HEART RESEARCH INSTITUTE (NZ)

HRI NZ Summer Scholarship Research Projects 2022

Atherosclerosis and Vascular Remodelling – Dr Ashish Misra

Our mission is to identify and gain insights from the genetic and molecular pathways involved in cardiovascular disorders, and exploit these pathways to provide better therapeutic options to eradicate cardiovascular disease.

- Project 1. Modulating coronary atherosclerosis through perivascular fat (PVAT)
- Project 2. Colchicine – A novel role in stabilising vulnerable atherosclerotic plaque

Cardiometabolic Disease – Dr John O'Sullivan

Our group's interests lie in exploring gene-environment interaction in the development of cardiometabolic diseases. In particular, we are interested in understanding complex energy metabolic changes in heart failure with preserved ejection fraction, a type of heart failure with high morbidity and growing in prevalence. We have assembled a diverse array of tools to enable us to do so: sophisticated metabolomic and lipidomic platforms; murine models of cardiometabolic disease; stable-isotope labelling flux analysis; clinical research clinics incorporating patient samples and imaging. We have extensive access to large-scale human databases that have carefully curated outcome phenotypes (eg, clinical endpoints) and intermediate phenotypes (eg, omic data) including the Framingham Heart Study and UK Biobank.

- Project 1. Leveraging cardiac substrates to improve cardiac energetics and outcomes in HFpEF
- Project 2. Elucidating the role of HMGCS2-mediated ketogenesis in HFpEF

Cardiovascular Medical Devices – Dr Anna Waterhouse

Our group focuses on how medical devices – such as artificial hearts, stents and bypass machines – interact with the body to prevent adverse patient reactions like blood clots. We apply cutting-edge bioengineering tools to develop new methodologies to assess and understand the interplay of events at the biointerface, where the devices interact with the patient. These events include blood vessel cell interactions and blood interactions. Our aim is to manipulate this interplay to improve medical device function, create novel medical devices and diagnostics, and both drug and non-drug based avenues for therapies.

- Project 1. Novel materials to reduce medical device thrombosis
- Project 2. Developing and utilising microsystems to evaluate medical device thrombosis

Cardiovascular-protective Signalling and Drug Discovery – Dr Xuyu Liu

Our group aims to develop chemoproteomic platforms to: (1) enable genome-wide understanding of how cardiovascular drugs perform in the context of genetic and disease complications, and (2) provide clinicians with chemical-genetic information to guide personalised medicine for cardiovascular disease treatment.

- Project 1. Application of chemoproteomics platforms to profile kinase signalling in platelets and cardiomyocytes
- Project 2. Rational design and synthesis of novel cardioprotective agents
- Project 3. Conditional knock-out of proteins in cardiovascular system by small-molecule modulators

Haematology – Dr Freda Passam

We aim to discover novel pathways in blood clotting which can lead to the development of effective and safe drugs to treat thrombosis. Current projects focus on understanding the role of platelet receptors and clotting proteins in thrombotic and bleeding disorders.

- Project 1. Defining the diabetic platel-ome
- Project 2. Thiol isomerases as novel antithrombotic targets

Thrombosis – Prof Shaun Jackson

Our research is focussed on the haemostatic and innate immune systems and their dysregulation in cardiovascular disease. Our main research focus is on blood cells (platelets, leukocytes), blood coagulation proteases and endothelial cells. These cell types play a fundamental role in the pathogenesis of diseases such as heart attack and ischaemic stroke, but also more broadly, in the context of inflammation, cancer metastasis and vascular development.

- Project 1. Understanding the mechanisms leading to microvascular dysfunction and poor cerebral perfusion in stroke
- Project 2. Investigation of a new thrombosis and inflammation mechanism triggered by 'death pathways' in platelets

Vascular Complications – Dr Mary Kavurma

Our mission is to understand fundamental mechanisms in molecular and cellular biology and develop more effective treatments for the debilitating conditions associated with vascular complications.

- Project 1. Resolving atherosclerosis by regulating inflammation
- Project 2. Novel gender-dependent mechanisms regulating peripheral artery disease

Note: The Summer Scholarship program may be cancelled at any time if travel restrictions or health regulations require it.