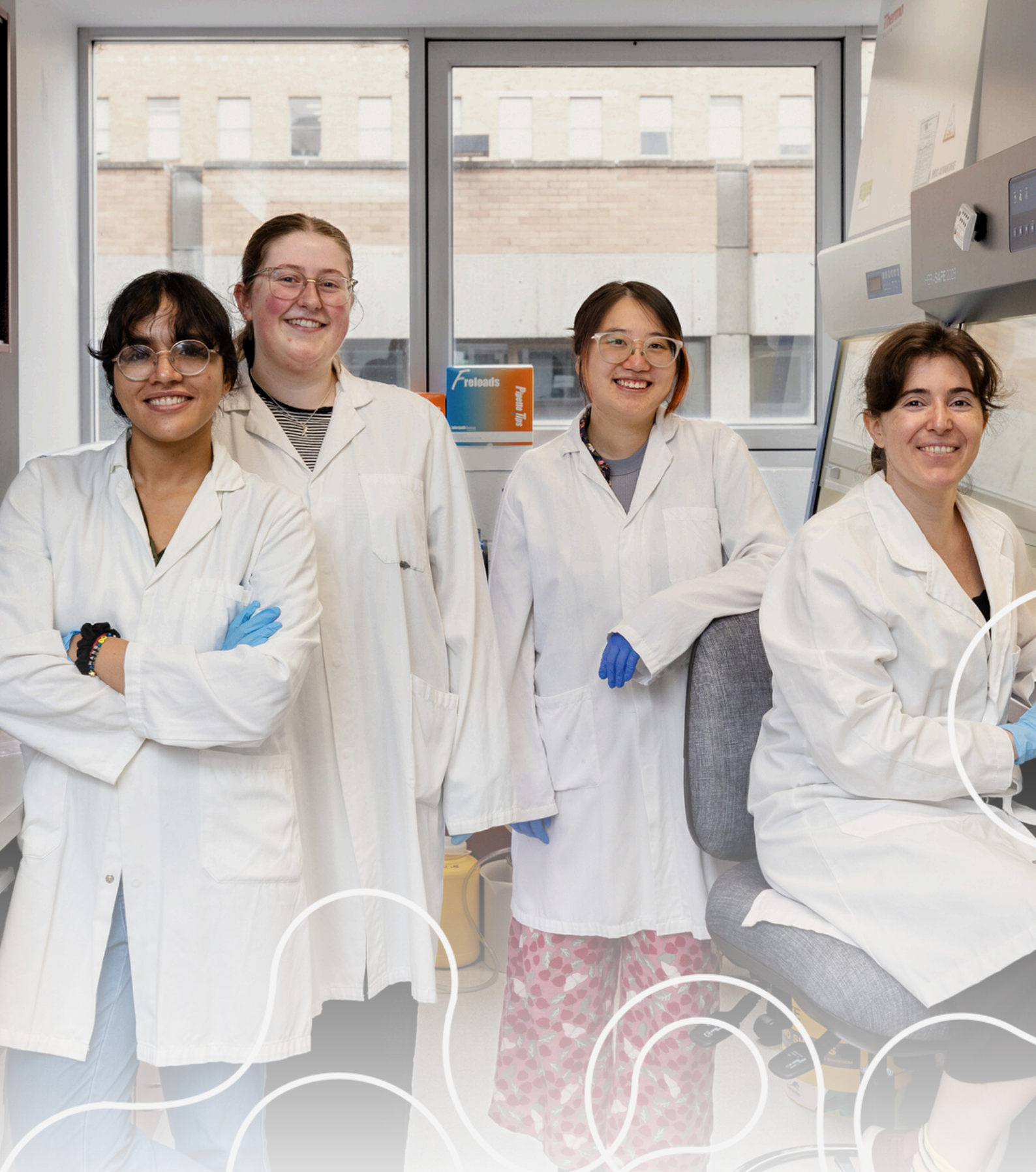

OUR SCIENCE YOUR FUTURE

A Snapshot of SVI's Student Projects

SVI
St Vincent's Institute
MEDICAL RESEARCH

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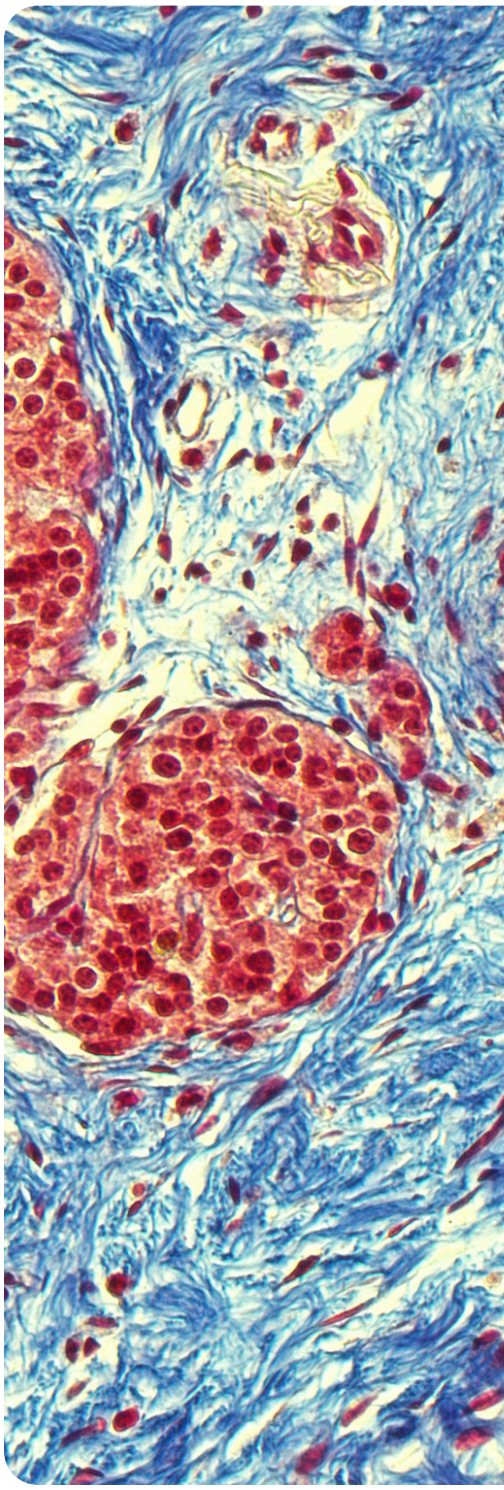
INSPIRED BY DISCOVERY, DRIVEN BY PURPOSE

St Vincent's Institute of Medical Research



Our research tackles some of the most critical health and disease challenges in the world today – cancer, diabetes, osteoporosis, cardiovascular disease and dementia. We believe the best science always has an eye toward the real-world problems it is trying to solve and is constantly looking for opportunities to make a difference now, as well as in the future.

Our fundamental research into human biology, health and disease is conducted alongside translational research and clinical trials. When fundamental and translational research are done side-by-side, we can accelerate important discoveries and make progress toward better treatments, diagnoses and even cures, sooner.

We push the boundaries of knowledge and we celebrate fundamental discoveries and practical applications alike, because we know that both are required to make advances in human healthcare. Indeed, there are no new breakthroughs, no new wonder drugs, no big leaps forward without new understanding.

We will stay the course, because we believe that for every question there is an answer.

We just need to find it.

SVI
St Vincent's Institute
MEDICAL RESEARCH

FIND YOUR OWN PATH

SVI Student Open Day

Visit SVI and See Science in Action

See your future in cutting edge science

At St Vincent's Institute of Medical Research, our scientists seek new knowledge to improve health outcomes, reducing the burden of ill-health on individuals and their loved ones.

Come in for a tour of SVI and see first hand what a working lab looks like. This opportunity to experience science in action is not to be missed**.**

- Meet students who have chosen to kick start their careers at SVI.
- Hear about our innovative and internationally renown research programs.
- Find out how to apply for our student projects, scholaships and top-up awards.
- Get help with some of the more practical things like writing an email that gets you an interview with a supervisor.

If you see your future in cutting-edge research or medicine, then take the first steps towards joining our world-class scientists and register for a tour today.

Spaces are limited so get in quick to secure your spot.

Tour Dates:

- Wednesday 28 Aug
- Wednesday 4 Sept
- Wednesday 11 Sept

Scan here for more information and to register

Have a question? Contact:
studentenquiries@svi.edu.au

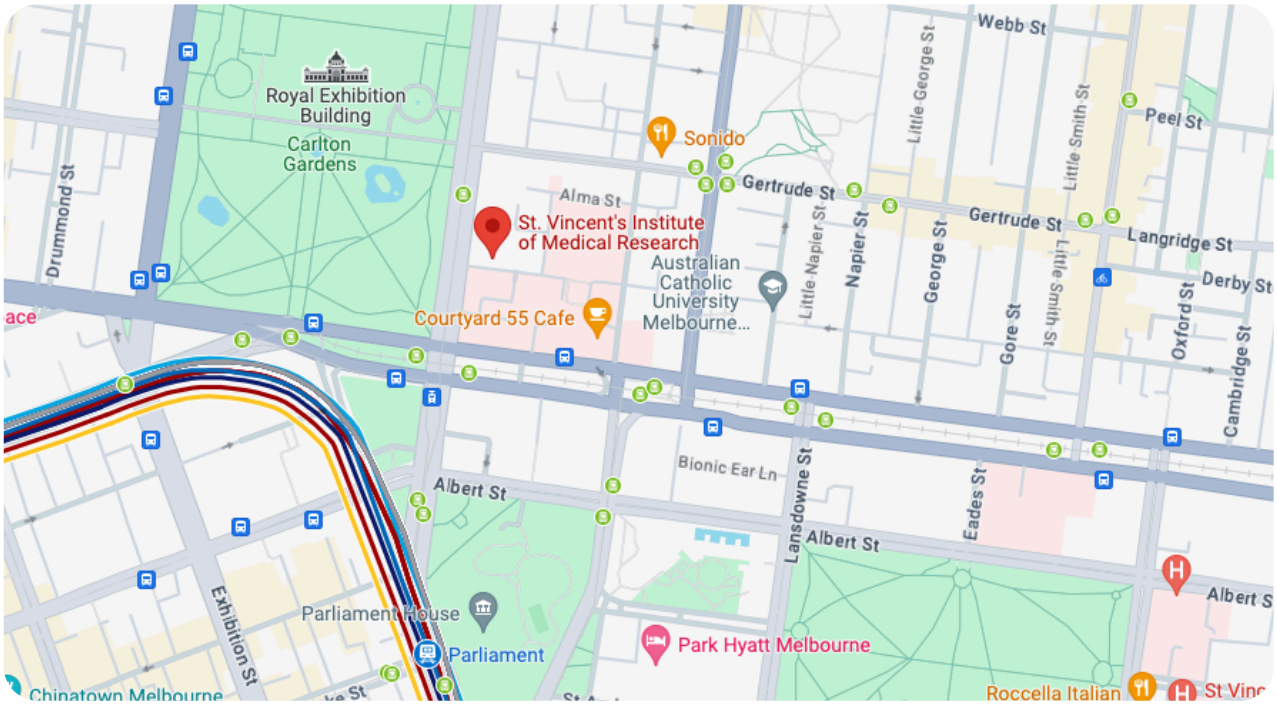
SVI
St Vincent's Institute
MEDICAL RESEARCH

YOUR NEW WORK LIFE

Fitzroy - Melbourne's Cultural Hub

Home to Brunswick Street, a food and culture lover's paradise

SVI is located on the St Vincent's Hospital campus, affiliated with the University of Melbourne, partners in the ACMD (Aikenhead Centre for Medical Discovery), and collaborates with other leading national & international research institutes.



We also host regular staff events like an annual hot cross bun baking competition, an AFL competition, Christmas party and so much more.

STUDENT PROJECTS

SVI
St Vincent's Institute
MEDICAL RESEARCH

DR DAVIS MCCARTHY

Bioinformatics & Cellular Genomics

We are broadly interested in all the ways in which computational approaches can drive biological discovery.

About the lab

We focus on the challenges of analysing and interpreting large-scale biological data. Bringing together expertise in bioinformatics, statistics and machine learning, we develop new methods and software and collaborate closely with a wide range of colleagues on studies motivated by specific biologically-focused questions.

Project snapshot

Methods for robust comparisons between highly heterogeneous spatial transcriptomics samples

Spatial transcriptomics technologies offer exciting opportunities for multi-modal investigations of cells and tissue structures. However, spatial transcriptomics samples are highly heterogeneous, making it challenging to make robust comparisons between samples from different individuals or conditions. This project will apply statistical and AI techniques to develop methods and software to enable robust comparisons across spatial transcriptomics samples.

Scan here for more information

PROFESSOR NATALIE SIMS

Bone Cell Biology and Disease

We study the cells inside the skeleton that control bone strength so we can design better ways of treating bone diseases like osteoporosis.

About the lab

By studying how our different bone cells behave, we will learn ways to control them. Bone cell research opens opportunities for conditions like osteoporosis and osteogenesis imperfecta to be treated more effectively, as well as to find ways to protect the skeleton in diseases such as arthritis, cancer and chronic inflammatory conditions.

Project snapshot

How are lysosomal processes involved in bone mineralisation?

The mechanisms that control the quantity of mineral crystals that are incorporated into the skeleton are poorly understood, even though this is a major contributor to bone strength. Our recent discoveries indicate that intracellular vesicles, including lysosomes, are involved in mineral secretion by osteoblasts (bone forming cells) and osteocytes (cells embedded in the bone). This project will use cell culture techniques, cell-based assays, and analysis of mouse bone structure to determine the function of lysosomes in osteocytes and osteoblasts.

How does bone composition change with ageing?

Bone mass decreases with ageing, leading to increased risk of fractures in the elderly. Bone material quality (e.g. the composition of bone, and its distribution in the skeleton) also changes with age, but whether this is caused by gradual deterioration over time, or by defective production of bone in older people is not known. This project will assess whether newly formed bone, made by older men and women has poor composition, using confocal microscopy, back-scattered electron microscopy, and computer based image analysis of the osteocyte network.

Scan here for more information

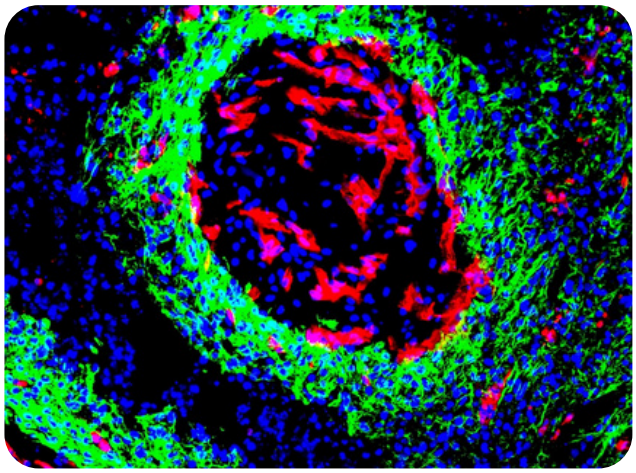
A/PROF MAX LIM

Cardiac Regeneration

We use human stem cells to engineer beating heart tissue on a lab dish to develop effective and translatable treatments for heart disease.

About the lab

Heart disease continues to be the leading cause of death worldwide. However, our understanding of this disease remains limited because human heart tissues are hard to come by. Human heart cells generated from stem cells can be used to grow human heart tissues in a lab dish. This pre-clinical human heart model has allowed us to test new drugs with the potential to protect the heart from injury, as well as to study genetic mutations that can cause heart disease.



Project snapshot

Investigating cardiometabolic disease using human induced pluripotent stem cells

This project aims to use cardiovascular cells, generated from human induced pluripotent stem cells, to establish human models of cardiometabolic diseases and develop new treatments.

Developing new treatments for Friedreich ataxia heart disease

Friedreich ataxia (FRDA) is a genetic disorder and heart disease is the leading cause of premature death in FRDA patients. There is currently no treatment for FRDA heart disease. We will use patient-specific stem cells to create a FRDA heart disease model-in-a-dish to achieve a better understanding of disease development and progression. This study will establish a pre-clinical human model of FRDA heart disease, for discovery of new therapies and to facilitate pre-clinical trials.

Scan here for more information

DR JARMON LEES

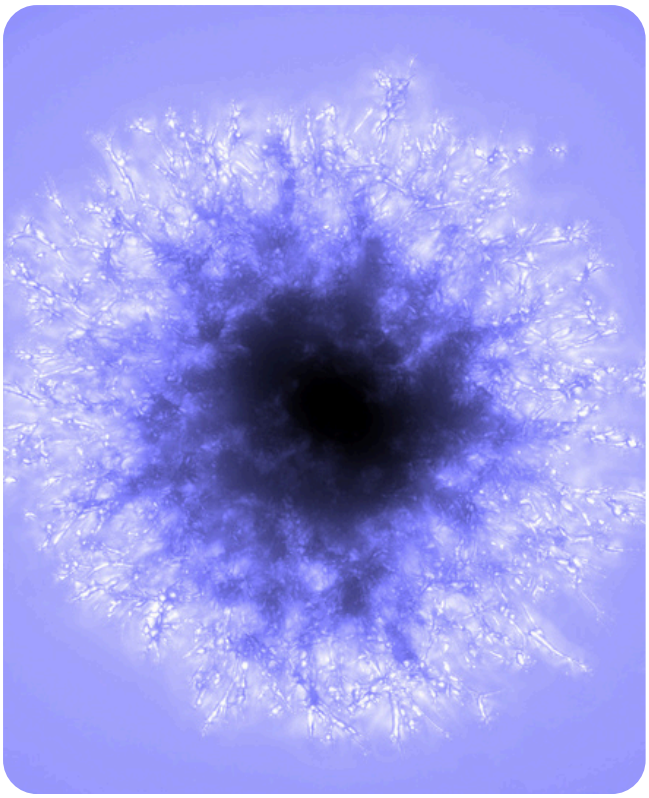
Cardiac Regeneration

We use human stem cells to engineer beating heart tissue on a lab dish to develop effective and translatable treatments for heart disease.

Project snapshot

Developing novel therapies for type 2 diabetic heart disease using human iPSC-derived multicellular cardiac organoids

Over 1 million Australians have type-2 diabetes (T2D) and most will die from heart disease. Heart disease caused specifically by diabetes is called diabetic cardiomyopathy, and there are currently no effective treatments. This project will target different pathways to confer greater and potentially synergistic cardioprotection using a combination drug therapy using a cutting-edge 3D multicellular human cardiac organoid model. The knowledge and skills involved in this project are suitable for students who are interested in stem cell biology, metabolic disease, and heart disease. A student working on this project will have the opportunity to learn various experimental skills, including cell culture, protein and gene analysis, histology and electrophysiology.



Scan here for more information

DR KIM LOH

Diabetes & Metabolic Disease

We aim to identify and develop novel therapeutic target for diabetes, obesity and cardiovascular disease.

About the lab

Metabolic diseases such as obesity and diabetes are major health concerns worldwide, with Australia being one of the most affected countries.

Diabetes increases cardiovascular risk at least three-fold, it is associated with accelerated atherosclerosis and linked to premature mortality. We are interested in studying the underlying mechanisms that contribute to the development of these metabolic disorders. Further understanding of the pathophysiology of obesity, diabetes and atherosclerosis will help us develop more effective therapeutic approaches for these diseases.

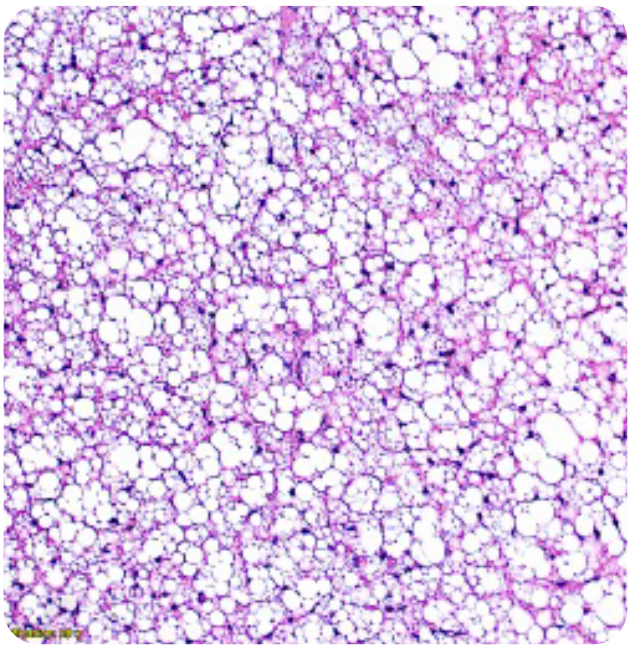
Project snapshot

Investigating a novel mechanism for improving beta-cell function in type 2 diabetes

We aim to investigate whether pharmacological inhibition of SIKs signalling will enhance β-cell function and improve glucose homeostasis in type 2 diabetes.

Investigating a novel mechanism for promoting weight loss in obesity.

We aim to investigate whether pharmacological inhibition of SIKs signalling will promote weight loss in obesity.



Scan here for more information

A/PROF ELAINE SANIJ

DNA Damage & Cancer Therapy

We are developing new therapeutic approaches to target drug resistance in ovarian cancer and in the blood cancer multiple myeloma.

About the lab

We investigate two cancers with high unmet clinical needs: multiple myeloma (a blood cancer) and ovarian cancer. Our research team seeks novel treatment approaches to overcome drug resistance in these cancers.

Project snapshot

Targeting the nucleoli to treat cancer

The nucleoli are the site of RNA polymerase I (Pol I) transcription of ribosomal RNA (rRNA) genes and ribosome assembly. We propose that activating nucleolar stress represents a promising new cancer therapy paradigm. This project aims to validate targets identified in our screens as mediators of nucleolar stress and novel cancer therapeutic targets

Define the role of mRNA translation reprogramming in multiple myeloma progression and response to therapy

Multiple myeloma (MM) is a rare cancer type of white blood cell called plasma cells within the bone marrow. This project will investigate altered mRNA translational activity in MM cells, will provide new understanding of MM oncogenic transformation and disease progression and identify novel therapeutic approaches for treating MM. The findings will provide new insight into mRNA translation reprogramming in MM pathogenesis and provide evidence for ribosomal protein (RPL5) as a potential biomarker of cancer therapy in MM.

Scan here for more information

A/PROF WAYNE CRISMANI

DNA Repair & Recombination

Our vision is to translate basic knowledge of DNA repair pathways to treatments for cancer, bone marrow failure syndromes, and infertility.

About the lab

We seek to understand the fundamentals of DNA repair pathways in both somatic and reproductive cells. Our particular focus is the Fanconi anaemia pathway, which is essential for repair of crosslinked DNA. Building on advances that we and other groups are making, we identify and characterise potential new treatments for diseases that are caused by problems of DNA repair.

Project snapshot

CRISPR Horizons: Illuminating Gene Mysteries through Saturation Genome Editing

The proposed research student project centers on exploring the potential of saturation genome editing as a powerful tool for understanding gene function and regulation in complex biological systems. Leveraging the advancements in CRISPR-based technologies, the project aims to systematically introduce diverse and targeted mutations in specific important human genes.

This project's outcomes hold tremendous promise for uncovering novel gene interactions, elucidating functional pathways, and providing valuable insights into the genetic basis of various biological processes, thus contributing to the advancement of both fundamental research and therapeutic applications.

Scan here for more information

A/PROF WAYNE CRISMANI

DNA Repair & Recombination

Our vision is to translate basic knowledge of DNA repair pathways to treatments for cancer, bone marrow failure syndromes, and infertility.

Project snapshot

Unraveling Tumor Suppression with a Novel Breast Cancer Mouse Model

The student research project aims to establish a novel breast cancer mouse model to investigate the potential tumor suppressor role of a specific gene in breast cancer development and progression. Through genetic engineering techniques, the student will generate a cohort of mice with targeted deletion or mutation of the gene of interest within mammary epithelial cells. The resulting mouse model will be carefully characterized and monitored for the development of breast tumors and metastasis. Histopathological, molecular, and functional analyses will be conducted to assess tumor growth, cellular behavior, and the impact of the gene manipulation on tumor suppression. By elucidating the gene's potential role as a tumor suppressor in breast cancer, this project has the potential to provide crucial insights into the underlying mechanisms of tumorigenesis and may offer new opportunities for targeted therapeutic interventions.

Dissecting the genetics of chromosome fragility for cancer predisposition conditions

This project investigates the genetic causes of chromosome breakage and cancer predisposition using traditional cytogenetic techniques, coupled with advanced CRISPR-based gene editing. During this project you will analyse the effect of loss of function of individual Fanconi anemia (FA) genes in a controlled isogenic background, such as hap1 cells and patient-dervied cells. By focusing on each gene as a unique variable, we aim to unravel the specific genetic mechanisms and severity of chromosome instability.

Scan the QR code to explore additional student projects:

- Hidden Challenges in Healthcare: Analyzing Diagnostic Delays for Rare and Chronic Diseases
- Automating Insights: Machine Learning Analysis of Testes Histology and Spermatogenesis
- AI-Powered Insight: Machine Learning Analysis of Ovarian Histology and Oogenesis
- SynapsisEnhance: Advancing Meiotic Immunofluorescence Data Analysis with an Improved R Package
- Next generation methods for rare childhood disease diagnostics
- How androgens affect blood production

A/PROF ANDREW DEANS

Genome Stability

We investigate the process of DNA repair, with applications in treatment of genetic disorders, cancer diagnosis and cancer therapy.

About the lab

Our team focuses on four lines of research that all aim to improve treatments for diseases involving DNA damage repair (DDR):

1. identifying potential DDR targets for treating common cancers;
2. defining DDR deficiencies that cause bone marrow failure and other childhood disorders;
3. knowing how our cells regulate and activate DDR to prevent ageing and cancer; and
4. (creating new life-long treatments for genetic diseases using DDR gene editing therapies.

Project snapshot

A method to improve CRISPR-Cas9 gene editing - Dr Astrid Glaser

CRISPR-Cas9 has emerged as a revolutionary gene editing tool with immense potential for treating genetic diseases. This undergraduate research project aims to develop an enhanced CRISPR-Cas9 system by directly combining Cas9 with a known DNA repair enzyme.

This project is ideal for students with a strong foundation in molecular biology and a keen interest in genetic engineering. While prior research experience is beneficial, enthusiasm for learning complex biological techniques and concepts is essential.

Scan here for more information

A/PROF ANDREW DEANS

Genome Stability

We investigate the process of DNA repair, with applications in treatment of genetic disorders, cancer diagnosis and cancer therapy.

Project snapshot

A cancer mutation processes driven by unusual DNA structures

This undergraduate research project aims to:
1. Elucidate how the identified enzyme suppresses cruciform formation
2. Investigate its relevance to cancer mutagenesis
3. Explore its potential as a therapeutic target

This project offers hands-on experience with advanced laboratory techniques and contributes to our understanding of genome stability and cancer-causing mutations. It may also uncover new approaches for targeting genome stability in cancer therapy.

Gene editing in blood stem cells

This research project will help improve our use of mRNA delivery methods (similar to the technology used in COVID vaccines) for gene editing in HSCs.

Students will be involved in: Designing and optimizing mRNA-based gene editing tools; Culturing and manipulating HSCs; Assessing gene editing efficiency and cell viability; Analyzing the long-term effects of gene editing in cell culture models

Scan here for more information

A/PROF IRENE GALLEGO ROMERO

Human Genomics & Evolution

We study the ways in which natural selection and evolution have shaped humans, in order to understand how our species' past defines our present.

About the lab

Our research sits at the intersection of gene regulation, human evolution and population genetics. We are particularly interested in the role gene regulatory processes have played throughout human evolution and continue to play in giving rise to present-day human diversity, and the implications this has for the widespread adoption of personalised medicine.

Project snapshot

Increasing equitable outcomes in precision medicine

Precision medicine seeks to tailor medical treatment to an individual's genome sequence, and promises to lead to better outcomes through the development of more effective therapies and therapeutics. However, the field is severely biased towards individuals of European descent, and has the potential to increase, rather than decrease, disparities in health care outcomes between groups and individuals. Our research directly seeks to reverse this trend, with available projects giving students the opportunity to work with genome sequencing data from diverse populations in Southeast Asia and develop their skills in computational data analysis.

Scan here for more information

A/PROF STUART MANNERING

Human Immunology

Our long-term objective is to manipulate the autoimmune response that causes type 1 diabetes (T1D) to prevent or reverse it.

About the lab

The Human Immunology Laboratory focuses on the autoimmune disease type 1 diabetes. Broadly, we have two goals. The first is to understand how and why insulin-producing beta cells, that live in the Islets of Langerhans, in the pancreas, are attacked by the immune system's T cells – which is the ultimate cause of T1D. Our second, related, goal is to use this information to develop safe and effective ways to stop disease progression for people, with or at high risk of developing type 1 diabetes.

Project snapshot

Dissecting the autoimmune pathogenesis of human type 1 diabetes

The work in the lab is divided into two broad themes: (i) understanding the underlying immune mechanisms that lead to T1D and (ii) applying this knowledge to develop better ways to diagnose, predict progression and delay or prevent the onset of T1D. Unusually for an autoimmune disease, T1D frequently develops in the first decades of life.

Currently, T1D is treated by frequent insulin injections which replaces the insulin normally produced by the beta cells. While insulin has been a life-saving therapy for T1D over the past 100 years, it is not a cure. People with T1D have must manage their insulin therapy and have a shorter life expectancy than those without T1D.

We have projects that investigate: (i) the antigen specificity of human islet-infiltrating T cells, (ii) the role of autoantibody responses in the pathogenesis of T1D and (iii) develop and validate new assays for monitoring changes in function of beta-cell antigen specific T cells in people with, or at risk of developing T1D.

Students who work on these projects will join a vigorous research group that currently three postdocs, three research assistants and three students. They will gain an excellent scientific and academic training in immunology, particularly human T-cell immunology and autoimmunity

Scan here for more information

PROFESSOR TOM KAY

Immunology

We study the precise mechanisms by which T cells destroy beta cells – the ultimate cause of type 1 diabetes – and test ways to prevent this from happening.

About the lab

In type 1 diabetes, insulin-producing beta cells (arranged in clusters called islets) are destroyed by immune mechanisms. The major immune cell type involved is the CD8+ cytotoxic T lymphocyte (CTL) that directly recognises short peptides derived from proteins like insulin presented by major histocompatibility complex class I proteins on the surface of beta cells.

Project snapshot

Clinical research using data and samples from clinical trials

We have just completed the Bandit trial, a placebo-controlled trial to investigate the safety and efficacy of baricitinib in individuals with recent-onset type 1 diabetes. Trials like Bandit produce large amounts of patient data with numerous immunological and metabolic parameters and numerous aliquots of plasma and peripheral blood mononuclear cells, the term used for preparations of lymphocytes and monocytes isolated from blood.

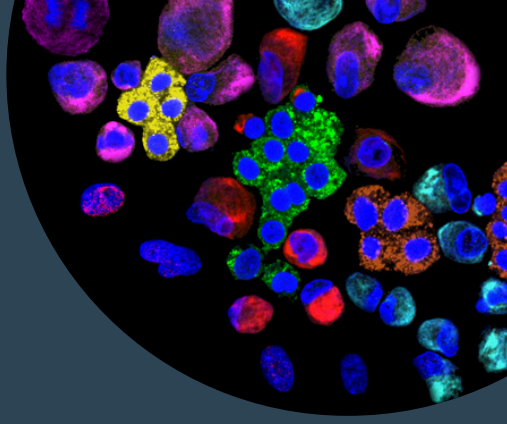
Impact of JAK inhibitors on T-cell exhaustion and other immune regulatory mechanisms

This study will utilise the NOD mouse model and our previously produced models of T-cell exhaustion to explore questions about JAK inhibitors and their affect on T-Cells.

Scan here for more information

Immunology

We study the precise mechanisms by which T cells destroy beta cells – the ultimate cause of type 1 diabetes – and test ways to prevent this from happening.



Project snapshot

Concurrent analysis of T-cell exhaustion in islet and tumour microenvironments in a novel tumour model in NOD mice. - Dr Gaurang Jhala

We hypothesise that islet antigen-specific T cells infiltrating the tumour will undergo severe T cell exhaustion. To examine how exhausted islet-specific T cells regulate the other effector T cells in NOD mice we will remove the tumour and follow the NOD mice to see if they are protected from diabetes.

Inducing T-cell exhaustion to prevent type 1 diabetes - A/Prof Bala Krishnamurthy

We have generated powerful animal models to test methods to induce T-cell exhaustion to prevent type 1 diabetes. We will study the number, function and exhausted phenotype of beta cell specific T cells in transgenic mice and their capacity to induce diabetes. We will also gain detailed mechanistic insight at the single cell level using transcriptomic profiling of islet reactive T cells. Our studies will lay the groundwork for developing future clinical studies.

Scan here for more information

DR TARA KARNEZIS

Lymphatic, adipose & regenerative medicine

We investigate and seek new treatments for Radiation Injury Bystander Effect (RIBE) in cancer patients and for lipoedema, a condition often misdiagnosed as obesity.

About the lab

The range of cancers for which radiotherapy is being used is ever expanding.

There is an unavoidable dose exposure that occurs in surrounding normal cells. This radiation exposure does not have the effect of simply killing normal cells but elicits a permanent damage or injury profile that persists and continues to evolve throughout the life of the patient. This is known as Radiation Injury Bystander Effect (RIBE). These changes result in ongoing tissue contracture, immense pain, soft tissue swelling, and tissue breakdown; in turn leading to significant disability, recurrent infection, impairment of quality of life, and potentially life-threatening exposure of vital structures such as the heart.

Project snapshot

Understanding the epigenetic regulation SphK2 in fat development and metabolic disease

Metabolic disease including obesity and diabetes is fast becoming one of the major health issues affecting human health to date. We have shown that SphK2 is an epigenetic regulator of fat formation when adipose derived stem cells are activated to become adipocytes, the major cellular component of adipose (fat) tissues, in both embryonic development and metabolic disease. We wish to further characterise this novel mechanism by understanding the interaction between SphK2 and the chromatin in adipose derieved stem cells to equistately control downstream expression of target genes that are responsible for many aspects of fat development in mouse and human tissue.

Scan here for more information

DR CHRIS LANGENDORF

Protein Engineering in Immunity & Metabolism

We investigate how a protein's structure is related to its function in both health and disease. We can then apply this knowledge to engineer our own molecules as potential therapeutics in disease states

About the lab

We integrate structural and biochemical techniques (X-ray crystallography, enzyme kinetics, SPR binding studies, protein engineering/design and mass spectrometry techniques like HDX-MS and phospho-proteomics) to provide a comprehensive view of the allosteric regulation of energy sensing proteins and protein-protein interactions of the immune system.

Project snapshot

Developing immune cell engagers for cancer therapeutics

A key determinant of all cancers is their ability to evade the host immune system. We are engineering immune cell engagers that allow the body's own immune cells to identify cancer cells and target them for cell death.

Protein engineered molecules for immune evasion

Many new therapies genetically modify patient's own cells to fight disease. This technique is associated with extremely high costs and lengthy lag-time to modify and amplify the new therapeutic cell lines. We are developing molecules to aid engineered cells evade the immune system, reducing cost and lag-time for cellular therapies.

Caspase 3 regulation of AMPK

AMP-activated protein kinase (AMPK) is a crucial metabolic enzyme that maintains cellular energy homeostasis and has been implicated in various diseases, including cancer. AMPK's role in cancer is complicated, however recent advances have provided some clarity whereby it was shown to be proteolytically cleaved by cell death effectors called caspases.

Scan here for more information

A/PROF MARK CHONG

RNA & T Cell Biology

We interrogate the genetic mechanisms that control development of the immune system, to better understand human health and disease.

About the lab

The RNA & T Cell Laboratory works in two general research areas. Firstly, we are interested in the molecular mechanisms that control immune cell development.

The immune system is comprised of a diverse range of cell types, and each type must be replenished continuously in appropriate numbers and with appropriate functional properties. This ensures that immunity against potential infections is maintained while inappropriate immune responses are suppressed. Any defect in this balance can result in susceptibility to infection or cancer, or the development of autoimmune disease.

Project snapshot

A novel function for interferon-gamma in preventing T-cell lymphoma

Interferon-gamma (IFNg) is pleiotropic cytokine that is important for anti-tumour immunity by activating cytotoxic lymphocytes and macrophages, and by acting directly on tumour cells to suppress their proliferation and induce apoptosis. Consistent with this, IFNg deficient mice exhibit a high incidence of T-cell lymphomas. However, IFNg may in fact be important in the process of lymphomagenesis (i.e. development of the malignancy), as opposed to immune responses to the lymphoma. Our hypothesis is that IFNg regulates MHC-antigen presentation in the thymus and that this is required for the establishment of the T cell lineage transcriptome program within developing thymocytes. We propose that a loss of IFNg signalling disrupts this process, resulting in lineage plasticity and transformation of developing thymocytes into lymphoma cells. This project will investigate this hypothesis by analysing a mouse model with genetic deficiency for IFNg signalling.

Scan here for more information

A/PROF MARK CHONG

RNA & T Cell Biology

We interrogate the genetic mechanisms that control development of the immune system, to better understand human health and disease.

Project snapshot

MicroRNA inhibition to modulate regulatory T cell impacts in disease

Foxp3+ Regulatory T cells (Tregs) are important for preventing autoimmunity and uncontrolled inflammation. They also modulate immune response to infectious disease and cancer. For example, Tregs that infiltrate tumours have been shown to be immunosuppressive and can prevent the activation of an effective anti-tumour immune response. We previously showed that microRNAs are critical for the functions of Tregs. MicroRNAs are small non-coding RNAs (~22nt in length) that regulate gene expression. Manipulating the expression of microRNAs may therefore be a way to control the activities of Tregs. This project will investigate if microRNA inhibitors can be delivered to Tregs via lentiviruses and if this can be employed to disrupt the immunosuppressive effects of Tregs within tumours by testing in mouse models of cancer.

Regulation of unconventional T cell development by coronin proteins

Natural Killer T (NKT) and Mucosal Associated Invariant T (MAIT) are specialised subsets of T cells that play important roles in immunity to pathogens, cancer and regulation of autoimmunity. They are collectively referred to as “unconventional” T cells because they do not recognise protein-derived antigens, like conventional CD4+ and CD8+ T cells. Instead NKT and MAIT cells recognise lipid and metabolite antigens, respectively. Like all T cells, unconventional T cells emerge from the thymus, but their development within the thymus remains poorly understood. Coronins are actin cytoskeleton regulators that regulate cellular motility, responses to extracellular signals, proliferation and other cellular process that are important for T cell development. We have discovered that NKT cells specifically express Coro2a, while MAIT cells specifically express Coro2b. This project will investigate if these two Coronins are important for regulating the development of these cells in the thymus by analysing Coro2a and Coro2b knockout mice.

Scan here for more information

A/PROF MARK CHONG

RNA & T Cell Biology

We interrogate the genetic mechanisms that control development of the immune system, to better understand human health and disease.

Project snapshot

Characterisation of novel a self-antigen-expressing antigen presenting cell in the thymus

T cell development in the thymus is a highly regulated process to generate a repertoire of T cells diverse enough to recognise any potential pathogen that the might body encounter. A by-product of this are T cells that can recognize self-antigen. If allowed to circulate through the body, such self-reactive T cells may cause autoimmunity and tissue damage. As such, a critical checkpoint in T cell development is the purging of potentially self-reactive T cells before they fully mature. Thymic medullary epithelial cells are known to play an important role in this negative selection by expressing self-antigens that are tested against developing thymocytes. However, we recently discovered a novel cell type that also expresses self-antigen in the thymus, and these may also be important for the negative selection of thymocytes. The goal of this project is to characterise this novel population in mice using flow cytometry. Questions to be address include: 1) When do these cells first appear in life? 2) Are they maintained throughout life? 3) Are perturbations in this population associated with autoimmunity? This new thymic population may therefore have important implications for our understanding of autoimmune disease.

Scan here for more information

PROF MICHAEL PARKER

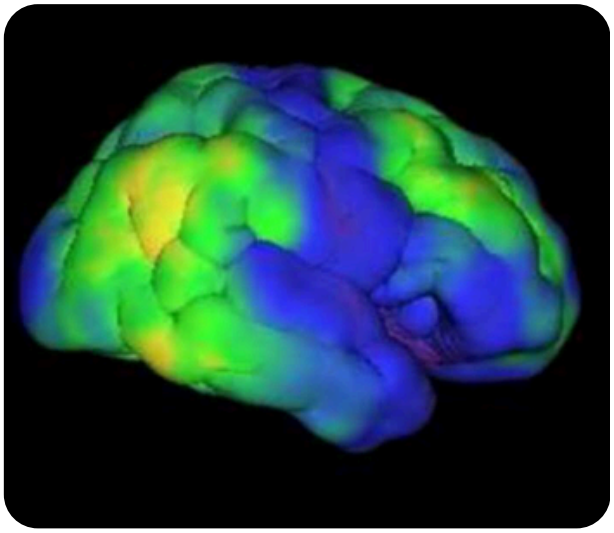
Structural Biology

We determine the three-dimensional atomic structures of proteins involved in disease, with a focus on neurodegenerative diseases and cancer. These structures help us to explore protein function, as well as to discover new drugs.

About the lab

The work of the Structural Biology Laboratory is internationally recognised. Our work has defined more than 200 crystal structures and more recently, structures derived from cryo-election microscopy – including those of membrane-associating proteins, detoxifying enzymes and protein kinases.

This work has provided insights into cancer, bacterial and viral infections, and neurological diseases such as Alzheimer's disease.



Project snapshot

Structural biology of proteins involved in mental illnesses

We are focused on understanding the molecular bases of a range of neurodegenerative diseases and to develop much needed treatments. One area of focus is Alzheimer's disease (AD) which is the fourth biggest killer in developed countries.

We are investigating the structure and function of key protein receptors found on the surface of microglia cells as a basis for the discovery of drugs to treat a range of neurodegenerative diseases including AD, Lewy Body Disease, Motor Neuron Disease and Parkinson's Disease.

Scan here for more information

DR JULIAN VIVIAN

Structural Immunobiology

We aim to reveal the way immune cells – with particular emphasis on 'natural killer' cells – communicate with their environment.

About the lab

Our lab is interested in cellular immunity and the interplay between cell surface receptors that drive the function of these cells. A focus of the lab is Natural Killer (NK) cells that keep constant watch over the body and detect and directly kill cells that have been transformed by viral infection or malignancy (cancer). Without NK cells, viral and tumour burdens are higher and progress more quickly.

Project snapshots

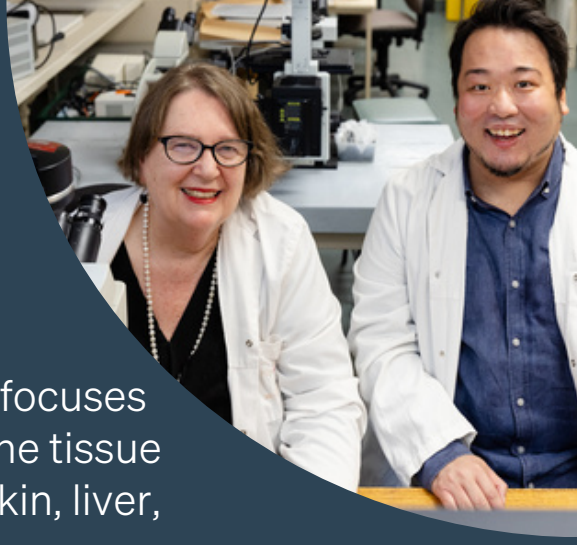
Advancing Cellular Immunotherapies through Immune Receptor Recognition of Tumour Microenvironment Factors

This project focuses on understanding immune receptor recognition of tumour micro-environment factors. The primary techniques employed will focus on protein and cellular engineering. The ultimate goal of this project is to advance cellular immunotherapies in the context of tumour surveillance.

Engineering Immune Proteins to Enhance NK and T Cell Function for Tumour Therapy

This project aims to engineer immune proteins to enhance NK cell and T cell fuction. The project will focus on protein engineering and yeast library screening of nanobodies with therapeutic potenital. The goal of this project is to develop molecules with commercial and thearpeutic potential for the treatment of human tumours.

Scan here for more information

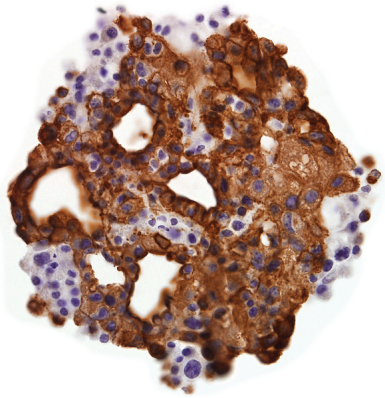


A/PROF GERALDINE MITCHELL
AND DR KIRYU YAP

Vascular Biology

Research in the Vascular Biology Laboratory focuses on creating small blood vessel networks for the tissue engineering of new tissues/organs, such as skin, liver, or pancreas.

About the lab



Using human primary cells or induced pluripotent stem cells, our laboratory generates vascularised human tissue contructs (including organoids). We are currently developing regenerative therapies targeting large and complex skin wounds, liver disease, and type 1 diabetes.

Project snapshot

Bio-engineering a human skin flap for reconstructive surgery

Reconstructive surgery aims to provide functional and aesthetic outcomes for patients with serious skin defects arising from trauma, cancer resection or diabetic wounds. The goal of this project is to develop protocols and techniques to lab-grow human skin that can sense touch. The human skin will be developed from hiPSC and include the main human skin layers – epidermis and dermis, and incorporate blood vessels and neural mechanoreceptors. Training in hiPSC cell culture, immunostaining/imaging, biofabrication and material science will be provided.

Stem cell-derived human liver organoids for regenerative medicine

We have developed techniques to produce hiPSC-derived human liver organoids, containing various cell typesincluding hepatocytes, cholangiocytes, endothelial cells, and stroma. Our next areas of focus include incorporating additional elements to increase the complexity and function of liver organoids, creating gene-edited liver organoids to correct genetic mutations or confer specific disease-resistant qualities, and developing new clinically-relevant strategies to transplant liver organoids into mouse models of liver disease.

Scan here for more information

SUPPORTING THE NEXT GENERATION OF RESEARCH LEADERS

SVI Student Resources

Students at SVI are generously supported by the Susan Alberti + Colin North Student Career Catalyst Program which includes initiatives like:

- “Speak Your Science” Communication & Career Development Workshops
- Summer & Winter Undergraduate internships
- Honours and Masters Awards for the best thesis

The Institute also hosts a highly active and engaged students society who regularly host fun events and networking nights. They also run a highly anticipated student retreat each year.

University of Melbourne information for Honours and masters programs

For students wishing to undertake an Honours or Masters program at St Vincent's Institute through the University of Melbourne, applications are open to:

- Internal applicants who have successfully completed or are about to complete the Bachelor of Biomedicine or the Bachelor of Science at the University of Melbourne
- External applicants who have successfully completed or are about to complete an equivalent undergraduate degree.

Enrol in an Honours or Masters program via study.unimelb.edu.au

Bachelor of Science (degree with Honours)

Bachelor of Biomedicine (degree with Honours)

Masters of Biomedical Science

Projects listed in this booklet can also be found in the SONIA project database and can be accessed and selected by interested students during the application process.

SVI

St Vincent's Institute
MEDICAL RESEARCH

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