The University of Melbourne, Department of Paediatrics and Murdoch Childrens Research Institute

Faculty of Medicine, Dentistry & Health Sciences

HONOURS & MASTERS PROJECTS 2026

Honours and Master of Biomedical Science

Online webinar will be held on **Tuesday 2 September at 4.30pm**

Register here

Honours and Masters Information Evening in person, **Thursday 11 September, 4.30pm onwards**

Register here

Contents

Laboratory based

Infection, Immunity and Global Health

1. Understanding streptococcal pathogenesis

Streptococcus pyogenes ('Strep A', group A streptococcus) is an important global pathogen. In a related bacterial species, Streptococcus pneumoniae, we and others have shown that viral co-infection can enhance bacterial virulence, by increasing bacterial density and inflammation in the host, and by driving changes in bacterial virulence gene expression. There is recent clinical epidemiologic evidence that viruses are also important in S. pyogenes pathogenesis, but little is known about this process. In this project, you will use murine and cell-culture models to examine the effect of viruses on S. pyogenes colonisation, transmission (spread to co-housed littermates) and disease, and the mechanisms involved. To achieve these aims, you will employ a range of methods such as bacterial transcriptomics, working with in vitro and/or in vivo models such respiratory cells from patients grown as air-liquid interface, genetic manipulation, as well as microbiological and immunological analysis of local and systemic samples. Your project will provide important novel data on key components of S. pyogenes pathogenesis and inform a pathway towards improving strategies for preventing S. pyogenes infections.

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Available as Masters Project: Yes

2. Changes in the pneumococcal population following vaccine introduction

Streptococcus pneumoniae (the pneumococcus) is a bacterial pathogen and a leading cause of morbidity and mortality worldwide. Pneumococci are classified into serotypes based on the type of capsule they produce. Although safe and effective vaccines that target of a subset of these serotypes have been available for over two decades, introduction in many low- and middle-income countries (where the burden of pneumococcal disease is greatest) is frustratingly slow. Vaccine introduction also leads to profound changes in the pneumococcal population structure. This can include a decline in vaccine-serotypes and replacement with non-vaccine-serotypes. Changes to the capsule of some strains means they are not recognized by vaccine-induced immunity (serotype switches, variants and new serotypes). However, these changes in the pneumococcal population have rarely been examined in low- and middle-income countries. In this project, you will leverage our unique set of samples from the Asia-Pacific to examine changes in the genetics of the pneumococcal population following vaccine introduction. Key approaches to this project include using genomics, bioinformatics, molecular biology, genetic manipulation of pneumococcal isolates and testing in a range of microbiological assays in vitro. Optional aspects include testing isolates in murine models of carriage, transmission and disease. Your research will provide new insights into how pneumococcal populations can change following vaccine introduction in high disease burden settings including Asia.

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3. Humoral immune responses in a human challenge model of Streptococcus pyogenes pharyngitis

Streptococcus pyogenes (Strep A) has an immense global public health burden, spanning a diverse clinical spectrum of communicable and non-communicable diseases, across the human life course. Despite over 100 years of research and development, there is still no vaccine for Strep A. Our team developed a controlled human infection model (CHIM) of Strep A pharyngitis as a platform for unique studies exploring Strep A host-pathogen interactions in its only natural (human) host. The CHIM enables unprecedented insight into infection and immunity, and we have curated an extensive biobank of unique clinical samples from these trials. This project aims to gain insight into protective immunity and immune responses by measuring antibodies against several important virulence factors using novel multiplex serology assays, before and after experimental infectious challenge with Strep A, and identifying any links with protection. We will also investigate cell-mediated immune responses using multiplex cytokine arrays. Additional techniques involved in the project may include processing patient blood samples, tissue culture and flow cytometry.

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4. Junk or adjunct? The place of protein synthesis inhibitors for treatment of severe invasive Streptococcus pyogenes infections in a time of rising clindamycin resistance

Streptococcus pyogenes causes deadly invasive infections including toxic shock syndrome and necrotising fasciitis. A multi-country surge of invasive infections affecting children and adults in many countries since late 2022 has renewed interest in key areas of uncertainty for the clinical management of these difficult cases. Widespread use of the protein synthesis inhibitor antibiotic clindamycin as an adjunctive antitoxin therapy for patients with severe invasive S. pyogenes infections is based on limited data from in vitro and observational clinical studies. However, at least 25% of invasive isolates are now clindamycin resistant in several countries. This study explores the effects of clindamycin and other antibiotics, using a panel of S. pyogenes isolates collected from severe invasive clinical cases, closely matched besides the detection of genes for clindamycin resistance. This project combines time-kill assays in different culture media, measurement of secreted S. pyogenes toxins in the culture supernatant, and stimulation of whole human blood with supernatant followed by measurement of cytokine release. Techniques involved in this project will include bacterial culture, automated and manual time-kill assays, ELISA, processing human blood samples, and multiplex cytokine assays. Additional techniques may include flow cytometry and proteomics.

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Available as Masters Project: Yes

5. Investigating the Off-Target Effects of Vaccines on Antiviral Immunity

This project will explore how vaccines influence immune responses beyond their intended targets, with a particular focus on effects on antiviral immunity. While vaccines are designed to protect against specific pathogens, increasing evidence suggests they can have broader immunological effects-sometimes enhancing or modulating responses to unrelated infections, including viruses. Bacillus Calmette-Guérin (BCG), the vaccine for tuberculosis is one that has been shown to have beneficial off-target ('heterologous' or 'non-specific') effects on human health. Through the BRACE trial, our large international randomised controlled trial of BCG vaccination healthcare workers in five countries, our team is investigating the clinical and immunology off-target effects of the BCG vaccine. Using the extensive biobank of samples from this well-characterised clinical trial, you will apply a range of immunological techniques (e.g. flow cytometry, cytokine profiling, transcriptomics) to examine how BCG vaccination shapes innate and adaptive antiviral responses. A key strength of this project is the ability to link immunological findings to clinical outcomes,

including susceptibility to viral infections. The project is suited to a student with a background in immunology, infectious diseases, or a related field, and an interest in translational human immunology. The candidate will gain experience in immunoprofiling, data analysis, and working with clinically derived human samples. This work will contribute to a broader understanding of how vaccines influence immune function in complex, real-world settings, with potential implications for vaccine design and public health policy.

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Available as Masters Project: Yes

6. Shaping TB Risk and Vaccine Response: The Role of Age in Mycobacterial Immunity

Tuberculosis (TB) is the leading cause of death from a single pathogen and a major global health threat, particularly in low-resource settings. Despite a vaccine being available for over 100 year, protective immunity against tuberculosis is not understood. In addition to Mycobacterium tuberculosis (Mtb), the bacterium that causes TB, other mycobacteria can cause devastating diseases such as leprosy and Buruli ulcer. While mycobacterial exposure is common only a small proportion of exposed individuals develop disease. Susceptibility to mycobacterial infection, disease progression, and vaccine effectiveness change across the human lifecourse. This project will collect samples from different age groups to characterise innate and adaptive immune responses to mycobacteria. A key focus will be on identifying age-specific immune profiles and understanding how immune maturation, and prior exposures shape the nature and magnitude of responses. The student will gain experience in human immunology (immunophenotyping and functional assays), comparative analysis across age groups, and interpretation of immune function in the context of infectious disease risk. Findings from this work will contribute to a broader understanding of immune development and ageing, and inform more effective interventions for TB and other mycobacterial diseases across the lifespan.

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Stem Cell Medicine

7. Bioengineering a dynamic culture platform to improve the maturity of iPSC-derived valve engineered tissue

Heart valve disease is a critical health burden and growing cause of mortality worldwide. To understand disease mechanisms and develop future treatments for heart disease, we have developed a valve engineered tissue platform derived from human pluripotent stem cells. Maturation of stem cell-derived tissues is an ongoing area of research, therefore the aims of this project are to improve tissue maturation with a dynamic culture platform to mimic the mechanical environment of the valve in the body. This project will utilise human pluripotent stem cell culture, directed differentiation protocols, bioengineering techniques, 3D printing, high throughput confocal microscopy and molecular biology techniques.

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Available as Masters Project: Yes

8. Using stem cell-derived valve tissues for Rheumatic Heart Disease research

Rheumatic Heart Disease (RHD) is a global healthcare problem affecting >40 million people worldwide, disproportionately affecting Australia's First Nations peoples and those in low-middle income settings. RHD is an autoimmune condition where the heart valves suffer permanent damage following repeated and untreated bacterial infection with Streptococcus pyogenes. Studying RHD is particularly challenging because it is a human specific disease, which makes traditional animal models unsuitable for this research. We have developed a human stem cell model of valve tissue to study RHD. This project aims to understand the role of autoantibodies in disease progression. The project will utilise human pluripotent stem cell culture, directed differentiation protocols, confocal microscopy, flow cytometry, patient serum isolation and molecular biology techniques.

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Available as Masters Project: Yes

9.Investigating altered cell fate in paediatric high-grade gliomas

Paediatric high-grade gliomas (pHGG) are a leading cause of childhood cancer death in Australia. Our research investigates the two major forms of pHGG: diffuse midline gliomas (DMG) and diffuse hemispheric glioma (DHG). These are highly aggressive and fatal brain tumours that arise in children and are one of many childhood cancers recognised as

diseases of dysregulated development. Our research aims to understand the underlying biology and aetiology of paedatric brain cancers towards discovering novel therapies. We hypothesise that manipulating neural cell fate and pushing tumour cells towards normal differentiation will reduce tumourigenesis. The aim of this project is to reprogram DHG neural cell fate trajectories towards normal differentiation. Patient-derived DHG cells will be modified by CRISPR-Cas9 deletion of the key interneuron-promoting transcription factor DLX2. Gene deletion will be validated and cells evaluated for changes in expression of specific progenitor and cell fate signature markers as well as histone marks via qPCR, RNAseq and Western blot analysis. Tumourigenicity will be measured by characterising cell proliferation, migration and colony growth in soft agar. Students will expect to gain experience in a range of cell culture and biochemical techniques.

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Available as Masters Project: Yes

10 Interrogating the interplay of endothelial and haematopoietic signalling governing the development of haematopoietic stem cells

The generation of haematopoietic stem cells (HSCs) from induced pluripotent stem cells (iPSCs) has great therapeutic potential for stem cell medicine. Our group has recently developed a landmark iPSC to HSC differentiation protocol, capable of producing human HSCs which can engraft into mouse models (Ng et al., Nature Biotech, 2024). This breakthrough protocol involves the precise sequential addition and removal of key signalling factors, such as cytokines, which drives the emergence of blood stem cells. However, we still do not fully understand how these signals are integrated in the genome to induce transition from one cell type to the next. A crucial and key hallmark of the development of haematopoietic stem cells is the transition from a specialised endothelial cell type to a haematopoietic cell type. This project proposal aims to interrogate the interplay between endothelial and haematopoietic signalling which regulates this transition. The student will undertake training in both wet lab and bioinformatic methods, and so will be suitable for applicants who have an interest in a broad range of methods. The student will learn how to culture iPSCs and will perform differentiations to develop HSCs. The wet lab methods which the student will perform include but are not limited to iPSC maintenance, differentiations, FACS analysis, cell sorting, RNA extraction for RT-qPCR and bulk RNA-Seq library preparation and ATAC-Seq library preparation. Dry lab methods include bioinformatic analysis of bulk RNA-Seq data, scRNA-Seq data, ATAC-Seq data and integration with publicly available tools and datasets. The student will develop practical experience in stem cell biology and genomics, and gain transferable skills in both experimental and computational analysis. Further to this, the student will participate in the full range of activities undertaken by members of the Blood Development research group at the Murdoch Children's Research Institute.

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11. Increasing beta cell yield for treatment of type 1 diabetes

Pluripotent stem cells (PSCs) are a promising alternative to cadaver-derived islets, potentially providing an unlimited supply of insulin-producing beta cells for transplantation therapies to treat type 1 diabetes. Numerous protocols that promote the differentiation of PSCs towards a beta cell fate have been published and generally aim to recapitulate signalling processes that occur during embryogenesis. However, there is one noticeable discord between in vivo pancreatic development and in vitro pancreatic differentiation - the absence of a clearly defined progenitor expansion stage in in vitro differentiations. In the embryo, prior to pancreatic specification, the gut tube undergoes significant expansion as the embryonic axis extends. Following this, the pancreatic progenitor compartment rapidly proliferates, undergoing branching morphogenesis, prior to endocrine differentiation, delamination and islet formation. The goal of this project will be to identify factors and/or pathways that can expand human PSC-derived pancreatic progenitor pools, thus allowing for efficient generation of large numbers of human PSC-derived beta cells for subsequent use in transplantation therapies. This project will involve but is not limited to cell culture, directed differentiation of human pluripotent stem cells and flow cytometry

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Available as Masters Project: Yes

12.Defining stem cell therapies for the treatment of type 1 diabetes

Stem cell-derived islets (sc-islets) generated from pluripotent stem cells (PSCs) are an alternative to donor-derived islets, potentially providing an unlimited number of insulin producing cells for transplantation. Numerous protocols that promote the differentiation of PSCs towards endocrine cell fates have been developed, with some underpinning clinical trials of PSC-derived products. To date, most trials have used of allogeneic PSCs, meaning, as with alloislet transplantation, recipients will still require extensive immunosuppression. However, a recent report describing the use of an autologous cell product - albeit in an immunosuppressed recipient, provides a proof of principle for autologous sc-islets, if certain challenges can be addressed. One hurdle for the use of autologous sc-islets is the widely recognized variability in the capacity of different PSC lines to differentiate to specific cell lineages. The difficulty of this challenge is compounded by the lack of predictive assays to quantify both differentiation efficiencies and to characterize the presence of off-target lineages. Similarly, in instances where differentiation efficiencies are poor, methods for enriching for desired target cell populations could circumvent the need to optimize differentiation methods for each personalized PSC line. The goal of this project is to identify and validate novel stage-specific markers for benchmarking PSC differentiation to pancreatic endocrine cell types. This project will involve but is not limited to cell culture, directed differentiation of human pluripotent stem cells, flow cytometry, single-cell RNA sequencing and associated bioinformatic techniques.

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Available as Masters Project: Yes

Genomic Medicine

13. Discovering novel genes and pathways to ataxia

Ataxia is the term for a group of neurological diseases that affect movement and coordination, impacting ~1:15,000 individuals. While there is considerable evidence that gene mutations cause ataxia, currently only ~30% of affected individuals receive a genetic diagnosis. A focus of our research is to identify novel genes that cause ataxia. We have recently identified several novel genetic causes of ataxia, caused by pathogenic repeat expansions. This is when a segment of repetitive DNA, termed a short tandem repeat, is significantly expanded in size compared to the general population. This project will utilise modern genomic technologies, including exome and genome sequencing and transcriptomics to characterise the size and structure of these novel repeat expansions. Subsequently, the genes will be characterised in patient-derived cells to study disease-specific mechanisms and identify potential therapeutic treatments. The successful candidate will have the opportunity to learn a range of laboratory techniques including generating and analysing Next Generation Sequence data, cell culture, immunocytochemistry, microscopy, real-time qPCR and western blot analysis. In addition, they will work closely with clinicians and bioinformaticians within a large multidisciplinary team.

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Available as Masters Project: Yes

14.Improving outcomes of mitochondrial diseases using human stem cell models

Mitochondria are our cellular power plants that burn sugars, fats and proteins to generate energy. Each week in Australia a child is born with a severe mitochondrial disorder. Many of these children die in the first years of life and most suffer from severe disease, particularly affecting their brain and/or heart. Access to these tissues from patients is limited, making it difficult to assess the impact on mitochondrial and other pathways contributing to disease pathology. This project will therefore use human pluripotent stem cell models of mitochondrial diseases that can be differentiated into clinically relevant cell types, such as neurons and cardiomyocytes, to investigate disease mechanisms and treatment approaches. The aims include: 1) Characterising cellular models of mitochondrial disease using human Embryonic Stem Cells (hESCs) and Induced Pluripotent Stem Cells (iPSCs) to study pathogenic pathways in differentiated cardiomyocytes or neurons, as well as their impact on mitochondrial function and cellular physiology. 3) Defining the impact of targeted therapeutic strategies in these models on the cellular proteome and other markers

of cellular homeostasis. We have established a panel of pluripotent stem cell models representing a range of mitochondrial diseases and pathways. This project will involve validation of a selected cell model from this panel, differentiated to either cardiomyocytes or neurons to assess the impact of the gene knockout on various aspects of mitochondrial and cellular function. Molecular and cellular characterizations may include generation of correction lines, mitochondrial and cellular functional assays (e.g. ATP synthesis, fluorescence microscopy, FACS, multi-electrode arrays), quantitative proteomics, RNAseq and organoid modelling. Students will develop skills in cell culture, molecular biology and biochemistry.

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Available as Masters Project: Yes

15. Functional genomics approaches in mitochondrial disease linked to LONP1

The majority of cellular energy is generated by mitochondria, which help convert sugars, fats and proteins to usable energy in the form of ATP through the process of oxidative phosphorylation (OXPHOS). While mitochondria have their own DNA, it encodes a limited number of genes, all associated with the OXPHOS system. Therefore, the vast majority of the ~1500 mitochondrial proteins are instead encoded on nuclear DNA, translated on cytosolic ribosomes and imported into the correct mitochondrial compartment using various molecular machineries that coordinate the process of mitochondrial protein trafficking. Mitochondrial diseases are rare genetic disorders that affect this energy generation process, often alongside other mitochondrial functions, and are linked to over 350 different nuclear and mitochondrial DNA encoded proteins. Currently, only ~50% of patients with suspected mitochondrial disease receive a genetic diagnosis. In many of these undiagnosed cases, genetic variants of uncertain significance (VUS) are identified in individuals that require further functional testing to determine pathogenicity. This project will employ functional genomics approaches to evaluate variants in LONP1, a gene encoding a mitochondrial protease linked to CODAS syndrome. Cellular disease models will be generated and studied alongside patient tissues and cell lines, using cellular, molecular and biochemical approaches including proteomics, transcriptomics, microscopy and western blotting. The results from this project will contribute to our understanding of LONP1 disease mechanisms and cellular stress response pathways and improve patient outcomes by characterising potentially disease-causing variants.

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Available as Masters Project: Yes

16.Validation of a novel ASO-based therapeutic for TRAPPC4-related disorder

We identified a new severe childhood neurological disorder where all affected children are homozygous for the exact same mutation in a well-conserved splice site of TRAPPC4 [1]. There are no treatments. We have designed and refined antisense oligonucleotides (ASOs) to modify aberrant splicing processes. Our lead ASOs increase protein levels and normalise the mis-splicing events. To our knowledge no stem cell models exist for this disease. In the proposed studies we will achieve the following: 1: Utilise existing patient-derived stem cells and characterise neuronal phenotypes due to TRAPPC4 deficiency. 2: Undertake functional validation of lead ASOs in patient stem cell derived neurons. By the end of this study, we anticipate identifying top safe ASO for future human trials.

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17. Engineering Skeletal Muscle in a Dish: Using Electrical and Biochemical Cues to Tune Muscle Maturation and Fibre Type

Skeletal muscle is a remarkably adaptable tissue, capable of altering its structure and function in response to different types of stress, including exercise, disuse, and injury. In the Muscle Research lab at the Murdoch Children's Research Institute, we use innovative stem cell technologies to model skeletal muscle in vitro. This project will focus on developing and characterising 2- and 3- dimensional skeletal muscle models derived from either primary muscle cells or induced pluripotent stem cells, from healthy individuals and those with genetic muscle conditions. A key goal of the project is to explore how different electrical stimulation protocols and metabolic or hormonal cues, drive muscle maturation and the development of disease. Students will investigate whether these interventions can promote a shift toward slower, more fatigue-resistant muscle fibres (like those used in endurance sports) or faster, more powerful fibres (critical for sprint performance). These findings have applications across the spectrum-from enhancing our understanding of genetic muscle diseases like muscular dystrophy, to modelling elite muscle performance. The project will involve a range of techniques, including stem cell culture and differentiation, 3D tissue engineering, immunofluorescence imaging, gene and protein expression analysis, and functional assays using the Mantarray system for real-time force measurement. This interdisciplinary project offers a unique opportunity to contribute to translational research with applications in regenerative medicine, sports science, and therapeutic development. Students will be supported by a multidisciplinary team of physiologists, stem cell biologists, and geneticists.

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18. Using neuronal models to characterise an epigenetic disorder affecting neurodevelopment

A growing body of genetic evidence has identified a large number of epigenetic regulator genes to be associated with neurodevelopmental disorders, suggesting that neurodevelopment is susceptible to epigenetic changes as neurons develop and mature. How these genes affect neuron-specific functions at the cellular level is largely unexplored. Furthermore, epigenetics is a reversible process and highly dynamic and can be manipulated to increase or decrease epigenetics marks with appropriate inhibitor or activator molecules. This therefore provides the opportunity to 'tune' these epigenetic marks in a therapeutic manner to restore proper epigenetic regulation within this set of neurodevelopmental disorders. This honours project aims to focus on a neurodevelopmental epigenetic disorder called Kabuki Syndrome cause by deleterious mutations in the KMT2D gene. KMT2D codes for a methyltransferase protein responsible for methylating histone 3 at lysine residue 4 (H3K4). Reduced function of KMT2D results in reduced methylation at H3K4, but what impact this has on cell function and neurodevelopment remains unknown. The successful candidate will use CRISPR/Cas9 gene editing to introduce patient mutations into KMT2D of human pluripotent stem cells (hPSC's) to mimic Kabuki syndrome genetics. hPSC's will then be differentiated into cortical neurons which mimics key cortical development hallmarks such as synaptic maturity, neurite growth and activity in a laboratory setting which will be assessed and analysed be the student for disorder-specific phenotypes. As Kabuki syndrome neurons have reduced histone methylation, can compounds capable of increasing histone methylation help treat these children? This honours project will conduct a targeted drug screen of methylation modulating compounds on Kabuki syndrome neuronal models and assess their therapeutic benefits. This project exposes students to a wide range of techniques including human stem cell culturing, CRISPR/Cas9 gene editing, neuronal differentiation, electrophysiology, molecular biology techniques, advanced microscopy and flow cytometry, drug screening pipelines and automation.

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19. Using patient derived stem cell models to identify candidate targets for the treatment of neurofibromatosis type 1.

Neurofibromatosis Type 1 (NF1) is a single-gene disorder caused by a loss-of-function mutation on one allele of the NF1 gene resulting in a reduction of the protein neurofibromin. Cognitive deficits occur in approximately 80% of children with the genetic syndrome, neurofibromatosis type 1 (NF1), making them the greatest cause of disability for individuals with this lifelong genetic condition. These manifest as academic failure due to learning disabilities (70%), attention deficit-hyperactivity disorder (ADHD; 40%) and a significantly

increased risk for autism spectrum disorder (ASD; 25%). Current therapies, whether medication or behavioural interventions, are often ineffective because they use 'trial and error' approaches targeting symptoms, rather than the cause. Therefore, there is an urgent need to discover new therapeutics for the impairing neurodevelopmental symptoms experienced by children with NF1. This drug screening project aims to identify compounds that may modulate neurofibromin expression using patient derived stem cell lines. The patient derived stem cells will be differentiated into neuronal cells and then used to perform a targeted small molecule drug screen. Functional readouts from the screen will include assessment of neurofibromin steady state levels as well as structural readouts including neurite development, length and number of neurons in the cultures. Once candidate compounds have been identified, validation assays will be performed in NF1-patient derived stem cell models to determine whether the compound treatment/s can ameliorate neuronal deficits. Extensive functional analyses will be performed including the assessment of neuron growth and maturation (using immunofluorescence assays), neuron function (using multi electrode arrays and calcium imaging) as well as biochemical assays such as western blotting, real time PCR and ELISAs to determine biological changes in our patient lines versus control lines.

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Population Health

20.Characterising the antibody responses that prevent, promote or predict the development of allergies

Allergies are a considerable burden to quality of life and can be potentially fatal in the case of anaphylaxis. The incidence of allergic diseases is rapidly increasing which necessitates a need to better understand how these diseases can be prevented, managed and treated. Allergen-specific antibodies are fundamental in promoting or preventing allergic diseases, whereby allergen-specific IgE drives allergic responses whilst IgG antibodies are capable of preventing allergic reactions. However, how these immune responses arise remains poorly understood and little is known to what extent allergen-specific IgG or IgA can influence allergic diseases in early life. This project will characterise the antibody responses to allergens in food allergic or tolerant children from world-leading intervention trials at the National Allergy Centre of Excellence. As part of the ongoing work at the Population Allergy laboratory, this project will provide cutting edge experience in epidemiology and immunology in an exciting and supportive work environment. Diverse laboratory techniques, including ELISA and flow cytometry will be utilised to quantify allergen-specific antibodies and unravel how such antibodies may promote or prevent allergic responses. By determining the quantity and isotype of allergen-specific antibodies, this project will greatly improve our understanding of how allergies arise in early life. Furthermore, statistical analyses will interrogate whether antibody data correlates with allergy status, thereby having the potential

to identify new biomarkers capable of predicting the likelihood of developing food allergies during childhood.

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21. Harnessing the untapped potential of residual clinical pregnancy samples for population-based pregnancy and child health research: Generation Victoria (GenV)

This project will suit students interested in (1) the health of pregnant women and their children, (2) biospecimen processing, and (3) biological 'omics data generation and analysis. It could support one or several students working as a team. The rising prevalence of chronic conditions such as obesity, asthma, mental health and autism, and the ongoing prevalence of pregnancy related conditions (gestational diabetes, pre-eclampsia, in utero growth restriction and preterm birth) render new research approaches paramount. All of these conditions can be traced back to the interaction of genetic and environmental risk factors that influence a range of biological and physiological processes. Mega-cohorts (n>100,000) like the UK Biobank have transformed later-life discovery and translation internationally. We want to do the same for children and have recruited nearly 50,000 families into Generation Victoria (GenV), many of whom have provided biosamples to help understand the biological processes that underpin health and disease. The GenV approach to biospecimen collection and banking is multifaceted and based on systems change as opposed to participant recruitment and tracking. Tens of thousands of routinely-collected clinical samples from pregnancy and birth are stored in the GenV automated -80C biorepository located at the Royal Children's Hospital. Before their release to researchers internationally, it is important to understand the impact of a range of parameters - collection processes, temperature and time to storage, on specific measures obtained a range of 'omics technologies (eg. transcriptomics, metagenomics, metabolomics, epigenomics) Students will access a subset of clinical samples and associated metadata. They will then test a range of processing parameters on data generated by external providers across one or more 'omics platform technologies. Understanding the factors that impact data for research will be tremendously important to inform future generations of researchers internationally who will access the GenV biobank and associated data repository with the aim of understanding the early life mechanistic origins of a range of chronic (often lifelong) health conditions.

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22. Optimising Biospecimen Collection Protocols for Large Early Childhood Cohorts in School Settings

This project offers students the chance to contribute to Generation Victoria (GenV), Australia's largest longitudinal child and parent cohort, tracking over 125,000 participants in order to tackle the rising health challenges of the 21st century. In 2026, students will help develop scalable, child-friendly biospecimen collection protocols ahead of GenV's Early School Wave in 2028-29. As one of a team, you will be involved in protocol development for biospecimen collection, and a qualitative analysis of the feasibility and acceptability of collecting biospecimens from children, in preparation for GenV's early school wave. This will include a review and cost-benefit analysis of biospecimen collection options suitable for young children as part of a short school-based assessment, including sampling and time-to-storage issues that may have downstream impacts on sample utility. You will also consult with consumers and experts to understand the acceptability of biospecimen collection from young children, and potential roadblocks to representative biospecimen uptake including uptake bias, sensitivity around genetic testing and cultural implications. Time permitting, the project may include small-scale piloting the collection of selected biosamples to validate solutions to overcome potential roadblocks to biospecimen uptake within the target cohort. Working with a collaborative team supported both by your dedicated supervisors and the GenV team, you will gain hands-on experience in research design, and contribute to real-world solutions in child health. This is a rare chance to explore your passion, be part of something bigger than yourself, and shape the future of child health.

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23. Determining diagnostic thresholds for tree nut allergies in children under 2 years old

Immunoglobulin E (IgE) antibody-mediated tree nut allergies are frequently life-long and severe as the accidental ingestion of tree nuts can risk life-threatening reactions. Tree nut allergies are also common, affecting 3% of Australian children by the time they reach primary school age. Early and accurate diagnoses are therefore critical to ensure IgE-mediated tree nut allergies are safely and appropriately managed. However, tree nut allergies can be a clinical and diagnostic challenge. First, an allergy-focused clinical history is taken to identify the causative tree nut and determine whether the patient's tree nut reaction may be IgE-mediated. IgE testing is then performed, via a blood test or skin prick test, to verify the presence of allergen-specific IgE antibodies to the suspected tree nut. Yet the diagnostic performance of IgE testing to different tree nuts is not well-defined for children under 2 years old: the age at which tree nut allergies typically develop. In this project, you will leverage our extensive and unique set of biospecimens from world-leading intervention trials at the National Allergy Centre of Excellence to investigate the diagnostic value of IgE testing for cashew, almond, and hazelnut allergies in children under 2 years old. You will use advanced, specialist ELISA technology to quantify tree nut specific-IgE antibodies and harness that data to determine diagnostic test thresholds which help guide clinical tree nut allergy

diagnosis in young children. You will gain multidisciplinary laboratory, epidemiological, and clinical trials research experience in a dynamic and supportive environment with the Population Allergy team. Findings from your Honours project will help address a crucial diagnostic gap for young children undergoing tree nut allergy investigations.

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Available as Masters Project: No

Clinical Sciences

24. Comparative Proteomic Analysis of Human Blood Fractions

This project will investigate the distinct protein compositions (proteomes) of various human blood fractions, including plasma, serum, and cellular components such as red blood cells. Utilizing mass spectrometry, this project aims to identify and quantify proteins extracted across these fractions. This comparative analysis will shed light on the unique biological roles and potential diagnostic biomarkers associated with each blood compartment, thereby providing a valuable database from which to design future clinical studies and improve diagnostic strategies.

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25. Development of a Novel Protein Extraction Method for Preterm Thymus and its Application in Studying Mechanical Ventilation Impact

This project will firstly systematically explore and refine various methodologies to maximize protein integrity and quantity from preterm thymus samples. Once the optimized extraction protocol is established, it will be applied to investigate the proteomic changes in the preterm thymus induced by mechanical ventilation. Mechanical ventilation is a life-saving intervention for preterm infants but is known to contribute to organ injury and systemic inflammation. This project will compare the protein profiles of thymus tissue from ventilated and non-ventilated preterm models and quantitative mass spectrometry will be employed to identify differentially expressed proteins, providing insights into the molecular mechanisms by which mechanical ventilation may influence thymic development, immune cell maturation, and overall immune function in vulnerable preterm infants. The findings from this project will contribute to a better understanding of ventilation-induced organ injury and could inform future strategies to mitigate its adverse effects on the developing immune system.

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26. Mechanistic Insights into CDKL5-Associated Epilepsy Using Resected Brain Tissue and Patient-Derived Neuronal Models

CDKL5 encephalopathy is a severe early-onset epilepsy caused by mutations in the X-linked CDKL5 gene, leading to intractable seizures and profound neurodevelopmental impairment. We have already applied Xenium spatial transcriptomics to resected cortical tissue from CDKL5 patients to better understand the factors that underlie seizures in these children. In this project, the student will undertake a comprehensive analysis of these spatial datasets to identify cell-type-specific transcriptional alterations and disrupted molecular pathways. Key tasks include image-guided region segmentation, differential gene expression and pathway enrichment analyses, integration with in-house and publicly available single-cell and bulk RNA-seq resources, and validation by immunohistochemistry on additional brain regions. To validate candidate drivers of seizures, the student can leverage existing patient-derived iPSC lines differentiated into cortical neurons. Validation approaches may include qPCR, immunostaining for synaptic markers, and multielectrode array recordings to assess network activity. Pharmacological perturbations using compounds known to modulate CDKL5-linked pathways will test the functional relevance of top candidate genes. By combining spatial transcriptomics with patient-derived neuronal models, this honours/master's/PhD project aims to uncover the cellular and molecular underpinnings of CDKL5-associated epilepsy and to identify potential targets for therapeutic intervention.

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27.Functional Validation of Epilepsy-Associated Variants of Uncertain Significance

IPCHiP (International Precision Child Health Partnership) is an initiative to accelerate discovery and improve outcomes in rare paediatric disease, and Gene-STEPS is its flagship programme-a rapid genetic-diagnostic pipeline for childhood epilepsies that integrates high-coverage sequencing with detailed phenotyping across four international centres. Despite these advances, many variants of uncertain significance (VUS) in epilepsy genes remain unclassified, leaving families without clear answers. In this project, the student will collaborate across our laboratory and clinical teams to identify patients harbouring high-priority VUS, then draw on our in-house multi-omic datasets to design and implement bespoke functional assays. Using cell-based models, including patient-derived induced pluripotent stem cell lines, the student will apply molecular and cellular readouts to detect variant-driven changes in gene function, protein behaviour and cellular physiology to

determine VUS pathogenicity. In addition, they will evaluate targeted interventions for their ability to rescue any observed deficits. By leveraging the Gene-STEPS discovery pipeline, this project will deliver the functional evidence needed to reclassify VUS, improve diagnostic yield in epilepsy, and potentially uncover novel targets for precision therapy.

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Non-laboratory based

Infection, Immunity and Global Health

28. Using the SnotWatch platform to understand the epidemiology and impact of respiratory viruses

The SnotWatch platform collates results of respiratory PCR tests from Victorian laboratories. There is opportunity to conduct epidemiological descriptions of tested pathogens. We have also developed an approach to describe the presentations to healthcare that are associated with peaks in virus circulation. This approach could be used to describe the association between circulating viruses and presentations for conditions such as GBS and cellulitis.

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29. Transcutaneous CO2 Monitoring Service Clinical Audit

Introduction:
Transcutaneous carbon dioxide ($TcCO_2$) monitoring is increasingly used in paediatric sleep and ventilation medicine for assessing gas exchange in children needing ventilatory support. However, systematic evaluation of its technical performance, accuracy across age groups, and clinical impact remains limited. Local experience at The Royal Children's Hospital (RCH) Melbourne indicates potential challenges in younger patients and variability in $TcCO_2$-capillary blood gas agreement. Evidence-based optimisation is needed to improve service delivery and patient outcomes.
Aims:
To evaluate the technical success and reliability of $TcCO_2$ monitoring across paediatric age groups.
To examine the correlation between $TcCO_2$ readings and capillary blood gas results.

To assess the impact of $TcCO_2$ monitoring on clinical decision-making and treatment modifications.
To identify factors influencing technical performance, including staff experience and sensor management practices.
Methods :
A retrospective clinical audit will include all paediatric patients who underwent $TcCO_2$ monitoring at RCH from late 2019 to 2025 (estimated n=400-500). Data will be extracted from the EPIC electronic medical record and Compumedics Nexus360 server. Key variables include demographics, technical success rates, $TcCO_2$-capillary blood gas correlation, clinical interventions based on $TcCO_2$ findings, and operational metrics such as sensor repositioning and setup times. Analyses will involve descriptive statistics, correlation coefficients, Bland-Altman plots, logistic regression for predictors of technical success, and thematic analysis of clinical documentation.
Clinical Implications:
This audit will provide the first comprehensive evaluation of paediatric $TcCO_2$ monitoring in an Australian setting. Results will inform evidence-based patient selection, staff training, and service protocols. Improved technical success and reliability may reduce invasive blood sampling and enhance clinical decisions, ultimately improving patient care and operational efficiency. Findings will also contribute to national guidelines for paediatric ventilatory monitoring.

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30. Feasibility and Efficacy of Remote Monitoring of Non-Invasive Ventilation (NIV) in Children

Introduction:
Non-invasive ventilation (NIV) is essential for children with neuromuscular disease (NMD) who develop chronic respiratory failure, requiring ongoing monitoring to ensure optimal outcomes and therapy adherence. The increasing complexity of these patients and the shift towards home-based care have been highlighted in recent guidelines, which recommend advanced remote monitoring technologies to support management and improve adherence in paediatric patients.
Aims:
To assess the reliability and effectiveness of remote monitoring compared to manual downloads.
To evaluate the added value of home monitoring with oxycapnography and respiratory effort bands in managing NIV.
To identify discrepancies in ventilation parameters and patient compliance between remote and manual data retrieval methods.
Methods :
All children requiring NIV (BiPAP) attending the Royal Children's Hospital (RCH) (n≈90) will be offered participation. Data will be collected at two time points during the project from both remote monitoring reports and manual downloads. Selected patients will also undergo home

monitoring using oxycapnography and respiratory effort bands. Analyses will compare ventilation parameters and patient compliance between remote and manual methods to assess consistency. The effectiveness of oxycapnography and respiratory effort bands in detecting ventilation issues will also be evaluated. Data collation and analysis will be performed by the student investigator.
Clinical Implications
This study will provide insights into the feasibility and efficacy of remote monitoring in paediatric home ventilation. Enhanced monitoring accuracy and reliability may improve therapy management, enabling early intervention for ventilation issues and non-compliance. Ultimately, the project aims to enhance patient outcomes and quality of life while potentially reducing healthcare costs through fewer hospital visits. Findings will contribute to guidelines and best practices for remote monitoring, supporting equitable, high-quality care across regions. Emerging evidence suggests built-in NIV device software can effectively manage patient-ventilator synchrony and leaks, improving overall performance. The results will also inform definitions for nocturnal hypoventilation and establish criteria for NIV initiation, follow-up, and weaning. Note: The home studies will use an RCH car via Hospital in the Home (HITH), so the student will require a full clean driver's licence. More information can be found here.

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Stem Cell Medicine

31. Analysis of spatial data in congenital heart diseases

Congenital heart disease affects 1 in 100 babies, while no cure currently exist, surgery in early weeks of life is usually required generating a great burden for the babies and their families. Most of the aetiology of congenital heart disease remains unknown. Spatial gene expression patterns are critical to understand how the heart develops and what underlying genetic patterns are behind heart malformation. High-throughput spatial temporal data have been recently generated with spatial transcriptomics technologies. Capitalising on these rich datasets, we aim to build a custom analysis workflow in which the cells are profiled with precise spatial gene expression information. The student will provide fundamental contribution to of this project, by: (1) analysing the spatial and single-cell RNA-seq datasets; (2) cross-validating the pattern in independent datasets and (3) associating observed spatial patterns with known literature in congenital heart disease. The outcome of this project is to discover novel genetic causes for congenital disease to improve the diagnostic and subsequent treatment of heart defects. Skills focus: proficiency in one programming language (e.g. Matlab, R, Python), basic understanding of cell and development biology, simulation, data visualisation, bulk / single-cell RNA-sequencing analysis. Laboratory Links: https://ramialison-lab.github.io/index.html

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32. Prevalence of significant chemotherapy toxicities amongst paediatric oncology patients

Childhood cancer patients experience a high burden of treatment-related toxicities. From an existing paediatric oncology cohort who have experienced adverse drug reactions, we would like to identify those who have experienced a significant toxicity, as defined by international cancer organisations, such as the Children's Oncology Group, for further investigation and to estimate prevalence.

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Clinical Sciences

33. Community and professional attitudes toward ADHD management approaches

Current guidelines recommend that people with ADHD receive a combination of medication and evidence-based psychosocial supports, with regular measurement and review of symptoms. This project aims to understand how people with ADHD, parents/caregivers, and health professionals perceive various ADHD management approaches and the integration of symptom measurement tools into care. This project will use data from a large online survey on experiences of ADHD clinical care in Australia. Findings from this project will help us understand potential barriers to care and how to improve adoption of recommended ADHD management strategies.

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Available as Masters Project: Yes

34. The predictive ability of imaging in Developmental Dysplasia of the Hip

Developmental dysplasia of the hip (DDH) is amongst the most common conditions in paediatric populations. The condition spans across a spectrum of abnormalities that range from delayed development of the hip through to complete dislocation. When detected before 6 months of age it usually can be effectively treated with conservative brace treatment. The successful endpoint for treatment is achieving a stable hip with normal imaging. However, in some cases, dysplasia will reoccur after successful resolution. Little is known about the

imaging parameter that may predict this reoccurence, particularly in large representative samples. Using data from a large prospective statewide registry in Victoria this research project will aim to determine: 1. The predictive ability for long-term outcomes of DDH of parameters measured by ultrasound 2. The predictive ability for long-term outcomes of DDH of parameters measured by Xray. This project will largely involve face-to-face data collection for the Victorian hip dysplasia registry, review of medical records of patients for missing data, data entry into both local and international registries for hip dysplasia, analysis of ultrasound and Xray images and quantitative statistical analyses.

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Available as Masters Project: Yes

35. Comparing treatment types in Developmental Dysplasia of the Hip

Developmental dysplasia of the hip is amongst the most common conditions in paediatric populations. The condition spans across a spectrum of abnormalities that range from delayed development of the hip through to complete dislocation. When detected before 6 months of age it can be effectively treated with conservative brace treatment. The successful endpoint for treatment is achieving a stable hip with normal imaging. However, little is known about the expected length of time to achieve this according to the type of brace used. Nor is it well understood, how complication rates, failure rates and long-term outcomes differ between treatment types, particularly in large representative samples. This project will seek to understand average brace treatment times in infants with DDH using data collected as part of the newly established state-wide VicHip registry. Specifically, the project will aim to compare long-term outcomes, and complication and failure rates in children treated with orthoses for DDH. Expected project tasks will include review of medical records, data entry and quantitative statistical analyses. The results of this work will contribute to the formulation of recommended clinical management and treatment protocols for DDH.

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36.Exploring parent perspectives to co-design approaches to detect and manage high blood pressure in children

Paediatric hypertension is an often overlooked yet significant health concern with potential long-term consequences. Early detection and management are crucial for preventing cardiovascular complications in adulthood. Despite its importance, childhood blood pressure (BP) screening is rarely performed, and new, pragmatic and cost-effective approaches for detecting and managing high blood pressure in children are needed. With new Australian guidelines for paediatric hypertension soon to be published, there is a timely opportunity to enhance screening practices and improve family engagement in this vital health initiative. This honours project aims to develop a family-centred approach to paediatric BP screening, ensuring its successful implementation and uptake. The study will employ experience-based

co-design methodology and qualitative research methods to involve parents directly in shaping the screening process. A series of experience-based co-design workshops will be conducted with up to 60 parents, including two in-person sessions and four online sessions. These workshops will facilitate collaborative discussions and creative problem-solving to address three key objectives: 1) identify the preferred process and setting for accessing childhood BP screening, 2) develop appropriate communication channels and positive messaging for screening invitations and outcomes, and 3) establish measures of successful implementation from a family perspective. Qualitative data analysis will be used to interpret the rich insights gathered from these workshops, ensuring a nuanced understanding of parental perspectives and preferences. By involving families in the design process and utilising robust qualitative research techniques, this research will enhance the acceptability and effectiveness of paediatric hypertension screening, and make an important contribution towards the goal of improving long-term cardiovascular health outcomes for Australian children.

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37. Exploring health care provider perspectives to co-design approaches to detect and manage high blood pressure in children

Paediatric hypertension remains a significant yet often unaddressed health concern in primary care settings. With new Australian guidelines for paediatric hypertension on the horizon, there is a crucial need to ensure effective implementation in clinical practice. However, many clinical guidelines fail to achieve their intended impact due to cultural, behavioural, and other contextual factors. This honours project aims to bridge the gap between guideline development and real-world implementation by engaging directly with front-line clinicians. The study will employ qualitative research methods to capture the perspectives of general practitioners (GPs) on adopting and implementing paediatric hypertension screening guidelines. A series of in-depth interviews and focus groups will be conducted with approximately 20 GPs, utilising a behaviour change framework to systematically identify barriers and enablers to guideline adoption. This approach will allow for a nuanced understanding of the challenges faced by clinicians and the potential strategies to overcome them. The research findings will inform the development of targeted implementation strategies and contribute to the creation of a hub-and-spoke model of clinical care for paediatric hypertension. By involving healthcare providers in the implementation process, this project aims to enhance the uptake and effectiveness of the new guidelines, ultimately improving the detection and management of hypertension in children. The insights gained from this study will not only benefit paediatric hypertension care but also provide valuable lessons for the implementation of other clinical guidelines in primary care settings.

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38.Characterisation of stem cell models of diffuse hemispheric gliomas

Paediatric high-grade gliomas (pHGG) are a leading cause of childhood cancer death in Australia. pHGGs including diffuse hemispheric glioma (DHG) are recognised as diseases of dysregulated development. DHG cells harbour mutations in histone variant genes that result in epigenetic alterations and recent work has shown that proper neural cell fate determination is dysregulated in the tumour cells. Little is known about the effects of histone variant gene mutations on brain development. We are using human pluripotent stem cells to generate brain organoids to model ventral forebrain development. The aim of this project is to generate and characterise stem cell lines in 3D brain organoid models. Gene reporter or histone mutant cell lines will be evaluated using immunofluorescent staining of organoids and imaging with confocal microscopy as well as RNA sequencing and Western blotting. The generation of hPSC brain organoid models will enable us to investigate the effects of tumour mutations on cell fate trajectories, cell type and behaviour during human brain development.

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39.Microstructural mapping of focal epilepsy using diffusion MRI

Developmental tumours and focal cortical dysplasia (FCD) are the most frequent pathologies found in children with drug resistant focal epilepsy who undergo epilepsy surgery. MRI plays a key role in identifying these malformations, and diffusion MRI (dMRI) techniques can provide quantitative information on the underlying microscopic structure of the brain tissue in vivo. FDG-PET and functional MRI also inform surgical decision making. Using pre-operative dMRI and FDG-PET data from approximately 200 histologically-confirmed epilepsy surgery patients, we will characterise the microstructural properties of lesions, to determine how these vary with pathology in order to improve non-invasive diagnosis in this cohort.

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40.The Self-and Others' emotion and Cognition in Adolescent Life (SOCIAL) study

Social processes, such as empathy and theory of mind, are vital for social functioning and building social competency in young people. Empathy is a social-affective process involving sharing someone's emotion. Theory of mind (ToM) on the other hand, is a social-cognitive process that involves reasoning about the thoughts or emotions of others. Both of these processes are required for successful social interactions. Impairments in these processes have been found in mental health and neurodevelopmental disorders. This project will behaviourally validate an empathy and ToM task for adolescents for ultimate use in the Magnetic Resonance Imaging (MRI) scanner. This will result in a tool for neuroscientists to investigate these processes, how they are impacted in clinical populations, and evaluate

treatments aimed to improve social processes. Depending on length of project (Masters versus PhD) and student interest/experience, this project may involve the following: working with young people, fMRI task programming and piloting, investigation of psychophysiological or neural correlates of social processing.

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41.The generation of unconventional T cells from stem cells using artificial organoid cultures

Unconventional T cells are a unique subset of immune cells that recognise non-peptide antigens presented by non-classical antigen-presenting molecules. These include CD1-restricted T cells, mucosal-associated invariant T (MAIT) cells, and γδ T cells. Unconventional T cells can respond rapidly upon activation, secreting high levels of inflammatory cytokines such as IFN-γ and TNF, and directly killing infected or abnormal cells through the release of perforin and granzymes. There is growing evidence that unconventional T cells play an important role in human diseases, including cancer, where they may contribute to anti-tumour immunity. However, the factors that control their development, frequency, and function remain poorly understood. In collaboration with the stem cell group at MCRI, we have developed a novel artificial thymic organoid (ATO) system that mimics the natural development of all T cells from induced pluripotent stem cells (iPSC). This system allows us to experimentally manipulate the development of these cells in ways that were not previously possible. This project will use this cutting-edge model in combination with other state of the art techniques to investigate the cellular and molecular signals that govern the development and function of unconventional T cells. The findings could contribute to the design of new "off-the-shelf" immunotherapies for the treatment of cancer and other diseases.

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42.What are the consequences of CDKL5 dysregulation human neurons?

The Cyclin-Dependent Kinase-like 5 (CDKL5) protein is critical for neuronal function and differentiation. CDKL5 Deficiency Disorder (CDD) is an X-linked developmental encephalopathy that results in early onset and difficult to control seizures and severe neurodevelopmental impairment, leading to lifelong disability. The CDKL5 protein is expressed in the brain, predominantly in neurons and regulates key phosphorylation events

that in turn regulate cell proliferation, neuronal maturation, synaptic activity, neuronal network function and the movement of subcellular cargo in neurons. The major aims of this proposal may encompass some of the following: 1. Contribute to our investigations on the critical role of the mammalian CDKL5 protein in human stem-cell derived neurons and brain organoids, through immunostaining, proteomics, electrophysiology and/or gene expression. 2.Increase our understanding of CDKL5 in key cellular events including maintenance and regulation of microtubule proteins, transcriptional regulators and DNA damage repair proteins. 3. This project will also interact with our drug repurposing screening program for CDKL5 and may encompass follow-up experiments validating drugs from our screening. We will identify key pathways regulated by CDKL5 and which will improve our understanding of how this kinase regulates synaptic activity in brain-like neural networks. We use a range of disease models including 2D neuronal culture and brain organoids. This project will contribute to a comprehensive and detailed understanding of the CDKL5 kinase in neuronal cell biology.

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43.Charting Recovery After Sarcoma Surgery: Prospective PROMs Analysis from the LimbDREAM Registry

Surgical treatment for Paediatric Sarcoma involves large operations, children and adolescents being asked to recover from massive surgery with recovery prolonged by the concurrent administration of chemotherapy. The LimbDREAM Registry collects 6-monthly patient-reported outcome measures (GOAL-LD, PODCI) for enrolled participants being treated for Paediatric Lower Limb Sarcoma. This prospective collection of both parent and adolescent-reported outcomes allows for examination of the complex interrelationship between diagnosis, function, surgical intervention, and the prolonged recovery periods following. We propose as a project to examine closely these outcome measures and how they relate to the different categories of intervention often utilised in Paediatric Sarcoma. By examining post-operative PROMS and how they change with time, we can assess when function plateaus and derive expected recovery periods. This also will provide additional information for pre-operative shared decision-making between patients, families, and the treating team about which surgical intervention is best for them, and what to expect from recovery afterwards. Additional subdomain analysis may be of use for comparison between interventions as well as between anatomic tumour locations. Such a project would cover: Calculation and analysis as well as an understanding of the strengths and weaknesses of the PROM scores utilised Development of prediction algorithms, to allow for comparison of future patient's progress against 'expected functional improvement' graphs Translation of results to healthcare consumer facing information materials, to support share decision making framework for families navigating treatment for paediatric Sarcoma

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44.Effects of osteochondromas management

Osteochondroma is a benign endochondral bone growth at the metaphysis of a bone. This condition commonly occurs in skeletally immature. This can occur in children's and adolescents' forearm bones (ulna or radius). Osteochondroma usually occurs as a single lesion (solitary osteochondroma). When two or more osteochondromas are present, this is called multiple osteochondromas and is usually a heritable condition (Multiple Hereditary Exostosis, MHE). This study will review the effects of the standard practice of forearm osteochondroma management at the Royal Children's Hospital-Melbourne (RCH). A retrospective observational study will be conducted to review clinical and radiographic outcomes of patients with forearm osteochondromas treated surgically at RCH. Data will be collected from medical records from RCH. Outcomes will be collected at the following time points: pre-operative and post-operative (3 months, 01 year, and annually till 10 years post-surgical) at standard clinical appointments. Data on clinical presentation, surgical approach, range of motion of wrist, and osseous deformity will be collected. Radiographs will be analysed for deformity parameters including ulnar length, radial articular angle, carpal slip, and radial head dislocation. Data will be analysed using SPSS software to compare pre- and post-treatment effects. Descriptive statistics will be used for demographic data, and frequency and proportions for categorical data. Comparative analysis will be performed using the student's t-test and chi-square test for continuous and categorical variables, respectively. A simple analysis of covariance (ANCOVA) of all time points will be undertaken as a secondary analysis. If the outcome is not normally distributed, non-parametric techniques will be used without adjustment (for example, the Mann-Whitney or the Kruskal-Wallis test).

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45.Neonatal limb ischemia management

Vascular insufficiency in a newborn's limb can occur due to a critical reduction of blood flow to a limb. This is known as neonatal limb ischemia. This potentially leads to serious complications such as ischaemic gangrene and auto-amputation of digits and extremities, with huge lifetime morbidity. Early diagnosis and treatment are crucial to minimise potential complications and amputations. Since the condition is very rare, there is little literature regarding the best management approach for neonatal limb ischemia. The controversies of management lie in whether clinicians should leave the try gangrene to demarcate versus taking a more aggressive approach with early surgical debridement. This study will review cases of neonatal limb ischemia treated at the Royal Children's Hospital in Melbourne (RCH). A retrospective study will be conducted to review clinical and radiographic outcomes of newborns diagnosed as neonatal limb ischemia. Data will be collected from medical records from RCH over the last 20 years. Data on causes for neonatal extremity ischemia, gangrene, surgical intervention, and long-term outcomes will be collected. Ethics approval will be obtained from the RCH ethics committee. Data will be analysed using relevant statistical methods according to the sample size/ data distribution.

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46.Deciphering ways of measuring neonatal lung function without radiation

Assessing lung function in neonates needing critical care is essential to optimise clinical care and improve outcomes. Unfortunately doing so without exposure to radiation has been challenging. Further, existing techniques have been intermittent in nature. An ideal outcome would be a bedside, non-invasive, continuous and radiation-free technique. Two such techniques now exists, lung ultrasound and electrical impedance tomography. We have been using both techniques as part of a large Victoria-wide study involving 550 babies (the BLUEPRINT study) that aims to develop phenotypes of early preterm lung disease, and then develop tools that can better guide clinical decisions and predict long-term respiratory outcomes. Both lung ultrasound and electrical impedance tomography measures are made simultaneously throughout the NICU stay. This honours project will determine the relationship between lung ultrasound and electrical impedance tomography assessments of lung function. Students will access the large dataset of existing babies within BLUEPRINT, as well as be involved in ongoing lung imaging and data collection for new babies in the study. This will involve hands-on exposure to lung ultrasound and electrical impedance tomography in the NICU. Students will analyse data from approximately 100-150 babies and learn skills in image analysis and statistical methods of assessing agreement and relationships. It is hoped that this will allow researchers and clinicians to better understand how each technique could best be used and how they may complement each other.

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47. Psychosocial outcomes of parents of young children with anorectal malformations

Parents of children born with anorectal malformations (ARM) face unique challenges in diagnosis and management, especially during the early years of their child's life. This project is part of an ongoing longitudinal study that commenced in 2019, aimed at evaluating the psychosocial outcomes of parents/carers of children with ARM using validated questionnaires. Students will have the opportunity to: recruit families with children diagnosed with ARM to participate in the study; administer validated questionnaires to the parents/carers; analyse data from the current timepoint and incorporate data from previous timepoints (since 2019); and evaluate the psychosocial outcomes and identify potential areas of support or intervention for these families. This project will provide valuable

insights into the psychosocial impact on parents/carers of children with ARM, a complex congenital condition that requires specialised care and management. By understanding their experiences and challenges, healthcare professionals can develop targeted support strategies and improve the overall quality of life for these families.

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Available as Masters Project: No

48.Take C.A.Re (Concussion Assessment and Recovery Research) Team

Concussion is defined as a traumatic brain injury where an impulsive force, caused by direct blow to the head, neck or body, is transmitted to the brain, triggering a neurotransmitter and metabolic cascade, with possible axonal injury, blood flow change and inflammation affecting the brain. Concussion can result in a constellation of non-specific and heterogeneous post-concussion symptoms (PCS), including balance impairment, somatic and/or emotional symptoms, cognitive impairment, and/or sleep disturbance. For most children and adults, PCS tend to resolve spontaneously within 2 to 4-weeks post-injury, however, approximately 30% will experience persisting PCS (pPCS) for greater than 4-weeks. pPCS can interfere with participation in school, sport, social, and recreational activities, with secondary consequences on mental health and quality of life. For the 30% of children and adolescents who experience pPCS, emerging biopsychosocial conceptualisations emphasise the contribution of injury, pre-injury, psychological, social, and environmental factors to the development and maintenance of these symptoms. Our team developed a multimodal intervention, Concussion Essentials (CE), that combines targeted education and management strategies for common symptoms, with physiotherapy and psychology treatment. Student projects will involve examination of child, parent or intervention factors that contribute to recovery of pPCS.

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Available as Masters Project: Yes

49.Assessing the Availability and Acceptability of Early-Life Diagnostic Tests for Bronchopulmonary Dysplasia

This project will investigate the factors influencing the availability and acceptability of novel early-life diagnostic tests for Bronchopulmonary Dysplasia (BPD) among healthcare professionals. BPD, a chronic lung disease, primarily affects premature infants, leading to significant morbidity and long-term health complications. Early and accurate diagnosis is crucial for timely intervention and improved patient outcomes. The project will employ a mixed-methods approach, combining qualitative and quantitative research techniques to provide valuable insights into the social, ethical, and practical considerations surrounding the implementation of early BPD diagnostic tests.

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Available as Masters Project: Yes

50. Lab Smarts for Little Patients: A New Approach to Blood Reference Ranges

Accurate interpretation of pathology results in children relies heavily on the use of appropriate age-specific reference ranges. Unlike adults, children experience rapid and dynamic physiological changes as they grow, making standard adult or broadly age-grouped reference ranges unsuitable. When reference ranges do not reflect this variability, test results may be incorrectly flagged as abnormal, leading to unnecessary follow-up investigations, increased family anxiety, and avoidable strain on healthcare services. This project aims to evaluate whether continuous age-based reference ranges-which adjust smoothly with age-offer significant advantages over traditional partitioned reference ranges, which categorise children into broad age bands. While continuous models are emerging as a more precise alternative, their adoption in clinical practice remains limited.

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Available as Masters Project: Yes

Population Health

51.Universal screening for congenital CMV: parental perspectives

Congenital cytomegalovirus infection (cCMV) is the most common infectious cause of childhood hearing loss. Recent trials have shown promise in early treatment of cCMV with oral valganciclovir for symptomatic cCMV, and international guidelines recommend targeted screening for cCMV at birth, along with consideration for universal cCMV screening. Our research team is gathering evidence on prevalence of cCMV in our community, along with economic evaluation of universal vs targeted cCMV screening. One missing piece of evidence is the voice of families - whether they find universal cCMV screening acceptable to them. This is a qualitative project exploring parental perceptions of universal cCMV screening offered in the newborn period. It will add a crucial piece of information for considering policy changes around cCMV screening.

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Available as Masters Project: Yes

52.The GenV Early School Wave pilot study

Join Australia's largest-ever child and parent cohort - Generation Victoria (GenV) - and help shape its landmark Early School Wave in 2028-29. This initiative will assess 50,000+ children across Victoria to tackle rising mental and physical health challenges. This project can support one to two students and is part of a broader team developing GenV's school-based measurement protocol across key health domains. The student(s) will work with senior GenV researchers and experts to design and test assessment measures that can be taken to scale with 6-7 year olds. Students will test their approach in different priority groups of children, and report on feasibility and acceptability data for their measure in the different groups. This project has a high focus on inclusive and accessible research practices. Students will gain valuable experience in research design, data collection with children with and without different developmental conditions, and the practicalities of large-scale health measurement. This is a unique opportunity to pursue your interests, be part of something bigger and contribute to real-world change in children's health and wellbeing.

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Available as Masters Project: Yes

Genomic Medicine

53.Evaluating Outcome Measures of Functional Independence in Friedreich Ataxia

Friedreich ataxia (FRDA) is an autosomal recessive neurodegenerative disorder. Symptoms typically begin between the ages of 10 and 15, with the first symptoms commonly gait ataxia and impaired balance. As the disease advances, mobility and the ability to perform daily activities declines significantly. On average, individuals lose the ability to walk within 10-15 years of symptom onset, significantly affecting their quality of life and independence. Given the profound impact of FRDA on physical function, it is essential to have reliable tools to measure these changes over time. The Activities of Daily Living component of the Friedreich Ataxia Rating Scale (FA-ADL) is an outcome measure that reflects the real-world impact of ataxia on daily life. It has demonstrated sensitivity to disease progression and served as a valuable exploratory endpoint in the MOXIe (clinical trial which evaluated efficacy of omavaloxelone in adults with FRDA. This project aims to compare the responsiveness of three outcome measures that assess independence in daily functioning: the FA-ADL, the Functional Independence Measure, and the Modified Barthel Index. Using longitudinal data from both children and adults enrolled in the studies at Murdoch Children's Research Institute (MCRI)/Monash Health, we will evaluate the internal and external responsiveness of these tools to natural disease progression. Responsiveness will also be compared to the modified Friedreich Ataxia Rating Scale, the first clinical outcome measure to be approved by the US FDA for use in clinical trials involving individuals with FRDA. Subgroup analyses will be conducted to compare progression rates across i) children vs. adults; ii) ambulant vs. non-ambulant individuals; iii) males vs. females; and iv) individuals with typical onset FRDA (onset < 20 years of age) vs. late onset FRDA. The student will join the Bruce Lefroy Centre at the MCRI, working within a multidisciplinary clinician researchers dedicated to developing sensitive and meaningful outcome measures for future clinical trials in FRDA.

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Associate Professor Louise Corben
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Available as Masters Project: No

UNIVERSITY OF MELBOURNE HONOURS ENTRY REQUIREMENTS

To be eligible to enter the Bachelor of Biomedicine (Degree with Honours) or the Bachelor of Science (Degree with Honours), applicants must satisfy both:

- the Faculty of Medicine, Dentistry and Health Sciences (MDHS) or Faculty of Science entry requirements.
- and the requirements of the department offering the Honours program.

Please note demonstrated eligibility does not guarantee a place in the Honours program. All successful applicants will also need to be selected for admission by the Department. The University of Melbourne handbook contains detailed information about the subjects available and entry requirements for departments offering Honours. https://handbook.unimelb.edu.au

For further details please visit;

Department of Paediatrics:
www.paediatrics.unimelb.edu.au

MCRI: https://www.mcri.edu.au/students/honours-students

MDHS: http://sc.mdhs.unimelb.edu.au/entry-requirements

HOW TO APPLY - MDHS HONOURS

Course Codes:

Bachelor of Biomedicine (Honours) – **BH-BMED**

Bachelor of Science (Honours) – **BH-SCI**

RCH Academic Centre Enrolling Unit is: **Department of Paediatrics**

If you wish to be considered for Honours in 2026, and you would like to undertake your project and coursework with the Murdoch Childrens Research Institute, Royal Children's Hospital, Academic Centre, Faculty of Medicine and Dentistry Sciences with the enrolling unit being Department of Paediatrics, you will need to carry out a FOUR STEP PROCESS.

STEP 1: Look for Projects and Contact Potential Supervisor (Note: 2026 Start Year Intake projects will be available in Sonia by mid-August.) You will need to decide which Supervisor(s) and Project(s) that you wish to apply for. To do this, contact potential supervisors listed in this Handbook, you should speak to them and organise a meeting to discuss the project further. Projects available for 2026 are also listed on the Murdoch Childrens Research Institute and Department of Paediatrics websites.

STEP 2: Submit Online Application: Register for the Honours Application Tracking System (SONIA) before making your application in SONIA. **Lodge an online application by Friday 31 October 2025 (Round 1), and Friday 09 January 2026(Round 2).**

http://mdhs-study.unimelb.edu.au/degrees/honours/apply-now#apply-now

STEP 3: Submit Project preference in Sonia: For Round 1 applicants, once you have submitted an online course application and met the minimum entry requirements, you will receive an email within 3 working days with your personal login to access the Honours Project Preference System – Sonia. Please follow the instructions to set up your login and submit your project preferences. If you have applied for Round 2, you will be contacted in early January about project preference submission in Sonia. You may select up to 4 project preferences in Round 1 or 3 project preferences in Round 2 and mid-year. You **MUST** contact the relevant supervisor(s) and reach an agreement before selecting their projects. You can log into Sonia to change your preferences any time by the preference submission closing dates.

STEP 4: Respond to Your Offer: Round one offers for entry into 2026 will be issued around mid-December 2025. Students must accept their offer by the Offer Lapse Date notes in their offer letter. Students who meet the minimum entry requirements but are not made a Round 1 offer may be considered for Round 2 under specific circumstances, but that is not guaranteed.

UNIVERSITY OF MELBOURNE MASTER OF BIOMEDICAL SCIENCE

The Master of Biomedical Science is a coursework program (Course code **MC-BMEDSC**) offered through the Department of Paediatrics. This program offers graduates a pathway into research or other science-based careers and can lead on to PhD studies. Students may consider undertaking a Masters as an alternative to the Honours Program.

Students undertake a major research project and discipline-specific coursework subjects offered by MDHS. A range of professional development subjects are offered to complement and enhance the research undertaken and to progress students' career opportunities.

MDHS website: http://mdhs-study.unimelb.edu.au/degrees/master-of-biomedical-science/overview