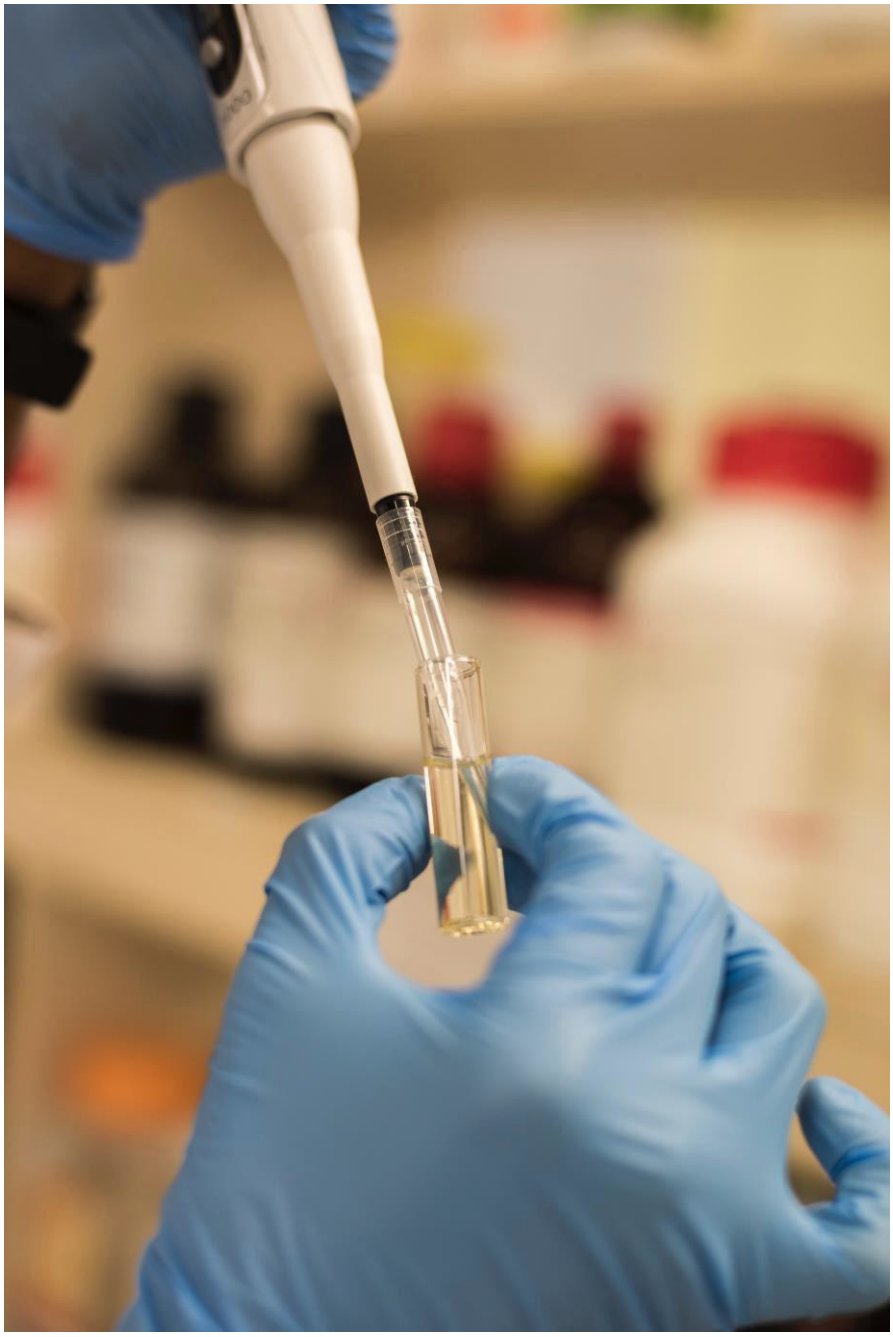
School of Medical Sciences (SoMS)

2023 Semester 1 Honours Projects

Updated 16 November 2022



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Welcome to School of Medical Sciences (SoMS) Honours 2023

Work on a real problem that affects real people

During an Honours year in Medical Sciences you can participate in world leading research in cancer, drug discovery, infectious diseases, neuroscience, respiratory medicine, stem cell biology and more. We have projects available across our Camperdown and Westmead precincts, as well as affiliated research institutes.

Honours Information session for Semester 1, 2023:
The Honours Awareness session for Semester 1, 2023 will be held on Monday 12 September at the Westmead Health Precinct Innovation Centre, Levels 5 and 6, Block K, 176 Hawkesbury Road, Westmead
Directions: From Westmead Train Station Entrance 10 is approximately a 7-minute walk along Hawkesbury Road. Enter the Hospital via Entrance 10 Hawkesbury Road (closest carparks P4 and P5). Take the Innovation Centre Lifts opposite Children's Emergency to Level 5 for the Honours info session led by Dr Paul Austin / Level 5 and 6 for poster viewing. Our concierge staff are on Level 6 and happy to help you find your seminar room.

Program information
Session 1: 11am-1pm – Focus on Infection, Immunity, and Inflammation / Cancer / Chronic Disease
11am-12pm - Honours Information session - Rooms 5307, 5308
12pm-1pm - Posters by current Honours students and meet Honours supervisors - L5 flow out area - Rooms 6002, 6122
Lunch provided - 1-2pm - Rooms 6000, 6007, 6003, 6206

Session 2: 2pm-4pm – Focus on Neuroscience / Molecular Biomedicine / Education Innovation / Biomedical Informatics / Digital Health
2pm-3pm - Honours Information session - Rooms 5307, 5308
3pm-4pm - Posters by current Honours students and meet Honours supervisors - L5 flow out area - Rooms 6002, 6122

If unable to attend in-person, the Honours Information session will be available by Zoom
Prospective Honours students, please register as soon as possible before the event: Zoom Registration

We will discuss the honours program including research project and coursework components, as well as different pathways into Honours, how to find a supervisor, and how to apply.

All available projects are organised by Honours area and are presented at the end of the booklet. If a project interests you, **please email supervisors directly and organize a time to meet with them.**

Once you have found a supervisor willing to take you on, please ask the supervisor to complete the Honours Supervisor Acceptance form. Once that is completed, you'll need to complete an expression of interest (EOI) form.

The EOI form can be found here:

Internal applicants (current and prior University of Sydney students): EOI Form
External applicants (students attending another University): EOI Form

Please complete the EOI in consultation with your supervisor, by selecting the appropriate honours area and choosing appropriate research modules that you would like to complete as part of SOMS4101. SOMS4101 unit and module descriptions can be found on the next pages.

The timeline for applications and enrolment into Honours is as follows:

15 December 2022	SoMS deadline for Expressions of Interest
January 2023	Deadline to apply for admission to Honours
December 2022 – 13 February 2023	Enrolment
13 February 2023	Intensive March (S1CIMR) – last day to add SOMS4101

Once you receive your offer, you must enrol in the correct units.

Semester One Enrolments should be:	Semester Two Enrolments should be:
SOMS4101	SOMS4102
SOMS4103	SOMS4106
SOMS4104	SOMS4107
SOMS4105	SOMS4108
	SCIE4999

The timeline for starting Honours is as follows:

1 February 2023	You may commence your research project, but only if you have completed your enrolment and are therefore insured to attend University
13 February 2023	SOMS4101 Research Skills for Medical Sciences (Intensive March) commences – there will be summative assessments starting from 14 February 2023
13 February 2023 – 14 March 2023	SOMS4101 teaching dates
15 March 2023	Research project commences for all

SoMS Honours Contacts

Dr Paul Austin	paul.austin@sydney.edu.au	SoMS Honours Lead
Dr Najla Nasr	najla.nasr@sydney.edu.au	SOMS4101 Coordinator
A/Prof Elizabeth Clarke	elizabeth.clarke@sydney.edu.au	Applied Medical Sciences (AMED)
Dr Carol Dobson-Stone	carol.dobson-stone@sydney.edu.au	Anatomy and Histology (ANAT) Cell and Developmental Biology (CELL) Medicinal Chemistry (MCHM) Neuroscience (NEUR) Pharmacology (PCOL)
Dr Mark Larance	mark.larance@sydney.edu.au	Immunology (IMMU) Infectious Diseases (INFD) Pathology (PATH) Physiology (PHSI)
General Admin queries	soms.honours@sydney.edu.au	

SOMS4101: Research Skills for Medical Sciences

Unit description

We face major health challenges in today's society that require new insights and approaches from bright minds. Tackling the big questions in medical sciences and health requires the research skills that will inform tomorrow's health outcomes for individuals and populations. Immersed in a multidisciplinary medical science and health research environment, you will develop the core skills required to undertake laboratory, clinical and population health research. You will learn how to design, execute, evaluate studies, and how to scrutinise data and research outcomes. You will work individually and collaboratively in small teams of students from different areas of specialisation to learn theoretical and practical aspects of specific research techniques, as well as the ethical and regulatory frameworks relevant to medical and health research. The practical classes, face-to-face workshops and online learning activities will equip you with knowledge and skills that will enable you to play an active role in finding meaningful solutions to difficult problems in a technical or research setting.

Unit overview

Week 1 (25%)	Week 2 (25%)#	Week 3 (25%)#	Week 4 (25%)#
Work Health and Safety (5%) **Westmead**	PCR/Genomics **Westmead**	Flow cytometry **Westmead**	Molecular and chemical probes in research **Camperdown**
Research Integrity (5%) **Camperdown**	Qualitative Research Methods **Westmead**	Cell culture **Camperdown**	Advanced immunostaining **Camperdown**
An introduction to Biostatistics (10%) **Camperdown**	Tissue preparation & Histological stains **Camperdown**	Mass Spec and HPLC **Camperdown**	Western blotting/proteomics **Westmead**
Ethics (5%) **Westmead**	Data analysis and data visualisation **Zoom**		

SOMS4101 starts on 13 February 2023 and concludes 15 March 2023.
In week 1 students will do all modules
#In weeks 2-4, students will choose 1 module from the two-four available.

Modules in weeks 2-4 will all follow the same format. Pre-readings online, with a short quiz. A workshop or practical with ~10 hours face to face, and a final report/exam. All assessments will be completed by the end of week 5.

Module Descriptions

Week 1 Compulsory Modules

Work Health and Safety, WHS (5%) – Zoom – Najla Nasr

This module aims to define why WHS is important and will introduce you to your responsibilities in the workplace. There will be a 2-hour interactive group workshop, where you will identify hazards via inspection of the workplace, consultation on health and safety issues and review of available information. You will also use a risk matrix to assess a risk by considering how hazards may cause harm, the likelihood of harm occurring and how severe the harm could be. You will also identify the hierarchy of risk controls from elimination to substitution, isolation, usage of engineering/administrative controls and personal protective equipment (PPE).

Research Integrity (5%) – Camperdown - Margaret Sunde / Paul Austin / Matt Naylor

This module will introduce you to the research integrity considerations you will face as a new researcher. You will participate in an introductory 2-hour workshop, where you will learn about the Research Code of Conduct and will consider case studies in small groups, focusing on common issues such as authorship, collaborative research, data management, conflicts of interest and plagiarism. Through group discussion you will learn the best practices and solutions for navigating all facets of research integrity and be equipped to complete the University's Responsible Research Module.

Introduction to Biostatistics (10%) - Camperdown – Jacques Raubenheimer / Firouzeh Noghrehchi / Adam Dunn

This module will demonstrate a set of common tools in biostatistics including comparing distributions and performing linear and logistic regression. Focusing on the presentation of results in research reports, you will learn how to report statistical analyses in research reports, including summarising data using descriptive statistics, hypothesis testing, and calculating relative risks, odds ratios, and confidence intervals. Teaching includes two 2-hour workshops working through practical examples from medical science with optional scripts available in R.

Ethics (5%) – Zoom – Wayne Hawthorn / Sharon Lee / Najla Nasr

This module aims to introduce the basic concepts of ethics and governance and outline the code of ethics and code of conduct. Teaching will include 3-hour interactive workshop discussions, where you will work through different scenarios to acquire the required principles in animal and human research and the frameworks, guidelines and government authorities they fall under. Through class discussion, you will also identify your key accountabilities for conducting research and evaluate your understanding of how to conduct research responsibly according to the institutional requirements and as set by legislation at both the state and federal levels.

Week 2 Modules (select one)

PCR/Genomics (25%) – Westmead – Najla Nasr

This module will introduce the key concepts of gene expression analysis. In workshops (4h), you will identify components of a PCR reaction, design appropriate controls, compare and contrast PCR, qPCR, digital droplet PCR, RNA-Sequencing, NanoString and single cell RNA sequencing, articulate differences between relative and absolute qPCR and their key applications, design primers and a qPCR experiment. In practical classes (4h), you will execute the designed experiment. In the analysis session (4h), you will evaluate key parameters for high quality PCR data, learn how to present the data in a written report covering the experimental design, results, figures, discuss strategies to circumvent failed experiments, limitations and data validation.

Qualitative Research Methods (25%) – Westmead – Stephanie Partridge

This module will focus on research strategies in the evaluation of health promotion interventions. We will cover key stages of health promotion evaluation, focusing on qualitative research methodologies for formative and process evaluations. Both types of evaluations are important steps for understanding health promotion intervention

effectiveness, especially in complex, multi-component programs. Teaching includes two 3-hour interactive workshops where students are provided examples of published literature for critical evaluation and students will work through real-world case studies presented by guest researchers. Through pre-workshop activities and workshop discussions you will learn the importance of these evaluations for implementation and dissemination of health promotion programs.

Tissue Preparation and Histological Stains (25%) – Camperdown – Katie Dixon / Sam Dowland

In this module you will gain a basic understanding of histological techniques, starting with fixation and paraffin-embedding of tissues, followed by cutting your own sections using a microtome. You will gain an understanding of how stains bind to different tissue types, and carry out staining protocols, including the haematoxylin and eosin stain. Using light microscopy, you will capture publication-quality images of your stained tissue and learn how to recognise artefacts.

Data analysis and visualisation (25%) – Camperdown/Zoom – Adam Dunn

This module will introduce common tools and methods used in the analysis and visual representation of large and complex datasets, including introductory methods in machine learning. You will be able to access and use practical datasets published in recent research articles. You will acquire analysis methods including data visualisation and supervised machine learning methods. Using R, you will independently develop the code needed to import, process, and visualise data from raw sources, and learn how complex data generated in biomedical sciences are analysed, interpreted, and effectively communicated in research reports. Please note that this module is designed for students who are already proficient with R and teaches best practice methods for data analysis and visualisation in research reporting.

Week 3 Modules (select one)

Flow Cytometry (25%) – Westmead – Najla Nasr

This module aims to introduce the key concepts that underpin flow cytometry. In workshops (4h), you will learn about the key components of flow cytometers, how to design flow panels, identify controls and how to achieve high quality flow and cell sorting. In a laboratory practical (7h), you will prepare cells and controls according to the panel design of the workshop, perform flow acquisition and record data on a flow cytometer. In the analysis session (4h), you will analyse, interpret and learn how to present your data in a written report spanning from the experimental design, results, figures to discussing strategies to circumvent potential failed experiments, limitations and data validation.

Cell culture (25%) – Camperdown – Lenka Munoz

Cell culture is a core laboratory technique in biomedical research, cellular and molecular biology, drug discovery and biotechnology laboratories. This module will include both practical and workshop components and will provide students with the necessary technical and critical reasoning skills to successfully perform cell culture. It is intended as an introduction to cell culture basics, covering topics such as getting familiar with the requirements of a laboratory dedicated to cell culture experiments, laboratory safety, aseptic techniques, microbial contamination of cell cultures, as well as teaching basic methods for passaging, freezing, and thawing cultured cells.

Mass Spec (25%) – Camperdown – Michael Gotsbacher

This module aims to introduce the key concepts that underpin liquid chromatography-mass spectrometry (LC-MS). In lectures (2 x 2h) and workshops (3 x 2h), you will learn about the key components of high-performance liquid chromatography (HPLC) and the mass spectrometer (MS) components, how to design studies, prepare your samples, develop your LC-MS methods, and achieve reliable high-quality data. In a laboratory practical (1h), you will visit Sydney MS and use equipment in this state-of-the-art facility offering world-class performance. In the analysis session (2h), you will learn how to analyse, interpret, present LCMS data and will discuss applications, their limitations and data validation. The tutorial (2h) will enable you to work on a report.

Week 4 Modules (select one)

Molecular and Chemical Probes in Research (25%) – Camperdown – Lenka Munoz

Molecular and chemical probes are important tools widely used to modify - usually to inhibit - the activity of individual proteins in cells or organisms and hence to determine their function. However, none of the probes are perfectly specific and sufficient on their own. Combined use of molecular (siRNA, shRNA, sgRNA) and (inhibitors) probes is required to reach conclusions regarding the function of an investigated protein. Through a series of interactive workshops, this module will introduce students to the field of molecular and chemical probes, and teach them how to use online resources in order to make a fully informed choice on probes and how to identify incorrect data in the published literature.

Advanced immunostaining - Labelling Specific Components of Cells and Tissues (25%) – Camperdown – Claire Goldsbury / Laura Lindsay

In this module you will learn how specific proteins, organelles and other components of cells and tissues can be selectively labelled and then visualized using optical and fluorescence microscopy. You will gain a broad theoretical knowledge of the diverse ways that fixed and live cells can be probed and imaged. Workshops will include important aspects of experiment design, controls as well as fluorophore and antibody selection. In the practical component of the module, you will design and perform an immunolabelling experiment on frozen tissue sections including appropriate controls. You will use fluorescence microscopes to take images of your stained sections and will discuss interpretation, analysis and publishing of immunofluorescent imaging.

Western Blotting/Proteomics (25%) – Westmead – Najla Nasr

This module will introduce Western blotting, a common technique for protein analysis. In workshops (4h), you will learn about different types of antibodies, design an experiment using fluorescent antibodies and compare it to other detection methods, discuss whether western blot data support the conclusions drawn in published papers and whether it failed to meet required reporting and image integrity standards. In practical classes (4h), you will execute the designed experiment. During analysis (2h), you will critically interpret and generate a figure using best practice reporting, learn how to present the data in a written report covering the experimental design, results, figures, discuss strategies to circumvent failed experiments, limitations and data validation. Small-group (max 4) lessons to learn the basic principles and best practice of husbandry (mouse and/or rat), to understand environmental variables and stressors that impact data, and to perform live mouse health checks, basic handling, anaesthesia and euthanasia, and monitoring.

Applied Medical Sciences Honours S1, 2023

Honours area	AMED
Primary Supervisor	Adeola Bamgboje-Ayodele
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Auxiliary Supervisor 1	Melissa Baysari
Auxiliary Supervisor 2	
Project ID	2023S1-34
Project title	Exploring clinician trust in AI-based clinical decision support systems
Project synopsis	It is not really possible for a health care provider to work and deliver patient care in our healthcare system without interacting with technology. The permeation of some technologies in healthcare, like clinical decision support systems (CDSS) and artificial intelligence (AI), have also raised issues related to trust. For example, in what contexts should AI be trusted, what makes a trustworthy system, and what factors contribute to user trust in AI? Research question and method What factors contribute to stakeholder trust in AI-based CDSS? This project involves a scoping review and interviews with stakeholders (e.g. clinicians).
Project keywords	Clinical decision support system; Artificial Intelligence, Human Factors, Trust
Laboratory location	Digital Health Human Factors Research Group, RC Mills Building, Camperdown

Honours area	AMED
Primary Supervisor	Ali Azimi
Email	ali.azimi@sydney.edu.au
Auxiliary Supervisor 1	Pablo Fernandez-Penas
Auxiliary Supervisor 2	Alexander Varey
Project ID	2023S1-225
Project title	Genomic Profiling of Cutaneous Squamous Cell Carcinoma in Solid Organ Transplant Recipients: A Pilot Study
Project synopsis	Cutaneous squamous cell carcinoma (cSCC) is a common malignancy in Australia. Compared with immunocompetent patients, solid organ transplant patients (SOTRs) are up to 51 times more likely to die from their cSCC. Despite an enhanced management pathway of prevention, close surveillance, early diagnosis, timely treatment and optimisation of the immunosuppressive regime, the SOTR population remains a challenging patient cohort from a cSCC standpoint. Therefore, the current project aims to study the genomic changes in clinical samples of cSCC through whole genome sequencing (WGS). The genomic changes in primary and metastatic cSCCs from SOTRs versus immunocompetent patients will be compared to identify actionable therapeutic targets. The successful completion of this study will identify novel therapeutic targets for improved management of cSCCs.
Project keywords	Genomic, Skin Cancer, Organ Transplan, Biomarker
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Tracy Bryan
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Auxiliary Supervisor 1	Ashley Harman
Auxiliary Supervisor 2	
Project ID	2023S1-153
Project title	Investigating the links between the DNA damage response and telomerase recruitment in cancer cells
Project synopsis	Telomerase is an enzyme which is responsible for lengthening telomeres in most cancer cells, allowing for their unlimited growth. Given that telomerase is not expressed in most normal cells, telomerase inhibition is an enticing target for anti-cancer therapy. However, while the function of telomerase is well characterised, less is known about the processes which regulate its function, including its recruitment to telomeres. We have previously demonstrated that the DNA damage response is important in regulating telomerase recruitment, while replication stress promotes this process. Given this, we hypothesise that there is controlled interplay between DNA replication, the DNA damage response and telomere maintenance. This project will elucidate the links between these processes using advanced microscopy techniques, genome editing and biochemical analyses.
Project keywords	Telomerase, telomere biology, DNA damage response
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Tony Cesare
Email	tcesare@cmri.org.au
Auxiliary Supervisor 1	Harriet Gee
Auxiliary Supervisor 2	
Project ID	2023S1-152
Project title	Cell death in radiotherapy
Project synopsis	Radiation therapy is responsible for 40% of cancer cures. Development of new technologies enables administration of high dose radiation within precise spatial targeting to kill tumour cells while sparing the surrounding healthy tissue. While it is clear high dose radiation therapy kills cells, the mechanism of cell death, and the genetic pathways that promote radiation therapy sensitivity and resistance are unknown. Our research is focused on creating a roadmap that will determine with certainty how tumour cells die following ART. To do this, we are determining the role of DNA damage response and repair pathways, cell cycle regulation, inflammatory signalling, and environmental factors in radiation therapy induced cell death. Opportunities are available in this project will be tailored to applicants' interests and strengths on an individual basis.
Project keywords	Radiation therapy, DNA damage, DNA repair, cell cycle, immune response
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Tony Cesare
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Auxiliary Supervisor 1	Noa Lamm-Shalem
Auxiliary Supervisor 2	Kate Giles
Project ID	2023S1-154
Project title	The replication stress response and genome instability
Project synopsis	Genome instability is a hallmark of cancer. A major driver of genome instability in oncogenesis is DNA "replication stress". Replication stress is broadly defined as any phenomena that negatively impacts copying of the genetic material and can arise through exogenous (e.g. low nutrient environment, genotoxic agents) or endogenous (e.g. oncogene expression) sources. Cells cope with replication stress through the “replication stress response” which arrests cell growth and mediates repair of the underlying lesions. Because tumour cells typically have high levels of endogenous replication stress, targeting the replication stress response is an opportunistic target in cancer therapy. Our research focuses on multiple aspects of the replication stress response. 1) Understanding how physical forces inside the nucleus alter nuclear architecture to mediate replication stress repair and 2) Understanding how chromatin is altered in the nuclear environment to enable replication stress repair. Opportunities are available in both projects will be tailored to applicants’ interests and strengths on an individual basis.
Project keywords	DNA replication, DNA damage, DNA repair, Genome stability, chromatin
Laboratory location	Children’s Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Yuyan Chen
Email	yuyan.chen@health.nsw.gov.au
Auxiliary Supervisor 1	Anai Gonzalez-Cordero
Auxiliary Supervisor 2	Alan Ma
Project ID	2023S1-160
Project title	Functional analysis of an unusual DICER1 variant using brain organoids generated from patient-derived iPSC cells
Project synopsis	DICER1 is a double-stranded RNA endonuclease (RNase III) which cleaves long dsRNAs and short hairpin pre-microRNA (miRNA) to produce siRNA and mature regulatory miRNA. DICER1 syndrome, caused by germline inheritable/de novo/mosaic DICER1 mutations, is a rare cancer predisposition syndrome characterised by distinctive tumour types typically in children/adolescents including the rare paediatric lung tumour (pleuropulmonary blastoma), and non-cancer phenotypes such as macrocephaly. We have identified an unusual DICER1 variant in a patient with unique clinical manifestations. Functional analyses have been performed using patient's fibroblast cells and dysregulated RNA/miRNA profiles were detected. To further examine the genotype-phenotype associations, we will generate brain organoids from induced pluripotent stem cells (iPSC) derived from the patient and assess the functional impacts of the mutated DICER1.
Project keywords	DICER1, iPSC, brain organoids
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Seo-Kyung Chung
Email	seokyung.chung@sydney.edu.au
Auxiliary Supervisor 1	Rucha Pandit
Auxiliary Supervisor 2	
Project ID	2023S1-103
Project title	Precision medicine in neurological disorders
Project synopsis	This research aims to identify novel mechanisms underlying neurodevelopmental disorders such as Malformations of Cortical Development (MCD) using the latest technologies including genome editing and brain organoids. This study will investigate disease mechanisms at molecular and cellular level using various in silico and in vitro analysis platforms. This project is part of multidisciplinary genomic & proteomic program for precision medicine in neurodevelopmental disorders.
Project keywords	Neuroscience, Human Genetics, Bioinformatics, Brain organoids, Cellular imaging, Protein characterisation, 3D protein modelling, Computer programming
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Seo-Kyung Chung
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Auxiliary Supervisor 1	Rucha Pandit
Auxiliary Supervisor 2	
Project ID	2023S1-105
Project title	Identifying the correct mechanisms underlying rare but devastating childhood epilepsy syndromes using in silico and in vitro platforms
Project synopsis	Identifying the correct mechanisms underlying rare but devastating childhood epilepsy syndromes using in silico and in vitro platforms. Currently, no effective treatment is available for Dravet Syndrome (DS), one of the most severe paediatric epilepsy syndromes. Identifying the exact mechanisms underlying DS is crucial for future therapeutic strategies. In this project, we will use both in silico and in vitro analysis methods to investigate genetic mutations in Dravet syndrome at molecular and cellular level. This project is also in collaboration with a well-established international network.
Project keywords	Neuroscience, Human Genetics, Bioinformatics, splicing assay, fluorescent image analysis, Protein characterisation, 3D protein modelling
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Seo-Kyung Chung
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Auxiliary Supervisor 1	Rucha Pandit
Auxiliary Supervisor 2	
Project ID	2023S1-106
Project title	Identifying the genetic causes of neurological disorders using next-generation sequencing technologies and in vitro functional platforms.
Project Synopsis	The glycinergic and GABAergic neurotransmission represents inhibitory signals in the human central nervous system. Hyperekplexia (or startle disease) is a rare paediatric neuromotor disorder and mutations in glycinergic genes account for 50% of cases. We have collected the largest global cohort of hyperekplexia cases from international sites over the past 20 years. In this project, we aim to identify novel genes and mechanisms underlying hyperekplexia using the latest genetic technologies including whole genome / exome sequencing.
Project keywords	Neuroscience, Human Genetics, Bioinformatics, Next Generation sequencing data analysis, alternative splicing analysis, Protein characterisation, 3D protein modelling, Computer programming
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Seo-Kyung Chung
Email	seokyung.chung@sydney.edu.au
Auxiliary Supervisor 1	Rucha Pandit
Auxiliary Supervisor 2	
Project ID	2023S1-107
Project title	Genomic investigation of neurodevelopmental disorders
Project synopsis	This research proposes to investigate mechanisms underlying neurodevelopmental disorders using in-vitro functional analysis and computer-based structural modelling of variants identified within the neurological disorders. The Translational Neurogenomics research group has been at the forefront for identifying the genetic causes for a variety of neurodevelopmental disorders. In order to gain a better understanding of disease mechanism, it is vital to characterise normal brain development and its dysfunction in these disorders. This project is part of multidisciplinary genomic & proteomic program for precision medicine in neurodevelopmental disorders.
Project keywords	Neuroscience, Human Genetics, Bioinformatics, Brain organoids, Cellular imaging, Protein characterisation, 3D protein modelling, Computer programming
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Sandra Cooper
Email	sandra.cooper@sydney.edu.au
Auxiliary Supervisor 1	Frances Evesson
Auxiliary Supervisor 2	Michaela Yuen
Project ID	2023S1-229
Project title	Splicing variants and our non-coding genome: a new frontier in clinical genomics
Project synopsis	Our research is revealing that genetic variants that affect mRNA splicing are a more common cause of genetic conditions than previously appreciated. One-third of our diagnosed families are now shown to bear a splicing variant – which account 86 % of diagnoses made for families who remained undiagnosed following whole exome sequencing. It is extremely likely that many among our undiagnosed families have a splicing variant in a disease gene we already know about. Muscle and nerve express many of our bodies 'extreme genes' - vital proteins encoded by some of the biggest genes, genes with the most exons, genes with enormous introns and subject to complex splicing. It is no wonder they are disease genes. This project will deploy new innovations to detect and confirm tricky causative splicing variants. Splicing is a form of RNA processing where introns are removed and exons fused together to make the mature mRNA encoding different protein isoforms. Splicing is catalyzed by the spliceosome, a large, multi-component RNA-protein complex that dynamically assembles into different super-complexes to precisely excise intronic sequences and ligate adjacent exons together. Although common, as splicing variants predominantly affect our non-coding genome, putative splice variants are incredibly difficult to detect, interpret, or act on clinically.
Project keywords	Genetic disease, mRNA splicing, RNA studies, bioinformatics
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Tony Cunningham
Email	tony.cunningham@sydney.edu.au
Auxiliary Supervisor 1	Naomi Truong
Auxiliary Supervisor 2	
Project ID	2023S1-156
Project title	Defining the intial immune response to herpes simplex virus infection in human genital skin to guide vaccine development
Project synopsis	Genital Herpes is one of the commonest STIs, caused by herpes simplex virus (HSV). To develop a herpes vaccine, the initial immune response in human genital mucosa needs to be defined. We showed that HSV is "relayed" from infected Langerhans cells in the epidermis to surrounding clusters of dendritic cells (DCs) and, other still undefined immune cells, in the dermis to initiate immunity. We can now profile mucosal immune cells by cyclic immunofluorescence microscopy (Westmead), and imaging mass cytometry (CPC), including in rare biopsies of herpes lesions. In this project you will comprehensively profile which subsets of DCs, T cells, NK cells and macrophages are present in these immune cell clusters in HSV infected human genital mucosal explants.
Project keywords	Virology, Immunology, vaccines, genital mucosa, Herpes simplex virus
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Joanna Diong
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Auxiliary Supervisor 1	Lisa Harvey
Auxiliary Supervisor 2	
Project ID	2023S1-44
Project title	Mechanisms and epidemiology of impaired human movement after spinal cord injury
Project synopsis	Motor impairment is the final common path of physical disability in spinal cord injury and many other neurological and musculoskeletal conditions. This project aims to estimate the mechanisms and epidemiology of common motor impairments in spinal cord injury, such as spasticity (velocity-dependent hyper-reflexia) and contracture (loss of range of motion). This study will involve analysing data from an observational cohort study to estimate the incidence of motor impairments and potential causes, using modern computational methods. Prospective students would have an interest in study design, and an interest in learning to write computer code (Python, Stata or R).
Project keywords	neuroscience, data science, computation, neuro, spinal, analysis, mechanisms
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	AMED
Primary Supervisor	John-Sebastian Eden
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Auxiliary Supervisor 1	Edward Holmes
Auxiliary Supervisor 2	Jen Kok
Project ID	2023S1-183
Project title	The impact of COVID-19 on the molecular epidemiology and evolution of endemic respiratory viruses
Project synopsis	This project aims to explore the impact the COVID-19 pandemic has had on the epidemiology and diversity of existing human respiratory viruses such as influenza, respiratory syncytial virus, rhinovirus, and other human coronaviruses such as 2293 and OC43. This project specifically looks to address the question of how the prevalence and genetic diversity of the viruses have changed due to the emergence of SARS-COV-2 and the public health measures put in place for its control. You will develop and apply methods for whole genome sequencing of respiratory viruses from clinical samples using the Illumina and Nanopore sequencers, and then use phylogenetic techniques to understand their evolution.
Project keywords	Virology, Respiratory viruses, Genomics, Phylogenetics, Evolution, SARS-CoV-2, COVID-19
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Frances Evesson
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Auxiliary Supervisor 1	Michaela Yuen
Auxiliary Supervisor 2	Sandra Cooper
Project ID	2023S1-228
Project title	Unlocking the mysteries of a childhood onset muscle disease
Project synopsis	We have identified that changes in a novel neuromuscular disease gene, PYROXD1, cause a severe muscle disease (myopathy) in children. PYROXD1 is an oxidoreductase enzyme that has a function that is essential for cell and animal life, but we are still working out exactly what that function is. At the same time, we are developing novel therapeutic interventions for this currently incurable condition.
Project keywords	Neuromuscular disease, genetic disease, therapy, cell biology
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Rowena Forsyth
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Auxiliary Supervisor 1	Krestina Amon
Auxiliary Supervisor 2	
Project ID	2023S1-25
Project title	Health professionals' use of online communities
Project synopsis	Online health communities such as Facebook groups are a popular form of social engagement and have been extensively studied as forms of patient support and doctor-patient engagement. Less well studied is how health professionals use these communities to connect with each other for professional and interpersonal support. This project uses a mixed method design of a questionnaire and qualitative interviews with current Australian health professionals to understand how they use and give meaning to their participation in peer networks for education, support and social interaction across different platforms and communities. The expected findings will show how participation in online communities interlinks with their offline professional interactions and provides benefits that may be inaccessible or unavailable in their offline worlds.
Project keywords	social media, health professionals
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	AMED
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Auxiliary Supervisor 1	Peng Wang
Auxiliary Supervisor 2	Shanika Nanayakkara
Project ID	2023S1-132
Project title	Developing causal machine learning algorithms to predict prognosis of dental trauma in paediatric population
Project synopsis	Traumatic dental injuries (TDIs) are frequently encountered amongst the paediatric population and often have long-term consequences such as pain, loss of function and aesthetic problems. The choice of initial treatment for TDIs is crucial for the clinical treatment outcome. This project aims to apply causal inference and machine learning to investigate factors affecting the treatment outcomes using data from electronic health records. The findings will inform the development of clinical guidelines and artificial intelligence based clinical assessment tool to improve prognosis of traumatised tooth.
Project keywords	machine learning, causality, traumatic dental injuries, paediatric dentistry
Laboratory location	Institute for Dental Research (Westmead)

Honours area	AMED
Primary Supervisor	Jinlong Gao
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Auxiliary Supervisor 1	Peng Wang
Auxiliary Supervisor 2	Shanika Nanayakkara
Project ID	2023S1-133
Project title	Exploring the potentials of causal machine learning algorithms in predicting the treatment outcomes of chronic periodontitis
Project synopsis	Periodontitis is one of the most prevalent oral diseases manifested as bleeding gums and eventually leads to tooth loss. Emerging findings also indicate that periodontitis is associated with several chronic systemic diseases, including colorectal cancer, rheumatoid arthritis, atherosclerosis, diabetes, and Alzheimer's disease. Effective individualised prevention and therapeutic strategies to manage periodontitis will significantly benefit oral and general wellbeing. This study aims to explore the potential of causality and machine learning algorithms in predicting clinical outcomes of periodontal disease. By leveraging data from a previous completed clinical trial, this project will investigate the complex interactions among risk factors of periodontitis, treatment options, and clinical outcomes.
Project keywords	machine learning, causality, periodontitis, treatment outcome prediction
Laboratory location	Institute for Dental Research (Westmead)

Honours area	AMED
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Project ID	2023S1-180
Project title	Generating novel synthetic receptors in T cells for targeting cancer
Project synopsis	T cell therapies have revolutionised cancer treatment. We are genetically engineering T cells to express synthetic - chimeric antigen receptors and transgenic T cell receptors (CARs and tgTCRs) to target tumour antigens, for therapies. The project involves designing combinations of novel receptors in the context of CRISPR knockout (KO) (of endogenous molecules) to increase specificity and safety of the engineered therapeutic cells. For e.g targeting WT1 and CD33/CD123 in a TCR KO background for leukaemia. This highly translational project will be attractive to an innovative mind with a penchant for immuno-oncology and molecular biology. The student will acquire technical skills in molecular designing, cloning, DNA extractions, T cell isolation from blood, manipulation and culture, flow cytometry, cytotoxicity, viability assays.
Project keywords	CAR T cells, tgTCR T cells, cell therapy, cancer, genetic engineering, synthetic receptors, molecular designing
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
Primary Supervisor	Mark Graham
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Auxiliary Supervisor 2	
Project ID	2023S1-172
Project title	Investigating the role of novel kinases in STG1 retinal organoids
Project synopsis	Stargardt's disease (STG1) is the most common inherited retinal disease, with no treatment. STG1 is characterised by loss of light-sensing photoreceptor cells in the macular region of the retina, resulting in irreversible vision loss. The aim of this project is to use induced pluripotent stem cell (iPSC)-derived retinal organoids to understand STG1 pathophysiology. Our group has performed phosphoproteomics analysis in STG1-derived retinal organoids generated from two patient iPSC lines. We have identified differentially expressed kinases in comparison to control organoids. This project will focus on validating these kinases using drugs and investigate already know disease biomarkers using different molecular techniques. Additionally, the student will learn stem cell tissue culture, including maintenance of iPSC lines and their differentiation into retinal organoids
Project keywords	Retinal disease, stem cells, retinal organoids, phosphoproteomics
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Mark Graham
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Project ID	2023S1-173
Project title	How does transcorneal electrical stimulation (TES) alter the cellular phenotype of the degenerating retina?
Project synopsis	We are investigating the ability of electrical stimulation, applied to the cornea, to preserve visual function. Timed delivery of TES to a mouse model of advanced retinal degeneration preserves behavioural response to light. RNA sequencing experiments revealed upregulation and downregulation of key candidate genes involved in TES-mediated phenotypes. This project will validate these new targets using molecular biology techniques. Further characterisation of the cellular phenotype of TES treated mouse eyes, via the histological preparations, immunohistochemistry and imaging will confirm expression of markers of interest. Thus, revealing important mechanisms of TES and validating this approach to treat vision loss.
Project keywords	Retinal disease, electrical stimulation, visual rescue
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Mark Graham
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Project ID	2023S1-175
Project title	Brain plasticity and seizure models in vitro - using brain organoids to study plasticity and neurological disease
Project synopsis	This project aims to characterise an in vitro model of homeostatic plasticity and epilepsy using cortical brain organoids. Various approaches for stimulating cortical organoids to evoke an electrophysiological response will be investigated. Primary mouse neurons will be investigated for comparison. This will involve use of a multi-electrode array device, western blotting, microscopy and potentially proteomics and other approaches. Stimulation will then be used to study the homeostatic plasticity paradigm, enabling the comparison of healthy and disease model organoids. Epilepsy is a focus because of the plasticity pathways that are engaged following seizure activity and the project has scope to investigate specific novel molecular mechanisms arising from our laboratories.
Project keywords	brain, organoid, plasticity, epilepsy, proteomics, electrophysiology
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
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Project ID	2023S1-166
Project title	Role of Vitamin D in muscle stem cells and regeneration
Project synopsis	We have demonstrated that vitamin D is important for normal muscle function, but its role in muscle regeneration is unclear. Using a novel model with vitamin D receptor (VDR) deletion in satellite cells (muscle stem cells) this project will study the role of VDR in muscle regeneration. This will involve animal physiological studies, metabolic cages, histology, real-time PCR, seahorse bioanalyser, and potentially sequencing studies (RNA-Seq).
Project keywords	vitamin D, muscle, injury, regeneration, stem cell, transcription factor
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-27
Project title	Developing antigen specific cellular therapies to prevent transplant rejection
Project synopsis	Transplantation is a life-saving therapy for patients with end stage of organ failure but many face challenges of rejection, graft loss and side effects of immunosuppressive drugs. Regulatory T cell therapy has been shown as a novel promising treatment to minimise immunosuppressive burden in transplantation. Preliminary data from our lab has shown that regulatory T cells (Tregs) isolated from human blood helps maintain tolerance and prevents islet graft rejection in a humanized mouse model. This project aims to identify a population of Tregs by a combination of unique key surface markers and to demonstrate their antigen specificity and suppressive function. Students will learn animal handling, cell culture techniques, cell isolation (CD4+ T cell, Treg), mixed lymphocyte reaction and flow-cytometry.
Project keywords	Transplant, cell therapy, preventing rejection
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Min Hu
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Auxiliary Supervisor 1	Philip J. O'Connell
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Project ID	2023S1-28
Project title	Towards a drug-free transplantation - how to improve regulatory T cell survival in transplantation
Project synopsis	In transplantation, a key goal is to achieve transplant-tolerance without immunosuppressive- drugs as they cause unnecessary side-effects. An emerging therapy involves using the body's immune cells to create a state where the recipient remains capable of responding to pathogens and the donor allograft is accepted. Previously we showed that regulatory T cells isolated from transplant-tolerant mice demonstrated tolerance, however the key cytokine that supports their survival is not well known. The project aims to investigate the role of IL-2, IL7 and IL33 pathways in Treg survival and assess their suppressive function. Students will learn animal handling, cell culture, molecular biology techniques such as flow-cytometry/ RT-PCR/ELISA, and we offer a unique opportunity to assist with a cutting-edge technique - single cell RNA sequencing.
Project keywords	transplantation, regulatory T cells, tolerance
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-162
Project title	Novel telomere maintenance states and associated therapeutic targets in cancer cells
Project synopsis	The maintenance of structures at chromosome ends, called telomeres, underpins the unlimited replicative potential of cancer cells. Molecular dependencies associated with telomere maintenance present promising targets for new cancer therapeutics. To provide a platform for the development of cancer treatments that target telomere biology, our team has completed a study of telomere maintenance states and proteogenomics in approximately 1000 cell lines derived from more than 30 cancer types. Through this study, we have identified cancer cell lines with telomere biology phenotypes that deviate from those previously described. This Honours project will investigate these novel telomere biology states and their associated molecular dependencies using a range of molecular and cell biology techniques, immunofluorescence microscopy, gene expression modulation and telomere biology assays.
Project keywords	cancer, telomere, cancer biology, gene expression, therapeutic target
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Heather Medbury
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Project ID	2023S1-141
Project title	Impact of lipids on monocyte metabolism
Project synopsis	Dyslipidaemias are the abnormal level of lipids, such as cholesterol, in the blood. Aside from their role in cardiovascular disease, they are associated with poor clinical outcomes in many prevalent burdensome conditions such as wound healing, infection and dementia. Our group has found that monocytes from those with dyslipidaemia have a heightened inflammatory profile suggesting that important lipid-associated immunopathological changes are occurring. Our in vitro studies suggest that specific lipids metabolically reprogram monocytes; these may be driving the immunopathological changes. The honours student will join us in delineating the clinical association between lipids and monocyte metabolic profile and assessing the possible causal relationship of these associations by cell culture studies. Methods used include Seahorse metabolic analysis and cell culture.
Project keywords	cardiovascular disease, lipids, inflammation, monocytes, reprograming
Laboratory location	Westmead Hospital

Honours area	AMED
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Project ID	2023S1-7
Project title	Defining tissue resident CD4 T cell subsets at the anogenital mucosa and their susceptibility to HIV infection
Project synopsis	Latently infected cells are the main barrier to an HIV cure, and little is known about the CD4 TRM subsets that inhabit anogenital tissues and which ones supports productive or latent HIV replication. We hypothesis that human anogenital tissues contain unique populations of TRM CD4 T cell subsets that will differ in their susceptibility to productive or latent HIV infection and we aim to define TRM CD4 T cell subsets and their susceptibility to HIV infection. A highlight of this projects is the use of real human tissues discarded from operations at many hospitals. Techniques you will learn: Extraction of immune cells from human tissue, Multiparameter flow cytometry to define all CD4 TRM phenotypes, Cell culture, HIV infection, and Interactions with clinicians.
Project keywords	HIV, CD4 T cells, Infection and latency.
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Philip O'Connell
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Project ID	2023S1-129
Project title	Key genes involved in kidney transplant rejection
Project synopsis	Kidney transplantation is a life-saving therapy for patients with end stage kidney failure. However, the success of this treatment has been limited by acute allograft rejection. My lab has recently identified several key driver genes including Caspase 1 that are associated with acute rejection in kidney transplant patients. This project aims to explore the role of Caspase 1 signaling in the development of acute rejection by using murine transplant models, to evaluate new agents for the prevention and treatment of rejection and develop new tools to identify patients at risk of acute rejection. Students will learn how to handle animals and provide post-operative care, tissue analysis (histology, immunohistochemical and immunofluorescent staining), and perform cell and molecular biology techniques such as flow cytometry, real time RT-PCR and ELISA. This study has the potential to lead to a PhD project.
Project keywords	Immunology, Transplantation, Rejection, Experimental Models
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Philip O'Connell
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Auxiliary Supervisor 1	Min Hu
Auxiliary Supervisor 2	Natasha Rogers
Project ID	2023S1-130
Project title	How does Belatacept and Sirolimus immunosuppression affect patient outcomes in islet transplantation?
Project synopsis	For patients with type 1 diabetes, islet transplantation enables independence from insulin therapy. Development of new drugs to prolong islet graft survival are needed in clinical practice. In recent clinical trials, we found a combination of Belatacept and Sirolimus was associated with increased regulatory T cells and central T cell memory response when compared to the traditional immunosuppression with Tacrolimus and Mycophenolate. The aim of this project is to further investigate how this new form of treatment with Belatacept and Sirolimus affects the cytokine profile of naïve, effector and memory T cells. This project teaches key immunological techniques such as patient sample handling (serum, blood), isolation of immune cells (CD4+ and CD8+ T cells), flow cytometry, cell culture, cytometric bead assay, enzyme-linked immunosorbent spot (ELISPOT).
Project keywords	Islet transplantation, Type 1 diabetes, immunosuppression
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-187
Project title	A fluorescent timer to reveal how brain cancer cells sense tissue stiffness in the tumour microenvironment.
Project synopsis	Brain cancer is the most common solid tumour in children. The cells are highly invasive, preventing successful eradication. Tissue stiffness promotes cancer invasion in other cancers, but how this affects brain cancer invasion is unknown. Stiff tissues stimulate the Yes-Associated Protein (YAP) transcriptional regulator. We have built a fluorescent timer carrying the YAP binding site coupled to a fluorescent protein that is green upon initial transcription and transitions to red over time. We will characterise the timer and analyse the activation of force-dependent signalling in brain cancer cells. We will use patient-derived brain cancer cells, organoids and a range of biochemical, molecular biology and microscopy-based analyses. Improved understanding of brain cancer cell invasion will help to target the invasive cells.
Project keywords	brain cancer, microscopy, invasion, cell biology, organoids, paediatric cancer
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	AMED
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Project ID	2023S1-90
Project title	Investigating the involvement of EBV infection in multiple sclerosis and systemic lupus erythematosus
Project synopsis	There is a significant association between Epstein-Barr virus (EBV) infection and several autoimmune diseases including multiple sclerosis (MS) and systemic lupus erythematosus (SLE). EBV infection results in transformation and immortalization of infected cells resulting in a lifelong infection. Cells infected with a laboratory strain of EBV, B95.8, result in generation of lymphoblastoid cell lines (LCLs). In this project we will characterise LCLs derived from MS and SLE patients using cell culture, flow cytometry, qPCR and proliferation assays. We will also use flow cytometry to search for EBV infected cells in blood samples collected from healthy controls, MS patients and SLE patients.
Project keywords	EBV, Multiple sclerosis, Lupus, flow cytometry, cell culture.
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Auxiliary Supervisor 2	
Project ID	2023S1-167
Project title	Data-intensive science to understand the molecular aetiology of disease
Project synopsis	Biotechnological advances have made it possible to monitor the expression levels of thousands of genes and proteins simultaneously promising exciting, ground-breaking discoveries in complex diseases. This project will focus on the application and/or development of statistical and machine learning methodology to analyse a high-dimensional biomedical experiment. Specialising in bioinformatics, my group works on projects spanning multiple diseases including melanoma, acute myeloid leukemia, Alzheimer's disease, multiple sclerosis and HIV. We also work with various high-throughput technologies including single-cell RNA-Seq, SWATH-MS, flow cytometry, CyTOF, CODEX imaging and imaging mass cytometry
Project keywords	Bioinformatics, big data, omics
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Ellis Patrick
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Auxiliary Supervisor 2	
Project ID	2023S1-169
Project title	Characterising a single cell's impact on disease with state-of-the-art high-throughput biomedical technologies.
Project synopsis	The University has invested millions of dollars purchasing various state-of-the-art technologies that can facilitate the molecular profiling of single cells. The biological and medical ramifications of these technologies are unparralled and have made it possible to investigate the impact of a single cell's impact on disease. As these technologies are new, the exciting scientific hypotheses that can be explored with them, as well as the analytic approaches needed to answer these, are still being actively developed. In this project we will apply or develop analytical techniques to characterise /single cells using technologies such as single-cell RNA-Seq, high-parameter flow-cytometry, CyTOF and hyperion imaging. These projects are suitable for anyone interested in bioinformatics, statistics, data science or data-intensive biology.
Project keywords	Bioinformatics, omics, single cell, cytometry
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Hilda Pickett
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Project ID	2023S1-170
Project title	Telomere length regulation in cancer cells
Project synopsis	Telomeres are repetitive regions of DNA that cap the ends of linear chromosomes. Telomeres shorten with each round of cell division until they become so short that they no longer functionally protect the chromosome. Telomere shortening triggers cellular senescence and limits the number of times normal human cells can divide. Cancer cells are immortal, and must activate a telomere maintenance mechanism to extend and repair their telomeres. This project will explore the mechanisms that become activated to extend telomeres in normal and cancer cells, and how these pathways contribute to cell proliferation. The project will also focus on therapeutic strategies to treat cancers based on the activated telomere maintenance mechanism. The research will employ cell culture and molecular biology techniques, including genetic manipulation by CRISPR and siRNA; DNA, RNA and protein analysis; advanced microscopy; and proteomics.
Project keywords	telomere, DNA damage, DNA repair, cell division, cancer
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Pierre Qian
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Auxiliary Supervisor 2	
Project ID	2023S1-186
Project title	Characterisation of aorticorenal ganglia
Project synopsis	Hypertension is a common problem ans the strongest modifiable risk factor for cardiovascular disease. Renal nerve hyperactivity contributes to hypertension and renal denervation may be an effective treatment option. We will investigate a novel method of electrically mapping out and targeting renal nerves from their origins at the aorticorenal ganglia. The student will work with large animal models and learn histological methods
Project keywords	Renal denervation, hypertension
Laboratory location	Westmead Hospital

Honours area	AMED
Primary Supervisor	Pierre Qian
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Project ID	2023S1-192
Project title	Fluoroless catheter ablation for heart rhythm disorders
Project synopsis	Catheter ablation for heart rhythm disorders is increasingly practiced clinically. Using 3D navigational systems and increasingly sophisticated technology and ultrasound imaging, we are now able to perform many of these procedures with no x-ray imaging. The student will work in a clinical context looking at procedural and patient outcomes at a large centre performing complex catheter ablation. They will be learn how to collect and analyse patient and procedural data and conduct clinical research.
Project keywords	arrhythmia, heart, rhythm disorder, clinical study, catheter ablation
Laboratory location	Westmead Hospital

Honours area	AMED
Primary Supervisor	Natasha Rogers
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Project ID	2023S1-20
Project title	The role of matrix proteins in osteoarthritis
Project synopsis	Osteoarthritis (OA) is a joint disease and one of the leading causes of musculoskeletal pain, disability and early retirement worldwide. Current therapeutic options for OA are limited to pain medications, physiotherapy and joint replacement surgery. Pain in OA correlates poorly with radiographic joint damage making it difficult to manage pain symptoms. Our team has identified a novel mechanistic pathway involved in the pathogenesis of OA - the matrix protein thrombospondin-1. We also found that mice lacking this protein are less susceptible to bone damage that is characteristic of OA. We now hypothesise that TSP1 signalling regulates the development of OA, and TSP1-targeted therapy will mitigate features of OA. This study will investigate the risks factors for developing early knee osteoarthritis and pain by targeting TSP1. We will use a mouse model of OA and these mice will undergo specialised MRI and CT imaging to detect bone and cartilage changes that are characteristic of OA. The project will involve analysis of these radiological images using specialised software, as well as analysis of bone and joint tissue isolated from these mice (involving histological staining and standard molecular biology techniques).
Project keywords	osteoarthritis, chronic kidney disease, molecular biology, tissue analysis
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Natasha Rogers
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Project ID	2023S1-21
Project title	Understanding the biology and treatment of cardiorenal syndrome
Project synopsis	Chronic kidney disease (CKD) is considered one of the strongest risk factors for the development of cardiovascular disease. The linked relationship between heart and kidney disease is called "cardiorenal syndrome". This project will determine a new role for the matrix protein thrombospondin-1, and its receptor CD47, contributing to cardiorenal syndrome. We have developed a mouse model of cardiorenal syndrome using 5/6 nephrectomy, and we are interested in comparing the response of different mutant mice as they develop heart disease (or not). We will also investigate the response of mice to different drugs designed to target cardiorenal syndrome. This project will involve echocardiography of mice and interpretation of these imaging studies, molecular biology experiments to investigate signal transduction processes.
Project keywords	Kidney disease, heart disease, Cell & Molecular Biology, Mouse experiments
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Natasha Rogers
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Project ID	2023S1-22
Project title	Novel cell therapies to prevent acute and chronic kidney disease
Project synopsis	Dendritic cells (DC) regulate the innate immune response, which is crucial to protection against, and repair from, acute and chronic kidney injury. DC therapy has been leveraged for autoimmune diseases and transplantation, and represents an appealing potential treatment for kidney disease, which has no current treatment other than standard-of-care. We have developed pharmacologically manipulated DC (tolerogenic DC, tolDC) that deliver both anti-inflammatory and anti-cell death responses to kidney cells. Preliminary data suggests these cells infused into mice are capable of protecting against acute kidney injury. This Honours project involves understanding the molecular characteristics of tolDC, and using them in several mouse models of kidney injury to reduce initial damage, as well as prevent progression of disease.
Project keywords	dendritic cells, inflammation, acute kidney injury, chronic kidney injury, fibrosis
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-23
Project title	Understanding how gene mutations influence the risk of kidney disease
Project synopsis	Acute kidney injury is a significant medical problem that does not resolve completely and typically leads to chronic kidney disease. My lab is interested in understanding the mechanisms that prevent recovery from acute injury and/or promote progression to chronic disease. We have recently demonstrated that a mutation in the zinc finger protein A20 protects against acute kidney injury by upregulating anti-apoptotic genes. This protection occurred despite an increase in inflammatory cell infiltrate and pro-inflammatory cytokine expression within the kidney. Inflammation is the hallmark of chronic kidney disease, and preliminary experiments show that mutated A20 paradoxically promotes chronic injury. This project will determine the molecular mechanisms underlying the progression from acute to chronic kidney disease.
Project keywords	Inflammation, Chronic kidney disease, Immune response, genomics
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-161
Project title	Defining the mechanism of Herpes simplex virus-1 spread from sensory nerves to skin
Project synopsis	Our lab focuses on defining how herpes simplex virus-1 (HSV-1) spreads from sensory axons to the skin during recurrent herpes. The honours project will aim to investigate whether HSV-1 exit from axons occurs via Ca2+regulated exocytosis, facilitated by the actin motor protein myosin V and whether HSV-1 exit from axons is the same when the axons are free or in contact with epithelial cells or immune cells such as epidermal dendritic cells. This project will utilise compartmentalised neuronal culture systems, confocal and electron microscopy to visualise virus exit from axons in the presence or absence of epithelial and dendritic cells. Droplet digital PCR will be used to measure virus release from axons. This project will be conducted at WIMR.
Project keywords	HSV-1, Sensory Neurons, virus transport, confocal microscopy, electron microscopy
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-171
Project title	Exploring corneal neovascularization
Project synopsis	The cornea is the clear avascular layer at the very front of the eye that acts as a window to the foreign world. Clinically, corneal vascularization is a major contributor to corneal blindness, which is the 4th most common cause of blindness worldwide. This project explores corneal neovascularization and looks at potential therapeutics for the treatment of corneal neovascularization with the aim of rapid translation into clinical trials. Thrombospondin (TSP)-1 is constitutively expressed in the cornea and plays a significant role in maintaining the corneal angiogenic privilege. TSP-1 knockout studies have revealed altered corneal innervation, altered lacrimal gland structure and function, as well as mononuclear infiltrates into the lacrimal gland. The current proposal is aimed to investigate one aspect of the corneal neovascularization progression focusing on the glycoprotein Thrombospondin-1.
Project keywords	inflammation; immunology; translation; cornea; neovascularization; angiogenesis; animal models; immunohistochemistry
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
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Project ID	2023S1-111
Project title	Mechanisms of treatment resistance in ovarian cancer
Project synopsis	Treatment resistance is a major prognostic challenge in ovarian cancer. In this project, we will be using cell lines from the Australian Ovarian Cancer Study to find novel targets that confer sensitivity to the front-line PARP inhibitor therapy beyond the known predictors of response to this promising mode of treatment.
Project keywords	Ovarian cancer, epithelial cancer, drug discovery, cancer treatment, gene editting
Laboratory location	Westmead Hospital

Honours area	AMED
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Project ID	2023S1-112
Project title	Study of post-radiation tumour cell remodelling in head and neck cancer
Project synopsis	Ionising radiation (IR) is an efficient mode of treatment although a significant rate of relapse post-treatment confers adverse prognosis to patients undergoing radiotherapy. In this project, we will be using a variety of 3D tumour models to study the molecular dynamics of head and neck squamous carcinoma cells undergoing IR treatment.
Project keywords	Radiotherapy, relapse, targeted treatment, cancer, head and neck cancer, 3D models
Laboratory location	Westmead Hospital

Honours area	AMED
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Project ID	2023S1-148
Project title	Characterization of germ layer progenitors in in vitro gastruloid models
Project synopsis	Early embryo contains multipotent cells that can generate every cell type of the body. As development progresses, changes in the transcriptional profile of cells reflect their commitment to specific germ layer tissue lineages. This project aims to understand the regulome (functional gene regulatory network) underpinning the allocation of germ layer progenitors and the specification and differentiation towards mesoderm and endoderm lineages. Elucidation of the molecular dynamics that drive the allocation of bipotential progenitors and the divergent differentiation into mesoderm and endoderm cell types will be undertaken in mammalian pluripotent stem cell based 2D and 3D in vitro gastruloid models, using CRISPR-based gene editing of molecular pathway activity, single cell omics analysis and phenomics imaging
Project keywords	Stem cells, Cell differentiation, Organoids, Genome-editing, Single cell omics
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Thomas Tu
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Auxiliary Supervisor 1	Mark Douglas
Auxiliary Supervisor 2	
Project ID	2023S1-120
Project title	Curing chronic Hepatitis B
Project synopsis	Chronic infection with the Hepatitis B virus is the single greatest cause of liver disease worldwide (responsible for 300 million current infections and 833 000 annual deaths through liver cancer or cirrhosis). Patients typically are infected for life and the infection is currently incurable. The virus persists in the liver in a therapy-resistant form (closed circular DNA, cccDNA). To cure infection, the cccDNA must be cleared. We have developed novel assays and have discovered new viral mechanisms that maintain cccDNA. The goal of this project is to disrupt these pathways, thereby curing the infection. Our project brings together broad expertise and collaborates with world-leaders in virus infection models, cell biology, gene therapy, and clinical practice. Our complementary approaches are centred in the fundamental biology that underpins the development of new treatments: 1) High-throughput screening of in vitro infection systems to find novel genes (and eventually drug candidates) that affect cccDNA; and 2) Analysis of human patient samples to find novel biomarkers for cccDNA monitoring.
Project keywords	Virology, chronic disease, Liver, Cancer, screening, patient samples, gene therapy
Laboratory location	Westmead Institute for Medical Research

Honours area	AMED
Primary Supervisor	Pengyi Yang
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Auxiliary Supervisor 1	Hani Jieun Kim
Auxiliary Supervisor 2	
Project ID	2023S1-122
Project title	Multi-omics data analysis and integration for understanding transitional cell states
Project synopsis	The study of cell types has been propagated by the recent advancements in single cell technologies that have enabled unprecedented insight into cellular heterogeneity. Yet most studies have investigated discrete cell states, and the investigation of intermediate and transitional cell types has been hampered by challenges associated with identifying these rarer cell states. However, characterising these intermediate cell states is important to enhance our understanding of cell state transitions during embryonic development. The increasing number of single-cell fetal transcriptomic and epigenomic atlases enables us to begin interrogating this question. Extending on our recently developed computational method, Cepo, this project will undertake a global approach to identify, investigate, and characterise transitional cell states.
Project keywords	Bioinformatics, computational, single cell, omics, cell type
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Pengyi Yang
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Project ID	2023S1-123
Project title	Cell type atlas-based analysis for estimating number of cell types and their annotation from single-cell transcriptomics data
Project synopsis	Single-cell transcriptomics technique is ideal for profiling of cell types in complex tissues and organs (e.g., brain, embryo) at single-cell resolution. Computationally detecting the number of cell types and annotating each cell type are essential tasks in analysing single-cell transcriptomics data. While various methods have been developed for these tasks (see our work https://doi.org/10.1186/s13059-022-02622-0), none of these methods explored the utility of large cell type atlases that have been recently generated. In this project, we will explore the utility of cell type atlas in helping to determine the number of cell types and annotating each cell type from single-cell transcriptomics data. We aim to design computational methods that will incorporate such information for facilitating future single-cell transcriptomics data analysis.
Project keywords	Computational, Systems biology, Bioinformatics, Single cell, Transcriptomics, Clustering, Cell type
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Pengyi Yang
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Auxiliary Supervisor 1	Katherine Zyner
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Project ID	2023S1-124
Project title	Investigating how cell signalling pathways influences changes to the epigenome during early stages of development
Project synopsis	During early development, stem cells receive extracellular signals that impact the cell type they will eventually become in an organism. Little is known about how these signalling cascades act at the epigenetic level. Previously, we have generated multi-omics data capturing global phosphorylation, protein, gene transcription and histone methylation changes during mouse stem cell differentiation (https://doi.org/10.1016/j.cels.2019.03.012). Many transcription factors, chromatin remodellers and histone modifiers were uncovered as predicted kinase specific substrates. This project aims to experimentally validate these predicted phosphorylated substrates to uncover mechanistic insight into how signalling cascades lead to changes in gene expression resulting in cell differentiation. The student will have the unique opportunity to work amongst both wet-lab and dry-lab environments.
Project keywords	Signalling, Stem cell, Chromatin, Epigenetics, Development, Kinase, Phosphorylation, Omics
Laboratory location	Children's Medical Research Institute (Westmead)

Honours area	AMED
Primary Supervisor	Michaela Yuen
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Project ID	2023S1-227
Project title	Identifying the missing genetics underlying skeletal muscle disease
Project synopsis	Skeletal muscle disease often results in early death or life-long debilitating physical disability in affected individuals. Even after years of investigations, many patients with inherited neuromuscular disorders do not know the genetic basis of their disease. Obtaining a precise genetic diagnosis is critical for families affected by genetic conditions to receive personalized medical care, to be eligible for clinical trials, and to enable family planning. Kids Neuroscience Centre is working with a network of national and international partners to use the latest innovations in genomic medicine to identify the "missing genetics" for our families with rare, nerve and muscle disorders. Our approach uses novel bioinformatic tools and focusses on non-coding variants (eg. variants that change gene splicing) and has been highly successful in identifying causative genes for many of our patients. This project will involve working with our clinical team at the Children's Hospital at Westmead, performing bioinformatics analyses of genomic sequencing data and laboratory based validation and characterisation of candidate genes.
Project keywords	Neuroscience, genetic disease, bioinformatics
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Anatomy and Histology Honours S1, 2023

Honours area	ANAT
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Auxiliary Supervisor 1	Adam Guastella
Auxiliary Supervisor 2	Eleni Demetriou
Project ID	2023S1-48
Project title	Evaluating mental health in children attending a craniofacial and cleft palate clinic
Project synopsis	This project is based in a craniofacial and cleft palate clinic at the Children's Hospital at Westmead and the Brain and Mind Centre, Camperdown. You will work within a multi-disciplinary team who conducts gold-standard assessments in assessing and treating children with craniofacial and cleft-palate conditions. You will evaluate mental health concerns in children and young people presenting with craniofacial and cleft palate conditions and determine the role of mental health in disability and functioning. Clinicians often report that children with these conditions have significant mental health concerns, however no research has systematically evaluated this. This project examines the developmental trajectories of mental health and functioning in children attending these clinics, leading to new avenues for assessment and support.
Project keywords	Hospital, Mental Health, Child, Child Development, Parental health
Laboratory location	Children's Hospital at Westmead

Honours area	ANAT
Primary Supervisor	Kelsie Boulton
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Auxiliary Supervisor 1	Adam Guastella
Auxiliary Supervisor 2	
Project ID	2023S1-49
Project title	Exploring Early Life Markers to Predict Social and Executive Functioning in Cerebral Palsy
Project synopsis	This project is based in a Cerebral Palsy Alliance early diagnosis clinic at Prairiewood and the Brain and Mind Centre, Camperdown. You will work with a multi-disciplinary team who use gold-standard assessments to detect and diagnose Cerebral Palsy from three months of age. Growing evidence indicates that children with Cerebral Palsy experience many social and executive functioning difficulties, and are at increased risk for receiving other diagnoses, such as Autism Spectrum Disorder. You will assess an early biological, attentional or social marker of developmental delay in infants with Cerebral Palsy. This project examines whether early markers of social and attentional functioning can be used to predict neurodevelopmental delays and divergence in children with Cerebral Palsy
Project keywords	Cerebral Palsy, Infancy, Child, Biomarkers, Neurodevelopment
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	ANAT
Primary Supervisor	Filip Braet
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Auxiliary Supervisor 1	Frank Lovicu
Auxiliary Supervisor 2	
Project ID	2023S1-215
Project title	Reprocessing histology samples for multimodal cellular analysis across length scales
Project synopsis	This project involves developing a sample preparation and bioimaging workflow for reprocessing paraffin-embedded tissues for multimodal microscopic analysis across length scales. Paraffin embedded tissue retains a wealth of structural information not fully exploited via light-microscopy alone. We aim to develop a simplified workflow that allows the collection of complementary structural information utilising, x-ray, light- and electron microscopy. Successful implementation of this novel approach will be applied to the investigation of relevant experimental animal models and clinical samples. The development of this innovative "morphomics" workflow will allow us to bolster our nano-analytical toolbelt to better understand pathobiological alterations and processes in human disease and as such give a new direction to "-omics science".
Project keywords	biomolecular and cellular microscopy; image analysis; histology; cell biology; ultrastructure; staining
Laboratory location	Madsen Building (F09) - SMM CRF DVCR

Honours area	ANAT
Primary Supervisor	Filip Braet
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Auxiliary Supervisor 1	Frank Lovicu
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Project ID	2023S1-216
Project title	In vitro induction of giant mitochondria in a hepatic cell line
Project synopsis	Mitochondria are the primary cellular structures that generate energy required to power the cells' biochemical reactions. Giant mitochondria are abnormal, extremely large mitochondria, observed in a variety of pathologies which are characterised by atypically arranged cristae, enlarged matrix granules and paracrystalline inclusions from unknown origin. Understanding the mechanism of mitochondrial gigantism and associated mitochondriopathies is essential given the importance of mitochondria to cellular function, human health and aging. This project involves the in vitro generation of giant mitochondria in human parenchymal cell lines to elucidate the ultrastructural mechanisms underlying their formation. Transmission electron microscopy will be applied to assess mitochondrial structural alterations in response to exogenous agents.
Project keywords	Cell Culture; Labelling; Ultrastructure; Electron Microscopy; Image Analysis
Laboratory location	Madsen Building (F09) SMM-CRF-DVCR

Honours area	ANAT
Primary Supervisor	Katie Dixon
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Project ID	2023S1-74
Project title	Identification of biomarkers for skin carcinogenesis
Project synopsis	Key contributors to development of ultraviolet radiation (UV)-induced skin tumours are UV-induced DNA damage and immune suppression. The vitamin D hormone, 1,25-dihydroxyvitamin D, reduces DNA damage, immune suppression and skin tumours, as do some vitamin D analogs. Yet several potentially photoprotective agents examined have reduced UV-generated DNA damage and immune suppression, but not skin tumours. Testing for efficacy against skin tumours is a long (40 weeks) and expensive process. Thus, the aim of this project is to find readily measurable markers to identify agents that will reduce skin tumours, since reductions in UV-induced DNA damage and immune suppression alone are not necessarily predictive. Techniques include but are not limited to: primary cell culture, immunohistochemistry, western blot, image analysis.
Project keywords	skin cancer, dermatology, cancer, carcinogenesis
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	ANAT
Primary Supervisor	Samson Dowland
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Auxiliary Supervisor 1	Laura Lindsay
Auxiliary Supervisor 2	
Project ID	2023S1-73
Project title	Developing a new non-hormonal contraceptive - investigating the endometrial impacts
Project synopsis	The current contraceptive choices for women are limited and most rely on disrupting the natural reproductive hormone cycle. We are developing a new non-hormonal intrauterine device (IUD) that would provide an alternative for women. This project will examine the impact of this IUD on the endometrium, investigating whether it affects uterine receptivity or causes inflammation or other side-effects. This will be explored in our animal model using a combination of techniques including electron microscopy and immunofluorescence.
Project keywords	Reproduction, contraception, pregnancy, microscopy, histology, cell biology
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	ANAT
Primary Supervisor	Adam Guastella
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Auxiliary Supervisor 1	Kelsie Boulton
Auxiliary Supervisor 2	
Project ID	2023S1-47
Project title	Early markers of neurodevelopmental delay in children diagnosed with autism
Project synopsis	This project is based in a child development assessment unit at Westmead and the Brain and Mind Centre Camperdown. You will work within a multi-disciplinary team that conducts gold standard clinical developmental assessments. Your research question will be whether an easy to administer biological assessment predicts the severity of neurodevelopmental delays in children. Growing evidence indicates that autism spectrum disorder (ASD) has diverse genetic, neurological, and environmental factors that contribute to its neurodevelopmental course. Childhood ASD is often accompanied by skin disorders, such as eczema, and other related atopic manifestations. This project examines the whether this underlying connection can be used to develop novel biological markers of neurodevelopment in young children, leading to new avenues for assessment and support.
Project keywords	Autism Child Neurodevelopment Inflammation Skin
Laboratory location	Children's Hospital at Westmead

Honours area	ANAT
Primary Supervisor	Adam Guastella
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Auxiliary Supervisor 1	Eleni Demetriou
Auxiliary Supervisor 2	Kelsie Boulton
Project ID	2023S1-50
Project title	Examining the circuitry of neurodevelopmental delays in autistic adults
Project synopsis	This project works in one of the largest neurodevelopment research clinics for youth and adults diagnosed with Autism Spectrum Disorder and is based at Camperdown. The clinic supports mental health and employment outcomes and examines novel cognitive and biomarker investigations to understand predictors of neurodevelopmental delays and functioning outcomes. Your project could examine a cognitive (e.g., eye tracking or cognitive assessment), biological (e.g., eye tracking, HRV) or observational (e.g., bioinformatic) marker that may provide targets for predicting clinical or functional outcomes. You will work within a clinical and research team consisting of post-doctoral fellows and students at the Brain and Mind Centre. You will be involved in recruitment and testing of participants, and data management/analysis for your thesis.
Project keywords	Autism; Diagnosis; Markers; Mental Health; Employment
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	ANAT
Primary Supervisor	Elizabeth Hegedus
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Auxiliary Supervisor 1	Bronwen Ackermann
Auxiliary Supervisor 2	
Project ID	2023S1-115
Project title	Carpal tunnel syndrome Interactive Health Game
Project synopsis	Carpal tunnel syndrome (CTS) is a commonly diagnosed peripheral neuropathy. Conservative management such as neurodynamics physiotherapy combined with home-exercise has shown superior outcomes to ease pain and prevent future injuries. Self-administered home-exercises allow ease of access to treatment, decreased financial cost, and greater functional improvement - when patients' adhere to the home exercise program. Interactive 'serious' games for healthcare purposes (health games) provide patients with feedback about their condition, and can motivate, engage and increase patients' adherence to treatment. This project aims to develop a virtual reality (VR) based health game to assist hand therapists to motivate and engage their CTS patients to maintain their intervention programs, to help them manage pain and improve function. Research plan: 1) needs analysis interviews of hand therapists, 2) develop a VR health game using facilities within the FMH Media Lab e.g. Artec 3D scanners, gaming software (Bender, Unity), 3) evaluate the pilot game using a REDCap survey.
Project keywords	Health games, virtual reality, carpal tunnel syndrome, physiotherapy
Laboratory location	FMH Media Lab, Level 2, Anderson Stuart Building

Honours area	ANAT
Primary Supervisor	Laura Lindsay
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Auxiliary Supervisor 2	
Project ID	2023S1-6
Project title	Exocytosis in Uterine Epithelial cells – control of maternal fetal communication
Project synopsis	Maternal foetal communication is important during early pregnancy. The uterus communicates with the implanting blastocyst via release of cellular contents and signals via a process of exocytosis. Precise mechanisms regulating exocytosis in uterine epithelial cells is currently unknown. Understanding exocytosis could advance development of a non-invasive uterine receptivity marker to improve pregnancy rates during IVF in humans and agricultural species. This project will use immunofluorescence microscopy, western blotting and ELISAs. There is the opportunity to use rat uterine samples to study in vivo mechanisms as well as a cell culture model to study exocytosis using receptive and non-receptive human endometrial cells lines.
Project keywords	uterus, fertility, IVF, pregnancy, implantation
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	ANAT
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Auxiliary Supervisor 1	Babak Sarrafpour
Auxiliary Supervisor 2	Smitha Sukumar
Project ID	2023S1-114
Project title	Chatbots and case-based learning
Project synopsis	This project will use chatbots to enrich dental students Case-based learning experience. The project will trial, develop and test a chatbot in a pre-clinical setting and compare to a traditionally delivered tutorial. The project will involve human-centred design, user research, prototyping and user evaluation. The developed resource will then be validated by comparison to traditionally delivered tutorial using quizzes, surveys and focus groups. Students will be involved in resource development, educational design and beta-testing.
Project keywords	chatbots dentistry case-based learning
Laboratory location	Media Lab, Anderson Stuart Building

Cell and Developmental Biology Honours S1, 2023

Honours area	CELL
Primary Supervisor	Poornima Balaji
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Project ID	2023S1-110
Project title	Mechanisms underlying Non-invasive Radiotherapy for Refractory Ventricular Arrhythmias
Project synopsis	Ventricular arrhythmias (VA) are abnormal, fast rhythms arising from the main pumping chambers of the heart(ventricles). VA causes 1 in 4 cardiovascular deaths. The available treatment options for VA result in significant morbidity and are often ineffective. In an extraordinary interdisciplinary venture, a pioneering new treatment modality using radiation therapy, normally used for treatment of cancers, has been applied for VA.Multiple beams of high energy X-rays are converged to target the scar in the heart causing the heart rhythm problems.Although clinically very promising, many unanswered questions remain. In this project we will assemble a multidisciplinary team to understand the dose of radiation needed and how it affects function of heart cells(cardiac myocytes) We will use cardiac myocytes differentiated from pluripotent stem cells as our model system to identify pathways and functional parameters modified in response to radiation treatment. The outcome of this research will be paradigm changing for treatment of heart rhythm disorders.
Project keywords	Heart disease, Radiation therapy, induced pluripotent stem cells,
Laboratory location	Westmead Hospital

Honours area	CELL
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Project ID	2023S1-230
Project title	Rejuvenating cultured dermal fibroblasts for burn injury treatment
Project synopsis	Hypertrophic scarring (HTS) represents a major clinical burden and life-long consequence of burns injuries (BI). The gold standard in the treatment of BI involves transplanting healthy skin autografts onto affected areas to achieve wound closure. The age of autologous skin is a major determinant in outcomes of wound healing (WH) and subsequent HTS. As individuals age, WH transitions from scar-free to fibrotic wound repair involving scar formation. Recent evidence suggests that the age of terminally differentiated somatic tissues can be reset (rejuvenated) without the loss of cellular identity using transient exposure to cellular reprograming factors. By rejuvenating autologous dermal fibroblasts using transient, non-integrative, partial reprogramming strategies, we hypothesise that BI wounds and donor sites will heal with improved scar outcomes.
Project keywords	Rejuvenation, regeneration, partial reprogramming, burns injuries, wound healing, scar formation.
Laboratory location	ANZAC Research Institute, (Concord General Repatriation Hospital)

Honours area	CELL
Primary Supervisor	Margot Day
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Project ID	2023S1-196
Project title	Improving preimplantation embryo development in vitro
Project synopsis	4% of babies born in Australia result from assisted reproduction involving fertilization and culture of the embryo in vitro. The embryo culture environment can cause significant alterations in gene expression, epigenetics, metabolism and cell proliferation during preimplantation development and these alterations may have effects on later life. Our studies aim to help us to understand the impact of the culture environment on preimplantation embryonic development in order to improve reproductive outcomes via assisted reproduction. We study the physiological processes involved in fertilization of the oocyte and proliferation of the cells in the preimplantation embryo. We use a range of techniques including in vitro fertilization, isolation and culture of preimplantation mouse embryos, gene expression, cell signalling and live cell imaging.
Project keywords	Embryo, IVF, reproduction, fertilisation
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	CELL
Primary Supervisor	Margot Day
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Project ID	2023S1-197
Project title	Use of amino acids and growth factors to improve early embryo development
Project synopsis	4% of babies born in Australia result from assisted reproduction involving fertilization and culture of the embryo in vitro. The embryo culture environment can cause significant alterations in gene expression, epigenetics, metabolism and cell proliferation during preimplantation development and these alterations may have effects on later life. Our studies aim to help us to understand the impact of the culture environment on preimplantation embryonic development in order to improve reproductive outcomes via assisted reproduction. We study the physiological processes involved in fertilization of the oocyte and proliferation of the cells in the preimplantation embryo. We use a range of techniques including in vitro fertilization, isolation and culture of preimplantation mouse embryos, gene expression, cell signalling and live cell imaging.
Project keywords	embryo development, IVF, fertilisation, reproduction
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	CELL
Primary Supervisor	Gemma Figtree
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Auxiliary Supervisor 2	
Project ID	2023S1-116
Project title	Vascular Function Assessment in Hypertensive Mice with Modified Redox Signalling
Project synopsis	The Na+-K+ pump plays an integral role in maintaining vascular homeostasis. Our laboratory found that by modifying a single amino acid residue on the Na+-K+ pump, it prevented adverse cardiac remodelling in a mouse model of hypertension. The effect of this modification in the blood vessel is yet to be determined. We therefore aim to test the hypothesis that this novel mouse model will be protected from hypertension-induced vascular dysfunction. The student will gain experience in performing small animal surgery and blood pressure measurement, ex vivo assessment of vascular function using wire-myography and various molecular biology techniques to delineate the specific signalling pathways that are altered by the Na+-K+ pump modification. This project will be based at the Kolling Institute.
Project keywords	Hypertension, Oxidative Stress, Blood vessel, Mouse model
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	CELL
Primary Supervisor	Daniel Hesselson
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Project ID	2023S1-168
Project title	Cell penetrating nanobodies to block critical cancer proteins
Project synopsis	Nanobodies are tiny antibodies that can engage challenging targets including proteins inside cells and tissues. Building on a previous honours project this will use cutting edge methods for directed evolution of proteins to target p53, a major driver of many cancers. This project will focus on enhancing the affinity and cell penetrating capabilities of existing p53 nanobodies using cutting edge directed evolution approaches. These will be identified by flow cytometry and next generation sequencing. Potential outcomes will be new tools to dissect the role of p53 in cancer and could produce potential p53-targeting therapeutics.
Project keywords	nanobodies, directed evolution, cancer, p53
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	CELL
Primary Supervisor	David James
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Project ID	2023S1-16
Project title	Cell Biology of Insulin Action
Project synopsis	Insulin and exercise activate extensive signalling cascades to regulate an array of cellular processes in muscle cells including increased glucose transport. The latter is mediated via translocation of the glucose transporter GLUT4 from intracellular vesicles to the plasma membrane. Defects in this underly insulin resistance and cardiometabolic disease. This project aims to determine how insulin controls GLUT4 trafficking. We have identified a phosphorylation site on a motor protein (Kif13a) that binds the Rab GTPase Rab10. Genetic knockdown of KIF13 impairs GLUT4 translocation. This project will investigate how insulin intersects with Rab GTPases, microtubules and the delivery of GLUT4 to the surface membrane. This project will involve cell culture, molecular biology, proteomics and live cell fluorescence microscopy.
Project keywords	Insulin, microscopy, signalling,
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	CELL
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Auxiliary Supervisor 2	Marin Healy
Project ID	2023S1-17
Project title	Integrating metabolism and genomics in mice
Project synopsis	We have a highly unique population of diversity outbred mice that we are screening for gene x environment interactions to better understand complex biological problems and diseases. The project is heavily data driven and will take a systems biology approach. This entails learning how to do genetic mapping, tissue proteomics and QTL analysis and integrating this information with metabolic phenotypes such as obesity and/or diabetes. Our goal is to identify genes and molecular pathways that are fundamentally linked to metabolic diseases.
Project keywords	mice, genetic, diabetes, obesity
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	CELL
Primary Supervisor	David James
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Auxiliary Supervisor 2	Sean Humphrey
Project ID	2023S1-18
Project title	Mechanism of insulin resistance
Project synopsis	Insulin resistance is a risk factor for developing several diseases, including type 2 diabetes, cardiovascular disease, and some cancers. Our group has discovered several links between mitochondrial metabolism and insulin resistance. This project investigates the molecular basis for how mitochondrial alterations affect insulin sensitivity in adipocytes and myocytes. In particular, we are interested in understanding how lipid accumulation affects mitochondrial function and structure driving insulin resistance. Students will learn a wide range of techniques in molecular biology, mitochondrial physiology, cell culture, metabolic/biochemical assays, microscopy, and western blotting.
Project keywords	Insulin resistance , diabetes, mitochondria, metabolism, adipocytes , molecular biology,
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	CELL
Primary Supervisor	David James
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Auxiliary Supervisor 1	Jacqueline Stoeckli
Auxiliary Supervisor 2	
Project ID	2023S1-19
Project title	Mechanism by which insulin regulates lipolysis in adipocytes
Project synopsis	The release of fatty acids from adipocytes, a process called lipolysis, is tightly regulated to maintain homeostasis. Catecholamines induce lipolysis during starvation, while in the presence of nutrients, insulin suppresses lipolysis. This is one of the most important actions of insulin in mammals and surprisingly little is known about the mechanism. Indeed, an impairment in this process may play a major role in diseases including non-alcoholic fatty liver disease and steatohepatitis. We have recently discovered a novel regulator of lipolysis in fat cells. This project will explore how catecholamines and/or insulin regulate the function of this protein to coordinate the release of fatty acids from lipid droplets. Students will culture adipocytes or use mouse adipose tissue, perform 96-well plate lipolysis assays involving calorimetric assays, Western blotting, among other techniques.
Project keywords	adipocytes, lipolysis, diabetes, mice, fatty acids,
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	CELL
Primary Supervisor	Frank Lovicu
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Auxiliary Supervisor 2	
Project ID	2023S1-45
Project title	HSPG regulation of growth factor signalling in lens cells
Project synopsis	This project will examine the role of HSPG glycoproteins in regulating different growth factors that are important for regulating both the normal and aberrant processes leading to cataract. Using animal models, along with tissue culture, and immunolabelling techniques, it will unravel the impact of HSPGs on lens cell behaviour and the signalling pathways driving this.
Project keywords	Lens, Signalling, HSPGs, Growth Factors, Eye, Blindness, Cataract, Proliferation, Differentiation, EMT
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	CELL
Primary Supervisor	Frank Lovicu
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Project ID	2023S1-46
Project title	The Role of p38 in TGFβ-Induced EMT Signalling Leading to Cataract
Project synopsis	A TGFß-induced fibrotic model using lens epithelial explants will be used to carry out studies to examine for changes to the localisation of p38, especially in its phosphorylated (active) form (pp38), and secondly to determine the impact of blocking this phosphorylation in TGFß-induced EMT. This research will serve to better understand EMT leading to fibrosis, specifically the role and potential therapeutic use for p38 in preventing or treating cataract.
Project keywords	Lens, Cataract, EMT, Blindness, TGFb, p38, fibrosis, signalling
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	CELL
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Project ID	2023S1-92
Project title	Cell reprogramming as a novel tool to stabilize advanced atherosclerotic plaque
Project synopsis	Clinical Problem. 1 in 4 Australian deaths is due to Coronary Heart Disease, making it the leading cause of death in our nation. Build-up of plaque within arteries, in a process termed atherosclerosis, is the principal driver of CHD. Unlike stable plaques, unstable plaques are like 'ticking time bombs': they occur at more sites, are more aggressive and are more likely to rupture causing thrombus formation resulting in heart attacks and stroke. Preventing the rupture of unstable plaques remains a major unmet need in clinical cardiology. In this project, we will reprogram plaque cells by using anti inflammatory therapy to increase disease protective cells which will stabilize plaques and prevent rupture. We will be using advanced transgenic mice, scRNA-Seq, FACS and confocal microscopy.
Project keywords	Atherosclerosis, Anti inflammatory therapy, macrophages, Genomics,
Laboratory location	Heart Research Institute (Camperdown)

Honours area	CELL
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Project ID	2023S1-93
Project title	Modulating coronary atherosclerosis through perivascular adipose tissue (PVAT)
Project synopsis	Perivascular adipose tissue (PVAT) anatomically proximal to vasculature has a distinctive cellular composition that modulates a range of cardiovascular disease (CVD) processes. Recently, it was shown that PVAT and the vessel wall communicate bidirectionally through release of inflammatory molecules, adipokines and oxidative products; as such, PVAT may be a potential therapeutic target in cardiovascular disease. We have shown that anti-inflammatory therapy in CV disease significantly reduced inflammatory trans-coronary cytokine levels. In this project, we aim to investigate if reducing inflammation prior to cardiac surgery reduce diffusion of inflammatory cytokines from the vessel wall, thereby inhibiting differentiation of pre-adipocytes into mature adipocytes. We will use advanced CV genetics, FACS, confocal microscopy and adipocyte culture.
Project keywords	inflammation, adipose tissue, atherosclerosis, cardiovascular disease, genomics
Laboratory location	Heart Research Institute (Camperdown)

Honours area	CELL
Primary Supervisor	Ashish Misra
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Auxiliary Supervisor 1	Sanjay Patel
Auxiliary Supervisor 2	
Project ID	2023S1-96
Project title	Identification of molecular and cellular mechanisms linking diabetes with atherosclerosis.
Project synopsis	The clinical problem – a looming tsunami of cardiovascular diseases: In 2004, renowned American cardiologist Valentin Fuster and his colleagues made the startling prediction that "one in three children born in the year 2000 will develop diabetes, resulting in a 30 per cent reduction in life expectancy". Thus, there is an urgent need to uncover the fundamental mechanisms underlying the development of diabetes, including how cardiovascular risk factors affect atherosclerosis Our overarching AIM is to identify novel factors and signalling pathways driven by cardiovascular risk factors - due to defective haematopoiesis - which affect gene expression of smooth muscle cells and myeloid cells in the atherosclerotic plaque. Significance: These studies will be the first to identify novel factors that cause premature cardiovascular disease in diabetic and obese patients. Technique used: Cardiovascular genetics, histology, RNA-Seq, cell culture, confocal microscopy
Project keywords	Diabetes, Atherosclerosis, cardiovascular genetics, Genomics, RNA-Seq, cellular reprogramming
Laboratory location	Heart Research Institute (Camperdown)

Honours area	CELL
Primary Supervisor	Michael Morris
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Auxiliary Supervisor 1	Margot Day
Auxiliary Supervisor 2	
Project ID	2023S1-55
Project title	Modelling early embryo development and neurogenesis using embryonic stem cells
Project synopsis	Embryonic stem (ES) cells have the potential to differentiate into any cell type of the developing embryo and adult. So, they are invaluable in understanding the molecular mechanisms that drive normal development and can provide a window into what happens during abnormal development. ES cells also have great potential in treating a large number of currently incurable or poorly treatable human diseases and injuries, including neuropathies, brain and spinal injuries, muscular diseases, and diabetes. We use ES cells as an in vitro model to understand the key molecular mechanisms underpinning critical developmental milestones forming the nervous system.
Project keywords	stem cells, embryos, cell signalling, neurogenesis
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	CELL
Primary Supervisor	Robert Vandenberg
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Auxiliary Supervisor 2	
Project ID	2023S1-200
Project title	Novel Mechanisms of Inhibition of Glycine Transport for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of novel inhibitors of glycine transporter 2 that show promise as analgesics for the treatment of neuropathic pain. You will investigate an intriguing observation that membrane cholesterol appears to modulate the mechanism of inhibition, which has implications for a wide range of drug discovery programs and understanding cell physiology. A range of projects can be designed around this idea and can include: 1. Site-directed mutagenesis studies to understand how the transporter responds to both inhibitor and cholesterol interactions; 2. Compare the activity of cholesterol with that of a series of steroids with the aim of identifying novel secondary modulators of glycine transport. Available for students in NEUR, PHSI, PCOL or MCHM Majors.
Project keywords	Drug Discovery, Chronic Pain, Glycine Transport, Membrane Lipids, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Immunology Honours S1, 2023

Honours area	IMMU
Primary Supervisor	Allison Abendroth
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Auxiliary Supervisor 1	Barry Slobedman
Auxiliary Supervisor 2	
Project ID	2023S1-66
Project title	Varicella Zoster Virus manipulation of human invariant NKT cells: Identification of a novel immune evasion strategy
Project synopsis	Human invariant NK T cells are an innate immune cell-type that function by detecting lipid antigens presented by the non-classical MHC molecule CD1d. Whilst very poorly understood, it is clear from clinical observations that this NKT cell/CD1d axis is very important in the control of varicella zoster virus (VZV) infection. This is because individuals with deficiencies in CD1d/NKT cells suffer from severe and sometimes fatal VZV infection. We have very recently discovered that VZV infection results in a profound downregulation of cell surface CD1d. This is the first evidence of VZV targeting this antigen presentation molecule and is consistent with the discovery of a novel immune evasion strategy. This project will build on this exciting new data to define the basis for VZV modulation of CD1d, including its functional consequences. You will work with a team of leaders in the field of virally encoded immune modulation. This project provides a student the opportunity to learn a variety of human virology and cell culture techniques including working with human blood cells, multi-colour flow cytometry and other immunological/cell biology techniques.
Project keywords	virus, virology, immune evasion, innate immune cells, NKT cells, immunology
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Allison Abendroth
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Auxiliary Supervisor 1	Barry Slobedman
Auxiliary Supervisor 2	
Project ID	2023S1-67
Project title	Herpesvirus disarming of Natural Killer (NK) cell recognition
Project synopsis	The human herpesviruses, herpes simplex virus type 1 (HSV-1) is a highly successful human pathogen and a master manipulator of the multiple arms of the host immune response. However, one area that is very poorly understood is the impact of HSV on natural killer (NK) cells. NK cells are innate cells that can selectively lyse virally infected cells after activating receptors on NK cells bind to their respective ligands. Two such ligands that play important roles in NK cell functionality are CD112 and CD155. We have very recently discovered that HSV-1 infection inhibits both CD112 and CD155, providing the first evidence of a novel immune evasion strategy encoded by this virus. This project will build on this discovery, by seeking to define the means by which HSV-1 is able to exert this immunomodulatory phenotype, including determining whether HSV-1 modulation of CD112 and/or CD115 will inhibit NK cell recognition/functionality. You will join a team of experts in virus encoded modulation of host immunity, and harness a number of techniques including viral culture, cell culture, flow cytometry and other immunological/cell biology techniques.
Project keywords	Virus, virology, herpesvirus, immunology, infection, NK cells, immune evasion
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Stephen Alexander
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Auxiliary Supervisor 1	Yuan Min Wang
Auxiliary Supervisor 2	
Project ID	2023S1-79
Project title	Targeting Pathogenic Genes: Making a Kidney Transplant for Life
Project synopsis	Kidney transplants mostly fail because of either chronic injury or immune attack. In this project the student will target proteins that are central for kidney rejection and also proteins that cause kidney injury. Using cutting edge gene therapy technologies including CRISPR and Base Editing they will evaluate these strategies in cell culture and models of organ transplantation. The techniques involve gene editing, cell culture, animal work. They will also be involved in studies of paediatric kidney transplantation, with studies of immune rejection and tolerance. The experiments will be carried out in the Centre for Kidney Research, at Children's Hospital Westmead. The facilities from Westmead Hub, including Kids Research Institute, WIMR, and CMRI will be used for this project
Project keywords	Kidney, transplantation, gene editing, CRISPR, children.
Laboratory location	Children's Hospital at Westmead

Honours area	IMMU
Primary Supervisor	Scott Byrne
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Auxiliary Supervisor 1	Angela Ferguson
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Project ID	2023S1-57
Project title	Understanding the immunopathogenesis of wound healing
Project synopsis	Wound healing is a delicately balanced sequence of overlapping events involving immune and non-immune cells (e.g. epithelial cells, fibroblasts). When wound healing is dysregulated, as in some people with diabetes, wounds can persist and develop into chronic ulcers that are recalcitrant to treatment and may progress to require amputation. This research project aims to study the involvement of immune cells in the wound healing process. You will use sophisticated models and tools including microscopy and flow cytometry at the Charles Perkins Centre Hub to interrogate the immune cells in wounds that heal normally as well as those that are delayed. These studies will reveal potentially new immunological targets to improve healing outcomes in patients.
Project keywords	Immunology, Wound Healing, Microscopy
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Scott Byrne
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Auxiliary Supervisor 1	Anneliese Ashhurst
Auxiliary Supervisor 2	
Project ID	2023S1-58
Project title	Harnessing peptide-based immunotherapy to control inflammatory disease
Project synopsis	There is no cure for inflammatory skin diseases which are costly and debilitating. Immune suppression is the only treatment option, but current therapies are expensive, can cause serious side-effects and are not always efficacious. Next generation therapeutics need to be safer, readily accessible and preferentially suppress local inflammation. This research project aims to assess the efficacy of new formulations of our patented peptide-therapeutic in models of inflammatory disease. Using sophisticated tools - including microscopy and flow cytometry at the Charles Perkins Centre Hub – you will interrogate the mechanism of action of this exciting new drug which has great potential as a next-generation anti-inflammatory.
Project keywords	Immunology, Autoimmune Disease, Inflammation, Drug Discovery
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Georgina Clark
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Auxiliary Supervisor 1	Pablo Silveira
Auxiliary Supervisor 2	
Project ID	2023S1-99
Project title	CD300e and CD300f as Novel Immune Regulatory Molecules for Controlling Tumour Growth
Project synopsis	CD300e and CD300f are lipid binding immunoregulatory molecules expressed on myeloid cells. Their restricted expression, and ability to regulate inflammatory micro-environments, makes them attractive therapeutic targets for manipulation of myeloid responses, including tumour suppressor myeloid cells. The aims of this project are to compare: 1) the phenotype and function of myeloid cells in CD300e-deficient or CD300f-deficient mice to wildtype mice and 2) their ability to regulate anti-tumour responses. The student will learn broad laboratory skills including flow cytometry, real-time PCR, cell culture, isolation of leucocyte populations through magnetic- and fluorescence- activated cell sorting and optimisation of mouse tumour models. The studies will contribute to our understanding of the mechanisms by which CD300e and CD300f modulate tumour.
Project keywords	Immunoregulatory Molecules, CD300e, CD300f, Tumour Suppressor Myeloid Cells
Laboratory location	ANZAC Research Institute, (Concord General Repatriation Hospital)

Honours area	IMMU
Primary Supervisor	Carl Feng
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Auxiliary Supervisor 1	Umaimainthan Palendira
Auxiliary Supervisor 2	
Project ID	2023S1-76
Project title	What is the immunological basis of granuloma formation?
Project synopsis	Mycobacterial diseases, such as tuberculosis and leprosy, remain a major health burden worldwide. Granuloma (a collection of inflammatory cells) is regarded as the epicentre of mycobacterial diseases. Yet, we know little about the types of immune cells and their spatial organisation within the lesions. This project will employ cutting-edge multiplex imaging platforms and bioinformatics tools to dissect the spatial dynamics of immune interactions in granulomas. By analyzing lesions at single cell level, the project will create a comprehensive immune landscape of mycobacterial granuloma in human and non-human primates. A deeper understanding of the cellular mechanisms underlying the initiation, resolution and disintegration of granulomas in infected issues will provide new insight into host defence mechanism and advance biomarker and drug discovery.
Project keywords	Inflammation, tissue imaging, immunology, infection, bioinformatics, immunity
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Carl Feng
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Project ID	2023S1-78
Project title	Balancing immune functions in respiratory infection
Project synopsis	Respiratory infectious diseases, such as COVID-19 and influenza, represent a major cause of death globally. Interestingly, mortality in individuals infected with these pathogens is often caused by immunopathology rather than uncontrolled pathogen replication. The hurdle in limiting immunopathology is that the same host molecules responsible for tissue damage are often essential for pathogen control. To understand such "double-edged sword" mechanisms in vivo, we have developed various animal models and technology platforms. In this project, you will use a novel mouse model to define regulatory events that mediate host survival in infection. Defining mechanisms that can mitigate tissue inflammation may lead to development of novel host-directed therapies for infectious diseases.
Project keywords	mice, in vivo, immunology, pathogen, respiratory infection, inflammation
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Carl Feng
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Project ID	2023S1-81
Project title	Visualising immune response in pathogen-infected hosts
Project synopsis	The successful containment of invading pathogens requires the rapid generation of large numbers of antigen-specific T cells with the correct effector function. This involves the activation of distinct programs, including cell proliferation, differentiation, and migration. Yet, we know little about how antigen-specific T cells execute their function at the site of infection. This project will use T cell transfer approach, cytokine signaling reporter mice and multiplex imaging techniques to define the spatiotemporal interaction between mycobacterium-specific T cells and pathogen-infected macrophages in mice. By simultaneously analyzing cytokine producing and responding cells, the project will lead to a better understanding of immune system function in vivo and pathogenesis of infectious diseases.
Project keywords	Inflammation, tissue imaging, immunology, infection, T lymphocytes
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Peter Hsu
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Auxiliary Supervisor 1	Philip Britton
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Project ID	2023S1-185
Project title	Examining SARS-CoV2 variant specific T cell responses in adults and children
Project synopsis	This project will examine the antigen specific T cell responses to various SARS-CoV2 variants in children and adult family members infected with SARS-CoV2 in 2020. The aims of the project are: 1. to determine whether infection with earlier strains of the virus provides protection in terms of cellular immunity to subsequent strains and 2. whether there are differences in the long term anti-viral immune responses between adults and children to various variants. The project will involve in vitro cultures where peripheral blood mononuclear cells are incubated with variant specific spike protein peptide pools. Stimulated, antigen specific T cells will be detected by multi-colour flow cytometry to identify activated T cells using defined marker combinations. Furthermore, the phenotype of these virus specific T cells will be examined in detail. This project will provide better understanding of the dynamics of cellular immune response to the rapidly changing landscape of SARS-CoV2 infection.
Project keywords	immunity, virus-specific T cells, SARS-CoV2
Laboratory location	Kids Research (part of Sydney Children's Hospital Network)

Honours area	IMMU
Primary Supervisor	Umaimainthan Palendira
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Project ID	2023S1-113
Project title	Immune related adverse event in Immunotherapy
Project synopsis	Immunotherapy has revolutionized cancer treatment in recent years. While immunotherapy intends to restore anti-tumour immunity, it also often leads to immune activation in normal host tissue, resulting in immune-related adverse events (irAEs). irAEs are a major barrier to the successful use of immunotherapies in oncology, contributing to significant morbidity and occasional mortality for an ever-increasing number of patients treated in the metastatic and adjuvant (post-operative) setting. An increasing number of antibodies targeting several different checkpoints are currently being trialled or developed. Moving forward, the use of combination therapies, currently only used in melanoma and kidney cancer, are likely to become more common and a lack of understanding of how irAEs develop will stifle the progress. This project will aim to understand the pathogenesis of skin related irAEs. The work will be performed in collaboration with Melanoma Institute and will incorporate novel technologies to map the immune landscape of affected skin tissues.
Project keywords	Immunotherapy, inflammation
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Umaimainthan Palendira
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Auxiliary Supervisor 1	Felix Marsh-Wakefield
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Project ID	2023S1-94
Project title	Understanding the pathogenesis of liver cancers
Project synopsis	Hepatocellular carcinoma (HCC) is the most common primary liver cancer. In 2020, it was the sixth most common cancer worldwide and the third most common cause of cancer death. Despite an increase in therapeutics available to treat HCC, the rate of disease continues to climb worldwide. With the advent of immunotherapies, a greater understanding of the immune system is essential to improve prognostics outcomes. We have a collaboration with Centenary Institute and RPA Hospital to collect tumour and blood samples from HCC patients to analyse immune profile. The project on offer will use high-dimensional cytometry (spectral flow cytometry and mass cytometry) to interrogate circulating immune cells. The student will also be exposed to bioinformatic approaches to make sense of such complex data.
Project keywords	Cancer, immune response
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-210
Project title	Herpesvirus infection of mucosal associated invariant T cells (MAIT) cells
Project synopsis	There has been burgeoning interest in the study of Mucosal Associated Invariant T cells (MAIT) cells due to the discovery that they play an important role in the control of a range of infections. However, the role and function of MAIT cells in the context of viral infection is an emerging area that remains poorly understood. We have recently made the novel discovery that MAIT cells are directly infectable with Herpes simplex virus (HSV). We are uniquely placed at an international level to build on this exciting finding to define the fundamental basis of such infection, including determining its functional impact on MAIT cells. We hypothesise that infection will lead to functional impairment of MAIT cell function that will have a profound impact on understanding the immune response to HSV, including in the co-infection setting, where HSV and MAIT cell activating bacterial infections are a common occurrence. You will be part of a multidisciplinary team with world-leading expertise in virology and/or MAIT cells. This project will include a range of techniques, including virus and mammalian cell culture, human blood work, multi-colour flow cytometry, cytokine profiling and other functional assays.
Project keywords	Virus, virology, herpesvirus, immunology, infection, T cells
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-65
Project title	The impact of human herpesviruses on the regulation of the non-classical MHC class I Like (MR1) molecule
Project synopsis	The non-classical MHC class I Like (MR1) molecule is the central component of the most recently discovered antigen presentation pathway. MR1 presents ligands derived from bacteria and fungi, to MAIT cells (a subset of T cells that recognises ligands presented by MR1). However, these ligands are not made by viruses, and so the field has largely ignored viruses in the context of MR1 antigen presentation. We challenged this paradigm and recently published in high-ranking journals, Cell Reports and the Journal of Infectious Diseases, the first evidence that viruses can profoundly inhibit MR1 expression and function. This project will build on this field-changing discovery, focusing on Herpes simplex virus (HSV) and its impact on MR1 expression and function. You will be part of a world-leading team of experts in this area, working with a range of techniques including virus and cell culture, flow cytometry, immunofluorescence staining, western blot, molecular detection approaches, and others.
Project keywords	Virus, virology, immune evasion, MHC, virus infection
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-222
Project title	Impact of human herpesvirus infection in transplantation
Project synopsis	Several human herpesviruses, especially human cytomegalovirus (HCMV), frequently cause significant disease following organ or stem cell transplantation. This is a consequence of reactivation of latent virus, present within the donor and/or recipient. Reactivation from latency results in newly replicating virus, which can cause a range of serious, often life-threatening complications, with the severity of virus reactivation from latency in these individuals broadly linked to the immune functioning of the host. However, the nature of the immune response when virus reactivates, including the types and number of various immune cells and related functions, has not been fully elucidated. This project will take advantage of newer technologies in immune cell profiling (eg mass cytometry), to define the nature of the immune cell subsets during virus reactivation in transplant recipients. You will join a team of researchers with unique expertise in such studies. The ultimate goal is to identify immune correlates of virus reactivation that will provide key diagnostic and/or prognostic information that will better inform intervention strategies to limit the impact of virus reactivation is transplant recipients.
Project keywords	human herpesvirus infection, virus reactivation, transplantation
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Megan Steain
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Auxiliary Supervisor 1	Margaret Sunde
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Project ID	2023S1-14
Project title	Firing up oncolytic vectors: viral based strategies to repurpose necroptosis
Project synopsis	Whilst the herpes simplex virus-1 (HSV-1)-based oncolytic vector T-VEC showed great promise in preclinical murine models, results in humans have been less successful. This may be due the differential nature of cell death induced by HSV-1 in murine versus human cells. In murine cells, HSV-1 actively triggers the highly inflammatory cell death pathway known as necroptosis, and activation of necroptosis in solid tumours has been shown to robustly activate systemic anti-tumour immunity. In contrast in human cells, HSV-1 actively inhibits necroptosis, and the motif responsible for this inhibition (known as a viral RHIM) is intact within TVEC. In this project you will engineer a modified HSV viral vector that activates necroptosis in human cells. A head-to-head comparison of the necroptosis-inducing vector with the original parental vector will be performed using cancer cell lines and ex vivo patient tumour samples. You will measure the ability of each vector to stimulate proinflammatory cytokine production and cell death in these samples.
Project keywords	Herpes simplex virus, cancer, inflammation, virus, cell death, immune response
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	John Rasko
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Project ID	2023S1-139
Project title	Investigating the therapeutic potential of a novel antiviral gene in innate immunity
Project synopsis	We have identified a novel antiviral gene, named it ZNF-MT. During infection, ZNF-MT activates the expression of dozens of innate immune genes. Pathogens have developed strategies to supress ZNF-MT to facilitate invasion and replication. In this proposal we will try to find a drug to re-activate the expression of ZNF-MT. To this aim, we will use both genetic approach and chemical library screening (e.g., Epigenetics Compound Library). We will also investigate how ZNF-MT activates the immune genes expression program. In this project, we will use a range of cell & molecular biology, immunology, biochemistry, and genetic engineering approaches. Techniques: Gene cloning, Stem cell culture, Western blotting, CRISPR/Cas9 genome editing, qRT-PCR, RNA-Seq, Mass spectrometry, Flow cytometry, Confocal microscopy
Project keywords	immunity, stem cells, epigenetic, gene editing, CRISPR/cas9, drug discovery, proteomics, RNA-Seq
Laboratory location	Centenary Institute (Camperdown)

Honours area	IMMU
Primary Supervisor	Joanne Reed
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Project ID	2023S1-151
Project title	Molecular characterisation of pathogenic factors in systemic amyloidosis
Project synopsis	Systemic amyloidosis is characterised by the overproduction of immunoglobulin light chains, which form insoluble aggregates and accumulate in the heart and kidneys. If untreated, systemic amyloidosis can cause tissue damage, organ failure and death. Diagnosing systemic amyloidosis can be challenging due to a similar clinical presentation to other amyloid diseases. However, distinguishing between amyloid diseases is important because distinct treatments are required. This project will use a variety of molecular and cellular techniques to express and analyse amyloid light chains isolated from patients with systemic amyloidosis. The goal is to identify unique molecular signatures that cause misfolding of immunoglobulin light chains. It is anticipated these molecular signatures will be utilised for accurate and early diagnosis of systemic amyloidosis
Project keywords	Disease pathology, molecular biology, immunoglobulin, amyloidosis, immunology
Laboratory location	Westmead Institute for Medical Research

Honours area	IMMU
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Project ID	2023S1-164
Project title	Endo-chip for the evaluation of novel anti-thrombotics in heparin induced thrombocytopenia (HIT)
Project synopsis	Heparin induced thrombocytopenia (HIT) is an immune reaction which develops in 5% of individuals exposed to the drug heparin. HIT causes severe thrombosis which may lead to limb gangrene and death. Patients with HIT develop antibodies to platelet factor 4, which activate platelets, neutrophils and monocytes by binding to their FcgRIIA receptor. There are still significant gaps in knowledge of the pathogenesis and treatment of HIT. Using an endothelial chip (Endo-chip), which simulates a human vessel, vascular thrombo-inflammation will be measured after exposure to antibody from patients with HIT and controls. The Endo-chip will be used to screen novel compounds, that we have developed, as potential treatments to prevent thrombotic complications in HIT.
Project keywords	heparin induced thrombocytopenia, HIT, platelet, antibody, thrombosis, endothelial cell, novel drugs
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	IMMU
Primary Supervisor	Camelia Quek
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Project ID	2023S1-165
Project title	Investigating individualised response and resistance in high-risk advanced melanoma
Project synopsis	The survival rates for patients with stage III melanoma have historically been poor. Recent advances in treatment with (neo)adjuvant immune checkpoint therapies that target cytotoxic T-lymphocyte-associated protein 4 and/or programmed cell death protein 1 pathways have demonstrated clinical benefits. However, the response objectives were not universal and a subset of melanoma patients still die from their disease. We hypothesise that the infiltration of immune subtypes are distinct in each treatment, and the tumour-reactive T cells are interacting with stroma components such as the fibroblast causing less engagement with the tumour cells. In order to dissect the complex tumour microenvironment to address our hypothesis, we will utilise single cell technologies such as the CODEX multiplex immunohistochemistry and sequencing at our laboratory and Single-cell/Cytometry Core Facilities located at Charles Perkins Centre. We anticipate that the outcomes will facilitate the design of molecularly informed diagnostics and biomarker development.
Project keywords	immunotherapy, melanoma, cancer, single cell, RNA, sequencing, imaging, immune therapies, drugs, genomics, transcriptomics, immunity, microenvironment
Laboratory location	Charles Perkins Centre (Camperdown)

Infectious Diseases Honours S1, 2023

Honours area	INFD
Primary Supervisor	Allison Abendroth
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Auxiliary Supervisor 1	Barry Slobedman
Auxiliary Supervisor 2	
Project ID	2023S1-212
Project title	Varicella Zoster Virus manipulation of human invariant NKT cells: Identification of a novel immune evasion strategy
Project synopsis	Human invariant NK T cells are an innate immune cell-type that function by detecting lipid antigens presented by the non-classical MHC molecule CD1d. Whilst very poorly understood, it is clear from clinical observations that this NKT cell/CD1d axis is very important in the control of varicella zoster virus (VZV) infection. This is because individuals with deficiencies in CD1d/NKT cells suffer from severe and sometimes fatal VZV infection. We have very recently discovered that VZV infection results in a profound downregulation of cell surface CD1d. This is the first evidence of VZV targeting this antigen presentation molecule and is consistent with the discovery of a novel immune evasion strategy. This project will build on this exciting new data to define the basis for VZV modulation of CD1d, including its functional consequences. You will work with a team of leaders in the field of virally encoded immune modulation. This project provides a student the opportunity to learn a variety of human virology and cell culture techniques including working with human blood cells, multi-colour flow cytometry and other immunological/cell biology techniques.
Project keywords	virus, virology, immune evasion, innate immune cells, NKT cells, immunology
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	INFD
Primary Supervisor	Allison Abendroth
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Project ID	2023S1-213
Project title	Herpesvirus disarming of Natural Killer (NK) cell recognition
Project synopsis	The human herpesviruses, herpes simplex virus type 1 (HSV-1) is a highly successful human pathogen and a master manipulator of the multiple arms of the host immune response. However, one area that is very poorly understood is the impact of HSV on natural killer (NK) cells. NK cells are innate cells that can selectively lyse virally infected cells after activating receptors on NK cells bind to their respective ligands. Two such ligands that play important roles in NK cell functionality are CD112 and CD155. We have very recently discovered that HSV-1 infection inhibits both CD112 and CD155, providing the first evidence of a novel immune evasion strategy encoded by this virus. This project will build on this discovery, by seeking to define the means by which HSV-1 is able to exert this immunomodulatory phenotype, including determining whether HSV-1 modulation of CD112 and/or CD115 will inhibit NK cell recognition/functionality. You will join a team of experts in virus encoded modulation of host immunity, and harness a number of techniques including viral culture, cell culture, flow cytometry and other immunological/cell biology techniques.
Project keywords	Virus, virology, herpesvirus, immunology, infection, NK cells, immune evasion
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	INFD
Primary Supervisor	Matthew Doyle
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Project ID	2023S1-59
Project title	Omp85 proteins as novel antibiotic targets against bacterial pathogens.
Project synopsis	The Omp85 superfamily of bacterial cell surface proteins are essential for bacterial survival. The aim of this project is to investigate diverse Omp85 family members as targets for antibiotic drug discovery. We will use membrane protein biochemistry and biophysical methods to isolate Omp85 proteins from E. coli and P. aeruginosa and assess their structure. These targets will be fed into state-of-the-art drug screening platforms to identify small molecule inhibitors. The practical benefits of this project will be to identify possible Omp85 inhibition mechanisms and to generate lead compounds that could be used as antibiotics to counter the rising global death toll from superbug infections. This work will also allow structures of inhibitor bound Omp85 proteins to be solved in subsequent projects.
Project keywords	Bacterial infectious diseases, antibiotics, drug discovery, molecular biology (expression construct design), protein engineering, membrane protein channels, nanodiscs.
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	INFD
Primary Supervisor	Matthew Doyle
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Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-60
Project title	How do Omp85 proteins function as protein transporters in bacterial pathogens?
Project synopsis	We will combine biochemistry, structural biology, protein tracking (in live bacteria), and protein engineering to investigate the molecular function of the Omp85 superfamily of membrane proteins (such as BamA and TamA). The aim of this project is to understand how Omp85 proteins transport polypeptides into/across the bacterial outer membrane. We will expand on our exciting finding that BamA can form a channel for protein export to the bacterial cell surface. These functions are essential for bacterial cell viability and for pathogens to cause disease. The information generated from this project will increase understanding of host-pathogen interactions and will support projects aiming to generate new antibiotics to counter the rising death toll from superbugs such as E. coli and P. aeruginosa.
Project keywords	Bacterial infectious diseases, membrane protein channels, molecular biology (gene knockouts and amino acid substitutions), tracking protein trafficking (within live cells), protein-protein interaction biochemistry (disulfide bond crosslinking), protein engineering.
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	INFD
Primary Supervisor	Tanya Golubchik
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Auxiliary Supervisor 1	Vitali Sintchenko
Auxiliary Supervisor 2	Rebecca Rockett
Project ID	2023S1-221
Project title	Simultaneous detection and genome sequencing of co-infecting pathogens from clinical samples
Project synopsis	Targeted metagenomics is a powerful technique that can detect and simultaneously sequence the genomes of several hundred viral and bacterial species in a single assay, and computational methods that make best use of this type of data are urgently needed. Targeted metagenomics enables surveillance of multiple circulating pathogens at the same time: for example, to examine co-circulation of SARS-CoV-2 and other respiratory viruses. We have an exciting program in targeted genomics, including developing a new comprehensive platform for mosquito-borne viruses such as Japanese encephalitis in NSW (COSMOS), studying overlapping transmission networks of co-circulating pathogens responsible for sexually-transmitted infections (STIs), as well as an established panel for surveillance of respiratory pathogens (Castanet). Students can choose a fully computational project, focusing on genome analysis and validation using machine learning to optimise pathogen diagnosis, or a combination of laboratory-based and computational work.
Project keywords	Targeted metagenomics, viruses, pathogens, pathogen genomics, machine learning, bioinformatics, mosquitos, encephalitis
Laboratory location	Sydney Institute for Infectious Diseases (Westmead)

Honours area	INFD
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-211
Project title	The impact of human herpesviruses on the regulation of the non-classical MHC class I Like (MR1) molecule
Project synopsis	The non-classical MHC class I Like (MR1) molecule is the central component of the most recently discovered antigen presentation pathway. MR1 presents ligands derived from bacteria and fungi, to MAIT cells (a subset of T cells that recognises ligands presented by MR1). However, these ligands are not made by viruses, and so the field has largely ignored viruses in the context of MR1 antigen presentation. We challenged this paradigm and recently published in high-ranking journals, Cell Reports and the Journal of Infectious Diseases, the first evidence that viruses can profoundly inhibit MR1 expression and function. This project will build on this field-changing discovery, focusing on Herpes simplex virus (HSV) and its impact on MR1 expression and function. You will be part of a world-leading team of experts in this area, working with a range of techniques including virus and cell culture, flow cytometry, immunofluorescence staining, western blot, molecular detection approaches, and others.
Project keywords	Virus, virology, immune evasion, MHC, virus infection
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	INFD
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-64
Project title	Herpesvirus infection of mucosal associated invariant T cells (MAIT) cells
Project synopsis	There has been burgeoning interest in the study of Mucosal Associated Invariant T cells (MAIT) cells due to the discovery that they play an important role in the control of a range of infections. However, the role and function of MAIT cells in the context of viral infection is an emerging area that remains poorly understood. We have recently made the novel discovery that MAIT cells are directly infectable with Herpes simplex virus (HSV). We are uniquely placed at an international level to build on this exciting finding to define the fundamental basis of such infection, including determining its functional impact on MAIT cells. We hypothesise that infection will lead to functional impairment of MAIT cell function that will have a profound impact on understanding the immune response to HSV, including in the co-infection setting, where HSV and MAIT cell activating bacterial infections are a common occurrence. You will be part of a multidisciplinary team with world-leading expertise in virology and/or MAIT cells. This project will include a range of techniques, including virus and mammalian cell culture, human blood work, multi-colour flow cytometry, cytokine profiling and other functional assays.
Project keywords	Virus, virology, herpesvirus, immunology, infection, T cells
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	INFD
Primary Supervisor	Barry Slobedman
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Auxiliary Supervisor 1	Allison Abendroth
Auxiliary Supervisor 2	
Project ID	2023S1-223
Project title	Impact of human herpesvirus infection in transplantation
Project synopsis	Several human herpesviruses, especially human cytomegalovirus (HCMV), frequently cause significant disease following organ or stem cell transplantation. This is a consequence of reactivation of latent virus, present within the donor and/or recipient. Reactivation from latency results in newly replicating virus, which can cause a range of serious, often life-threatening complications, with the severity of virus reactivation from latency in these individuals broadly linked to the immune functioning of the host. However, the nature of the immune response when virus reactivates, including the types and number of various immune cells and related functions, has not been fully elucidated. This project will take advantage of newer technologies in immune cell profiling (eg mass cytometry), to define the nature of the immune cell subsets during virus reactivation in transplant recipients. You will join a team of researchers with unique expertise in such studies. The ultimate goal is to identify immune correlates of virus reactivation that will provide key diagnostic and/or prognostic information that will better inform intervention strategies to limit the impact of virus reactivation is transplant recipients
Project keywords	human herpesvirus infection, virus reactivation, transplantation
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	INFD
Primary Supervisor	Sophie Stocker
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Auxiliary Supervisor 1	Johannes Alffenaar
Auxiliary Supervisor 2	
Project ID	2023S1-231
Project title	Optimising selection of antifungal therapy: Can we predict lack of voriconazole response?
Project synopsis	Antifungal agents are the first-line treatment for invasive fungal infections (IFI). The safe and effective use of voriconazole is problematic due to its highly variable pharmacokinetics and narrow therapeutic index. Thus, alternative antifungal agents are recommended for patients experiencing treatment failure or drug-related toxicity. This project aims to identify factors associated with the selection of alternative antifungal agents during voriconazole therapy. The findings will guide future prospective studies on patient outcomes with optimal precision dosing of antifungals. The student will conduct a retrospective audit of vorizonazole therapy at Westmead Hospital and St Vincent's Hospital, Sydney (1 May 2019 to 30 June 2022). Information on antifungal indication, patient demographics, voriconazole dosing, plasma voriconazole concentration, efficacy and toxicity outcomes will be obtained. Trough voriconazole concentrations will be predicted using Bayesian forecasting software. Data analysis will included multivariate regression. This project is based at Westmead Hospital and St Vincent's Hospital, Sydney.
Project keywords	voriconazole, precision dosing, clinical audit, modelling and simulation
Laboratory location	Westmead Hospital and St Vincent's Hospital

Medicinal Chemistry Honours S1, 2023

Honours area	MCHM
Primary Supervisor	Tara Christie
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Auxiliary Supervisor 1	Fabio Zanini
Auxiliary Supervisor 2	
Project ID	2023S1-194
Project title	Antivirals that inhibit translation
Project synopsis	Viruses are obligate parasites, meaning they are completely reliant on their host cell machinery for replication. Host factors hijacked during infection include the translation initiation machinery which synthesises viral proteins from viral RNA. This project will seek to uncover the molecular basis of antiviral compounds, including those that have been used to treat viral infections such as COVID-19, which have been reported to target the translation initiation machinery. You will purify recombinant proteins, perform biochemical assays, and determine the structures of antiviral-protein complexes using x-ray crystallography.
Project keywords	Biochemistry, structural biology, translation, protein synthesis, virus
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Tara Christie
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Auxiliary Supervisor 1	Fabio Zanini
Auxiliary Supervisor 2	
Project ID	2023S1-195
Project title	Understanding the molecular basis of an engineered ACE2 COVID-19 therapeutic
Project synopsis	SARS-CoV-2 infects cells via an interaction between the viral spike protein and the host cell-surface ACE2 receptor. The spike protein of the Omicron variant displays higher affinity towards ACE2 compared with previous strains, and escapes effective neutralisation from five monoclonal antibodies (mAbs) approved for the treatment of COVID-19. We hypothesise that a therapeutic modelled on the ACE2 protein itself might be advantageous to traditional mAbs as such molecules will be resistant to SARS-CoV-2 mutational escape. We have engineered an ACE2 therapeutic that not only displays increased affinity for SARS-CoV-2 spike protein variants, but also enhanced neutralisation capacity. This project will investigate the molecular basis of the interaction between our engineered ACE2 therapeutic and the SARS-CoV-2 spike protein, and will assess the affinity of this therapeutic against spike proteins from emerging COVID-19 variants.
Project keywords	Biochemistry, structural biology, COVID, virus, therapy
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Rachel Codd
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Auxiliary Supervisor 1	Todd Markham
Auxiliary Supervisor 2	
Project ID	2023S1-15
Project title	Modulating Drug Properties Through Deuteration
Project synopsis	The FDA approved the first deuterated drug Austedo in 2017. Compared to the hydrogen parent (two methoxy units), Austedo (two methoxy-d3 units) has attenuated metabolism, which halves dosing and improves patient compliance and outcomes. This landmark deuterium switch heralds the clinical potential of deuterium analogues. The iron chelator desferrioxamine B (DFOB) is used for patients with genetic blood disorders who need regular blood transfusions and develop secondary iron overload. The 15-min plasma half-life of DFOB necessitates a difficult-to-tolerate administration regimen, which reduces compliance. This project will synthesize (requirement/interest: organic chemistry) deuterated analogues of DFOB, and measure in vitro plasma half-life compared to DFOB. The project aims to deliver DFOB-d10 and per-deuterated DFOB-d41, as the most deuterated natural product on record.
Project keywords	medicinal chemistry, drug design, organic synthesis, NMR spectroscopy
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Rachel Codd
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Auxiliary Supervisor 1	Todd Markham
Auxiliary Supervisor 2	
Project ID	2023S1-198
Project title	Developing Technologies to Secure Sovereign Medicine Supply
Project synopsis	Australia has a stark reliance on imported medicines with over 90% coming from overseas. This vulnerability in our medicine supply chain translates to clinical vulnerabilities in maintaining Australian healthcare standards. We need to drive the development of new technologies and pathways to improve sovereign medicine security. We have shown a simple affinity purification method used in molecular biology laboratories worldwide can be pivoted to purify a range of clinical secondary bacterial metabolites (anticancer, antibacterial, iron overload) from fermentation mixtures. The method is simple, inexpensive, and aqueous-compatible, which supports sustainability. In this project (interest: biotechnology/pharmacology/biochemistry/microbiology) you will prepare a bespoke affinity matrix and evaluate its use in purifying an antibiotic on the WHO List of Essential Medicines directly from bacterial culture.
Project keywords	biotechnology, medicine production, analytical chemistry, chromatography
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Rachel Codd
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Auxiliary Supervisor 1	Todd Markham
Auxiliary Supervisor 2	
Project ID	2023S1-56
Project title	Using Enzymes to Make New Molecules
Project synopsis	When we conceive a new molecule to test as a drug or a compound with other function(s), we next plan its access. Chemical synthesis is a standard and useful pathway, although this can require multiple reactions/purification steps. It would be remarkable if we could harness the power of enzymes to generate new molecules and to screen these biocombinatorial pools of structurally diverse compounds for useful function. Our group has discovered an enzyme from a marine bacterium that catalyses amide-bond forming reactions using substrates with metal binding capacity. In this project (requirement/interest: pharmacology, chemical biology, biochemistry/molecular biology) you will use this enzyme with a mix-and-match substrate approach to generate a pool of metal binding compounds and establish a structure-metal selectivity relationship
Project keywords	biocombinatorial chemistry, metal chelators, structure-property relationship, drug design.
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Margaret Sunde
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Auxiliary Supervisor 1	Megan Steain
Auxiliary Supervisor 2	
Project ID	2023S1-207
Project title	Harnessing the programmed cell death pathway necroptosis for anticancer treatment
Project synopsis	RIPK3 is a key protein in the cell death pathway necroptosis. Modulation of necroptosis has been proposed as a therapeutic option for some cancers. Sequence differences between mouse and human RIPK3 make it difficult to interpret the impact of drugs that modulate necroptosis when preclinical testing uses mice. The ICP6 protein from HSV1 inhibits necroptosis in human cells to maintain infection but triggers it in murine cells. This project will identify the key molecular details of the RIPK3:ICP6 interaction, by comparing interactions between ICP6 and human and murine RIPK3. The proteins will be produced recombinantly and examined using biochemical and biophysical assays that probe the stability of the complexes. This study will contribute towards harnessing necroptosis for improved cancer treatments.
Project keywords	necroptosis, cell death, anti-tumour immunity, protein complexes
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Margaret Sunde
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Project ID	2023S1-208
Project title	Tau filament structures associated with repetitive head injury
Project synopsis	Chronic traumatic encephalopathy (CTE) is a neurodegenerative condition caused, at least in part, by exposure to repetitive head impacts. It has been identified in participants of sports such as boxing and football. The disease is defined by the deposition of hyperphosphorylated tau protein in neurons, around small blood vessels in the cerebral cortex. This project will involve preparation of tau filaments that are representative of CTE and Alzheimer's Disease pathology from recombinant protein. These will be screened to determine whether the molecular signature of CTE tau can be distinguished by fluorescent probes and a range of biochemical analyses. The identification of molecules specific for CTE- or AD-associated tau deposits would facilitate diagnosis and could pave the way for therapeutic intervention.
Project keywords	Tau, amyloid filaments, neurodegeneration
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Robert Vandenberg
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Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-202
Project title	Novel Mechanisms of Inhibition of Glycine Transport for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of novel inhibitors of glycine transporter 2 that show promise as analgesics for the treatment of neuropathic pain. You will investigate an intriguing observation that membrane cholesterol appears to modulate the mechanism of inhibition, which has implications for a wide range of drug discovery programs and understanding cell physiology. A range of projects can be designed around this idea and can include: 1. Site-directed mutagenesis studies to understand how the transporter responds to both inhibitor and cholesterol interactions; 2. Compare the activity of cholesterol with that of a series of steroids with the aim of identifying novel secondary modulators of glycine transport. Available for students in NEUR, PHSI, PCOL or MCHM Majors.
Project keywords	Drug Discovery, Chronic Pain, Glycine Transport, Membrane Lipids, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Robert Vandenberg
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Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-205
Project title	Stimulation of Glycine Receptors for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of lipid molecules that stimulate the activity of glycine receptors, which have the potential to be developed into analgesics for the treatment of chronic pain. In this project you will collaborate with computer scientists to identify drug-like molecules that mimic the activity of these novel lipids. Your role in this project will be to first screen the activity of the lipid mimics on glycine receptors using electrophysiological techniques to identify hit compounds for further development, second establish the pharmacodynamic parameters that define their mechanism of action; and if time permits identify the binding site for the compounds using mutagenesis and molecular modelling studies. Available for students in NEUR, CELL, PHSI, PCOL or MCHM Majors.
Project keywords	Glycine Receptors, Chronic Pain, Drug Discovery, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	MCHM
Primary Supervisor	Jingjing You
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Auxiliary Supervisor 1	Gerard Sutton
Auxiliary Supervisor 2	Sheng Hua
Project ID	2023S1-177
Project title	Effect of collagen on corneal repairing
Project synopsis	Collagen is a main matrix protein in cornea. In particularly, human collagen I made up 80% of corneal stromal protein. The details on how collagen interact with corneal stromal cells have been researched and indicated collagen as a scaffold can support cell growth. This project will look into the details on how exogenous collagen I can affect corneal wound healing. The techniques involved will be: tissue culturing, biomaterial fabrications, wound healing assays and electron microscopy. Facilities: Sydney Analytic Hub
Project keywords	Collagen, Fibroblast cells, Corneal cells
Laboratory location	Save Sight Institute, located at Sydney Eye Hospital

Honours area	MCHM
Primary Supervisor	Jingjing You
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Auxiliary Supervisor 1	Matthew Simunovic
Auxiliary Supervisor 2	
Project ID	2023S1-189
Project title	Investigation on the interaction between collagen and retinal pigment epithelial cells
Project synopsis	Retinal diseases are the key leading cause to blindness. Retinal pigment epithelial cells (RPE) play an important role in maintaining retinal health and in the various retinal diseases including retinal detachment and age-related macular degeneration. The goal of this project is to investigating retinal regeneration in relation to collagen. It also aims to test cell printing retinal layers. The student will learn constructing collagen based scaffold, monitoring cellular behaviours of RPE cells and conduct some pilot cell printing experiments.
Project keywords	RPE, bioengineering, collagen, retina, cell printing
Laboratory location	Save Sight Institute, located at Sydney Eye Hospital

Neuroscience Honours S1, 2023

Honours area	NEUR
Primary Supervisor	Karin Aubrey
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Auxiliary Supervisor 1	Yo Otsu
Auxiliary Supervisor 2	Neda Assareh
Project ID	2023S1-179
Project title	The neurobiology of pain
Project synopsis	Up to 20% of Australians live with chronic pain but current medications and treatments are only partially effective for about half of them. The Aubrey laboratory studies the neurobiology of pain and its associated behaviours. Although there is a robust framework for understanding pain circuits, the function and roles of specific cell types within these circuits are unknown, and there is a long way to go to reach the level of understanding needed to rationally develop effective new therapeutics to improve the lives of people living with pain. To bridge this gap, we use electrophysiological, opto- and chemogenetics, vector-mediated tracing, and behavioural approaches to understand the neural circuits that drive our responses to pain. We have one honours project available for semester 1, 2023. You will have the chance to carry out a behavioural project with immunohistochemistry. The possibility for an electrophysiology project exists for a highly motivated and interested candidate.
Project keywords	pain modulation, animal models, immunohistochemistry, electrophysiology
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	NEUR
Primary Supervisor	Paul Austin
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Auxiliary Supervisor 1	Andrew Harman
Auxiliary Supervisor 2	
Project ID	2023S1-1
Project title	Investigating peripheral immune activation in chronic pain conditions using mass cytometry and imaging mass cytometry
Project synopsis	Chronic pain is highly debilitating and affects up to 1 in 3 people during their lifetime. Current treatment options are limited, and people can suffer for years or decades. The immune system is increasingly understood to have a role in chronic pain pathogenesis. The project will use the latest time-of-flight mass cytometry technology to assess inflammation in skin biopsies and blood taken from chronic pain patients compared to healthy controls. Using mass cytometry, the student will measure up to 40 inflammatory markers at once. This is a huge leap forward compared to just a handful of markers used in older technology. Blood markers and skin images will be analysed using the latest computer algorithms to assess information from all 40 markers and to look for interactions between immune cells and peripheral nerve fibres. It is expected that inflammatory changes in the skin and blood will correlate with pain intensity. Therefore, findings from these analyses will provide the most detailed picture of immunological changes in chronic pain to date and are highly likely to identify chronic pain markers that can be used to diagnose, predict pain severity, and direct the search for new and effective treatments.
Project keywords	Chronic pain, mass cytometry, imaging mass cytometry
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Paul Austin
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Auxiliary Supervisor 1	Andrew Harman
Auxiliary Supervisor 2	
Project ID	2023S1-2
Project title	Exploring the anti-inflammatory effects of photobiomodulation in animal models of chronic nerve pain and childhood dementia
Project synopsis	In this project the student will explore the anti-inflammatory effects of photobiomodulation (PBM), the application of red and infra-red light to biological tissues. PBM has been shown to relieve pain and be neuroprotective, however the mechanism remains unclear. Therefore, this study aims to investigate the beneficial effects of PBM in rats following chronic nerve pain and/or in symptomatic MPS IIIA mice, a model of the childhood dementia Sanfilippo Syndrome. Post-mortem analysis in the chronic nerve pain model will investigate immune cell infiltration to the nerve and spinal cord, as well as blood inflammatory markers; in the MPS IIIA study analysis will assess neuronal and mitochondrial health; synapse formation and neuroinflammation. We anticipate this study will provide overwhelming evidence of the beneficial anti-inflammatory effects of PBM in the peripheral and central nervous systems. This will provide empirical evidence in support of the clinical application of PBM to treat chronic nerve pain and children with Sanfilippo syndrome
Project keywords	photobiomodulation, inflammation, pain, dementia
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Kay Double
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Auxiliary Supervisor 1	Ben Rowlands
Auxiliary Supervisor 2	
Project ID	2023S1-77
Project title	Developing a disease-modifying treatment for Parkinson disease
Project synopsis	We recently identified a new pathology in the brains of people with Parkinson disease, associated with neuronal death. We developed a novel mouse model that expresses this pathology associated with brain cell death. We are completing a project to test if treatment with a new drug in clinical trial in patients with Parkinson disease will reduce the formation of this novel proteinopathy. An Honours student will be involved in studying brain tissues from mice treated with this new drug to determine if drug treatment does indeed reduce the production of the toxic protein form. Methods include brain tissue sectioning, immunofluorescence staining, microscopy and quantifying abnormal proteins, as well as measuring metal levels in the brain. This project is expected to result in published outcomes and may contribute to the development of a disease-modify drug for Parkinson's disease.
Project keywords	neurodegenerative disease, Parkinson disease, drug treatment, disease-modifying, microscopy, immunofluorescence
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Kay Double
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Auxiliary Supervisor 1	Ben Rowlands
Auxiliary Supervisor 2	
Project ID	2023S1-80
Project title	Developing a PET imaging method for brain copper
Project synopsis	Several brain disorders, including amyotrophic lateral sclerosis, Parkinson's disease and Alzheimer's disease disrupt copper homeostasis, and clinical trials on the effectiveness of copper supplementation for these diseases are underway. We cannot directly measure copper in the living human brain, so the effectiveness of therapies for restoring CNS copper cannot be measured in patients. An Honours student will be involved in developing the PET-based method to image and quantify copper in the living brain of mice. This project is expected to result in published outcomes and may improve the safety and efficacy of treatment of disorders of central copper dyshomeostasis.
Project keywords	brain, PET imaging, copper, mouse model
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Eleanor Drummond
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Auxiliary Supervisor 1	Tomas Kavanagh
Auxiliary Supervisor 2	
Project ID	2023S1-33
Project title	Uncovering the Protein Changes That Drive Neuropathology Development in Frontotemporal Dementia
Project synopsis	This project aims to understand the protein changes in the human brain that drive the development of neuropathology in three subtypes of Frontotemporal Dementia – Progressive Supranuclear Palsy, Corticobasal Degeneration and Pick's Disease. You will analyse state-of-the-art mass spectrometry data detailing the protein changes in insoluble proteins in these three diseases (as these have the greatest potential as downstream drug targets). You will then perform validation and mechanistic studies on at least 3 of the most interesting proteins to determine how these proteins are driving the development of neuropathology in the unique types of frontotemporal dementia. To do this you will use techniques such as immunohistochemistry, Western blot, co-immunoprecipitation and cell culture. All experiments will be done using human tissue samples.
Project keywords	Frontotemporal Dementia, neurodegeneration, human brain, proteomics, neuropathology
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	YuHong Fu
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Auxiliary Supervisor 1	Tony Hsiao
Auxiliary Supervisor 2	Glenda Halliday
Project ID	2023S1-89
Project title	Glial involvement in the synucleinopathy
Project synopsis	Glia over numbers of neurons in the brain. These cells play essential roles in maintaining neuronal functions by providing energy, trophic factors, surveillance, and myelin sheath. Alpha-synuclein is a small protein encoded by SNCA, the firstly recognised risk gene associated with Parkinson's disease (PD). This protein is involved in numerous cellular functions. Despite the aggregated alpha-synuclein being a typical pathological feature of a spectrum of disorders (collectively called synucleinopathies, including PD), how glia are involved in this proteinopathy remains unknown. This research aims to understand the glial role in disease mechanisms and reveal their signature molecules. The potential technique includes cell culture, WB, and state-of-the-art histology, image analysis, and microscopy.
Project keywords	Alpha-Synuclein, Glia, Neurodegeneration
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Jennifer Gamble
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Auxiliary Supervisor 1	KaKa Ting
Auxiliary Supervisor 2	
Project ID	2023S1-82
Project title	Blood brain barrier changes in Alzheimer's Disease
Project synopsis	We have identified that the blood brain barrier is significantly disrupted even before other pathologies of Alzheimer's disease manifest. The changes result in vascular leak a known early marker of cognitive decline in humans. The project will investigate the molecular and functional changes in the vasculature that are induced by age and by soluble amyloid expression and the impact on plaque and tau formation and cognitive decline. The use of drugs to reverse the dysfunction will be tested for their effects on pathology. Techniques include: mouse models of AD, PCR, confocal microscopy imaging, Western blots, mouse brain dissection, sectioning, immunostaining
Project keywords	alzheimer's disease
Laboratory location	Centenary Institute (Camperdown)

Honours area	NEUR
Primary Supervisor	Claire Goldsbury
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Auxiliary Supervisor 1	Laura Piccio
Auxiliary Supervisor 2	
Project ID	2023S1-218
Project title	Microglia in multiple sclerosis
Project synopsis	Multiple sclerosis (MS) is a CNS chronic inflammatory autoimmune disease causing oligodendrocyte damage, demyelination and axonal loss and a major cause of disability in young adults. Therapies target immune-inflammatory responses, but none are capable of promoting CNS repair. TREM2 (triggering receptor expressed on myeloid cells-2) in microglia may be involved in activating myelin clearance activities, a crucial process to make way for re-myelination and repair [Cignarella F et al Acta Neuropathol 2020;140:513-534]. TREM2 is also expressed on infiltrating peripheral macrophages [Cantoni C et al Acta neuropathol 2015;129:429-447; Filipello F et al Neurobiol Dis 2022;165:105630]. This project involves characterisation of TREM2 on microglia/macrophages within acute-active, chronic-active and inactive MS lesions in human tissues, using confocal microscopy and image analysis. The work will help reveal the spatiotemporal role of TREM2 in promoting re-myelination and axonal protection in MS.
Project keywords	Microglia, macrophage, multiple sclerosis, central nervous system, TREM2, innate immunity
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Claire Goldsbury
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Auxiliary Supervisor 1	Laura Piccio
Auxiliary Supervisor 2	Monokesh Sen
Project ID	2023S1-220
Project title	Microglia in Alzheimer's disease
Project synopsis	Microglial cell activity and/or dysfunction is involved in the aetiology of Alzheimer's disease (AD), but how this works is still not understood. Polymorphisms in genes encoding components of innate immunity, that are expressed in myeloid and microglial cells, are linked to increased AD risk. One of these AD-linked genes encodes TREM2 (triggering receptor expressed on myeloid cells 2), and rare variants in this gene are linked to a 2 to 4 fold increased risk of AD. By characterising microglia in autopsy AD and control human brain sections, we found evidence that microglia are transiently activated in the evolution of AD plaque lesions at their earliest stages, but, in later stage lesions, microglial activation is dissipated or resolved (Paasila et al., 2020; Paasila et al., 2019; Davies et al., 2017). This work suggests that microglia activation may relate to a neuroprotective activity against early disease-triggering injury. This would be consistent with the genetic evidence that suggests partial loss of TREM2 function, potentially in microglia, contributes to AD risk. This honours project aims to take this work further by evaluating TREM2 distribution and its expression in microglial cells in early and late-stage AD lesions (Part 1). We hypothesise that we will see TREM2 upregulation at the earliest stages of AD lesion development. We will use immunofluorescence microscopy and image analysis to address this hypothesis. Importantly TREM2 regulation involves its shedding from the plasma membrane. Increased secreted sTREM2 is found in the CSF of AD patients (Ewers et al., 2020). In the second part of this project, we aim to characterise the nature of sTREM2 from cultured macrophages (Part 2). We hypothesise that TREM2 will be found associated with extracellular vesicles (EVs). Circulating EVs may be significant for systemic signalling aspects of sTREM relating to health and disease.
Project keywords	Microglia, Alzheimer Disease, central nervous system, innate immunity
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 2	Nathan Delang
Project ID	2023S1-36
Project title	Using advanced neuroimaging techniques to investigate the effects of soccer heading on the brain.
Project synopsis	Our team is conducting a clinical trial investigating the neural effects of subconcussive impacts in sport (namely, soccer heading). Briefly, our participants (N=15) (all healthy soccer players) complete two treatment sessions during which they perform a soccer heading or soccer kicking (control) task in a randomised, crossover design. We then collect blood samples, assess cognitive function, and use MRI to obtain sophisticated measures of brain structure, function, and chemistry (obtained using fMRI, DTI, MRS and ASL techniques). Our clinical trial is due to conclude in late-2022 and we invite an honour's student with an interest in neuroscience to analyse our DTI (diffusion tensor imaging) scans in order to determine whether soccer heading alters the brain's white and grey matter microstructure.
Project keywords	subconcussive impacts; soccer heading; sport; brain structure; magnetic resonance imaging; diffusion weighted imaging; neuroscience
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 1	Noemi Meylakh
Auxiliary Supervisor 2	
Project ID	2023S1-43
Project title	Brain imaging of placebo analgesia
Project synopsis	The perception of pain can be powerfully influenced by an individual's expectations and beliefs. For example, when an individual expects pain relief, an inert treatment can produce an analgesic response - i.e. placebo analgesia. While the phenomena of placebo analgesia has been well-documented, the basic circuitry underpinning their expression, in particular the circuits within the brainstem, remain largely undefined. This project will involve ultra-high field MRI techniques to determine underlying neural mechanisms associated with placebo analgesia in humans.
Project keywords	placebo, human brain imaging
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Kevin Keay
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Project ID	2023S1-100
Project title	TO WHAT EXTENT IS CHRONIC PAIN A LEARNED RESPONSE? INVESTIGATING THE NOCEBO EFFECT IN RATS WITH CHRONIC NEUROPATHIC PAIN
Project synopsis	Background: The experience of pain is multidimensional, resulting from complex interactions between one's physiological condition, psychological state and social circumstances. What's more, an individual's perception of pain can also be influenced by their prior experiences, their current context and their expectations of pain. For instance, during the development of chronic pain, an individual may learn associations between their pain and particular stimuli, activities or situations, and then experience heightened pain when they re-encounter these contexts (or avoid the context altogether in fear of exacerbating their pain). This situation describes what is now more commonly referred to as the 'nocebo effect'. Recent studies have demonstrated that these learned pain responses can be evoked in rodents as well, allowing for precise dissection of the neurobiological mechanisms that underlie this phenomenon, and forms the basis of this project. Aims: 1) To investigate to what extent the pain behaviours of neuropathically-injured rodents are due to prior learning and/or contextual expectations. 2) To identify the neural mechanisms that underlie this phenomenon and investigate potential methods to block this learning. Application: Identifying the neural mechanisms that underlie nocebo responses in chronic pain could allow for the development of novel treatments that block these harmful responses. This would significantly ease the psychological, social and economic burden of chronic pain in clinical populations. Significance: Chronic pain currently affects up to 20% of Australians. Its pathophysiology is still not well-understood. Identifying the neural mechanisms that underlie the development and maintenance of chronic pain is the first step in developing new therapies that effectively manage the disabling consequences of chronic pain.
Project keywords	Pain, chronic pain, learning, neuroanatomy, Immunohistochemistry, nocebo
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 1	James Kang
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Project ID	2023S1-51
Project title	CHARACTERISATION OF NEURONAL-GLIAL INTERACTIONS DURING THE TRANSITION TO CHRONIC PAIN.
Project synopsis	Chronic pain is a debilitating condition that is now categorized as a disease state that affects over 3 million Australians. Its pathophysiology is poorly understood and presents an important barrier for the development of effective treatment strategies. There is now strong evidence that suggest changes in the brain involving neuronal-glial interactions may underlie the development and maintenance of the chronic pain state. Human and preclinical studies have shown astrogliosis (astrocyte activation) occurs following a nerve injury and continues with the persistence of the pain. However, it remains to be elucidated whether astrogliosis during the initiation and maintenance of chronic pain may be the driving mechanism for changes in neural activity that results in the transition from acute to chronic pain states. Current pharmacological treatments for chronic pain focus primarily on the altered neural function in patients and have been largely ineffective with poor clinical outcomes. Targeting glial cells may provide an alternative therapeutic option. Aims: 1) To investigate the activation pattern of astrocytes in preclinical models of neuropathic pain using combinations of MRI/PET imaging, autoradiography and histological/immunohistological techniques. 2) Investigate neuronal-glial interactions during the transition from acute to chronic neuropathic pain in the pain pathways in a pre-clinical model of neuropathic pain. Application: The data from these experiments will form the basis for future in vivo PET/MRI imaging of the effects of pharmacological inactivation of astrocyte activation in the preclinical and clinical setting, which will allow for the real-time analysis of glial specific treatment options in chronic pain. Chronic pain is now categorized as a disease and affects over 3 million Australians. Its pathophysiology is not well-established which represents an important gap in the understanding of this disease and the exploration of effective therapies.
Project keywords	autoradiography, immunohistology, imaging, pain, chronic pain, neuroanatomy, astrocytes, glia
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
Primary Supervisor	Catherine Leamey
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Auxiliary Supervisor 1	Matthew Simunovic
Auxiliary Supervisor 2	
Project ID	2023S1-97
Project title	Restoration of vision in mouse models of blindness using optogenetics
Project synopsis	This project will make use of optogenetics approaches to restore vision to mice with retinal degeneration. While there is exciting evidence of improved retinal light responses in these mice, the impact on central visual pathways is not well understood. The study will assess how retinal degeneration and its restoration impact upon the organisation and function of the central visual pathway. State of the art optogenetic approaches will be combined with anatomical and functional assessment. The project will be performed in collaboration with Professor Matthew Simunovic from the Save Sight Institute and Drs Atomu Sawatari and Dario Protti from SoMS.
Project keywords	Optogenetics, retinal degeneration, neural plasticity
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	NEUR
Primary Supervisor	Noemi Meylakh
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Auxiliary Supervisor 2	
Project ID	2023S1-42
Project title	Neurobiology of spinal cord stimulation pain relief
Project synopsis	Current management strategies for chronic pain remain inadequate. One potentially effective treatment option is spinal cord stimulation (SCS). SCS is delivered via an implantable neurostimulator delivering electrical pulses via a lead to the dorsal aspect of the spinal cord. Whilst pain signals are thought to be inhibited at the level of the spinal cord, the exact mechanism by which SCS works remains unknown. Spinal/supraspinal mechanisms are potentially involved in SCS induced pain relief, including brainstem endogenous analgesic circuits. Determining neural mechanisms responsible for SCS may provide details as to how the brain modulates on-going neuropathic pain. This project will involve human brain imaging techniques to determine underlying neural mechanisms associated with pain relief during SCS in chronic back pain sufferers.
Project keywords	chronic pain, neural stimulation, brain imaging
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 2	
Project ID	2023S1-87
Project title	CRF-DA interactions and cognitive flexibility following chronic stress
Project synopsis	Chronic stress impairs cognitive processes such as cognitive flexibility, decision making and motivation. These impairments are associated with altered dopaminergic activity in the dorsal striatum. The project will use a combination of animal behavioural, immunohistochemistry and molecular techniques to investigate hemispheric differences in the interactions between the CRF system and the dopaminergic neurons of the substantia nigra pars compacta (SNpc), and how these differences alter information processing within the striatum, contributing to either vulnerability or resilience to stress. We will specifically investigate whether CRF activity in the SNpc following chronic stress leads to impairment in cognitive flexibility by altering the pattern of dopamine receptors activation in the dorsal striatum.
Project keywords	stress, neuroscience, dopamine, decision making, striatum
Laboratory location	UNSW, school of psychology

Honours area	NEUR
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Auxiliary Supervisor 2	Claire Goldsbury
Project ID	2023S1-217
Project title	Mechanisms of demyelination and remyelination in the central nervous system to model the human disease multiple sclerosis
Project synopsis	Multiple sclerosis is a complex disease of the central nervous system (CNS) where an inadequate remyelination resulted in progressive demyelination and neurodegeneration is observed. This lack of remyelination could be related to the inadequate phagocytosis by microglia. Study with Lysolecithin model, it is found that modulation of short chain fatty acids (SCFAs) receptor (Gpr109a) in microglia leads to the augmentation of phagocytosis and remyelination in aging mice. However, it is not known the role of SCFAs in cuprizone model, a model of CNS demyelination and remyelination. The current project will study the effects of Gpr109a on microglial cells in the cuprizone-induced demyelination model.
Project keywords	Multiple sclerosis, remyelination, central nervous system, preclinical models
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 2	Claire Goldsbury
Project ID	2023S1-219
Project title	Role of diet in the experimental model of multiple sclerosis
Project synopsis	Multiple sclerosis (MS) is a complex disease of the central nervous system due to a combination of genetic and environmental factors. Diet is a potential environmental factor that could be implicated in MS. Dr. Piccio's group has shown that intermittent fasting (IF) ameliorates experimental autoimmune encephalomyelitis (EAE), the main MS animal model. They have investigated several mechanisms, including changes in blood adipokines and in the gut microbiome, all leading to a reduction of inflammation. The project will study the effects of diet on immune cells, circulating metabolites or metabolites derived from the gut microbiota in the EAE model
Project keywords	Multiple sclerosis, autoimmunity, diet, central nervous system
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	NEUR
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Project ID	2023S1-98
Project title	Optogenetic restoration in a mouse model of macular degeneration : Assessing recovery of visual function
Project synopsis	Recent advances in the use of optogenetics to restore vision in mouse models of macular degeneration hold great promise. Our team is pioneering the expression of novel photo active channels in retina to drive visual function. Projects will be available to behaviourally assess visual recovery in transgenic animals that have been treated with these exciting constructs. Successful outcomes will provide valuable information for the development of novel therapies to treat this debilitating condition.
Project keywords	Macular Degeneration, Behavioural Analysis, Optogenetics, Vision, Visual Recovery
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	NEUR
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Auxiliary Supervisor 2	
Project ID	2023S1-199
Project title	Novel Mechanisms of Inhibition of Glycine Transport for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of novel inhibitors of glycine transporter 2 that show promise as analgesics for the treatment of neuropathic pain. You will investigate an intriguing observation that membrane cholesterol appears to modulate the mechanism of inhibition, which has implications for a wide range of drug discovery programs and understanding cell physiology. A range of projects can be designed around this idea and can include: 1. Site-directed mutagenesis studies to understand how the transporter responds to both inhibitor and cholesterol interactions; 2. Compare the activity of cholesterol with that of a series of steroids with the aim of identifying novel secondary modulators of glycine transport. Available for students in NEUR, PHSI, PCOL or MCHM Majors.
Project keywords	Drug Discovery, Chronic Pain, Glycine Transport, Membrane Lipids, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	NEUR
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Project ID	2023S1-203
Project title	Stimulation of Glycine Receptors for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of lipid molecules that stimulate the activity of glycine receptors, which have the potential to be developed into analgesics for the treatment of chronic pain. In this project you will collaborate with computer scientists to identify drug-like molecules that mimic the activity of these novel lipids. Your role in this project will be to first screen the activity of the lipid mimics on glycine receptors using electrophysiological techniques to identify hit compounds for further development, second establish the pharmacodynamic parameters that define their mechanism of action; and if time permits identify the binding site for the compounds using mutagenesis and molecular modelling studies. Available for students in NEUR, CELL, PHSI, PCOL or MCHM Majors.
Project keywords	Glycine Receptors, Chronic Pain, Drug Discovery, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Pathology Honours S1,2023

Honours area	PATH
Primary Supervisor	Charles Bailey
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Auxiliary Supervisor 2	
Project ID	2023S1-134
Project title	CTCF dysregulation and loss of cell polarity in epithelial cancers
Project synopsis	DNA binding by the tumour suppressor protein CTCF, an essential regulator of transcription and chromatin architecture, can be disrupted by somatic mutation leading to gene dysregulation. In epithelial cancers such as endometrial or pancreatic cancer this can lead to loss of cell polarity, invasion and metastasis. During CTCF mutation, the cytoskeletal remodeling protein ZNF185 and pro-metastasis factor S100A4 are upregulated, disrupting cell polarity. This project will quantify CTCF DNA binding, detect and visualise ZNF185 and S100A4 binding partners, and examine the alteration of cell polarity in 3D spheroids and organoid cultures of endometrial and pancreatic cancers. Techniques: recombinant DNA cloning, cell culture, Western blotting, CRISPR/Cas9 genome editing, ChIP, qRT-PCR, RNA-Seq, co-immunoprecipitation, mass spectrometry, flow cytometry, confocal microscopy, spheroid cultures
Project keywords	endometrial cancer, pancreatic cancer, tumour suppressor, transcriptional regulation, metastasis, mutation
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-135
Project title	Chromatin organisation and alternative splicing masterminded by CTCF
Project synopsis	CTCF protein is a master regulator of chromatin architecture and gene expression. CTCF co-ordinates the folding of DNA into chromatin loops within topologically associating domains. Alternative splicing is a complex biological process which enriches the complexity of transcriptomes and protein diversity. The interplay between chromatin architecture and alternative splicing has not been elucidated. In vitro and in vivo models from our lab have shown that CTCF contributes to transcriptomic complexity through directly and indirectly regulating alternative splicing. In this project, a robust in vitro alternative splicing model featuring CTCF-mediated chromatin looping will be interrogated using acute depletion of CTCF and mutagenesis studies. Techniques: DNA cloning, cell culture, Western blotting, CRISPR/Cas9, RNA-Seq, qRT-PCR, bioinformatics (RNA- and ChIP-Seq analysis, data visualisation)
Project keywords	Chromatin organisation and alternative splicing masterminded by CTCF
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-136
Project title	Modulating AAV host factors to improve gene therapy efficacy
Project synopsis	Adeno-associated virus (AAV) is widely used as a gene therapy vector due to its tissue-tropism and safety profile. Improved transduction efficiency of AAV vectors has been achieved by engineering capsids with higher affinity, cell specificity and increased resistance to neutralising antibodies. Increasing AAV-mediated therapeutic efficacy by modulating host entry factors remains unexplored. KIAA0319L (aka AAV receptor (AAVR)) is an essential host entry factor for most AAV serotypes. We have identified other factors dependent and independent of KIAA0319L that also regulate AAV uptake. Molecular genetic and cell biological techniques will be used to examine AAV uptake when host factor expression is modulated. Techniques: DNA cloning, cell culture, Western blotting, CRISPR/Cas9, virus transductions, RNA-Seq, co-immunoprecipitation, mass spectrometry, flow cytometry, confocal microscopy
Project keywords	gene therapy, viral entry, host factor
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-137
Project title	Understanding the interplay between miRNAs and alternative splicing regulation using genomics
Project synopsis	Post-transcriptional gene regulation can occur via intron retention (IR), a type of alternate splicing leading to nonsense-mediated decay; and microRNA (miRNA) binding to the 3'UTR of messenger RNA (mRNA). In different cancers, the burden of IR can increase, suggesting a potential trigger for uncontrolled cell proliferation. We have previously found that mRNAs with retained introns (RI) are enriched with miRNA binding sites. However, the functional consequence of miRNA binding to RI is not known yet. To investigate further, we hypothesise a novel post-transcriptional gene regulatory mechanism via RI-miRNA interplay. In this project, we propose a systemic analysis of RI-miRNA interplay through integration of publicly available genomics data. Techniques: Sequence alignment, R-Bioconductor, R-tidyverse, R-markdown.
Project keywords	bioinformatics, transcriptional regulation, alternative splicing
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-131
Project title	Identifying unreliable cancer research papers and their contributions to future research
Project synopsis	Incorrect published research wastes resources, slows research translation, and reduces trust in science. We have previously described problematic human gene function publications that feature wrongly identified nucleotide sequence reagents. Based on our previous results, we worry that many problematic human research papers remain to be discovered. This project will identify problematic cancer research papers by screening for known and emerging features of problematic papers, and analysing papers that cite problematic papers. The project involves extracting different types of publication data, fact-checking nucleotide sequence identities, constructing and analysing citation networks and performing data and statistics analyses. This project is based at the NSW Health Statewide Biobank at Camperdown but can also be completed remotely as no laboratory facilities are required
Project keywords	Cancer research, human genes, sequence analysis, fact-checking
Laboratory location	NSW Health Statewide Biobank, Missenden Road, Camperdown

Honours area	PATH
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Project ID	2023S1-9
Project title	Can exogenous myeloperoxidase precipitate synovial injury in models of rheumatoid arthritis?
Project synopsis	Rheumatoid Arthritis results in synovial thickening and cartilage damage in response to an autoimmune response to synovial antigens. The process is amplified by the citrullination of synovial antigens which are thought to be an essential contributor to the rheumatoid arthritis (RA) disease pathogenesis. Neutrophil derived myeloperoxidase is thought to mediate citrullination and in this project we will use a mice air-pouch model of rheumatoid arthritis to determine if exogenous myeloperoxidase alone could induce citrullination of synovial-like antigens while intervening with myeloperoxidase inhibitors. Outcomes of this project could pave the way to a deeper understanding of the pathogenesis of RA, while identifying myeloperoxidase as novel key target for future therapies.
Project keywords	Rheumatoid Arthritis, myeloperoxidase, inflammation,
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
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Project ID	2023S1-159
Project title	Disulphide-mediated regulation of thrombosis in cardiovascular diseases
Project synopsis	Cardiovascular disease is the leading cause of death worldwide accounting for 31% of all deaths per year. Thrombosis, or clot formation in the arteries, obstructs blood flow and underlies the pathology of ischemic heart disease, ischemic stroke, and venous thromboembolism. For decades, the blood coagulation cascade has been known to be controlled by a series of proteolytic events converting inactive clotting factors into their active forms. We have discovered that blood coagulation is also regulated by the formation or cleavage of disulphide bonds in platelet receptors and clotting factors. Disulphide bonds are covalent bonds that form between two cysteine residues. They are sensitive to redox reactions and also to shear force in the circulation. Using cell-based assays, flow cytometry, fluorescence microscopy and mass spectrometry, this project will investigate how disulphide bonds control the functions of platelet receptors and clotting factors in blood coagulation. Elucidation of disulphide-mediated mechanisms will enable the design of novel therapeutics to target thrombosis to reduce the risks of developing cardiovascular diseases.
Project keywords	Proteomics, redox, thrombosis, stroke, proteomics, cardiovascular disease
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
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Project ID	2023S1-4
Project title	Targeting the Cancer Clock: Role of Hypoxia in Regulating Brain Tumour Circadian Rhythms
Project synopsis	Circadian rhythms regulate sleep, metabolism and cell division, which have a 24-hour pattern. Rhythmicity is generated by transcription factors in cells. Brain tumours often have disrupted circadian rhythms, and animal studies have shown that disrupted rhythms enhance tumour growth. It isn't clear how these rhythms are disrupted. Low oxygen environments are a hallmark of solid tumours. Our hypothesis is that hypoxia disrupts rhythms by activating a transcription factor known as Hypoxia Inducible Factor (HIF). Little is known about how HIF and circadian rhythms might interact in tumours. This project uses hypoxia models to study circadian rhythms in brain tumours. Students will investigate the molecular biology related to HIF, the molecular clock (CLOCK/BMAL1) and test anti-cancer drugs that inhibit these pathways.
Project keywords	gene expression, hypoxia, circadian rhythms, cancer biology, sleep, molecular clock
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
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Auxiliary Supervisor 2	John O'Sullivan
Project ID	2023S1-8
Project title	Hypoxia and the heart
Project synopsis	Heart failure is debilitating and affects more than one million Australians. Half of all heart failure patients have normal contraction, but impaired relaxation. This condition is known as “HFpEF”. There are no effective therapies for HFpEF and we lack a clear understanding of how it develops. A common risk factor is obstructive sleep apnoea (OSA). OSA is common and is characterised by periods of intermittent hypoxia (low oxygen) in the blood and heart. The goal of this project is to better understand how OSA and hypoxia affect the heart and contribute to cardiovascular disease, like heart failure. Cell pathways of interest include those involved in oxygen sensing (HIF, ADO and KDMs). Techniques include metabolomics, immunohistochemistry, western blotting, qRT-PCR.
Project keywords	hypoxia, sleep apnea, cardiovascular disease, heart, oxygen
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Anthony Don
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Project ID	2023S1-13
Project title	Understanding the greatest genetic risk factor for Alzheimer's disease
Project synopsis	Synopsis: Inheriting the e4 allele of the APOE gene is by far the greatest genetic risk factor for Alzheimer's disease, whereas the e2 allele is protective. APOE encodes the lipid carrier protein Apolipoprotein E. This project will use advanced mass spectrometry, mouse and cell culture models to determine the cellular and molecular basis for the effect of APOE genotype on Alzheimer's disease risk, which is one of the most important questions in current dementia research. My team's current work suggests that the e4 allele impairs lipid turnover in the ageing brain. Aims: 1. Determine how ApoE affects brain lipid turnover in vivo 2. Determine whether ApoE is necessary for microglial lipid phagocytosis Techniques: Cell culture, genetic mouse models, metabolomics, mass spectrometry. Keywords: Dementia, Alzheimer's disease, glia, mass spectrometry, metabolomics, lipids, biochemistry
Project keywords	dementia, Alzheimer's disease, glia, mass spectrometry, metabolomics, lipids, biochemistry, myelin
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
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Project ID	2023S1-149
Project title	Proteases in the Pathogenesis of Chronic Liver Injury and Cancer
Project synopsis	Primary liver cancer and is the 3rd leading cause of cancer related deaths. We are addressing the urgent need to develop a greater understanding of pathogenesis for improved therapeutics. The pathogenesis of chronic liver injury and cancer is driven by chronic cell death and proliferation and inflammation. Cirrhosis generally precedes cancer in the liver. Proteases are important in cancer pathogenesis and suit drug development. We primarily study fibroblast activation protein (FAP) and DPP9 as proteases associated with cancer pathogenesis. I discuss with each student their interests, skills and aspirations in order to design a suitable project within this field. TRAINING: Mouse genetics, immunohistochemistry, flow cytometry, qPCR, immunoblotting, protease assays, ELISA and confocal microscopy.
Project keywords	cirrhosis, NASH, cancer, liver, DPP4, fibrosis, mouse, human
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-174
Project title	Circulating Fibroblast Activating Protein as a Diagnostic Tool in Liver Disease
Project synopsis	Non-alcoholic fatty liver disease is poised to become one of the biggest contributors to liver transplants in the next decade. Chronic lipid accumulation activates fibrotic pathways leading to fibrosis. Liver fibrosis is a crucial predictor of progression towards cirrhosis and cancer, so its assessment is critical in determining treatment eligibility and in risk-stratification. Our lab has a keen interest in the Dipeptidyl Peptidase family of enzymes which includes fibroblast activated protein. A suitable project will be designed around the candidate students' interests, skills and aspirations with a focus on the potential of FAP as a biomarker for liver disease progression. Training: Cell culture/transfection; enzymatic assays; immunohistochemistry; flow cytometry; qPCR
Project keywords	Non-alcholic fatty liver disease, NAFLD, liver fibrosis, liver cancer, cirrhosis, non-alcoholic hepatosteatosis, NASH
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
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Project ID	2023S1-91
Project title	Vibrational spectroscopic examination of the immunomodulatory properties of diverse metals
Project synopsis	Nickel and possibly chromium have recently been identified as virulence factors in pathogenic fungi, bacteria and parasites, such as those in malaria. This project will investigate the effects of chromium, vanadium or nickel loading of immune cells. Specifically, monocytes and endothelial cells will be used to model bacterial-induced inflammation, Th1-type or Th2-type inflammation and the changes triggered by metals in lipids, proteins, nucleic acids and carbohydrates will be analysed using various modalities of vibrational spectroscopies, which are also sensitive to biomolecular conformational changes. These techniques will also allow us to define metal-induced changes in extracellular vesicles released from these immune cells. Research questions: 1. how can exogenous metals (ingested through food, dietary supplements, and environmental exposure) modulate the biomolecular content of immune cells? 2. how do diverse metals change the biomolecular content in subtypes of extracellular vesicles, namely exosomes, microvesicles and apoptotic bodies?
Project keywords	inflammation, metals, extracellular vesicles, vibrational spectroscopies
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	PATH
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Project ID	2023S1-86
Project title	Investigating the role of Extracellular Vesicles in Malignant Mesothelioma Tumor Microenvironment
Project synopsis	Although Mesothelioma aetiology is well known, therapeutic success with this disease has been unsatisfactory; thus, there is an urgency in understanding the mechanisms that determine the rate of mesothelioma progression and invasion to neighbouring organs, so that they can be targeted with novel preventive therapeutic strategies contributing to the field of precision medicine. Extracellular vesicles (EV) are membrane-enclosed vesicles that are released from all cell types and can transfer information to other cells, thereby influencing their function. In this study we hypothesized that mesothelioma tumour derived EV play a pivotal role in cell-cell communication in the tumour microenvironment including the modulation of the lung fibroblast function, contributing to development and progression of mesothelioma. This project is a great opportunity for a driven student who would like to tackle a very novel and fast growing area, and learn techniques such as cell culture, EV isolation, microscopy, western blot analysis, 3D bio-printer and vibrational spectroscopy.
Project keywords	Extracellular vesicles, Exosomes, Cancer, Mesothelioma, Immunotherapy, Fibroblast, Biomarker, tumour microenvironment
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	PATH
Primary Supervisor	Zaklina Kovacevic
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Auxiliary Supervisor 1	Sumit Sahni
Auxiliary Supervisor 2	
Project ID	2023S1-83
Project title	Exploiting metabolic vulnerabilities in pancreatic cancer
Project synopsis	Pancreatic cancer (PC) cells have re-wired metabolism that fuels their growth under hypoxic and nutrient-depleted conditions. Underpinning this metabolic re-programming are the surrounding cancer associated fibroblasts (CAFs), which directly interact with PC cells to produce metabolites that fuel PC progression and development of chemotherapy resistance. This project will comprehensively investigate a library of clinically validated metabolism-targeting agents and their effect on the metabolic cross-talk between PC cells and CAFs using in vitro 3D PC/CAF co-culture spheroids. Top performing agents will be validated using human PC organoids and their potential synergy with current PC chemotherapies evaluated under normal and hypoxic conditions. This important pre-clinical assessment will unveil new molecular vulnerabilities that can be targeted to enhance efficacy of current PC chemotherapies.
Project keywords	Pancreatic cancer, tumour microenvironment, metabolism
Laboratory location	Medical Foundation Building (Camperdown)

Honours area	PATH
Primary Supervisor	Danqing Min
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Auxiliary Supervisor 1	Stephen Twigg
Auxiliary Supervisor 2	
Project ID	2023S1-121
Project title	Macrophage polarization in diabetes - possible role in delayed wound healing
Project synopsis	Migration of monocytes from the circulation followed by their subsequent accumulation in tissue as differentiated macrophages is a process thought to be important in many diabetes complications such as foot ulcer. This Honours project is to investigate the effects of diabetes environments on macrophage polarization and whether the changes of macrophage profile contribute to pathophysiology of delayed wound healing in diabetes. This project will be carried out in association with a team of enthusiastic and experienced scientists and clinicians and will involve studying the macrophage profiles by flow cytometry, cell migration by live-cell imaging and the regulation pathways by Western blot and real time qRT-PCR.
Project keywords	diabetes, wound healing, immunity, inflammation
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Mark Molloy
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Auxiliary Supervisor 1	Jun Li
Auxiliary Supervisor 2	
Project ID	2023S1-40
Project title	Targeting DNA repair in colorectal cancer
Project synopsis	We have discovered that some colorectal cancers with high mutational burdens are associated with defects in repair of double-strand DNA breaks. We hypothesise that these tumours would be responsive to chemotherapy which can be enhanced with the use of PARP inhibitor drugs. This study will investigate combined use of these drugs in CRC cells where homologous recombination repair genes have been disabled. Techniques used include in vitro cell assays, gene silencing, relevant functional assays and proteomic mass spectrometry.
Project keywords	colorectal cancer, DNA repair, proteomics, drug therapy
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PATH
Primary Supervisor	Mark Molloy
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Auxiliary Supervisor 1	Jun Li
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Project ID	2023S1-41
Project title	Understanding bowel cancer recurrence
Project synopsis	Early stages of colorectal cancer (CRC) are mostly curative with surgery. However, 10-15% of patients with early disease will recur with distant metastasis within 3 years of their primary surgery. This project seeks to discover proteins in primary CRC that predict for recurrence. Proteins will be extracted from formalin-fixed tumour sections using laser microdissection from a CRC patient cohort with recurrence and matched no-recurrence specimens. Mass spectrometry proteomics will be used to identify and quantify proteins using the Kolling Institute core research facility. Functional significance of dysregulated proteins will be assessed using gene silencing and in vitro assays.
Project keywords	bowel cancer, metastasis, proteomics
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PATH
Primary Supervisor	Lenka Munoz
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Auxiliary Supervisor 1	George Joun
Auxiliary Supervisor 2	
Project ID	2023S1-31
Project title	Investigating mechanisms maintaining drug-tolerant persister cells in glioblastoma
Project synopsis	Glioblastoma is a fatal brain tumour, with no effective therapy. We have developed novel drugs that potently kill glioblastoma cells and are now in preclinical development. However, glioblastomas are known to recur even after a robust initial response to therapy. We discovered that whilst our drugs killed the majority of glioblastoma cells, a small population of drug-tolerant cells known as persisters survived. Histone proteomics and whole-genome RNASeq identified mechanisms maintaining persister cells. In this project, cellular/molecular biology as well as pharmacological approaches will be employed to interrogate the pathological mechanisms maintaining persister cells in glioblastoma. This project will lead to the identification of improved therapies against glioblastoma and will be completed in the state-of-the-art research facilities at the Charles Perkins Centre.
Project keywords	glioblastoma, cell signalling, molecular mechanism, drug tolerance, cancer dormancy
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Freda Passam
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Auxiliary Supervisor 1	Mark Larance
Auxiliary Supervisor 2	John O' Sullivan
Project ID	2023S1-163
Project title	Discovery of new platelet targets to improve the management of coronary artery disease
Project synopsis	Only 1 in 4 patients who have suffered from a heart attack will receive long term protection with available anti-platelet treatments. There is a need to find new targets for monitoring and treating patients after their first event. Our labs have developed the first of its kind multi-omic platform to identify molecular targets/pathways that cause persistent platelet activity and recurrence of coronary artery ischemic events. Complete platelet profiling (proteome, metabolome, transcriptome) will be performed in parallel with standard clinico-laboratory assessment in individuals after a first ischemic event. We will identify platelet molecular targets associated with systemic inflammation and recurrent events which can be targeted to improve the management of coronary artery disease.
Project keywords	coronary artery disease, cardiovascular event, heat attack, platelets, proteomics, metabolomics, transcriptomics
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	John Rasko
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Auxiliary Supervisor 1	Alex Wong
Auxiliary Supervisor 2	
Project ID	2023S1-138
Project title	The role of splicing factor TRA2B in acute myeloid leukaemia
Project synopsis	Acute myeloid leukaemia (AML) is a severe blood cancer affecting more than 1,000 new Australians each year. Our analysis of AML patient RNAseq data shows transformer 2 beta homolog (TRA2B) is a splicing factor associated with poor prognosis. However, little is known as to how TRA2B-associated alternative splicing contributes to AML. This project will identify the alternative splicing signature associated with TRA2B by performing TRA2B shRNA knockdown in the AML cell line, MOLM-13, followed by RNA sequencing. Leukaemia-relevant known or novel splicing events will be experimentally validated using RT-qPCR, Western blot, flow cytometry (where applicable) and mass spectrometry. Characterising the TRA2B splicing signature will assist in identifying novel splicing-related prognostic markers and potential therapeutic targets for this deadly disorder.
Project keywords	acute myeloid leukaemia, alternative splicing, intron retention, RNA sequencing, bioinformatics
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	John Rasko
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Project ID	2023S1-140
Project title	Gene therapy with genetically modified adeno-associated viruses
Project synopsis	There are over 6,500 genetic diseases without a cure. Gene therapy with adeno-associated viruses (AAV) is a potential curative option for patients with these rare genetic diseases. Our group has championed AAV-based gene therapy in Australia over the past two decades culminating in dozens of life-saving clinical trials. This project aims to better characterise AAV as a virus as well as a gene therapy vector at the molecular level. We will apply CRISPR-based genome editing tools to understand how AAVs serotypes interact differently with same host cells. We have several projects aimed at deciphering AAV host-pathogen interactions. This honours project will be a part of an already ongoing study and will directly contribute to research publication(s). Techniques: Cell Culture, CRISPR, Cloning, Western Blotting, Flow cytometry, Immunofluorescence, qRT-PCR, DNA/RNA seq
Project keywords	Gene therapy, CRISPR screens, Adeno-associated virus, host-pathogen interactions
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Babak Sarrafpour
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Auxiliary Supervisor 1	Jinlong Gao
Auxiliary Supervisor 2	Yogambha Ramaswamy
Project ID	2023S1-224
Project title	The effect of mechanical stiffness of the culture environment on bacterial adhesion, proliferation and acid production
Project synopsis	Periodontal disease and caries are both important and prevalent dental diseases in both developed and developing countries. Adhesion of the bacterial biofilm, resistance of the biofilm to mechanical abrasion, and mechanical penetration of biofilms into periodontal pockets, are influenced by mechanical stiffness of plaque. While mechanical stiffness is a visibly important property of plaque, the effects of this on bacterial adhesion, proliferation, death and acid production are not well known. Given the importance of bacterial plaque in dental disease, we consider it important to explore the biological responsiveness of bacteria to stiffness. We believe this can provide insights into the mechanobiological role of dental plaque and dental disease, to eventually lead to the development of new and effective and targeted therapies that operate through varying mechanical plaque properties.
Project keywords	Dental plaque, Oral microbes, mechanical stiffness
Laboratory location	Westmead Centre for Oral Health and its associated Institute of Dental Research

Honours area	PATH
Primary Supervisor	Simone Schoenwaelder
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Auxiliary Supervisor 1	Shaun Jackson
Auxiliary Supervisor 2	
Project ID	2023S1-125
Project title	Development of novel antiplatelet and anticoagulant drugs for the treatment of stroke
Project synopsis	Acute stroke requires the prompt re-opening of occluded blood vessels to minimise tissue death - typically achieved through delivery of fibrinolytic agents modelled on tissue-type plasminogen activator (t-PA). Despite the significant burden stroke has on the community, progress in the management of stroke continues to be unsatisfactory, with only one clinically approved thrombolytic agent for IS therapy. We have identified novel antithrombotic drug that are highly effective at promoting and facilitating thrombus dissolution and complete vascular reperfusion, without markedly increasing tail bleeding times. In this project, we will examine the safety and effectiveness of either a novel antiplatelet or novel anticoagulant, for their ability to facilitate reopening of the blood vessel and examine its impact on end-organ damage, particularly in the stroke context. These studies will not only provide important insight into our understanding of blood clot formation but may also lead to new approaches to regulate the size and stability of blood clots forming in the body, providing major clinical benefit in the delivery of thrombolytic therapy (blood clot removal).
Project keywords	Ischaemic stroke, adjunct thrombolysis, novel antithrombotics
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Richard Scolyer
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Project ID	2023S1-157
Project title	Characterisation of spatial and temporal patterns of disease progression in melanoma patients with a history of in-transit metastases
Project synopsis	In-transit metastasis (ITM) is a type of metastasis unique to cutaneous melanoma. While surgical removal is the first line of treatment for patients with ITM, many are treated with immune checkpoint inhibitor (ICI) therapies. In this project the student will characterise the association between anatomical patterns of disease, response to treatment and survival outcomes in patients with a history of ITM treated with first-line surgery or ICI. The student will have access to the largest clinical database worldwide of melanoma patients at Melanoma Institute Australia, Charles Perkins Centre, University of Sydney. The student will utilise advanced statistical techniques and biostatistical methods to identify patients with distinct patterns of disease progression that associate with response and survival.
Project keywords	cancer, solid cancer, melanoma, computational analysis, metastasis, cancer progression, cancer response, survival, pathological factor, immunotherapy
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Greg Sutherland
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Auxiliary Supervisor 1	Markus Hofer
Auxiliary Supervisor 2	James Willmott
Project ID	2023S1-38
Project title	Molecular correlates of Alzheimer's disease neuropathology
Project synopsis	This will be a combination wet and dry lab project. My lab produces quantitative data from immunohistochemistry (multiplex) examination of post mortem human brain tissue. This data is generated from multiple regions across individuals with and without dementia. We use this data in correlation analysis with RNA-seq data generated from the other side of the brain (frozen tissue). The idea is to understand the RNA-seq data better by having information of relative density of cell and their subtypes, as well as degree of AD pathology. The endgame is to find the earliest pathogenic clues for AD, that can serve as targets for new therapeutics.
Project keywords	Alzheimer's disease, brain, genomics, neuropathology
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Greg Sutherland
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Auxiliary Supervisor 1	Makus Hofer
Auxiliary Supervisor 2	James Willmott
Project ID	2023S1-39
Project title	Molecular correlates of alcohol-related brain injury
Project synopsis	This will be a combination wet and dry lab project. My lab produces quantitative data from immunohistochemistry (multiplex) examination of post-mortem human brain tissue. Alcohol-related brain injury manifests as widespread white matter loss and occasional neuron loss in specific regions. We use multiplex staining and image analysis to generate data on cell types, cell and sub-cellular organelle density. This data is used to understand RNA-seq data generated from the opposite hemisphere. At present how chronic alcohol cause the pathology seen is unknown. THis study is trying to understand these mechanisms better, towards new therapeutics to halt or reverse alcohol-related brain injury.
Project keywords	brain, alcohol-induce injury, neuropathology, transcriptomics
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Jessamy Tiffen
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Auxiliary Supervisor 1	Justin Wong
Auxiliary Supervisor 2	Cindy Tseng
Project ID	2023S1-144
Project title	Why are men more likely to die from cancer compared to women? A study of X-linked epigenetic regulators in melanoma.
Project synopsis	Background: Men are more than twice as likely to die from melanoma compared to women. This project proposes genes located on sex chromosomes may explain differences in the ability to combat cancer between males and females. The Project: has identified new X-linked epigenetic regulators that escape inactivation and are more highly expressed in women compared to men. Many are involved in immune responses but the mechanisms of how they may protect females against cancer remains a mystery. You will explore how gain or loss of genes encoding these regulators in melanoma cells may lead to worse disease in males compared to females. Techniques: Cell culture, gene editing, western blotting, PCR, RNA-seq, cell biology growth assays (proliferation, cell cycle, colony formation).
Project keywords	Cancer, Melanoma, Epigenetics, Histone modifiers, Chromatin remodelers, Gene editing, sex differences, Immuno oncology
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Jessamy Tiffen
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Auxiliary Supervisor 1	Justin Wong
Auxiliary Supervisor 2	Cindy Tseng
Project ID	2023S1-145
Project title	Identifying epigenetic drivers of drug resistant melanoma.
Project synopsis	Background: Targeted therapy with the use of inhibitors against BRAF mutant melanoma revolutionised treatment, however, the majority of patients will relapse. New drugs that target epigenetic regulators are promising therapeutic targets in treatment resistant melanoma. The Project: We are performing a high throughput drug screen of over 700 different compounds that target epigenetic regulators. These drugs will be tested in our unique patient derived melanoma cell lines acquired prior to and following the development of BRAF inhibitor resistance. You will validate our top 'hits' by gene editing and additional drug studies to explore how disruption of epigenetic regulation can kill drug resistant melanoma. Techniques: Cell culture, drug studies, gene editing, western blotting, PCR, RNA-seq, cell biology growth assays.
Project keywords	Cancer, Melanoma, Epigenetics, Treatment resistance, Gene editing, Targeted therapy, Drug screening
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Jessamy Tiffen
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Auxiliary Supervisor 1	Justin Wong
Auxiliary Supervisor 2	Cindy Tseng
Project ID	2023S1-146
Project title	Understanding the role of epigenetic mediated dedifferentiation in melanoma
Project synopsis	Background: Melanomas do not consist of cells in one state, but rather four distinct subtypes based on differentiation status. This ranges from the least differentiated or stem-like through to the most differentiated (closest to normal melanocytes). This extraordinary plasticity allows melanomas to switch phenotypes in order to evade treatments. The project: We have identified a major epigenetic regulator that is highly expressed in undifferentiated melanoma. You will explore how gain or loss in the expression of the gene encoding this regulator controls melanoma differentiation and growth. Additionally, we will identify key proteins that interact with this regulator. Techniques: Cell culture, gene editing, western blotting, PCR, RNA-seq, in vitro cell biology growth assays (proliferation, cell cycle, colony formation), mass-spectrometry co-immunoprecipitation.
Project keywords	Cancer, Melanoma, Epigenetics, Treatment resistance, Gene editing, Mass-spectrometry, Protein interactions
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Melanie White
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Auxiliary Supervisor 1	Stephen Twigg
Auxiliary Supervisor 2	
Project ID	2023S1-108
Project title	A disease signature of altered energetics in cardiometabolic syndrome
Project synopsis	A decrease in contractile performance that is underpinned by fibrotic changes, in the absence of coronary artery disease is the defining phenotype associated with cardiometabolic syndrome. This pathology arises at the intersection of obesity, type 2 diabetes and dyslipidaemia and is often associated with non-alcoholic fatty liver disease. This project will investigate how the heart adapts to altered energetic provisions through the lens of acetylation. Proteins and histones can be modified by acetylation to impact function and capacity. In the White lab, you will have access to pre-clinical models and imaging. We are experts in heart physiology, protein biochemistry, mass spectrometry and post-translational modification analysis. In your honours year you will have the opportunity to develop these skills and apply them to a cutting edge clinical question.
Project keywords	Heart, Cardiometabolic syndrome, Pre-clinical model
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Melanie White
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Auxiliary Supervisor 1	Stephen Twigg
Auxiliary Supervisor 2	
Project ID	2023S1-109
Project title	Understanding the cardiac-hepatic nexus
Project synopsis	Emerging evidence suggests that hepatic health has a role to play in cardiovascular pathogenesis. Non-alcoholic fatty liver disease is a spectrum of reversible diseases that impacts the capacity of the liver to perform physiological roles including metabolic regulation, production of blood proteins and lipid regulation. This project will investigate how the liver adapts to obesity, hyperglycaemia and metabolic syndrome and the extent of this impact on the heart. In the White lab, you will have access to pre-clinical models and imaging. We are experts in heart physiology, protein biochemistry, mass spectrometry and post-translational modification analysis. In your honours year you will have the opportunity to develop these skills and apply them to the define the pathological drivers of hepatic disease needed to impair cardiac physiology before the onset of traditional CVD risk factors.
Project keywords	Heart, Liver, Cardiometabolic Disease, Non Alcoholic Fatty Liver Disease, Pre-clinical Model
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Paul Witting
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Project ID	2023S1-29
Project title	The PAD4 inhibitor of nuclear extracellular traps improves colitis in experimental mice
Project synopsis	The role of Peptidylarginine deiminases, or PADs (enzymes) is crucial for the formation of nuclear extracellular traps (NETs) in the extracellular domain. For example, PAD4 is expressed in neutrophils and is essential for the formation of NETs via PAD4-mediated histone citrullination and this process is abrogated by pharmacological targeting of PAD4. However, NETs can also damage host tissues particularly if the activity is persistent and the underlying microbial infection is controlled leaving the host tissue vulnerable to the potent oxidants being produced. Thus, the goal of this study is to test a known PAD4 inhibitor on the formation/inhibition of the NET structures and downstream damage in the colon of mice.
Project keywords	PAD4 inhibitor, nuclear extracellular traps, experimental colitis, inflammation, experimental mice
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Justin Wong
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Project ID	2023S1-127
Project title	Exploring RNA modification to identify new genes that cause cancer
Project synopsis	Our team has been studying one of the hottest areas in epigenetics and RNA biology – RNA modification. In the last 5 years, we have begun to understand how aberrant changes to RNA modification, particularly the type of modification called m6A, lead to cancers. Many enzymes that control m6A RNA modification have been reported to be aberrantly expressed in diverse human cancers. As a consequence, m6A modification levels are altered in oncogenes to increase their expression, thereby promoting cancer development and progression The candidate will explore how gain or loss in the expression of genes encoding these enzymes lead to increased cancer cell proliferation and invasiveness. Techniques: quantitative reverse transcription PCR, cell culture, western blotting, flow cytometry and molecular cloning, microscopy.
Project keywords	Epigenetics, cancer, gene expression, RNA modification, m6A
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PATH
Primary Supervisor	Dannel Yeo
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Auxiliary Supervisor 1	Sharon Sagnella
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Project ID	2023S1-181
Project title	Investigating CAR-T Cell Therapy for Pancreatic Cancer
Project synopsis	Chimeric antigen receptor-engineered T-cell (CAR-T) therapy is a relatively recent form of immunotherapy. It has been proven to be effective in blood cancers. However, it is yet to be proven in solid cancers. Patient's isolated T cells are modified to express the CAR with the capacity to bind specific tumour antigens and specifically kill cancer cells. This project will examine biological factors to improve CAR T-cell efficacy in pancreatic cancer such as antigen density, CAR T-cell affinity, and tumour heterogeneity. Using novel 2D/3D pancreatic cancer models, mechanisms of resistance will be explored and characterised. Skills/tools: mammalian cell culture, cellular impedance assays, live cell imaging, isolating T cells, lentivirus gene transfer, receptor quantitation and flow cytometry (immune phenotyping), RT-qPCR, cytokine analysis (ELISA).
Project keywords	CAR-T, Immunotherapy, Pancreatic Cancer, Immune effector cell, T cell, Tumour
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Dannel Yeo
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Auxiliary Supervisor 1	Bijay Dhungel
Auxiliary Supervisor 2	
Project ID	2023S1-182
Project title	Investigating Molecular Drivers of Metastasis in Pancreatic Cancer
Project synopsis	Metastatic spread accounts for the majority of cancer-related deaths in pancreatic cancer. Our group is interested in rare circulating tumour cells found in the blood of cancer patients to provide molecular insights into an individual's cancer. Understanding how these rare cells in the blood are able to travel and colonise at specific metastatic sites can facilitate the development of novel therapeutic strategies. This project will use cutting-edge technologies like liquid biopsies and CRISPR-based genetic screens to identify and characterise new molecular pathways. Techniques: CRISPR, cell culture, molecular biology, western blot, PCR, microscopy, flow cytometry
Project keywords	Pancreatic Cancer, Metastasis, Circulating Tumour Cells, CRISPR, genetic screens
Laboratory location	Centenary Institute (Camperdown)

Honours area	PATH
Primary Supervisor	Yuping Yuan
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Auxiliary Supervisor 1	Mike Wu
Auxiliary Supervisor 2	Shaun Jackson
Project ID	2023S1-126
Project title	Investigation of a new thrombosis and inflammation mechanism triggered by 'death pathways' in platelets
Project synopsis	Ischemia reperfusion (IR) injury commonly occurs in a wide range of human diseases, including acute myocardial infarction (AMI) and ischemic stroke. IR injury is characterised by poor blood flow in the micro-vasculature, exacerbating tissue ischaemic and organ injury. We have identified a new mechanism by which platelets and neutrophils cause microvascular obstruction. This previously unrecognised thrombotic mechanism is induced by the fragile membranes from dying platelets, that physically bridge adjacent neutrophils to facilitate neutrophil aggregation, leading to vessel occlusion. We can demonstrate that dying platelets convert neutrophils to a hyperadhesive inflammatory state. In turn, neutrophils can induce platelet death via production of oxidants. These new findings suggest a bidirectional communication mechanism operating between platelets and neutrophils, that may exacerbate microvasculature dysfunction and inflammation during IR injury. We are investigating this unique communication and its contribution to IR injury. These studies will use (i) in vitro functional assays to assess platelet death and neutrophil hyperadhesive function; (ii) mouse models of IR injury adopted to investigate microvascular dysfunction; and (iii) real-time in vivo imaging of platelet death and neutrophil-platelet adhesion dynamics in the microvasculature during IR injury.
Project keywords	Ischaemia reperfusion injury, mechanisms of clotting
Laboratory location	Charles Perkins Centre (Camperdown)

Pharmacology Honours S1, 2023

Honours area	PCOL
Primary Supervisor	Jonathon Arnold
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Auxiliary Supervisor 1	Richard Kevin
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Project ID	2023S1-158
Project title	Examining the effects of cannabinoids as anticonvulsant and hypnotic agents
Project synopsis	The cannabinoids have emerged as a promising new class of anticonvulsant and hypnotic drugs. Our research program aims to develop next-generation cannabinoids with superior effects to the phytocannabinoid cannabidiol (CBD). More specifically, we aim to further explore whether novel cannabinoids found in cannabis display anticonvulsant and hypnotic properties, as well as synthetic derivatives that may have enhanced efficacy or pharmacokinetic properties. The current project will assess novel cannabinoid compounds in rodent models of epilepsy and sleep.
Project keywords	cannabinoids; epilepsy; insomnia; anticonvulsant; hypnotic; cannabidiol
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	Jonathon Arnold
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Project ID	2023S1-184
Project title	Development of Peripherally-Restricted Cannabinoid Therapeutics
Project synopsis	Cannabinoid receptor agonists may be useful for the treatment of a variety of health conditions like neuropathic pain. However, activation of cannabinoid receptors in the brain produces intoxication (i.e., the cannabis "high"), limiting their therapeutic potential. Development of peripherally-restricted cannabinoid receptor agonists that do not enter the central nervous system could have significant value. This project will investigate the peripheral selectivity of a library of recently developed ligands in mice, using behavioural and physiological testing, coupled with mass spectrometry analysis of biological samples. The project will be carried out at the Brain and Mind Centre with The Lambert Initiative for Cannabinoid Therapeutics.
Project keywords	Cannabinoid, Drug Design, Therapeutics, Mice, Animals, Pharmacology, Mass Spectrometry, Brain, Neuropharmacology
Laboratory location	Brain and Mind Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	Nick Buckley
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Auxiliary Supervisor 2	
Project ID	2023S1-70
Project title	Which drugs are over-represented in suicide and poisonings?
Project synopsis	This project is suited to students interested in moving into research areas of epidemiology, public health, or clinical medicine. The Honours student will analyse agents involved in poisoning and suicide (from Poisons centre, hospital and/or coronial data). They will compare these to patient-level dispensing claims from Pharmaceutical Benefits Scheme (PBS) 10% sample data, calculating the proportion of Australians using various therapeutic medicine classes on a given day. They will have the scope to focus on particular areas of interest, such as particular drug classes or specific age/gender groups. This project will introduce clinical and PBS data, and teach epidemiological and statistical analytical skills.
Project keywords	epidemiology toxicology pharmacology poisoning biomedical informatics
Laboratory location	R C Mills building

Honours area	PCOL
Primary Supervisor	Rachel Codd
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Auxiliary Supervisor 1	Todd Markham
Auxiliary Supervisor 2	
Project ID	2023S1-206
Project title	Modulating Drug Properties Through Deuteration
Project synopsis	The FDA approved the first deuterated drug Austedo in 2017. Compared to the hydrogen parent (two methoxy units), Austedo (two methoxy-d3 units) has attenuated metabolism, which halves dosing and improves patient compliance and outcomes. This landmark deuterium switch heralds the clinical potential of deuterium analogues. The iron chelator desferrioxamine B (DFOB) is used for patients with genetic blood disorders who need regular blood transfusions and develop secondary iron overload. The 15-min plasma half-life of DFOB necessitates a difficult-to-tolerate administration regimen, which reduces compliance. This project will synthesize (requirement/interest: organic chemistry) deuterated analogues of DFOB, and measure in vitro plasma half-life compared to DFOB. The project aims to deliver DFOB-d10 and per-deuterated DFOB-d41, as the most deuterated natural product on record.
Project keywords	medicinal chemistry, drug design, organic synthesis, NMR spectroscopy
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Rachel Codd
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Project ID	2023S1-209
Project title	Using Enzymes to Make New Molecules
Project synopsis	When we conceive a new molecule to test as a drug or a compound with other function(s), we next plan its access. Chemical synthesis is a standard and useful pathway, although this can require multiple reactions/purification steps. It would be remarkable if we could harness the power of enzymes to generate new molecules and to screen these biocombinatorial pools of structurally diverse compounds for useful function. Our group has discovered an enzyme from a marine bacterium that catalyses amide-bond forming reactions using substrates with metal binding capacity. In this project (requirement/interest: pharmacology, chemical biology, biochemistry/molecular biology) you will use this enzyme with a mix-and-match substrate approach to generate a pool of metal binding compounds and establish a structure-metal selectivity relationship
Project keywords	biocombinatorial chemistry, metal chelators, structure-property relationship, drug design.
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
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Auxiliary Supervisor 2	
Project ID	2023S1-214
Project title	Developing Technologies to Secure Sovereign Medicine Supply
Project synopsis	Australia has a stark reliance on imported medicines with over 90% coming from overseas. This vulnerability in our medicine supply chain translates to clinical vulnerabilities in maintaining Australian healthcare standards. We need to drive the development of new technologies and pathways to improve sovereign medicine security. We have shown a simple affinity purification method used in molecular biology laboratories worldwide can be pivoted to purify a range of clinical secondary bacterial metabolites (anticancer, antibacterial, iron overload) from fermentation mixtures. The method is simple, inexpensive, and aqueous-compatible, which supports sustainability. In this project (interest: biotechnology/pharmacology/biochemistry/microbiology) you will prepare a bespoke affinity matrix and evaluate its use in purifying an antibiotic on the WHO List of Essential Medicines directly from bacterial culture.
Project keywords	biotechnology, medicine production, analytical chemistry, chromatography
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Anthony Don
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Auxiliary Supervisor 1	Jacob Qi
Auxiliary Supervisor 2	
Project ID	2023S1-35
Project title	Pharmacological restoration of myelin in multiple sclerosis
Project synopsis	Synopsis: Degeneration of myelin causes neurodegenerative conditions including multiple sclerosis, inherited leukodystrophies, and dementia. There is a pressing need for therapeutics that protect the myelinating cells, oligodendrocytes, and promote remyelination of denuded axons. Our research has established an essential requirement for the signalling lipid S1P in oligodendrocyte protection and remyelination after injury. This is clinically important because S1P receptor agonists, which are used as immunosuppressants in MS therapy, may also confer myelin protection. Project Aim: Determine whether pharmacological activation of S1P receptors 1 and/or 5 protects oligodendrocytes against cytotoxic insults in vitro (cell culture) and in vivo (mice), and the signalling mechanisms involved. Techniques: Mammalian cell culture, metabolomic/lipidomic mass spectrometry, molecular and cell biology
Project keywords	Multiple sclerosis, glia, neuroscience, mass spectrometry, cell biology
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	Sarah Hilmer
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Auxiliary Supervisor 1	John Mach
Auxiliary Supervisor 2	
Project ID	2023S1-69
Project title	The effect of polypharmacy and deprescribing on physical function and proteomic changes of middle-aged mice: Investigation of the role of the liver.
Project synopsis	Polypharmacy (concurrent use of ≥5 different medicines) is experienced by most older Australians and is associated with adverse outcomes such as falls, frailty, and mortality in observational studies. This study will investigate the mechanism behind polypharmacy induced adverse geriatric outcomes with a focus on the liver. It will consist of (1) monitoring a large animal study (drug intake and welfare), (2) conducting animal behavioural testing, (3) extracting hepatic tissue to conduct proteomic analysis, and (4) holistic approach of investigating relationship of measured outcomes with molecular changes (1-3). Specific experimental techniques include learning how to conduct large animal studies, behavioural testing (openfield, nesting, LABORAS), proteomics and bioinformatic analysis. The student's data may be publishable within a paper reporting the broader project.
Project keywords	Polypharmacy, Liver, behavioural testing, molecular changes, proteomics
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PCOL
Primary Supervisor	Tina Hinton
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Auxiliary Supervisor 1	Rania Salama
Auxiliary Supervisor 2	
Project ID	2023S1-176
Project title	Exploring healthcare and biomedical students' and educators' perspectives on sustainable online practices in post COVID-19 higher education
Project synopsis	Little research currently exists examining how online and technology-enhanced learning arising out of necessity during COVID-19 restrictions will be sustained, and the potential impact on student motivation to study online. In collaboration with the Health Education Scholarship research group at Macquarie University, this project investigates factors affecting motivation of biomedical and healthcare students and educators for online/hybrid learning, using the Self-Determination Theory (SDT) framework. Questionnaires and qualitative semi-structured interviews will be undertaken to examine students' and/or educators' perspectives on the utility and sustainability of online learning methods and tools, structured around assessment of the SDT needs of competence, autonomy and relatedness. Outcomes of this study will inform future practices to improve motivation, and consequently performance, of healthcare students in online/hybrid education.
Project keywords	online learning, technology-enhanced learning, biomedical education, healthcare education, self-determination theory, questionnaire, interview
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	John Mach
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Auxiliary Supervisor 1	Sarah Hilmer
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Project ID	2023S1-63
Project title	The effect of polypharmacy and deprescribing on physical function and proteomic changes of middle-aged mice: investigation of the role of the brain.
Project synopsis	Polypharmacy (concurrent use of ≥5 different medicines) is experienced by most older Australians and is associated with adverse outcomes such as falls, confusion and cognitive impairment in observational studies. This study will investigate the mechanism behind polypharmacy induced adverse geriatric outcomes with a focus on the brain. It will consist of (1) monitoring a large animal study (drug intake and welfare), (2) conducting animal behavioural testing, (3) extracting hippocampal tissue to conduct proteomic analysis, and (4) holistic approach of investigating relationship of measured outcomes with molecular changes (1-3). Specific experimental techniques include learning how to conduct large animal studies, behavioural testing (openfield, nesting, LABORAS, cognitive testing), proteomics and bioinformatic analysis. The student's data may be publishable within a paper reporting the broader project.
Project keywords	Polypharmacy, brain, behavioural testing, molecular changes, proteomics
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PCOL
Primary Supervisor	Slade Matthews
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Auxiliary Supervisor 1	Helen Ritchie
Auxiliary Supervisor 2	
Project ID	2023S1-155
Project title	Application of Bayes Theorem to Machine Learning Ames Mutagen Classifiers
Project synopsis	Detection of potential mutagens using computational toxicology is important for public safety in the chemical regulation and drug development fields. Several computational models of Ames mutagenicity have been developed, room for improvement exists in the area of weight of evidence approaches to classification. Recently a first Bayesian approach was published[1], this project will develop of more systematic and cheminformatics-based approach to application of Bayes Theorem to Ames chemical mutagenicity prediction. This project asks "Would incorporation of Bayes Theorem to mutagen prediction via cheminformatic chemical grouping yield an index of predictive confidence that correlates with ground-state outcomes and thus provide a weight of evidence Ames mutagenicity prediction?" A sub-question asks "What is the most effective cheminformatic chemical grouping for Ames prediction".
Project keywords	Computational, toxicology, modelling, cancer, mutagenicity, QSAR
Laboratory location	Badham A16

Honours area	PCOL
Primary Supervisor	Sarasa Mohammadi
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Auxiliary Supervisor 1	Robert Vandenberg
Auxiliary Supervisor 2	
Project ID	2023S1-150
Project title	Targeting glycine transporters and receptors to treat pain: analgesic and side effect testing in vivo
Project synopsis	Chronic pain can be debilitating and difficult to manage, severely reducing quality of life. New analgesics are desperately needed that act through new mechanisms of action. Our group uses behavioural neuroscience to improve our understanding of existing analgesics, test new drugs and drug classes, and better understand pain physiology. This project uses mouse models to investigate a new class of analgesic drugs; glycine transporter inhibitors, or dual action glycine transporter inhibitors/glycine receptor stimulators. The project uses pre-clinical screening methods to determine the analgesic efficacy in chronic pain models, any possible side-effects, and any abuse liability of these novel compounds.
Project keywords	Animal models, glycine, pain, analgeisa, side effects, in vivo, pharmacology, drug discovery
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	Lenka Munoz
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Auxiliary Supervisor 1	George Joun
Auxiliary Supervisor 2	
Project ID	2023S1-30
Project title	Validation of novel drug targets in glioblastoma stem cells
Project synopsis	Glioblastoma is a fatal brain tumour with no effective therapy. In order to identify new drug targets for the development of effective glioblastoma therapeutics, we performed genome-wide CRISPR screen using glioblastoma stem cells. We identified a number of druggable targets which are critical for the survival and proliferation of glioblastoma stem cells. In this project, cellular/molecular biology as well as pharmacological approaches will be employed to validate selected glioblastoma genes as viable drug targets and interrogate their roles in maintaining glioblastoma stem cells. This project will lead to the identification of novel therapies against glioblastoma and will be completed in the state-of-the-art research facilities at the Charles Perkins Centre.
Project keywords	cancer, glioblastoma, target validation, drug discovery
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PCOL
Primary Supervisor	Jacques Raubenheimer
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Auxiliary Supervisor 1	Nick Buckley
Auxiliary Supervisor 2	Rose Cairns
Project ID	2023S1-104
Project title	Poisoning comorbidity study
Project synopsis	Our dataset containing information on a decade of NSW poisonings contains a large number (±9 million) of comorbid ICD10 codes from hospital admissions. Students will analyse this dataset to determine: 1. The most common co-morbid ICD10 codes accompanying poisoning (overall, and for specific classes of poisoning) 2. The association between co-morbid codes and eventual outcome 3. The association between co-morbid codes and repeated self-poisoning 4. The association between co-morbid codes and subsequent admissions Students will work in the BIDH offices and will employ statistical programming (in R or SAS) to extract and analyse data and create data visualisations. The student will produce a final report in article-format presenting an appropriate literature review, methods, results and discussion.
Project keywords	Poisoning; Big data; ICD10; co-morbidity
Laboratory location	RC Mills

Honours area	PCOL
Primary Supervisor	Renae Ryan
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Auxiliary Supervisor 1	Robert Vandenberg
Auxiliary Supervisor 2	
Project ID	2023S1-12
Project title	Molecular mechanisms of glutamate transporters
Project synopsis	We use structural biology and biophysical techniques to investigate the molecular mechanisms of neurotransmitter and amino acid transporters. The aim of this project is to develop a structural model for transporters from the dual function glutamate transporter family (SLC1A). This family includes the human glutamate transporters (EAATs) and neutral amino acid transporters (ASCTs) that can also function as chloride channels. We aim to understand how these transporters malfunction in neurological disease states (eg. episodic ataxia) and in cancer. This information is then used to develop therapeutics that are both transporter-specific and subtype selective to treat these disorders. This NHMRC funded project is a collaboration with researchers at McGill University, Canada and the University of Illinois at Urbana-Champaign, USA.
Project keywords	glutamate transporter, ataxia, cancer, neuroscience, biochemistry, structural biology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Margaret Sunde
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Auxiliary Supervisor 1	Megan Steain
Auxiliary Supervisor 2	
Project ID	2023S1-52
Project title	Harnessing the programmed cell death pathway necroptosis for anticancer treatment
Project synopsis	RIPK3 is a key protein in the cell death pathway necroptosis. Modulation of necroptosis has been proposed as a therapeutic option for some cancers. Sequence differences between mouse and human RIPK3 make it difficult to interpret the impact of drugs that modulate necroptosis when preclinical testing uses mice. The ICP6 protein from HSV1 inhibits necroptosis in human cells to maintain infection but triggers it in murine cells. This project will identify the key molecular details of the RIPK3:ICP6 interaction, by comparing interactions between ICP6 and human and murine RIPK3. The proteins will be produced recombinantly and examined using biochemical and biophysical assays that probe the stability of the complexes. This study will contribute towards harnessing necroptosis for improved cancer treatments.
Project keywords	necroptosis, cell death, anti-tumour immunity, protein complexes
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Margaret Sunde
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Auxiliary Supervisor 1	Catherine Suter
Auxiliary Supervisor 2	
Project ID	2023S1-53
Project title	Tau filament structures associated with repetitive head injury
Project synopsis	Chronic traumatic encephalopathy (CTE) is a neurodegenerative condition caused, at least in part, by exposure to repetitive head impacts. It has been identified in participants of sports such as boxing and football. The disease is defined by the deposition of hyperphosphorylated tau protein in neurons, around small blood vessels in the cerebral cortex. This project will involve preparation of tau filaments that are representative of CTE and Alzheimer's Disease pathology from recombinant protein. These will be screened to determine whether the molecular signature of CTE tau can be distinguished by fluorescent probes and a range of biochemical analyses. The identification of molecules specific for CTE- or AD-associated tau deposits would facilitate diagnosis and could pave the way for therapeutic intervention.
Project keywords	Tau, amyloid filaments, neurodegeneration
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
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Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-10
Project title	Novel Mechanisms of Inhibition of Glycine Transport for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of novel inhibitors of glycine transporter 2 that show promise as analgesics for the treatment of neuropathic pain. You will investigate an intriguing observation that membrane cholesterol appears to modulate the mechanism of inhibition, which has implications for a wide range of drug discovery programs and understanding cell physiology. A range of projects can be designed around this idea and can include: 1. Site-directed mutagenesis studies to understand how the transporter responds to both inhibitor and cholesterol interactions; 2. Compare the activity of cholesterol with that of a series of steroids with the aim of identifying novel secondary modulators of glycine transport. Available for students in NEUR, PHSI, PCOL or MCHM Majors.
Project keywords	Drug Discovery, Chronic Pain, Glycine Transport, Membrane Lipids, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Robert Vandenberg
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Auxiliary Supervisor 1	Renae Ryan
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Project ID	2023S1-11
Project title	Stimulation of Glycine Receptors for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of lipid molecules that stimulate the activity of glycine receptors, which have the potential to be developed into analgesics for the treatment of chronic pain. In this project you will collaborate with computer scientists to identify drug-like molecules that mimic the activity of these novel lipids. Your role in this project will be to first screen the activity of the lipid mimics on glycine receptors using electrophysiological techniques to identify hit compounds for further development, second establish the pharmacodynamic parameters that define their mechanism of action; and if time permits identify the binding site for the compounds using mutagenesis and molecular modelling studies. Available for students in NEUR, CELL, PHSI, PCOL or MCHM Majors.
Project keywords	Glycine Receptors, Chronic Pain, Drug Discovery, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Christopher Vaughan
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Auxiliary Supervisor 1	Neda Assareh
Auxiliary Supervisor 2	
Project ID	2023S1-147
Project title	Chronic pain, endogenous cannabinoids and stress
Project synopsis	This project is aimed at identifying the mechanisms underlying intractable chronic neuropathic pain. In neuropathic pain states there are maladaptations in brain systems which control pain, stress, and learning. These systems are interconnected and are regulated by endogenous cannabinoids. This study will examine how the control of pain, stress and learning are altered in a rodent model neuropathic pain. It will also involve identifying the role of endogenous cannabinoids in this process, plus how it might be alleviated by novel cannabinoid drugs. This is an animal-based study which will involve recovery surgery, pain and behavioural testing and drug delivery. It will be carried out in the Kolling Institute laboratories.
Project keywords	Neuropathic pain, endocannabinoid, fear, learning, extinction
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PCOL
Primary Supervisor	Eryn Werry
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Auxiliary Supervisor 1	Michael Kassiou
Auxiliary Supervisor 2	
Project ID	2023S1-142
Project title	Developing novel Vasopressin 1A receptor antagonists for autism spectrum disorder
Project synopsis	Vasopressin 1a receptors (V1aRs) are distributed throughout key social networks in the brain. SNPs in the V1aR gene are linked to social symptoms in autism spectrum disorder. The drug company, Roche, recently progressed a candidate V1aR antagonist into a phase II clinical trial, where it was safely tolerated and showed pro-social effects in autism spectrum disorder. This was progressed to a phase III trial where it failed to meet primary endpoints. As such, there remains a lack of clinically viable V1aR antagonists. This project will use tissue culture and cellular assays (eg IP1 assay) to index the potency of a novel class of V1aR antagonists and explore structure-activity relationships to inform further iterative drug design.
Project keywords	vasopressin, autism spectrum disorder, drug discovery, structure-activity relationships, pharmacology, in vitro
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PCOL
Primary Supervisor	Fanfan Zhou
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Auxiliary Supervisor 1	Michael Murray
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Project ID	2023S1-128
Project title	Establishing 3D cell culture for human eye cancer drug discovery
Project synopsis	Cells growing on monolayers have been widely used in drug discovery; however, traditional 2D cell culture poorly mimics the characteristics of solid tumours. In this project we will establish 3D cell culture models for use in human eye cancer. Culture conditions will be optimised with eye cancer cell lines for the testing of several potential lead molecules that we have developed. These agents have potent anti-cancer actions in traditional 2D human eye cancer models. The novel drug candidates will now be tested in 3D culture to provide important validation in drug discovery research. The findings from this project will produce advanced in vitro models for drug development prior to clinical translation in eye cancer patients.
Project keywords	eye cancer, drug discovery, drug development, 3D culture, anti-cancer drug
Laboratory location	Pharmacy building A15

Physiology Honours S1, 2023

Honours area	PHSI
Primary Supervisor	Sian Cartland
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Auxiliary Supervisor 1	Jonathan Danon
Auxiliary Supervisor 2	
Project ID	2023S1-188
Project title	Evaluating novel TSPO ligands to target inflammation and cholesterol transport in atherosclerosis
Project synopsis	The main cause of CVD is atherosclerosis, a chronic inflammatory disease. Macrophages play a pivotal role, promoting or suppressing atherogenesis and related inflammation, depending on their functional state. The 18 kDa translocator protein (TSPO) is expressed on macrophages and increases in response to stress and/or injury. It is associated with multiple biological functions including cholesterol transport and inflammatory response. There is growing evidence that modulation of TSPO can be cardioprotective. In this project we will identify whether treating macrophages with newly identified TSPO ligands can improve cell function, inflammation and cholesterol transport, potentially attenuating disease. Techniques used will include tissue culture, cell isolation and differentiation, PCR, western blotting/ELISAs and functional cell assays.
Project keywords	Atherosclerosis, inflammation, macrophage
Laboratory location	Heart Research Institute (Camperdown)

Honours area	PHSI
Primary Supervisor	Sarah Glastras
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Auxiliary Supervisor 1	Sonia Saad
Auxiliary Supervisor 2	Amita Bansal
Project ID	2023S1-119
Project title	Effects of developmental exposure to environmental plasticisers and Western diet on the long-term kidney function of the offspring
Project synopsis	Developmental exposure to widely used environmental plasticisers, bisphenol A (BPA) and phthalate (DEHP), or poor nutrition (e.g. high fat high sugar diet; Western diet) increases the long-term risk of metabolic health diseases, including obesity and type 2 diabetes in adulthood. However, the impact of these exposures on diabetic complications (kidney disease) remains poorly understood. Dr Bansal has established a novel rodent model of developmental plasticiser exposure at ANU. The current findings from this model suggest that the developmental plasticiser exposure increases susceptibility to a postweaning Western diet exposure in the offspring and leads to development of diabetes. Such that upon a postweaning Western diet exposure the male offspring, whose mothers were exposed to a plasticiser diet pre-weaning, developed diabetes in adulthood (defined as fed blood glucose levels >20 mM across two consecutive days) compared to offspring of mothers fed a Control, or Western diet pre-weaning. This effect was sex specific as female offspring did not develop diabetes. We now aim to explore the effect of these developmental exposures on the long-term kidney function of the offspring in this established rodent model. The animal component of this study has already been performed at the Australian National University. Therefore, your role will be to perform laboratory-based experiments including Western blotting, immunohistochemistry and real-time PCR. You will be shown and guided on how to do these experiments. You will be working alongside a team of over 10 researchers. You will be specifically investigating the role of the kidney in mediating the metabolic phenotype observed in these offspring exposed to maternal plasticisers and Western diet. Your role will include analysis of data, interpretation of results and manuscript preparation. All work will take place at the Kolling Institute which is located on the Royal North Shore Hospital campus.
Project keywords	developmental programming, kidney, maternal obesity
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PHSI
Primary Supervisor	Sarah Glastras
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Auxiliary Supervisor 1	Sonia Saad
Auxiliary Supervisor 2	Natassia Rodrigo
Project ID	2023S1-61
Project title	Improving cardiovascular health in mothers: The role of preconception weight loss in reducing cardiac stress associated with maternal obesity?
Project synopsis	Mothers with obesity are at higher risk of adverse cardiovascular outcomes in their lifetime, and during pregnancy cardiac stress can significantly influence maternal and foetal outcomes. Weight loss prior to pregnancy should be advocated yet previous studies have failed to identify methods of weight loss for women prior to pregnancy that can improve maternal and foetal outcomes. We aim to explore the effect of weight loss, either by diet modification or pre-pregnancy administration of the glucose-like peptide-1 (GLP-1) agonist liraglutide, on cardiovascular health in mothers using a mouse model. The animal component of this study has already been performed. Therefore, your role will be to perform laboratory-based experiments including Western blotting, immunohistochemistry and real-time PCR. You will be shown and guided on how to do these experiments. Your role will include analysis of data, interpretation of results and manuscript preparation.
Project keywords	obesity, pregnancy, incretin, oxidative stress, inflammation
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PHSI
Primary Supervisor	Vanessa Hayes
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Project ID	2023S1-32
Project title	Refining the root region of the human mitochondrial evolutionary tree
Project synopsis	Tracing patterns of maternally inherited human mitochondrial genome variation in contemporary populations has been an invaluable resource for studying anatomically modern human evolution. The evidence is clear, modern humans emerged in Africa, sharing a common human family some 200 thousand years ago. Through sequencing of mitogenomes representing the root region of the maternal human family tree (rare L0 lineages), the Hayes lab have suggested that our modern human family spent the first over 70 thousand years evolving in Botswana. Recently, the lab has sequenced an additional 100 rare L0 mitogenomes. The student will merge this new data with available rare L0 mitogenomes, to further refine the basal phylogenetic divergence, coalescence times and prehistory of modern humans earliest shared family using phylogenetic methods.
Project keywords	phylogenetics, human evolution, human ancestry, mitogenomes
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Nathan Johnson
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Auxiliary Supervisor 1	Callum Baker
Auxiliary Supervisor 2	Stephen Twigg
Project ID	2023S1-226
Project title	The Effect of Low-Volume Exercise Training on Visceral Adipose Tissue
Project synopsis	Excess lipid stores in visceral adipose tissue (VAT) contributes to metabolic disease, however, exercise can have a positive impact on VAT. The PACE-G study investigated the impact of low volume exercise on ectopic fat stores and VAT. The aim of this project is to analyse the VAT imaging from the PACE-G study and determine the effect of the intervention on VAT and association with clinical outcomes.
Project keywords	Exercise, High-intensity Interval training, resistance training, HIIT, VAT, Visceral Adipose Tissue, exercise physiology, ectopic fat, exercise therapy.
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Mary Kavurma
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Auxiliary Supervisor 2	
Project ID	2023S1-190
Project title	2. Novel mechanisms regulating sex-specific peripheral artery disease
Project synopsis	Peripheral artery disease (PAD) is more prevalent in women, even though women are often misdiagnosed and not adequately screened. Why this is the case is unclear. In this project we will examine changes to vessel architecture from murine and human PAD tissues and assess sex-specific function(s) of endothelial cells in vitro. Multiple techniques will be used including histology, gene expression (qPCR, Western blotting), isolation of primary endothelial cells, tissue culture, cell functional studies (proliferation, migration, angiogenesis).
Project keywords	Peripheral artery disease, endothelial function
Laboratory location	Heart Research Institute (Camperdown)

Honours area	PHSI
Primary Supervisor	Melkam Kebede
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Auxiliary Supervisor 1	Nikki Lee
Auxiliary Supervisor 2	Mark Larance
Project ID	2023S1-102
Project title	Sorting out the insulin granule
Project synopsis	We have recently uncovered a critical role for a novel protein (VPS41) in insulin secretory granule homeostasis. β-cell specific deletion of VPS41 in mice results in severe depletion of insulin leading to diabetes. The mechanisms behind VPS41's action in β-cells is currently unknown, and this project aims to understand how VPS41 controls the production, maturity and stability of insulin secretory granules.
Project keywords	type 2 diabetes, insulin secretion, pancreatic beta-cells, exocytosis, beta-cell dysfunction,
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Melkam Kebede
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Auxiliary Supervisor 1	Peter Thorn
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Project ID	2023S1-37
Project title	Establish mechanisms that regulate insulin secretory granule secretory competence using Cab45 knockout pancreatic β-cells.
Project synopsis	A major feature in the pathogenesis of type 2 diabetes (T2D) is the loss of pancreatic β-cell function. This manifests mainly as a reduction in glucose-stimulated insulin secretion. Our research interest is to understand the mechanisms of β-cell failure in the pathogenesis of T2D. We have recently identified a novel gene, Cab45, critical for the insulin secretory pathway in β-cells. We show that β-cell specific deletion of Cab45 (both in cell lines and in mice) results in blunted glucose stimulated insulin secretion. The mechanism for this dysregulation of insulin secretion in Cab45 KO cells is not known. In this project we test the hypothesis that Cab45 is critical for the generation of high quality (secretory competent) insulin secretory granules and its deletion results in the generation of inferior quality secretory granules that cannot fuse with the plasma membrane. To test this hypothesis, we will (1) use three-dimensional two-photon live-cell imaging to map the fusion events of individual insulin secretory granules with the cell membrane and (2) proteomics approaches to determine the molecular composition of insulin secretory granules in Cab45 KO and control cells. The project will give us key insight into the mechanism of β-cell failure in the pathogenesis of T2D.
Project keywords	type 2 diabetes, insulin secretion, pancreatic beta-cells, exocytosis, beta-cell dysfunction, calcium
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Mark Larance
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Auxiliary Supervisor 2	
Project ID	2023S1-71
Project title	Sexual Dimorphism in Response to Dietary Restriction
Project synopsis	Intermittent fasting (IF) is an established intervention to treat the growing obesity epidemic. However, the interaction between dietary interventions and sex remains a significant gap in knowledge. In this study, you will use unbiased proteome analysis to identify novel diet-sex interactions in adipose tissue. These experiments will use the mouse model system and employ the every other day fasting (EODF) diet model. Mass spectrometry-based proteomic analysis will be performed on adipose depots (visceral and subcutaneous) using the SydneyMS core facility. Statistical analysis and pathway enrichment will reveal novel interactions.
Project keywords	proteomics, mass spectrometry, mouse, intermittent fasting, adipose, diet, sex, gender
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Mark Larance
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Auxiliary Supervisor 2	
Project ID	2023S1-72
Project title	Characterisation of the novel hormone erusiolin
Project synopsis	Erusiolin is a novel hormone we discovered that we hypothesise plays a role in appetite regulation. This project is to characterise the role of this hormone in mammalian physiology using human clinical trial samples, CRISPR knock-out mice, peptide injection experiments and bioinformatic analysis. Mass spectrometry-based proteomic analysis will be performed on blood samples using the SydneyMS core facility. Statistical analysis and pathway enrichment will reveal the regulation of this hormone and new functions in target organs.
Project keywords	metabolism, proteomics, hormone, mass spectrometry, diet, nutrition, appetite
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
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Auxiliary Supervisor 2	
Project ID	2023S1-95
Project title	Mapping the Interactome of Human Platelets using Proteomics
Project synopsis	Platelets are central to blood clotting via their rapid response to stimuli such as thrombin activation. Their activation induces the secretion of proteins that promote platelet aggregation and inflammation. However, how these proteins interact in complexes has never been examined at the proteome-wide scale and many gaps in our knowledge exist. In the project, you will use crosslinking mass spectrometry based proteome analysis to identify protein-protein interactions at high resolution using the SydneyMS core facility. This crossling data will be used to build and validate protein complex structures derived either from existing crystal structures or structures predicted by Alphafold2 and Multimer.
Project keywords	Platelet, clotting, mass spectrometry, proteomics, crosslinking, interactions, alphafold, complex, structure
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
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Auxiliary Supervisor 1	Peter Thorn
Auxiliary Supervisor 2	Natalie Kwai
Project ID	2023S1-84
Project title	Neuroregenerative Gene Therapy via Bionic Array-Directed Gene Electrotransfer (BaDGE®) of Nerve Growth Factors.
Project synopsis	BaDGE® technology was initially developed to enhance sound quality with the bionic ear. Pre-clinical studies have achieved regeneration of auditory neurons and improved hearing performance. This technology is now in clinical trial. This project seeks to advance cochlear gene therapy in addition to applications for gene augmentation outside the hearing space, through the unique BaDGE® platform. The aim is to improve the efficacy of BaDGE® through optimisation of electrotransfer parameters and electrode design using reporter genes such as GFP to quantify efficiency. The proposed project will also validate novel therapeutic gene constructs using immunohistochemical techniques. The readout of gene transfer efficiency and immunohistochemical analysis will be determined using epifluorescence and confocal microscopy.
Project keywords	Gene Expression, Neuroscience, Hearing, Nerve Injury, Neurotrophin
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Philip Poronnik
Email	philip.poronnik@sydney.edu.au
Auxiliary Supervisor 1	Melissa Cameron
Auxiliary Supervisor 2	Craig Campbell
Project ID	2023S1-101
Project title	The deteriorating patient
Project synopsis	We are developing with our industry partners, a virtual deteriorating patient that is aimed at helping 2nd year physiology student to explore basic physiology in the context of a real patient. The platform is largely complete but requires further development and refinement as well as evaluation. You will play the lead role in bringing this tool into the curriculum, including implementation in semester one.
Project keywords	physiology, virtual reality, education, technology
Laboratory location	Anderson Stuart Building F13

Honours area	PHSI
Primary Supervisor	Philip Poronnik
Email	philip.poronnik@sydney.edu.au
Auxiliary Supervisor 1	Martin Brown
Auxiliary Supervisor 2	Craig Campbell
Project ID	2023S1-88
Project title	Emerging technologies in medical science education
Project synopsis	We are exploring the use of emerging virtual technologies such as VR and AR to complement and extend engagement and learning in medical sciences. This is an excellent opportunity to join the FMH Media Lab team to learn about, build and evaluate assets to be used in the undergraduate curriculum. You will learn the essentials of content creation and design and gamification principles to create pedagogically valid tools for medical science.
Project keywords	virtual reality, curriculum, education, gamification
Laboratory location	Anderson Stuart Building F13

Honours area	PHSI
Primary Supervisor	Renae Ryan
Email	renae.ryan@sydney.edu.au
Auxiliary Supervisor 1	Robert Vandenberg
Auxiliary Supervisor 2	
Project ID	2023S1-24
Project title	Molecular mechanisms of glutamate transporters
Project synopsis	We use structural biology and biophysical techniques to investigate the molecular mechanisms of neurotransmitter and amino acid transporters. The aim of this project is to develop a structural model for transporters from the dual function glutamate transporter family (SLC1A). This family includes the human glutamate transporters (EAATs) and neutral amino acid transporters (ASCTs) that can also function as chloride channels. We aim to understand how these transporters malfunction in neurological disease states (eg. episodic ataxia) and in cancer. This information is then used to develop therapeutics that are both transporter-specific and subtype selective to treat these disorders. This NHMRC funded project is a collaboration with researchers at McGill University, Canada and the University of Illinois at Urbana-Champaign, USA.
Project keywords	glutamate transporter, ataxia, cancer, neuroscience, biochemistry, structural biology, electrophysiology, biophysics
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PHSI
Primary Supervisor	Sonia Saad
Email	sonia.saad@sydney.edu.au
Auxiliary Supervisor 1	Natassia Rodrigo
Auxiliary Supervisor 2	
Project ID	2023S1-62
Project title	The role of appetite regulation in the brain on weight modulation in the perinatal period: Can preconception weight loss reduce adverse metabolic outcomes for mother and baby?
Project synopsis	Offspring born to obese mothers and those born to mothers affected by gestational diabetes mellitus (GDM) in pregnancy are at risk of long-term metabolic health issues, including obesity and type 2 diabetes in adulthood. Obese mothers themselves are at higher risk of adverse cardiovascular outcomes. Previous studies have failed to identify methods of weight loss for women prior to pregnancy that can reduce perinatal morbidity and ameliorate adverse foetal programming effects. We aim to explore the effect of weight loss, either by diet modification or pre-pregnancy administration of the glucose-like peptide-1 (GLP-1) agonist liraglutide, on appetite regulation within the brains of mothers and offspring using a rodent model. The animal component of this study has already been performed. Therefore, your role will be to perform laboratory-based experiments including Western blottings, immunohistochemistry and real-time PCR. You will be shown and guided on how to do these experiments. You will be working alongside alongside a team of over 10 researchers. You will be specifically looking at the role of the brain (specifically the hypothalamus) in weight regulation in the perinatal period, impacting outcomes for the mother and offspring exposed to maternal obesity and/or liraglutide. Your role will include analysis of data, interpretation of results and manuscript preparation. All work will take place at the Kolling Institute which is located on the Royal North Shore Hospital campus.
Project keywords	obesity, diabetes, foetal programming, appetite, hormones, incretin
Laboratory location	Kolling Research Institute, located at The Royal North Shore Hospital

Honours area	PHSI
Primary Supervisor	Aaron Schindeler
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Auxiliary Supervisor 1	Michelle McDonald
Auxiliary Supervisor 2	
Project ID	2023S1-178
Project title	Novel approaches to prevent Densoumab withdrawal induced bone loss
Project synopsis	Denosumab (Dmab) is an anti-RANKL therapy used to reduce bone loss and fractures in patients with osteoporosis. Treatment withdrawal can lead to rapid bone loss and increased fracture risk through accelerated bone resorption by osteoclasts. We have shown that osteoclasts undergo fission to form an intermediate and distinct osteoclast lineage cell, the osteomorph. Osteomorphs and osteoclast pre-cursors rapidly re-fuse to form aggressive osteoclasts, driving bone loss associated with Dmab withdrawal. This honours project will examine TNF-alpha inhibition and CTLA-4 stimulation as novel approaches to minimize bone loss post-Dmab and to study their effects on osteomorph-osteoclast dynamics. The student will gain proficiency in mammalian cell culture and live cell imaging, which will be used to examine osteoclast dynamics, fission and fusion.
Project keywords	Osteoclast, anti-resorptive therapy, live cell imaging, Denosumab, bone
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Richard Tan
Email	richard.tan@sydney.edu.au
Auxiliary Supervisor 1	Steven Wise
Auxiliary Supervisor 2	
Project ID	2023S1-68
Project title	Developing bioengineered approaches for locally delivering immunotherapies for cardiovascular disease
Project synopsis	Cardiovascular disease (CVD) remains the leading cause of mortality worldwide and the largest health burden on our economy. Inflammation is increasingly implicated as a key biological driver behind CVD pathology however inflammation-targeting drugs (immunotherapy) are not routinely used in clinical management of the disease. This project will work across a team of bioengineers, vascular biologists, and clinicians to study new biomaterials-based platforms to help localise the delivery of immunotherapies, to improve their effectiveness, longevity, and safety for vascular applications. Key elements of the project include further development of a proprietary nanoparticle platform, delivery of anti-inflammatory agents in cell culture models and ultimately evaluation of safety and efficacy of the best agents in pre-clinical models.
Project keywords	cardiovascular disease, bioengineering, medical devices, inflammation, biomaterials
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Robert Vandenberg
Email	robert.vandenberg@sydney.edu.au
Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-201
Project title	Novel Mechanisms of Inhibition of Glycine Transport for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of novel inhibitors of glycine transporter 2 that show promise as analgesics for the treatment of neuropathic pain. You will investigate an intriguing observation that membrane cholesterol appears to modulate the mechanism of inhibition, which has implications for a wide range of drug discovery programs and understanding cell physiology. A range of projects can be designed around this idea and can include: 1. Site-directed mutagenesis studies to understand how the transporter responds to both inhibitor and cholesterol interactions; 2. Compare the activity of cholesterol with that of a series of steroids with the aim of identifying novel secondary modulators of glycine transport. Available for students in NEUR, PHSI, PCOL or MCHM Majors.
Project keywords	Drug Discovery, Chronic Pain, Glycine Transport, Membrane Lipids, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PHSI
Primary Supervisor	Robert Vandenberg
Email	robert.vandenberg@sydney.edu.au
Auxiliary Supervisor 1	Renae Ryan
Auxiliary Supervisor 2	
Project ID	2023S1-204
Project title	Stimulation of Glycine Receptors for the Treatment of Chronic Pain
Project synopsis	We have discovered a series of lipid molecules that stimulate the activity of glycine receptors, which have the potential to be developed into analgesics for the treatment of chronic pain. In this project you will collaborate with computer scientists to identify drug-like molecules that mimic the activity of these novel lipids. Your role in this project will be to first screen the activity of the lipid mimics on glycine receptors using electrophysiological techniques to identify hit compounds for further development, second establish the pharmacodynamic parameters that define their mechanism of action; and if time permits identify the binding site for the compounds using mutagenesis and molecular modelling studies. Available for students in NEUR, CELL, PHSI, PCOL or MCHM Majors.
Project keywords	Glycine Receptors, Chronic Pain, Drug Discovery, Cell Physiology, Pharmacology
Laboratory location	Molecular Bioscience Building (G08) (Camperdown)

Honours area	PHSI
Primary Supervisor	Anna Waterhouse
Email	anna.waterhouse@sydney.edu.au
Auxiliary Supervisor 1	Steven Wise
Auxiliary Supervisor 2	
Project ID	2023S1-117
Project title	Investigating endothelial cell dysfunction
Project synopsis	An intact endothelium is critical to maintain vascular homeostasis and prevent thrombosis and atherosclerosis. Endothelial dysfunction can occur for many reasons including the implantation of medical devices, vessel injury, high blood pressure, elevated lipids, or inflammation. Recent evidence has demonstrated that alterations in flow conditions to cause endothelial dysfunction, results in endothelial cell reprogramming. This project aims to understand the effect of different stimuli on endothelial cell phenotype and dysfunction. Cells will be cultured and characterised under static conditions with a range of stimuli. Successful candidates will be evaluated under flow conditions in microfluidic, Organ-on-a-chip models already established by the Waterhouse lab at the Charles Perkins Centre using immunofluorescence and microscopy techniques.
Project keywords	cardiovascular, endothelium, cell culture, fluorescence microscopy, microfluidics
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Anna Waterhouse
Email	anna.waterhouse@sydney.edu.au
Auxiliary Supervisor 1	Steven Wise
Auxiliary Supervisor 2	
Project ID	2023S1-118
Project title	Understanding and reducing fibrin clot formation on medical devices
Project synopsis	Medical devices such as artificial hearts can fail due the device materials causing blood clots (thrombosis) meaning that patients require additional blood thinning medication, increasing their risk for additional complications. Dr Anna Waterhouse and her team aim to understand how medical device blood clots form by analysing healthy and clinical samples on clinical materials. We are also developing a novel, super slippery, liquid-repellent surface coatings to prevent blood clot formation using which will also be analysed in static assays and microfluidic systems to understand its mechanism of action, with the goal of translating this to medical devices in the clinic to prevent their failure. This project will involve histology and microscopy at the Charles Perkins Centre.
Project keywords	cardiovascular, thrombosis, medical devices, fluorescence microscopy
Laboratory location	Charles Perkins Centre (Camperdown)

Honours area	PHSI
Primary Supervisor	Steven Wise
Email	steven.wise@sydney.edu.au
Auxiliary Supervisor 1	Richard Tan
Auxiliary Supervisor 2	
Project ID	2023S1-85
Project title	Bioengineering New Synthetic Conduits for Arterial Revascularisation
Project synopsis	We have identified the strong potential of silk fibroin, a natural biomaterial for use as a synthetic vascular graft. We have demonstrated that silk can be engineered to have tailored mechanical properties, outperforming commercially available materials in long-term pre-clinical models. With support from the National Heart Foundation, this project will determine the best combination of physical and biological properties for a small diameter silk conduit, aiming to provide a cell-free, off-the-shelf synthetic graft that would revolutionise the treatment of coronary and peripheral artery disease.
Project keywords	vascular graft, bioengineering, materials
Laboratory location	Charles Perkins Centre (Camperdown)

Honours Information Day Poster Presentations

SESSION 1: 12-1pm CURRENT HONOURS STUDENTS POSTERS

Poster no.	Student	Supervisor	Project Title
1	Helen Chen	Carl Feng	What is the immunological basis of granuloma formation?
2	Yu Na Chung	Kerrie Sandgren	Mode of action of mRNA vaccines in human lymph nodes
3	Julie Ha	Nicholas Manolios	Evaluation of tolerability and efficacy of transdermal application of cannabidiol (CBD)and palmitoylethanodamide (PEA) in patients with osteoarthritis: Pharmacokinetic study CBD and PEA applied to skin
4	XingYang Hu	Warwick Britton	Immunological basis of granulomatous disease
5	Linda Lin	Georges Grau	Deep phenotyping of MS patients' leukocyte subsets and extracellular vesicles
6	Joelle Mahmoud	Andrew Harman	Investigating the immune profile in inflammatory bowel disease
7	Andrew Auwyang	Grant Parnell	Vitamin D and the immune system in multiple sclerosis
8	Laylaa Hoosen	Paul Witting	Developing protocols to specifically identify myeloperoxidase-mediated damage to the colon during inflammatory bowel disease
9	Jennifer Supple	Belal Chami	The anti-inflammatory potential of cannabinoid and cannabinoid-like compounds
10	Arian Nasser	Freda Passam	Endo-chip for the study of clots after ChAdOx1 (AZD1222) vaccine
11	Pranav Reddy	Fabienne Brilot-Turville	Multiple sclerosis and Covid-19 vaccination
12	Julen Reyes	Laurence Macia	Role of diet and gut microbiota on immunity and health
13	Camille Potier	Laurence Macia	Role of diet and gut microbiota on immunity and health
14	Alexander Siu	Tuba Gide	Biomarkers of response and resistance associated with Lenvatinib plus anti-P
15	Fidelia Susanto	Heather Medbury	Monocyte metabolism with increased cardiovascular disease risk
16	Cyrus Tsui	Jennifer Gamble	Understanding the ageing of endothelial cells in Alzheimer's Disease
17	Sophie Webster	Jennifer Gamble	Understanding the ageing of blood vessels in Alzheimer's Disease
18	Michael Xie	James Wilmott	Developing a predictive model for recurrence in stage III melanoma patients
19	Malik Bloul	Megan Steain	Neutralisation of SARS-CoV-2
20	Wade Bocking	Sanjay Swaminathan	EBV and the immune system in systemic lupus erythematosus
21	Daniel Buffa	Kristie Bertram	Investigating human tissue dendritic cell migration in response to viruses
22	Samantha Cronin	Andrew Harman	Investigating the role of CLEC5A in HIV uptake by human tissue dendritic cells
23	Samantha Du	Tony Cunningham	Pathogenesis of HIV and Herpes simplex viral infections underpinning development of new preventatitve and therapeutic strategies
24	Bryan Hong	Caroline Royle	IFN in HIV immunity and reactivation
25	Tara Opadchy	Allison Abendroth	Impact of varicella zoster virus on the innate immune resposne
26	Farhan Ameen	Ellis Patrick	Characterising a cell's impact on disease with state-of-the-art throughput
27	Alexander Nicholls	Ellis Patrick	Data-intensive science to understand the molecular aetiology of disease
28	Sarah Smith	Vitali Sintchenko	The impact of public health interventions on population genomics of SARS-Co
29	Harout Ajoyan	Thomas Tu	Hepatitis B: from virological concepts to cure for cancer
30	Ella McCutcheon	Tuba Gide	Identifying and matching novel drug combinations to the correct patients
31	Isaiah Balot	Pablo Fernandez-Pena	The identification of novel therapeutic targets for cutaneous squamous cell
32	Sarah Ho	Charles Bailey	Dissecting the role of ZNF185 in CTCF-mutant endometrial cancer
33	Sarah McLucas	Dinny Graham	Novel paradigms for investigating drivers of the in situ to invasive transition in breast cancer
34	Winston Lay	Elham Hosseini-Beheshti	Investigating the role of extracellular vesicles in the tumour microenvironment
35	Julianne Nayar	Katie Dixon	Uncovering early markers that predict efficacy of sun protective agents in reducing skin carcinogenesis
36	Jiawei Chang	Zaklina Kovacevic	Investigating the cross-talk between cancer cells and the tumour microenvironment
37	Dat Pham	Naisana Seyedasli	The role of metabolic stress in radiation induced remodelling of oral squamous carcinoma cells
38	Anthony Pirrello	Dannel Yeo	Characterising pancreatic cancer circulating tumour cells
39	Carla Jensen	Jenny Wang	Epigenetic regulation of leukaemia stem cells for developing a new therapy / Developing an innovative therapeutic strategy targeting malignant stem cells
40	Hannah Prsa	Andrew Hoy	Unravelling the metabolic link between the host and breast cancer disease progression
41	Mingchang Zhang	Mark Gorrell	Post-proline protease DPP9 in primary liver cancer
42	Anabel Withy	Andrew Hoy	Cancer cell metabolism
43	Akshaya Ramanathan	Kavitha Gowrishankar	Developing PRAME specific transgenic TCRs as a therapeutic to treat cancer
44	Christopher Keshishian	Sumit Sahni	Development of a novel therapy to overcome chemotherapy resistance in pancreatic cancer
45	Michelle Tanro	Naisana Seyedasli	The role of ECM in the response of ovarian carcinoma cells to platinum-based therapy
46	Lisset Contreras Luna	Pablo Silveira	Controlling tumours through CD300 immunoregulatory molecules
47	Simardeep Dhillon	Ali Azimi	Validation of a proteomic model for the early detection of primary cutaneous squaous cell carcinoma at risk of metastasis
48	Lauren Faul	Ali Azimi	Can proteomic analysis of scarless biopsies discriminate between eczema, psoriasis and actinic keratosis?
49	Teah Goodhand	Geraldine O'Neill	Taking aim at moving targets: Forcing receptor retention at the membrane surface
50	Lei He	Tracy Bryan	Gene editing as a potential therapeutic strategy for telomere-related bone marrow failure
51	Nina Krivosic	Yuyan Chen	Testing neuroblastoma cell lines with CAR T cells and molecular profiling
52	Ella Dopper	Jonathan Karpelowsky	Investigate the application of C-circles testing as a liquid biopsy approach
53	Amanda Purcell	Sarah Glastras	The role of appetite regulation in the brain on weight modulation in the perinatal period: Can preconception weight loss reduce adverse metabolic outcomes for mother and baby?
54	Liam Sida	Kimberly Alexander	A liquid gold biopsy for brain cancer
55	Hamish Ram	Anna Waterhouse	Understanding and reducing fibrin clot formation on medical devices
56	Matthew Darnell	Richard Tan	Local delivery of anti-inflammatory agents to treat peripheral artery disease
57	Christopher Davis	Sian Cartland	Resolving atherosclerosis by modulating inflammation
58	Yu-Wen Fu	Ashish Misra	Cell reprogramming as a novel tool to stabilize advanced atherosclerotic plaque
59	Tanya Gambhir	Anna Waterhouse	Organ-on-a-chip model of endothelial-biomaterial interactions
60	Ethan Italiano	Shaun Jackson	Understanding the mechanisms leading to microvascular dysfunction
61	Olivia Joseph	Sarah Glastras	The role of preconception weight loss in reducing cardiac stress associated with maternal obesity
62	Vijaishree Kumar	Ashish Misra	Modulating coronary atherosclerosis through perivascular adipose tissue

63	Naomi Luo	Steven Wise	Developing new small diameter vascular grafts
64	Pashtana Noori	Shaun Jackson	Understanding the mechanisms leading to microvascular dysfunction
65	Michael Rahman	John O'Sullivan	Exploring the relationship of maternal diet to fetal cardiac hypertrophy
66	Masoud Haghighi	Melanie White	Why does the diabetic heart behave differently? The role of energy-sensing…
67	Jackie Zhou	Melanie White	Why does the diabetic heart behave differently? The rol of hepatic creatine production
68	Jia Ying Shao	Paul Witting	Impact of Nanoselenium on thyroid health
69	Oliver Patrick Perillo	Mark Larance	Characterisation of the novel hormone erusiolin
70	Sophie Bailey	Daniel Waller	Evaluation of a novel transition service for adolescents and young adults with chronic health conditions
71	Reema Wehbe	Clara Zwack	Survey preferences for diet and physical activity in young people with mild intellectual disability

SESSION 1: 12-1pm HONOURS SUPERVISORS POSTERS

Supervisor	Poster Title	Project Titles
Barry Slobedman	Novel modulation of host immune functions by human herpesviruses	1. Herpesvirus infection of mucosal associated invariant T cells (MAIT) cells 2. Impact of human herpesvirus infection in transplantation
Margie Sunde	Amyloid fibrils in health and disease	1. Harnessing the programmed cell death pathway necroptosis for anticancer treatment 2. Tau filament structures associated with repetitive head injury
Tara Christie	Manipulating host-virus interactions for therapy	1. Antivirals that inhibit translation 2. Understanding the molecular basis of an engineered ACE2 COVID-19 therapeutic
Melkam Kebede (poster presenter Mark Germanos)	Sorting out the insulin granule	Establish mechanisms that regulate insulin secretory granule secretory competence using Cab45 knockout pancreatic β-cells
Tanya Golubchik	Simultaneous detection and genome sequencing of viruses and bacteria directly from clinical samples	Simultaneous detection and genome sequencing of viruses and bacteria directly from clinical samples

SESSION 2: 3-4 pm CURRENT HONOURS STUDENTS POSTERS

Poster no.	Student	Supervisor	Project Title
1	Annabelle Hawkins	Karen Scott	Enhancing adolescents' health through digital health literacy
2	Mandy Vuong	Rowena Forsyth	Health professionals' use of online communities
3	Anthony Simmon	Alexander Holden	Understanding Patient and Practitioner Knowledge of Dental Record Access Rights
4	Mohamad Elzein	Phil Poronnik	Virtual gallery and curation of student learning
5	Antonina Stewart	Elizabeth Hegedus	What is feedback anyway? Student perceptions of electronic feedback
6	Rajpreet Bajwa	Helen Ritchie	Medications and pregnancy: The role of the dentist - a descriptive study
7	Kate Borja	Elizabeth Hegedus	Turning a virtual skeleton into a radiograph
8	Kevin Law	Filip Braet	Establishment of a new multimodal correlative microscopy approach for cellular analysis across length scales
9	Kate Carey	Margot Day	Improving preimplantation embryo development in vitro
10	Alexander Cunningham	Laura Lindsay	Exocytosis in uterine epithelial cells - control of maternal fetal communication
11	Leyla Meharg	Margot Day	Use of amino acids and growth factors to improve early embryo development
12	Joseph Wang	Rachel Codd	Exploiting biosynthetic enzymes to make new drug-like molecules
13	Sara Elnour	Rucha Pandit	Precision medicine in neurological disorders
14	Darshwiin Indrawathan	Michaela Yeun	MYOD1-myogenesis for RNA-diagnostics of muscle genes in undiagnosed families
15	Maya Matty	Seo-Kyung Chung	Genomic investigation of neurodevelopmental disorders
16	Khin-Thethtar Nyunt	Seo-Kyung Chung	Identifying the genetic causes of neurological disorders using next-generation
17	Lennon Abonyi	Mac Shine	Nonlinear neuronal dynamics of layer 5 pyramidal neurons: A cellular mechanism for cortical integration
18	Gabrielle Adler	Woojin Scott Kim	A novel biomarker for Alzheimer's and Parkinson's Disease: Human endogenous retrovirus K
19	Yvonne Aguirre Candia	Claire Goldsbury	Microglia in Alzheimer's disease
20	Naomi Benjamin	Marina Kennerson	Developing age-dependent cellular models of late-onset neurodegenerative disease
21	Thomas Cahir	Dario Protti	Restoration of vision by optogenetic therapy
22	Olivia Davanzo	Kevin Keay	Neural-glial interactions in chronic pain
23	Risha Degamia	Luke Henderson	Neural-glial interactions in chronic pain
24	Angela Doshen	Luke Henderson	Brain imaging and spinal cord stimulation
25	Harrison Gard	Laura Piccio	Role of diet in the experimental models of multiple sclerosis
26	Anjie Ge	Laura Piccio	Role of diet in the experimental models of multiple sclerosis
27	Michael D'Souza	Karen Cullen	Microvascular pathology in Alzheimer's disease - mapping lesions and microvessels
28	Kevin Jin	Paul Austin	Exploring novel photobiomodulation parameters in an animal model of Sanfilippo syndrome
29	Connor Jobson	James Kang	Imaging the transition from acute to chronic pain
30	Connor Karozis	Kay Double	Molecular mechanisms of potential new treatment for Parkinson's disease
31	Jackson Karrasch	Paul Austin	Investigating peripheral immune activation in CRPS using imaging mass cytometry
32	Dowon Kim	Carol Dobson-Stone	The role of CYLD binding partners in frontotemporal dementia and motor neurone disease
33	Kelvin Le	Woojin Scott Kim	Developing blood biomarkers for frontotemporal dementia and motor neurone disease
34	Sol Lim	Gaelle Emvalomenos	Brain adaptations underlying chronic pain
35	Sachi Lauchlan	Nic Dzamko	3D culture models to understand Parkinson's disease
36	Tom Linstrom	Karin Aubrey	Role of GlyT2+ neurons in the midbrain
37	Drishya Mainali	Claire Goldsbury	Microglia in Alzheimer's disease
38	Katherine Moruzi	Nic Dzamko	Using stem cell models to understand Parkinson's Disease
39	Sarah Rosolen	Kay Double	Developing the first tool to quantify copper levels in the living brain
40	Bianca Setionago	Christopher Gordon	Investigating slow wave dissipation in insomnia disorder
41	Isabella Vatovec	Noemi Meylakh	Brain mechanisms underlying placebo analgesia

42	Michelle Chen	Tina Hinton	Exploring barriers and solutions in implementing effective disciplinary practices through remote curriculum delivery for healthcare students in a higher education setting
43	Natalie Clubley	Eryn Werry	Finding new drugs and diagnostic agents for frontotemporal dementia
44	India Dodgson	Anthony Don	Pharmacological control of oligodendrocyte bioenergetics to promote myelin
45	Willem du Preez	Lenka Munoz	Validation of novel drug targets in glioblastoma stem cells
46	Damien Andrew Ha	Robert Vandenberg	Discovery of glycine transport inhibitors for the treatment of pain
47	Tessa Hitchins	Nicholas Buckley	Which drugs are over-represented in suicide and poisonings?
48	Irina Lotsaris	Robert Vandenberg	Novel allosteric inhibitors of glycine transport inhibitors for the treatment of pain
49	Toni Michael	Sophie Stocker	Effect of self-monitoring urate on allopurinol adherence
50	Jenny Ni	Rachel Codd	Discovery of potential antibacterial targets using virulence factor surrogates
51	Paus Paulus	Fanfan Zhou	To develop novel therapies to treat human Uveal Melanoma
52	Roderick Peel	Sarah Hilmer	The effect of opioid, polypharmacy, and deprescribing on physical function and side effects in middle aged osteoarthritic mice
53	Lamisa Sadia	Christopher Vaughan	Endocannabinoid control of chronic pain and stress
54	Fiona Schnitzler	Sinthia Bosnic-Anticevich	Identifying patterns of medication management for people with severe asthma: A pharmacy dispensing database study
55	Jake Watts	Robert Vandenberg	Cholesterol modulation of glycine transport inhibitor actions
56	Kevin Winardi	John Mach	The effect of polypharmacy on molecular signatures in organs from old aged
57	Annabelle Perfrement	David James	Determining the role of mitoprotease miPEP in insulin resistance
58	Sonia Samy	Stephen Alexander	Curing genetic kidney disease
59	Olivia van Gelder	Stephen Alexander	A kidney transplant for life
60	Luiz Mello Lima	Natasha Rogers	Another way to die - investigating pyroptosis in models of disease and transplantation
61	Aadhar Moudgil	Natasha Rogers	Drug repurposing to treat kidney injury
62	Nancy Nirmal Raj	Kedar Ghimire	No time to die - how to improve islet survival in diabetes and transplantation
63	Christian Kyriakou	Stuart Thomas	Right atrial scarring in patients with atrial fibrilation
64	Shayekh Abedin	Pierre Qian	Optimising radiofrequency ablation for treating hearty rhythm disorders
65	Lachlan McDonald	Alistair McEwan	Electrical impedance of cardiac tissue due to thermal ablation
66	Amir Pour	Stuart Thomas	Fluoroless catheter ablation therapy for cardiac arrhythmias
67	Mirna Moucharrafie	Chameen Samarawickrama	Investigating tsp-1 and vascular privilege in the cornea
68	Renee Zanella	Chameen Samarawickrama	Characterising immune, vascular and neuronal changes following TSP-1 blockade and ocular surface inflammation
69	Khanh Vy Do	Aaron Schindeler	Bone-binding antimicrobials for prevention of osteomyelitis
70	Anastasia Kharichkova	Munira Xaymardan	Biphasic differentiation of tongue satellite cells into skeletal and cardiac muscle cells
71	Yilan Wu	Amanda Brandon	Nutritional influences on health and lifespan in mice