



**FHMRI**  
FLINDERS HEALTH & MEDICAL  
RESEARCH INSTITUTE

**STUDY WITH US: SUMMER RESEARCH  
AWARDS 2022-23**



# Introduction to Flinders Health and Medical Institute (FHMRI)

## Understanding life. Accelerating medical innovation. Promoting healthy communities.

FHMRI brings together world-leading, innovative and inspiring research experts to improve health, prevent disease and combat health inequities. We work with health practitioners and patients to better understand and seek solutions to the most pressing health and medical needs of Australians, inclusive of those in rural and remote communities.

The Institute is comprised of three research themes and a Research Education and Development (RED) Hub, which bring together diverse research and education strengths.

The three thematic areas are:

### 1. Molecular Biosciences

To cure disease and improve health, we need to know more about how the body works and then understand the molecular basis of what can go wrong. Our researchers are undertaking cutting edge research to find scientific solutions to clinical dilemmas. We are making discoveries across an array of research programs including defining the complex mechanisms underlying the microbiome-gut-brain axis and the nervous system, identifying novel molecules and pathways involved in cancer, tackling immunity and drug resistant bacteria and creating new approaches to providing early disease detection methods and medical treatments.

### 2. Clinical Translation

Our clinical researchers work to develop and implement new methods for the prevention, diagnosis and treatment of disease to improve health. This is facilitated by their co-location with Flinders Medical Centre and private hospital, and strong partnerships with rural and remote communities. Clinicians, researchers, and nurses are working together to enhance understanding about blinding eye conditions, heart and vascular disease, sleep disorders, and many other diseases.

### 3. Healthy Communities

Living a healthy life means more than just the absence of disease – it encompasses our physical, mental and social wellbeing. While many Australians enjoy good health, there is still an unacceptable divide in health inequalities. Our research is committed to understanding the effects of people's circumstances on their health, including the impact of living in rural and remote locations and being Aboriginal and Torres Strait Islander peoples. We use health data research to minimise and prevent injury and disease and promote better health and seek to improve the organisation and delivery of health services.

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# Research Supervisors and their Summer Research Award Projects

## Clinical Translation

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**Supervisor name:** **Dr Minh-Son To**

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**Name of research group:**

**Health Data and Clinical Trials (HDCT)**

**Description of research area and interests:** Our research focus is the application of artificial intelligence and deep learning methods to the analysis of medical imaging.

We work across various clinical domains (e.g. ophthalmology, orthopaedics, and neurosurgery) and different imaging modalities (e.g. optical coherence tomography, plain X-ray radiography, computed tomography, and magnetic resonance imaging).



**Outline of project:** Intracranial haemorrhage accounts for 15% of all strokes. Detecting and characterising intracranial haemorrhage on CT imaging is critical for timely management, monitoring, follow-up, and prognostication.

The aim of this project is to develop artificial intelligence models for automatically detecting brain haemorrhage on plain CT head scans.

This project will utilise a large multi-institutional, and multinational brain haemorrhage CT dataset consisting of 874 035-images.

The project will explore and extend unsupervised deep learning algorithms for image segmentation tasks, which enable partitioning of all image pixels into "haemorrhage" or "no haemorrhage" segments.

**Supervisor name:** Associate Professor Luke Grzeskowiak

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**Name of research group:** Paediatric, Reproductive and Perinatal Pharmacoepidemiology

**Description of research area and interests:** Nearly all women take medications during pregnancy or lactation, but greater than 90% of medications lack adequate information on efficacy or safety in this setting. Due to this lack of knowledge, thousands of unborn children are exposed to harmful medications every day, resulting in adverse pregnancy outcomes (e.g. miscarriages, preterm birth, birth defects, and growth restriction) and long-term effects on child health and development (e.g. metabolic disorders, neurodevelopmental disorders), whereas other women deliberately avoid safe pharmacological treatment for illnesses that may jeopardize maternal and infant health if left untreated.



My research is focused on improving maternal and child health through the development and promotion of safer, more effective and personalised approaches to pharmacotherapy. My research utilises a range of methodologies including conducting clinical trials, utilising 'big data' to undertake large observational studies, and qualitative methods (e.g. consumer interviews and/or surveys).

**Outline of projects:** Potential projects covered below, but open to discussion of topics.

- Provide evidence surrounding medication utilisation to understand patterns of consumer and prescriber behaviour, and identify and address evidence-practice gaps.
- Generate robust and reliable outcome estimates to facilitate informed decision making regarding the potential benefits, risks, and uncertainties of medication use.
- Identify the common characteristics of individuals at greatest likelihood of experiencing medication harms or benefits, to enable improved targeting of treatment interventions.

Possible areas of research include:

- Asthma management during pregnancy
- Iron deficiency anaemia in pregnancy
- Management of common lactation problems including lactation insufficiency and mastitis
- Antibiotic dosing in pregnancy
- Postpartum pain management
- Antidepressant use in pregnancy or in young people
- Medication utilisation in primary care
- Medication safety interventions in neonatal care.

Supervisor name: **Dr Erin Morton**

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Name of research group: **Health Data and Clinical Trials (HDCT)**

**Description of research area and interests:** Our research focus is the innovative design and conduct of clinical trials and health data activities for the purpose of translating research questions into improved health for the community, with a particular interest in digital health. Our studies can range from Phase 0 – IV (first-in-human to post-marketing) to national registries, in both academia and industry, and for pharmaceuticals, medical devices, and other interventions in patient care.

**Outline of projects:** Multiple options for research projects are available. In addition to the various study types listed above, we support the learning of many different research skills – e.g. study design, medical writing, patient/participant recruiting, research business operations, quality assurance, data design/collection/handling/analysis, ethical & governance concerns – in many therapeutic areas.

Talk to us if there's a particular research area or role you're most interested in and we'll see what options can be crafted – our research inventory is constantly changing, as are our various collaborators. At the time of this statement we have currently active projects in surgery, anaesthetics, digital health, rheumatology, neurodivergence, cardiology, and reproductive medicine amongst others.

Read more about HDCT here: <https://www.flinders.edu.au/health-medical-research-institute/hdct>



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# Research Supervisors and their Summer Research Award Projects

## Healthy Communities

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Supervisor name: **Professor Billie Bonevski**

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Name of research group: **Public Health**

**Description of research area and interests:** Chronic diseases such as cardiovascular disease, cancer, diabetes, respiratory diseases place the greatest health burden on the Australian community. Many of these conditions are preventable and share common health behaviour risk factors such as smoking, alcohol consumption, physical inactivity and poor nutrition or low levels of screening. Our research is focussed on understanding health behaviours and using this knowledge to design, evaluate and scale up health behaviour change interventions for the primary and secondary prevention of chronic diseases. One feature of our research is targeting population groups who are at increased risk of chronic diseases due to socioeconomic, cultural, or clinical factors. For example, both prevalence of health risk factors and chronic disease outcomes are worse in rural and remote areas than in the cities. Our interventions aim to change behaviours at individual, organisational and community levels to promote health. Much of our research involves community-based partners and stakeholders including health providers and services, non-government organisations and consumers to increase the reach of our research impact.



### Outline of projects:

- Design and evaluation of a health mobile phone app for pregnant Aboriginal and Torres Strait Islander mothers and their children under 5 years.
- Where do people in rural and remote communities go to seek information on reducing alcohol consumption?
- Designing tobacco control messages for people with mental ill health.
- Pilot testing elements in the Wellbeing SA Aboriginal Health Promotion Plan.
- Best practice/evidence regarding online youth engagement to support meaningful social connection and protective behaviours.
- Addressing youth social isolation through co-design.
- Evaluation of Wellbeing SA Wellbeing Hubs – possible projects could look at medium term impact and/or the use of citizen science in evaluation.
- Conducting an Aboriginal Health needs assessment for SA.
- Co-design of messages to prevent youth vaping uptake.



**Supervisor name:** **Dr Courtney Ryder**

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**Name of research group:** Injury Studies

**Description of research area and interests:** Injury is a major global public health problem and one of the leading causes of mortality and disability worldwide. Traffic accidents, drowning, burns and falls are common unintentional injuries, with neglect, physical violence and suicide being intentional forms. In injury I have a particular passion on equity, where my work is leading new ways of working with Indigenous Data through knowledge interface methodology and Indigenous Data sovereignty to change the deficit discourse surrounding Aboriginal and Torres Strait Islander health statistics.



My research uses knowledge interface methodology, bringing together a variety of research methodologies; quantitative, qualitative, Indigenous knowledges, to critically analyse data and reshape the way in which we contextualise outcomes focussing on health equity. The areas of injury of which I am primarily focussed include burns, falls, traumatic brain injury and traffic accidents. In this I have a particular focus on Aboriginal and Torres Strait islander communities across the life course. Other areas of expertise include out-of-pocket healthcare expenditure and Indigenous knowledges in the curriculum.

My research work involves collaborations with researchers and communities associated with The George Institute for Global Health, University of New South Wales, Westmead Hospital, Monash University, Alfred Trauma Centre and the University of Melbourne.

### **Outline of projects:**

#### Burns injuries

- **Coolamon Study:** This explores the care of Aboriginal and Torres Strait Islander children with burns in Queensland, New South Wales, South Australia and the Northern Territory. Researchers followed children for two years post burn to understand the impact and cost of burns, to understand patient experience, and to find better ways of caring for children with burns. [coolamonstudy.org.au](http://coolamonstudy.org.au)
- **Safer Pathways:** This project works in partnership with an Aboriginal Health worker, Westmead burn unit team members and families to develop a specific patient-centred discharge and follow-up planning service. The aim is to develop a model of care that will be integrated in the burns clinic and will enhance health care for Aboriginal and Torres Strait Islander children and their families.

## Falls

- Ironbark Trial: The Ironbark trial aims to show that the Ironbark: Standing Strong and Tall program reduces the rate of falls in Aboriginal people 45 years and older, compared to people who participate in the Ironbark: Healthy Community program. [ironbarkproject.org.au](http://ironbarkproject.org.au)

## Traumatic Brain Injury

- ATBIND: The Australian Traumatic Brain Injury National Data project aims to identify the key determinants of outcomes for patients with moderate to severe traumatic brain injury (TBI) across Australia. ATBIND uses current and extended data, to analyse the impact of variations in location, demographics, injury mechanism, system-level processes of (TBI) patient referral, transfer, prehospital care, emergency department reception and hospital care on hospital discharge disposition. This work will include the establishment of a data-based set of national clinical quality indicators, targeting the identified key gaps (including for the health of Aboriginal and/or Torres Strait Islander communities).

Supervisor name: **Associate  
Professor Anna Ziersch**

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**Name of research group: Social determinants of migrant and refugee health research group**

**Description of research area and interests:** Our multidisciplinary research examines the social determinants of health for people from migrant and refugee backgrounds. We use collaborative participatory research approaches drawing on qualitative and quantitative methods, as well as systematic evidence reviews, and have a focus on policy and practice impact.

**Outline of projects:** Our research projects cover a broad range of areas of migrant and refugee health for children and adults including disability, employment, housing and neighbourhood, access to health services (oral, maternal and primary health), family and domestic violence, caring responsibilities, pain and sleep. Please get in contact to discuss involvement in a project that suits your specific interests and learning outcomes.





**Supervisor name:** **Dr Zhaoli Dai-Keller**

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**Name of research group:** Public Health

**Description of research area and interests:** Dr. Dai-Keller is a nutritional epidemiologist and population health scientist (PhD in epidemiology from National University of Singapore in 2015). Her research interests include the role of nutrition in ageing and health across populations from diverse ethnic and cultural backgrounds. Other interests include health policy assessment and research integrity. Her research has been covered in mass media, including the NY Times (2017), CNN (2021), The Australian Science Media Exchange (2021), and Sydney Morning Herald (2022), among others.



She has published over 40 publications, including in high-impact medical journals such as the BMJ, Annals of Rheumatic Diseases, and PLOS Medicine. In addition, she is an associate editor for Nutrition Journal and an editorial board member for BMC Geriatrics.

Dr. Dai-Keller welcomes students interested in food/nutrition and chronic disease prevention research topics. These may include quantitative research using cohorts or survey data, conducting systematic reviews (including narrative reviews), and using open-access resources in novel research.

**Outline of projects:** Current planning on:

- Migrant women's health
- Diet quality through a cultural lens
- Use of cannabis in pain management.

**Supervisor name:** **Dr Ashlea Bartram**

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**Name of research group:** **National Centre for Education and Training on Addiction (NCETA)**

**Description of research area and interests:** NCETA is an internationally recognised research centre in the alcohol and other drugs (AOD) field. Our core areas of research focus are:

- The promotion of workforce development principles, research and evaluation of effective practices.
- Investigating the prevention, prevalence and effect of alcohol and other drugs use in society.
- Development and evaluation of intervention programs and resources for workplaces and other organisations.



#### **Outline of projects:**

*Parental supply of alcohol:* Parental supply of alcohol is a key determinant of adolescent risky drinking and associated with alcohol-related harms, yet parents are now the most common source of supply for underage drinkers. We are conducting a program of work to identify parent characteristics associated with parental supply and develop effective campaign messaging to discourage supply. Students will have the opportunity to assist with analyses of data from surveys and focus groups with Australian parents of adolescents.

*Online delivery of AOD services:* The trend towards online delivery of alcohol and other drug services has been hastened by COVID-19, and e-health is expected to be a key component of service delivery into the future. E-health has potential benefits for clients such as flexibility, convenience, and increased access to specialists, but there is a need to examine the quality and effectiveness of online service delivery, including in which circumstances and for which clients it may or may not be appropriate. Students will have the opportunity to contribute to a systematic review on this topic.

*Stigma and the AOD workforce:* There is a need to increase the number of health and social services graduates willing and able to engage in AOD work, either by working in AOD-specific roles or by identifying and screening for potential AOD-related harms among clients encountered in other fields of work. One factor that may limit interest in engaging in AOD work is the stigma associated with AOD use. We aim to identify factors associated with interest in AOD work among health and social services students, including personal and professional values held by students toward people who use AOD. Students will have the opportunity to contribute to the design of a survey of final year health and social services students.

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# Research Supervisors and their Summer Research Award Projects

## Molecular Biosciences

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Supervisor name: **Dr Alyce Martin**

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Name of research group: **Molecular and cellular physiology**

**Description of research area and interests:** My research interests are on how bacteria communicate with specialised hormone-producing cells in the intestine and the downstream effects on several physiological processes.



**Outline of projects:** Investigating how bacteria communicate with serotonin-producing enterochromaffin cells in the mouse and human intestine. Defining how a high fat diet increases serotonin levels in the gut.

Supervisor name: **Professor Janni Petersen**

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Name of research group: **Environmental control of cell growth and cell division**

**Description of research area and interests:** Janni Petersen is a cancer cell biologist, who has an interest in understanding the mechanisms that allow cancer cells to grow and divide. Cancer is a disease of inappropriate cell growth and cell division. Cancer cells migrate to colonize new parts of the body, here they undergo cell division in environments with limited nutrient supply therefore, cancer cells are frequently nutritionally stressed. In shedding light on the mechanisms behind environmental and metabolic control of cell division and cell survival we aim to identify novel target for the treatment of human cancers.



**Outline of projects:**

- Understanding cancer cell metabolism.
- The impact of cell metabolism on DNA repair and its implications for aging and cancer.
- Cancer cells survival under nutrient stress, what makes cancer cells unique?

**Supervisor name:** Professor Briony Forbes

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**Name of research group:** Proteins in Metabolism and Cancer

**Description of research area and interests:** The Forbes lab aims to develop novel treatments for diabetes and cancer through understanding the basic mechanism by which insulin and insulin-like growth factors (IGFs) bind and activate their receptors to promote metabolic control, cell growth and survival. Surprisingly we still lack fundamental information as to how insulin and IGFs interact with their receptors to promote the key conformational changes required to activate the receptor tyrosine kinase domains and subsequent downstream signaling pathways. We will probe this interaction by making novel mutants of the ligands and the receptors and then testing these in cell-based assays for their abilities to promote downstream signaling. This will allow us to understand in detail which interactions between the ligands and the receptors are key for promoting specific receptor activation outcomes. Ultimately this information will allow us to create novel insulins for the treatment of diabetes and novel IGF inhibitors for the treatment of cancers that are dependent on IGF signaling for growth and survival.

**Outline of projects:** Development of novel treatments for diabetes and cancer through understanding the basic mechanism by which insulin-like growth factors (IGFs) and insulin bind and activate their receptors (the IGF-1R and the insulin receptor) to promote cell growth, survival and metabolic control.

**Supervisor name:** Dr Ashley Hopkins

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**Name of research group:** Clinical Cancer Epidemiology Lab

**Description of research area and interests:** The Clinical Cancer Epidemiology Lab aims to deliver actionable prediction strategies and breakthroughs that improve the lives of patients with cancer. We achieve this through epidemiological research which honours the contributions of patients who have enrolled their clinical data and experiences to science.

**Outline of projects:** My research team leverages established collaborations with industry partners (e.g. Pfizer, Roche, Lilly) to identify biomarkers and predictors of efficacy, quality-of-life, and adverse outcomes associated with anti-cancer medicines. Our objective is to bring together big data and emerging data science breakthroughs (e.g., machine learning and artificial intelligence) to inform oncologists and clinical practice guidelines about the selection of the right medicine for the right patient. We have current active projects informing the precision use of anti-cancer medicines across breast, lung, prostate, colorectal and other major cancer types.



**Supervisor name:** **Dr Luke Grundy**  
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**Name of research group:** Visceral Pain Research Group

**Description of research area and interests:** Chronic pelvic pain derives from our internal organs and is a major, but underacknowledged clinical issue affecting >1Million Australians every year. Chronic pelvic pain is a key clinical feature of a number of common bladder disorders and can arise spontaneously, as a result of recurrent urinary tract infection (UTIs), or as a consequence of chemotherapy and immunotherapy. There are no current clinically efficacious and safe pharmacological treatments or cures for chronic pelvic pain, ensuring patients continue to live with diminished personal, psychological, sexual, social, and professional life. My research program focuses on understanding the mechanisms responsible for the development of chronic pelvic pain and the development of novel and safe pharmacotherapies to treat or prevent chronic pelvic pain from developing.

**Outline of projects:**

- UTI's – Patients with chronic and/or recurrent UTI's are at increased risk of developing chronic pelvic pain and functional bladder disorders associated with altered sensation, including interstitial cystitis. The underlying mechanisms responsible for inducing this protracted state of neuronal hypersensitivity are unknown. Multiple projects are available for enthusiastic students to investigate the complex interactions of bacteria, the toxins that they release, and the development of inflammation in the modulation of sensory nerve function. Interventional studies focus on modulation of the gut and bladder microbiome, and the identification of the ion channels and receptors that regulate neuronal hypersensitivity.
- Bladder Cancer – The most common treatment for non-muscle invasive bladder cancer is BCG immunotherapy. However, many patients experience bladder pain that limits their therapeutic dose, decreasing treatment efficacy. Projects are available for students to investigate the mechanisms of BCG induced bladder pain, and test novel prophylactic therapies to prevent the development of pain during bladder cancer treatment.
- Drug Delivery – Traditional approaches to pain management, such as opioid based analgesics, are unsuitable for treating chronic pelvic pain due to their debilitating side effects, including addiction and dependence. Taking a different approach, we have shown that we can effectively inhibit bladder pain via instillation of therapeutic compounds into the bladder lumen. The next step required to advance this transformative intervention is to develop drug delivery systems that allow selective targeting of the bladder following systemic administration. Projects are available for students to test innovative nanoparticle drug delivery systems for the treatment of chronic pelvic pain in the absence of side effects.

Supervisor name: **Professor Simon Conn**

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Name of research group: **Circular RNAs in Cancer Laboratory**

**Description of research area and interests:** Throughout my career, I have loved the challenges and opportunities of Molecular & Cellular Biology. Despite DNA sequencing identifying 26,000 genes, next-generation sequencing of the RNA transcripts has shown, unequivocally, that the canonical RNAs from these genes are the exception, rather than the rule. We are the only dedicated laboratory in Australia investigating the most contemporary class of non-coding RNA transcripts in eukaryotes, called circular RNAs. We are interested in how they are formed and regulated in cancer, human diseases and across stem cell differentiation. These are my molecular heroes and once you start researching them, I guarantee you will not be able to stop.



**Outline of projects:** All projects in my laboratory are focussed on the initiation, progression, diagnosis and treatment of human disease, with a particular focus on cancers. The common element to these projects is that students possessing a high level of molecular biology skills and motivation to make a difference (to even one person) will find the laboratory an excellent environment for achieving high-impact outputs.



**Supervisor name:** **Dr Dusan Matusica**

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**Name of research group:** Pain and Sensory Cell Biology Lab

**Description of research area and interests:** We are interested in biomarkers that can be used to detect and define pain. Detecting pain seems easy, it hurts, but determination of e.g. a response to treatment or defining pain in newborns or people that cannot express themselves is more challenging. We aim to find and develop biomarkers in blood and cerebrospinal fluid of humans and animal models of pain types by using different strategies. This will be an essential tool to reduce the burden of chronic pain and the misuse of pain killers such as opioids.

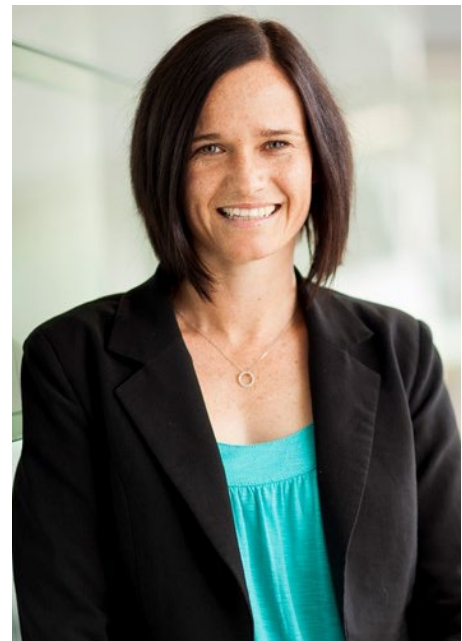
**Outline of projects:**

- Development of a sentinel cell line to detect and differentiate between pain types in serum.
- Development of a novel neuron-chip interface that allows growth of different pain neurons phenotypes.
- Detection of human vesicular miRNAs in complex CSF solutions.

**Supervisor name:** **Dr Claire Jessup**

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**Name of research group:** Immunomodulation Laboratory

**Description of research area and interests:** Our research investigates the immunology underlying human diseases including Type 1 diabetes, transplantation and cancer. We focus on molecules, called immune checkpoints, that are involved in the activation of immune cells. Specifically, we use proteins that block or enhance signalling through checkpoint molecules to dial the immune system up or down. We examine the responses of human immune cell populations derived from blood and tissue samples Our goal is to harness the power of the immune system to modulate disease.

**Outline of projects:**

- Immune checkpoints in ovarian cancer.
- PD1 signalling in Type 1 diabetes.
- Signalling through serotonin receptors during inflammation.

Supervisor name: **Associate Professor  
Munish Puri**

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Name of research group: **Bioprocessing (Medical  
Biotechnology)**

**Description of research area and interests:** The Research Program in my laboratory focuses on various issues pertaining to the Biotechnology and Pharmaceutical industries. The major goals of my research are to produce and purify novel therapeutic proteins/small metabolites (known as bioactives) from a variety of sources e.g. microbes, animal and plant cells and to improve their functional efficiency and specific activity for carrying out transformations of pharmaceutical intermediates/animal cell products with health benefits. This can be accomplished by two strategies: Bioprocessing and Metabolic engineering.



The following research is currently underway in partnership with our national and international collaborators: *a) health and nutrition* to develop preventive medicine and nutritional supplements to improve human health; *b) food biotechnology* for nutraceutical extraction and functional food development relating to single cell oils that are rich in omega-3 fatty acids, and enzyme production; *c) nanobiotechnology* for enhancing the thermostability of enzymes that have application in health products and *d) health substantiation* by validation of the function(s) of bioactives.

**Outline of projects:** Several projects will be offered, each focused on developing a solution to an industry problem that is associated with human health globally.

- i. Development of single cell oils rich in omega-3 fatty acids to assist human nutrition
- ii. Development of controlled alginate hydrolysis for medical applications
- iii. Characterisation of the delivery of therapeutic proteins to diseased cells
- iv. Targeting fatty acid metabolism for containing obesity
- v. Green extraction process development for novel bioactives.

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**Name of research group:** **Biomedical Nanoengineering Lab**

**Description of research area and interests:** My research is focused on engineering biointerface, which has been known as the region where biomacromolecules and cells interact with materials at the molecular, nano-, and cellular levels. Biointerface engineering is crucial for numerous applications ranging from biotechnology to medicine. Our Biomedical Nanoengineering Lab aims to engineer the biointerface to modulate the biological response for specific biomedical applications. Engaging with team members, students will have the opportunity to collaborate with chemists, physicists, biologists, microbiologists, and clinicians. Students will acquire the knowledge and abilities necessary to investigate the interaction between cells and biomaterials.



**Outline of projects:** We have a wide range of projects to design biomaterials or process which can be used in many medical applications, including;

- Bioengineering Antimicrobial Biomaterials. Designing materials at various scales to stop infections for different applications such as orthopaedic implants, catheters, wound dressing, etc.
- Designing Drug Delivery System. This project is focused on encapsulating drugs in lipid or biopolymer formulations. Various techniques will be used in this project to encapsulate the desired drug molecules.
- Designing biosensors for detecting the early sign of infections. The focus of this project is designing biosensors that can glow or change colour to alert the infections.