisor: Dr. Tetyana Rocks (School of Medicine): tetyana.rocks@deakin.edu.au

Suitable for: Honours

Immunity

Project reference: 1712

Identifying levels of inflammation from neonatal cord blood white blood cells in a twin birth cohort

Supervisors: Garth Stephenson, Jeffrey Craig, Vera Ignjatovic

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

The maternal immune system plays a vital role in pregnancy and reproduction. White blood cells (WBC), cytokines and chemokines are pivotal in the development and function of the placenta and fetus. A complete blood count is an examination used to evaluate the clinical condition of neonates where cord blood (CB) WBC counts can indicate types of infection whilst cell ratios indicate levels of inflammation. CB can provide information about fetal haematopoiesis, infections (chorioamnionitis) and perinatal insults (asphyxia). Previous studies have identified differences in CB WBC levels between sexes and delivery modes. Also factors such as maternal age, health and race, and environmental factors such as smoking, and alcohol may contribute to maternal immune activation and increased cytokine levels which effects fetal WBC counts. It is therefore important to identify which factors contribute to the neonatal WBC populations in relation to both the healthy and pathological states.

Research question:

This project will use data from the Peri/postnatal epigenetic Twin Study (PETS) to examine CB WBC counts and ratios to identify states of infection in neonates and determine the effect of maternal and environmental factors on CB WBC. This information will contribute to the etiology of already diagnosed and future conditions within this cohort including neurodevelopmental disorders. We hypothesise that specific CB WBC signatures will be associated with disease states in the neonate/child.

Techniques, methods, analyses and day to day activities:

Variance component modelling using the R package 3.5 to estimate the proportion of variance due to maternal and/or environmental factors. Linear regression to analyse WBC counts treating twin pair as clusters, to account for correlated data. Additional data will be used to perform standard linear regression with “twins as individuals” initially controlling for potential confounders. This model will provide estimates of both within-pair and between-pair associations.

Contact supervisor: Dr. Garth Stephenson (School of Medicine): garth.stephenson@deakin.edu.au

Suitable for: Honours

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1711

Investigating innate immune cells and their regulation using customised animal models.

Supervisors: Clifford Liongue, Alister Ward

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Pathogens represent a constant challenge to maintaining health, with the first line of defence being the innate immune system. Key components of this system are the white blood cells called neutrophils and macrophages. Neutrophils are the 'first-responders' and serve to 'seek and destroy' pathogens by a variety of mechanisms, typically dying in the process. Macrophages, on the other hand, arrive later and carry out a range of functions, including phagocytosis and coordination of an appropriate immune response. Neutrophils and macrophages are controlled by a network of cytokines, which represent key mediators of cell to cell communication, such as from an infected cell to a neutrophil or macrophage or from a macrophage to other immune cells.
Zebrafish represents a powerful experimental model for understanding development and disease, due to its similarities with mammalian immune systems, which has been used to better understand the immune system and its responses to pathogens.

Research question:

We have created a series of customised zebrafish lines where the cytokine signalling components have been modified to be either more or less activated using genome editing technologies. The aim of this project is to investigate the regulation of neutrophil and macrophage functions by cytokine signalling components using these zebrafish lines.

Techniques, methods, analyses and day to day activities:

This project will utilise cutting-edge techniques to directly image and study live zebrafish macrophages and neutrophils responding to immune challenges. This includes use of a customised range of zebrafish knockout and transgenic lines coupled with fluorescent activated cell sorting, fluorescent microscopy and molecular biology techniques such as PCR, qPCR, high resolution melt analysis, sanger sequencing, and in vitro transcription.

Contact supervisor: Dr. Clifford Liongue (School of Medicine): c.liongue@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1706

Role of mucin 1 in allergy

Supervisors: Posh Dhar, Cenk Suphioglu

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

The nasal transcriptome affects the incidence and severity of respiratory diseases, including lung infections and asthma. One of the genes that are highly expressed in the nasal tract is mucin 1. Mucin 1 (MUC1) is a cell membrane-associated mucin, widely expressed on mucosal epithelial cells lining the respiratory tracts of the human body and on immune cells. MUC1 performs multiple functions on epithelial surfaces that confer protection against respiratory diseases: 1) It can limit the access of pathogens to the host epithelium both by steric hindrance and by acting as a releasable decoy 2) MUC1 inhibits the activation of the Toll-like receptor signalling pathways that are activated by respiratory pathogens, thereby suppressing the downstream production of pro-inflammatory cytokines, resulting in dampened inflammatory responses. 3) MUC1 affects the phagocytosis of microorganisms, thus affecting their clearance from the tissue.

Research question:

This study will analyse the role of MUC1 in the nasal epithelium during a challenge by allergens and pathogens. To assess this, the expression of MUC1 will be knocked-out and the effect of this on the immune responses induced by a range of allergens will be analysed.

Techniques, methods, analyses and day to day activities:

To address this, the expression of MUC1 will be silenced/knocked-out using either RNAi or CRISPR in a human nasal epithelial cell line. The effect of this on the immune responses induced by a range of allergens and pathogens will be analysed by ELISA and qPCR.

Contact supervisor: Dr. Posh Dhar (School of Medicine): posh.dhar@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1705

Role of MUC13 in the pathogenesis of malaria

Supervisors: Posh Dhar, Tania De Koning-Ward

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Malaria is a vector-borne disease caused by the Plasmodium parasite, which is prevalent in tropical and sub-tropical countries. Infection with the malarial parasite clinically manifests as mild to severe disease forms, depending on the interplay of host and parasite-associated factors. One such host factor, called mucin 13 (MUC13) has been identified as a biomarker for malaria infection. MUC13 is a cell-membrane associated carbohydrate-rich protein that is expressed on a range of epithelial cells. MUC13 has been shown to have pro-inflammatory properties in epithelial cells against a range of pathogens and their molecules.

Research question:

This study will investigate the role of MUC13 during the pathogenesis of malaria infections. The immune-modulatory functions of MUC13 on the incidence and severity of malaria infections will be dissected. To address this, the expression of MUC13 will be silenced/knocked-out and the effect of this on the immune responses induced by the parasite will be analysed.

Techniques, methods, analyses and day to day activities:

For this project, a wide variety of techniques will be employed, including culturing of malaria parasites, co-culture assays of the parasite with human cell-lines and flow cytometry. The expression of MUC13 will be knocked-out using CRISPR in a human liver cell line. Immune responses will be quantified by ELISA and qPCR.

Contact supervisor: Dr. Posh Dhar (School of Medicine): posh.dhar@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1697

Free the cytokines! Uncovering the relationship between ADAMTS7, fibronectin and migration

Supervisors: John Stambas

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Influenza viruses pose an ongoing threat to human health. Improving current therapeutic strategies is critical to ensure adequate protection for future pandemics. Recent in vitro and in vivo influenza virus studies have identified novel host genes involved in influenza virus immunity. A number of these genes encode for extracellular matrix (ECM) remodelling enzymes called “ADAMTS”. This project will utilise cell culture and ADAMTS-/- models to characterise the role these enzymes play in influenza virus infection. Specifically, our laboratory plans to identify the relationship between the ECM enzyme ADAMTS7 and fibronectin. Fibronectin is an extracellular matrix proteoglycan involved in cell adhesion, maturation, and cell trafficking. To date, the role of fibronectin during influenza A virus infection is currently unknown. This project seeks to uncover how ADAMTS7 mediates fibronectin interactions with cytokines and chemokines and how this impacts immunity following infection.

Research question:

Do ADAMTS7 and fibronectin interactions contribute to migration following influenza A virus infection?
Hypothesis: ADAMTS7 interaction with fibronectin alters cytokine and chemokine expression in the extracellular matrix to influence immune responses.
Specific Aims:
1. To determine the direct relationship between ADAMTS7 and fibronectin in vitro.
2. To investigate cytokine and fibronectin expression and immunity in vivo in the absence of ADAMTS7.

Techniques, methods, analyses and day to day activities:

The honours student will perform in vitro experiments to investigate the interaction between ADAMTS7 and fibronectin. This project will provide the student with expertise cell biology techniques and allow the student to design and optimize novel methodologies investigating ADAMTS cleavage. The student will be trained in handling mice and will be responsible for performing in vivo experiments evaluating cellular trafficking and cytokine responses in following influenza A virus infection.

Contact supervisor: Prof. John Stambas (School of Medicine): john.stambas@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1696

Send Help ASAP! CISH regulation of influenza-specific CD4+ T cell help

Supervisors: John Stambas, Alister Ward

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Influenza A virus (IAV) is responsible for over 200,000 hospitalizations in the United States alone and has a wide-ranging socio-economic impact. Currently, IAV-specific therapeutics target viral components that result in increased rates of mutation and the development of drug resistance. New findings suggest that therapeutics targeting host responses reduce the likelihood of resistance.
Cytokine-inducible SH2-containing protein (CISH) is member of the SOCS family of proteins involved in regulating cytokine signalling. Single nucleotide polymorphisms in the promoter region of the human Cish gene have been associated with enhanced susceptibility to infectious diseases, including bacteria and viruses. Preliminary data in the Stambas laboratory suggests that CISH influences T cell responses following influenza virus infection. This project will assess its contribution to CD4+ T cell responses.

Research question:

Does CISH regulate CD4+ T cell development and function during influenza A virus infection?
Hypothesis: CISH mediates CD4+ development via disrupted IL-2 and TCR signalling resulting in increased severity of disease.
Aims:
1. To identify how the absence of Cish alters the influenza-specific CD4+ T cell responses following virus infection.
2. To investigate how the absence of Cish influences CD4+ T cell proliferation and function ex vivo.

Techniques, methods, analyses and day to day activities:

This project will provide the student with expertise in performing cutting edge techniques including tetramer and ICS staining. The student will be trained in the handling mice and will be responsible for performing ex vivo experiments evaluating the proliferative capacity, differentiation and function of CD4+ T cells. Students will use flow cytometry to analyse experimental outcomes and will develop an understanding of tissue culture, molecular biology, virology and immunology techniques.

Contact supervisor: Prof. John Stambas (School of Medicine): john.stambas@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1686

Control of early blood and immune cell development: role of Ikaros transcription factors

Supervisors: Alister Ward, Clifford Liongue

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

The Ikaros family of zinc finger transcription factors are strongly conserved throughout vertebrate evolution, with specific family members shown to be important for immune system development. They act by binding to specific promoter elements of key genes involved in this process, typically repressing their expression. Perturbation of these transcription factors can lead to various diseases, particularly lymphomas and leukemias. However, relatively little is known about the function of two of the more divergent members of this transcription family, Eos and Pegasus.

Research question:

Studies in our laboratory and elsewhere have suggested that the various family members interact in a variety of both synergistic and antagonistic ways, which may be very important in disease. The aim of this Project is to investigate the role of Eos and Pegasus in blood and immune development through the analysis of specific zebrafish eos and pegasus mutant lines, coupled with investigation of the genes regulated by these proteins and the other family members with which they interact.

Techniques, methods, analyses and day to day activities:

This Project will use a range of molecular, cellular and developmental biological approaches coupled with transcriptional and biochemical studies. The majority of the work will utilize zebrafish mutant lines, but some cell culture may also be involved.

Contact supervisor: Prof. Alister Ward (School of Medicine): award@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1685

Innate immune cells and their regulation in zebrafish

Supervisors: Alister Ward, Clifford Liongue

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

Pathogens represent a constant challenge to maintaining health, with the first line of defence being the innate immune system. Key components of this system are the white blood cells called neutrophils, macrophages and natural killer (NK) cells. Neutrophils are the 'first-responders' and serve to 'seek and destroy' bacterial and other pathogens by a variety of mechanisms, typically dying in the process. NK cells are pivotal in destroying virus-infected or cancerous cells. Macrophages carry out a range of functions, including phagocytosis and coordination of an appropriate immune response. These innate immune cells are controlled by a network of cytokines, which represent key mediators of cell to cell communication.

Research question:

Zebrafish represents a powerful experimental model for understanding development and disease, which we and others have used to better understand the immune system and its control. The aim of this project is to investigate innate immune cell functions in this model, and especially its regulation by cytokine receptor signalling.

Techniques, methods, analyses and day to day activities:

This project will utilise cutting-edge techniques to directly image and study live zebrafish macrophages and neutrophils responding to immune challenges. This includes use of a customised range of zebrafish knockout and transgenic lines coupled with fluorescent activated cell sorting, confocal microscopy and molecular biology techniques.

Contact supervisor: Prof. Alister Ward (School of Medicine): award@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1683

Role of cytokine receptor signalling in development and disease

Supervisors: Alister Ward, Clifford Liongue

Location: Waurn Ponds Campus

Research centre: CMMR, IMPACT

Project background:

The correct development and maintenance of multi-cellular organisms is supported by systems enabling cells to communicate to one another in response to distinct cues. Cytokines are polypeptides that are produced and secreted by cells following a variety of stimuli and induce a range of cellular effects via specific cytokine receptors located on the cell surface. These receptors signal to the nucleus via the so-called 'JAK-STAT-SOCS' signalling pathway to mediate effects on gene transcription and cell physiology that are particularly important in blood and immune cell development. Perturbation of this pathway is associated with several diseases, including inflammation and cancer.

Research question:

This Project aims to further our understanding of the Cytokine receptor-JAK-STAT-SOCS pathway at the molecular level, as well as elucidating how changes in this pathway lead to disease, particularly cancer. This approach will provide insight into the underlying biology as well as establishing a platform for the development of therapeutics to combat relevant diseases.

Techniques, methods, analyses and day to day activities:

This Project will use sophisticated molecular and cellular approaches to investigate the role of one or more components of the Cytokine receptor-JAK-STAT-SOCS pathway and its interaction with other pathway components. This will involve studies of mutant and transgenic zebrafish lines.

Contact supervisor: Prof. Alister Ward (School of Medicine): award@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Infection

Project reference: 1694

Investigation of neurotropism and the long-term neurological impacts of coronavirus infections

Supervisors: Vinod Sundaramoorthy, Nathan Godde, John Bingham, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Research centre: IMPACT

Project background:

Many viruses infect the nervous system after escaping host defence at the primary site of infection causing immediate or delayed neuropathology. Similarly, while coronaviruses primarily affect the respiratory system, neurological manifestations are observed in human coronavirus infections including the 2019 SARS-CoV-2. Coronavirus such as SARS-CoV and HCoV-OC43 have been shown to spread via the olfactory tract into the brain, possibly by propagation within neuronal network. Neurological symptoms observed in SARS, MERS and COVID19 infections further suggest a potential conserved mechanism of neurotropism among these closely related coronaviruses. With millions of people infected in the current COVID19 pandemic, it is now highly essential to obtain complete knowledge of the mechanism of coronavirus neuroinvasion and its potential impact on the long-term neurological functioning of survivors.

Research question:

We have recently developed advanced stem cell-derived ex-vivo model of human central nervous system (CNS) using microfluidics. Using these ex-vivo models, the project aims to investigate how coronaviruses SARS-CoV, SARS-CoV-2 and MERS infect human neural cells and whether such infection could induce molecular changes affecting the functioning of nervous system. This will involve investigation of mechanism behind uptake of coronavirus in human neurons and spread within neuronal network.

Techniques, methods, analyses and day to day activities:

The candidate will generate ex-vivo models using specialized microfluidic devices to resemble human neuronal network. Using these model systems, the candidate will examine the mechanism of neurotropism and neuropathological effects of coronavirus infections by viral titrations assays, confocal and electron microscopy, RNA-seq and proteomics. In addition, the candidate will perform specific cellular assays to examine the functioning of neurons during and after coronavirus infection.

Contact supervisor: Dr. Vinod Sundaramoorthy (School of Medicine): v.sundaramoorthy@deakin.edu.au

Suitable for: MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1693

Targeting endolysosomal and autophagy pathways to identify potential therapeutics for COVID19

Supervisors: Vinod Sundaramoorthy, Michelle Baker, John Bingham, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Research centre: IMPACT

Project background:

The current COVID19 pandemic has drastically changed our lives and killed hundreds of thousands worldwide. Hence there is an urgent need to identify potential therapeutics against SARS-CoV-2 and other emerging coronaviruses. Endocytosis is a process by which essential biomolecules enters cells. Coronaviruses hijacks this vesicular trafficking pathway to enter host cells, while simultaneously evading autophagy and lysosomal mediated degradation. This control over cellular endolysosomal pathways allows coronaviruses including SARS-CoV-2 to infect and replicate freely in host cells. However, the mechanism of how SARS-CoV-2 hijacks endolysosomal pathways and nature of modifications induced in these essential cellular processes are unknown. This project will aim to identify these mechanisms using ex-vivo models of human airway epithelium, with the ultimate aim of developing potential new therapeutics against COVID19.

Research question:

We hypothesize that understanding how SARS-CoV-2 modifies endolysosomal pathways could identify potential therapeutics for COVID19. The project will utilise primary human bronchial epithelial cells to investigate the dynamics of endolysosomal pathways at different stages of SARS-CoV-2 infection. The project aims to identify how the virus activates or impedes specific stages of endocytosis, autophagy and vesicular trafficking processes to facilitate its own infection and replication.

Techniques, methods, analyses and day to day activities:

The candidate will develop 3D and 2D ex-vivo models of human airway epithelium with in-built reporters to analyse endolysosomal pathways during SARS-CoV-2 infection using advanced imaging and biochemical assays. This includes high-throughput confocal microscopy screening of established drug libraries acting on different endolysosomal pathways. Additional techniques will involve viral interactome analysis and functional validation of novel targets by gene knockout/overexpression analysis.

Contact supervisor: Dr. Vinod Sundaramoorthy (School of Medicine): v.sundaramoorthy@deakin.edu.au

Suitable for: MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1682

Association between Vancomycin MIC creep with poor outcomes in S. aureus bacteraemia

Supervisor: Eugene Athan

Location: Barwon Health, Geelong

Research centre: CMMR, IMPACT, GCEID

Project background:

S. aureus is a gram-positive bacterium that has a high likelihood to become antibiotic resistant. It is also the second most common cause of blood stream infections, known clinically as bacteraemia. S. aureus bacteraemia has a mortality rate of up to 40%, despite adequate therapy. The reasons for poor outcomes in S. aureus bacteraemia are unknown but is an emerging field in the literature. One debated factor for poor outcomes is the presence of vancomycin Minimum Inhibition Concentration [MIC] creep, which is where the MIC of vancomycin needed to inhibit the bacteria is within susceptible range but is closer to being classified as resistant. A prior study investigating poor outcomes in SAB identified that the S. aureus strains isolated from S. aureus bacteraemia are highly susceptible to antibiotics, however the effect of MIC creep was not investigated.

Research question:

Reduced susceptibility to Vancomycin will be associated with poor outcome in invasive Staphylococcus aureus infection in a prospective cohort.
Reduced susceptibility to Vancomycin is unrelated to Methicillin resistance and is an independent factor of poor outcome and virulence in clinical Staphylococcus aureus strains.

Techniques, methods, analyses and day to day activities:

In this honour's project, microbiological [antibiotic susceptibility assays, culturing, possible other assays] and possible bioinformatic analyses will be performed to assess the effect of MIC creep on outcome of S. aureus bacteraemia.
Routine microbiologic culture and antimicrobial susceptibility testing of cohort of Staphylococcus aureus isolated collected over last 3 years.

Contact supervisor: Prof. Eugene Athan (Barwon Health): e.athan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1681

Identifying the Carriage rate of S. aureus in S. aureus bacteraemia patients from the Barwon Region

Supervisor: Eugene Athan

Location: Barwon Health, Geelong

Research centre: CMMR, IMPACT, GCEID

Project background:

S. aureus is a gram-positive bacterium which can be beneficial, opportunistic or pathogenic. 33% of the global population are colonised with S. aureus permanently, and a large proportion of the population will be colonised transiently in their lifetime. A serious infection of S. aureus is a blood stream infection, known clinically as bacteraemia, which can have a mortality rate of up to 40% despite treatment options. A significant factor of mortality is the source of the infection, with unknown sources associated with an increased risk of death. In a prior study of the Barwon region, we determined that the source of infection was unknown for 34.8% of cases. The carriage rates of S. aureus in the Geelong region are currently unknown, which may suggest that the high proportion of unknown sources in bacteraemia may be attributed to a colonisation source.

Research question:

Asymptomatic carriage of Staphylococcus aureus is very common in healthy controls and patients with invasive infection.
Carriage may protect against invasive infection by Staphylococcus aureus.
Carriage by virulent strains of Staphylococcus aureus is associated with invasive infection.

Techniques, methods, analyses and day to day activities:

In this honour's project, microbiological [culturing, identification assays] and molecular techniques [DNA extraction, 16s sequencing] will be utilised to identify the proportion of S. aureus carriage in S. aureus bacteraemia patients.
Swabbing of nose and groin of healthy volunteers.
Swabbing of known patients with invasive Staphylococcus aureus infection.
Culture and whole genome sequencing of strains.

Contact supervisor: Prof. Eugene Athan (Barwon Health): e.athan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1640

Impact of malaria control on parasite transmission dynamics and drug resistance in PNG

Supervisor: Alyssa Barry

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Malaria is responsible for over 400,000 deaths and 200 million clinical episodes of the disease each year. Intensified control and elimination programs of malaria endemic countries have made substantial progress in reducing this global burden in the last two decades, however progress has now stagnated, and in some countries the disease has resurged. Measuring parasite genome evolution during transmission decline and rebound may provide insights into the causes of this resurgence.

Plasmodium vivax is a major contributor to the malaria burden outside sub-Saharan Africa. After the implementation of enhanced malaria control measures in 2006-8, P. vivax transmission initially declined but had rebounded by 2014. Rebounding infections were low density (submicroscopic), largely asymptomatic and less complex (fewer strains per infection) than previous years (Koepfl et al. 2017).

Research question:

Population genetic analyses revealed a bottleneck in 2010 with a clade that seeded the 2014 rebound. We hypothesise that this rebound resulted from adaptation to control efforts (e.g. through emergence of a drug resistant or a less virulent and thus undetectable parasite population). The overarching aim of this project is to conduct whole genome sequencing (WGS) of parasite isolates spanning this period to investigate parasite population evolution during transmission decline and rebound.

Techniques, methods, analyses and day to day activities:

Samples will subject to WGS (MinION and Illumina) and population genomic analyses. Population structure will be measured to define transmission dynamics at each time point, and to classify samples into different clades. Genome wide scans of natural selection will identify any genomic regions under selection in the rebounding parasite population (Henden et al. 2018). Data analysis pipelines and in-house developed software have been developed to address the bioinformatics needs of this project.

Contact supervisor: Assoc. Prof. Alyssa Barry (School of Medicine): a.barry@deakin.edu.au

Suitable for: Honours, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1639

Unravelling the mystery of the flesh-eating bacteria: M. ulcerans

Supervisors: Eugene Athan, Daniel O'Brien

Location: Barwon Health, Geelong

Research centre: IMPACT, GCEID

Project background:

Mycobacteria ulcerans (Bairnsdale or Buruli ulcer) is a bacterial pathogen found in the environment that continues to cause serious skin and soft tissue destructive disease in Victoria. It is an emerging infectious disease-causing significant morbidity in coastal Victoria and in rural west Africa.
It is the third most important mycobacterial pathogen after TB and Leprosy. Potential environmental and wildlife reservoirs are unknown, and the mode of transmission remains unclear. We propose further epidemiological, clinical and microbiological studies to characterise Mycobacteria ulcerans in Victoria.

Research question:

There are genotypic specific features resulting in severe disease.
Antimicrobial resistance can occur in Mycobacteria ulcerans strains.
Variation of disease may be due to host factors.
Whole genome sequencing of strains may inform the virulence of clinical disease.

Techniques, methods, analyses and day to day activities:

Geographic information system analysis including weather, rainfall, seasonality and land development associated with all cases identified in Victoria (Honours project or PhD)
-Epidemiological and clinical analysis of large patient cohort (Honours project)
-Microbiological laboratory analyses of isolates and therapy (PhD only)
-Genotyping of strains (Honours project)
-Serosurvey of human population (PhD only)
-Study of potential animal reservoirs (PhD only)

Contact supervisor: Prof. Eugene Athan (Barwon Health): e.athan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1638

Device and biofilm infections: fighting the super bugs

Supervisors: Eugene Athan, Richard Page

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Joint replacement surgery is now commonplace in developed countries. This technology has greatly enhanced the quality of life of Australians. Infections of bones and joints in particular prosthetic joints remain a major medical and surgical challenge. This is further complicated by the emergence of multiresistant bacterial infections such as methicillin resistant staphylococcus aureus (MRSA), Vancomycin resistant enterococci (VRE) and extended spectrum betalactamase (ESBLs) producing Gram negative organisms. We propose detailed microbiological analyses of all cases of orthopaedic infections including biofilm studies in vitro and scoping for an in vivo mouse model of prosthetic joint infection.

Research question:

Whale dentine is a suitable bone substrate for Biofilm in vitro systems.
Staphylococcal biofilms directly damage bone substrate
Staphylococcal biofilms indirectly damage bone substrate by toxin mediators such as Protein A.
Staphylococcal biofilm directly activates the activity of human osteoclasts.

Techniques, methods, analyses and day to day activities:

Optimise in vitro staphylococcal biofilm systems on whale dentine to study direct effects on substrate.
Optimise in vitro staphylococcal biofilm systems on whale dentine to study in indirect effects on substrate.
Scanning EM for measuring substrate changes.
Assess effects of Staphylococcal biofilm on human osteoclast assays

Contact supervisor: Prof. Eugene Athan (Barwon Health): e.athan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1633

Screening of compounds that kill malaria parasites by blocking malaria protein export

Supervisors: Tania de Koning-Ward, Kathryn Matthews, Rebecca Edgar, Joyanta Modak

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

The Plasmodium parasites that cause malaria are one of the most successful pathogens to infect mankind. By exporting hundreds of their proteins into their host red blood cell, malaria parasites are able to drastically modify their host cell, enabling the parasite to replicate and cause disease while at the same time avoiding destruction by the human host. Malaria proteins destined for export utilize a single gateway called PTEX to gain entry into the host cell. We have validated by knocking down expression of PTEX that protein export is blocked and is lethal to the parasite. Hence PTEX is an outstanding anti-malaria drug target.

Research question:

This project aims to genetically engineer and then utilise novel parasite lines that export a fluorescently labelled protein for the screening of compounds that kill the parasite by performing parasite growth assays and elucidating whether the death of the parasite is due to a block in protein export. If compounds that block protein export are identified, the mechanism by which they block protein export will then be elucidated using a raft of molecular and cellular biology techniques.

Techniques, methods, analyses and day to day activities:

The project will provide the student with a very broad skills base including molecular and cellular biology techniques (generation of molecular constructs, imaging), parasitology techniques (culturing, transfection, growth assays) and the use of FACS to monitor parasite development.

Contact supervisor: Prof. Tania de Koning-Ward (School of Medicine): taniad@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

Project reference: 1632

The role of ADAMTS in malaria pathogenesis

Supervisors: Tania de Koning-Ward, John Stambas

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Malaria is a disease of global significance, with ~400,000 people dying each year out of the ~216 million people infected. The disease is caused by infection with parasites belonging to the genus Plasmodium. Severe malaria occurs when the infection becomes complicated by serious organ failure, including in the brain and lung, or by abnormalities in the patient's blood or metabolism. Understanding why some people are more at risk from developing severe disease is crucial to the development of adjunct therapies to reduce the fatality rates. One family of proteins that could affect the risk of developing severe disease is the ADAMTS (extracellular matrix structural proteins) family that contain 19 members. The ADAMTS proteins influence cell adhesion to the extracellular matrix and the ability of cells to migrate.
Knockout mice that lack expression of specific ADAMTS proteins provides a powerful tool to assess the contribution ADAMTS's to malaria pathogenesis.

Research question:

We hypothesize ADAMTS 5 and 7 knockout mice will be protected from cerebral malaria and respiratory distress via the prevention of pro-inflammatory immune responses that contribute to disease.
This project will utilise ADAMTS knockout mice in malaria infection studies to characterize the role that the ADAMTS enzymes play in the pathogenesis of malaria infection, and co-culture of macrophages and malaria to look at effect of knocking down ADAMTS on inflammatory responses.

Techniques, methods, analyses and day to day activities:

This project will require the handling of mice. It will involve mouse infection studies with malaria parasites, analysis of malaria pathogenesis, extraction of mouse tissues, histology, quantitative PCR, flow cytometry and imaging to assess the trafficking of immune cells to parasite-infected organs and a variety of immunological assays. It will also involve in vitro cell culturing.

Contact supervisor: Prof. Tania de Koning-Ward (School of Medicine): taniad@deakin.edu.au

Suitable for: Honours, MPhil

Metabolic Disease

Project reference: 1687

Hydrogen sulfide and the developmental origins of health and disease (DOHaD)

Supervisors: Bryony McNeill, Ryan Wood-Bradley

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Non-communicable diseases such as cardiovascular disease, type 2 diabetes and hypertension are a significant cause of morbidity and mortality in Australia and worldwide. Although the causes of these diseases are multifactorial, it has been identified that environmental conditions experienced in early life, during the fetal and neonatal periods, can have a long-lasting influence on adult health. This process is known as fetal programming. Although the signalling mechanisms responsible for this are still being identified, the placenta and developing kidney have been identified as being particularly sensitive to environmental conditions during pregnancy, and are an important research priority.

One of the key areas of interest in our laboratory is the role of hydrogen sulfide in the process of fetal programming. Previously considered a noxious gas, hydrogen sulfide is now known to have important protective effects in the cardiovascular system, kidney, and placenta.

Research question:

The regulation of hydrogen sulfide production and degradation is complex and involves the interaction between a number of enzymes and other signalling factors, the role of which have not yet been described in the context of fetal programming. This gap in our knowledge forms the basis of this project.

The aim of this honours project is to investigate the effects of maternal diet on hydrogen sulfide signalling pathways in the developing kidney and placenta.

Techniques, methods, analyses and day to day activities:

The study will be conducted using a rat model. The student will learn a range of analytical techniques, including histology, biochemistry assays, immunohistochemistry, and molecular biology. The student will also learn a range of statistical analyses, critical review of scientific literature, and oral and written presentation skills.

Contact supervisor: Dr. Bryony McNeill (School of Medicine): bryony.mcneill@deakin.edu.au

Suitable for: Honours

Project reference: 1664

Discovery of New Targets for the Treatment of Diabetes

Supervisor: Kathryn Aston-Mourney

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Type 2 diabetes is one of the major health burdens facing the world today with 422 million people affected. Type 2 Diabetes is characterised by hyperglycaemia due to failure of the insulin producing cells in the pancreas (beta-cells). Beta-cell failure is progressive, with patients requiring additional medications over time and eventually insulin injections in order to control their blood glucose levels. Current diabetes treatments cannot stop or slow the progression of beta-cell failure; therefore, it is vital that we obtain a better understanding of how beta-cell failure occurs and how it could be targeted by new treatments.

Research question:

This project will investigate possible contributors to beta-cell failure and whether they can be targeted pharmacologically to reduce beta-cell failure and thereby delay or prevent the development and progression of beta-cell failure in Type 2 Diabetes.

Techniques, methods, analyses and day to day activities:

This study will use a mouse model and animal cell lines.
Summary of techniques to be used:
-Cell Culture
-Ex vivo culture of pancreatic islets
-Analysis of insulin secretion
-Analysis of cell death
-RNA extraction and purification
-Real-time PCR
-Western blotting
-ELISA
-Metabolic profiling
-Mitochondrial flux analysis

Contact supervisor: Dr. Kathryn Aston-Mourney (School of Medicine): k.astonmourney@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1663

A Cure for Type 1 Diabetes: Improving Islet Transplantation Success

Supervisors: Kathryn Aston-Mourney, Richard Williams

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Type 1 diabetes is one of the most common chronic diseases in children. It is characterised by autoimmune destruction of the insulin producing cells in the pancreas (beta-cells) resulting in the need for insulin injections. New hope for a cure has been given with the development of islet transplantation techniques however currently these require several donors in order to provide enough islets and the long-term success rates are poor with only 10% of transplants still functioning after 5 years. This poor success is due in part to the high amount of stress the islets undergo following the transplant and prior to becoming engrafted. Therefore, the development of techniques to protect the islets from these stressors and improve engraftment would greatly increase not only transplant success but also long-term outcomes.

Research question:

Our lab is developing novel compounds that can protect islets from diabetic conditions. This project will determine whether these can protect transplanted islets and transplantation outcomes.
Ultimately this project could lead to greatly improving the success of this cure.

Techniques, methods, analyses and day to day activities:

This study will use a mouse model and animal cell lines.
Summary of techniques to be used:
-Cell culture
-Islet isolation
-Islet transplantation
-Ex vivo culture of pancreatic islets
-Analysis of insulin secretion
-Analysis of cell death
-RNA extraction and purification
-Real-time PCR
-Western blotting
-ELISA
-Immunohistochemistry

Contact supervisor: Dr. Kathryn Aston-Mourney (School of Medicine): k.astonmourney@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1655

Effect of metformin on kidney development and function.

Supervisors: Bryony McNeill, Kathryn Aston-Mourney, Leni Rivera

Location: Waurn Ponds Campus

Research centre: Other

Project background:

Diabetes during pregnancy, or gestational diabetes, is becoming increasingly prevalent. Gestational Diabetes increases the risks of adverse effects during pregnancy including pre-eclampsia, large for gestational age offspring and fetal abnormalities. Poor glucose control during pregnancy also increases the risk for adult obesity and type 2 diabetes in the offspring. A major complication leading to morbidity and mortality of type 2 diabetes is diabetic kidney disease. Therefore, effectively treating gestational diabetes is of utmost importance to limit type 2 diabetes and diabetic kidney disease. One of the most effective pharmaceuticals to manage blood glucose is the type 2 diabetes drug metformin, and this drug is being used more widely to treat gestational diabetes. However, as metformin can cross the placenta, and the effects of this drug on the developing fetus are largely unknown, more information is required to fully understand the possible benefits or hazards of this treatment.

Research question:

Further as metformin is cleared via the kidney it could have a significant effect on the developing kidney of the fetus.
This project aims to use a mouse model to determine the effect of maternal metformin treatment on offspring kidney development and the associated long term consequences for kidney function in adulthood.

Techniques, methods, analyses and day to day activities:

Summary of techniques to be used:
- Mouse metabolic measurements including kidney function, body weight, food intake etc.
- Kidney histology
- ELISA
- Western blotting
- RNA extraction
- Real-time PCR
- Statistical analysis

Contact supervisor: Dr. Bryony McNeill (School of Medicine): bryony.mcneill@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project is subject to final approvals.

Project reference: 1654

Effect of metformin on gut microbiome in gestational diabetes

Supervisors: Leni Rivera, Kathryn Aston-Mourney, Bryony McNeill

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Diabetes during pregnancy, or gestational diabetes, is becoming increasingly prevalent. Gestational Diabetes increases the risks of adverse effects during pregnancy including pre-eclampsia, large for gestational age offspring and foetal abnormalities. Poor glucose control during pregnancy also increases the risk for adult obesity and type 2 diabetes in the offspring, therefore effectively treating gestational diabetes is of utmost importance. One of the most effective pharmaceuticals to manage blood glucose is the type 2 diabetes drug metformin, and this drug is being used more widely to treat gestational diabetes. One of effects metformin treatment has is to alter the gut microbiome, which may be beneficial for diabetes management. However, as offspring develop their microbiomes from their mother during birth, an altered microbiome may translate to changes in the offspring microbiome thereby altering their susceptibility or resilience to a wide range of diseases, including diabetes.

Research question:

This project aims to use a mouse model to determine the effect of maternal metformin treatment on maternal gut microbiome and whether this results in differences in the gut microbiome or gut function of the offspring.

Techniques, methods, analyses and day to day activities:

Summary of techniques to be used:
- Mouse measurements including body weight, food intake etc.
- Bacterial DNA extraction
- Next Generation Sequencing
- Microbiome analysis
- Gut permeability measurement
- ELISA
- Western blotting
- Real-time PCR
- Statistical analysis

Contact supervisor: Dr. Leni Rivera (School of Medicine): leni.rivera@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project is subject to final approvals.

Project reference: 1653

In utero metformin treatment to reduce the risk of adult diabetes

Supervisors: Kathryn Aston-Mourney, Bryony McNeill, Leni Rivera

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Diabetes during pregnancy, or gestational diabetes, is becoming increasingly prevalent. Gestational Diabetes increases the risks of adverse effects during pregnancy including pre-eclampsia, large for gestational age offspring and foetal abnormalities. Poor glucose control during pregnancy also increases the risk for adult obesity and type 2 diabetes in the offspring, therefore effectively treating gestational diabetes is of utmost importance. One of the most effective pharmaceuticals to manage blood glucose is the type 2 diabetes drug metformin. However, the use of metformin during pregnancy, while becoming increasingly common, is still under debate. The main concern is that metformin can cross the placenta and the effects of this drug on the developing fetus are largely unknown.

Research question:

We have shown that metformin actually increases beta-cell number in developing zebrafish suggesting that it could have beneficial effects to reduce the later development of type 2 diabetes.
This project aims to use a mouse model to determine the effect of maternal metformin treatment on offspring beta-cell number, mass and function and protection from diabetes development in adulthood.

Techniques, methods, analyses and day to day activities:

Summary of techniques to be used:
- Mouse metabolic measurements including intravenous glucose tolerance test, body weight, food intake etc.
- Pancreatic histology
- ELISA
- Western blotting
- RNA extraction
- Real-time PCR
- Statistical analysis

Contact supervisor: Dr. Kathryn Aston-Mourney (School of Medicine): k.astonmourney@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project is subject to final approvals.

Project reference: 1644

The metabolic basis of heart disease in obesity

Supervisor: Sean McGee

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Most obese patients suffer from impaired cardiac function, which over time progresses to heart failure. This obesity-induced cardiomyopathy is independent of hypertension and coronary heart disease and is related to alterations in cardiac metabolism. However, the mechanisms underpinning this metabolic reprogramming of the heart in obesity remains unknown.
Our previous studies have identified a factor released from fat tissue into the circulation that alters cardiac metabolism. However, how this occurs is currently unclear.

Research question:

This project will extend on these findings to uncover how this factor alters cardiac metabolism and whether it can be targeted therapeutically to improve cardiac function in obesity.

This project will increase our understanding of how heart disease develops in obesity and could also reveal new treatment approaches to combat this disease, which remains one of the major causes of mortality in obese patients.

Techniques, methods, analyses and day to day activities:

Using a mouse model, the project will involve obesity studies in novel transgenic mice, assessment of cardiac function in these mice using ultrasound echocardiography and molecular analyses in the hearts of these mice. These molecular analyses include genome-wide gene expression analysis, quantification of intracellular signalling pathway activation using western blotting and determination of intracellular metabolite levels using mass-spectrometry-based metabolomics analysis.

Contact supervisor: Prof. Sean McGee (School of Medicine): sean.mcgee@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1643

Molecular mechanisms governing the adaptive response to exercise

Supervisor: Sean McGee

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Physical exercise is fundamental for the optimal function of all biological systems. Indeed, exercise is essential for good health, while inactivity underpins many chronic diseases. However, the biology that explains how exercise has profound benefits for so many biological systems remain poorly understood.

The work from our laboratory has made substantial progress towards understanding these mechanisms. In a series of publications, we have revealed an important role for a signalling axis centred around the myocyte enhancer factor 2A (MEF2A) transcription factor in driving skeletal muscle adaptation to exercise.

Research question:

This project will exploit the important role of MEF2A in the adaptive response to exercise to uncover new signalling and transcriptional networks that positively influence diverse biological processes that positively impact health.

This project will increase our understanding of how exercise has positive benefits on all aspects of health, and could also reveal new treatment approaches for a range of chronic diseases.

Techniques, methods, analyses and day to day activities:

The project will involve exercise studies in novel transgenic mice, genome-wide gene expression analysis, quantification of intracellular signalling pathway activation using western blotting and determination of intracellular metabolite levels using mass-spectrometry-based metabolomics analysis.

Contact supervisor: Prof. Sean McGee (School of Medicine): sean.mcgee@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1628

Improving the gut barrier in metabolic diseases

Supervisor: Leni Rivera

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

A traditional whole-food diet consists of higher intakes of foods such as vegetables, fruits, seafood, whole grains, lean meat, nuts, and legumes, with avoidance of processed foods. Currently, in both developed and emerging economies, there is a preference to consume nutrient-poor, energy-dense, and highly processed foods. Many people are both overfed and undernourished. This transition from traditional to the modern diet has seen increases in obesity, non-alcoholic fatty liver disease, and other metabolic diseases. The first vulnerable organ to encounter these substances is the intestine. There is now increasing recognition that intestinal damage contributes to downstream effects.

Research question:

This project aims:

- To determine how specific components of the modern diet affects enteric neurons, mucosal structure and function in vitro.

- To investigate the beneficial effects of dietary modification and supplementation in improving gut health and gut barrier function.

Techniques, methods, analyses and day to day activities:

This project, using a mouse model, will involve:

- Comprehensive analysis of metabolic health
- Cell culture
- Molecular analysis
- Gut physiology including measuring gut leakiness
- Histological and immunohistochemical analysis to determine changes in gut morphology and other organs
- Analysis of gut microbiota

Contact supervisor: Dr. Leni Rivera (School of Medicine): leni.rivera@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1626

Gut feelings about diet: how food influences gut health and behaviour

Supervisor: Leni Rivera

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

In Australia, both obesity and depression are important public health issues. However, developing evidence suggests that these two disorders may share key underlying mechanisms. Obese individuals have an increased risk of developing depression and this risk is doubled in the presence of diabetes. Likewise, depressed individuals are more likely to be overweight and to have a poor diet. Emerging and compelling evidence suggests that the gut bacterial population, or microbiota, plays an important role in the development of both obesity and changes in mood state.

Research question:

We do not have a clear picture of the mechanisms by which diet, gut microbiota and brain function interact, and how we may be able to moderate or reverse these effects. We can address this by identifying modifiable factors that contribute to the development of obesity and depression, such as diet. For this reason, this study aims to investigate various dietary modifications that can be used to improve gut health and behaviour.

Techniques, methods, analyses and day to day activities:

This project will involve:

- Analysis of behaviour
- Analysis of metabolic health
- Gut physiology including measuring gut leakiness
- Histological and immunohistochemical analysis to determine changes in gut morphology and other organs
- Analysis of gut microbiota

Contact supervisor: Dr. Leni Rivera (School of Medicine): leni.rivera@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Musculoskeletal Medicine

Project reference: 1695

Building a Brain: Designing Materials to Restore Function

Supervisor: Richard Williams

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

In order to more effectively treat injury, we must mimic biology with an approach that reproduces the environment found in healthy tissues. Rationally designed nano/biomaterial hydrogel scaffolds can be engineered mechanically, morphologically and chemically to deliver drugs, cells and growth factors. As such, these 3D hydrogels can be applied to stabilise damaged tissue to enhance and accelerate regeneration. However, a significant and ongoing challenge is to influence the human immune response to both reduce damage and accept therapeutic intervention

Research question:

Can we design artificial microenvironments that will allow stem cells to repair damaged brain tissue?

(i)How Is the polysaccharide fucoidan distributed in our currently developed co-assembled scaffold?
(ii) Can the polysaccharide composition be varied at the interface for tuned cellular recognition and specific biological activity?
(iii) Will a covalently linked polysaccharide based nanoscaffold perform in a superior way to the co-assembled system?

Techniques, methods, analyses and day to day activities:

the student will use a combination of chemistry, materials science, and analysis to generate materials, and cell culture and molecular biology techniques to assess the biological outcome of the materials.

The student will learn a diverse range of laboratory techniques that will prove applicable to a wide range of fields.

Contact supervisor: Dr. Richard Williams (School of Medicine): richard.williams@deakin.edu.au

Suitable for: Honours

Project reference: 1684

Lithium and bone formation and function

Supervisors: Lana Williams, Jason Hodge, Rasika Samarasinghe, Julie Pasco

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Bone loss and increased fracture risk with psychotropic agents is gaining recognition as a major public health problem. We were among the first to document a link between selective serotonin reuptake inhibitors (SSRIs) and reduced bone mineral density (BMD) (Williams et al 2008). We were also the first to show that there are agent specific differences in the effects of SSRIs on bone (Hodge et al 2013). Interestingly, in comparison there are minimal data on the effects of lithium. Lithium is a mood stabiliser used often in the treatment of bipolar disorder. Recent animal study has suggested anabolic effects of the agent, which has been supported by human studies (Liu et al 2019). This preservation of bone mass is contra to what has been seen in the presence of psychiatric disorders and other psychotropic agents. Thus, a comprehensive understanding of the mechanism of action of lithium in bone metabolism is needed and likely to reveal potential molecular targets for novel bone therapies.

Research question:

This proposed study is one component of an existing multimethod program of work investigating psychiatric disorders, medications used in their treatment and bone health. This project specifically aims to determine whether lithium influences human osteoclast and osteoblast differentiation and function in vitro.

Techniques, methods, analyses and day to day activities:

This project will utilise a novel human model of osteoclastogenesis, using precursor cells derived from umbilical cord blood, as well as an osteoblast model utilising human adipose tissue derived mesenchymal stem cells to investigate the role of lithium in bone cell formation and function. A series of cell culture and molecular techniques including real-time polymerase chain reaction, Western blot analysis and immunohistochemistry will be utilised.

Contact supervisor: Assoc. Prof. Lana Williams (School of Medicine): l.williams@deakin.edu.au

Suitable for: Honours

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

Project reference: 1679

Gestational diabetes and childhood fracture

Supervisors: Natalie Hyde, Julie Pasco, Kara Holloway-Kew

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

In both adult and pediatric populations, individuals with diabetes mellitus (DM) are reported to have a higher bone density but paradoxically they have been shown to have an increased risk of fracture. Moreover, there is also evidence to suggest that the origins of bone health may begin in early life. Given that diabetes is a risk factor for poor bone heath at an individual level, and the origins of bone health may begin in early life, it is plausible that exposure to gestational diabetes in utero may adversely affect child skeletal development.

Research question:

Fracture is the most common and costly injury occurring in childhood. Thus, it is crucial to identify at-risk populations to allow for effective monitoring and interventions.
The study will aim to determine if gestational diabetes mellitus (GDM) is associated with fracture in the offspring.
It is hypothesised that there will be an increased risk of childhood fracture in children born to mothers with GDM.

Techniques, methods, analyses and day to day activities:

The student undertaking this project will develop their understanding of epidemiological studies, while working with experienced researchers within IMPACT. The student will independently manage and collect healthcare data from medical records from University Hospital, Geelong to identify fracture cases and non-fractured controls and perform appropriate statistical analyses.

Contact supervisor: Dr. Natalie Hyde (Barwon Health): natalie.hyde@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1641

Investigating wrist, hand and finger injuries in Australian Rules Football players

Supervisors: Stephen Gill, Richard Page, Julian Stella

Location: Barwon Health, Geelong

Research centre: CMMR

Project background:

Wrist, hand and finger injuries appear to be a common but under-recognised consequence of participation in Australian Rules Football (ARF). Our team is currently conducting the largest investigation to-date of ARF injuries in community-level footballers. The study is a partnership with the AFL and 12 emergency departments throughout Geelong and South West Victoria. In 2019, we collected data on over 1600 presentations to emergency departments that involved injuries incurred while playing ARF. The study has identified a large number of wrist, hand and finger injuries. The proposed study will investigate the causes and consequences of these injuries.

Research question:

The aims of the study are to:
1) investigate the mechanisms by which wrist, hand and finger injuries occur
2) define in greater detail the nature (diagnosis) of each wrist, hand and finger injury
3) investigate the treatment required for each wrist, hand and finger injury
4) investigate if there are any differences in mechanism, injury type and treatment between males and females

Techniques, methods, analyses and day to day activities:

The study will involve extracting relevant data from our current dataset and supplementing these data with information which will be extracted from each patient's medical record. The dataset will be analysed and presented with descriptive statistics. Differences between females and males will be assessed with chi-squared statistics. It is expected that the study will be presented at a national or international conference and in a peer-reviewed journal article.

Contact supervisor: Dr. Stephen Gill (School of Medicine): stephen.gill2@deakin.edu.au

Suitable for: Honours

Project reference: 1627

Investigating outcomes following joint replacement surgery in people with osteoporosis

Supervisors: Stephen Gill, Richard Page, Lana Williams, Julie Pasco

Location: Barwon Health, Geelong

Research centre: CMMR

Project background:

Joint replacement surgery and osteoporosis are both common. More than 110,000 joint replacements occur in Australia each year. Osteoporosis effects an estimated 23% of women and 6% of men aged 50 and over is. However, the effects of osteoporosis in people undergoing joint replacement are largely unknown. People with osteoporosis could have poorer postoperative outcomes due to reduced bone quality.

Two research groups at Deakin University conduct studies regarding osteoporosis and joint replacement surgery. The Geelong Osteoporosis Study is a prospective observational study of over 5,000 men and women. The study collects information regarding osteoporosis and health-status with a variety of tools such as bone densitometry and questionnaires. The Barwon Joint Registry collects information from people undergoing joint replacement at Barwon Health or St John of God Hospital Geelong. Information includes operation details, complications, and pain, function and quality of life scores.

Research question:

The aim of the proposed study is to investigate outcomes following hip, knee or shoulder replacement in people with osteoporosis. Specifically, the study will use data from the Geelong Osteoporosis Study (GOS) and Barwon Joint Registry (BJR) to determine if people with osteoporosis have poorer postoperative outcomes compared to people without osteoporosis.

Techniques, methods, analyses and day to day activities:

The study will involve extracting relevant data from the Geelong Osteoporosis Study (GOS) and Barwon Joint Registry (BJR). The dataset will be analysed for differences in postoperative outcomes in people with and without osteoporosis.

Contact supervisor: Dr. Stephen Gill (School of Medicine): stephen.gill2@deakin.edu.au

Suitable for: Honours

Project reference: 1621

Antipsychotics and bone metabolism

Supervisors: Lana Williams, Jason Hodge, Rasika Samarasinghe, Julie Pasco

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Antipsychotics are amongst the most commonly used medications, particularly in younger adults, and their use for schizophrenia and related conditions tends to be lifelong. There is emerging evidence to suggest that antipsychotics are noxious to bone, although, the extent of this risk, which agents are most implicated, and the pathways underlying this risk are poorly understood. For example, prolactin, a peptide hormone primarily associated with breast-feeding, has long thought to be the key mediator of bone loss associated with antipsychotic treatment; however, this is now disputed. The high burden of osteoporosis and fractures and the long-term asymptomatic nature of this adverse effect make an active and independent investigation imperative.

Research question:

To clarify operative mechanisms, the aim of this project is to determine the effects of the bioactive amines, dopamine and serotonin, and antipsychotics, on human osteoclast and osteoblast differentiation and function in vitro and identify signalling pathways affected by these drugs. Furthermore, the actions of antipsychotics on embryonic bone formation and adult bone microstructure in vivo will be determined.

Techniques, methods, analyses and day to day activities:

This project will combine data from both human (in vitro) and zebrafish (in vivo) systems and will utilise a series of cell culture and molecular techniques including real-time polymerase chain reaction, Western blot analysis and immunohistochemistry.

Contact supervisor: Assoc. Prof. Lana Williams (Barwon Health): l.williams@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Neuroscience

Project reference: 1690

Identifying new ways to tackle neurodegeneration by learning from rabies virus

Supervisors: Vinod Sundaramoorthy, John Bingham, Alister Ward

Location: CSIRO (Australian Animal Health Laboratory), Geelong

Research centre: IMPACT

Project background:

Premature degeneration and loss of long projections of neurons such as axons and dendrites result in impaired neurological functioning during ageing and in many neurodegenerative diseases. Currently there is no effective treatment to reduce or prevent axonal degeneration. In contrast, Rabies is a fatal neurological infection, where the virus uses axonal projections to spread within the host nervous system. We have recently discovered that some strains of rabies virus have an inherent ability to inhibit degeneration of axons and keep them healthy to produce an efficient infection in the nervous system. In an innovative inspired-by-nature approach, we aim to study this recently discovered abilities of rabies virus to identify new strategies for treating neurodegenerative diseases.

Research question:

We hypothesize that investigation of natural abilities of rabies virus could provide novel information about the signalling mechanisms and molecules controlling axonal degeneration in neurons. Using ex-vivo neuronal model systems we aim to identify the mechanism of how rabies virus blocks axonal degeneration. This could provide information to reverse engineer the specific ability of rabies virus without its harmful effects to develop safe and effective strategies for treating neurodegeneration.

Techniques, methods, analyses and day to day activities:

The candidate will develop advanced ex-vivo neuronal model system using primary mouse neurons and stem cell-derived human neurons to study the biological mechanisms associated with rabies infections at PC3 using diverse techniques including mass spectrometry, RNA-Seq and confocal imaging. The project will also include development of novel recombinant viral tools for live confocal imaging of infected neurons and proximity dependent viral interactome analysis.

Contact supervisor: Dr. Vinod Sundaramoorthy (School of Medicine): v.sundaramoorthy@deakin.edu.au

Suitable for: MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1673

Use of prescription medication amongst people who are dependent on methamphetamine

Supervisors: Alyna Turner, Olivia Dean

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Methamphetamine dependence an increasing health concern. People who are dependent on methamphetamine also use prescription medications. This includes prescribed use for comorbid conditions (e.g., antidepressants), and non-prescribed use to manage the adverse effects of methamphetamine use (e.g., insomnia, withdrawal symptoms). The combination of these medications with methamphetamine has potential health implications, including elevated risk of toxicity and overdose. Exploring patterns of prescription medication use among people with methamphetamine dependence will support guidelines on the prescribing of medications to people who use this drug.

Research question:

Exploring patterns of prescription medication use among people with methamphetamine dependence may provide insights useful to inform medication guidelines. The aim of the project is to determine the patterns of use of prescription medication people who have engaged with a clinical trial of a treatment for methamphetamine dependence.

Techniques, methods, analyses and day to day activities:

The project will utilise data collected from a 12-week clinical trial of N-acetyl cysteine for methamphetamine dependence. Details of prescription medications were collected at each weekly assessment. The student will build the relevant database and analyse patterns of medication use. This project is nested within a larger project at TRIALS and as such, the student will be exposed to a variety of research activities.

Contact supervisor: Dr. Alyna Turner (School of Medicine): a.turner@deakin.edu.au

Suitable for: Honours

Project reference: 1669

Personality disorder and treatment response in people with bipolar disorder

Supervisors: Alyna Turner, Bianca Kavanagh

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

There is conflicting evidence regarding whether presence of personality disorder has an impact on treatment outcomes for comorbid depression, with little evidence regarding impact on bipolar depression. This project will utilise data collected from a clinical trial of N-acetyl cysteine and nutraceuticals for bipolar disorder. A validated screening questionnaire for personality disorder was administered at week 4 of the 16-week intervention study.

Research question:

Understanding whether co-occurring conditions, such as personality disorder, impact on treatment outcomes for people with bipolar disorder is important to help guide future intervention development. The aim of the study is to determine whether presence of personality disorder predicts treatment outcomes in people with bipolar disorder.

Techniques, methods, analyses and day to day activities:

Using personality disorder as the exploratory factor, the project will explore statistical modelling to determine the impact on treatment outcomes.

Contact supervisor: Dr. Alyna Turner (School of Medicine): a.turner@deakin.edu.au

Suitable for: Honours

Project reference: 1668

Examining the influence of systemic comorbidity on inflammation and treatment response in depression

Supervisors: Adam Walker, Olivia Dean

Location: IMPACT, HERB Building B, Level 3

Research centre: IMPACT

Project background:

There is a growing appreciation that a proportion of patients diagnosed with mood-related disorders exhibit chronic low-grade inflammation, as measured by increased peripheral and central inflammatory cytokines, inflammatory mediators, metabolites and acute phase reactants. Instances of systemic illness are also typically higher in patients with clinical depression compared with non-depressed controls. Systemic illness also triggers inflammatory mediators. It has been suggested that depressed patients with perturbed inflammatory pathways are more likely to experience treatment-resistant depression and may be more or less likely to respond to certain treatments. The influence of comorbid systemic illness on this treatment-resistance is not well understood. Thus, investigation of the relationship between systemic conditions and biological factors, and clinical trial outcomes is warranted.

Research question:

The overarching aim of this research project is to investigate how co-morbid systemic disorders (nervous, respiratory, cardiovascular, endocrine, gastrointestinal, genitourinary, musculoskeletal or other) may relate to peripheral biological markers of inflammation and treatment response in a participant experiencing a current episode of depression.

Techniques, methods, analyses and day to day activities:

The student will be required to explore covariates, mediators and moderators of response to determine subgroups of people who may response more poorly based on the category of their comorbid systemic illness, and/or inflammatory profile.

Contact supervisor: Dr. Adam Walker (School of Medicine): a.walker@deakin.edu.au

Suitable for: Honours

Project reference: 1667

Examining the relationship between symptoms of anxiety and markers of inflammation in depression.

Supervisors: Adam Walker, Olivia Dean

Location: IMPACT, HERB Building B, Level 3

Research centre: IMPACT

Project background:

There is a growing appreciation that a proportion of patients diagnosed with mood-related and anxiety-related disorders exhibit a chronic low-grade inflammation, as measured by increased peripheral and central inflammatory cytokines, inflammatory mediators, metabolites and acute phase reactants. It has been suggested that patients with perturbed inflammation are more likely to experience treatment-resistant depression and may be more or less likely to respond to certain treatments. Moreover, both anxious symptoms and co-morbid anxiety disorders (particularly generalised anxiety disorder) have been found to be predict lower rates of response and remission in depression. The nature of the relationship between anxiety symptoms and biological factors, and whether or not they can be used for prognostic or theragnostic purposes remains unclear.

Research question:

The overarching aim of this research project is to investigate how symptoms of anxiety, as measured by the Hamilton Anxiety Rating Scale (HAM-A), and/or a co-morbid diagnosis of anxiety-like disorder may relate to peripheral biological markers of inflammation and treatment response in a participants experiencing a current episode of depression.

Techniques, methods, analyses and day to day activities:

The student will be required to explore covariates, mediators and moderators of response to determine subgroups of people who may response better based on their inflammatory profile.

Contact supervisor: Dr. Adam Walker (School of Medicine): a.walker@deakin.edu.au

Suitable for: Honours

Project reference: 1666

Personality disorder and treatment response in people who are dependent on methamphetamine

Supervisors: Alyna Turner, Bianca Kavanagh

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Methamphetamine use an increasing health concern, however there are limited treatment options for those experiencing dependence. N-acetyl cysteine has previously been associated with reduced cravings in people with methamphetamine dependence, and we have conducted a clinical trial to see if it can be used to reduce use. Personality disorder is a common comorbid condition in people with substance use disorders and may impact on outcomes.

Research question:

It is important to understand whether presence of personality disorder might impact on treatment outcomes in people with methamphetamine dependence. The aim of the study is to determine whether presence of personality disorder (as measured by a validated screening tool) predicts treatment outcomes in people in a clinical trial of a treatment for methamphetamine dependence.

Techniques, methods, analyses and day to day activities:

The project will utilise data collected from a clinical trial of N-acetyl cysteine for methamphetamine dependence. Using personality disorder as the exploratory factor, the project will use statistical modelling to determine the impact on treatment outcomes. The project will involve supplementary data entry on a trial of mangosteen pericarp to enhance the project and provide a more rounded honours experience for the student.

Contact supervisor: Dr. Alyna Turner (School of Medicine): a.turner@deakin.edu.au

Suitable for: Honours

Project reference: 1658

How can IL-6 be used to better predict treatment response in affective disorders?

Supervisors: Olivia Dean, Chiara Bortolasci, Adam Walker

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

There is a clear need to tailor psychiatric medications better to improve outcomes for people experiencing mental illness. This project will bring together data from several completed randomised controlled trials that explored novel adjunctive treatments for affective disorders (depression and bipolar disorder). The aim of the project is to utilise statistical analyses to determine subgroups of people that may respond to study treatments, based on their IL-6 levels.

Research question:

What is the predictive value of IL-6, a cytokine, on the treatment response of people with affective disorders who took part in adjunctive novel therapy trials? IL-6 has been shown to have value in some studies but results are inconsistent. Can IL-6 be effectively used to predict treatment response in subgroups of individuals?

Techniques, methods, analyses and day to day activities:

The student will be required to use statistical methods to explore covariates, mediators and moderators of response to determine subgroups of people who may response better based on their IL-6 profile. The project will utilise data collected from several trial of novel therapies including n-acetyl cysteine and minocycline.

Contact supervisor: Assoc. Prof. Olivia Dean (School of Medicine): o.dean@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1645

Depression and the gut-brain axis: a systems biology approach

Supervisors: Amy Loughman, Felice Jacka, Julie Pasco

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The estimated 300 million people globally who experience Major Depressive Disorder have a significant burden of disease. Depression is highly multifactorial in nature, posing a major barrier to understanding how it begins, develops and is perpetuated. The gut-brain-axis, including the community of microbes in the gut - the microbiome - is an integral part of this picture.

This project will incorporate investigation of multiple interacting factors with machine learning to understand the causes of depression, predicting risk, and to uncover novel opportunities for both treatment and prevention.

Research question:

The aim of this project is to enable accurate estimation of depression risk and modifiable intervention targets through machine learning modelling. The overarching hypothesis is that the gut-brain-axis and established risk factors are mechanistically linked to brain processes in depression. Specific sub-hypotheses will be developed by the student and supervisory team during candidature.

Techniques, methods, analyses and day to day activities:

The student will undertake preparation of biosamples collected as part of the latest waves of the Geelong Osteoporosis Study, including DNA extraction ahead of microbiome sequencing. The student will also develop skills in bioinformatic and statistical coding of microbiome data, and development of machine learning models to integrate psychiatric, health behavioural, microbiome and other biological data.

Contact supervisor: Dr. Amy Loughman (School of Medicine): amy.loughman@deakin.edu.au

Suitable for: PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

Project reference: 1625

Group-based psychological stress management for early stage breast cancer patients

Supervisors: Lana Williams, John Toumbourou, Vicki White, Michael Antoni, Stephanie Cowdery

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

This project will include the establishment and completion of a randomised trial to replicate the implementation and evaluation of a 10-week group-based psychological stress management program, which has evidence from trials in the United States (US) for reducing depressive symptoms, stress experiences and inflammation markers for breast cancer patients (Stagl et al, 2015: https://doi.org/10.1007/s10549-015-3626-6). The protocol includes a longitudinal follow-up, with measures harmonised to a large existing cohort study.

Research question:

The proposed PhD project by publication aims to evaluate the hypothesis that reducing depressive symptoms, stress experiences and in turn inflammation markers predicts time free from cancer and survival time for non-metastatic breast cancer patients.

Techniques, methods, analyses and day to day activities:

The student will be involved in all aspects of the research process from assisting in setting up the clinical trial, collecting health data from research participants to entering the information into large databases, completing statistical analyses and preparing manuscripts for publication.

Contact supervisor: Assoc. Prof. Lana Williams (School of Medicine): l.williams@deakin.edu.au

Suitable for: PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1624

The effect of novel metabolites on irritable bowel syndrome

Supervisor: Wolfgang Marx

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Irritable bowel syndrome is a highly prevalent disorder, yet the relevant pathways involved in this disease requires further investigation. Emerging evidence suggests that the kynurenine pathway, well-investigated for its role in brain and mental health, may be altered in people with IBS. However, there is a lack of systematic appraisal of the current evidence. Further investigation into this novel pathway may provide further insight regarding the relevant pathways involved in IBS pathology and suggest pathways for potential targeted treatments

Research question:

Rational: There is a number of studies that have investigated differences kynurenine metabolites in people with IBS; however, there is no current systematic review of these data
Aim: To conduct a systematic review and meta-analysis of studies that have investigated the effect of kynurenine metabolites in people with IBS compared to healthy controls

Techniques, methods, analyses and day to day activities:

The student will be trained to conduct a high-quality systematic review of the existing literature and meta-analysis. This is will involve protocol planning and registration, PRISMA guidelines, and basic meta-analysis skills. This project is designed with the potential to develop a peer-reviewed publication.

Contact supervisor: Dr. Wolfgang Marx (School of Medicine): wolf.marx@deakin.edu.au

Suitable for: MPhil

Other considerations:

This project is subject to final approvals.

Project reference: 1623

Mechanisms underpinning lithium responsiveness in bipolar disorder

Supervisors: Chiara Bortolasci, Ken Walder, Bruna Parry

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Bipolar disorder is a debilitating disease that is difficult to treat. Lithium works very well in some patients, but not in others. The factors underlying lithium efficacy are unknown. To work towards understanding the factors underlying lithium efficacy, we need to better understand the mechanism of action of lithium. Some studies have been done, highlighting potential effects on energy metabolism, which is consistent with the energy dysregulation hypothesis of bipolar disorder. However, the data to support this is limited and has been generated using inadequate or irrelevant model systems.

Research question:

We have collected blood samples from participants with bipolar disorder that are either lithium responders or non-responders. Peripheral mononuclear blood cells were isolated and transformed into human pluripotent stem cells. In this project, stem cells will be differentiated in a novel cell co-culture system containing a mixture of neurons and astrocytes and we will investigate aspects of energy metabolism and/or inflammation that can shed a light on the mechanism involved in lithium response.

Techniques, methods, analyses and day to day activities:

The project involves the culture of stem cells, differentiation of stem cells in neurons/astrocytes, immunocytochemistry, RNA extraction, gene expression and c-DNA quantification, plate-based assays (including ELISAs), mitochondrial-related assays, statistical analyses.

Contact supervisor: Dr. Chiara Bortolasci (School of Medicine): bchiara@deakin.edu.au

Suitable for: Honours, PhD

Project reference: 1622

Alternative approach in the treatment of bipolar disorder

Supervisors: Chiara Bortolasci, Ken Walder, Bruna Parry

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Bipolar disorder (BD) is a significant public health issue, imposing a major burden on sufferers, family members, and the healthcare system, resulting in decreased quality of life and increased suicide risk and medical and disability costs. Current treatments for bipolar disorder – namely mood stabilizers, antipsychotics, antidepressants – generally only work for a minority. Moreover, the treatment shortfalls disproportionately affect the most debilitating phase of the disease: depression, the phase in which patients spend most of their lives. These treatments are also related to side-effects (including renal dysfunction, hypothyroidism, and hypercalcemia). Therefore, there is a major unmet need for new compounds to treat the depressive phase of BD.
Given the complex pathophysiology exemplified by the need for polypharmacy for effective treatment, agents that influence multiple biological pathways are more likely to be effective as novel treatments.

Research question:

We have a compound with encouraging preliminary data to be used to treat BD depression. This project aims to test the effects of this compound on mitochondrial function, inflammation and neurite outgrowth in a neuronal and astrocyte co-culture from bipolar disorder patient-derived stem cells.

Techniques, methods, analyses and day to day activities:

The project involves the culture of stem cells, differentiation of stem cells in neurons/astrocytes, immunocytochemistry, RNA extraction, gene expression and c-DNA quantification, plate-based assays (including ELISAs), mitochondrial-related assays, statistical analyses.

Contact supervisor: Dr. Chiara Bortolasci (School of Medicine): bchiara@deakin.edu.au

Suitable for: Honours, PhD

Project reference: 1620

Repurposing drugs to treat bipolar disorder and schizophrenia

Supervisors: Ken Walder, Chiara Bortolasci

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Current treatment options for bipolar disorder and schizophrenia are inadequate, and there is an urgent need for new therapies with better efficacy and more favourable side-effect profiles. Development of new drugs takes many years and is very expensive, so an alternative strategy receiving considerable attentions is drug repurposing, the process of identifying a new indication for an existing drug. This project will utilise cutting edge cell models derived from induced pluripotent stem cells collected from participants with bipolar disorder or schizophrenia and healthy, matched controls, along with state-of-the-art molecular biology techniques to repurpose drugs to treat these disorders.

Research question:

Drug discovery for mental health disorders is at a virtual standstill, and new treatments are urgently required. In this project we will test the hypothesis that stem cell models and molecular biology can be used to repurpose drugs for bipolar disorder and schizophrenia. The aim of the project is to repurpose a drug for one of these disorders such that the drug is ready to progress to clinical testing in patients.

Techniques, methods, analyses and day to day activities:

Day to day activities will include cell culture, differentiation of stem cells into cortical networks, next generation sequencing, measurement of microRNAs and long non-coding RNAs, bioinformatics, and a range of bioassays measuring mitochondrial function, oxidative stress, neurite outgrowth and inflammation.

Contact supervisor: Prof. Ken Walder (School of Medicine): walder@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1619

Evaluation of the quality of online information regarding dietary supplements and mental health

Supervisor: Wolfgang Marx

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

There is significant patient interest in the use of dietary supplements for treating mental illness. Some dietary supplements (e.g. omega-3 fatty acids) are well explored both for safety and efficacy. However, others have low-quality evidence and/or significant safety concerns. People with mental illness often seek information regarding lifestyle and dietary supplements on the internet to help them make treatment decisions. However, the accuracy of the information available online is not always reliable.

Research question:

Rationale: Due to the high interest in dietary supplements, there is a need to evaluate the accuracy of online sources of relevant information.
Aims: Using validated tools, online sources (websites and YouTube) will be evaluated for readability and accuracy.

Techniques, methods, analyses and day to day activities:

A comprehensive content analysis will be undertaken of eligible websites and YouTube videos. The accuracy of the information will be evaluated by comparing the key messages with relevant evidence-based guidelines. The DISCERN tool will be used to evaluate the quality of the material. Health literacy demand will be evaluated using the Patient Education Material Assessment Tool And validated readability calculators.

Contact supervisor: Dr. Wolfgang Marx (School of Medicine): wolf.marx@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project is subject to final approvals.

Project reference: 1615

Exploring novel markers of chronic fatigue syndrome

Supervisor: Wolfgang Marx

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Chronic fatigue syndrome (CFS), also known as myalgic encephalomyelitis (ME), is characterised by physical symptoms including post-exertional malaise, muscle and/or joint pain, sore throat, unrefreshing sleep, and impaired cognitive functioning and mood. This disabling raft of symptoms means that a sobering 74% of people with ME/CFS are severely limited or unable to work. Underscoring this scale of impact: the USA loses an estimated USD$9.1 billion in productivity per year to ME/CFS. Yet despite its severe burden, very little is known regarding the pathophysiology of this disease. This project will identify emerging mechanisms related to chronic fatigue syndrome and investigate this further within a case-control design

Research question:

Rationale: There is a lack of understanding regarding the pathophysiology of ME/CFS that requires further investigation.
Aims: To investigate novel mechanisms related to inflammation, oxidative stress, mitochondrial dysfunction, and the microbiome within a group of people with ME/CFS compared to healthy controls

Techniques, methods, analyses and day to day activities:

This PhD candidate will receive training in Good Clinical Practice, clinical trial design and statistical analysis, and systematic review and meta-analysis methods. The candidate will lead the design, ethics approval, data collection, and analysis of a clinical trial.

Contact supervisor: Dr. Wolfgang Marx (School of Medicine): wolf.marx@deakin.edu.au

Suitable for: PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1613

How does the microbiome affect multiple sclerosis?

Supervisor: Wolfgang Marx

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The RELIEF trial is an ongoing NHMRC-funded multi-centre randomized controlled trial that is investigating the role of a combined mitochondrial nutraceutical therapy for fatigue and depression in 150 people with multiple sclerosis. In addition to exploring the efficacy of this therapy, we are interested in the interaction between the intervention and implicated pathways in multiple sclerosis and how this may influence treatment response. Oxidative stress, mitochondrial function, metabolomic, microbiome, and genomic data are being collected as part of this trial and will be available to explore this research question. Results generated from this PhD will provide high-quality data regarding the potential pathways that mediate treatment response in multiple sclerosis and may provide insight for potential future targeted interventions.

Research question:

Rational: Fatigue is highly prevalent in multiple sclerosis populations; however, effective treatments are lacking. Exploring relevant pathways and how they may affect treatment efficacy may provide insight into relevant mechanisms of action and future treatment targets.
Aim: To explore the effect of biological pathways on treatment response in 150 participants relapse-remitting multiple sclerosis

Techniques, methods, analyses and day to day activities:

The microbiome and, depending on the candidate's interest, various "omic" datasets will be available for analysis. The candidate will be trained to use Stata and R statistical packages to conduct their analysis. Experience with data collection and participant follow-up may also be available to the student. The candidate will also be trained in systematic review/meta-analysis skills to assess the existing literature.

Contact supervisor: Dr. Wolfgang Marx (School of Medicine): wolf.marx@deakin.edu.au

Suitable for: PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1612

The influence of lung inflammation and social stress on mental health

Supervisors: Craig Smith, Justin Read

Location: Waurn Ponds Campus

Research centre: CMMR

Project background:

Lung inflammation can be caused by many factors, such as infection (including COVID-19), asthma, and COPD. Lung inflammation can adversely affect mental health and trigger diseases such as depression. The 'lung-brain axis' and mechanisms through which lung inflammation influences the brain remain poorly understood. This project will investigate this gap in knowledge, using a mouse model of asthma. Additionally, the social environment of humans (and mice) is known to play an important role in mental health, and surprisingly, on our inflammatory response. Strong, positive social connectivity is protective against pathological inflammation and mental health problems, while social stress (including social isolation) is a risk factor for depression and other disorders. This project will investigate mechanisms within the brain through which social stress and lung-inflammation interact to influence mental health, to identify novel targets that can be influenced by drugs to treat depression.

Research question:

Aim 1. Characterise behavioural changes relevant to depression (including anxiety and social withdrawal) in a mouse model of asthma, versus controls.
Aim 2. Determine whether these behavioural changes are more pronounced in subordinate mice, compared to dominant cage-mates.
Aim 3. Collect brain, lung and blood tissues from mice to examine the pathological mechanisms that underlie these effects. In doing so, identify novel pathways that can be pharmacologically targeted to treat depression.

Techniques, methods, analyses and day to day activities:

Aim 1 & 2: The asthma model involves treating mice with inhaled nebulized allergen vapour. Anxiety and other behaviours will be assessed using paradigms such as the elevated plus maze. Social hierarchy will be determined using the tube dominance test.
Aim 3: Brain, lung and blood tissues will be collected. Immunohistochemistry and/or gene expression analysis will be performed on the brains and lungs, while blood will be analysed for inflammatory markers using ELISA.

Contact supervisor: Dr. Craig Smith (School of Medicine): craig.smith@deakin.edu.au

Suitable for: MPhil, PhD

Other considerations:

This project is subject to final approvals.

Public health

Project reference: 1701

The person-centredness of healthcare for people with multiple chronic conditions (multimorbidity)

Supervisors: Kevin Mc Namara, Vincent Versace

Location: Waurn Ponds Campus

Research centre: DRH

Project background:

Patients with multiple health conditions (multimorbidity) are increasingly prevalent in health services delivery as our population ages. Our previous research has identified that health services have not been designed to meet their needs, and that there is often a lack of clinical evidence to guide treatment for this group. These patients experience considerable out of pocket expenses to treat their multiple conditions, a significant time and travel burden in attending appointments at multiple health professionals and specialists, conflicting health advice and treatments, increased complexity of self-management, and poor coordination of care. Recent research by supervisors has explored the burden of healthcare on patients, and how it could be improved.

Research question:

This project aims to determine what constitutes a person-centred approach to the management of multimorbidity, and to evaluate the feasibility of implementing person-centred care. Evidence generated from this project will inform important gaps in health service delivery.

Techniques, methods, analyses and day to day activities:

You will learn about the challenges faced by patients with multiple health conditions, the difficulties of care coordination, and what doctors and other health professionals could do to better support their needs. The project will help to develop a range of health service skills including the conduct of interviews and focus groups, survey design, participant sampling, ethics processes, co-design and trial implementation.

Contact supervisor: Assoc. Prof. Kevin Mc Namara (School of Medicine): kevin.mcnamara@deakin.edu.au

Suitable for: MPhil, PhD

Project reference: 1700

Understanding the burden of healthcare for older patients with multiple chronic conditions

Supervisors: Kevin Mc Namara, Andrea Hernan, Vincent Versace

Location: Waurn Ponds Campus

Research centre: DRH

Project background:

Patients with multiple health conditions (multimorbidity) are increasingly prevalent in health services delivery as our population ages. Our previous research has identified that health services have not been designed to meet their needs, and that there is often a lack of clinical evidence to guide treatment for this group. These patients experience considerable out of pocket expenses to treat their multiple conditions, a significant time and travel burden in attending appointments at multiple health professionals and specialists, conflicting health advice and treatments, increased complexity of self-management, and poor coordination of care. Recent research by supervisors has explored the burden of healthcare on patients, and how it could be improved.

Research question:

This project aims to further explore the nature of this burden on patients, and to explore the relationship between healthcare burden and adverse patient-centric and healthcare outcomes. Evidence generated from this project will inform important gaps in health service delivery.

Techniques, methods, analyses and day to day activities:

You will learn about the challenges faced by patients with multiple health conditions, the difficulties of care coordination, and what doctors and other health professionals could do to better support their needs. The project will help to develop a range of health service skills including the conduct of interviews and focus groups, survey design, participant sampling, ethics processes, and quantitative data analysis using statistical software.

Contact supervisor: Assoc. Prof. Kevin Mc Namara (School of Medicine): kevin.mcnamara@deakin.edu.au

Suitable for: MPhil, PhD

Project reference: 1692

Investigating the accuracy of self-reported medication use in a population-based study

Supervisors: Sarah Hosking, Amy Page, Lana Williams, Kara Holloway-Kew, Julie Pasco

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

While medications assist in treating and managing many conditions, taking many medications together poses risks. Medication related harm such as drug interactions, cognitive impairment, falls, fractures and early mortality costs the Australian healthcare system $1.4 billion annually. Often prescribers rely on a 'medication reconciliation' combining medication information from multiple sources, including self-report, to ensure medications are appropriate and avoid harms. A poorer ability to self-report medications could result in some individuals taking unnecessarily medications and may lead to medication related harms. Evidence suggests some population groups including socially disadvantaged individuals, older adults and those managing complex chronic conditions such as diabetes or cardiovascular disease may be at greater risk of medication related harm.
Identifying inaccuracies in self-reported medication use may help to identify those at increased risk of harm.

Research question:

Ensuring individuals know which medications they are taking is important in preventing medication related harm.
This project will:
- Investigate the accuracy of self-reported medication regimens compared to dispensing data in a large health and lifestyle study.
- Investigate associations between sociodemographic factors and health factors and inaccurate report of medications.

Techniques, methods, analyses and day to day activities:

The candidate will work with a multi-disciplinary team of researchers in undertaking this project. The project will provide opportunities for the candidate to assist with data collection as part of the current follow-up of the health and lifestyle study, undertake data linkage with large prescriber databases and learn how to use statistical software. It is anticipated the candidate will learn and utilise sensitivity and specificity analyses and regression analyses as part of this project.

Contact supervisor: Dr. Sarah Hosking (School of Medicine): s.hosking@deakin.edu.au

Suitable for: Honours

Project reference: 1691

How can we realise the potential of mobile apps for mental health? - A pilot study

Supervisors: Lesley Berk, Mohamed Abdelrazek

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Living through the pandemic has highlighted the urgent need to find effective online and mobile app solutions to augment treatment. There are lots of mobile apps available to enhance mental health, but few are evidence based. Also, little is known about how to make these apps useful and engaging to people with severe mental health problems, or what psychosocial, app content, design and technical factors influence use and outcomes. We developed an app as part of a psychosocial intervention, MyMAPS for people with bipolar disorder, that was provided as an adjunct to pharmacological treatment. Data from the MyMAPS trial, end users and the research literature could inform ways to upgrade and improve the app, which could then be piloted to assess its effect on user engagement, satisfaction and mental health. Findings from this research could assist clinicians and app developers to create useful and engaging apps in the future.

Research question:

This project asks 1) What can previous research, data from our MyMAPS trial and the views of end-users teach us about improving user satisfaction and engagement with apps, and enhancing mental health benefits? 2) In line with this evidence, what changes can be made to improve and upgrade the MyMAPS app? 3) Does a pilot study that implements some of the recommended changes to the app show improvements in user satisfaction, engagement and mental health?

Techniques, methods, analyses and day to day activities:

As a PhD student, you will be part of a supportive and vibrant team led by both clinical and IT supervisors and mentored to progress your career in the much needed area of digital health. This PhD involves a systematic literature review and analyses of data about app use from the MyMAPS trial, using your findings to implement changes to the app, evaluating your changes in a small pilot RCT, quantitative and qualitative analyses of results, and writing up what you have learned.

Contact supervisor: Dr. Lesley Berk (School of Medicine): l.berk@deakin.edu.au

Suitable for: PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1677

Nutrition during pregnancy and child mental health

Supervisors: Natalie Hyde, Julie Pasco, Lana Williams

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The Developmental Origins of Health and Disease paradigm suggests that foetal growth and development is not only determined by the foetal genome, but also by its interactions with the environment in utero. Though these seminal findings were primarily focused around coronary heart disease, studies have linked the environment in utero to several non-communicable diseases, including mental health conditions. Furthermore, adolescence is a peak time for onset for mental health conditions and thus represents a key period for detection prevention and intervention.

Research question:

Identification of factors during adolescence that are associated with mental health symptomology are crucial. Thus, this project will aim to determine the association between early life nutritional exposures, specifically in pregnancy with offspring mental health symptomology during adolescence.
It is hypothesised that suboptimal nutrition, including vitamin D status, will be associated with increased mental health symptomatology in adolescence.

Techniques, methods, analyses and day to day activities:

The student undertaking this project will develop their understanding of longitudinal cohort studies, while working with experienced researchers at the Epi-Centre for Health Ageing within IMPACT. The student will assist with data collection, including a mail-out follow-up of the Vitamin D in Pregnancy Study, with scope to assist with collection of clinical measures at a young adult follow-up. They will also independently perform appropriate cross-sectional and longitudinal statistical analyses.

Contact supervisor: Dr. Natalie Hyde (Barwon Health): natalie.hyde@deakin.edu.au

Suitable for: Honours, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1670

Piloting iPupilX for objective dietary assessment

Supervisors: Colin Bell, Asim Bhatti, Robyn Perlstein

Location: Waurn Ponds Campus

Research centre: Other

Project background:

Food has a direct impact on health and diet-related diseases such as cardiovascular disease and cancers, are major causes of morbidity and mortality in Australia. Monitoring food intake is vital for identifying which foods, and in what amounts contribute to the burden of disease or protect us from it. Current methods of assessing diet rely heavily on memory and are expensive to implement. Wearable technologies may be able to enhance or even replace these assessment methods, improving accuracy and lowering costs.

Research question:

iPupilX is a unique lightweight wearable technology developed at Deakin University that will capture images of food consumption and use algorithms to recognize foods and estimate portion size and nutrient content. The assessment method will be validated against the ASA24, an automated self-administered 24-hour dietary assessment tool developed by the United States National Cancer Institute and adapted to reflect the Australia Food supply and nutrient databases.

Techniques, methods, analyses and day to day activities:

A convenience sample of Medical Students, who are members of NutMed, will be invited to wear the iPupilX glasses for one weekday and one weekend day and to complete the self-administered ASA24 food recall the following days. Data from the iPupilX and the food recall will be uploaded onto a Deakin database and analysed to determine nutrient intakes. Nutrient intakes from the images and from the 24-hr recall will be compared with the recall as the gold standard.

Contact supervisor: Prof. Colin Bell (School of Medicine): colin.bell@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1652

Musculoskeletal deficits and risk of hospitalisation

Supervisors: Kara Holloway-Kew, Julie Pasco, Natalie Hyde, Sarah Hosking

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

In Australia, the population is ageing, which will lead to an increasing burden on the healthcare system, including an increased rate of hospitalisations. Many of these hospitalisations are preventable.
The prevalence of musculoskeletal conditions is also increasing in Australia. The Australian Institute of Health and Welfare have reported that the rate of hospitalisation for musculoskeletal conditions increased by 13% between 2004-2005 and 2013-2014.

Deficits in bone and muscle have been linked to hospitalisations for reasons such as fracture, or those specifically related to the conditions. However, fewer studies have examined all-cause hospital admissions and whether musculoskeletal deficits are therefore, reflective of poorer overall health.

This project will investigate associations between poor musculoskeletal health and all-cause hospital admissions using prospective data from the Geelong Osteoporosis Study.

Research question:

Rationale and Aim: Knowledge of how musculoskeletal deficits influence hospitalisation will provide intervention targets. The aim is to use longitudinal data to identify associations between poor muscle and bone health and hospitalisation.

Hypothesis: It is expected that musculoskeletal deficits will be a marker for poorer health and thus, those with these deficits will have a higher number and frequency of hospitalisations, as well as a longer length of stay.

Techniques, methods, analyses and day to day activities:

This project is situated with the Epi-Centre for Healthy Ageing, at the University Hospital Geelong. It will involve epidemiological techniques including participant-researcher interaction, database manipulation and complex statistical analyses. The candidate will perform data cleaning, analysis and interpretation, as well as collect primary data from participants of the Geelong Osteoporosis Study.

Contact supervisor: Dr. Kara Holloway-Kew (School of Medicine): k.holloway@deakin.edu.au

Suitable for: Honours

Project reference: 1649

Enhancing Australia's Dietary Guidelines

Supervisor: Colin Bell

Location: Waurn Ponds Campus

Research centre: Other

Project background:

The Australian Dietary Guidelines apply to all Australians and are designed to help Australians make healthy food choices to ensure normal growth in infants and children and improve quality of life and well-being. Having a long and healthy life is only one of many reasons why people eat; however, and it is possible that the guidelines are not as effective as they could be because they overlook social, cultural and contextual reasons for the food choices we make. Brazil have recently introduced Dietary Guidelines shaped around principles that take into account broader influences on how and why people eat.

Research question:

The aim of this project is to compare and contrast Australian and Brazilian Dietary Guidelines to identify barriers and facilitators to the acceptability of the Australian Dietary Guidelines make recommendations for improving the readability and relevance of the Guidelines for all Australians.

Techniques, methods, analyses and day to day activities:

A language and thematic analysis of the Australian and Brazilian Dietary Guidelines and review of published literature describing guideline acceptability. This project uses qualitative research methods and will require an exemption from an ethics application.

Contact supervisor: Prof. Colin Bell (School of Medicine): colin.bell@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1648

Let's get physical

Supervisors: Colin Bell, Shannon Sahlqvist

Location: Waurn Ponds Campus

Research centre: Other

Project background:

Active Geelong is a collaborative project that brings together leading businesses, doctors, researchers and individuals to address inactivity in the Geelong region. The vision of Active Geelong is to help make Geelong Australia's most active city (https://www.activegeelong.org.au/).

Participation in regular physical activity can help prevent a range of chronic diseases, including cardiovascular disease and diabetes that are common in south west Victoria. Active Geelong is works with workplaces to support employees to become more active.

Research question:

Workplaces register their interest through a website where information is gathered on workplaces, reasons for participation, preferred physical activity interventions and outcomes. With a view to enhancing the impact of Active Geelong and providing evidence for similar initiatives, this project will evaluate the process and impact of the Active Geelong Workplace initiative.

Techniques, methods, analyses and day to day activities:

Cross-sectional survey of physical activities programs in Geelong workplaces and before and after surveys of employees to determine the short-term impact of Active Geelong. Activities will include data collection at a variety of Geelong workplaces (via zoom if necessary), cleaning and analysis of qualitative and quantitative data.

Contact supervisor: Prof. Colin Bell (School of Medicine): colin.bell@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1646

Exploring health care for trans and gender-diverse patients at Kardinia Health, Geelong

Supervisors: Erik Martin, Andrew Sanigorski, Nic Brayshaw

Location: Waurn Ponds Campus

Research centre: Other

Project background:

Trans and gender diverse (TGD) people represent approximately 1% of the Australian population. Whilst larger cities tend to have larger populations to support specialist LGBTI clinics, TGD health care in rural and regional areas is more likely to be delivered by mainstream services. TGD people have complex health needs, and report mixed experiences when engaging with mainstream primary care services, which can affect their willingness to attend such services, continuity of care and ultimately health outcomes. There is limited evidence on how mainstream services are best adapted to suit the needs of TGD patients, although one study suggests that better training of healthcare professionals and more accessible care to treat TGD patients is necessary.

Kardinia Health is a mainstream allied health service in Geelong, and despite TGD people representing a very small proportion of the population, over 100 TGD people from the region are registered Kardinia Health patients, which is likely to exceed many other practices in the Greater Geelong region. Kardinia Health has sought to adopt a model of care that is inclusive and welcoming to TGD patients, although no formal studies have been conducted to ascertain how this has been received by TGD patients, and in particular what the barriers and facilitators to effective care exist amongst this population.

Research question:

The aim of this study is to explore barriers and facilitators to TGD health care at Kardinia Health. This is crucial to inform how this service can improve care for this marginalised population, which may serve as an important lesson for other mainstream services in other rural and regional areas.

Techniques, methods, analyses and day to day activities:

After reviewing the literature in this topic, the student will collect qualitative data in the form of semi-structured interviews with approximately 8-12 participants. Whilst much of the work is desk-based, the student will also liaise with relevant clinical and research staff in KH and Deakin University as part of a collaborative team.

Contact supervisor: Dr. Erik Martin (School of Medicine): e.martin@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1637

Antimicrobial stewardship measures of success

Supervisor: Eugene Athan

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Antimicrobial Stewardship (AMS): curbing the unnecessary use of antimicrobials is the best defence against resistant microbes. AMS is an organised program that aims to reduce the inappropriate use of antimicrobials to provide the best clinical outcomes & reduce any adverse consequences that include drug toxicity, antimicrobial resistance & financial costs. Such programs utilise antimicrobial restriction, approval systems or electronic decision support tools to optimise prescribing. Successful in the acute hospital setting in many countries around the world. There is limited evidence from other countries in community general practice where the majority (80%) of antibiotic prescribing in Australia is initiated. We will undertake baseline audits of antibiotic prescribing in 3 pilot GP clinics. This involves reviewing all GP consultations which resulted in antibiotic prescribing.

Research question:

Is improvement in antimicrobial prescribing sustainable after face to face training to 1 year?
Educational intervention will improve antimicrobial prescribing in General Practice.
Educational intervention will improve antimicrobial prescribing in General Practice and be sustained at 2 years. This includes improvements in documentation; improvements in ordering microbiology samples; and improvements in appropriate antibiotic choice dose and duration.

Techniques, methods, analyses and day to day activities:

Analyse time trends in prescribing compliance over the course of the intervention examining rates & significant differences in time.
We will also monitor C. difficile incidence rates in the region before and during intervention.
Analysis of change in antibiotic prescribing simple quantitative comparisons before and after intervention.
Honours will be 3-month analysis of antibiotic prescribing. Quantitative analysis and some statistical analysis.

Contact supervisor: Prof. Eugene Athan (Barwon Health): e.athan@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Project reference: 1618

Developing a lifestyle program for people at risk of mental disorders

Supervisors: Adrienne O'Neil, Felice Jacka

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Meta-analyses show that dietary and exercise interventions have likely comparable efficacy for improving distress and depression. When delivered together, in an integrated way, their benefits may be cumulative. Yet surprisingly, when compared to other conditions like diabetes and coronary heart disease for which lifestyle programs form the foundation of primary and secondary prevention, no such integrated programs exist within clinical practice for mental health. This project aims to adapt what we know works in other settings (e.g. diabetes prevention) and applies it to individuals at risk of developing a mood disorder.

Research question:

To develop a group-based, lifestyle program delivered by telehealth to reduce mental health symptoms in Australians with elevated anxiety, depression and/or and psychological distress.

To demonstrate feasibility, acceptability and maintenance of the program over 8 weeks.

Techniques, methods, analyses and day to day activities:

This PhD project will involve protocol development including study design and enactment, recruitment, evaluation, project management and stakeholder engagement. This will include reviews of the literature and quantitative data collection and analysis. Use of statistical software packages (e.g. Stata, SPSS) will be required (training available). Good Clinical Practice training will be provided.

Contact supervisor: Assoc. Prof. Adrienne O'Neil (School of Medicine): adrienne.oneil@deakin.edu.au

Suitable for: PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1616

Effectiveness and feasibility of a dietary intervention for depression in primary care

Supervisor: Felice Jacka

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

The Royal Australian and New Zealand College of Psychiatrists' clinical practice guidelines for mood disorders now recommend diet, exercise and other lifestyle targets as Step 0 for treating clinical depression. While the translation of the current evidence base into clinical guidelines in psychiatry is promising, General Practitioners (GPs) remain at the forefront of mental health services. GPs are the gatekeepers of health service provision and is the most prevalent condition seen in 14.9% of patients, second only to hypertension. As such, implementing and evaluating dietary intervention as a treatment for clinical depression within the primary care setting in which existing referral pathways and financial mechanisms can be used is a logical and much needed next step in translating the evidence from the field of nutritional psychiatry into mainstream health services and providing options for patients with depression.

Research question:

To conduct pilot RCT to assess:
Whether patients presenting to primary care with clinical depression who receive a dietary-based, dietitian-led treatment program ("SMILES 2.0") intervention show improved mood compared to those receiving psychotherapy-based, psychologist-led treatment program at 12 weeks?
Barriers and enablers in primary care (including patient level, provider level and financial)?

Techniques, methods, analyses and day to day activities:

This PhD project will involve protocol development including study design and enactment, recruitment, evaluation, project management and stakeholder engagement. This will include reviews of the literature and quantitative data collection and analysis.

Contact supervisor: Assoc. Prof. Felice Jacka (School of Medicine): adrienne.oneil@deakin.edu.au

Suitable for: PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1606

Online education to better mental health through diet

Supervisor: Tetyana Rocks

Location: Barwon Health, Geelong

Research centre: IMPACT

Project background:

Current evidence shows a strong association between diet quality and mental and brain health outcomes across life stages. What is more, improvements in the dietary intake have demonstrated to lead to improvements in several mental health conditions, for example, depression. The idea of improving one's mental health through diet is highly appealing from the individual and society perspective; however, there is a large amount of misinformation available to consumers about dietary treatment of health conditions.

Research question:

This project involves exploring consumers' perception of online educational resources on diet and physical, mental and brain health through series of surveys. The surveys will be undertaken as part of a Free Online Course on FutureLearnTM platform and will explore general health and nutrition knowledge, attitudes and behaviours.

Techniques, methods, analyses and day to day activities:

The student will be supported to conduct a preliminary literature review, develop research question, and analyse the available data.

Contact supervisor: Dr. Tetyana Rocks (School of Medicine): tetyana.rocks@deakin.edu.au

Suitable for: Honours

Rural and Regional Health

Project reference: 1704

Optimising the use of embedded researchers for knowledge translation in health services

Supervisors: Anna Wong Shee, Kevin Mc Namara

Location: Ballarat Health Service

Research centre: DRH

Project background:

Successful translation of research into practice relies on a detailed understanding (and knowledge) of the health service context in order to adapt the evidence appropriately. The use of clinician researchers, conjoint appointments and other types of 'embedded researchers' represents a key strategy to facilitate knowledge translation. In Victoria, there has been significant investment in the use of embedded researchers to bolster health service research capacity and the translation of knowledge into clinical practice. However, little is known about the characteristics and challenges of embedded research, how embedded researchers facilitate knowledge translation, and the support required for embedded researchers. In addition, the majority of embedded research positions are in metropolitan health settings few studies have explored the unique context of embedded research and knowledge translation within regional health centres or their effectiveness and challenges.

Research question:

This project will undertake research to establish a framework for supporting rural and regional ERs and for guiding best practice knowledge translation. The student will actively engage ERs and other stakeholders to determine their experiences, the nature of current activities, and their attitudes and preferences regarding the role.

Techniques, methods, analyses and day to day activities:

Data collection will primarily involve interviews, focus groups and surveys in its early stages, and the use of both qualitative and quantitative analysis methods. The student will draw from existing implementation and organisational science theories and frameworks to inform the development of a suitable framework for supporting embedded researchers.

Contact supervisor: Assoc. Prof. Anna Wong Shee (School of Medicine): Anna.WongShee@bhs.org.au

Suitable for: MPhil, PhD

Project reference: 1703

Implementing best practice non-surgical care for hip and knee osteoarthritis in the Grampians region

Supervisor: Anna Wong Shee

Location: Ballarat Health Service

Research centre: DRH

Project background:

Knee and hip osteoarthritis (OA) affect one in 12 Australians, significantly reducing quality of life, and increasing morbidity and healthcare costs. Osteoarthritis is an Australian National Health Priority Area condition, yet current management of OA is suboptimal and more than two thirds of people with OA report faring badly with their condition. Despite exercise therapy having the strongest evidence base of any available treatment, only 4% of people with OA are referred for this treatment, which has the potential to reduce the need for surgery and to improve outcomes of those who do proceed to joint replacement. People in the Grampians region have a high prevalence of OA and limited access to care. Ballarat Health Service's Orthopaedic Specialist Clinic has 1890 consumers waiting for assessment, (778 with knee or hip OA) with a wait time up to 1007 days. There is an urgent need for implementation of evidence-based exercise therapies into routine clinical practice.

Research question:

This project will evaluate the implementation of the Good Living with Arthritis (Denmark) program, a best practice self-management model of care incorporating exercise for people with hip and knee OA. Program evaluation outcomes include barriers and facilitators to implementation, and acceptability of the program to health professionals and health services. Patient outcomes include quality of life, functional measures, pain levels, and use of pain medication.

Techniques, methods, analyses and day to day activities:

This project will provide students with an opportunity to develop a range of health service research skills including implementation research skills, the conduct of interviews and focus groups, survey design, qualitative and quantitative data analysis. Research participants will include consumers, allied health professionals, GPs, and orthopaedic specialists.

Contact supervisor: Assoc. Prof. Anna Wong Shee (School of Medicine): Anna.WongShee@bhs.org.au

Suitable for: MPhil, PhD

Project reference: 1702

Health service interventions to improve rural food environments and prevent non-communicable disease

Supervisors: Anna Wong Shee, Laura Alston, Vincent Versace

Location: Ballarat Health Service

Research centre: DRH

Project background:

Rural communities across the globe experience significant challenges in accessing healthy food. Rural areas have been characterised to have less healthy food environments, which adversely impacts dietary intake and increases risk of preventable non-communicable diseases. The World Health Organisation recommends that targeting food environments be a priority in addressing NCDs worldwide, in vulnerable populations, such as rural communities. There is however scarce evidence to inform effective interventions in rural communities.

Rural health services are recognised as health leaders in their communities. These organisations serve as ideal leadership bodies to create positive change in food environments, however there is very little evidence globally on effective health service interventions, and no published Australian studies. Evidence is urgently needed to inform interventions that improve the healthiness of rural food environments leading in rural and regional communities.

Research question:

This study will undertake pilot food environment interventions with two regional health services, Ballarat Health Services and Colac Area Health. The interventions will focus on improving the access and promotion of healthy food in rural health service settings. The project will generate new and novel evidence on the effectiveness of food environment interventions in rural health services, along with understanding barriers and facilitators to the progress and upscaling of such work.

Techniques, methods, analyses and day to day activities:

This project will provide students with an opportunity to develop a range of research skills including how to conduct of interviews and focus groups, survey design, qualitative and quantitative data analysis along with industry experience and network building. The project will involve co-design and working collaboratively with multiple stakeholders, and the student will be highly supported by researchers embedded within both health services.

Contact supervisor: Assoc. Prof. Anna Wong Shee (School of Medicine): Anna.WongShee@bhs.org.au

Suitable for: MPhil, PhD

Project reference: 1678

Agrichemical exposure and its effect on the mental health of farmers

Supervisors: Susan Brumby, Jacquie Cotton, Alison Kennedy

Location: Western District Health Service, Hamilton

Research centre: NCFH

Project background:

Australian farmers/agricultural workers are exposed to a wide variety of pesticides, including Organophosphate (OP) insecticides. Acute poisonings are reported due to the inhibition of Cholinesterase (ChE). Whilst acute poisonings are less common in Australia, little is known about low level chronic exposures. Previous research suggests links between ChE inhibition susceptibility to stress and increased levels of neuropsychiatric, anxiety-and depression-like behaviour.
Australian farmers are at greater risk of suicide than the general population. Some research has explored the cultural/contextual factors underlying this increased risk. There has also been some research linking psychological functioning, depression and neurobehavioural problems with pesticide and/or insecticide exposure. However, there is a lack of research exploring the underlying mechanisms contributing to this in the farming population.

Research question:

This research aims to explore links and improve understanding of mechanisms linking chronic low-level agrichemical exposure and adverse mental health outcomes for farmers and agricultural workers engaged in crop and livestock operations in Western Victoria with self-reported agrichemical use.

Techniques, methods, analyses and day to day activities:

Participants will complete either the K10 (existing data on psychological distress) or the Depression, Anxiety and Stress Scale (DASS 21). Measurement of blood cholinesterase will be conducted using fingerpicks. Comprehensive self-reporting of periodical agrichemical usage will also be collected. Qualitative interviews will be undertaken with a sample of farmers to further understand the relationship between exposure and mental wellbeing.

Contact supervisor: Prof. Susan Brumby (School of Medicine): susan.brumby@deakin.edu.au

Suitable for: PhD

Other considerations:

This project involves the handling of human blood and bodily substances, any student undertaking this project will be advised by the Principal Investigator to review your vaccination history and immune status.

This project is subject to final approvals.

Project reference: 1676

Comparing outcomes of bariatric surgery for public and private patients in rural Victoria

Supervisors: Susan Brumby, Jodie Nelson

Location: Western District Health Service, Hamilton

Research centre: NCFH

Project background:

In the regional/rural setting patients access bariatric surgery either as a private or public patient in a Public Hospital. Through the private pathway they can fund this surgery through their superannuation, private health insurance or through their personal funds.
Patients in the 'Private' Pathway have a shorter turnaround from their initial referral to their date of surgery (8 months) in comparison to those who travel through the public pathway (2-3 years).
Little is known about the variation in outcomes for patients following these two distinct pathways.

Research question:

This research will focus on the outcomes of the comparative pathways between private and public patients. The term 'outcome' takes into account client perceived Quality of Life, percentage of Excess Weight Loss, reduction in the dosage or need for medications, and reversal of comorbidities.

Techniques, methods, analyses and day to day activities:

The study will examine retrospective data and collect new data in the form of a post-operative questionnaire and some in-depth interviews. Investigation will include the difference in waiting periods between the 2 cohorts, demographics, level of education, co-morbidities, anthropometrics, number of appointments and education received by the health service pre surgery. Pre surgery data will have already been collected by previous Honours student.

Contact supervisor: Prof. Susan Brumby (School of Medicine): susan.brumby@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1675

An investigation of behavioural indicators of suicide stigma reduction

Supervisors: Alison Kennedy, Susan Brumby

Location: Western District Health Service, Hamilton

Research centre: NCFH

Project background:

Online interventions have been used to reduce stigma among members of the Australian rural community who have been bereaved by suicide, attempted suicide, cared for someone who attempted suicide, have had thoughts of suicide, or been touched by suicide in some other way.
Intervention participants engage via a tailored digital pathway through which they experience personal stories from community members impacted by suicide, video messages from stigma experts and health professionals, written information, links to resources and opportunities to set personal goals for stigma reduction and wellbeing. An optional element of participation is to write a digital message conveying a personal experience or message of support to others participating in the intervention.

Research question:

This project aims to identify and understand behavioural indicators of stigma reduction contained in digital messages left on the Ripple Effect website and inform future work to reduce stigma and prevent suicide in Australia's rural and farming communities.

Techniques, methods, analyses and day to day activities:

Methods will include thematic analysis of existing qualitative data (postcard messages) from the Ripple Effect website (www.therippleeffect.com.au). Process of analysis will include becoming familiar with the data; data coding; searching for themes; reviewing, defining and naming themes; and reporting on themes.

Contact supervisor: Dr. Alison Kennedy (School of Medicine): a.kennedy@deakin.edu.au

Suitable for: Honours

Project reference: 1674

National Quadbike Spraying and Injury Surveillance Project (QuadSIS)

Supervisors: Jacquie Cotton, Susan Brumby

Location: Western District Health Service, Hamilton

Research centre: NCFH

Project background:

Quadbikes are extensively used in Australia within the agriculture and forestry industries. It is estimated that quadbikes are responsible for an average of 16 fatalities per year and six accident and emergency presentations per day. Whilst quadbikes are also used for recreation such as sport, hunting and tourism, the major use in Australia is farming. Tasks involving the use of quadbikes that are considered 'high risk' include transportation, weed control/spraying and mustering. The risks associated with the use of spray tanks mounted on the rear rack and the shifting of tank fluid are high. Quantifying the extent to which farmers and farm workers are undertaking this task may inform education and direct work practices when using quad bikes for this task.

Research question:

The objectives of this study are:

(i) To investigate the experiences of private agrichemical applicators using quad bikes for spraying, and
(ii) To determine the mechanisms for injury and any contributing factors associated with occupational deaths whilst spraying with a quad bike

Techniques, methods, analyses and day to day activities:

Surveying 200+ farmers/agricultural workers (self-report questionnaire). Analysing national farm injury data (existing) on quad bike spraying related deaths & injury between 2010-2016. Conducting & analysing qualitative interviews (face-to-face & phone) to understand the relationship between quadbike use, spraying and farm injury. The student will have to travel for data collection and analysis.

Contact supervisor: Dr. Jacquie Cotton (School of Medicine): j.cotton@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1672

Examining the experiences of rural workers following a stroke

Supervisors: Alison Kennedy, Alyna Turner, Sarah Baker

Location: Western District Health Service, Hamilton

Research centre: NCFH

Project background:

Return to work after stroke is an important rehabilitation outcome. While the available rehabilitation and return to work support services and resources are increasing in metropolitan areas, those in rural areas may have limited access. With the increased availability and focus on telehealth services, this could act as a means to decrease service gaps. However, it is important to consider the unique needs and challenges of those living and working in rural communities when designing and delivering services. We have previously investigated the responses and return to farming life and work for farmers following traumatic injury. We now wish to use a similar approach to investigate the experiences of rural workers post stroke. Information gathered from this study will help inform post-stroke return to work service development and delivery targeted towards rural workers, including farmers. Financial support for accommodation will be available to support the student's location in Hamilton.

Research question:

The aim of the study is to investigate the experiences of rural workers (including farmers, farm workers, farming family members and other) during the return to work journey following a stroke. We will investigate, using a qualitative approach, perceived barriers and facilitators to return to work post stroke.

Techniques, methods, analyses and day to day activities:

We will recruit people who had a stroke >4 months prior, who live in a rural location, who were working prior to their stroke and who wanted to return to work post stroke (whether or not they did return). A multi-pronged recruitment strategy will target broader Victoria, due to likely low numbers in any particular geographic region. In depth, semi-structured interviews will be conducted by telephone, videoconference or face-to-face. Interviews will be transcribed and undergo thematic analysis.

Contact supervisor: Dr. Alison Kennedy (School of Medicine): a.kennedy@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Vision Science

Project reference: 1689

Changes in motion perception with changes in stereopsis

Supervisors: Amanda Douglass, Larry Abel

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

When we catch a ball thrown to us, we have to estimate its motion accurately. Our perception of motion in depth makes use of changes in image disparity as an object approaches, but other cues (such as size changes) also contribute. With the ability to have virtual environments with no stereo, normal stereo or hyperstereo (where the image is seen as if the eyes were further apart), we can now examine how this ability is affected by these changes in stereopsis. For distorted viewing, we can further examine whether training improves performance.

Research question:

The aim of this project is to determine the effect of altering stereopsis on motion perception. Besides being of inherent interest, results may also apply to hyperstereoscopic displays used in some modern aircraft and in night vision helmet displays.

Techniques, methods, analyses and day to day activities:

Day-to-day activities will involve students developing skills in creating experiments in virtual reality, data collection and analysis. Students will also be introduced to optometric measures of depth perception and eye tracking techniques to examine performance on the task of estimating motion.

Contact supervisor: Dr. Amanda Douglass (School of Medicine): amanda.douglass@deakin.edu.au

Suitable for: Honours

Other considerations:

This project is subject to final approvals.

Project reference: 1634

Ethnography in children diagnosed with Amblyopia

Supervisors: Amanda Douglass, Geoff Sampson, Rosemary Woodcock, Lienors Torre, Alexia Maddox

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Amblyopia ('lazy eye') is a developmental eye condition which reduces vision in one eye. Patients with amblyopia show reduced quality of life scores. Traditional treatment involves patching or using eye drops to penalise the preferred eye to encourage strengthening of vision in the amblyopic eye. However, these current treatments have poor compliance with children as they temporarily reduce their ability to undertake normal tasks. The condition is well understood from a clinical perspective, with visual improvement best in younger years when neural plasticity is greatest (8 years and younger). Novel treatments, including VR games, are beginning to be developed as a strategy to address some of the aspects affecting compliance. However, very little is known about amblyopia as a day to day experience. Moreover, there is no qualitative data to explore how these treatments are experienced by children and their families, and the resilience strategies used.

Research question:

How do children with amblyopia, and their families, make sense of and experience their initial journey through first diagnosis and treatment approaches? A greater understanding of the experience may enable improved treatment journeys for patients and their family.

Techniques, methods, analyses and day to day activities:

Using digital ethnography as our research methodology, we will gather personal stories of the amblyopia experience. Data collected through interviews and interactive probes within the household will be analysed using NVivo to identify what typifies the amblyopia experience on a day to day basis. This data will contribute material for media products, such as animations, to help educate clinicians and teachers about amblyopia, facilitate empathy and understanding, and improve treatment regimens.

Contact supervisor: Dr. Amanda Douglass (School of Medicine): amanda.douglass@deakin.edu.au

Suitable for: Honours, MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1631

New colour vision tests and visual standards

Supervisors: Amanda Douglass, Geoff Sampson, Alex Gentle, John Parkes

Location: Waurn Ponds Campus

Research centre: IMPACT

Project background:

Congenital colour vision defects affect up to 8% of males and 0.5% of females. Colour vision is an important part of driving and for many occupations including, railway, aviation and maritime tasks. Some tasks are safety critical and, if the incorrect colour judgement is made, may in result in serious safety consequences. Colour vision deficiency can result in a reduced capability to detect specific colours, making it difficult to see when, or indeed if, these lights are lit; this has implications for traffic signals and brake light detection as well as specific occupational tasks. Colour vision standards use traditional matching tests, often designed for other tasks, in order to determine a person's degree of colour deficiency and determine task safety. Newer computerised colour vision tests have recently become available. We do not, however, have information linking performance on these tests to the majority of real-world occupational tasks.

Research question:

This project aims to investigate the validity of newer colour vision tests including the Colour Assessment and Diagnosis (CAD) and ColorDx CCT-HD for assessing safe performance on a range of tasks, including high speed driving. This research may inform future occupational colour vision standards.

Techniques, methods, analyses and day to day activities:

Students will be introduced to colour vision assessment techniques and the scientific principles underlying these and will build and use simulations based on the critical aspects of different tasks. Performance of a range of colour vision abilities on these tasks will then be linked with colour vision results on newer colour vision technologies. Students do not need to be clinically qualified to undertake this project.

Contact supervisor: Dr. Amanda Douglass (School of Medicine): amanda.douglass@deakin.edu.au

Suitable for: MPhil, PhD

Other considerations:

This project is subject to final approvals.

Project reference: 1629

Acquired colour vision defects – improving assessment efficiency

Supervisors: Geoff Sampson, Amanda Douglass, Alex Gentle

Location: Waurn Ponds Campus

Research centre: Other

Project background:

Congenital colour vision defects affect up to 8% of males and 0.5% of females. This is well-recognised by health care providers and researchers, and efficient screening tests are readily available. Colour vision can, however, also be detrimentally affected by pathological processes and by some pharmaceutical agents; testing for this is much less commonly performed. This may limit understanding of the full impact of eye disease or medication on an individual's vision and quality of life. The gold-standard test for acquired colour vision loss is the Farnsworth-Munsell 100 Hue test (FM-100). The limitation to its use is that its administration is time demanding and it requires high levels of concentration. Finding more efficient ways to assess acquired colour vision loss would likely increase assessment frequency and provide better outcomes for people who are affected.

Research question:

This project aims to investigate ways of improving the efficiency of FM-100 administration, and consequently improving its usage frequency by relevant vision scientists and health-care practitioners. Early pilot data supports that this is viable by applying test strategies that have not previously been investigated. The hypothesis is that a shortened and time-efficient form of the FM-100 will accurately predict outcomes on the full test.

Techniques, methods, analyses and day to day activities:

Students will learn colour vision assessment techniques. As well as the FM-100, a number of established and developing colour vision assessment tools and task-specific lighting sources will be used as points of comparison during this study. Students will develop a comprehensive understanding of the basic biological and perceptual sciences underlying colour vision, the clinical application of these and the impact of visual neuro-pathology on colour perception.

Contact supervisor: Dr. Geoff Sampson (School of Medicine): geoff.sampson@deakin.edu.au

Suitable for: Honours, MPhil

Other considerations:

This project is subject to final approvals.