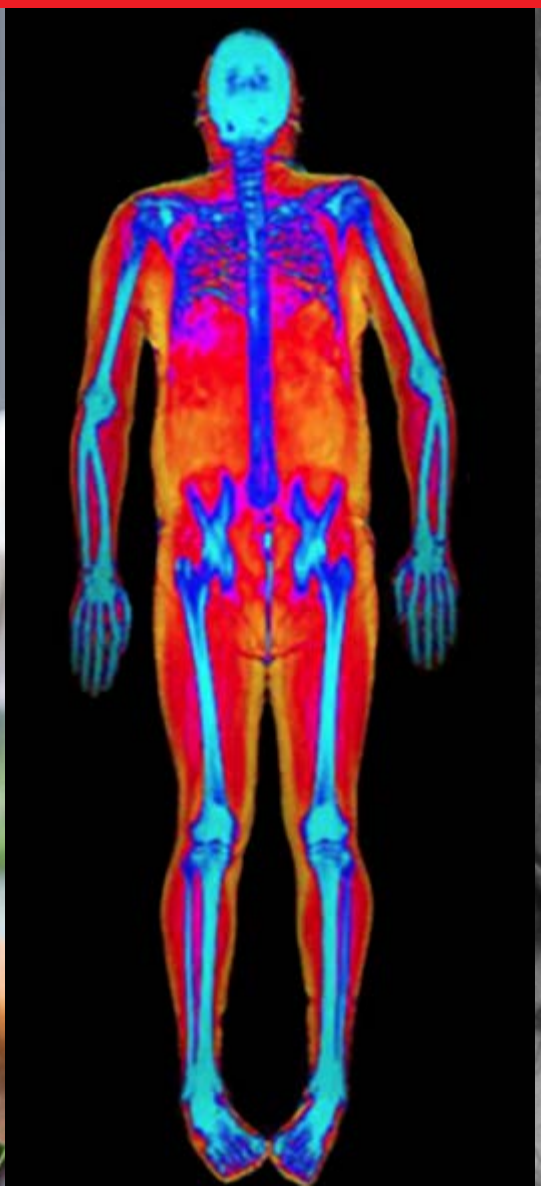
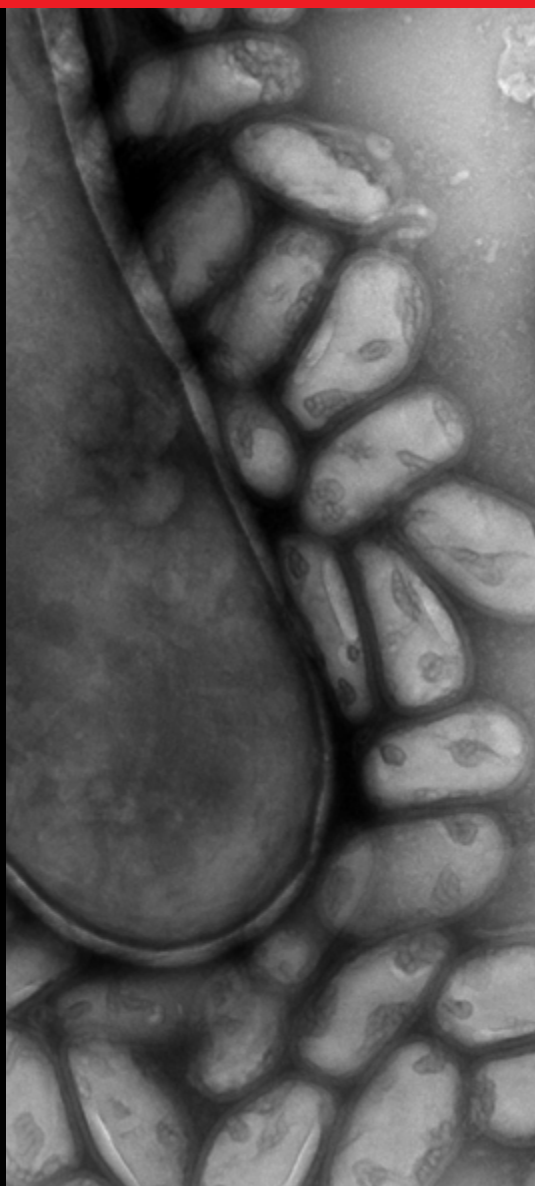
2025 Honours in the School of Agriculture, Biomedicine & Environment





Visit our website for up-to-date information and upcoming information sessions:

https://www.latrobe.edu.au/school-agriculture-biomedicine-and-environment/honours

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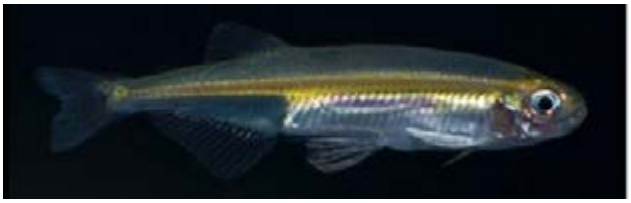

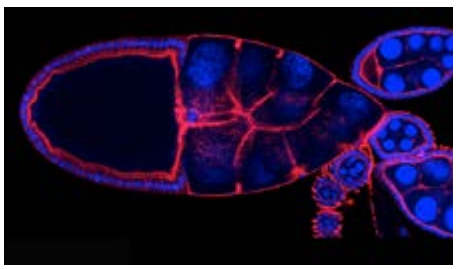

General Information

Welcome to SABE

Congratulations on selecting the Honours program within the School of Agriculture, Biomedicine and Environment!

The School of Agriculture, Biomedicine and Environment (SABE) is the largest in the University and generates a significant proportion of the University's research across a broad range of disciplines. These include: Agriculture, Botany, Soil Science, Animal Physiology and Health, Plant Science, Agronomy, Ecology, Evolution, Genetics, Conservation Biology, Zoology, Neurobiology, Microbiology, Physiology and Pharmacology, Anatomy, Biochemistry, Cell Biology, Chemistry, Cardiovascular Physiology and Translational Science.

Doing a Honours research project in SABE will place you at the edge of known scientific knowledge in your area of interest, which I hope will be both exhilarating and satisfying. Creating new knowledge and sharing this with your colleagues will allow you to appreciate the scientific method and instill in you a curiosity that can be quite addictive. On your path to discovery, you will be supported by academic supervisors with years of experience and expertise to guide you through your research project and state-of-the-art infrastructure. I wish you only success in your research endeavours during Honours and hope you consider joining our postgraduate student body in the future.

Prof. Shaun Collin

Dean, School of Agriculture, Biomedicine and Environment (SABE)

Dr. Katrina Binger

Honours coordinator for SABE

Hello, my name is Katrina and I am the coordinator for the SABE Honours program.

I fell in love with research during my Honours year (which is too many years ago to mention!). Before Honours, I never intended to be a researcher or scientist, but once I got my first result I was hooked!

It is hard to describe to students just how transformative your Honours year will be. You won't have any timetables telling you what you need to do each week; instead you complete self-directed, largely practical tasks. You won't have weekly lectures and assessments; instead you will work solidly for the whole course on one project which will be assessed right at the end. Whilst Honours is an independent study year, you won't be alone; instead, you will be mentored closely by our extremely talented scientists and embedded in a group of like-minded students and researchers. You will find Honours fun, exhilarating, frustrating, intense, and like nothing you have ever done before. For most students, Honours inspires a life-long love of research and I certainly hope that happens for you!

My role as SABE Honours coordinator is to help students: (1) decide to do Honours in SABE, (2) choose a research project, and (3) apply. This is the purpose of this information booklet. If you have any questions or problems, or just need some guidance, please email us: sabehonours@latrobe.edu.au

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General information

What is Honours?

As an Honours student in our school, you will embark on a new set of adventures, very different to your undergraduate experience. Honours students fully immerse themselves in a research topic and experience first-hand what a career in research is like. Our students work alongside world-leading researchers in a variety of discipline areas, ultimately, becoming experts in data analysis, critical thinking, and the use of cutting-edge scientific techniques. Our goal in Honours is to transform you from an undergraduate student (who learns about science from a textbook) into a successful researcher (who rewrites textbooks).

What skills will you obtain by doing Honours in the School of Agriculture, Biomedicine & Environment (SABE)?

Students who undertake Honours in SABE will work on an exciting, research-based project. You will learn a multitude of practical laboratory or field skills, access state-of-the-art technology, analyse data, think critically and develop skills in communicating your research. Our Honours graduates are highly sought-after by employers from all sectors. Skills include:

- A range of important scientific technical skills (fieldwork, animal, cellular, biochemical and/or molecular laboratory techniques) that are required to perform everyday research.
- Skills to manage a research project, from effective time-management to the detailed planning and execution of experiments.
- Critical thinking: learning to read and understand technical and scientific literature, evaluate published data and interpret your own results.
- Communication skills (both written and oral) required to present your research to scientific and generalist audiences.

What are the entry requirements for Honours in SABE?

Honours is a 4th year of your undergraduate degree, meaning you need to have finished your Bachelor's degree before you start. Our requirements for entry are:

1. Completed Bachelor's degree (or at least will be completed by the time Honours begins).
2. Achieve an average mark (WAM) of 60 or better across all third-year subjects.
3. Achieve a WAM greater than 65 in four discipline-specific 3rd year subjects.
4. Obtain the approval of a research supervisor

Note: the final selection of students into Honours projects is at the discretion of the research supervisor. This means that even if you meet all the other criteria, the most important eligibility requirement is that you select a research supervisor AND they agree to take you on.

When is Honours in SABE offered?

Honours in SABE has two entry points. You can commence your Honours year:

- in February, concluding mid-November
- in July, concluding mid-June the following year.

No matter when you start Honours, the year is structured so that it ends with the submission of a thesis detailing your research accomplishments.

Can I study full-time or part-time?

Honours in SABE is available for both full-time and part-time study. However, this is dependent on the nature of the research project and willingness of the supervisor. We have indicated in this booklet whether research projects are available for full-time study, part-time, or both.

What is the time-requirement for Honours?

Honours should be thought of as an intensive work-experience placement. Students studying full-time should expect a time commitment of 40 hours per week, while part-time students should expect a time commitment of 20 hours per week. Students will also have to spend additional time working towards coursework subjects and research assessments such as the preparation of presentations or thesis writing.

Where will my project be located?

Honours projects in SABE are supervised by scientists in a variety of state-of-the-art research facilities. Where you conduct your project will depend on where your supervisor is located - you may even not have a fixed location and spend your time in the field! Our Honours projects are available at the Bundoora and Albury-Wodonga La Trobe University campuses; within institutes such as the La Trobe Institute for Molecular Science (LIMS) or AgriBio; or at external research sites such as the Olivia Newton-John Cancer Research Institute (ONJCRI) in Heidelberg, and Baker Heart and Diabetes Institute in Prahran. No matter where you do your Honours project, you will have access to superb facilities and interact with a large number of groups with similar scientific interests.

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Scholarships and financial aid

La Trobe Access Scholarships

Honours is a very intense year, and it is often difficult for students to juggle their personal employment(s) and the time required for their research project. Access scholarships and bursaries are intended to support Australia students from all backgrounds to reach their potential at University. These are designed to support students who may have:

- Experienced financial difficulties
- Gone through personal hardship
- Come from a disadvantaged or underrepresented background.

All new and continuing La Trobe students are eligible to apply. Unfortunately, international students are not eligible.

Access scholarships are worth $5000 per year.

Bursaries are usually valued at a $1000 one-off payment.

Applications for Semester 1, 2025

Applications for Access Scholarships and Bursaries for Semester 1, 2025 are processed through VTAC:

- Applications open at the start of August and close at the start of October.
- Please see https://www.latrobe.edu.au/scholarships/apply for dates and how to apply.

Applications for Semester 2, 2025

Applications for Access Scholarships and Bursaries for Semester 2, 2024 are processed by La Trobe scholarshops office:

- Applications open at the start of May and close at the start of July.
- Please see https://www.latrobe.edu.au/scholarships/apply for dates and how to apply.

Merit-based scholarships are also offered to recognise academic achievement. These are automatically assessed based on your results and don't require an application.

Department of Environment and Genetics (EG) Scholarships

Students who undertake a project in the Department in Environment & Genetics are automatically considered for one of several merit-based scholarships:

- Nature Advisory Botanical Scholarship: comprising a stipend and contribution to research costs up to $15,000. Available to students doing a project that involves plant community/ botanical identification work.
- Richard Zann Bursary: Available to students with a research topic in ecological zoology and who come from a rural area.
- Peter Rawlinson Award: Award of $500. Available to students with a research topic in field-based animal ecology.
- David Ashton Memorial Scholarship: Award of $1000. Available for students with a research topic on the ecology of Australian fauna.

These scholarships are automatically awarded to students based on their 3rd year marks and the appropriateness of the research project. Students do not need to apply and will be notified if successful.

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Career outcomes

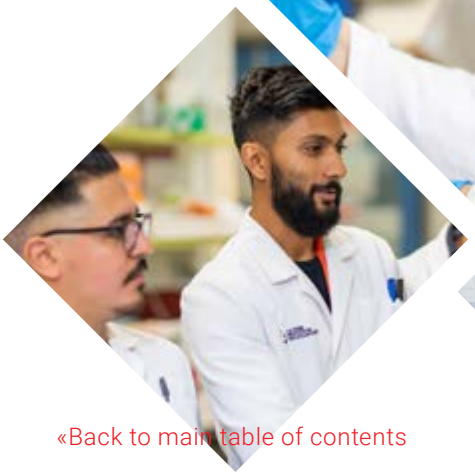
Our Honours graduates are highly employable, being sought after by other universities, research institutes, hospitals and biotechnology companies. The majority of our Honours graduates develop a love for research during their placement, and decide to continue in research by undertaking further postgraduate study (Masters/PhD). Our graduates then go on undertake further postdoctoral research, within Australia or overseas. Others, including those listed below, pursue diverse non-academic roles in industry, medicine, biotechnology and others:

- Dr Nicole van der Weerden (Honours 2003, PhD 2007) is now the Chief Executive Officer of Hexima (a successful biotechnology company).
- David Bloomer (Honours 2012, PhD 2017) is also working in the biotechnology industry, within the recombinant proteins sector at CSL.
- Will Graf (Honours 2018) is now employed at the Police Forensics Laboratory.
- Stephanie Paone (Honours 2013, PhD 2018) works as Clinical Research Coordinator at Nucleus Network.
- Dr Luke Duncon (Honours, PhD 2017) works as a researcher at Bayer Crop Science.
- Dr Ellen Reid (PhD 2012) is a patent scientist at Jones Tulloch.







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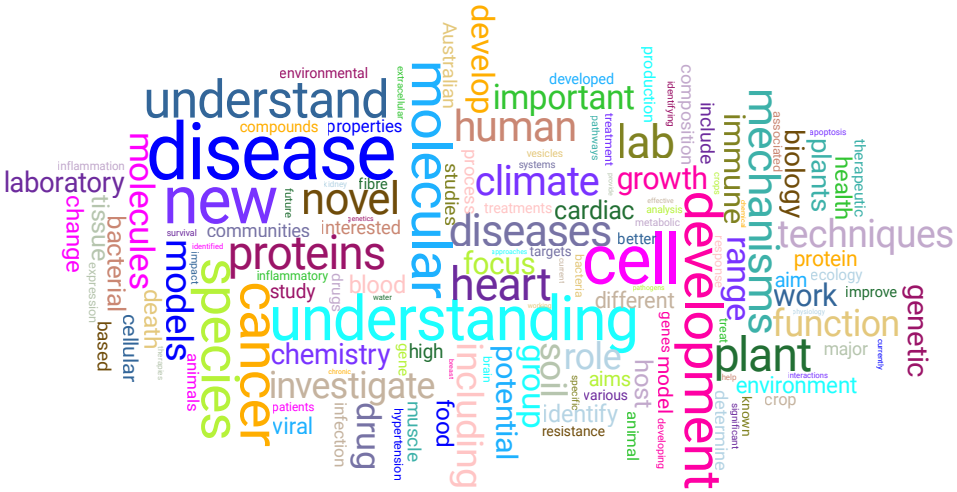
How do you choose a project?

SABE research overview

Our research topics

The most important selection criteria for entry into Honours is the approval of a research supervisor. **This involves students selecting a research project they want to do AND the research supervisor agreeing to supervise the student.** The first step in this process is for students to make a shortlist of the Honours projects that they find interesting. This can be overwhelming for students as our researchers work on such a large variety of exciting and important research topics. This word cloud was generated from the projects available in this booklet - you can see how many things we research! Your first job is to identify areas of science or 'research discipline(s)' that are most appropriate to your undergraduate degree and interests.



Location, location, location!

We also conduct our research in many different ways, and at a variety of locations. The location of your Honours supervisor is likely to be where your project is located. Therefore, this may be something you want to consider when choosing a Honours project. Our researchers are located at:

- La Trobe University **Bundoora** campus, (variety of buildings);
- La Trobe Institute for Molecular Science (**LIMS**), a research institute located within the Bundoora campus;
- **AgriBio**, a biosciences institute also located within the Bundoora campus;
- Centre for Freshwater Ecosystems, located within the La Trobe University **Albury-Wodonga** campus;
- **Baker Institute**, located next to the Alfred Hospital in Prahran;
- The Olivia Newton-John Cancer Research Institute (**ONJCRI**), situated next to the Austin Hospital in Heidelberg.

In this booklet, the project location is indicated in the heading of every supervisor's information page.

La Trobe University Bundoora campus

La Trobe Institute for Molecular Science (LIMS)

AgriBio, Centre for AgriBioscience

Centre for Freshwater Ecosystems
La Trobe University
Albury-Wodonga campus

Baker Institute
Prahran, Melbourne

Olivia Newton-John Cancer Research Institute (ONJCRI)
Heidelberg, Melbourne

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How to use this booklet to find your perfect project

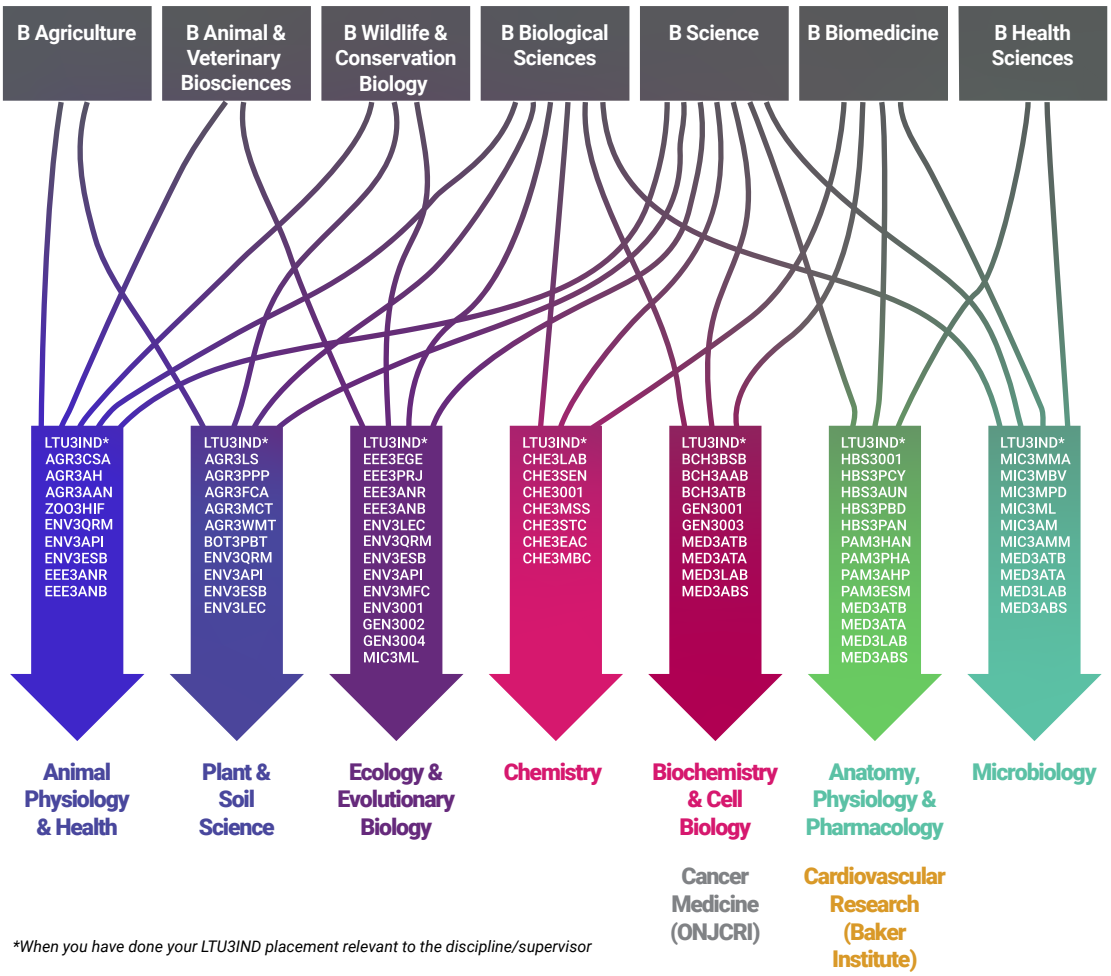
In the final year of your Bachelor's degree, you would have taken a number of 3rd year subjects pertaining to a specific scientific discipline. These subjects were probably in an area of science that most fascinated you. You are therefore likely to be most interested in research projects focused on that same area of science.

To help you identify a Honours research project, take a look at the infographic below: find your undergraduate degree and some of the 3rd year subjects that you have taken. These will correspond to one or more research disciplines which will have Honours projects that are most appropriate for you. **Note: this is only a guide and is by no means definitive! You may find yourself with the expertisie/interest for multiple disciplines.**

Step 1. Select your Undergraduate course

Step 2. Find the 3rd-year subjects you studied (you may find them in multiple instances)

Step 3. The research discipline that align with your 3rd-year subjects is where we suggest you focus on finding a Honours project.



*When you have done your LTU3IND placement relevant to the discipline/supervisor

Now you have a feel for the research disipline that is your best fit, it's time to look at the projects on offer! Every project page in this booklet will tell you:

- The name and contact details of the supervisor, so you can organise a meeting.
- How many project positions they have available, whether they start in February or July, and whether they are available for full-time or part-time study.
- The techniques that you will likely learn by doing Honours with them.
- Information about the lab/research theme and maybe some project specifics.

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Getting help

Need help finding a project?

Finding a research project and supervisor is the most critical part of the application process... but, this can also be an overwhelming experience for students. We have a lot of people ready to help you!

You can contact any of the following people through our SABE Honours email address: sabehonours@latrobe.edu.au

Dr. Katrina Binger

SABE Honours coordinator (on leave until Oct 2024)

General SABE Honours enquiries, course & subject selection.

Dr. Jarrod Church

Interim SABE Honours coordinator

General SABE Honours enquiries, course & subject selection; advice on Microbiology, Anatomy, Physiology & Pharmacology Honours projects.

Dr. Travis Dutka

Animal Physiology & Plant and Soil Science Honours coordinator

Advice on Animal Physiology & Health, Plant and Soil Science Honours projects.

A/Prof. Erinna Lee

Biochemistry, Cell Biology and ONJCRI Honours coordinator

Advice on Biochemistry, Cell Biology and projects located at the ONJCRI.

Dr. Aleicia Holland

Ecology & Evolutionary Biology Honours coordinator

Advice on Ecology & Evolutionary Biology Honours projects.

Prof. Judy de Haan

Cardiovascular Research (Baker Institute) Honours advisor

Advice on Honours projects located at the Baker Institute.

A/Prof. Belinda Abbott

Chemistry Honours coordinator

Advice on Chemistry Honours projects.

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LTU3IND placements

What is LTU3IND?

Undertaking an Industry Placement is an excellent way to put theory into practice and develop professional skills in a working environment. A fantastic pathway into Honours is to conduct your LTU3IND placement in one our research labs - essentially, having a 'taster' of what Honours is like. This is a subject that you can take in the third year of your degree, i.e., before you enrol in Honours.

Completing an industry placement as part of your undergraduate degree will assist you to develop professional networks that enable you to more easily gain employment upon graduation. You will explore what it means to be a member of a professional team in a workplace, reflect upon your experiences and career aspirations and develop transferrable skills that will improve your employability.

The industry placement experience is designed by you, to meet your interests, with the support of La Trobe academic staff.

Available to Undergraduate students in their second and third year, LTU3IND offers a range of domestic placement opportunities. It is a 15-credit point elective subjects that is designed to help you develop your employability skills within a professional setting.

As a student in LTU3IND you will:

- complete 100 hours of approved work placement
- contribute to the workplace in a meaningful way as a supervised professional; this may include working on solving an organisational problem, developing a new activity, analysing data to improve a work practice, and more.

How do I source a LTU3IND placement in SABE?

LTU3IND requires you to self-source your placement, which must be approved by the Subject Coordinator before census date or you will need to withdraw your enrolment. Undergraduate students must also have completed 120 credit points prior to undertaking LTU3IND.

To make finding a placement easier for you, we have indicated those research supervisors that are offering LTU3IND placement with this badge:

You will need to contact the research supervisors that you are interested in doing a placement with via the information provided on their page.

How to apply for LTU3IND?

The application procedure is:

1. Students peruse this book and arrange meetings with research supervisor to discuss the project.

2. Once a supervisor and placement is found, student and supervisor together complete the LTU3IND Placement Description Form (download here).

3. Students submit their online application as a self-sourced placement (attaching the completed project description form) via the link: https://www.latrobe.edu.au/students/opportunities/wil-placements/elective-placements/industry-placement-subjects/how-to-apply

4. Application will be reviewed by the Industry Placements Team and students/supervisors will be contacted if the activities/project outlined in the form doesn't align with the SILOs or due diligence has not been met.

5. Students will be advised if their application has been approved by the Subject Coordinator via the Industry Placements email (allow two weeks).

6. A work-based learning (WBL) agreement will be completed and paperwork finalised – students cannot commence their placement until they have received final approval confirmation.

Note: LTU3IND placements do not guarantee entry into the SABE Honours program. Also, you do not have to do a LTU3IND placement to be eligible for Honours. This is purely a pathway that may help you identify if honours is for you, and/or what sort of honours projects you would like to pursue.

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Projects Available in 2025

SABE research disciplines

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Animal Physiology & Health

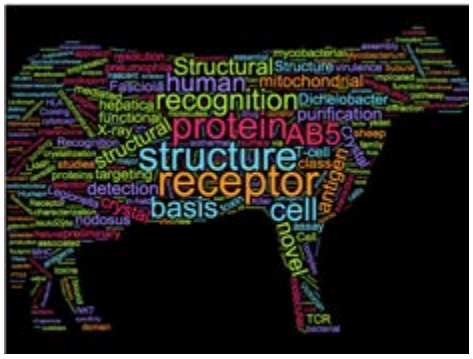
Prof. Travis Beddoe
AgriBio

E-mail: t.beddoe@latrobe.edu.au
Website: click here

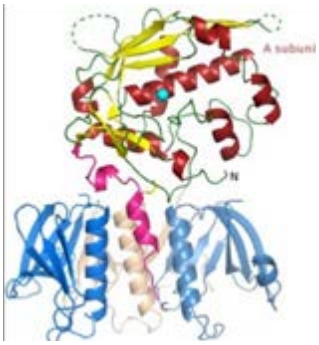
- Bacterial overexpression of proteins
- Protein biochemistry incl. protease assays
- Mass spectrometry
- Gene expression assays
- Animal or plant identification
- Bioinformatics
- Immunoassays
- Field work & ecological assays

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Feb only**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Agriculture Bio-Solutions Lab has access to state-of-the-art facilities for studying host-pathogen interactions in livestock. Due to industrialized farming, there has been an increase in endemic disease that has resulted in multi-million-dollar losses to the farming industry per annum due to poor productivity, failure to thrive and death. The use of antimicrobials to treat these diseases has led to an increase in drug-resistant strains of pathogens. Pathogen control programs based solely on the use of anti-microbial drugs are no longer considered sustainable because of an increased prevalence of bacterial resistance, high costs and concerns regarding residues in the food and environment. To provide improved sustainable health and welfare outcomes in livestock production, the Agriculture Bio-solutions lab has developed a complete "Bench to Barn" research program focusing on 1) field-deployable diagnostics, and 2) molecular understanding of disease pathogenesis 3) sustainable treatment solutions (vaccines and breeding).



Project 1. Field-deployable diagnostics. The ability to quickly diagnosis infectious agents in the field will lead to better treatment and management decisions in real-time. We will take advantage of new innovative gene amplification technology termed loop-mediated isothermal amplification. The high sensitivity of LAMP enables detection of the pathogens in sample material without time-consuming preparation thus being able to detect pathogens within 30 min. We are developing a range of LAMP assays and associated sampling technologies to rapidly identify infectious agents in-field.



Project 2. Vaccine Development. Vaccinating humans and animals is a very effective way to prevent them from becoming infected and thereby reduce the need for antibiotics. Currently, work is underway investigating the use of AB5 toxin family as mucosal vaccine adjuvants and various novel production vaccine platforms such as algae to produce lost-cost vaccines.

Project 3. Honey Bees, the most important livestock species. Approximately one-third of the typical Western diet requires bee pollination, and honey bees (Apis mellifera) are the primary pollinators of numerous food crops, including fruits, nuts, vegetables, and oilseeds and annually, insect-pollinated crops are valued at approximately US$175 billion worldwide. We have combined our strengths in research to focus on improving bee health through 1) field-deployable diagnostic test for viruses, 2) understanding of the seasonal dynamics and co-occurrence patterns of honey bee pathogens and 3) development of novel therapeutic to aid honey bee health.

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Prof. Shaun Collin
Bundoora

Whole organism bioimaging (CT)

Electron microscopy

Field work

Animal handling

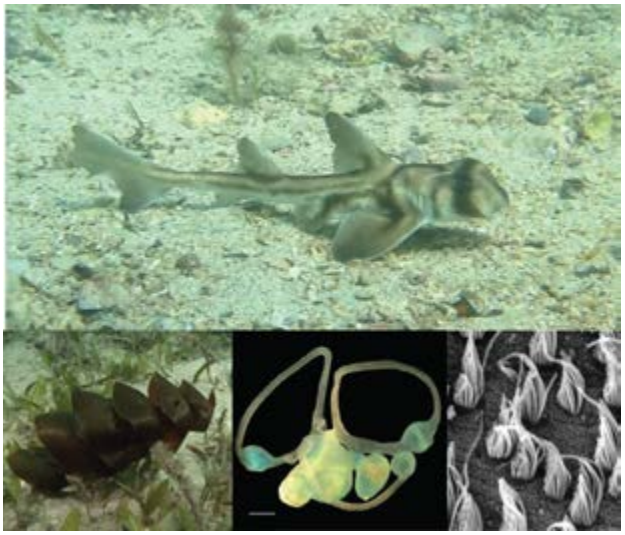
Histology

E-mail: s.collin@latrobe.edu.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Neuroecology Group uses neurobiological techniques to investigate the neural bases of behaviour in the context of an animal's habitat and ecology. Many animals rely on vision, olfaction, audition, lateral line, electroreception and gustation to find food and mates, avoid predation, navigate their environment and even migrate over long distances. We examine the importance of each of these senses by studying the peripheral sense organs and the brain and help environmental managers understand species vulnerability to environmental change and their capacity for sensory plasticity. Projects are co-supervised by academics such as Caroline Kerr, Lucille Chapuis, and Travis Dutka.

Project 1: Sensory system development in the Port Jackson shark. Elasmobranchs (sharks and rays) have a battery of highly refined senses that have been shaped by over 400 million years of evolution. Understanding the pattern of the sensory systems embryonic development is essential for an appreciation of their respective function and roles through life history. The student will investigate the development of a sensory system (e.g. the lateral line, the olfactory system, or the auditory system). Depending on the student's interests, the project will involve learning neuroanatomical, morphological, microscopy and bioimaging methods.



Project 2: Chemoreception in Australian ghost sharks. This project will focus on the sense of smell (olfaction) in a little-known group of cartilaginous fishes, the ghost sharks. These deep-sea fishes occupy different depth ranges and use chemical cues to find food, avoid predation, find reproductive partners and even migrate over long distances to lay their eggs. Using preserved specimens, bioimaging and immunohistochemistry will be used to predict the relative importance of olfactory sensitivity in each species' life history and behaviour. The work will ultimately assist in assessing the vulnerability of these pelagic predators to chemical pollutants.

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Dr. Kerry Fanson
Bundoora

Available for Industry placement

E-mail: k.fanson@latrobe.edu.au
Website: click here

- Immunoassays
- Microscopy
- Animal handling
- Animal behaviour studies
- Field work

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The Wildlife Endocrinology Lab studies the complex interactions between stress and reproductive physiology with the aim of improving animal conservation and welfare. A major focus in our lab is understanding how changes in the environment impact animal physiology. We rely primarily on non-invasive hormone monitoring to conduct longitudinal investigations on the physiology of wildlife species, but often integrate a range of other techniques depending on the project.

Topic 1: Untangling the interactions between stress and reproduction. Glucocorticoids (cortisol and corticosterone) are often referred to as "stress hormones" and are assumed to inhibit reproduction. However, there is growing evidence that glucocorticoids promote healthy reproduction under certain circumstances. Our lab employs a range of techniques (non-invasive hormone monitoring, histology, PCR) to tease apart the complexity of this relationship between glucocorticoids and reproductive success.

Topic 2: Novel indicators of stress. Stress is one of the most widely studied topics in biology, but unfortunately there are no good bioindicators of how "stressed" an animal is. Our lab is exploring different techniques to develop novel indicators of animal condition, or stress. Potential methods include metabolomics, steroid profiling, IgA, and longitudinal hormone monitoring.

Topic 3: Zoo animal welfare. The Wildlife Endocrinology Lab works closely with Zoos Victoria to monitor the health and reproductive status of their animals. The exact project will depend on the current requests from Zoos Victoria. Examples of previous projects include: how zoo visitors affect animal well-being, characterising the reproductive endocrinology of mountain pygmy-possums to improve captive breeding success, and using detection dogs to identify oestrous in Tasmanian devils.

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A/Prof. Richard Peters
Bundoora

E-mail: richard.peters@latrobe.edu.au
Website: click here

Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **July**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Animal behaviour studies
- Animal or plant identification
- Field work
- Animal handling

Research in the Animal Behaviour Group covers broad interests in animal behaviour, with both theoretical and applied benefits. Current and planned projects cover the evolution of animal signals including vibratory, acoustic, and movement-based visual signals, the thermal ecology of lizards and the abundance and diversity of spiders on agricultural land. We undertake most of our research in the field and collaborate nationally and internationally.

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Plant & Soil Science

Dr. Ali Bajwa
AgriBio

Available for Industry placement

Field work

Plant Phenotyping

Seed germination bioassays

Bioinformatics

Gene expression analyses (incl. PCR, qPCR)

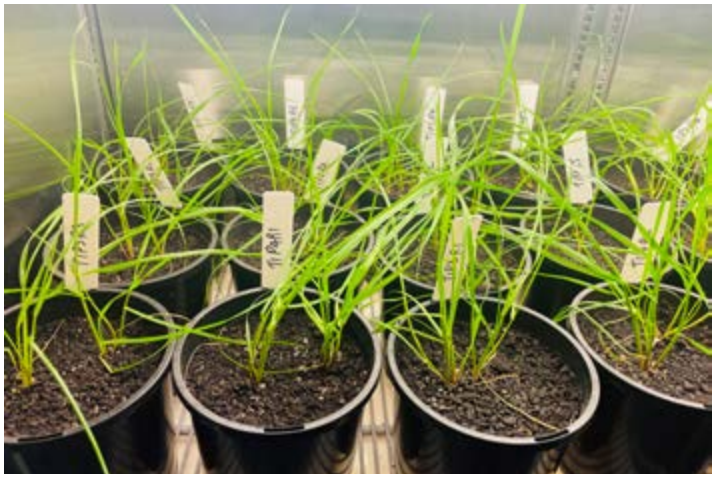
Metabolomics

E-mail: a.bajwa@latrobe.edu.au
Website: click here

Number of projects: **1 Feb, 2 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

We deal with the 'bad guys' of the plant world. Weeds and invasive plant species, often labelled as 'unwanted plants', have far-reaching impacts on food security and environmental protection. These noxious plants cost the Australian economy over $4 billion per annum through reduced food production and expensive weed control practices. Our research is focused on understanding weed biology and evolution to develop sustainable weed management strategies. You will be based in AgriBio Facility in Bundoora Campus with cutting-edge plant growth, Lab and analytical facilities, inter-disciplinary training, excellent work-environment, and mentoring. We have the following 3 projects available:

Project 1: Tackling the 'Weeds – Climate Change' Nexus (prefer Feb start). We are conducting cutting-edge, empirical research to understand weeds' adaptive mechanisms, especially phonological changes and their physiological and genetic bases in weed species exposed to different selection pressures. This project will focus on studying the impact of drought and/or heat stress on the adaptive biology of a couple of major problematic weed species (we have a plenty to choose from). You will have the opportunity to get involved in short field work for seed collection followed by controlled-condition, glasshouse experiments and Lab-based analyses.



Project 2 - What's turning the beauty into a beast? Studying the phenotypic and genetic diversity of weedy Gazania species. In this project, you would be working with arguably Australia's most beautiful weed, gazania. Two weedy species of genus Gazania (Gazania linearis and G. rigens), both introduced from South Africa as ornamental garden plants, have become widespread invasive weeds in southern and western Australia. They have significant negative ecological, environmental, agricultural and socio-economic impacts. you will undertake an assessment of phenotypic variation of these two species and genomic assessment of hybridisation between introduced G. linearis and G. rigens in Australia. You will learn and/or improve your skills in weed ecology and plant genetics/molecular biology as well as bioinformatics.

Project 3 - Breaking the Dormancy: Unravelling the physiological and molecular basis of seed dormancy of annual ryegrass (prefer July start). This project aims to better understand the seed biology of Australia's most troublesome cropping weed, annual ryegrass (Lolium rigidum). Working on this system will be enable them to conduct fundamental research on a contemporary, applied problem (best of both worlds). You will have the opportunity to learn and apply seed germination bioassays, seed microscopy, dormancy breaking techniques and molecular studies.

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A/Prof. Berin Boughton
AgriBio

Available for Industry placement

Mass Spectrometry Imaging

Bioinformatics

Proteomics & Metabolomics

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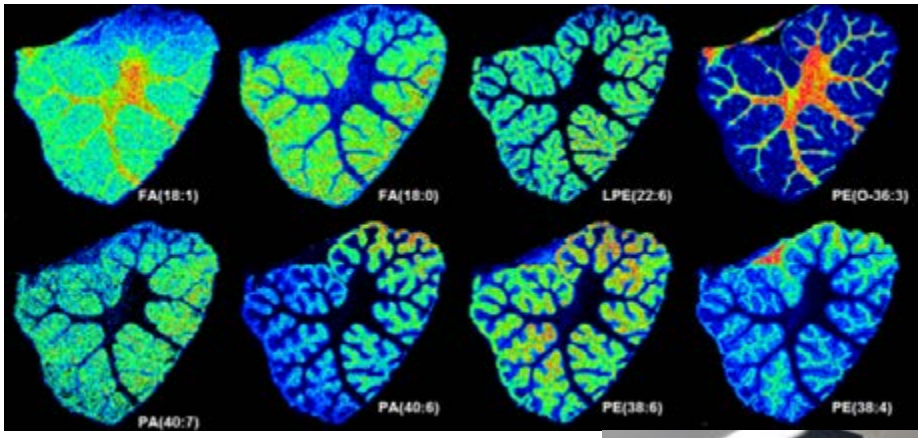
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Spatial mapping of biomolecules using Mass Spectrometry Imaging (MSI) is a powerful technique that can provide unique insights into their functional roles in higher organisms. Animals and plants are exquisitely compartmentalized into specific tissues and cells performing specialized processes. Understanding the spatial distribution and expression of biomolecules, including metabolites, proteins and glycans is fundamental to advancing our understanding in physiology, medicine and biology. Based in La Trobe Institute for Sustainable Agriculture and Food, my research dissects plant, animal and human biology using mass spectrometry.



Project 1. Endometriosis - Linking biomolecules to endometriotic lesions using MSI. Endometriosis is a common disease defined by the presence of benign lesions of endometrial-like tissue outside of the uterus. Endometriosis affects more than 11% of women in Australia, with a range of symptoms that include chronic pelvic pain, dysmenorrhea and infertility. The economic and social impacts are wide. The current gold standard for diagnosis is expensive and invasive laparoscopic surgery, which contributes to lengthy delays in diagnosis. The aetiology of endometriosis remains poorly understood but patients, clinicians and researchers all agree that new non-surgical therapies are urgently needed to reduce the severity of symptoms. Identification of non-invasive endometriosis biomarker/s – a measurable factor correlating with disease presence or activity – has therefore become a priority, although no biomarker has been validated. Little is known about the localised metabolomic and proteomic microenvironment associated with lesions. We believe that profiling and identification of metabolites and proteins directly associated with lesions and peritoneal fluid will provide important information on endometriosis biology, allowing us to identify potential biomarkers.

Project 2. Exploring spatial responses to stress by developing new MSI techniques. Spatial and temporal complexity are at the forefront of challenges to our understanding of eukaryotic metabolism under both normal and pathological conditions. Higher organisms, segregate metabolism between organs, tissues, cells, and subcellular organelles, operating over circadian and developmental time regimes, continuously adjusting to environmental perturbations. Understanding the flux of proteins and metabolites through metabolic pathways in vivo is essential to understand key aspects of biology. Changes in metabolism occur before observable changes in phenotype. Consequently, identification of early subtle changes is often needed to unveil root molecular mechanisms. Currently, few approaches enable systems wide spatial profiling of biomolecule turnover in vivo, localizing specific biomolecules within tissues and cells. In this project, we will develop cutting-edge stable isotope and bioorthogonal labelling strategies to measure localized biomolecule turnover in vitro and in vivo.

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Prof. Roman Buckow
LIMS2

Available for Industry placement

- Microscopy - Confocal, Electron & Light
- Protein biochemistry (SDS-PAGE, western blotting)
- Biophysical characterisation of proteins
- Protein purification & analyses of reaction rates
- Isothermal calorimetry
- Extraction of organic materials

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Number of projects: **4**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Our state-of-the-art Food Science Centre is dedicated to advancing the science of food, nutrition, and safety with a focus on sustainability and health. Equipped with advanced analytical instruments, we explore the science behind sustainable ingredients (e.g., plant proteins) in designing innovative and delicious food products. We also prioritise research in gut health, aiming to understand how food components modulate and interact with the microbiome to enhance well-being.

Project 1. Extraction and characterisation of oil bodies from oilseeds. Dive into the world of oil seeds and explore their hidden potential. This exciting project involves extracting oil bodies using innovative and sustainable methods. These oil bodies are rich in essential fatty acids, proteins, and bioactive compounds. You will learn and apply various extraction techniques, microscopy, spectroscopy, and chromatography to characterise their composition and stability.

Project 2. Camelina protein structure, and functionality. This project aims to extract and characterise proteins from camelina sativa seeds or seed cake, a by-product of the camelina oil extraction industry. You will explore the structural characteristics and functional properties of camelina proteins. Gain hands-on experience in protein extraction, functionality testing, rheological characterisation, and advanced spectroscopy techniques. This project offers a unique opportunity to optimise camelina proteins for innovative and healthy food applications.

Project 3. Investigating the structure/function relationship of gels prepared from chickpea. Plant proteins have in the last few years become a focus point in the food industry. Alternative milks and alternative meat products are available in retail outlets, however their acceptance by consumers has been challenging for a range of reasons. You will investigate the structural features of chickpea powders extracted from cultivars shown to exhibit differing gelation properties and examine the association between microstructure and textural properties. You will gain hands on experience in the processing of chickpea powders, gelation dynamics, confocal microscopy and rheological characterisation.

Project 4. Rapid functionality testing of plant proteins. Making plant-based milk, cheese and meat involves the heating and processing of plant proteins, often under pressure. This project is to develop a rapid functionality testing method for a range of different plant protein ingredients to benchmark them against established methods. You will develop skills in the rheological analysis of protein-based food materials, characterising their viscoelastic behaviour as a function of shear, temperature and pressure.

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Dr. Marisa Collins
AgriBio

Available for Industry placement

Field work

Crop physiology

Glasshouse work

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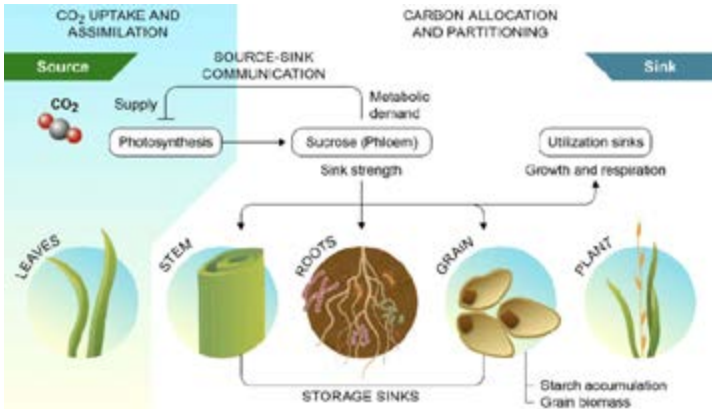
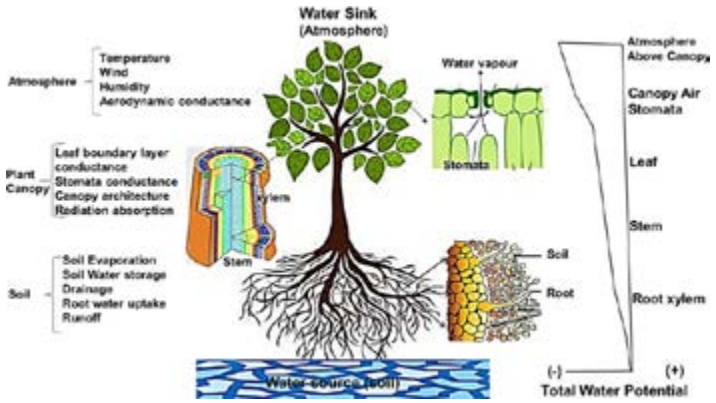
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**





Our research aims to improve crop productivity under challenging conditions by examining drivers of yield and sensitivity of crop species to abiotic stressors such as high temperatures and drought.

Research theme 1. Climate change. In legume crops (also known as pulses such as chickpea, lentils, mungbean and fababean) we investigate and develop understanding of the tolerance sensitivity to high temperatures, drought and interactions between heat/and drought that are likely to impact production under future climate conditions. This research allows identification of useful traits for increasing stress tolerance and yield stability in new varieties and particularly legume crops which generally perform poorly under stress. Understanding crop physiology, or the way crops interact with environment also enables us to build crop models that can directly examine the predicted impacts and risks associated with climate change on future crop production in Australia.

Project title 1. Does foliar potassium (K) improve yield and drought tolerance of major legume crops in Australia?

Project title 2. Can we improve yield in legume crops through better understanding of factors affecting flowering and pod-set?

Research theme 2. Improving global food systems. Global food systems will need to almost double their yield to feed the projected global population in 2050. To meet this challenge, we need to substantially increase production and consumption of healthy and sustainable alternative proteins, such as those from legume crops. Legumes have the potential to deliver food ingredients which support a healthy balanced diet and contribute to a reduced demand on foods from animal origins. In Australia, legume seed yield improvement has traditionally focussed on disease resistance and herbicide tolerance rather than nutritional traits such as protein content. Protein abundance and composition is known to differ between species and is variably impacted by stress conditions. What determines the flux of metabolism between protein, carbohydrates (starch and dietary fibre) and other nutrients in legume grains and how this is influenced by growing environments is mostly uncharacterised. The project will select germplasm to begin preliminary assessment of these traits in legume crops as a pathway towards attempting to address some of these knowledge gaps

Project 1. To assess the suitability of existing legume germplasm for development of plant-based protein production in Australia. This will focus on preliminary investigation into the impact of environmental conditions on protein and carbohydrate dynamics in legume seed.

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A/Prof. Monika Doblin
AgriBio

Available for Industry placement

Microscopy - Light, fluorescence & electron

Proteomics

Gene expression analyses (incl. PCR, qPCR)

Protein biochemistry (SDS-PAGE, western blotting)

Bioinformatics

Molecular cloning and CRISPR-Cas9 gene editing

Plant tissue culture

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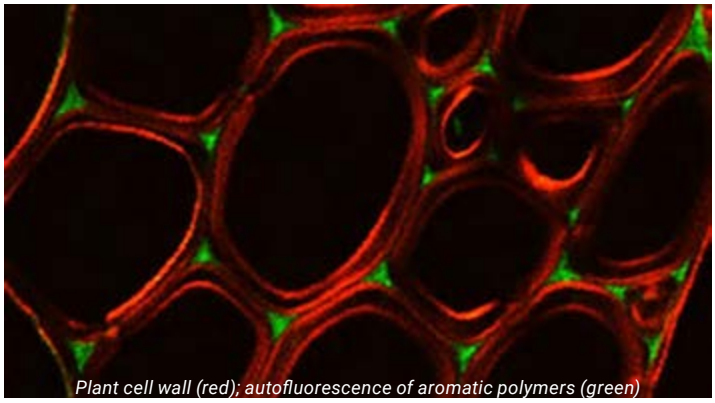
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

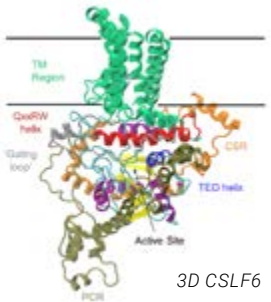
The Plant Cell Walls and Bioactive Secondary Metabolite Group aims to understand how biopolymers are made and regulated. Biopolymers and secondary metabolites include some of the most abundant and renewable carbon-based molecules on Earth and have a range of applications for biomaterials, food and medicines. By understanding how biopolymer abundance is controlled, we can ultimately breed plants with optimal levels for specific end uses. Our group is also part of the Protected Cropping Hub that aims to improve production of plant-derived horticultural and medicinal products, including cannabinoids, terpenes and other plant secondary metabolites.

Most plant biomass consists of a carbohydrate-rich matrix present in cell walls. Cell walls, a major carbon sink, are our most renewable bio-resource and determine the quality and quantity of most plant-based products (food, fibre and fuel). Primary cell wall components are a key source of soluble dietary fibre (critical for human health). Secondary cell walls are the major constituents of insoluble fibre for textiles, pulp and paper manufacture and timber products and increasingly for fuel and biocomposite construction. Understanding how plant cell walls are made, what they are composed of, and what determines their mechanical properties gives us the capacity to make 'designer walls' using plant biotechnology tools such as genetic transformation and gene editing.



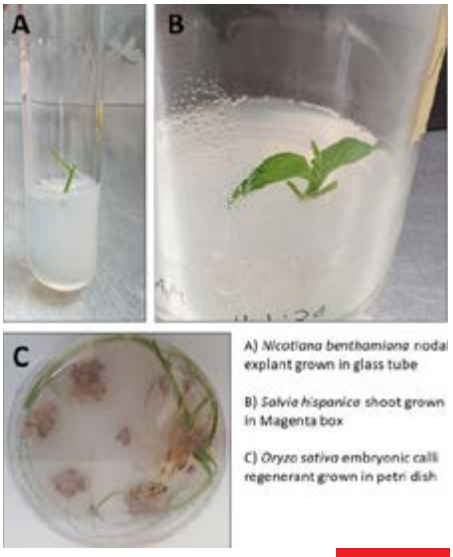
Plant cell wall (red); autofluorescence of aromatic polymers (green)

Project 1: Dietary Fibre for Human Health. Mixed linkage glucan (MLG) is a soluble dietary fibre found in cereals. Chain structure strongly influences its solubility, with MLG in oat and barley being much more soluble than in wheat. Our research aims to understand how the biosynthesis, assembly and turnover of MLG is regulated. This project will focus on characterising the major catalytic subunit of MLG synthase, Cellulose synthase like F6, using a combination of genetics, molecular biology, biochemistry and cell biology techniques.



3D CSLF6

Project 2: Biotechnology Using Plant Tissue Culture. Some plant species containing valuable biomolecules can be maintained in vitro as aseptic cultures. Plant tissue culture is a means to conserve elite germplasm and an enabling technology for improving genetic potential via gene editing and/or transformation, including for synthetic biology purposes. This project will explore the use of tissue culture and genetic transformation techniques to enhance the production of important biomolecules e.g. macro/micronutrients, specialised metabolites, proteins or glycans, biomass utilisation for food, fibre or fuel purposes and/or enhancing climate change resilience amongst established and future crops.



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Prof. Tony Gendall
AgriBio

Available for Industry placement

- Plant biotechnology
- Genetic sequencing & expression analyses
- Chromosomal/nucleotide extraction assays
- Microscopy - Light, fluorescence & electron
- Bioinformatics
- Proteomics

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Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My lab uses a wide range of tools, including genetics, molecular biology, and bioinformatics to investigate several aspects of plant biology, physiology and development. We use a range of techniques, including gene cloning, T-DNA mutants and CRISPR gene editing, transgenics, sequencing and bioinformatics in both model and non-model species.

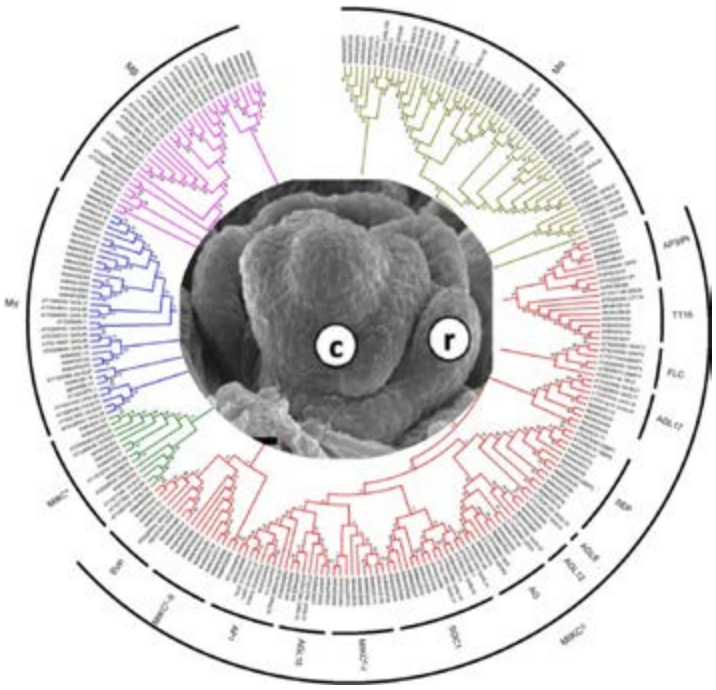
As part of the ARC Research Hub for Medicinal Agriculture, and the new ARC Research Hub for Protected Cropping, we have a bioinformatics-based project to investigate the regulation of flowering time in Cannabis, using an extensive dataset from an RNAseq time course during floral initiation.

As part of the ARC Sustainable Crop Protection Hub we are developing a novel double-stranded RNA (dsRNA) approach to control grey mould (Botrytis cinerea) disease in Strawberry using BioClayTM, and have a range of possible projects in this area, including with Dr Donovan Garcia Ceron a project to investigate the role of fungal extracellular vesicle (EVs) in plant pathogenesis, and a separate project to investigate the biology of mycoviruses – the viruses infecting fungi and their role in pathogenicity.

We also have an interest in the proteins that fuel seed germination (seed storage proteins) and have a project to investigate the function of genes in the model legume Lotus japonicus using natural transposon mutants.

With colleagues at Plant Innovation Center at the DAFF Post-Entry Quarantine facility, we have an applied project investigating the use of microneedles for the rapid detection of plant viruses.

Strawberry disease assays



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Dr. Kim Johnson
AgriBio

Available for Industry placement

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Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Plant phenotyping
- Gene expression analyses
- PCR assays
- Microscopy (light & electron)

The research aims of our group is to understand how plants alter their growth and development in response to stress. Stress can be experienced from developmental processes, such as cell growth or from the external environment. These stresses initiate responses to adapt the carbohydrate-rich cell wall that surrounds each cell and plays an incredibly important role regulating plant shape, strength and provides protection to the plant. Walls are our most renewable bio-resource and they determine the quality and quantity of most plant-based products used in modern human societies such as food, fibre, fuel and biomaterials. The expected outcome of projects in our group is the ability to modulate wall composition and plant growth to improve Australian crops.

Project 1: Investigating native grain tolerance of compacted soil for regeneration projects. Australian native grass species, such as kangaroo grass and native millet, are adapted to Australia's variable climate and reported to tolerate low nutrient, acid soils and water stress. What remains unclear is how native grasses cope in compacted soils. Soil compaction is a major issue in Australia and along with a range of other soil constraints, reduces rooting depth of plants and their ability to access water and nutrients. Many agricultural and cleared landscapes have compacted soils making regeneration projects challenging. This project attempts to address this gap in knowledge by investigating a panel of native grasses in two main Australian soil types that experience compaction.

Project 2: Developing sex determination tests for Cannabis. Cannabis is a diverse, multi-use crop for fibre, food and medicines. Cannabis is dioecious, meaning male and females are on separate plants. Female plants are used for medicinal purposes as the flowers produce more cannabinoids than males. Male plants are excluded from production systems, however, stress can cause conversion of females to males. A reliable and fast test to identify females and males that can be used in-field is desired. This project will use a LAMP PCR based approach, a rapid robust and inexpensive diagnostic test to determine the sex of individual plants using a small amount of leaf material.

Project 3: Field-based disease detection assays for crops. Stripe rust is one of the most devastating diseases of wheat globally, and can lead to 50% crop loss in susceptible cultivars. Wet conditions experienced during recent growing season has resulted in high incidences of stripe rust across the Victorian wheat belt. This project aims to develop disease detection assays for stripe rust (P. striiformis f.sp. tritici.) and leaf rust (P. triticina) using a rapid isothermal PCR based method that can be used as an early warning system for farmers.

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Prof. Mathew Lewsey
AgriBio

Available for Industry placement

Gene expression analyses

PCR assays

Plant development analysis

Light microscopy

Bioinformatics

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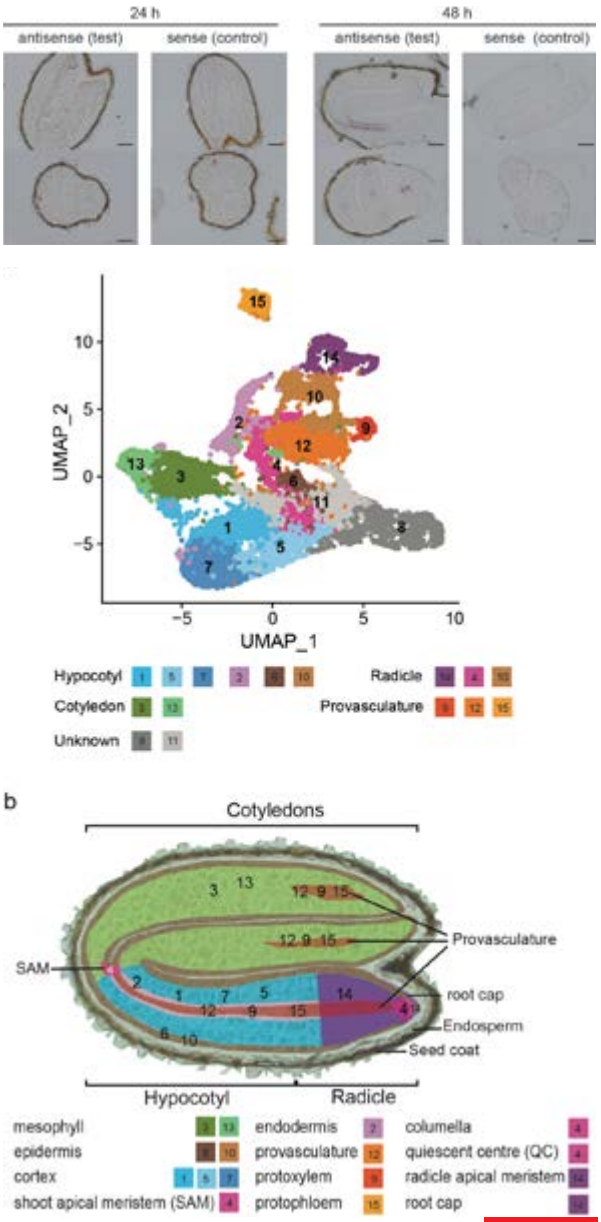
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My lab studies how plants perceive the world around them and interact with their environments by regulation of their genomes. We apply this work with commercial partners who grow a range of agricultural crops including cannabis, opium poppies, barley, oats and peas. In a project co-supervised with senior postdoc Lim Chee Liew, you can study how gene expression contributes to the control of seed germination.

Seeds provide 70% of global food resources, being the most valuable output from plant production. They also play a critical role in agriculture because germination is the first step during a plant's lifecycle which involves extensive changes in gene expression. It is governed by nutrient resources, endogenous hormone levels and environmental stimuli, and these requirements vary between plant species. Despite the importance of germination, crucial information is missing in our current understanding of gene expression profiles during seed germination.

Changes of gene expression are regulated by transcription factors. Transcription factors are proteins that control gene expression by binding to the promoter regions of genes. This project aims to study transcription factors involved in seed germination by using T-DNA mutant lines of Arabidopsis thaliana, the model plant species for research in plant biology. First, we aim to obtain homozygous T-DNA lines by genotyping which involve basic molecular techniques including DNA extraction, polymerase chain reaction (PCR), and gel electrophoresis. After we obtain homozygous T-DNA line, we will comfirm the gene knockout by examining the gene expression of the target gene. This will require RNA extract, cDNA synthesis, and qRT-PCR. Then, we can use the T-DNA knockout mutants to study the effect of mutation of transcription factors on seed germination by phenotyping. Several traits will be measured to evaluate seed germination such as germination rate, hypocotyl length, and cotyledon expansion.

By understanding the fundamental genome regulation network during seed germination, we can develop practical solution to ensure germination happen at the right time uniformly. Uniform germination enables growers to achieve optimal plant-spacing and harvesting time and germination at correct time increase the likelihood of successful plant growth.



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Dr. Dugald Reid
AgriBio

Available for Industry placement

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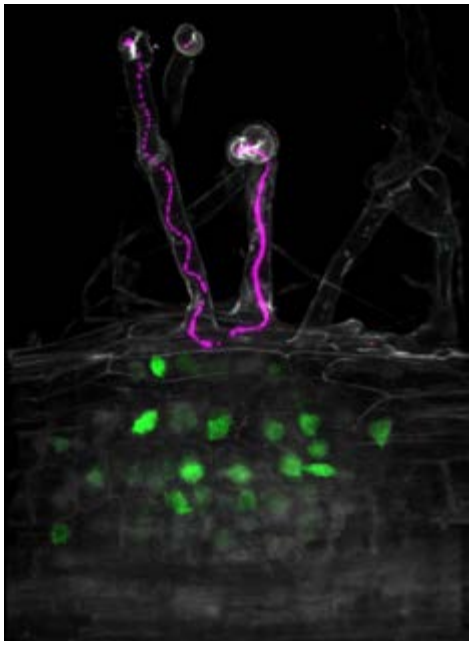
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Bioinformatics
- Plant phenotyping
- CRISPR-Cas9 gene editing of cells
- Gene expression analyses
- Molecular cloning



Legumes provide a sustainable means of producing high value protein for human diets and animal feed. These characteristics of legumes arise due to their ability to engage in a symbiotic relationship with soil bacteria that provide nitrogen to support plant growth. This nitrogen-fixation occurs in specific organs that form on legume roots known as nodules. Despite this beneficial relationship, legumes have not realised their full potential in our predominantly cereal-based cropping systems. One of the major reasons that legumes fail to compete with cereal crops is their relatively poorer tolerance of environmental stresses. We use genetics, gene expression analysis and plant developmental studies to identify mechanisms of legume adaptation and resilience to the environment. These approaches aim to identify genes that can be manipulated to improve legume performance, ultimately increasing the productivity and profitability of legume agriculture.

Project 1. Tuning N-fixation to the environment. We have identified a master regulator of nitrogen fixation that controls the senescence (controlled breakdown) of legume nodules. This project aims to generate genetic variation in this key gene guided by our understanding of the protein structure and function. Novel genetic variants will be tested for their ability to enhance the tolerance of legume nodules to applied stresses.

Project 2. Root system responses to water stress. This project will investigate the variation in root system responses to water stress within a natural population of the model legume Lotus japonicus. This variation can be used to identify the genes underlying phenotypic variation using genome-wide association mapping. These genes will be further investigated to understand how they contribute to improving the resilience of legume root systems.

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A/Prof. Penelope Smith
AgriBio

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Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Plant transformation
- Molecular cloning (e.g. expression vectors)
- Gene expression analyses
- Bioinformatics
- Cell culture - eukaryotes, incl. primary and cell lines

With the world's population increasing we need to produce more food sustainably, without contributing to global warming and other environmental problems. Agriculture relies on nitrogen fertilizers that are chemically synthesized and production requires lots of energy which is expensive and contributes to carbon emissions and global warming. When applied in excess these fertilizers can also pollute waterways. An alternative to use of N fertilizers is to harness biological nitrogen fixation (BNF) involving microbes that can fix nitrogen from the atmosphere. Legume crops can form a symbiosis with rhizobia bacteria which fix N and provide it to the plant reducing its requirement for N fertilizer. Some of the fixed N is also left in the soil reducing the need for fertilizers in subsequent non-legume crops. As part of the symbiosis a new organ called a nodule develops on roots to house the rhizobia and the rhizobia are enclosed in a membrane in infected cells in these nodule.

Project 1. Characterizing transporters and regulatory proteins essential for N fixation. In exchange for fixed N the plant provides a range of nutrients to the rhizobia. My group is investigating the transport of nutrients to rhizobia and its regulation. This project will use new single cell transcriptomic data to identify transporters or regulatory proteins in infected nodule cells. They will then be characterised using knockouts in transgenic root systems, real-time PCR and expression in yeast.

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Prof. Caixian Tang
AgriBio

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Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

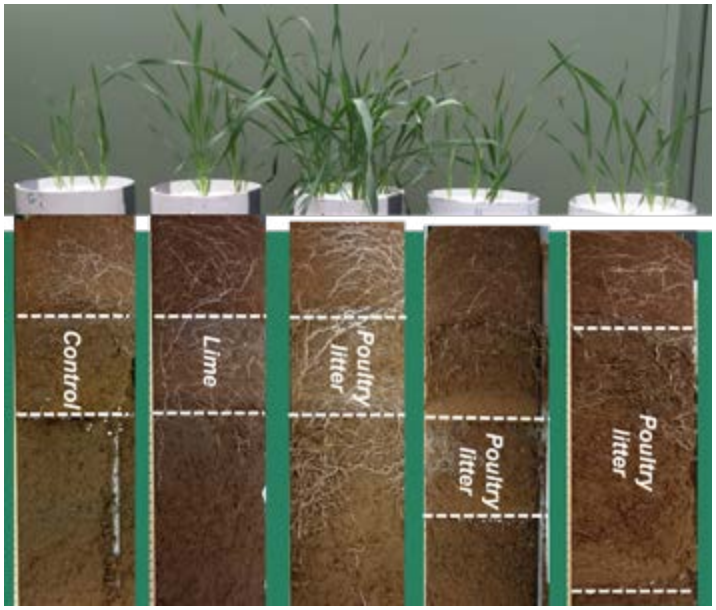
- Soil management
- Analytical skills
- Industry experience
- Glasshouse trials

Soils contribute $63b annually to Australian economy through agricultural production. Soil degradation is widespread and limits sustainable food production under current climate change. Our interdisciplinary research focuses on management of soil constraints, contamination and nutrients, and impacts of climate change and farming practices on soil processes and carbon sequestration.

Project 1. Increasing levels of atmospheric CO2 associated with global warming, stimulates the growth of many plant species. However, it is unknown how high CO2 levels affects soil health and crop nutrient demands. This research aims to understand how elevated CO2 affects carbon, nitrogen and phosphorus dynamics in major soils. It elucidates the interconnection between soil organic matter decomposition and nitrogen and phosphorus availability, and understand the microbiological contribution to carbon, nitrogen and phosphorus cycling under elevated CO2.

Projects 2. Comparing the effectiveness of new fertilizer types: associated with industry Incitec Pivot Fertilizers. The project compares the performance and efficiency of fertiliser products (slow released, controlled released coated fertilisers), examines the effects of microbiological stimulants on their effectiveness, and understand how the fertiliser products affect soil properties and crop nutrient uptake. Controlled-environment studies will be conducted. Plant growth, physiological responses, plant nutrient concentration, soil properties, and fertilizer-use efficiency will be determined.

Project 3. Phosphorus fertilizers are important in sustaining crop yields. Each year, Australian farmers use ~450,000 tonnes of P fertilizers. Only 10-30% is absorbed by crops, leaving unused P remaining in the soil. The project studies the impacts of crop species, soil type and farming practice on biochemistry at the soil-plant interface (rhizosphere) to understand how to enhance crop P-use efficiency and to reduce P-fertiliser use.



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ARC Center of Excellence - Plants for Space (AgriBio)

Available for Industry placement

PLANTS FOR SPACE
ARC CENTRE OF EXCELLENCE

- Bioinformatics
- Metabolomics
- Gene expression analyses incl. sequencing
- Biophysical characterisation of materials
- PCR assays
- Light microscopy
- Molecular cloning (e.g. expression vectors)

E-mail: plants for space emails
Website: click here

Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Long-term off-Earth habitation is on the horizon. By 2028, an established presence on the Moon will be a precursor to crewed Mars missions but key challenges for mission planners still exist, such as:

- Providing a nutritious, varied food supply to sustain physical and mental well-being for humans during long-term Space habitation – the current mass and volume restrictions for food inhibit mission feasibility, and resupply is not a current option.
- The technology to provide robust, reconfigurable and on-demand generation of resources such as pharmaceuticals and construction materials.

In many respects, Space habitation amplifies the multi-faceted sustainability challenges we face in food and biomaterial production on Earth.

The ARC Centre of Excellence in Plants for Space is an Australia-wide research collaboration. La Trobe hosts a substantial research and outreach node through the labs of Professor Mathew G. Lewsey and Dr Kim Johnson. Plants for Space will develop new plant efficiency solutions for challenging Earth and Space environments, e.g., low-water, high-saline agriculture, and low-input productivity options for food processing, storage, and distribution.

Project 1. Investigating plant sensing and signalling pathways in Space environments. Crewed missions to the Moon and Mars are planned within the next twenty years. Long-term Space exploration and habitation will require the growth of plants for food as re-supply from Earth will not be possible. Technological advances and greater understanding of how plants grow in Space environments are required. Plants sense physical changes in the environment and at the cellular level using mechanosensors located at the cell wall-plasma membrane-cytoplasm interface. Using simulated Space environments this project aims to understand the effect of gravity and mechanosensing on basic cellular processes in plants.

Project 2. Duckweed in Space - developing programmable biofactories. Astronauts will need to porduce many different resources where they are, because they will not survive the long journey to Mars. Plant synthetic biology offers a solution, where we reprogram plants to act as biological factories. We have selected duckweed, a very fast growing aquatic plant, as the basis for our Space factories. In this project you will explore the best duckweeds to use, how they can be grown fastest, and what new bioproducts they can make.

Project 3. Conditioning strawberries for growing in space. Strawberries are a desirable crop for growing on and off earth due to the taste and flavour of the fruit and vegetative propagation to maintain plants without a seed stage. Plant propagation is done through runners and commercial production produces 100 M runners a year worth $40 M. Optimising runner production in soil-less substrates, such as hydroponics or aeroponics and conditioning plants for optimal production through understanding of temperature and light requirements is desired for growth on earth and in Space. This project will compare growth of strawberries in soil-based and soil-less systems and aims to identify temperature and light conditions for optimal productivity in different cultivars.

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Ecology & Evolutionary Biology

Prof. Nick Bond
Albury-Wodonga

Available for Industry placement

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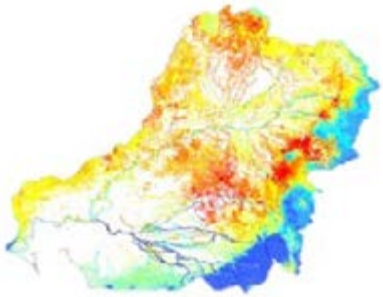
Website: click here

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Field work
- Ecological assays
- Animal handling
- Animal behaviour studies
- Ecological modelling (GIS)

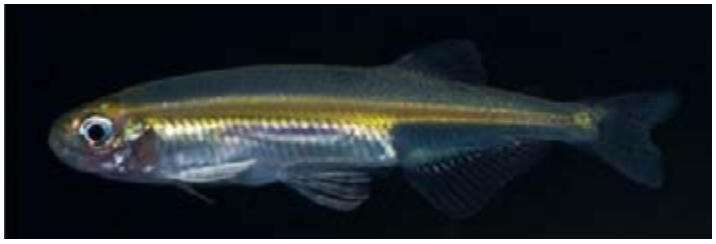
My research focusses on understanding the influence of biotic and abiotic drivers on the structure and function of aquatic ecosystems. A major focus for this work is understanding the effects of climate and hydrologic variability on population dynamics and on ecosystem processes, including ecosystem productivity and food web dynamics. My research combines both field and desktop analysis, including the use of GIS and spatial datasets to explore hypotheses at large spatial scales. I am also particularly interested in applying research to help tackle important water and catchment management issues.

Project 1. The effects of climate-variability and change on species distributions. Australia is the driest inhabited continent and experiences extreme patterns of interannual climate variability and frequent drought. Water stress, particularly during drought, is a major driver of species distributions in aquatic ecosystems, and climate change will strengthen this effect. Projects in this area involve using a range of field and modelling approaches to relate species occurrence patterns to the effects of climate, hydrology, fire and other physiographic variables, and then used these models to predict potential future shifts in species range, abundance and occupancy of particular habitats. These predictions are also being combined with conservation planning models to prioritise areas for protection and targeted management interventions.



Project 2. Ecohydrology of intermittent stream networks. In many regions of the world up to 80% of the river network undergoes regular drying. During these dry periods surface water habitats can contract to isolated waterholes dotted along the river channel, which become critical refuges for aquatic biota. Project opportunities exist to study processes occurring within individual waterholes, such as the water quality and food-web structure, through to the role of catchment hydrology in determining waterhole persistence across entire riverscapes, and the way in which this influences metapopulation structure and dynamics.

Project 3. Quantifying productivity and fish growth rates across different habitats. Many fish species have a short critical period after hatching when sufficient food must be available to allow survival. This project will investigate zooplankton production and associated fish growth across a range of floodplain habitat types, including river channels, perennial wetlands and intermittent wetlands.



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Dr. Charles Feigin
Bundoora

Available for Industry placement

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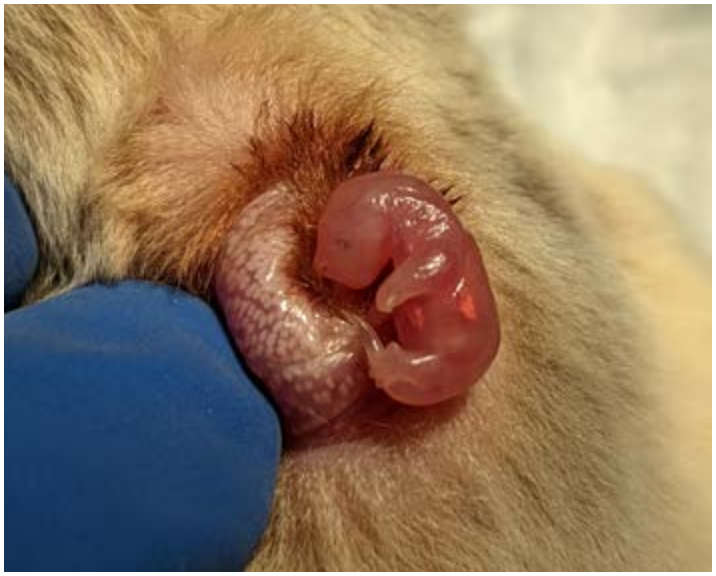
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Whole organism bioimaging
- Cell culture - eukaryotes, incl. primary and cell lines
- Animal handling
- Molecular cloning (e.g. expression vectors)
- Nucleotide extraction & genomics

My lab aims to clarify the role of molecular and developmental mechanisms in shaping trait diversity. DNA encodes the information that underpins the 'endless forms' of biodiversity on our planet. In animals, the critical stages of embryonic and juvenile development are where much of these genetic instructions are realized, leading to the formation of adaptive traits. However, genes do not function in isolation. The effects of genetic variation are heavily influenced by the dynamic molecular interactions in which they are involved. To fully explain animal diversity, modern evolutionary theory must incorporate the mechanisms that link genotypic changes to their phenotypic outcomes during development.



In the Developmental Evolution Group, we harness the remarkable diversity of non-traditional model species to explore how the structure of developmental programs shapes patterns and biases in trait variation across the tree of life. Our research delves into the formation of adaptive traits using a variety of techniques, including functional genomics, imaging, and in vitro and in vivo manipulations. We place our findings within an evolutionary context through comparative studies at the genomic, developmental and phenotypic levels. To support this work, we train new lab members to be proficient in both wet lab techniques and basic computational skills.

Current research in our lab includes:

- The genomic and developmental basis of skin traits
- Evolutionary drivers of morphological stasis in 'living fossils'
- Control of diapause, DNA repair, and embryonic survival

Students have the opportunity to work on projects involving marsupial or arthropod models, with options for both wet lab and/or computational approaches. In 2025 we are especially keen to attract students interested in comparative development and genomics. Our lab also collaborates with the Melbourne-based Thylacine Integrated Genetic Restoration Research (TIGRR) Lab, with co-supervision opportunities available for projects related to conservation genetics and biotechnology in marsupials.

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Prof. Heloise Gibb
Bundoora

Available for Industry placement

Field work

Ecological assays

Bioinformatics

Animal or plant identification

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Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The insect ecology laboratory investigates community ecology and conservation of terrestrial invertebrates, currently focussing on ants and litter dwelling invertebrates. Insect biodiversity decline has been recognised as an environmental crisis. In Australia, only one third of terrestrial invertebrates are described, making it difficult to target conservation efforts. Narrow-range endemic species are less likely to be described, yet are at higher risk of extinction due to anthropogenic causes. Honours and placement positions focus on the study of endemism and post-fire restoration of invertebrates in forested landscapes in SE Australia. Projects in the use of artificial intelligence to recognise terrestrial invertebrates will also be available.

Project 1. Litter transplants for post-fire restoration of litter invertebrates. This project will resample sites burnt during the 2019-2020 mega-fires to determine the recovery of litter fauna. Many litter invertebrates are dispersal-limited and may struggle to recolonise following fires, so the student will trial restoration methods to maximise the efficacy of leaf litter transplants in restoring invertebrate assemblages following high severity fire.

Project 2. Phylogeography and population genetics in cryptic leaf litter species. This project will undertake genetic studies of leaf litter invertebrates to better understand species delimitation in rainforests and to determine the historic and present-day environmental factors that permit or prevent dispersal and connectivity.

Project 3. Image recognition of insects for biodiversity surveys. This project investigates the viability of using 3D imaging of insects to enable automated image recognition surveys of invertebrate biodiversity.

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Dr. Shannon Hedtke
Bundoora

Genetic sequencing

Bioinformatics & computer modelling (incl. AI)

PCR assays

Light microscopy

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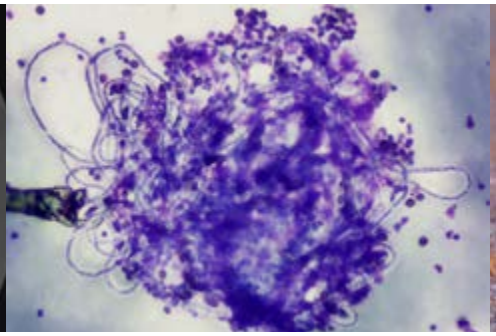
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**



Recent news on brain worms from snakes, zombie fungus in ants, and the Varroa mites in honeybees makes it clear that how people interact with the environment has a big impact on the risk of disease for people and other animals. Our lab uses genomics, bioinformatics, and modelling to study how features in the environment impact the risk of parasite diseases.

Increased risks of infections with parasites come from potential host switches from wild to domestic animals or people, from the introduction of disease from one area to another when hosts migrate, and from the evolution of parasite resistance to the drugs used for treatment. We use genomics to ask how features of the environment impact the distribution of insects that transmit diseases and how management decisions affect a parasite species' genetic diversity. Our vision is to provide tools to aid in the elimination of parasite diseases that are a public health threat, and to provide training for domestic and international students and for workers in endemic countries to support the global use and development of these tools.

Project 1: Working towards elimination of a mosquito-borne disease in the South Pacific. Parasite diseases are treatable and preventable, but persistent parasite infection continues in many areas in the world. Elimination of these diseases is possible only if reasons for continuing infection are identified. Lymphatic filariasis (LF), or elephantiasis, is a neglected tropical disease caused by parasites that are transmitted by mosquitoes. Chronic complications of LF are the leading cause of long-term physical disability worldwide. LF remains a public health scourge in the Pacific, persisting in Australia's near neighbours Papua New Guinea, Fiji, and Samoa. This project would involve sequencing and comparing parasites collected from mosquitoes to those collected from people living in the same area to figure out whether parasites are moving across the islands of Samoa.

Project 2: Genomics of blackflies in Africa. At least 10-20% of blackflies are pest species for people and animals—blackfly biting rates in one area in Cameroon was estimated at 87,000 per person. Many blackflies transmit nematode parasites such as those that cause the disease river blindness. There are many cryptic blackfly species that vary in their biting preferences (humans vs other animals) and in their ability to transmit parasites. This project would involve sequencing blackflies and comparing their genomes to explore how the distribution of blackflies are impacted by the environment.

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Dr. Susan Hoebee Bundoora

Available for Industry placement

Field work

Pollinator & breeding systems

Ecological assays

Bioinformatics

Light microscopy

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Number of projects: **3**
Full-time or part-time: **Full-time**
Feb or July start: **Either**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The research in my group combines studies of plant reproduction, together with genetic/genomic studies. Our focus is typically related to issues of native species conservation or weed biology. We work in the field and the lab to explore issues including pollen viability, floral visitors and their effectiveness for seed set, as well as population connectivity and species delineation using sequencing and bioinformatics.

I have two honours projects on offer that explore genomics and/or post-fire recruitment in either the Ben Major Grevillea or the Mt Cole Grevillea, both listed as critically endangered species. These projects can be somewhat modified to suit student preferences.

Additionally, and in collaboration with colleagues from APSS, we are seeking honours students in the area of plant breeding, pollination and flower development in horticultural and native plants (see the profile of Assoc Prof Tony Gendall); as well as an honours student to study the phenotypic and genetic diversity of weedy Gazania species (see the profile of Dr Ali Bajwa).

I welcome enquiries from students with interests in these areas and encourage you to meet and speak with current students in my lab.

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Dr. Aleicia Holland
Albury-Wodonga

Available for Industry placement

Field work

Ecotoxicology

Animal handling

Ecological assays

Animal or plant identification

E-mail: a.holland2@latrobe.edu.au
Website: click here

Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Aquatic ecosystems: freshwater and marine are at increasing risk from climate change and anthropogenic pressures. Our research investigates the effects of abiotic factors on aquatic systems, communities and biota using a range of field and laboratory techniques. Our field sites span tropical, temperate, marine and alpine environments including streams, rivers, lakes and wetlands, where we explore interactions of aquatic biota with their environment such as the influence of dissolved organic matter (DOM) on aquatic communities and food webs, fish/microbe interactions, and direct effects of contaminants and environmental stressors on ecosystem function and biota.

We also use controlled laboratory experiments to understand chemical processes, interactions of biota with their chemical environment, and the bioavailability and toxicity of contaminants.

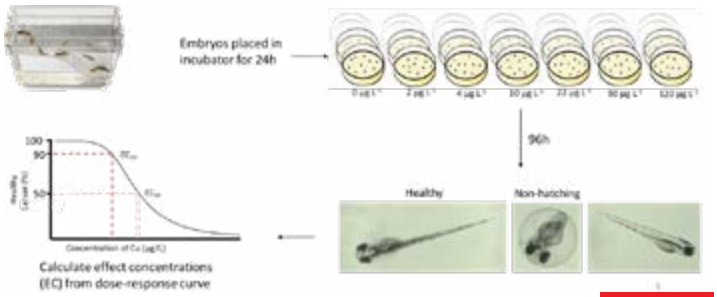
I currently have interest in recruiting students for the following topics:

Project 1. Microbiomes of Flathead and Fiddler ray and response to contaminants in Port Phillip Bay.

Project 2. Effect of fire on alpine peatland streams.

Project 3. Mechanisms behind toxicity of metals to aquatic biota

Project 4. Biota of naturally acidic streams



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Dr. Vanessa Kellerman
Bundoora

Available for Industry placement

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Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Field work
- Ecological assays
- Animal handling
- Drosophila melongaster models
- PCR assays

My research aims to understand how abiotic and biotic factors shape the distribution of insect species and, in doing so, make predictions about how species will respond to climate change. Because insects are ectothermic and do not regulate their body temperature, a species' capacity to tolerate hot/dry/cold environments often dictates where they live. I am interested in studying the evolution of these traits (heat/desiccation/cold tolerance) and the extent to which these traits can shift via genetics and plasticity. To answer these questions, I work on two systems I work on two systems: the highly tractable (lab-based) Drosophila system and (field-based) native bees.

Project 1. Exploring trade-offs between cold tolerance and phenotypic plasticity in Drosophila. Phenotypic plasticity is the capacity for individuals to modify their phenotypes in response to the environment. Understanding species' capacity to respond to plasticity is important, given that plasticity is expected to shape how species respond to climate change. Theory predicts that the capacity to respond via phenotypic plasticity stress/tolerance traits trades off with innate resistance. That is, you can't be highly tolerant to stress (cold) and highly plastic. In this project, you will examine whether phenotypic plasticity in cold resistance varies across species adapted to different environments and whether high cold tolerance trades off with plasticity.

Project 2. How does temperature shape competitive outcomes in Drosophila. Temperature is often considered the most important variable shaping the distribution of insect species. But species rarely live in isolation, and competition between other species can influence species' capacity to adapt to different environments. In this project, you will examine how competition between Drosophila species affects fitness traits (fecundity/viability) across a range of temperatures to determine how competition and temperature interact to shape Drosophila distributions.

Project 3. Flying thermal limits and endothermy in bees. Native bees offer crucial pollination services to natural and agricultural environments, yet how temperature shapes their foraging decisions is poorly understood. In this project, you will sample native bees from natural environments across thermally variable days to determine the temperature range at which different species forage. You will examine how the body temperatures of bees match with ambient temperatures to examine whether bees are physiologically or behaviourally regulating their body temperatures.

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Prof. John Morgan
Bundoora

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Website: click here

Number of projects: **1-2**
Full-time or part-time: **Either**
Feb or July start: **July**
Masters conversion: **Yes**
LTU3IND placement: **No**

Field work

Plant identification

Ecological assays

We study the ways that natural vegetation changes in response to global change drivers (climate, disturbance, invasions), the ways that plant populations interact with other species, and the approaches necessary to conserve rare species and endangered communities. In 2025, I offer two projects (but am very happy to hear your own ideas, and I can discuss other ideas with you too).

Project 1. Do below-ground 'states' of native grasslands mirror above-ground 'states'? Vegetation can vary in its composition and structure, often as a consequence of its history of disturbance by things such as fire and grazing. The outcomes of disturbance on vegetation states are actually pretty well-known for threatened grasslands across south-eastern Australia and these ideas underpin conservation management actions aimed at moving these vegetation states to a better condition (diversity of native plants, reduction of weeds, etc). This concept has, however, rarely extended to below-ground states in grasslands - such as nutrient cycling, fertility and soil seed banks - indeed, do below-ground 'states' even exist? What happens below-ground will likely have a profound impact on the ability to restore grasslands and seems a glaring gap in our understanding. In this project, we will quantify the soil seed bank (size, composition, distribution in the soil) of native grasslands in the emerging Western Grassland Reserve - and we will look to see if above-ground degradation sequences ripple through to the below-ground. If so, a clearer picture of the capacity to rebuild grasslands will likely emerge. This project will suit someone interested in seeds, regeneration and ecological restoration.

Project 2. Why does the morphology of Kangaroo Grass vary so much across Australia? Linking plant form to plant function. What makes a species widespread and hence, ecologically successful? It's not enough to say that successful species tolerate diverse environments? What is it about their form that contributes to success? For species such as Kangaroo Grass (Themeda triandra), the most widespread flowering plant in Australia, there is much variation in morphology across the species' range, which manifests itself as differences in leaves, root/shoot ratio, flowering culm height and awn length. But how do such morphological differences contribute to ecological functional difference? This study will explore how two key plant attributes – growth, seed production – vary in environmental space. Growth (biomass) is about occupancy and persistence in productive environments. Seed production (re-occupancy of less productive sites) is about regeneration and colonisation. Does one come at the expense of the other? This project will test whether trade-offs exist between growth and reproduction in Themeda, using collections from all over Australia, allied to a focus on the range frontier in Victoria where stunning 'mutations' have been found. It will require field collection, glasshouse work/a common garden experiment and lots of thinking around how you'd examine plant strategy variation across a species' range. This project will suit a student interested in plant ecological strategy and biogeography.

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Dr. Saul Gonzalez Murcia
Albury-Wodonga

Available for Industry placement

Field work

Animal handling

Ecological assays

Genetic sequencing

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Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My research understands the architecture of biological communities and factors that destabilize them and could result in biodiversity loss. I attempt to measure critical points that can disrupt elasticity, resilience and carrying capacity of populations, communities, and ecosystems. I expect to determine thresholds of environmental stress that might results in biodiversity loss and changes in biogeographical patterns based on current and future environmental scenarios. Understanding these dynamics will help to promote better ecosystems management and support conservation efforts.My research interest is related to understanding the architecture of biological communities and factors that destabilize them and could result in biodiversity loss. I attempt to measure critical points that can disrupt elasticity, resilience and carrying capacity of populations, communities, and ecosystems. I expect to determine thresholds of environmental stress that might results in biodiversity loss and changes in biogeographical patterns based on current and future environmental scenarios. Understanding these dynamics will help to promote better ecosystems management and support conservation efforts.

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Dr. Nick Murphy
Bundoora

Available for Industry placement

Phylogenetics

Ecological assays

Population genetics

Genetic sequencing

Field work

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Website: click here

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Either**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My lab uses genetic tools to better understand biodiversity. We utilise advances in genomic techniques for molecular ecology studies and to better understand the evolution of species. We work on a range of species, using phylogenetic reconstruction and population genetic analyses to understand why species are found where they are, how changes in the environment may impact their distributions, and utilise sensitive genetic techniques such as eDNA and diet analysis to determine how species interact with their environment. I have four projects currently listed below, but please speak with me if you are generally interested in the molecular ecology and evolution of species.

Project 1. Identifying hotspots of endemism in Australian invertebrates. The rainforests of SE Australia exist as islands of wet habitats surrounded by expanding seas of dry forest. They provide home to a mostly unknown relict fauna of poorly dispersing forest floor invertebrates that play a critical role in recycling organic matter. This project will undertake DNA sequencing studies, and you will generate phylogenetic analyses of a group of forest floor invertebrates to explain the biogeographic patterns of endemism among these forest islands. This project is part of a larger project aimed at determining hotspots of endemism in this region for conservation management.

Project 2. Are there climate refugia in the Australian alps? Alpine and subalpine ecosystems host a unique suite of Australian plants and animals under threat due to climate change. However, climate change has fluctuated considerably over the past 100, 000 years, and is not new to the alps. This project investigates whether subalpine frost hollows which likely provide a consistent cold climate have been critical for the maintenance of alpine ecosystems in Australia. Using a combination of ecological and evolutionary approaches, you will examine the hypothesis that sub-alpine frost hollows are refuges of evolutionary and ecological diversity for plants and animals in the Australian alpine environment.

Project 3. eDNA and terrestrial invasive mammals. Environmental DNA (eDNA) methods detect genetic signatures left behind by plants and animals. eDNA techniques are well established for the detection of aquatic species in water samples; however, the detection of terrestrial species requires further development. This project will use different samples (e.g. water, air, spider webs, and insect diets) to determine how eDNA methods can help identify invasion fronts in mammals at heavily forested sites. By understanding how factors such as rainfall, UV light and even soil type influence the detection of eDNA, you will assist in the development of guidelines for eDNA detection of large bodied invasive species.

*Project 4. Better deer management from deer pellets.*Due to their elusive nature, the exact number of invasive deer and their movement in and out of locations are very difficult to understand. However, deer leave behind genetic signatures in faecal pellets, and this project will utilise these signatures to better understand how many deer are present in an area where they may have come from, and possibly even how recently they were active. You will use genotyping methods developed in our lab for deer faecal pellets and a combination of controlled experiments and field surveys to develop better methods for invasive deer monitoring, using a readily accessible source of genetic material.

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Dr. Ryan Phillips
Bundoora

Ecological assays

Animal or plant identification

Field work

Experimental design

Plant reintroduction

Animal behaviour studies

E-mail: R.Phillips@latrobe.edu.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

The study of plant-pollinator interactions is critical for understanding the evolution of the incredible morphological and taxonomic diversity of both flowering plants and nectar feeding animals. Further, in Australia there are many cases of specialised pollination systems, meaning that numerous plants are vulnerable to the loss of pollinators following anthropogenic modification of the landscape. We tackle both theoretical and applied questions, with a particular focus on orchids pollinated by sexual or food deception, and the rich diversity of Australian plants pollinated by birds or mammals.

Project 1: Using plant-pollinator networks to identify the ecological interactions needed to support rare plant species. Plant-pollinator networks have become a popular tool for attempting to understand the processes that enable co-existence of diverse communities of plants and pollinators. However, a potentially important application for the network approach is to understand the role of pollinators and co-occurring plant species for facilitating reproduction of endangered plant species. This project will investigate plant-pollinator networks for endangered Victorian plants with the aim of identifying key species for management, and suitable communities for plant reintroductions.

Project 2: Floral adaptations to specialised pollination strategies. Although having a range of pollinator species may provide greater reproductive assurance, many plants are specialized on one or few pollinator species. Specialized plants often evolve exaggerated floral traits as natural selection favours morphological and chemical refinement based on the preferences, behaviours and morphology of a specific pollinator. Thus, understanding the origins of specialized pollination systems is critical for understanding the diversity of floral traits exhibited by flowering plants. Potential topics include identifying the pollinators of morphologically unusual Australian plants, testing the role of various floral traits in achieving pollinator attraction, and exploring the ecological consequences of using specialized strategies.

Project 3: How do bird-pollinated plants shape bird communities? In Australia, bird pollinated plants vary from towering eucalypts to diminutive understory plants. They also vary in floral structure, ranging from generalist species that attract numerous honeyeaters and parrots, to species with tubular flowers that are likely specialised on long-beaked honeyeaters. Surprisingly, many understory species have received little attention in terms of which species pollinate them, and whether their flowering drives the composition of bird communities. We plan to investigate these issues in the threatened Brisbane Ranges Grevillea (co-supervised with Susan Hoebee).

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A/Prof. Jim Radford
Bundoora

Available for Industry placement

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- Fauna surveys
- Habitat assessment
- Field work
- Landscape metrics
- Biodiversity indicators
- Geographic information systems (GIS)

Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **July**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

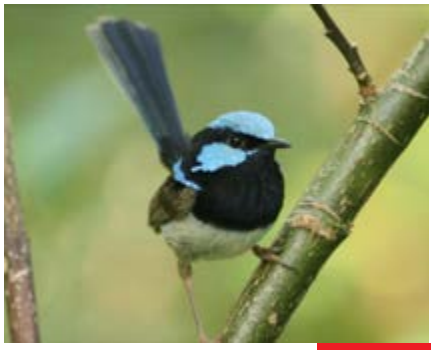
Our lab undertakes research that is focused on how to conserve species, ecological communities and ecosystems in human-modified landscapes. Our research examines how landscape structure and landscape change affect the ecology and conservation of native flora and fauna. We often adopt a landscape perspective that looks at the influence of factors like the extent, configuration and composition of landscape elements on the distribution of species, and the diversity and composition of communities. Our aim is to identify strategies and management responses that are most likely to sustain wildlife in regions experiencing change associated with agricultural land-use, wildfire, and urban development. Our research uses field surveys and experimental manipulations, statistical modelling and analysis of spatial data using GIS.

Major research topic areas include:

- Landscape change and nature conservation (especially birds) in agricultural environments
- Fire ecology and the relationship between fire regimes and conservation of species and communities
- Conservation biology of wildlife species (especially birds) and communities
- Provision of ecosystem services by wildlife in agricultural landscapes
- Innovative ways to detect, monitor and manage wildlife species

If you are interested in these topics, please contact me to discuss your ideas and potential projects.

2025 Honours project. Farmland conservation: transitioning to higher biodiversity farmland futures. Agriculture is the most widespread land-use on earth. Natural Capital Accounting, which involves a 'spatial inventory' of all the types of ecosystems present on a farm, has emerged as a promising tool to identify areas of high biodiversity value and track changes in ecological integrity over time on farms. The accounts are underpinned by state-and-transition models that are used to predict and map the biodiversity values of farms. This project will test assumptions about the biodiversity outcomes of selected transitions (e.g., fertiliser use, grazing management) on farms that have applied different management approaches. The project will involve conducting field surveys of either birds, invertebrates or plants (depending on the student's interest and skills) to determine the influence of farmland management (sustainable agricultural approaches) on biodiversity.



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Dr. Michael Shackleton
Albury-Wodonga

Available for Industry placement

E-mail: m.shackleton@latrobe.edu.au
Website: click here

- Field work
- PCR assays & genetic sequencing
- Ecological assays
- Animal behaviour studies
- Species distribution modelling

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

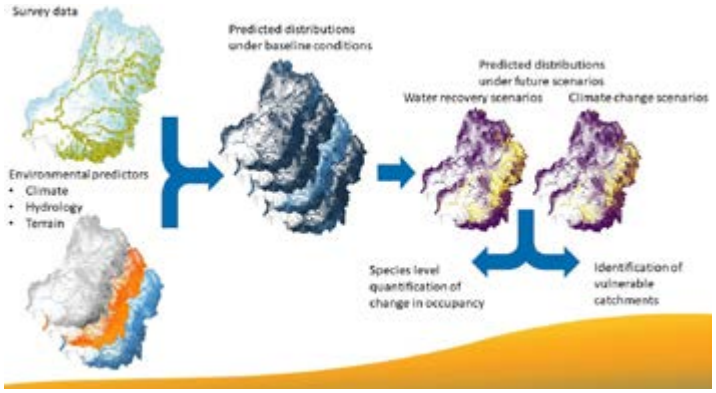
My lab is primarily interested in aquatic ecology, specifically around understanding species distributions and responses to environmental parameters - especially those impacted by climate change. I use traditional and molecular (i.e. metabarcoding) survey techniques to characterise communities and model their responses to various impacts.

Projects in my lab generally involve some field and lab work, spatial analyses, and modelling. I am open to discussing project areas that potential honours, masters or PhD students are interested in. However, projects that I am particularly wanting to pursue over the next year include:

Project 1. Understanding the impact of temperature on food-web characteristics. Multiple research questions can be investigated here but will involve measuring invertebrate body mass and nutritional makeup and could involve rearing invertebrates at different temperatures or collecting invertebrates from various climates.

Project 2. Investigating the role of groundwater inflows in alpine streams as potential refugia for aquatic organisms. This project will investigate whether groundwater impacted zones support communities of aquatic macroinvertebrates that are distinct from other microhabitats. It could also involve investigating the responses of alpine macroinvertebrates to different thermal regimes in terms life stage development, recruitment, and/or physiology.

Project 3. Investigating the thermal niches of aquatic macroinvertebrates. This project will investigate the fundamental and realised niches of aquatic macroinvertebrates. The project will involve collecting field data, undertaking respirometry experiments, mining and utilising data held in public repositories, and creating species distribution models. It will help to develop a better understanding of how thermal niches and climate determines macroinvertebrate distributions and how these distributions are likely to change under projected climate change scenarios.



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A/Prof. James Van Dyke
Albury-Wodonga

Available for Industry placement

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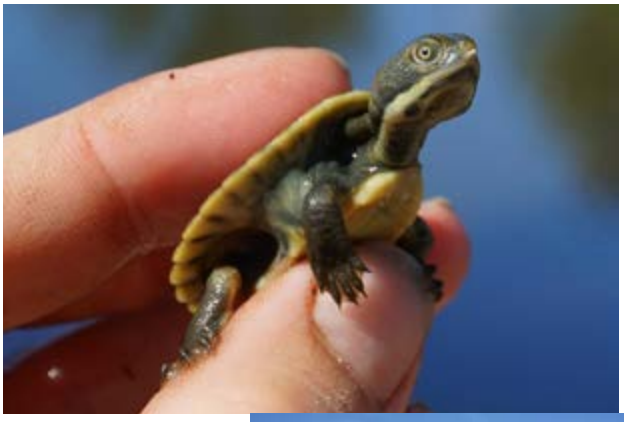
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **July**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Animal handling
- Ecological assays
- Field work
- Animal or plant identification
- Animal behaviour studies
- Ultrasonography

My lab studies a range of topics related to vertebrate ecology, reproduction, and conservation. Currently, I have considerable funding available for projects focusing on the ecology and conservation of freshwater turtles, as well as citizen science initiatives (1 Million Turtles) aimed at engaging the public in turtle conservation. Most of this work takes place in the Murray-Darling basin, and I have contacts and collaborations from throughout the region.

Our main aim is to develop, test, and implement new ways of protecting turtle nests from foxes, which destroy turtle nests. While doing this, we also conduct trapping surveys to compare and monitor turtle populations over time. We also conduct projects radiotracking hatchling and adult turtles to better understand their ecology and biology, and we are developing projects around taste aversion to further manage fox impacts on turtle nests.

In addition to field-based projects, we have access to a nationwide Citizen Science database (www.turtlesat.org.au) which is available for computer-based analyses, like species distribution modelling. I work with all prospective honours students to develop their own projects within these areas and based on their own interests and expertise. If any of these ideas sound interesting, please get in touch with me, because our summer field season is near and there are plenty of opportunities to get some hands-on experience with the work we do for a day or two, which may help you make a decision about a possible project. Our honours projects typically are extendable for MSc degrees as well.



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Biochemistry & Cell Biology

Dr. Katrina Binger
LIMS

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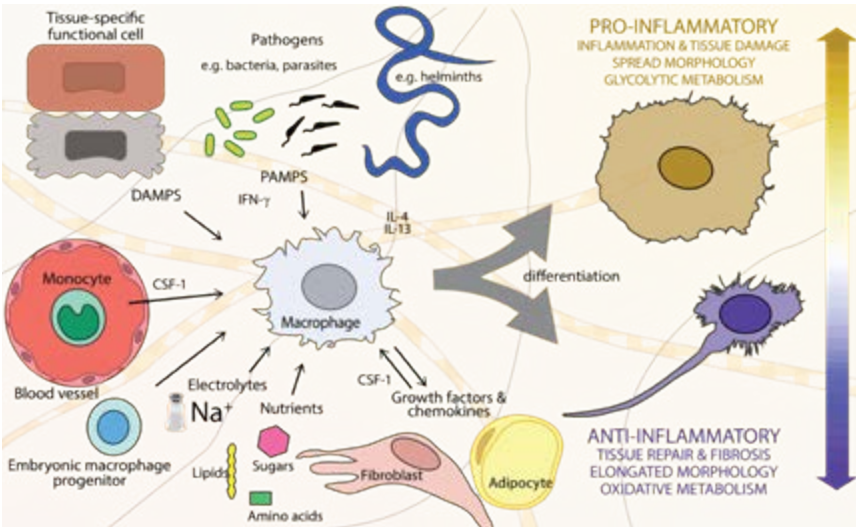
Website: click here

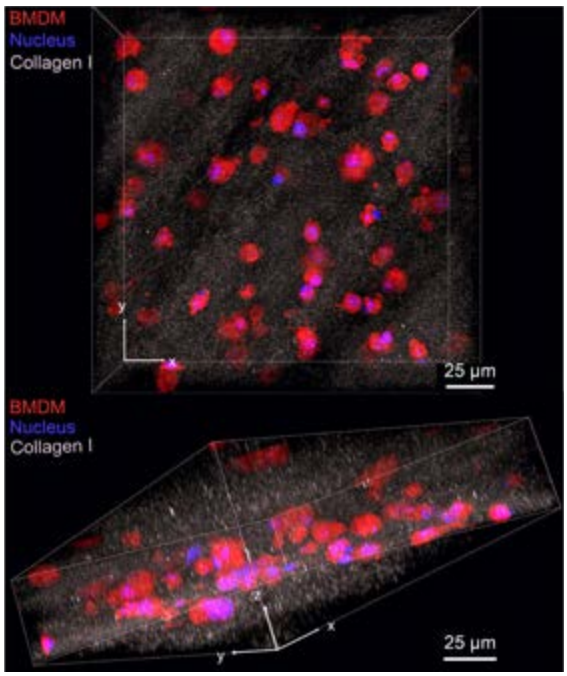
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

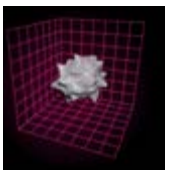
- 3D cell culture
- Flow cytometry
- Metabolism assays
- Protein biochemistry
- Mammalian cell culture
- Gene expression analyses (PCR, qPCR)
- Confocal fluorescence microscopy

We think macrophages are the best immune cells: they protect us from infection, repair our tissues when they get damaged, and help our organs perform their specific functions. Despite all these 'good' functions, macrophages can also acquire 'bad' phenotypes which cause diseases like high blood pressure, diabetes, inflammation and autoimmunity. Our research aims to understand how the environment of our tissues affects macrophage function. We look at a wide variety of environmental factors like 3D mechanical properties, the influence of extracellular-matrix proteins, and small molecules like metabolites and electrolytes.

For each of these general areas I have a range of projects in mind, which can be tailored to suit the skills development and interest of individual students.







Project 1. Macrophages go 3D. We've found that culturing macrophages in 3D scaffolds affects how they function - but we don't know why. In this project, students will develop scaffolds of different stiffnesses and conduct experiments to see how this affects their shape, metabolism, and function. We will isolate macrophages from different organs to see if macrophages from soft tissues like the brain, behave the same as macrophages from stiffer organs like the heart.

Project 2. Modelling fibrotic vessels with 3D cell culture. During high blood pressure, our vessels stiffen as a result of the fibrotic activity of macrophages. Also, other cells within the blood vessel send signals that induce macrophages to become fibrotic - these can be soluble proteins and metabolites, or direct signals from cell-cell contacts. In this project, you will model this complex interplay by developing 3D co-cultures of macrophages and other vessel cells like fibroblasts and pericytes.

Project 3. Vitronectin: an extracellular matrix (ECM) protein that promotes anti-inflammatory macrophage function? We have recently found that the interaction of macrophages with the ECM protein vitronectin promotes an anti-inflammatory phenotype. In this project students will employ chemistry and proteomics to identify proteins that vitronectin binds to on macrophages, which will be information we could use in future drug discovery projects.

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Dr. Lesley Cheng
LIMS

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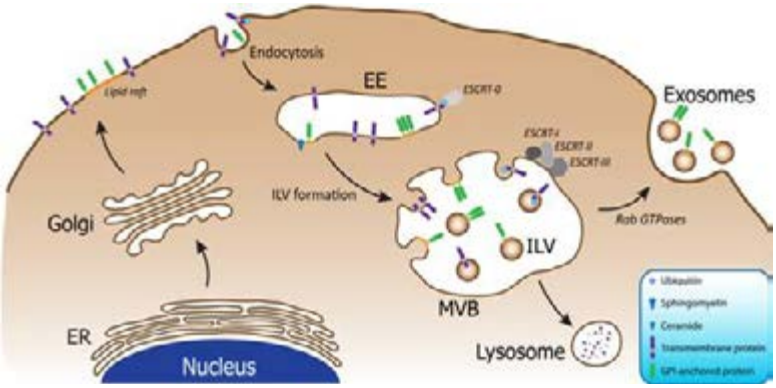
- Cell culture - eukaryotes incl. primary & cell lines
- Proteomics
- Protein biochemistry (SDS-PAGE & western blotting)
- Immunoassays (ELISAs, I-P)
- Genetic sequencing
- Molecular cloning
- Gene expression analyses (PCR, qPCR)
- Bioinformatics

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Neurodegenerative diseases, such as Alzheimer's disease (AD) is one of the leading causes of death world-wide. At the early stages of AD, neurons that control memory and thinking are attacked by toxic proteins that causes pre-mature neuronal death. Brain tissue becomes damaged, and patients begin to experience symptoms such as dementia related memory and cognitive impairment – a stage of disease when it is difficult to repair with disease-modifying drugs. Currently, the diagnosis process involves invasive procedures such as brain imaging and cerebrospinal fluid testing but is often performed at the symptomatic stage when damage to the brain has begun. Hence, there is currently an unmet need for an early, convenient, low-invasive blood-based test to diagnose AD. Our group focuses on developing diagnostic tests for neurodegenerative diseases such as Alzheimer's and Parkinson's disease but, also other similar dementia disorders to allow for differential diagnosis.



Project 1. It's in the blood – Extracellular Vesicles. Exosomes are extracellular vesicles (EVs) that are secreted from cells and tissues where they can then be found circulating throughout the body. They can carry protein and genetic material which have been shown to reflect the host cell. EVs can be isolated from blood making them a potential source of disease biomarkers. Our hypothesis is that EVs secreted from neurons within brain tissue can migrate through the blood brain barrier (BBB) into the blood whereby brain biomarkers are readily detected and reflective of disease occurring the brain, equivalent to a 'liquid biopsy' of the brain. We utilise 'Next-Generation' deep sequencing to identify all the RNA species, in particular microRNA, in EVs isolated from human post-mortem brain tissue and blood of patients with neurodegenerative diseases.

Project 2. Brain-derived EVs. Historically, it has been challenging to develop biomarkers for brain diseases as neurological biomarkers do not cross the BBB so sampling peripheral whole blood is not reflective of the brain. However, brain-derived EVs (BDEVs) can cross the BBB through specialised transport channels that allow BDEVs to pass the BBB. Our research group has the capability to isolate BDEVs from human brain tissues, a complete game-changer from using cell culture models. We can now investigate the contents and role of EVs isolated from the brain of patients diagnosed with a neurodegenerative disease from an entirely new perspective.

Projects will be developed around investigating the biology of EVs at the interface of the brain and blood to identify specific biomarkers for neurodegenerative diseases and further our knowledge about EVs.

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Prof. Stephanie Gras
LIMS

Available for Industry placement

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- X-ray crystallography
- Bacterial over-expression of protein & purification
- Biophysical characterisation of proteins
- Bioinformatics & molecular modelling
- Flow cytometry & immunoassays
- Protein biochemistry
- Mammalian cell culture
- Gene expression analyses & sequencing

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Viruses and pathogens are part of day-to-day encounters that the immune system needs to deal with. How the immune system "sees", recognises and eliminates viral infection is not fully understood. Indeed, viruses can mutate and as a result escape the immune system surveillance. If we were to develop better vaccine and drugs, or even vaccine against viruses like HIV, it is essential to understand the mechanism of viral recognition and viral escape prior to this. Our lab use multiple techniques in biochemistry, structural biology, and cellular immunology that students can choose to study.

Examples of projects in our lab:

Influenza virus continue to be a health burden in human, with ½ million death per year globally. We used immunological assays and flow cytometry to assess the response of human immune cells towards influenza virus derived peptides, determining which induce an immune response (immunogenic) and which do not. We also use Xray crystallography to make 3D structures of viral peptides bound to immune system proteins (HLA molecule) in complex with T cell receptor (TCR) at the Australian Synchrotron. We discover new Influenza epitopes as potential target for therapeutics/vaccine development.

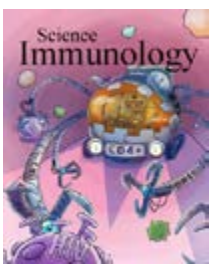

FIG 1. First TCR-HIV-MHC-II complex. Galperin, ***Science Immunology***. 2018

FIG 2. T cells recognition of SARS-CoV-2 and other seasonal coronaviruses. Lineburg et al, ***Immunity***, 2021.

HIV virus has of very high mutation rates and despite the dramatic life improvement provided by current antiretroviral therapy, HIV and AIDS are still health burdens. To tackle these issues, our work focus on a subset of individuals– named controllers – known to control HIV infection and/or delay AIDS disease progression. We will employ flow cytometry to assess T cell functionality and X-ray crystallography to create 3D structures of HIV epitopes and better understand the interaction between the peptide and the TCR, and link those observations with the function of the T cell (FIG 1).

SARS-CoV-2 virus is responsible for COVID and we have join the fight against SARS-CoV-2 infection, and our previous work on viral immunology places us naturally to provide and understanding of the T cell immune response to this new virus. We use protein chemistry, crystallography, as well as cellular immunity to provide a basis and better understanding of the impact of the SARS-CoV-2 infection. We have published the first structures of SARS-CoV-2 epitopes presented by Human Leukocyte Antigens (HLA) molecules that are the target of killer T cells. We are studying the immune response to SARS-CoV-2 and to COVID vaccines (FIG 2).

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A/Prof. Begona Heras
LIMS

Available for Industry placement

X-ray crystallography

Protease activity assays

Bacterial over-expression of protein

Molecular cloning

Biophysical characterisation of proteins (SAXS, CD, etc)

Protein biochemistry incl. immunoprecipitation

Confocal & Super resolution fluorescence microscopy

Cell culture - eukaryotes incl. primary & cell lines

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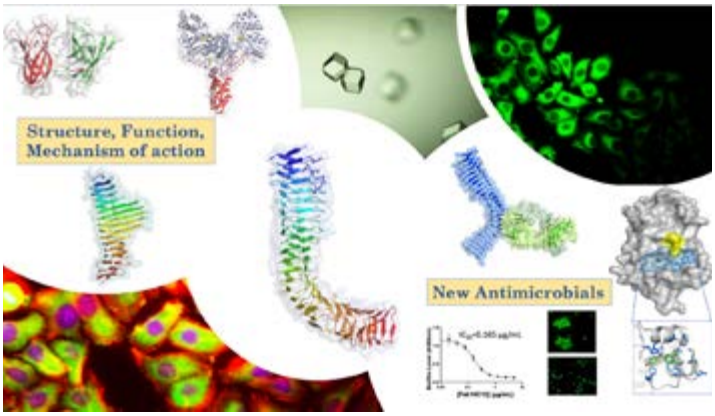
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Bacterial infections pose one of the most significant health threats of the 21st century. Antimicrobial-resistant superbugs are projected to cause over 10 million deaths annually by 2050, potentially becoming the leading cause of death in humans. With increasing bacterial resistance and a lack of new drugs entering the market, there is an urgent need to deepen our understanding of the mechanisms underlying bacterial pathogenesis to identify new therapeutic targets.

At the Heras laboratory, we focus on investigating virulence mechanisms in Gram-negative bacteria to develop antibiotics that disarm rather than kill bacteria. Our research particularly targets critical high-priority pathogens listed by the World Health Organization (WHO), such as Escherichia coli, Serratia, Salmonella, and Neisseria species. Our ultimate goal is to develop “resistance-proof” antimicrobials.



Students working in the Heras laboratory can engage in a variety of techniques applied to our key projects:

Project 1: Investigation of Bacterial Autotransporters. Autotransporters are the largest group of cell-surface proteins responsible for host colonization and biofilm formation. This project combines recombinant protein expression and purification, structural biology, molecular microbiology, and biophysics techniques such as Surface Plasmon Resonance (SPR), Circular Dichroism (CD), and Analytical Ultracentrifugation (AUC). The aim is to dissect the structure and function of these crucial bacterial proteins and develop molecules that block their function, thereby inhibiting biofilm formation and acting as new pathogenesis-blocking agents.

Project 2: Elucidating Mechanisms of Bacterial Resistance Development. This project focuses on understanding how bacteria develop resistance to antibiotics. Using X-ray crystallography in combination with biochemistry, molecular microbiology, and computational studies, we aim to uncover the mechanisms of resistance. The findings will be used to develop small, drug-like inhibitors that block these resistance processes, providing a new class of antibacterials.

With these projects, we aim to advance the field of antimicrobial research by identifying novel targets and developing innovative strategies to combat the growing threat of bacterial resistance. Our multidisciplinary approach will result in effective and sustainable treatments for bacterial infections.

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Prof. Mark Hulett
LIMS

Available for Industry placement

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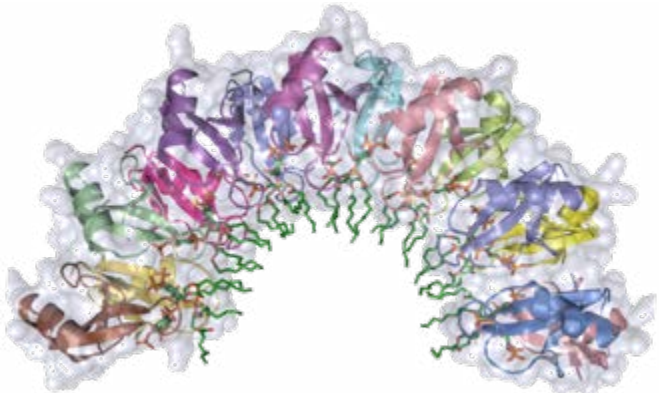
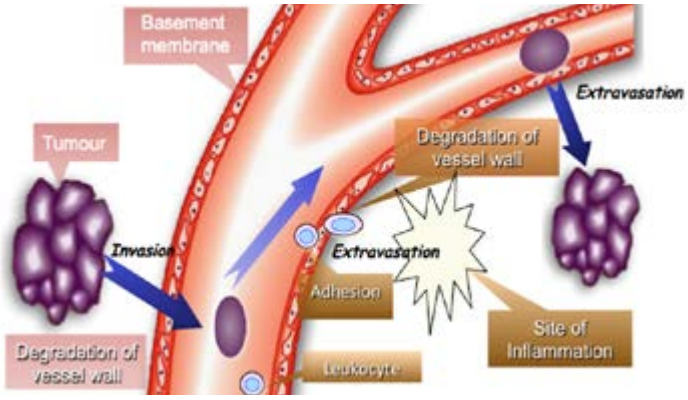
Website: click here

- Infection & Immunity
- Cancer
- Mammalian cell culture
- Flow cytometry
- Animal models of disease
- Microscopy - electron, confocal, light
- CRISPR-Cas9 gene editing
- Protein biochemistry

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**





Cancer and infectious diseases are major global health problems. There is an urgent need for more effective anti-cancer therapies and new antibiotics to address the rise of antimicrobial resistance. Our research focuses on two key areas (i) defining the molecular basis of the enzyme heparanase in tumour progression to develop inhibitors as anti-cancer drugs, and (ii) understanding the mechanism of action of innate defense peptides against target cells for development as anticancer and antimicrobial therapeutics. In consultation with prospective honours students we will design projects that are appropriate to your interests under the following themes.

Project 1. Heparanase function in tumour progression. The ability of malignant tumour cells to escape from primary tumour sites and spread through the circulation to other sites in the body (metastasis) is what makes cancer such a deadly disease. An essential process in metastasis is cell invasion - where tumour cells move into and out of the vasculature. The activity of heparan-sulphate (HS)-degrading enzymes has been shown to play a key role in cell invasion by degrading extracellular matrices. We have shown that heparanase is the dominant HS-degrading enzyme in mammalian tissues, making it an attractive drug target. We are trying to (i) understand the molecular basis of heparanase function, (ii) defining heparanase expression in cancer, and (iii) using heparanase knockout mice in disease models to define the precise role and contribution of heparanase in tumour progression.

Project 2. Innate defense molecules as novel antimicrobial and anti-cancer agents. Defensins are innate immune molecules found ubiquitously in the animal and plant kingdoms that often exhibit broad activity against microbial pathogens and mammalian cancer cells. We have described a conserved mechanism of action by defensins against pathogenic bacteria, fungi and enveloped viruses, as well as cancer cells. The defensins target and kill such pathogens and cancer cells using a novel cell lysis mechanism via direct binding to specific plasma membrane phospholipids. Our aim is to define the defensin mechanism of action to engineer improved forms for development as novel antimicrobial and anticancer therapeutics. We have extensive research programs dedicated to (i) investigating the molecular basis of the antimicrobial and anti-cancer activity of defensins using a range of biochemical and biophysical methods including in vitro pathogen and cell viability assays, live cell imaging, electron microscopy and X-ray crystallography (in collaboration with the Kvansakul lab); and (ii) in vivo testing and pharmacokinetic properties of defensins in models of infection and tumour progression.

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Prof. Patrick Humbert
LIMS

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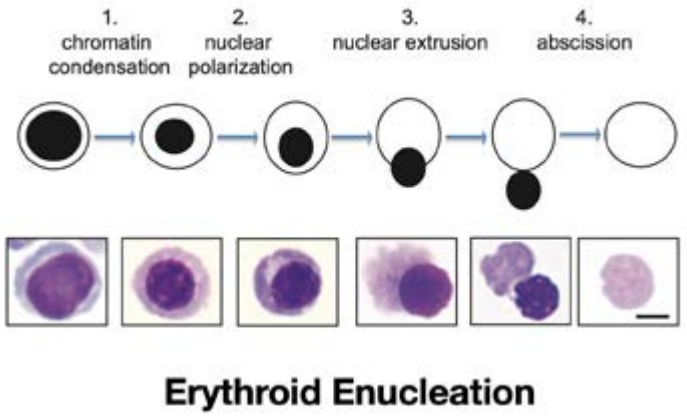
Website: click here

- Cancer
- Animal models of disease
- Mammalian cell culture
- Microscopy - electron, confocal, light
- CRISPR-Cas9 gene editing
- Flow cytometry
- 3D cell culture
- Protein biochemistry

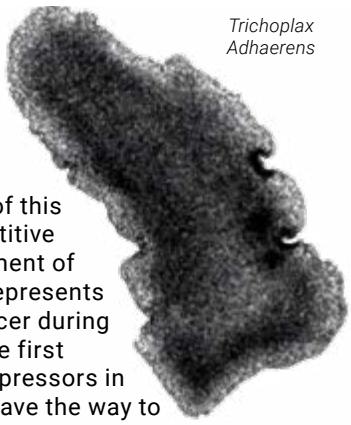
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

We are interested in the origins of cancer, both how cancer begins in humans but also when cancer first arose in multicellular organisms during evolution. One of the very first changes that drives cancer is a change in the organisation of cells in tissue, these are regulated by genes known as cell polarity genes and our lab focusses on how tissue organisation is regulated by these genes during tissue development, regeneration and at the outset of cancer. We examine this using 3D mini human organ cultures and by studying one of the simplest and most ancient animals on Earth, *Trichoplax Adhaerens*. These studies provide fundamental insights into the origins of cancer that pave the way to how we understand and prevent human cancer. A second area in the lab focusses on how our body generates red blood cells with the long-term aim to produce artificial bespoke blood for transplantation.

Project 1: How did the red blood cell lose its nucleus? Our lab has identified a number of new regulators of enucleation, the process by which red blood cells lose their nuclei. In this project you will identify how these new regulators control enucleation. This will help develop strategies to enhance the production of red blood cells *in vitro* for patient transplantation purposes.



Erythroid Enucleation



Trichoplax Adhaerens

Project 2: How did cancer begin? The evolution of the first animal from a single cell organism to one consisting of multiple cells required new mechanisms that allowed cooperation between cells. Breakdown of this cooperation by over-competitive 'cheating' cells to the detriment of the whole animal's health represents the first appearance of cancer during evolution. You will study the first oncogenes and tumour suppressors in *Trichoplax Adhaerens* and pave the way to how we understand human cancer.

Project 3: How does gravity effect regeneration and cancer? Altered gravitational conditions (weightlessness) cause detrimental effects on stem cell function and wound healing. The impact of altered gravity on biology has become a critical consideration for the long-term stay of humans and animals in space as well as for space tissue engineering. You will work as part of an international collaboration with the German Aerospace Center (DLR), to test for the first time how altered gravity may affect the development of tissue organisation and regenerative programs in one of the simplest and most ancient multicellular animals on Earth, *Trichoplax Adhaerens*. Due to its size, regenerative properties and its reported ability to sense gravity, *Trichoplax* provides an ideal model system to decipher the effects of altered gravity on animal architecture and regeneration. We will initially use ground-based facilities to simulate weightlessness, then examine impact of real microgravity conditions (as well as Moon and Mars gravity) on tissue organisation and regeneration using parabolic flights. This will provide insights into molecular mechanisms impacting regeneration and cancer in space that will inform human health for long-term space flights.

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Dr. Travis Johnson
LIMS

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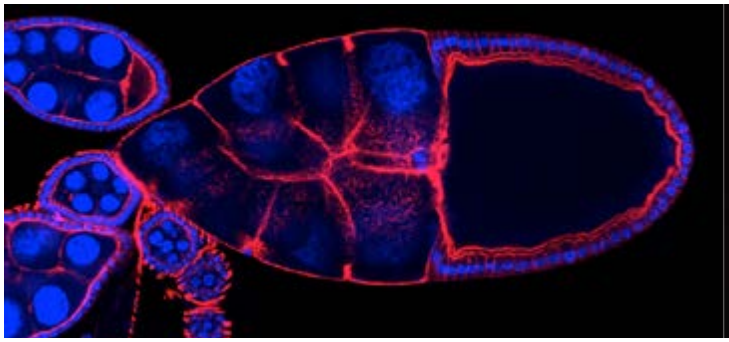
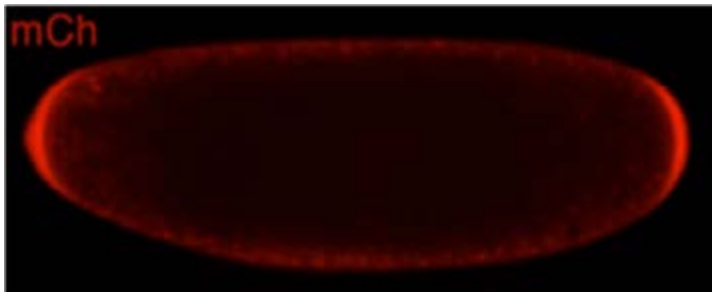
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Drosophila melongaster models
- Bioinformatics & molecular modelling
- Confocal & super resolution fluorescence microscopy
- Protein biochemistry (SDS-PAGE, western blotting)
- Animal behaviour & models of disease studies
- Histology (incl. immunohistochemistry)
- Metabolomics
- Molecular cloning & PCR assays



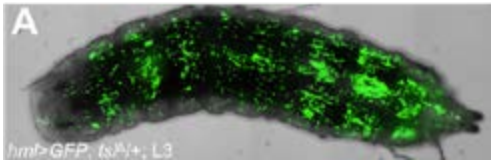
The Johnson Lab uses the powerful genetic model organism, the fruit fly (Drosophila melanogaster), to understand the actions of critical developmental and environmental factors that are involved in cellular decision making processes (growth, proliferation and differentiation). His lab uses sophisticated genetic experiments, including genome-wide screens, and the generation of transgenic strains to discover new genes and novel mechanisms of cell communication. The Johnson Lab further extends to using flies to study human disease via the discovery of the genetic and molecular bases of human diseases, as well as developing novel treatments. We use advanced imaging (e.g. confocal microscopy), genetic technologies (e.g. CRISPR/Cas9 mutagenesis), biochemistry (protein purification and analysis), cell biology, and molecular and 'omics approaches.



Project 1. Growth factor trafficking and secretion in early embryo patterning. This project aims to use fixed and live cell imaging, as well as molecular genetics to investigate the secretory pathway taken by a unique growth factor involved in a critical developmental event in the very early Drosophila embryo. It will reveal new information about specialised secretory pathways and how patterning is achieved.

Project 2. Novel mechanisms that control blood cell numbers. This project will use genetic tools to disrupt gene function specifically in fluorescently-labelled blood cells and advanced imaging techniques to learn how blood cells talk to other blood cells and tissues and decide whether or not to proliferate. It will reveal new insights into the mechanisms used to control blood cell numbers for homeostasis and during disease.

Project 3. Using diet to treat a model of metabolic disease. This project will characterise a genetic model of a human inherited metabolic disease and test a variety of potential dietary interventions. This will require Drosophila genetics, tissue analysis and imaging and the quantification of traits such as survival, developmental timing, behaviour and the generation of synthetic diets.



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A/Prof. Erinna Lee
LIMS and ONJCRI

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Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

- 3D cell culture
- Cell transfection
- Cell culture - eukaryotes incl. primary & cell lines
- Protein biochemistry (SDS-PAGE, western blotting)
- Flow cytometry
- CRISPR-Cas9 gene editing of cells
- Gene expression analyses

Cells possess distinct pathways that promote their survival or death. These pathways are tightly regulated but when this regulation goes awry, diseases ensue. Our lab is interested in the pathway of apoptosis which is a form of programmed cell death. It is often dysfunctional in cancer, mainly due to the presence of excess amounts of proteins that confer survival.

BH3-mimetics are a class of drugs that work by directly antagonising the pro-survival components of the apoptotic machinery. These have shown clinical efficacy in blood cancers, but this success has yet to be translated to solid cancers. This is largely due to the dependency of many solid cancers on multiple pro-survival proteins conferring their unwanted survival.

Pancreatic cancer has a five-year survival rate of less than 10% owing to ineffective treatment measures and the aggressive nature of the disease. It is predicted to become the second leading cause of cancer death by the end of the decade. Hence, there is an urgent need to improve therapeutic strategies for this cancer.

From an unbiased high-throughput drug screen conducted by our lab, we have now identified novel and effective combinations of a BH3-mimetic plus various classes of FDA approved drugs. This Honours project aims to investigate the mechanisms by which these drug combinations induce effective killing of pancreatic cancer cells. Results generated could provide the basis of a novel treatment modality for this devastating cancer.

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Dr. Kha Phan
LIMS

Available for Industry placement

- Cell culture - eukaryotes & prokaryotes
- CRISPR-Cas9 gene editing of cells
- Protein biochemistry (SDS-PAGE, western blotting)
- PCR assays
- Flow cytometry & immunoassays
- Animal models of disease
- Light microscopy
- Histology (incl. immunohistochemistry)

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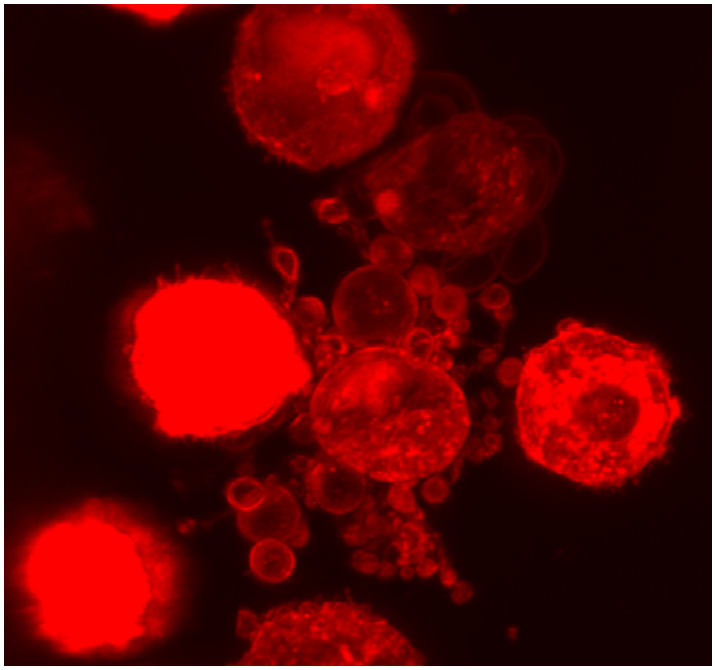
Website: click here

Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Billions of cells die every day in our bodies as part of normal development, homeostasis and diseases. Dying cells often actively attract and engage scavenging phagocytes to promote the clearance of their cell corpses (a process known as 'efferocytosis'). Defective efferocytosis have been linked linked to chronic inflammation and autoimmunity due to subsequent cell lysis as well as exposure of autoantigens. Notably, upon efferocytosis, cell corpses elicit various cellular responses in the engulfing phagocytes depending on packaged cargoes, including immune modulation, cell survival, division and differentiation as well as pathogenesis. For example, we have recently shown that SARS-CoV-2 infection-derived ApoBDs can facilitate viral entry, independently of the canonical ACE-2 receptor, into macrophages, triggering exacerbated inflammation that is consistent to severe COVID-19. Despite the pivotal (patho) physiological roles and promising therapeutic potential, the molecular mechanisms underlying apoptotic cell clearance by efferocytosis remains largely underexplored. In collaboration with Prof. Ivan Poon (La Trobe) and Prof. Jun Suzuki (Kyoto University), you will identify novel regulators for this processes using a new genome-wide CRISPR/Cas9 screening techniques. You will also functionally characterise the identified positive hits and elucidate novel mechanism(s). This project will not only provide further insights into efferocytosis but also open a new avenue for therapeutic designs for infection and chronic inflammatory diseases.



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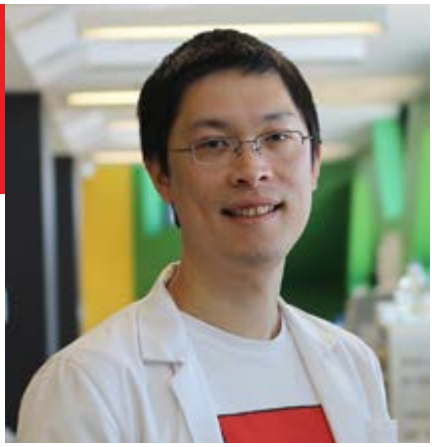
Prof. Ivan Poon
LIMS

Available for Industry placement



E-mail: l.poon@latrobe.edu.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Infection & immunity
- Cell culture - eukaryotes, incl. primary & cell lines
- Flow cytometry
- Animal handling
- Microscopy - electron, confocal, light
- CRISR-Cas9 gene editing of cells
- Cell transfection

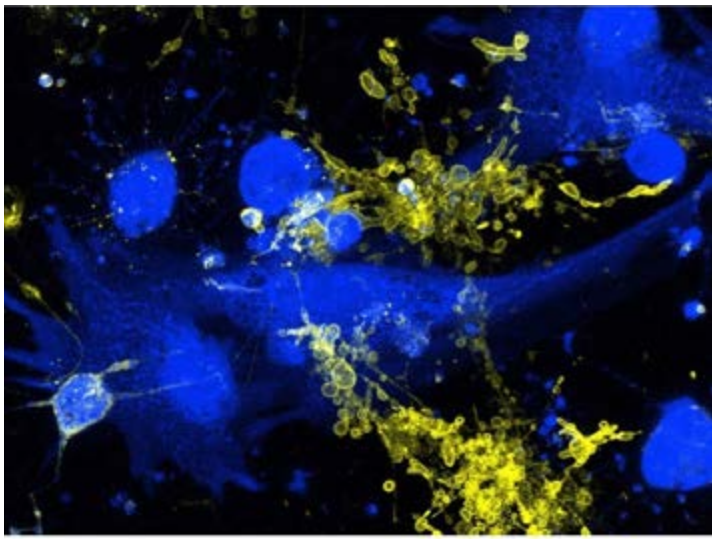
Billions of cells die daily as part of normal turnover in various organs. It is vital that dying cells are rapidly removed as their accumulation has been linked to inflammation, autoimmunity, cancer and infection. To aid efficient removal of dead cells, dying cells often disassemble into smaller fragments for neighbouring cells to engulf. Certain cellular components can be packaged selectively into these fragments to regulate tissue repair and immunity. We aim to understand the machinery that controls how dying cells can disassemble into smaller pieces, the importance of cell disassembly in disease settings (e.g. influenza A infection), and identify new drugs to control this process.

Project 1. Develop zebrafish models to visualise the cell clearance and disassembly. Apoptosis (programmed cell death) occurs in all tissues as part of development homeostasis, and pathogenic processes including infection and cardiovascular disorders. Apoptotic cells often disassemble into smaller membrane-bound extracellular vesicles called apoptotic bodies (ApoBDs). We have demonstrated that the formation of ApoBDs is a highly regulated process in T lymphocytes and monocytes. We discovered a new type of membrane protrusion (coined "apoptopodia") that facilitates the separation of membrane blebs during apoptosis to generate individual ApoBDs. In this project, you will develop new animal models to visualise this process in vivo. In particular, you will establish new transgenic zebrafish lines to monitor how dying cells disassemble and their interaction with neighbouring cells.

Project 2. Role of dying cell disassembly in viral trafficking. Extracellular vesicles including apoptotic bodies (ApoBDs) have been implicated to regulate physiological and pathological processes via the molecules they carry inside or exposed on their surface. The importance of generating ApoBDs during apoptosis in pathophysiological settings is poorly understood. In particular, we study the role of apoptotic cell disassembly in the context of viral infection. During certain viral infection, infected cells can undergo apoptosis to shutdown cellular machinery as a defence mechanism to limit viral replication. Notably, we discovered recently that phagocytic removal of ApoBDs generated from influenza A virus or SARS-CoV-2 infected cells may also facilitate the spread of infection, and the phagocyte could become infected following the engulfment of ApoBDs containing viral particles. Utilising influenza A virus infection as a model, this project will explore the molecular mechanisms underpinning this novel route of viral entry into host cells. This include identifying the engulfment receptors involved in ApoBD uptake as well as elucidating the downstream mechanisms of viral entry.

Further reading:
Apoptotic cell clearance and disassembly:
- https://www.nature.com/articles/nri3607
- https://www.nature.com/articles/ncomms8439

ApoBDs in viral infection:
- https://www.nature.com/articles/s42003-020-0955-8
- https://www.biorxiv.org/content/10.1101/2023.11.03.565419v1.abstract



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Dr. Nick Reynolds
LIMS

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Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Nanoscience
- 3D bioprinting
- Mammalian cell culture
- Microscopy - electron, confocal, light
- Small-angle X-ray scattering
- Biophysical characterisation of materials
- Biosensors

The research in my lab can be broadly defined as Bionanotechnology. I am interested in developing materials with applications in tissue engineering, developing next generation biosensing materials, and better understanding the origin viral infections.

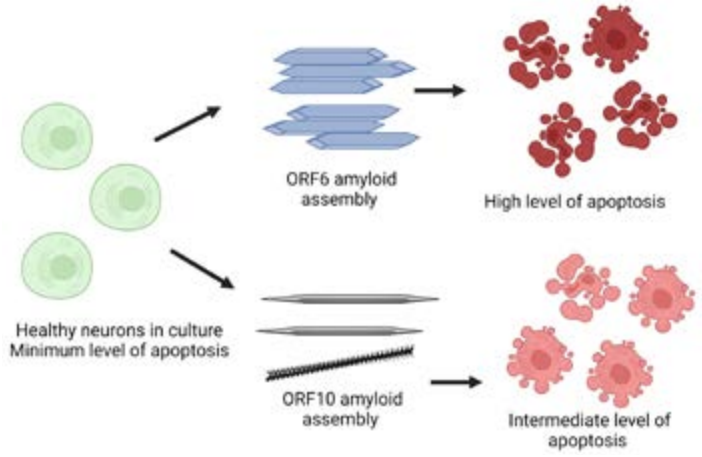
Depending on the students preferences and experience there are a number of potential collaborative projects on offer:

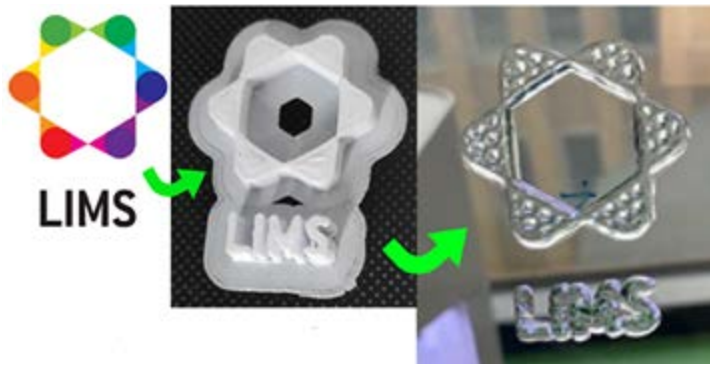
Project 1: Investigating the role that protein aggregation playing in viral infections including COVID-19 and Influenza. (in collaboration with Dr Sarah Annesley and A/Prof Ashley Mansell)

Project 2: 3D Bioprinting for Tissue Engineering. This project will involve 3D printing of cells encapsulated in hydrogels. The encapsulated cells will then be assessed for their ability to grow new human cartilage or their behavior as immune cells (in collaboration with Dr Katrina Binger).

Project 3: Self-propelled swimming materials for biosensing applications (in collaboration with Dr Saimon Silva)

Please get in touch via email if you would like some more information about any of the projects on offer.





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Dr. Sarah Stewart
LIMS

Available for Industry placement

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- Cancer
- Proteomics
- Mammalian cell culture
- Protein biochemistry
- CRISPR-Cas9 gene editing
- Flow cytometry
- Confocal fluorescence microscopy

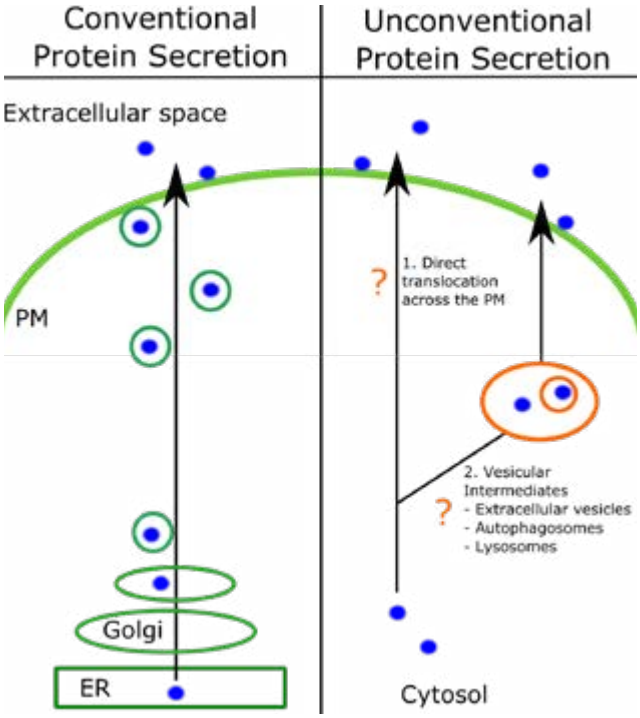
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **No**
LTU3IND placement: **No**

Eukaryotic cells have a highly evolved system of protein secretion, and dysfunction in this pathway is associated with many diseases including cancer, infection and neurological disorders. Most proteins in the human body are secreted using the endoplasmic reticulum (ER)/Golgi network, defining the conventional secretory pathway. However, several cytosolic proteins that lack a signal peptide for entry into the ER can be secreted by alternative routes, called unconventional protein secretion (UPS) pathways. The extracellular functions of these proteins have been well documented, as are associations of their perturbed secretion with disease.

Despite the well described extracellular functions of unconventionally secreted proteins, the mechanism(s) of UPS and its regulation remain largely uncharacterised. This represents a major gap in our understanding of the fundamental mechanisms supporting protein trafficking and secretion. Our goal is to understand how cytosolic proteins are secreted from mammalian cells and describe the pathways and molecular regulators involved in UPS. We are investigating several major pathways including direct translocation across the plasma membrane and the role of extracellular vesicles in UPS. Understanding these fundamental cellular processes is extremely important and may lead to novel drug targets for a range of diseases.

Project 1. How do proteins cross membrane barriers for unconventional secretion. This project aims to understand whether different unconventionally secreted proteins can cross the plasma membrane using a universal molecular mechanism.

Project 2. Inside-out: Extracellular vesicles for unconventional protein secretion. This project will investigate which unconventionally secreted proteins are associated with extracellular vesicles (EVs) and examine whether EV biogenesis is an important regulator of their secretion.



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Prof. Coral Warr
LIMS

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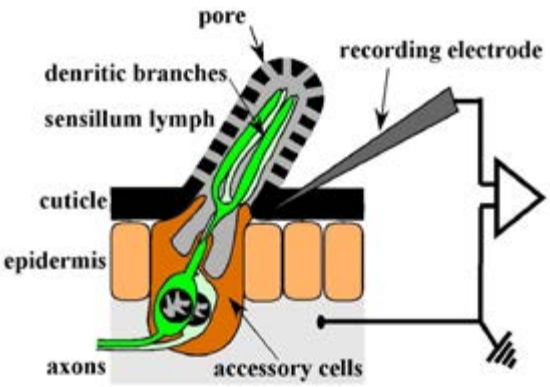
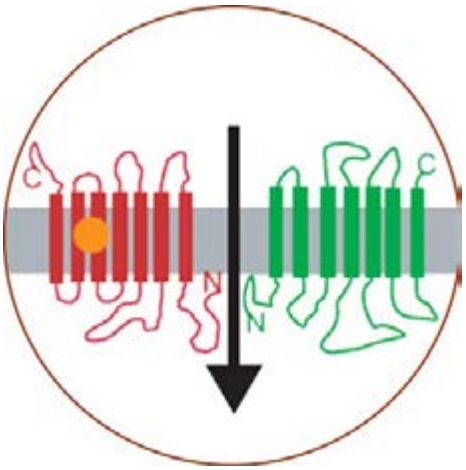
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Drosophila melanogaster models
- Electrophysiology, calcium imaging
- Light microscopy
- Molecular cloning
- Animal handling & behaviour studies

In the Warr lab we study how insects detect and respond to odorants, in particular the function and evolution of the odorant receptor protein superfamily. Prof Warr is an expert in this family, which she identified in the model genetic insect Drosophila melanogaster.

An honours project is available as part of our collaboration with Agriculture Victoria Research, and will be co-supervised by Associate Professor Paul Cunningham and Dr Alex Piper from AgVic. Our overall collaboration aims to identify odorant receptors that the Queensland fruitfly (a major horticultural pest) uses to detect the host plants on which it lays eggs. This research has a long term goal of informing innovative new approaches to pest control by manipulating the flies ability to find their hosts. The honours student will work on part of this large collaboration and the project can be tailored to the interests of the student. Options include molecular genetic studies where we express Qfly receptors in Drosophila in order to study their function, or detailed behavioural and electrophysiological studies to identify host-emitted chemicals of interest, or both.





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Dr. Lakshmi Wijeyewickrema
LIMS

Available for Industry placement

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- Infection & Immunity
- Molecular cloning
- Protease activity assays
- Bacterial over-expression of protein
- Protein biochemistry

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

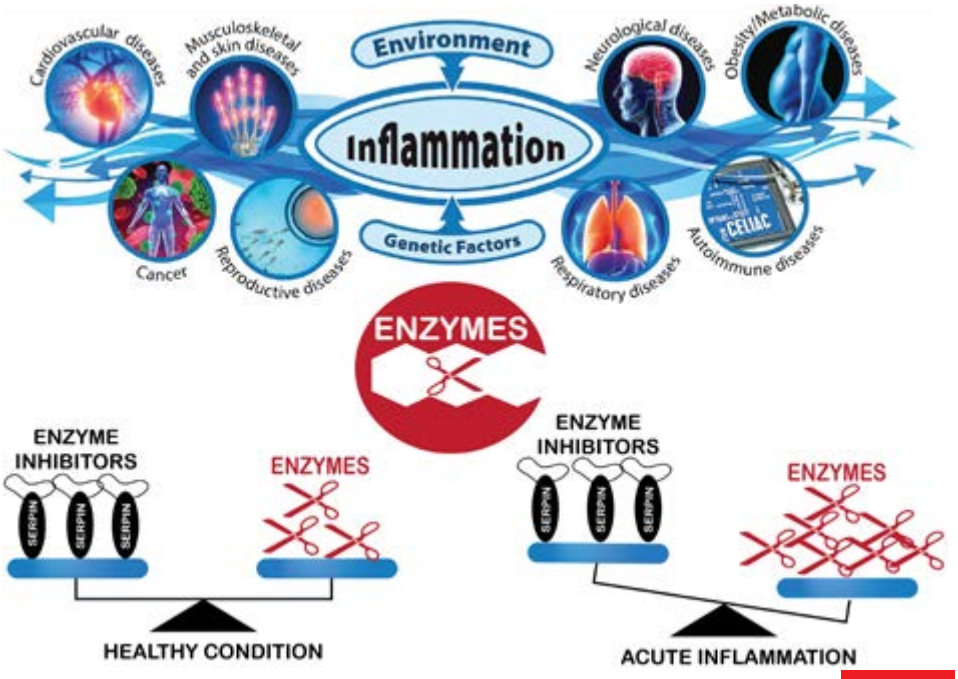
Enzymes are truly remarkable molecular machines that operate tirelessly within our bodies, allowing us to carry out even the most basic biological functions. These unsung heroes keep us healthy and functioning by catalysing essential chemical reactions. But enzymes are not just vital for basic survival – they also play a critical role in regulating inflammation and other immune system functions. Inflammation is one of the body's most important defence mechanisms, protecting us against harm and aiding in the healing process.

By delving into the intricacies of enzyme function, we can unlock the secrets of disease prevention and treatment. Targeting specific enzymes offers a promising approach to developing new therapies for combating inflammation, infection, and a host of other health issues. However, we must also consider the delicate balance between enzymes and their inhibitors. An imbalance of enzymes and their inhibitors can lead to the overproduction of inflammatory molecules, which can contribute to the development of chronic inflammation and various diseases.

By gaining a deeper understanding of the delicate balance between enzymes and their inhibitors, we can develop new strategies to prevent and treat inflammation, leading to better health outcomes for all.

Project 1. The enemy within: targeting the viral entry facilitator of SARS-CoV-2 as a therapeutic strategy.

Project 2. Designing specific enzyme inhibitors: the good, the bad, and the impossible.



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Chemistry

A/Prof. Belinda Abbott
LIMS

Chemical synthesis - organic

Mass spectrometry (small molecules)

Medicinal chemistry

Chromatography (flash column, HPLC)

NMR spectroscopy

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Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Medicinal chemistry involves the design, synthesis and development of the molecules we need in order to understand, prevent and treat disease. Research projects in medicinal chemistry primarily use the practical skills required for organic synthesis, purification and chacterisation. Biological assays are undertaken in partnership with our collaborators in order to the understand the structure-activity relationships of our synthesised compounds against the disease target.

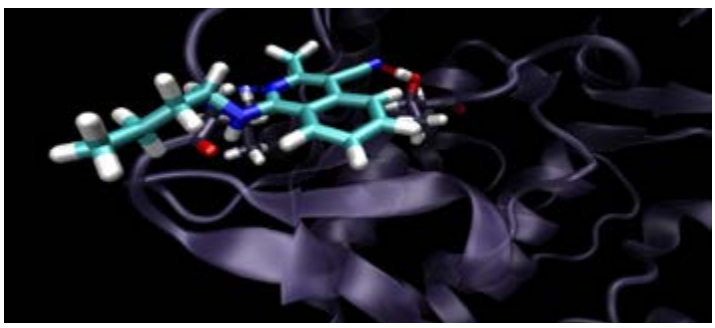
Project 1. Inhibiting P.falciparum in the search for a novel antimalarial agent. Malaria causes a significant impact on the health and economy of the developing world. Enzymes which are important in the life cycle of the malaria parasite could possibly be attractive targets for novel antimalarial agents. We are synthesising analogues of the isoquinoline compound known as A4 to evaluate against Plasmodium falciparum in order to develop a selective and potent inhibitor.

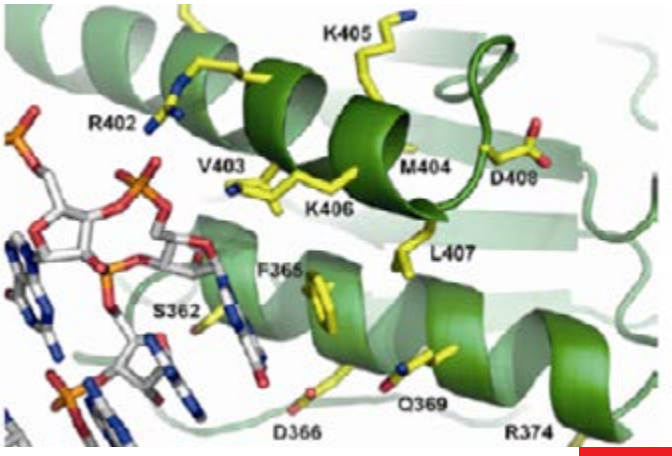
Project 2. Using fragment-based drug design to disrupt bacterial infection. The bacterial signal recognition particle (SRP) is an essential ribonucleoprotein complex responsible for the delivery of proteins to the plasma membrane in bacteria. Interrupting the interactions of SRP with its receptor represents a promising strategy for the development of novel antibiotics. This project aims to expand fragments obtained from a screening library into higher affinity antibacterial compounds using the approach of fragment-based drug design.

Abbott Lab 2022

Project 3. Design, synthesis and evaluation of Drp1 inhibitors. The mitochondrial protein dynamin-related protein (Drp1) has been implicated in the development of a number of neurodegenerative diseases including Alzheimer's disease. This project aims to develop the first small molecule inhibitors of human Drp1 which can be used to reveal the specific role of this protein in dementia and for evaluation as a potential lead for drug development.

Project 4. Small molecules for the effective treatment of motor neurone disease (MND). Protein transport is critical for healthy motor neurons. We have identified a lead molecule that enhances decreases cellular stress, prevents the formation of inclusions and prevents cell death (apoptosis). This project aims to develop compounds with neuroprotective activity as there are currently no effective therapeutic treatments or cure for MND.





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A/Prof. Peter Barnard
LIMS

Available for Industry placement

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Website: click here

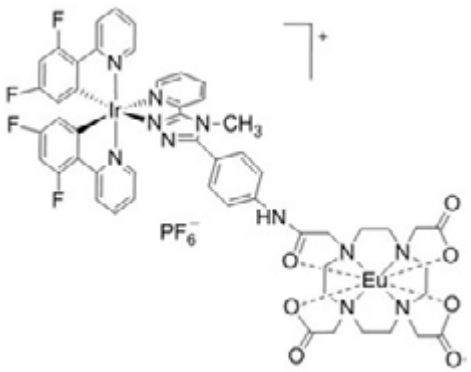
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Chemical synthesis - organic & inorganic
- Nuclear magnetic resonance
- Light microscopy
- Mass spectrometry
- X-ray crystallography

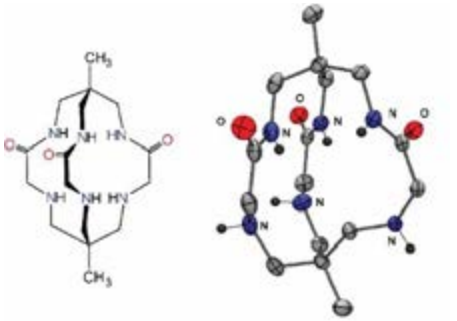
The main focus of the Barnard research lab is the synthesis and development of organic ligands and coordination complexes for medicinal and biological imaging applications. Organic and inorganic synthetic chemistry in combination with a wide range of analytical techniques are used for the generation and characterisation of new compounds.

*Project 1. Synthesis and Studies of Luminescent Gold, Ruthenium, Iridium and Lanthanide Complexes.*We are interested in the synthesis of new luminescent coordination compounds of gold, ruthenium, iridium and the lanthanide metals. Current efforts are being directed at tuning the luminescent properties of the d-block complexes and the synthesis of d-f heterobimetallic arrays for sensor applications.

Project 2. Radiopharmaceutical Imaging Agents for Cancer Diagnosis. This is a collaborative project with the Australian Nuclear Science and Technology Organisation (ANSTO) involving the development of new radiopharmaceutical imaging agents for disease diagnosis. A range of ligand systems are being used in combination with metallic radionuclides such as Tc-99m, Cu-64 and Zr-89. Technetium-99m is the most widely used radionuclide in medical imaging and a wide array of 99mTc labelled compounds are currently used to image different organs and a number of diseases. As all isotopes of Tc are radioactive, we develop new chemistry using Re and we have prepared a series of Re(I) complexes of NHC ligands. Recently we have also labelled these NHC ligands with 99mTc. See: Chemical Communications 53 (15), 2311-2314, 2017 and Inorganic chemistry 53 (20), 10862-10873, 2014.



Project 3. Synthesis and coordination chemistry of amide containing molecules. The amide or peptide functional group is critical to life as it provide the linkage between adjacent amino acid residues in proteins. Amides also display interesting coordination chemistry. We are working on the synthesis of new ligands incorporating amide groups. An example of a triamidetriamine macrobicyclic cage ligand designed to form highly stable metal complexes is shown. See: Inorganic Chemistry 53 (1), 468–477, 2014.



*Project 4. Silver and gold-based antibacterial compounds.*We are interested in the development of gold and silver-based complexes of N-heterocyclic carbene ligands as new antibacterial agents. Some of the compounds prepared show excellent activity against multi-drug resistant bacterial strains and importantly no antibacterial resistance developed against these metal containing complexes, whilst resistance was developed against the widely used broad-spectrum antibiotic ciprofloxacin in the same bacterial strains. This project will aim to prepare targeted gold and silver metallodrugs and potential new antibiotics.

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Prof. Jason Dutton
LIMS

Available for Industry placement

- Chemical synthesis - organic & inorganic
- Mass spectrometry
- Nuclear magnetic resonance
- X-ray crystallography

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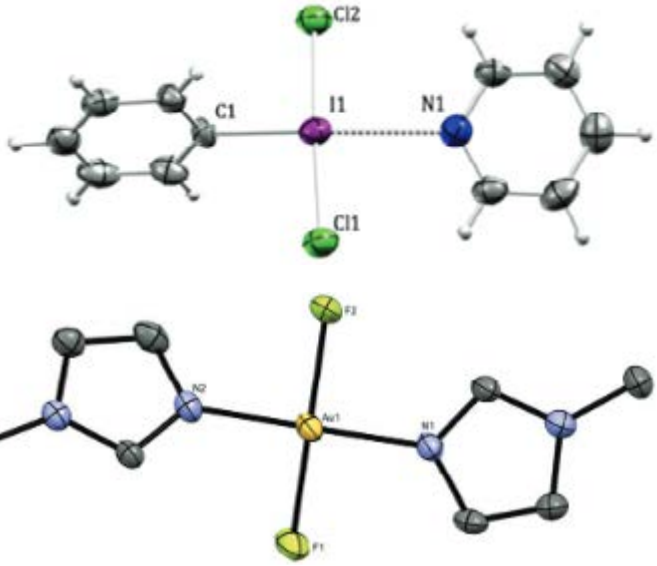
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The Dutton lab invents new chemistry across both inorganic and organic chemistry, covering the breadth of the periodic table. We do this with a general tact of making molecules uncomfortable by providing them with either too many or too few electrons, which normally leads to a reactive situation and the uncovering of interesting new classes of molecules or chemical transformations. We have for example in the past few years discovered the weakest known C=C double bond by giving a molecule too many electrons that is the only alkene known to react with atmospheric O2, and the most positive metal-fluorine bond by giving a molecule too few electrons. Often the transformations we discover are found simply by serendipity.



Specific projects that are on offer next year include in organic chemistry the generation of halogenation reagents (ie brominating reagents) that are stronger and faster than Br2 itself, yet much easier and safer to handle. For the inorganically inclined, we are looking at methods of making metal-fluorine bonds more reactive for the purpose of direct transformations of cheap C-H bonds into value added C-F bonds. A student joining the Dutton lab can expect to learn a variety of synthetic chemistry techniques, a whole lot of NMR and mass spec and some X-ray crystallography. Interested students can also potentially learn how to analyze their systems with theoretical chemistry techniques. Most of all students in the Dutton lab learn that chance favours the prepared mind!

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Dr. George (Wren) Greene
LIMS

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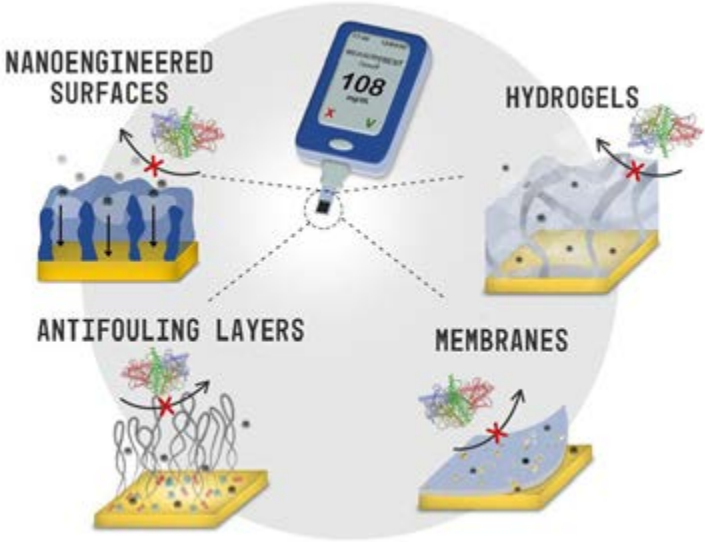
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

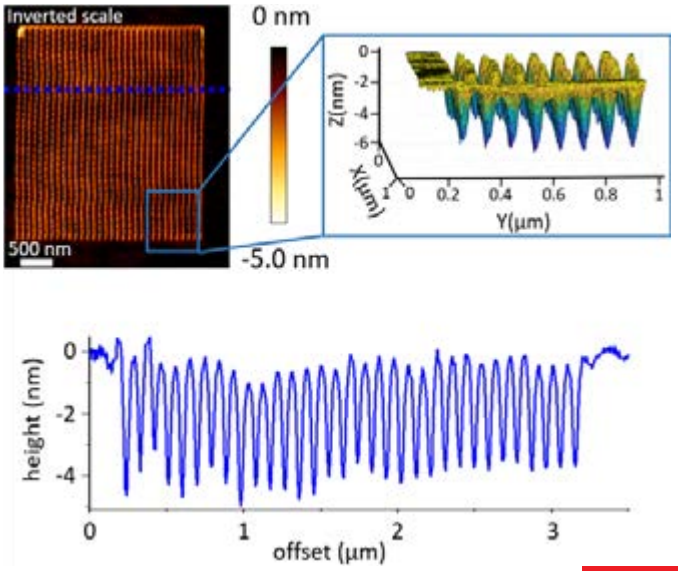
- Physical chemistry
- Biophysical characterisation of materials
- Conductive polymers
- Analyses of reaction rates
- Electrochemistry
- Interfacial science
- Atomic force microscopy

Our lab utilizes the physical chemistry of interfaces to engineer innovative materials and surfaces that exhibit multifunctional and responsive properties. Utilizing a multidisciplinary approach which draws on principles from biology, electrochemistry, inorganic chemistry, and geology, we control intermolecular and interfacial interactions and interfacial electric fields to create biosensors, drug delivery, bionic, and nanofabrication technologies. We are currently seeking students for two research projects:

Project 1: Anti-fouling coatings to improve the sensitivity of implantable electrochemical sensors. This project will combine a biological antiadhesive protein known as 'lubricin' with a novel electrochemically polymerized polymer to create a non-fouling electrochemical sensor that can prevent the performance losses caused by biofouling when exposed to biological fluids (e.g. blood, cerebrial fluid, ect.). In this project, the student develop and validate a biosensor for quantifying the neurotransmitter dopamine and master methods in electrochemistry (e.g. cyclic voltammetry, electrochemical polymerization, impedance spectroscopy, etc.) and gain experience with the quartz crystal microbalance technique.

Project 2: Geologically inspired nanofabrication. This project is inspired by 'pressure solution' (PS); a fundamental 'deformation' and mass transfer mechanism in Geology. At its heart, PS describes the enhanced dissolution rate observed when two minerals are pressed together at high pressure in an electrolyte. This project will harness the pressure solution effect to do 'nanoimprinting lithography' which will create nanopatterned surfaces in glass substrates. This project will involve the development of nanoimprinting methods and apparatuses and provide firsthand experience in atomic force microscopy imaging and surface characterization.





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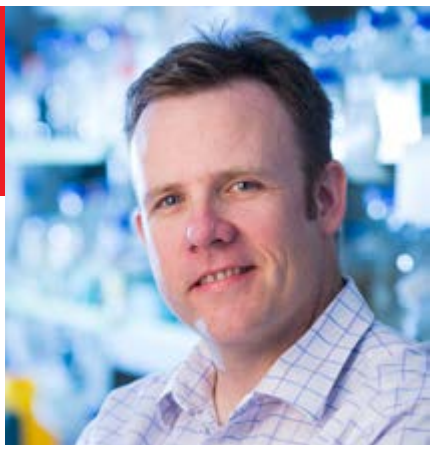
Prof. Conor Hogan
LIMS



- Cyclic voltammetry
- Electrochemiluminescence
- Spectroelectrochemistry
- Electrochemical impedance spectroscopy
- Materials inket printing
- Time-correlated single photon counting
- Photoluminescence spectroscopy

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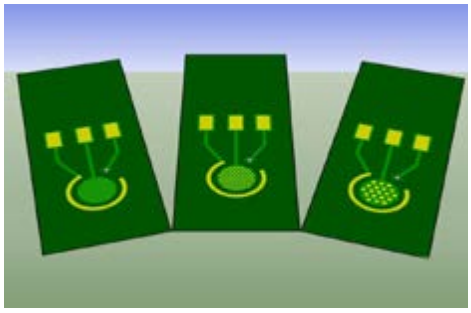
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

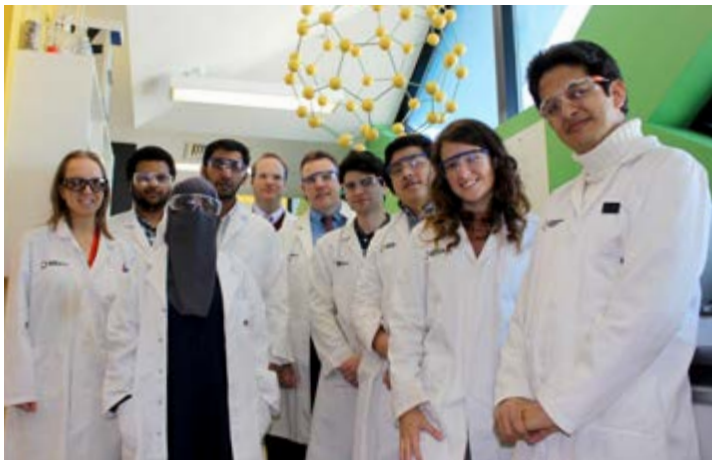


Our group conducts fundamental research to expand the bounds of analytical science, with a focus on electrochemistry and electrochemiluminescence (ECL); and we translate these findings using a multidisciplinary approach into low-cost, miniaturised sensors and devices for health, the environment, and food and beverages.

We are leaders in mobile-phone based sensing, including developing and using Android voltammetry to measure analytes of interest to industry. We are producing our own sensors using materials printing, and laser cutting and engraving.

We also pioneer new approaches to detection science using ECL, which combines electrochemistry and photochemistry. Our work includes developing and characterising new ECL materials to enable sensing in whole blood, and of multiple analytes at the same time; optimising conditions so that we can detect exquisitely low analyte concentrations within and outside of laboratory settings; and exploring a new approach to detecting analytes through an emerging technique known as bipolar ECL.

Building on our fundamental science, we seek to develop novel sensing technologies and miniaturised instruments for use at point-of-need. The development of simple, inexpensive (yet quantitative) sensors has the potential make (bio) chemical analysis widely available. Such technology would be transformational for health, agriculture, industry and the environment.



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A/Prof. Yuning Hong
LIMS

Available for Industry placement

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Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

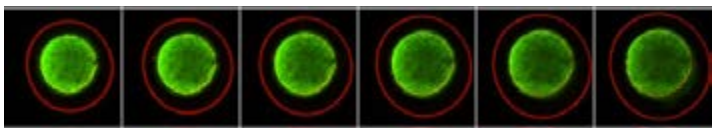
- Chemical synthesis - organic
- Flow cytometry
- Cell culture - eukaryotes incl. primary & cell lines
- Confocal & super resolution fluorescence microscopy
- Protein biochemistry (SDS-PAGE, western blotting)

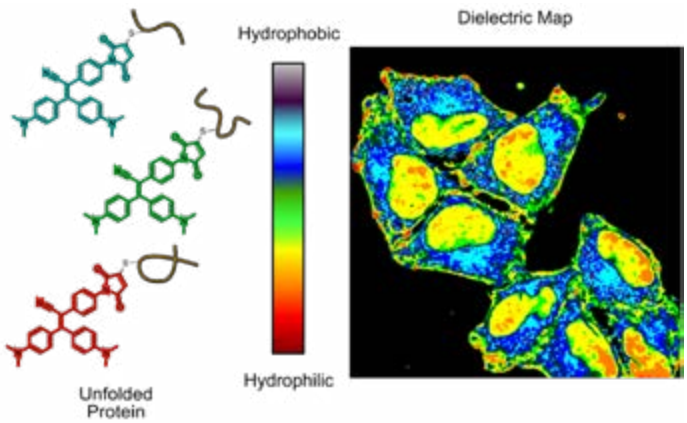
Our Group develops novel chemical compounds, usually with interesting fluorescent behaviors, to study how proteins changes in live cells under drug treatment and in cell models of Parkinson's, Huntington's and Motor Neuron Diseases. The molecules we create can selectively turn on their fluorescence or change their colors in response to subtle changes such as protein misfolding, modifications and degradation. Some of them can also allow us to enrich proteins that undergo abnormal changes from the entire proteome and serve as biomarkers for disease diagnosis and potentially targets for disease treatment.

If you love both chemistry and biology and couldn't decide which discipline you want to go, come and join us. In our group, you can design and synthesize your own fluorescent dyes and use them in live cells and even in zebrafish models to reveal hidden molecular level mechanisms related to protein quality control, stress response and cell survival.

Project 1. Develop novel autophagy sensors (two projects with different focuses). Autophagy ("self-eating") is a cellular housekeeping process in which unwanted components are identified, degraded, and recycled. As autophagy is a multi-step, dynamic process, current tools based on transfecting fluorescent proteins have many disadvantages. In this project, chemical probes that can selectively target autophagy marker proteins will be developed (synthesis). Their interaction with model marker proteins will be investigated (potentially protein expression, purification, and biophysics). Next, we will use these probes to visualize and quantify different stages of autophagy (cell culture, confocal microscopy and flow cytometry). Further to that will be the applications in neurodegenerative disease models in collaboration with Dr Sarah Annesley and Prof Paul Fisher in MAPP, and in zebrafish models with Dr Seb Dworkin in MAPP.

Project 2. Synthesis of orthogonal targeting chemical probes for misfolded proteins. Proteostasis is a housekeeping process cells undertake to maintain the proper folding and functions of proteins. Collapse of proteostasis capacity has been linked to many neurodegenerative diseases such as Huntington's, Alzheimer's and Motor Neuron Diseases. To monitor the effectiveness of the proteostasis machinery in cells, our strategy is to measure the change of certain amino acid exposure or modifications using novel fluorescent probes (synthesis). Their selectivity towards folded, misfolded, and aggregated proteins will be tested (photophysics, biophysics), followed by testing them in the complex cellular environment (cell culture, confocal microscopy and flow cytometry. Further to that will be in conjunction with mass spectrometry proteomics to identify proteins labelled by collaborating with A/Prof David Greening in Baker/LIMS.





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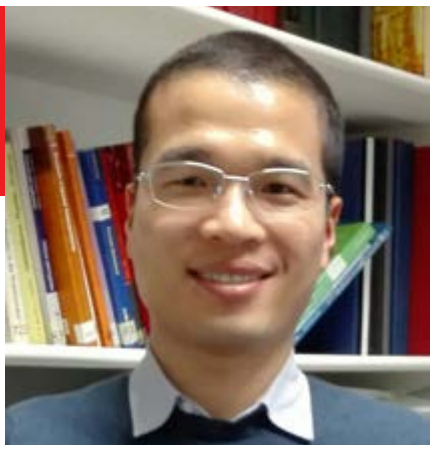
Dr. Wenyi Li
LIMS

Available for Industry placement



Chemical synthesis - organic

Biophysical characterisation of materials

Cell culture - eukaryotes incl. primary & cell lines

Cell culture - prokaryotes

Mass spectrometry

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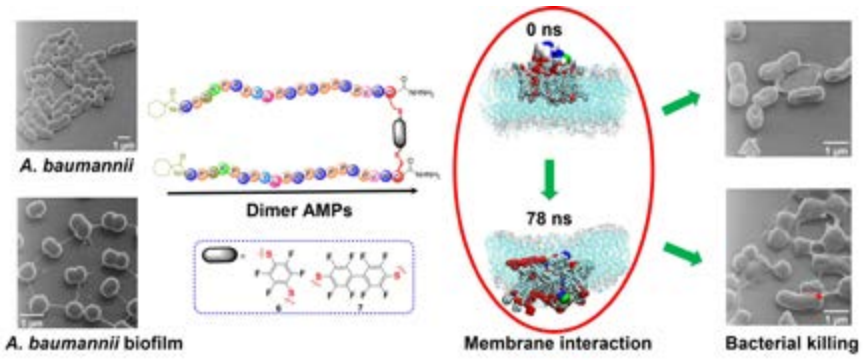
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Antimicrobial resistance has become a growing concern due to the potential lethality of infections caused by resistant bacteria. To address this problem, Dr Li's research focuses on the use of antimicrobial peptides (AMPs), which are part of the host's natural defense system and have potent antimicrobial activity with a reduced tendency to induce resistance. The goal is to develop novel alternative antibiotics by chemically modifying AMPs to enhance their effectiveness and result in significant conformational changes.

Several promising native AMPs, including Chex1-Arg20, pardaxin, and magainin, have been identified, but their stability and strong haemolytic activity make them challenging to translate and apply pharmacologically. Therefore, the research group aims to investigate the activity of these AMPs and chemically modify them to enhance their potency against pathogenic bacteria.

Project 1: Antimicrobial peptide multimerization. This project involves the multimerization of AMPs to confer improved properties on other AMPs by enhancing their cationic charge and improving their interaction with bacterial membranes. The research team has developed a series of new dimeric AMPs to target WHO priority critical Gram-negative bacterial pathogens, such as A. baumannii and its multi-drug-resistant strain. They plan to prepare analogues of selected peptides and screen several bifunctional linkers to determine the general applicability of this method.



Project 2: Preparing antimicrobial peptide-antibiotic conjugates. The second project aims to prepare antimicrobial peptide-antibiotic conjugates to contend with multi-drug-resistant bacteria by using combinations of conventional antibiotics with AMPs. The research team will use different linker and conjugation approaches to enhance the bioactivity of AMPs and investigate their mode of action. These approaches can be achieved through total solid-phase synthesis or in solution via a variety of bimolecular reactions.

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Prof. Adam Mechler
LIMS

Available for Industry placement

Atomic force microscopy

Biophysical characterisation of materials

Mass spectrometry

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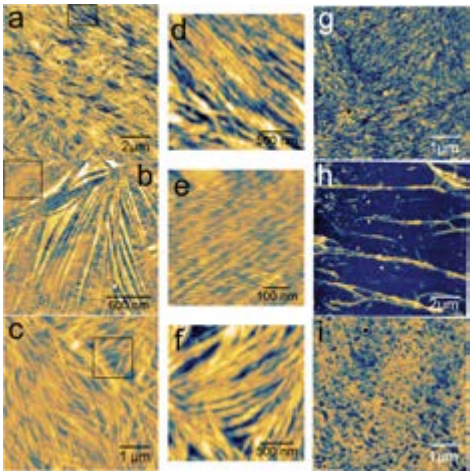
Website: click here

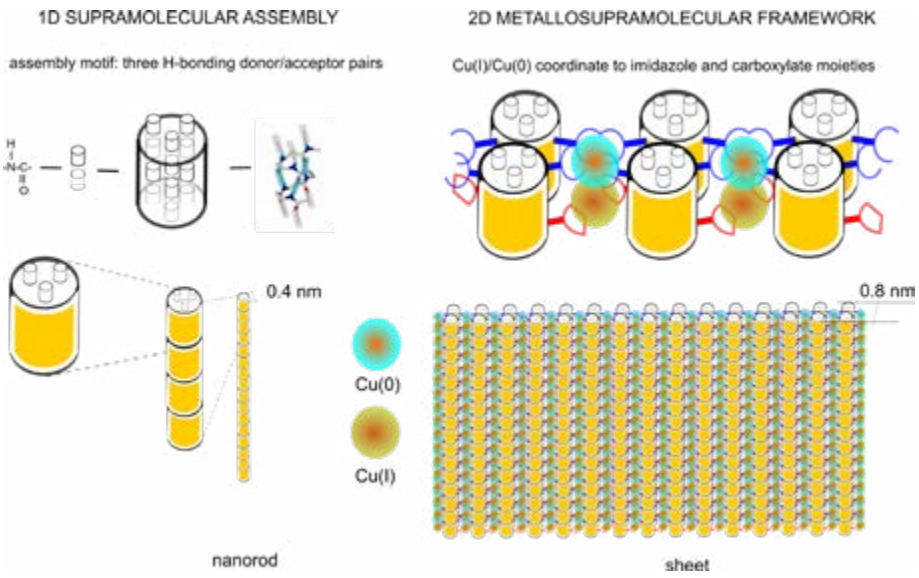
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

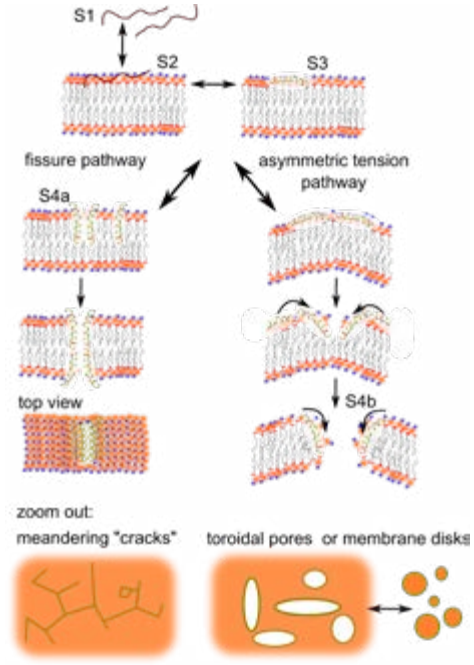
We study the interactions between molecules that lead to a range of phenomena from the simple, such as aggregation of small particles in a solvent, to the highly complex, such as the formation of cell membranes, protein folding and the self-assembly of biomolecular machines. The spontaneous assembly of complex nano-to-microstructures from small molecule precursors opens up new horizons in designing molecular processes, leading to e.g. pharmacological strategies that target bacteria and viruses with molecular "smart bullets", or self-assembling molecular electronics. The future of nanobiotechnology is underpinned by this research.

Projects include:

- Physical chemistry of biomolecule interactions, such as structure of cell membranes,
- Membrane disrupting antibiotic/ antiviral/antifungal peptides,
- Design of bioinspired molecular LEGO systems to create functional nanomaterials or devices.







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A/Prof. Evan Robertson
LIMS

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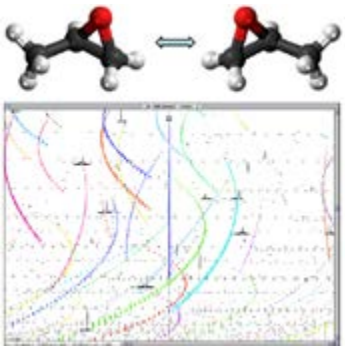
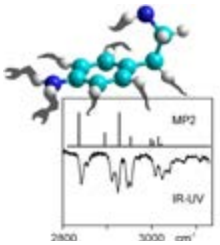
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

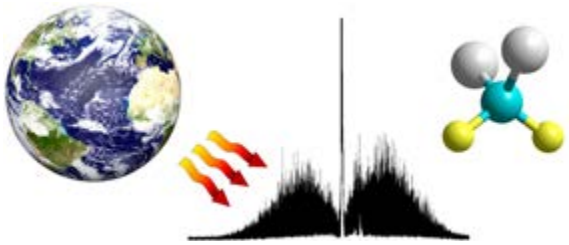
- IR spectroscopy
- Molecular modelling
- Raman spectroscopy
- Pulsed ns lasers
- Electronics

We exploit powerful light sources such as infrared, visible and ultraviolet lasers, or the Australian Synchrotron's infrared beamline to study molecules relevant to pharmaceutics, atmospheres and astrochemistry. Life on earth is intrinsically chiral. In the building block molecules such as proteins and sugars, "left-handed" or "right-handed" forms are possible, but only one one type is found and the reason for this choice remains unclear. Astrochemistry may well play a role and yet amongst the 200 molecules detected in the interstellar medium outside our solar system to date, propylene oxide is the only one that is chiral. We are undertaking work to increase understanding of its' spectral properties in the crucial microwave region used for detection. Other work is aimed at finding other chiral molecules in space and identifying the molecules responsible for thousands of unidentified absorption lines measured by radioastronomy.

The absorption of infrared radiation by greenhouse gases in the atmosphere is at the heart of human induced climate change. Some of our research into fluorocarbons has revealed the fine details that may be used to efficiently model the complex pattern of IR absorption within the atmospheric greenhouse window.







Aerosols also play a key role in our atmosphere, affecting the climate both directly through absorption and reflection of light, and indirectly by hosting chemical reactions and influencing cloud formation. A specialised cooling cell with unique capabilities at the Australian synchrotron's IR beamline enabled us to measure the first far IR spectra of water ice nanoparticles.

The conformational shape of biological molecules, and their interactions with the surrounding environment including water molecules are critical to their functioning. Laser-based gas phase spectroscopy combined with appropriate computer modelling generates precise structural information on molecules such as neurotransmitters that provide a rigorous platform for understanding their behaviour and ultimately, rationalizing drug design. The resonant two photon ionisation technique allows electronic and IR spectra to be measured for molecules cooled to a few Kelvin. This results in beautiful, simplified spectra that can be interpreted to reveal the preferred shapes of molecules and how strongly they interact via hydrogen bonding with water.

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Dr. Saimon M. Silva
LIMS

Available for Industry placement

- Analytical chemistry
- Electrochemical sensing
- Sensors & Biosensors
- Point-of-care diagnostics

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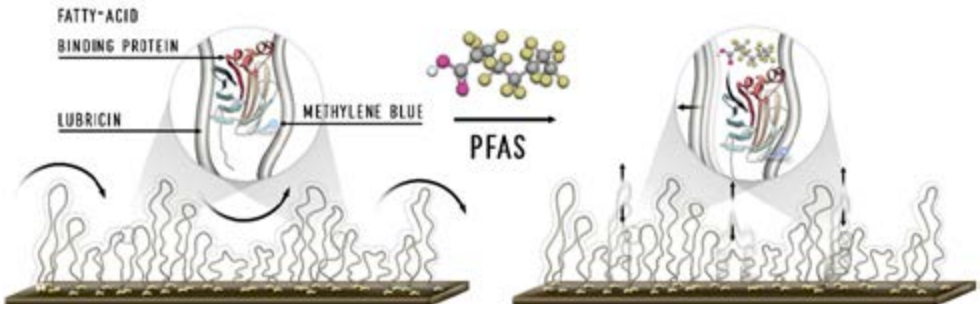
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**



Our research group is highly interdisciplinary and strongly focuses on translational research. We build new smart materials and interfaces for application in sensors and biosensors to detect molecules of biological, medical, and environmental interest. Our main areas of expertise are electrochemistry, analytical chemistry, surface modification, and synthesis of nanomaterials and biomaterials.

Project 1. Point-of-care sensors for cancer diagnostics and monitoring. Blood-based cancer biomarkers represent a range of promising diagnostic analytes for the early detection and surveillance of cancer. Current detection approaches involving serology protein-based assays and circulating tumour DNA tests rely upon an intravenous blood draw, sample processing, and testing requiring a specialised laboratory setting. This project aims to advance the development of next-generation cancer biomarker detection for on-spot detection of cancer analytes using rapid and inexpensive portable electrochemical biosensors. This is expected to provide significant benefits for cancer patients, especially in remote locations, where surveillance methods can be limited and expensive for early detection of cancer and monitoring of disease recurrence during treatment.

Project 2. Chemical contaminated water: biosensors for rapid, on-the-spot detection. This project aims to develop a versatile biosensor system for rapid on-site detection and monitoring of toxic per- and poly-fluoroalkyl substances (PFAS) in contaminated waterways. PFAS are also known as the 'forever chemicals' and have become a major environmental pollutant that threatens human and ecological health; in Australia PFAS contamination is prevalent in both urban and rural areas, and all Australians are expected to have detectable levels of toxic PFAS in their blood. Current conventional PFAS detection methods rely on sample collection and transport to a centralized laboratory, which is expensive and time-consuming. Thus, there is a need for low-cost portable sensors for the on-spot monitoring of PFAS. In order to achieve specific molecular recognition for PFAS detection, this project will employ protein-based surface chemistries, where fatty-acid binding proteins will be used as the PFAS recognition elements. The produced electrode surfaces will be fully characterized and analytically challenged in 'real-world' contaminated water samples.

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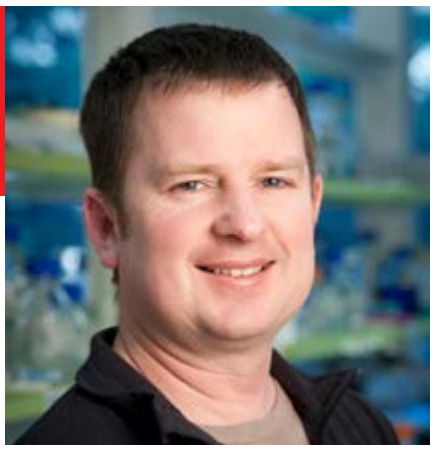
A/Prof. David Wilson
LIMS



Computational chemistry

Molecular modelling (computational incl. AI)

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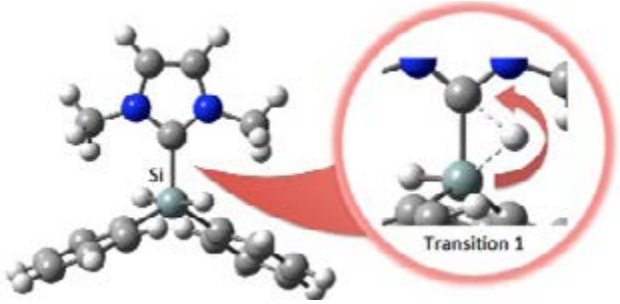
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Our group "does chemistry by computer" to understand the structures and properties of molecules and how they react. We focus on the chemistry of important molecules, molecules with unusual bonding environments, and the prediction of new and novel chemistry.

Project 1. Predicting new chemistry and probing novel bonding environments. Our group has a track record of proposing seminal main-group molecules that are inherently unstable but can be stabilized by ligands. We also proposed new covalent metal-metal bonds such as Be-Be and Be-Mg, which have subsequently been reported in Science and elsewhere. These metal-metal bonds are fascinating – they have properties of both covalent and metallic bonds. There are current projects focused on (i) beryllium chemistry and novel metal-metal bonding, (ii) designing new and novel carbene ligands, and (iii) coordination compounds, including using carbon as a ligand.

Project 2. Modelling reaction mechanisms to understand critical reactivity. There are several projects, such as the involvement of PhICl2 in catalysing organic reactions or reactions of borole rings with unsaturated molecules.

Project 3. Making new tools for modelling chemistry. We develop new basis sets for use in molecular modelling, to ensure people can accurately model the entire periodic table!



Project 4. Luminescent materials. The development of light-emitting diodes (LEDs) and sensors is a hot topic, for which metal-based (eg. iridium, ruthenium) materials and boron-doped PAHs are ideal targets. These are purely computational projects that are sometimes in collaboration with experimentalists including Prof Gilliard (MIT), Prof Francis (Deakin), Prof Hogan, and A/Prof Barnard. We model luminescence, in addition to UV-Vis spectra, MOs, and redox properties. Boron-doped systems often have unique radical character that is fascinating to model.

Project 5. High-accuracy energetics and properties. Focused on accurate energies and properties where we can push the limits of computational chemistry methods and supercomputers. We can produce results as good as, and sometimes better than experiment! We recently demonstrated how to calculate the shielding of H2 to within 0.001 ppm of experiment, and extended the 19F scale by 800 ppm! Projects include (i) NMR shielding including 19F, 9Be, and 15N, (iii) development and/or testing of new basis sets, and (iv) assessing the anharmonicity of N-F bonds and its impact on molecular properties.

Project 6. Using machine learning in chemistry. This is a new field that is rapidly developing – using computer fitting to speed up analysis in areas such as drug design and materials design. For a student with python experience, this would represent a challenging yet rewarding project.

All students develop an advanced understanding of chemical structure and reactivity, develop enhanced analysis, and problem-solving skills.

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Microbiology

Dr. Sarah Annesley
Bundoora

Available for Industry placement

- Live cell metabolism assays (Seahorse)
- Cell culture - eukaryotes, incl. primary & cell lines
- Cell culture - prokaryotes
- Immunoassays
- Gene expression analyses & sequencing
- Molecular cloning
- Protein biochemistry (SDS-PAGE, western blotting)
- Metabolomics

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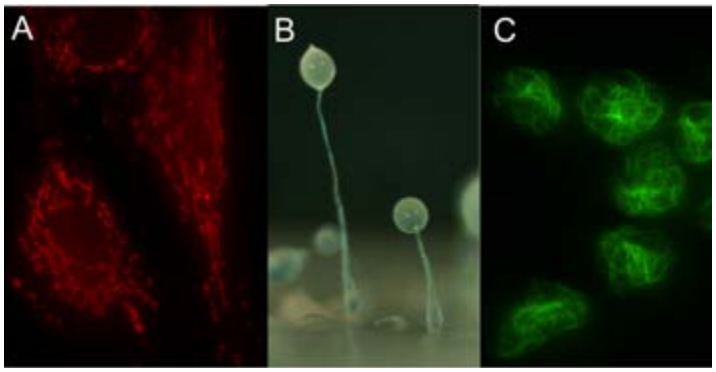
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My laboratory investigates diseases that affect the central nervous system with a particular focus on three main disorders, Parkinson's Disease, Myalgic Encephalomyelitis/ Chronic Fatigue Syndrome (ME/CFS) and Long COVID. Our aim is to characterise these disorders, investigating the mechanisms of the disease process at the cellular and molecular level. We aim to discover how these mechanisms can be manipulated for treatment and to identify biomarkers which can be developed into world-first diagnostic tests.

Project 1. Parkinson's Disease (PD). PD is the second most common neurodegenerative disorder worldwide. Most cases of PD are sporadic with no known genetic cause but a small percentage of patients (5-10%) are due to inherited genetic mutations. We use human cell lines (immortalised blood cells called lymphoblasts) derived from patients with sporadic and genetic forms of PD. Our main objectives are to increase our understanding of the underlying disease mechanisms and pathways, identify biomarkers of the disease and identify patients early in the disease process prior to clinical diagnosis. We do this via analysing mitochondrial and lysosomal function, activity levels of proteins, measurement of calcium responses and analysis of gene expression changes.



Project 2. Myalgic Encephalomyelitis/ Chronic Fatigue Syndrome (ME/CFS). ME/CFS is a debilitating chronic condition characterised by a disabling fatigue and a post-exertional malaise which is a worsening of symptoms after a mental or physical exertion. The disease is triggered by a range of bodily insults, most commonly a viral infection. Currently there is no cure and no clear treatments or diagnostic tests are available. Using lymphoblasts generated from ME/CFS patients we have identified clear defects in energy production and in the activities and expression levels of key proteins involved in energy production. Using patient lymphocytes, lymphoblasts and fibroblasts we are now working to further characterise these defects, understand disease mechanisms, identify disease biomarkers and develop a diagnostic test.

Project 3. Long COVID. Beyond the immediate acute effects of the virus responsible for the COVID-19 pandemic a large number of people are experiencing ongoing symptoms many weeks and months beyond the original infection. The illness afflicting these patients is termed Long COVID and it shares many similarities with ME/CFS. Our laboratory has begun to investigate the similarities and differences between the two disease cohorts, identify biomarkers of Long COVID and use these to identify which post-COVID patients are likely to go on and develop Long COVID.

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Dr. Sean Bay
Bundoora

Available for Industry placement

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Website: click here

- Field work
- Ecological assays
- Gene expression analyses (PCR assays)
- Bioinformatics & spatial modelling
- Radioisotope analysis
- Soil physicochemical analysis
- Gas chromatography
- LiDAR scanning

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

We advance research on the microbial ecology of terrestrial and aquatic ecosystems, tackling global challenges including environmental degradation, food security, and climate change. We mentor future leaders and scientists in an inclusive and collaborative setting that fosters innovation and a deeper understanding of complex systems.

Project 1: Cave primary production. Investigate how photo-and chemosynthetic primary production strategies interact along gradients of light. This project investigates how bacteria aquire energy and carbon in subterranean habitats, from the light-filled entrance to the deep, dark regions. This study will also look at how artificial light in show-caves influences the growth of photosynthetic biofilm and lampenflora. You will collect samples and learn about techniques in meta genomics, bioinformatics, gas chromatography, and isotope studies. Our discoveries will shed light on the carbon cycle and the effects of climate change on subterranean ecosystems.

Project 2. Atmospheric energy for growth and survival Investigate the activity and biogeographic distribution of cave methanotrophs. The goal of this project is to look into the distribution and functional role of bacteria in cave ecosystems that use atmospheric methane to survive and grow. Studies have discovered that these bacteria are abundant in caves, but the ecological factors that influence their assembly process and metabolic activity remain poorly understood. You will collect samples and learn methods in spatial ecology, 16S amplicon sequencing, metagenomics, bioinformatics, and gas chromatography. This study will shed light on the critical role that caves play in mitigating the consequences of climate change by functioning as carbon sinks for potent greenhouse gases, such as methane.

Project 3. The cave environment. Investigate the geospatial, environmental, and geochemical characteristics of volcanic and limestone caves. The goal of this project is to develop a precise map of cave morphology while also measuring microclimate, atmospheric turnover, and physiochemistry in order to identify the spatial extent, volume, and subterranean redox environment. This data will inform sampling designs and build taxonomic and functional distribution models to understand drivers of microbial assembly and activity. You will collect samples, and learn skills in GIS, LiDAR, spatial ecology and bioinformatics. This study has the potential to provide valuable insights into the contribution of caves to global nutrient budgets. This knowledge is crucial for managing ecosystem health and mitigating the negative impacts of climate change.

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A/Prof. Karla Helbig
Bundoora

Available for Industry placement

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Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Feb**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

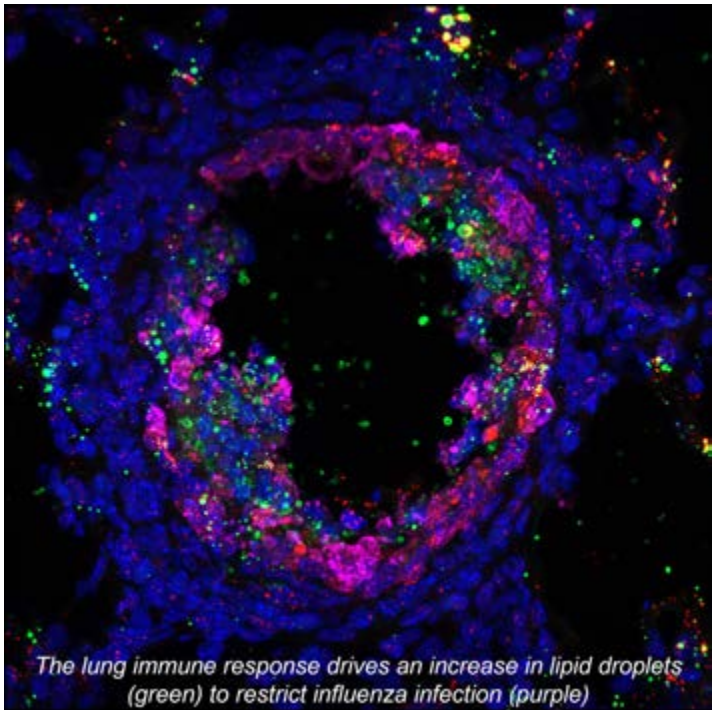
- Cell culture - eukaryotes incl. primary & cell lines
- Cell culture - prokaryotes
- Animal handling
- Animal models of disease
- Gene expression analyses
- Cell transfection
- Microscopy - confocal & super resolution
- Molecular cloning

Viruses infect all living organisms, and our laboratory studies the early host response to viral infections in humans, and other mammalian and non-mammalian animal hosts, such as abalone. Specifically, we are interested in the role of antiviral cytokines called interferons, and how they orchestrate and control the host anti-viral response.

Our team uses advanced imaging, molecular, and genomic techniques to examine the cellular and molecular mechanisms of the host response to viral infection. Our research aims to better understand how host cells control viral infection, and use this information to development novel strategies to combat viral infection in both humans and animals. Currently our projects centre around two main themes:

Theme 1: Understanding the role of lipid droplets in driving viral clearance from host cells. Our group has recently shown that lipid droplets are upregulated very rapidly following viral infection of a cell, and that these lipid droplets drive heightened expression of antiviral cytokines. Projects in this theme use viruses such as Zika virus, influenza and dengue virus to understand the role of lipid droplets in both infections of the lung and the brain.

Theme 2: Can we protect abalone against lethal Herpesvirus infection? Australian abalone are very susceptible to abalone herpesvirus and our group work together with abalone farmers in Victoria to develop novel solutions to protect these animals against viral infection. We work both with abalone housed in our laboratory as well as farmed abalone. Projects in this theme will investigate basic mechanisms that underpin abalone resistance and susceptibility to viruses, using live animal models of viral infection.



The lung immune response drives an increase in lipid droplets (green) to restrict influenza infection (purple)

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A/Prof. Ashley Mansell
Bundoora

Available for Industry placement

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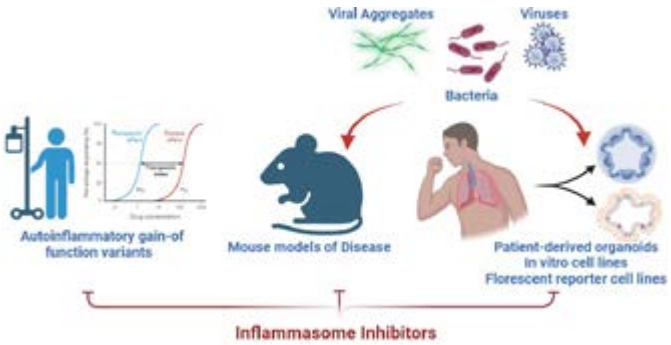
Website: click here

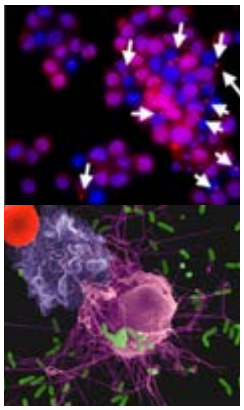
- Animal models of disease
- Cell culture - eukaryotes, incl. primary & cell lines
- Cell transfection
- 3D cell culture
- Histology & Immunoassays
- Live cell metabolism assays (Seahorse)
- Microscopy - electron, confocal & super resolution
- Protein biochemistry (SDS-PAGE, western blotting)

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Either**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Have you ever wondered why seasonal influenza usually only makes us mildly sick, while avian influenza has a mortality rate exceeding 40%? Or why SARS-CoV-2 caused severe lung pathology, while previous coronaviruses typically resulted in mild colds? The key to these questions lies in the body's innate immune response and the role of inflammasomes in driving disease severity.

Innate immunity is the body's first line of defense against infections and injuries, providing an immediate response to pathogens and stress. A key component of innate immunity is the inflammasome, a multiprotein complex that detects pathogenic microorganisms and stress signals. Excessive or dysregulated inflammasome activation is associated with infections, pulmonary, neurodegenerative, cardiovascular, metabolic, and gastrointestinal diseases. Our team uses novel animal and in vitro infection models, advanced imaging, and cellular and molecular biology techniques to understand the mechanisms of innate immunity and inflammasome activation. Based on these discoveries, we are also developing new therapies for infectious diseases, autoimmune disorders, and chronic inflammatory conditions, highlighting their fundamental role in maintaining health and combating disease.





Theme 1: Viral Aggregates Activate Inflammasome Complexes and Drive Disease Severity. Recent research has identified that certain viruses, such as pathogenic influenza strains, SARS-CoV-2, and Hendra virus, produce aggregated viral proteins when they infect human cells. These viral aggregates activate the NLRP3 inflammasome, a critical component of the innate immune system. The activation of the NLRP3 inflammasome leads to the production of excessive inflammatory cytokines, which drive the severity of the disease. This project aims to examine and characterize viral aggregates and their role in activating the inflammasome complex, molecular mapping these aggregates to identify emerging pathogenic viral strains and target the inflammasome to identify novel therapies.

Theme 2: The Role of the NLRP1 Inflammasome in Innate Immunity. The role of NLRP1 in human disease has only recently become clearer due to a lack of identified agonists, limited expression and activation in immune cells, and poor conservation between humans and rodents. This theme will characterise recently identified patient-derived human variants of NLRP1, investigate the role of NLRP1 in responding to infections by Dengue, Zika, Herpes, and influenza viruses, and characterize the world's first "humanised" NLRP1 mouse. Additionally, it will explore targeting NLRP1-induced inflammation with the world's only NLRP1 inhibitor, and to develop anti-NLRP1 therapeutic strategies.

Theme 3: Innate Immune Immunometabolism. Immunometabolism describes the interplay between immunological and metabolic processes, which are critical to the immediate innate immune response to infection. We have previously identified a critical role for the immune modulator STAT3 in regulating the immunometabolic programming of macrophage mitochondria. This theme will expand on these earlier studies to understand the mechanisms of action of mitochondrial STAT3 and its regulation of mitochondrial respiration.

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Dr. Katelyn Mroczek
Bundoora

Available for Industry placement

E-mail: k.mroczek@latrobe.edu.au
Website: click here

Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Pedagogy
- Qualitative analysis
- Animation
- Scientific Illustration
- Interviewing

I'm motivated to create resources to help students understand core microbiological concepts by representing them in different ways. By understanding how students learn, we can design for learning and create content to promote student success. I'm interested in using technology such as animations and illustration software to supplement lectures and reinforce understanding of concepts for practical classes.

Project 1: Design and evaluate the use of technology, such as scientific illustrations and/or animation software to enhance student learning of core concepts. This project will aim to create educational resources to increase understanding of essential knowledge in microbiology.

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Dr. Steve Petrovski
Bundoora

Available for Industry placement

- Microscopy - light & electron (TEM, SEM)
- Gene expression analyses (PCR assays)
- Bacterial overexpression of proteins
- Cell transfection
- Bioinformatics
- Molecular cloning incl. CRISPR-Cas9 editing
- Genetic sequencing

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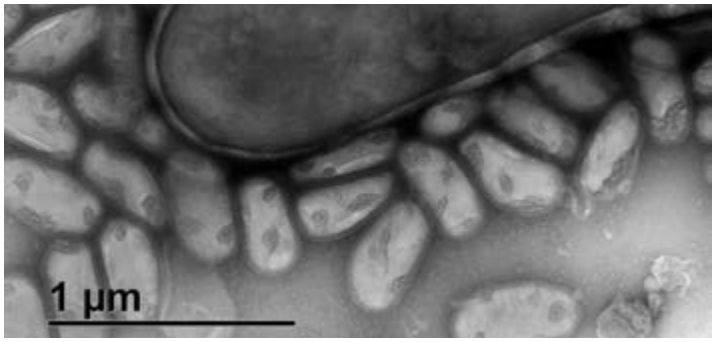
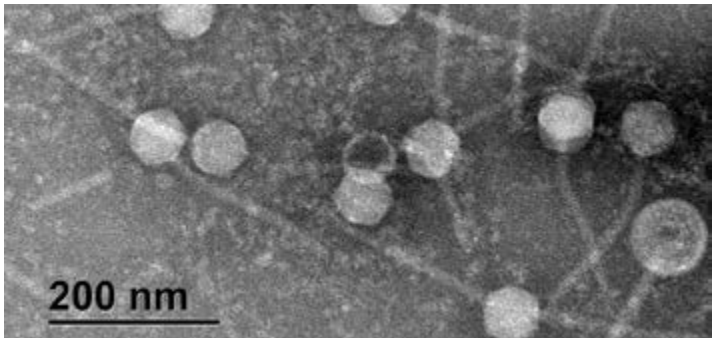
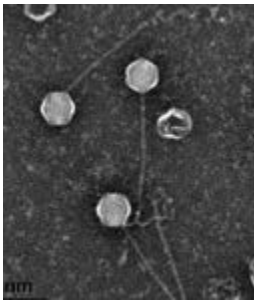
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**





Horizontal gene transfer (HGT) is the mechanism of gene-swapping and genetic exchange between bacteria. HGT provides opportunities for bacteria to evolve over long and short timespans. The best-known contribution of HGT has been the rapid dissemination of numerous antimicrobial-resistance determinants amongst diverse, clinically significant, bacterial species, a situation that now threatens the usefulness of antimicrobials in the treatment of bacterial infections. Plasmids, transposons and bacteriophages are vital components of HGT and are the subjects of our research.

Our research group uses a range of techniques including molecular genetic techniques, transmission electron microscopy, next generation sequencing, microbiological techniques to understand molecular mechanisms involved in HGT and ways to prevent the dissemination of antimicrobial resistance genes. Biocontrol of recalcitrant bacterial species in both clinical and environmental settings are investigated using phages and parasitic bacteria. We screen and isolate phages that specifically infect bacteria responsible for topical infections and organisms implicated in operational problems in wastewater treatment plants. These phages are used in the development of novel products that can be used to treat clinical infections or environmental problems. We have also started to isolate parasitic bacteria that are able to lyse their host as phages are able to do. We are interested in the bacterial interactions with the parasite and ways we can manipulate their growth to solve environmental problems.



Project 1. Characterisation of bacteriophage and understanding their interactions with host bacteria. Bacteriophages can lyse their host bacteria and this can be a useful tool in controlling the proliferation of its host in different settings. This project area will involve the isolation and characterisation phages and their use in biocontrol of phage therapy.

Project 2. Fertility inhibition of IncP plasmids using the fipB locus. Plasmids that belong to the IncP family are broad host range and transfer at high frequency to many different bacterial species disseminating antimicrobial resistance genes. The expression of three genes from another plasmid within a cell reduces the transfer of the IncP plasmids. This project will investigate the molecular mechanism involved in the inhibition of plasmid transfer.

Project 3. Investigation of growth kinetics of M. amalyticus. M. amayticus is a novel parasitic bacterium that has the ability to lyse its host bacterium. M. amalyticus has the ability to lyse at least 20 different bacterial strains. This project will investigate the similarities and differences on the diverse host strains.

Other projects are available but you will need to speak with Steve.

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Dr. Jennifer Wood
Bundoora

Ecological assays

Field work

Next generation sequencing

Bioinformatics

Gene expression analyses (PCR, qPCR)

E-mail: jen.wood@latrobe.edu.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Our research group advances holistic approaches to restoration, agriculture, and conservation by investigating microbial communities and their functional traits. These traits aid microbial survival and significantly impact ecosystem health. Using cutting-edge Omics technologies and environmental measures, we explore the ecology and function of microbiomes associated with soil, plants, animals, and overall ecosystem health. Our work shapes sustainable practices and develops real-world solutions for pressing environmental challenges.

Project 1: Investigating Soil Health in Agriculture and Urban Agriculture. Current land-use practices have reduced soil organic matter by 20-70% in the top 10 cm of Australian soils, impacting water retention, nutrient availability, and productivity. This project examines soil microbial responses to various organic matter (OM) inputs in a restoration context and in traditional and urban agricultural settings, focusing on inputs with differing carbon-to-nitrogen (C:N) ratios and levels of carbon complexity. By examining microbial activity and community structure in response to different OM inputs, we aim to understand their long-term effects on soil function and develop strategies for restoring and maintaining soil health.

Project 2: Discovering Functional Indicators of Soil Health. Current metrics for measuring soil health are inadequate, leaving a critical gap in our ability to accurately assess and manage soil ecosystems. This project explores novel strategies for evaluating soil health, focusing on developing functional indicators that are meaningful and translatable for farmers and land managers. By examining innovative metrics such as DNA and RNA ratios, microbial activity, and alternative methods for measuring soil organic matter, we seek to provide a comprehensive understanding of soil health and support sustainable agricultural practices.

Project 3: Microbial Indicators of Wetland Health and Resilience. Wetlands are essential for agricultural sustainability and biodiversity, providing crucial ecosystem services such as water filtration, detoxification, nutrient cycling, and carbon and methane sequestration. Our research indicates that wetlands exhibit high metabolic diversity, a potential indicator of their health and ability to provide ecosystem services. This project aims to identify microbial indicators of wetland health and resilience by studying microbial communities and their functional traits across a gradient of wetland states, from pristine to degraded. We will investigate how these communities respond to drought conditions, exacerbated by climate change, and their capacity to reestablish critical functions post-drought. By understanding wetland resilience, we aim to develop strategies to maintain their essential ecosystem services amidst environmental changes.

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Anatomy, Physiology & Pharmacology

Dr. James (Jim) Bell
Bundoora

Cell culture - eukaryotes incl. primary & cell lines

Protein biochemistry (SDS-PAGE, western blotting)

Animal models of disease

Light microscopy

Histology

E-mail: j.bell@latrobe.edu.au
Website: click here

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Cardiac Disease Mechanisms lab seeks to understand the cellular and molecular mechanisms driving heart diseases. We focus on examining the underlying causes and pathological consequences of cardiac rhythm and relaxation irregularities (arrhythmias and diastolic dysfunction respectively) and heart attacks (myocardial infarction), and how these may differ in men and women. The overall goal is to validate novel molecular targets that advance sex-specific preventative therapies for aged and obese populations at risk of developing heart disease.

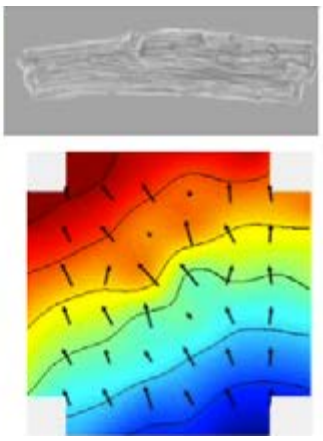
The lab has two primary research themes – specifically, the pathological influence of 'heart fat' as an emerging mediator of heart disease and the role of sex and sex steroids in determining heart health. The fat immediately surrounding the heart increases markedly in obesity, with aging, and post-menopause – all important risk factors for heart disease. We are investigating how the fat interacts with heart muscle to cause cardiac dysfunction and identifying the factors released from the fat (including locally synthesised estrogens) that convey communication between these two neighbouring tissues.

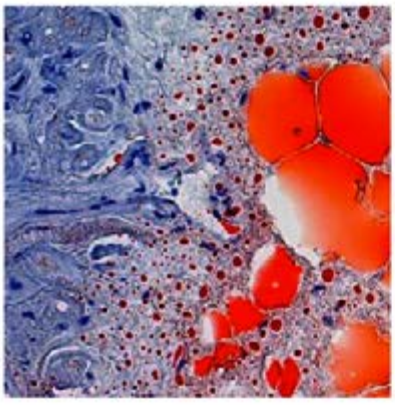
Honours projects include:

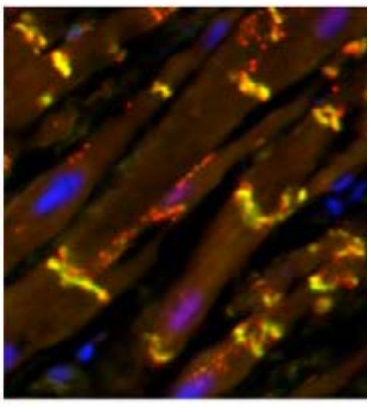
Project 1: Showing how a fatty heart drives cardiac pathologies

Project 2: Understanding the role of locally synthesised steroids in the heart

Our research scope is facilitated through an extensive expertise in in vivo, ex vivo, in vitro and molecular methodologies, and further supported by ongoing pre-clinical/clinical collaborations developed both nationally (University of Melbourne, Macquarie University) and internationally (University of Birmingham, UK).







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Dr. Michael De Silva
Bundoora

- Animal handling
- Animal models of disease
- Animal behaviour studies
- Flow cytometry
- Genetic sequencing & expression analyses
- Histology
- Microscopy - light, confocal & super resolution

E-mail: t.desilva@latrobe.edu.au
Website: click here

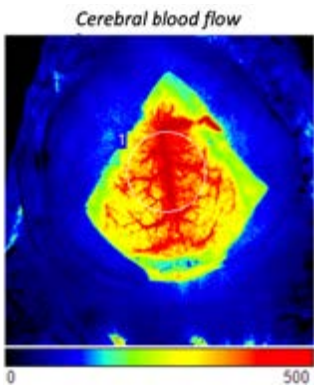
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

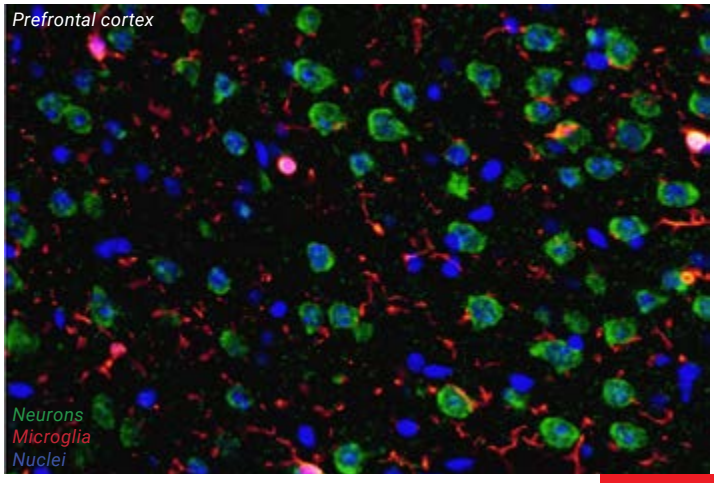
Cerebrovascular diseases (stroke, dementias) are a major health concern in Australia and throughout the world. The brain is and its circulation are particularly sensitive to disease. Cardiovascular diseases disrupt the function of cerebral arteries which leads to a dysregulation of cerebral blood flow. This may lead to altered blood flow to the brain which may starve neurons of the continuous supply of oxygen and other nutrients essential for their function. Insufficient delivery of oxygen and nutrients to the brain is a major factor in neuronal dysfunction and may contribute to the development of cognitive impairment (e.g. loss of memory).

Our research focuses on the effects on cardiovascular diseases (e.g. hypertension, ischaemic stroke, metabolic syndrome) on the brain and its circulation. We utilise animal models of disease as well as state of the art imaging, molecular and behavioural testing techniques to determine the impact of disease on the brain and identify potential targets for therapy.

Project 1. Effect of human amniotic stem cells on brain injury and cognitive function. Cardiovascular diseases (hypertension, metabolic syndrome) are known to promote brain injury and may therefore, result in impairment of cognition. The complex mechanisms that underly these diseases mean that a single therapeutic agent is unlikely to be effective. Human amnion epithelial cells (hAECs) have many properties (eg. anti-inflammatory, antifibrotic, regenerative and immunologically inert) that make them attractive candidates for a cell-based therapy for disease. This project will determine whether hAECs can treat cardiovascular disease-induced brain injury and cognitive impairment.

Project 2. Targeting estrogen signalling to reduce dementia risk. We have found postmenopausal women with hypertension to have the greatest reduction in brain health between ages 60-80. This decline is greater than in groups regarded as "unhealthier" (e.g. males with multiple cardiovascular diseases). Loss of protection by estrogen after menopause is a likely contributor. We have shown that activation of the G protein-coupled estrogen receptor (GPER) is protective in cardiovascular disease models, including hypertension and stroke. Importantly, selective activation of GPER avoids unwanted effects that result from activation of classical estrogen receptors. In this project we will study menopause-accelerated brain atrophy and cognitive decline in female mice with hypertension and if these changes to brain health can be prevented by pharmacological targeting of GPER.





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A/Prof. Seb Dworkin
Bundoora

Available for Industry placement

- Animal handling
- CRISPR-Cas9 gene editing
- Animal models of disease
- Genetic sequencing & expression analyses
- Zebrafish microinjection
- Microscopy - light, confocal & super resolution

E-mail: s.dworkin@latrobe.edu.au
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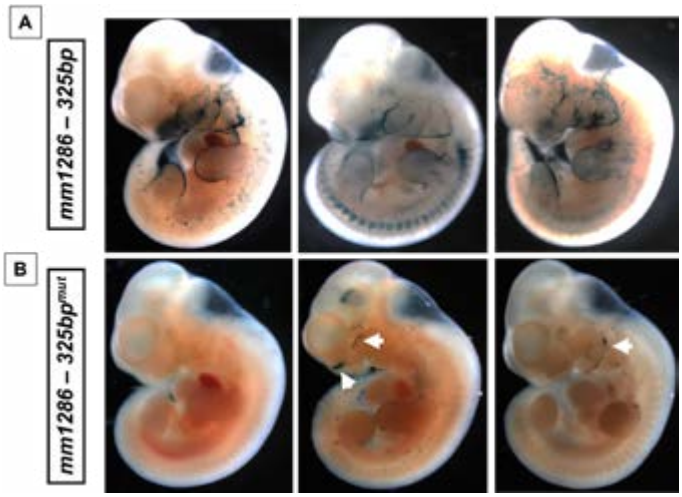
Number of projects: **1 in Feb**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

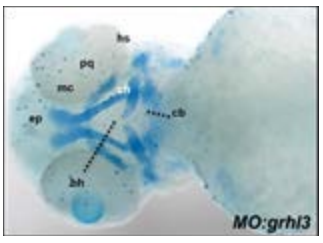
Understanding how a single, fertilised cell develops into an entire, fully functioning baby, is one of the most incredible fundamentals of life. It is also a process across the entire animal kingdom. Amazingly, this process usually works perfectly well - that is, the baby develops without any problems. However, in ~4-5% of cases, things do go wrong, resulting in problems with structure or function in the baby that we term "birth defects".

Understanding the genetic and non-genetic causes of these birth defects is the major focus of my groups' work. In particular, we aim to understand what are the factors that allow for correct formation of the brain, head, face, jaws and skin. In my group we use animal models - zebrafish and mouse - that harbor defined genetic mutations in order to understand how these genes function in regulating development.



Moreover, we are now also using our models to better understand how we can "rescue" birth defects of genetic origin through supplementing the fish water (or mouse diet) with safe bioactive natural product compounds (such as vitamins and plant extracts). Ideally, we hope to discover novel molecules that may be safely given in pregnancy to reduce the incidence or severity of potential birth defects.

The various Honours projects in the lab will involve analysis of zebrafish models to identify the functions of new genes in development, particularly craniofacial development, and will identify novel bioactive compounds to prevent, or reduce, defect severity. Each project will be tailored to individual student backgrounds and interests; a working (minimum 2nd year undergraduate level) knowledge of genetics is essential, and an interest in embryology and developmental biology would be advantageous.



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Dr. Brooke Huuskes
Bundoora

Available for Industry placement

E-mail: b.huuskes@latrobe.edu.au
Website: click here

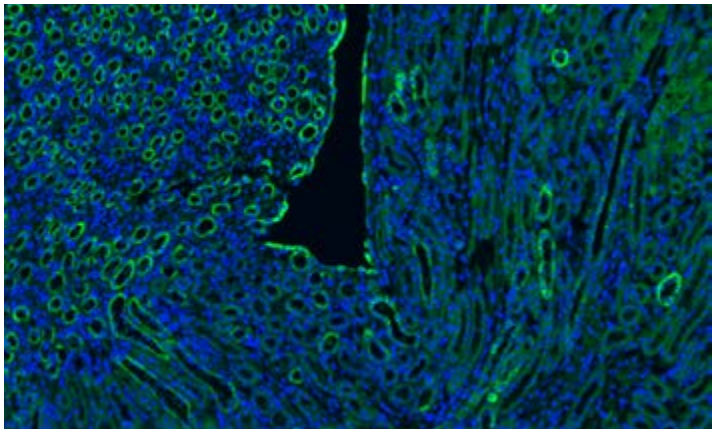
- Cell culture - eukaryotes incl. primary & cell lines
- Gene expression analyses
- Animal models of disease
- Histology
- Animal handling
- Light microscopy

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The mission of the Cardiorenal Division is to lessen the burden of those living with chronic kidney disease (CKD). There is no cure for CKD, which affects more that 10% of the world's population. Current therapies for CKD only slow the progression of disease and a significant number of people progress to end-stage kidney disease requiring either dialysis or kidney transplantation. People on dialysis are more likely to die of a cardiovascular event before getting a transplant, and there is a significant shortage of available organs to be transplanted.

To do this we aim to understand the cellular and molecular mechanisms that cause kidney inflammation and fibrosis in a range of kidney diseases, including in the pathology of hypertension and genetic kidney conditions. By understanding these pathways, new therapeutic strategies can be identified and targeted for patients suffering kidney disease.

We additionally use applied qualitative research methods to perform research priority setting activities and to understand the perspectives of those living with chronic kidney disease. This research helps inform practice and policy for improved patient-centered outcomes.

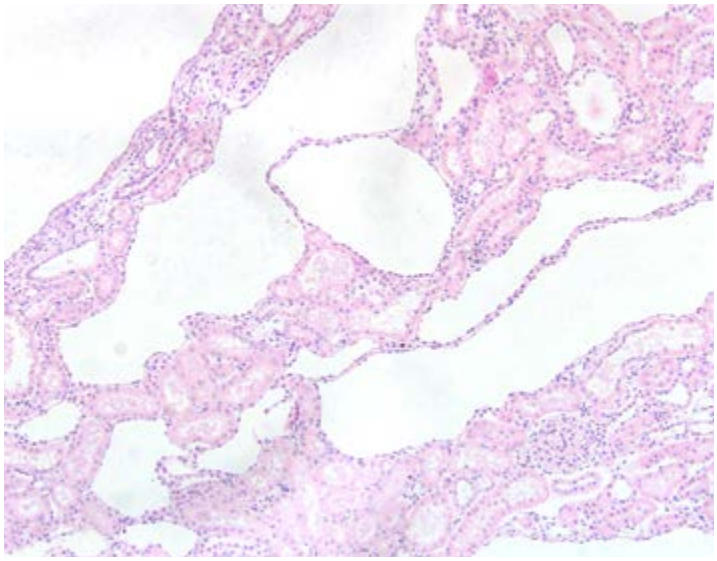


Project 1: Understanding the role of the immune system in polycystic kidney disease

Project 2: Unravel the role of cell death in kidney disease

Project 3: Modeling polycystic kidney disease using zebrafish

Project 4: Research priority setting in xenotransplantation



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Dr. Chris van der Poel
Bundoora

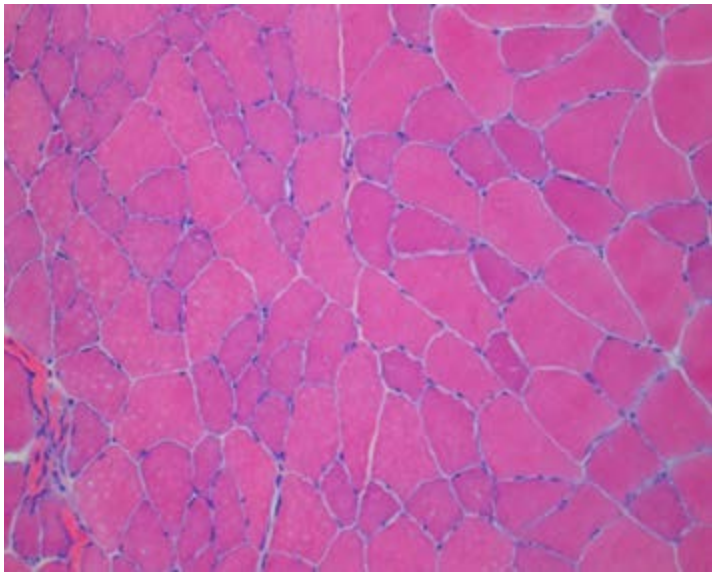
Available for Industry placement

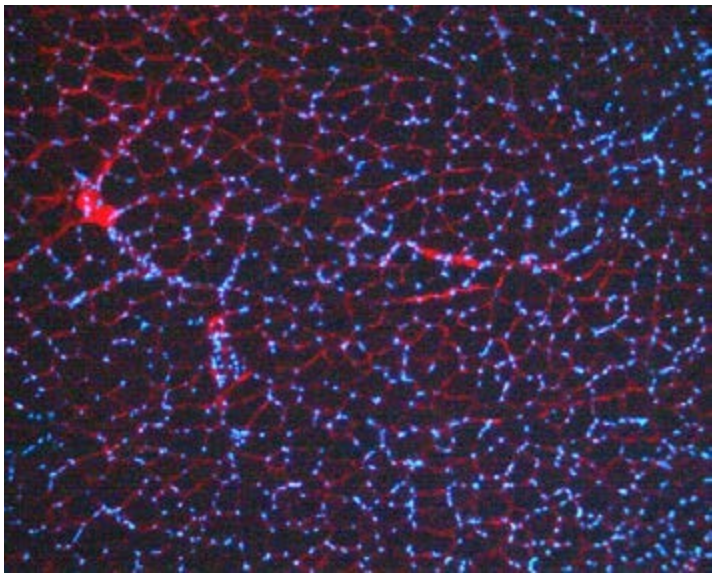
E-mail: c.vanderpoel@latrobe.edu.au
Website: click here

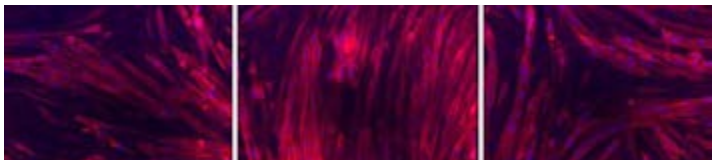
- Animal handling
- Animal models of disease
- Cell culture - eukaryotes incl. primary & cell lines
- Histology & Immunoassays
- Light microscopy
- Gene expression analyses

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The central research theme of our laboratory is the comprehensive exploration of muscle function and repair mechanisms to advance therapeutic interventions and rehabilitation strategies. Our work is particularly focused on improving the regeneration processes of skeletal muscle post injury, which is crucial for athletes, those in physically demanding professions, and patients suffering from muscle-related disorders such as muscular dystrophies and sarcopenia. Additionally, we investigate the impact of pharmacological/ergogenic aids on muscle contraction, adaptation to physical training, and post-injury recovery. By bridging basic muscle biology with applied therapeutic approaches, our research aims to enhance muscle health and performance across various populations, ultimately contributing to faster, more effective rehabilitation and improved quality of life.







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Dr. Maria Jelinic
Bundoora

Available for Industry placement

- Animal handling
- Immunoassays
- Animal models of disease
- PCR assays
- Flow cytometry
- Light microscopy
- Histology

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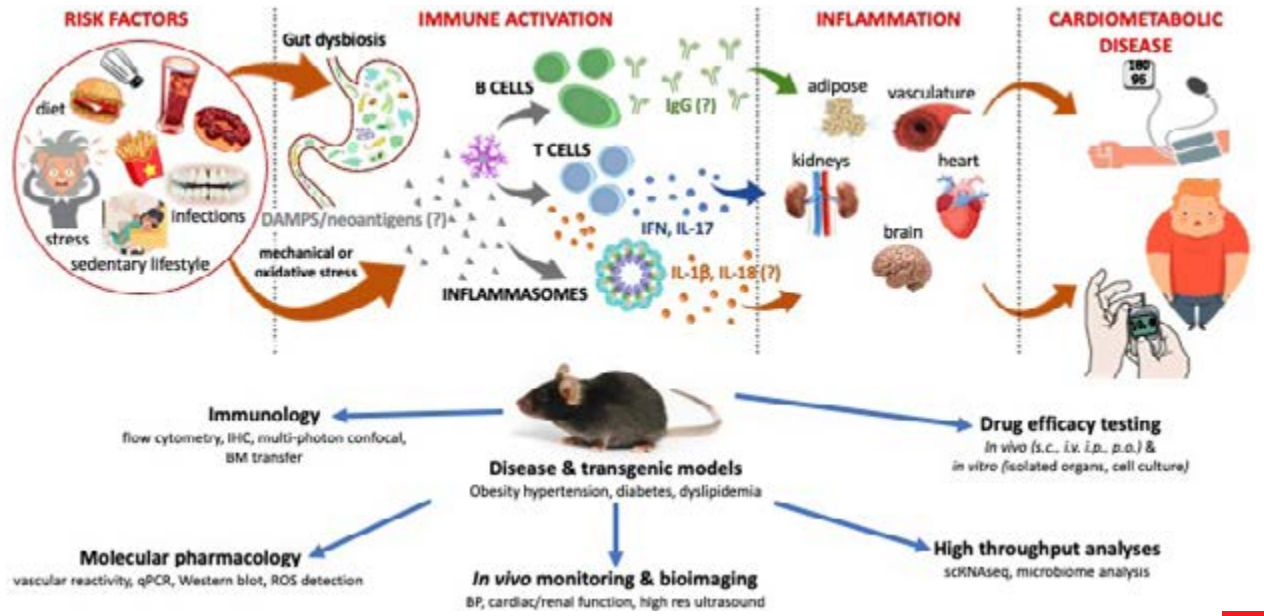
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The Obesity and Diabetes Research Group investigates the mechanisms that drive cardiac, vascular and renal complications in cardiometabolic disease using clinically-relevant rodent models. One limitation the group recently addressed is the sex bias in preclinical studies of cardiometabolic disease. It is well-established that an overwhelming majority of rodent studies in cardiometabolic disease are in males. This is at least partly due to female rodents being highly resistant to weight gain and the development of metabolic disturbances in response to traditional models of cardiometabolic disease. Recently, the Obesity and Diabetes Research group developed a new mouse model of diet-induced metabolic syndrome where weight gain and glycaemic dysregulation are comparable between sexes. This model is now being used by the group (and by collaborators) in several research projects (described next).

Project 1. Comparing the effects of intermittent fasting in metabolic syndrome in males and females. Intermittent fasting is an effective and natural strategy for weight control and reversal of metabolic disturbances such as hyperglycemia, hypertension and dyslipidemia. Many studies have shown these beneficial effects of intermittent fasting in the setting of metabolic syndrome, but very few studies have considered the effect of sex. Considering that there are major sexual dimorphisms in the presentation and progression effects of intermittent fasting in male and female mice with metabolic syndrome to determine whether this therapeutic lifestyle intervention has any sex-specific effects.

Project 2: Characterising a new mouse model of atherosclerosis. Atherosclerosis is one of the leading causes of death worldwide, but is difficult to treat pharmacologically due to a poor understanding of the molecular mechanisms that contribute to disease progression. One factor that has limited our progress in understanding is that many of the animal models to date do not accurately reflect the clinical presentation of patients. This honours project would directly address this gap in the field by characterising a new clinically-relevant mouse model of atherosclerosis that my research group is developing.



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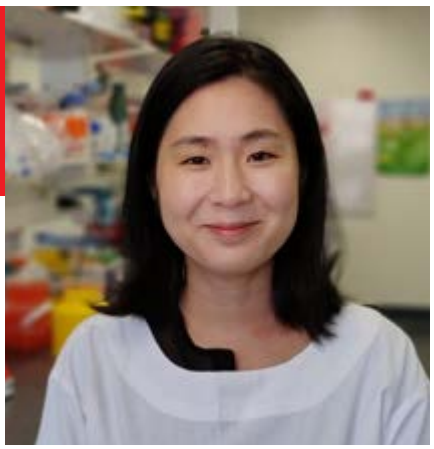
Dr. Helena Kim
Bundoora

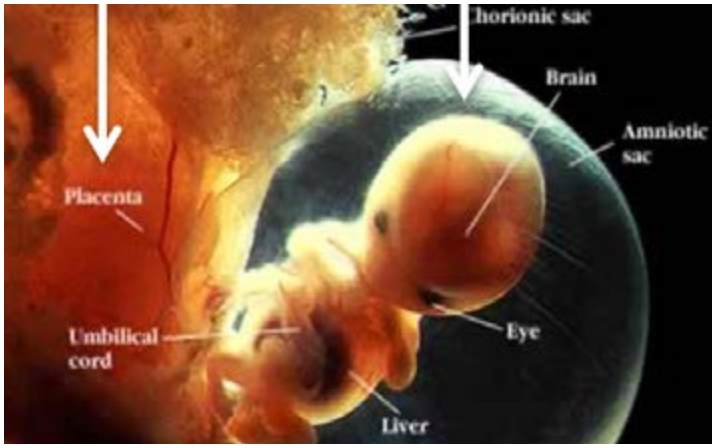


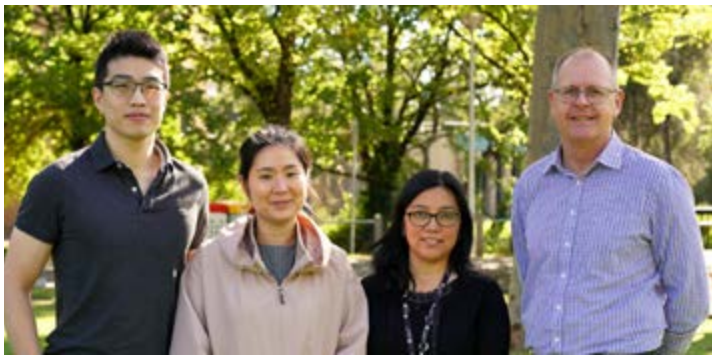
E-mail: h.kim2@latrobe.edu.au
Website: click here

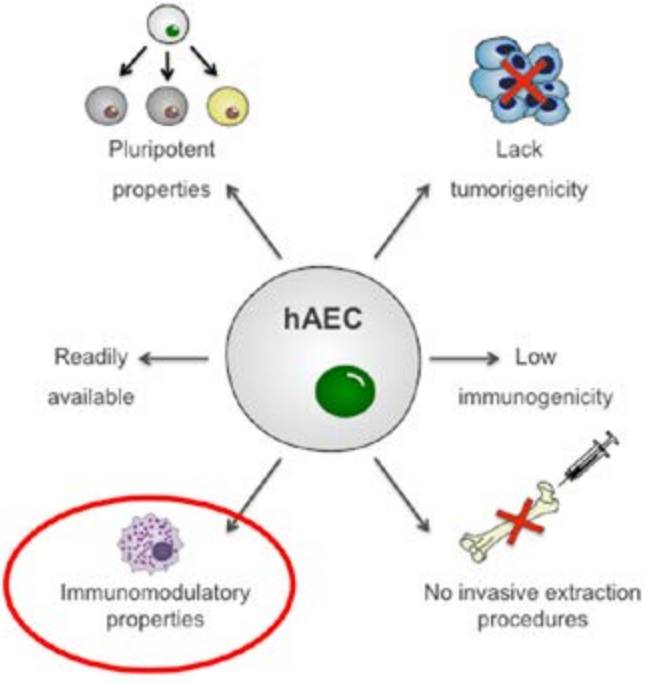
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

- Experimental stroke surgery & treatment
- Animal behaviour studies
- Animal handling
- Flow cytometry
- Gene expression assays
- Histology
- Light microscopy

Our Centre for Cardiovascular Biology and Disease Research is investigating mechanisms that cause heart attacks and strokes, with a specific focus on discovering new therapies that can prevent them. Heart attacks and strokes occur when cardiac or brain tissue is deprived of blood due to the blockage of a coronary or cerebral artery, respectively. Our research is generally aimed at identifying the disease pathways within the blood vessel wall that lead to arterial blockages, as well as the inflammatory mechanisms in the ischaemic organs that eventually lead to cell death. This project would be a part of the work being done in the Stroke Division of our Centre, that is led by Drs Helena Kim and Richard Zhang together with Prof Sobey. We are particularly interested in determining whether cell therapies can effectively treat stroke.







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Prof. Robyn Murphy
LIMS

Available for Industry placement

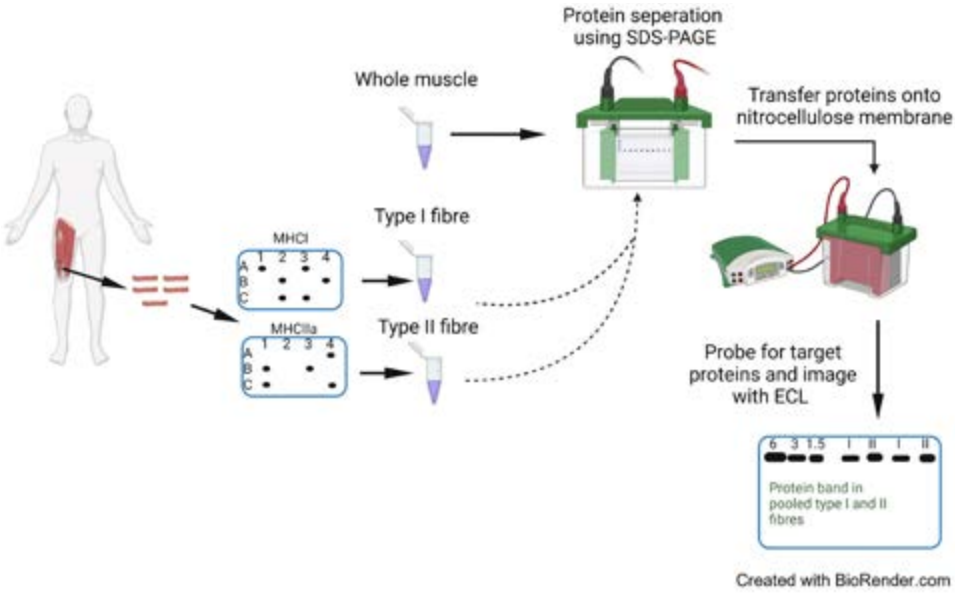
E-mail: R.Murphy@latrobe.edu.au
Website: click here

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Infection & Immunity
- Protein biochemistry
- Animal models of disease
- Proteomics
- Histology (incl. immunohistochemistry)
- Microscopy - electron, confocal, light

Our group studies the various aspects of skeletal muscle function in health and disease, using exercise and disease models in humans, as well as animal models. We address many problems at a cellular level, allowing the differences that exist between cells (muscle fibres) that sit side by side in a whole muscle. We have discovered that a protein, metallomatrix protein 9 (MMP9) that has known functions outside muscle, is present inside the muscle cells as well. This project will work towards understanding the function of intracellular MMP9. The study will use tissue from rodents and likely also humans.
Given the role of mitochondria in muscle and during exercise, as well as the fibre specific responses to exercise and in mitochondrial abundance and likely function, we explore mitochondrial content, function and/or dynamics in skeletal muscle. Of particular interest are diseases such as Type 2 diabetes and the exploration of any impairments in mitochondrial function in skeletal muscle obtained from old compared with young individuals. This project will work towards understanding the function of Calcium handling in the mitochondria.

Other projects are possible by discussion with Robyn. There are many possibilities that fall under the overall research objectives of the group. These could include animal or human studies.



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A/Prof. Antony (Bill) Vinh
Bundoora

Available for Industry placement

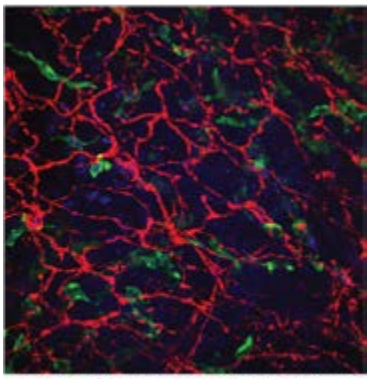
E-mail: a.vinh@latrobe.edu.au
Website: click here

- Animal handling
- Animal models of disease
- Flow cytometry
- Bioinformatics
- Histology
- Genetic expression analyses
- Immunoassays

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

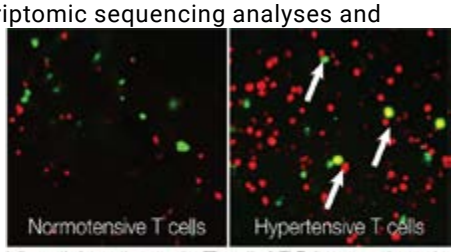
The Hypertension and Immunobiology Research Division aims to discover and validate novel cellular and molecular mechanisms and targets to treat hypertension and related end-organ damage. High blood pressure (BP) remains the leading cause of death worldwide. Despite the availability of several drugs to treat hypertension, 50% of patients still have uncontrolled high BP. Furthermore, in 90% of cases of hypertension, the cause remains unknown, which clearly indicates a lack of understanding of the mechanisms that drive sustained elevations in BP.

At the Hypertension and Immunobiology Research Division at the Centre for Cardiovascular Biology and Disease Research, we study novel mechanisms that drive hypertension and related end-organ damage. We have identified that non-classical physiological pathways of BP control such as inflammation, the immune system, fibrosis and the gut microbiome are major influencers of hypertension. Our team specialises in using a multidisciplinary approach to study hypertension, which includes expertise in pharmacology, physiology, immunology, molecular and cellular biology. Our world-leading capabilities in several pre-clinical models of hypertension (e.g., angiotensin II, DOCA-salt, metabolic syndrome), with gold-standard in vivo tools (radiotelemetry, ultrasound imaging, transdermal GFR) has allowed for the discovery and validation of novel targets and drug therapies to treat hypertension and related pathologies such as heart disease, chronic kidney disease, aortic stiffening and fibrosis.



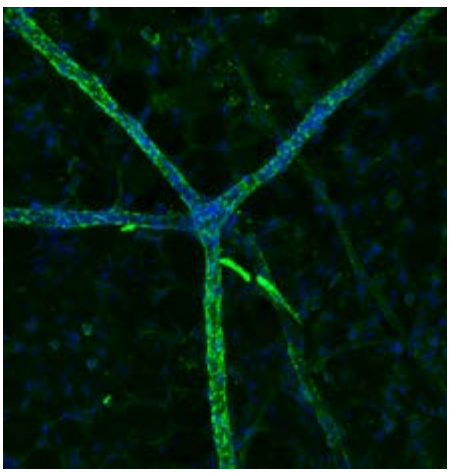
Sympathetic nerves (red) and macrophage (green) infiltration in renal arteries of hypertensive mice.

Project 1. B and T lymphocytes/cells in hypertension. Primary supervisor: Dr Hericka Figueiredo Galvao, A/Prof Bill Vinh. B and T cells have been shown to be required for the full development of hypertension. However, the precise mechanisms remain understudied. This project will combine pre-clinical models of hypertension, next-generation single-cell transcriptomic sequencing analyses and machine learning to interrogate the contribution of the adaptive immune system to hypertension. Techniques and skills that will be learnt include animal handling and BP detection, flow cytometry and complex bioinformatic analysis.



Visualising dynamic T cell-APC interactions in the perivascular fat of hypertensive mice (Red: T cells; Green: APCs)

Project 2. Bacteriophages and Hypertension. Primary supervisor: A/Prof Bill Vinh, Prof Grant Drummond, A/Prof Steve Petrovski. Loss of "healthy promoting" gut bacteria - or microbiome - is recognised as an important driver of cardiovascular disease such as high blood pressure (also known as hypertension). Much of the focus in this area of research has been associated with bacteria, while much less attention on the virome and more specifically, bacteriophages - virus that kill bacteria - which outnumber bacteria almost 10-fold. We have isolated a a world-first lytic bacteriophage that targets one of the most abundant gut commensal bacteria. This projects aims to test the impact of administering this lytic phage on the gut microenvironment, and determine whether these changes impact the development of hypertension. Techniques and skills that will be learnt include animal handling and surgery, blood pressure detection, flow cytometry and histology.



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Cardiovascular Research (Baker Institute)

A/Prof. David Greening
Baker Heart & Diabetes Institute

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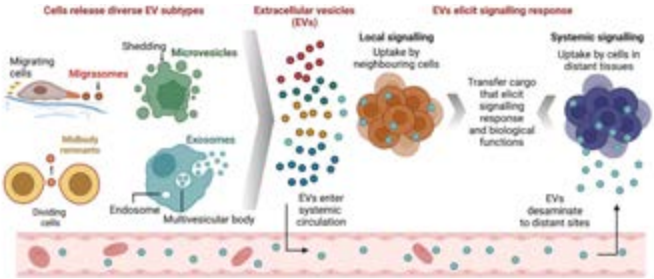
- Mass spectrometry
- Proteomics
- Cell culture - eukaryotes incl. primary & cell lines
- Confocal and Super resolution microscopy
- Bioinformatics
- Nanocarrier (cell-derived) generation

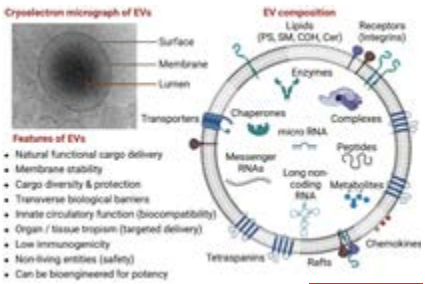
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Molecular Proteomics laboratory develops advances approaches to study the molecular function of secreted factors and extracellular vesicles (EVs) in cardiometabolic disease and normal physiology through quantitative proteomics and multi-omic technologies. Our research impact has led to new understanding of the molecular function of small cell-derived nanovesicles (EVs) and their intercellular signalling. The advanced approaches developed in our lab have identified novel regulators of cell function and EV biology, design of candidate drug delivery vehicles, and functional delivery of proteins. Our team has utilised this knowledge for commercial and translational potential.

Project 1. Mapping the surface of extracellular vesicles. How specific surface proteins on extracellular vesicles medicate cell signalling and function. The extracellular vesicle (EV) surface (surfaceome) acts as a fundamental signalling gateway by bridging intra- and extracellular signalling networks, dictates EVs' capacity to communicate and interact with their environment, and is a source of potential disease biomarkers and therapeutic targets. This project will focus on understanding purified circulating EVs and defining the surface composition, insights into origin from specific tissues in health and disease. The project will also lead new mass spectrometry approaches applied to biofluid analyses developed by our team. The student will be exposed to novel EV purification & characterisation approaches, cutting edge technologies including quantitative proteomics, as well as informatics, functional assays, and biofluid handling/ processing. The project will overall lead to new insights into composition of circulating EVs, surface markers of circulating EVs, and implications in intercellular signalling and function.



Project 2. Bioengineered extracellular vesicles for cardiovascular therapeutics. Extracellular vesicles (EVs) are secreted membrane-enclosed nano-sized particles (40–1,000 nm) that deliver biological information between cells. Moreover, EVs possess natural biocompatibility and stability that allow them to cross biological membranes and that protect them from degradation. Recent studies have shown that EVs-mediated crosstalk between different cell types in the heart could play important roles in the maintenance of cardiac homeostasis and the pathogenesis of heart diseases. In particular, EVs secreted by different types of stem cells exhibit cardioprotective effects. However, numerous studies have shown that intravenously injected EVs are quickly cleared by macrophages of the mononuclear phagocyte system (MPS) and preferentially accumulate in MPS organs such as the liver, spleen, and lung. This project will investigate how to specifically load and deliver a biological payload in nano-carriers for the targeted and selective delivery to the heart, to better understand the mechanisms of proteome reprogramming target cardiac cells in cardiac dysfunction, and engineering strategies to modify EV targeting capacity. Various antibody and peptide conjugate strategies will be used for targeting. These understandings will aid in the development of targeted therapeutic strategies for cardiovascular disease.



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Prof. Peter Meikle
Baker Heart & Diabetes Institute

Available for Industry placement

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- Animal models of disease
- Flow cytometry
- Cell culture - eukaryotes, incl. primary & cell lines
- Metabolomics (incl. lipidomics)
- Bioinformatics

Number of projects: **3**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Dysregulation of lipid metabolism underpins multiple diseases including obesity, type 2 diabetes, cardiovascular disease and age related dementia. While lipid metabolic pathways are well characterised, their dysregulation resulting from environmental and genetic influences are less well understood, particularly in a setting of chronic disease. The Metabolomics laboratory has utilised tandem mass spectrometry to developed the only high-throughput lipidomics platform in Australia and has performed some of the largest clinical and population lipidomic studies reported. These have enabled the characterisation of metabolic pathways and identified lipidomic biomarker profiles that are able to better predict disease risk and therapeutic efficacy. Modulation of the same pathways now holds potential as an interventional strategy to prevent, attenuate or treat the major chronic diseases. We are applying our state of the art lipidomic capabilities to characterise the relationship between lipid metabolism and cardiometabolic disease. Clinical translation of the outcomes from these studies will deliver new diagnostic/risk assessment/monitoring tests and therapeutic interventions for chronic disease.

We have a number of Honours/Masters/PhD projects available for 2024 in areas of lipid metabolism, mass spectrometry and bioinformatics. These include:

1. Characterising myeloperoxidase oxidation on lipids and lipoproteins. *Co-supervisor Dr Kevin Huynh*
2. Development and validation of a high throughput clinical lipidomics platform. *Co-supervisor Dr Thomas Meikle*
3. Exploring the impact of enriching breast milk ether lipids on offspring's endogenous lipidome. *Co-supervisor Dr Sudip Paul and Dr Yow Keat Tham*
4. Exploring the role of breast milk ether lipids in modulating immune function in early life. *Co-supervisor Dr Sudip Paul, Dr Satvika Burugupalli and Dr Alexandra George*
5. Revolutionising disease prediction and management through plasma lipidomic profiling. *Co-supervisor Dr Corey Giles*
6. Understanding the effects of plasmalogen modulation on the systemic lipidome. *Co-supervisor Dr Yow Keat Tham and Dr Sudip Paul*
7. Unlocking the secrets of cardiometabolic diseases through multi-omic integration. *Co-supervisor Dr Corey Giles*

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Cancer Medicine (Olivia Newton-John Cancer Research Institute)

Dr. Annalisa Carli
ONJCRI

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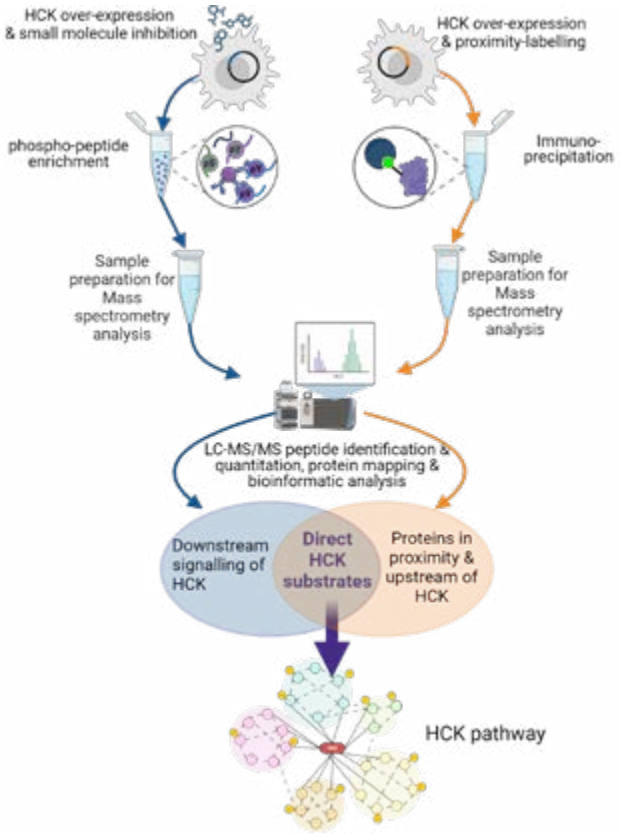
- Cell culture - eukaryotes incl. primary & cell lines
- Proteomics
- Cell transfection
- Immunoassays
- Protein biochemistry

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Cancer and Inflammation Laboratory ant the Olivia Newton-John Cancer Research Institute is led by Prof. Matthias Ernst and focusses on the interplay between cancer cells and other cells within the tumour micro-environment, and finding targets that can aid in inducing an anti-tumour immune response to more effectively kill the cancer cells.

This honours project aims to identify the down-stream pathway of the Hematopoietic Cell Kinase (HCK). Chronic obstructive pulmonary disease (COPD) and lung cancer are major worldwide health concerns. The most prominent shared feature between COPD and lung cancer is an environment of chronic inflammation and accumulation of alternative activated macrophages (AAM). The myeloid-specific kinase HCK is a molecular switch that promotes polarization of myeloid cells including AAM. Accordingly, pharmacologic inhibition of HCK reduces tumour growth, while excessive HCK activity promotes smoke-induced lung inflammation and COPD. However, we neither understand the contribution of HCK in specific myeloid cell types, nor the protein interactome by which HCK promotes these diseases, which collectively limits our capacity to optimally exploit HCK as a shared therapeutic target for the treatment of COPD and lung cancer. The overall aim of this project is to characterise the protein interactome of HCK to identify the cellular and molecular mechanisms by which anti-HCK treatment confers therapeutic benefits to lung cancer and COPD.



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Dr. Jessica da Gama Duarte
ONJCRI

Available for Industry placement

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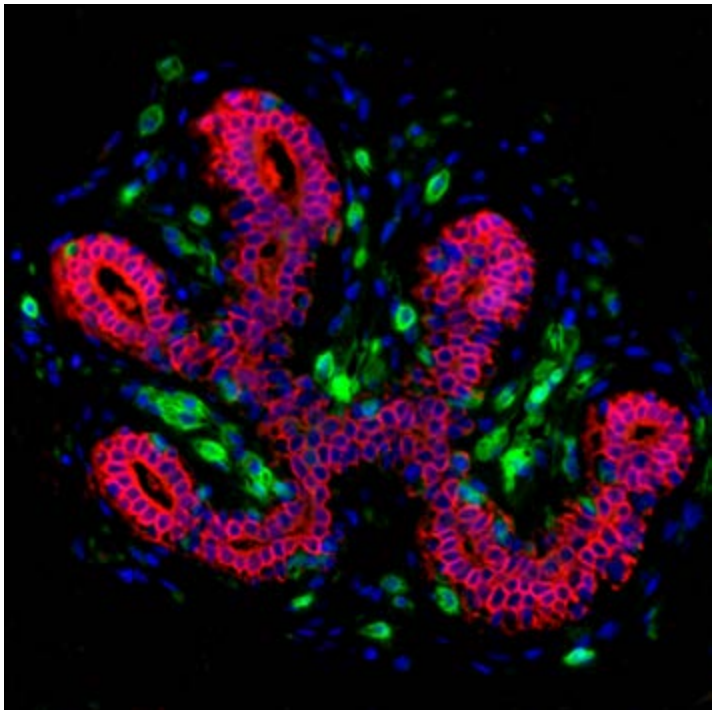
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Confocal fluorescence microscopy
- Histology (incl. immunohistochemistry)

Our lab uses and develop cutting-edge methodologies, including multiplex immuno-fluorescence and RNA-Scope for the characterization of the tumour microenvironment, and protein arrays for the detection of cancer-specific antibodies, among others. We are exploring how successful immune recognition is orchestrated in solid tumours, and translated from early (innate arm) to late (adaptive) immune responses. The laboratory has extensive experience in clinical trial monitoring and collaborative industry projects, all centered on improving outcomes and quality of life for cancer patients. We collaborate with several leading cancer research laboratories in Australia and internationally.

Project 1. Overcoming cancer immune evasion. Effective immune engagement with a tumour occurs when immune cells recognize and destroy malignant cells. This recognition happens when immune cells "see" changes in cancer cell proteins via so called major histocompatibility class I (MHC class I) molecules. However, tumours have developed multiple ways of escaping an immune attack, often leading to uncontrolled tumour growth. A common escape mechanism is loss of MHC class I and associated proteins which prevents immune cell recognition and makes tumour cells "invisible" to most immune cells. Recent studies have shown evidence that other less common immune cells (gamma-delta T cells) may be able to take center stage in this setting due to unknown mechanisms, as their anti-tumoural function is independent of MHC class I. Hence, characterising changes to the tumour immune crosstalk during immune escape is crucial to understand how these mechanisms can be overcome and may provide important novel therapeutic avenues.



In this project, we propose investigating the immune infiltrate during this common mechanism of cancer immune evasion which often takes place in bowel cancers, and to compare that to instances where these have not yet taken place. Here, we will comprehensively characterise the immune cell infiltrate of 859 primary tumours, as well as matched metastatic tumours for a subset of these patients. These samples are an unparalleled valuable resource which has been made available to us. These findings will be compared to disease stage, tumour mutations, and survival outcomes, among other clinical features. This may identify novel strategies that can be therapeutically manipulated to potentiate immune control of tumours, thereby overcoming cancer immune evasion, and improving patient outcomes.

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Prof. John Mariadason
ONJCRI

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- Cancer
- Cell culture - eukaryotes incl. primary & cell lines
- 3D cell culture
- Molecular cloning & CRISPR-Cas9 gene editing
- Gene expression analysis (sequencing & PCR)
- Protein biochemistry
- Histology (incl. immunohistochemistry)
- Flow cytometry

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

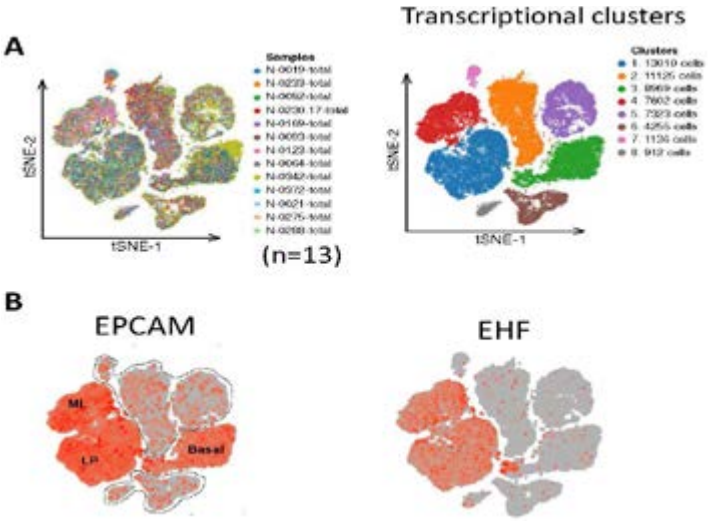
Our team is looking for new ways to treat colon (bowel), breast and liver cancers. We are particularly focused on identifying and targeting major proteins that enable tumour cells to survive in the body, and are testing whether drugs which work in other cancers can be re-purposed for treatment of gastrointestinal cancers.

Project 1. Role of the EHF transcription factor in breast cancer. We recently generated an Ehf knockout mouse, and found that female mice are unable to feed their pups. Examination of the mammary glands of Ehf KO mice revealed a pronounced defect in the development of this tissue during pregnancy. Expression of EHF is also downregulated in human breast cancers, particularly the triple negative subtype, where tumours with low EHF expression have a poorer outcome. Triple negative breast cancers (TNBC's) comprise ~20% of all breast cancers, and have limited treatment options. There is therefore an urgent need to identify the driver genes which give rise of this subtype so that new treatments can be developed.

The goal of this Honours project is to determine the role of EHF in the growth, survival, migration and chemotherapy response in triple negative breast cancer cells. We will achieve this as follows:

1. Determine the level of EHF mRNA and protein expression in 20 breast cancer cell lines, including 5 TNBC cell lines.
2. Determine the effect of EHF re-expression on cell proliferation, survival, migration and response to chemotherapy in TNBC cells.
3. Determine the effect of EHF knockdown in TNBC cells which express EHF on cell proliferation, survival, migration and response to chemotherapy.
4. Identify the target genes of EHF in TNBC cells following EHF knockdown or overexpression.

The student undertaking this project will learn the fundamental concepts of cancer biology, and use a variety of techniques including working with cell line models of breast cancer, western blotting, immunohistochemistry, transfections and assessing response to drug treatment.



EHF expression in total cells from human breast tissue

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Dr. Delphine Merino
ONJCRI

Available for Industry placement

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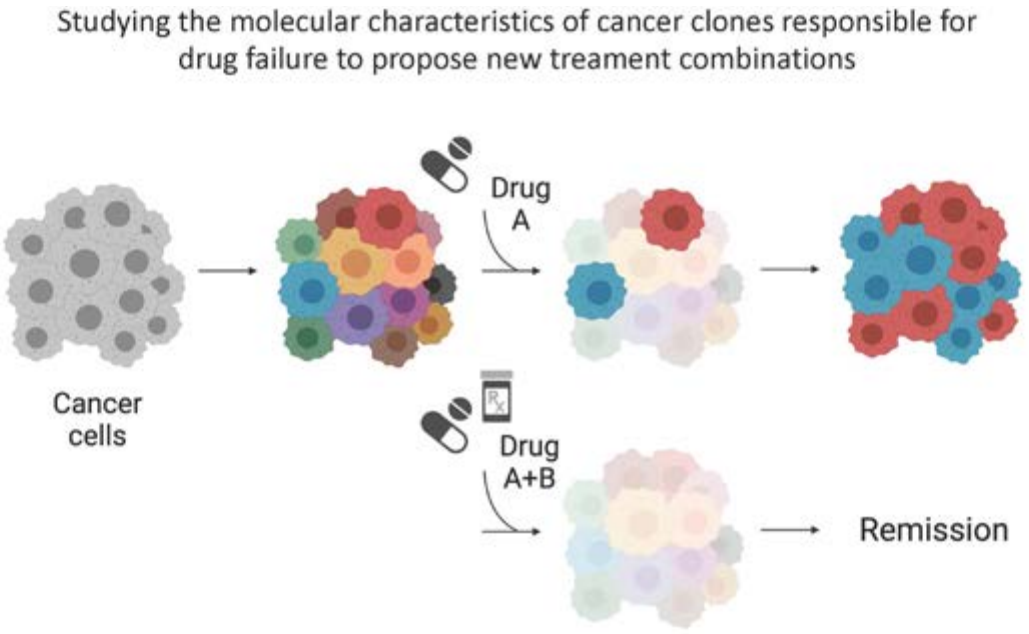
- Cancer
- Cell culture - eukaryotes incl. primary & cell lines
- Confocal fluorescence microscopy
- Molecular cloning & cell transfection
- Animal models of disease
- Flow cytometry
- Genetic sequencing
- Drug assays

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Glioblastoma is the most aggressive form of brain cancer. The lack of improvement for patients with glioblastoma in the last 30 years is multifactorial, including widespread cellular differences between cells in any one cancer mass (tumour heterogeneity), lack of adequate laboratory models and the lack of combinatorial approaches in the clinic.

This project will address all these issues by using new cell lines that have been labelled with fluorescent barcodes, a process called optical barcoding. This technology allows individual cancer cells to be tagged with fluorescent proteins, enabling the identification, quantification and characterisation by imaging, flow cytometry and single cell sequencing. The cell lines have been chosen to include the three common molecular subtypes of glioblastoma (EGFR normal levels in 50%, EGFR high levels in 25% and EGFRvIII mutated in 25%).

The objective of this project is to treat these barcoded cell lines in the lab, using realistic treatment approaches that mirror that used in the clinic. In addition, we will also test novel drugs, especially in combination with chemo-radiation. Using the barcoding tags, we can now identify the individual cells that respond or don't respond, and then analyse these by sequencing to understand what underlies their drug sensitivity. In this way, we will make novel discoveries, identify newer treatment approaches, and identify new ways of determining which patients will benefit best from different therapies.



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Dr. Bhupinder Pal
ONJCRI

Available for Industry placement

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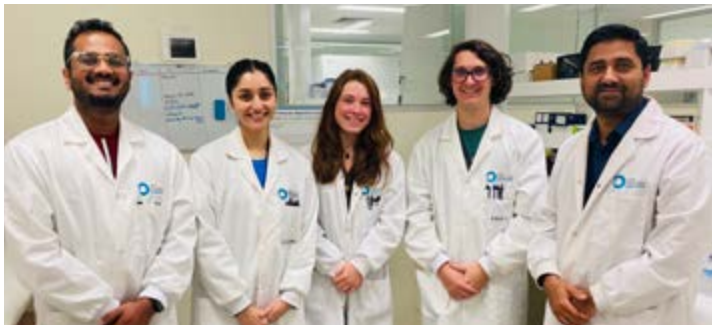
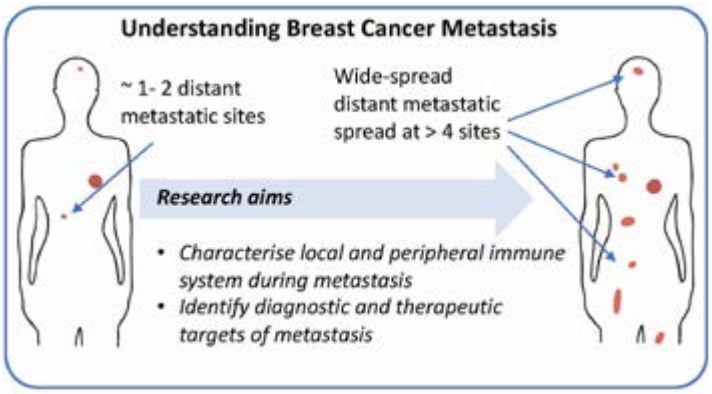
- Cancer
- Mammalian cell culture
- Animal handling & models of disease
- Flow cytometry
- Single-cell genomics & spatial transcriptomics
- Histology & immunoassays
- 3D cell culture
- Bioinformatics

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

We apply new molecular techniques that allow epigenetic, transcriptomic and spatial gene analysis at the single-cell level. The Cancer Single Cell Genomics Laboratory is embedded within La Trobe University's School of Cancer Medicine at ONJCRI. The lab provides a unique scientific environment that enables students to gain research experience in cancer biology, genomics and development biology. We utilises mouse models and patient samples to gain novel molecular insights during normal mammary gland development and understand the role of tissue heterogeneity during cancer progression.





Project 1. Understanding breast cancer metastatic disease to design new and improved diagnostic and treatment strategies. Majority of breast cancer related deaths are due to metastasis, where cancer spreads to multiple organs including the lung, liver, bone and brain. Our goal is to find a cure for metastatic disease and detect it at an early, treatable stage. The proposed project is built on exciting discoveries made by our lab and is designed to study the role of circulating immune cells in blood and tumour microenvironment during metastasis. Our project offers the opportunity to learn various cutting-edge molecular techniques (Single-cell RNAseq/Spatial transcriptomics) and utilise mouse mammary tumour models to test candidate immunotherapy targets.

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Dr. Ajith Vasanthakumar
ONJCRI

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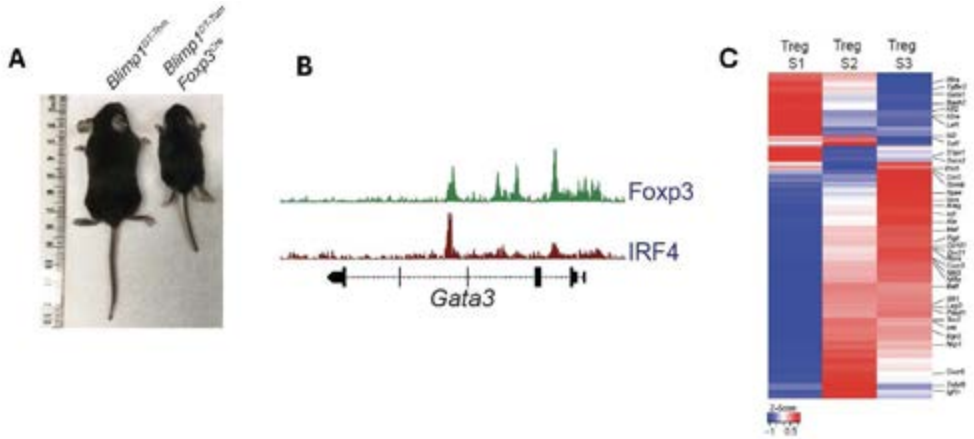
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

- Animal handling & models of disease
- Histology & immunoassays
- Mammalian cell culture
- Genetic sequencing
- Chromosomal/nucleotide extraction assays
- Flow cytometry

My lab investigates a process known as tumour immune suppression, which impairs the function of cancer-fighting immune cells and promotes tumour growth. This suppression is mediated by a specialised immune cell type called regulatory T cells (Tregs). While Tregs are detrimental in the context of cancer, they are essential for preventing autoimmune diseases. Consequently, systemic targeting of Tregs to reduce immune suppression in tumours carries the risk of inducing severe autoimmunity. Our goal is to identify druggable molecules that can specifically target Tregs within tumours, thereby reversing immune suppression and enhancing anti-tumour immunity, while minimizing autoimmune side effects.

Project 1. Understanding Tissue Imprinting by the FOXP3 Transcription Factor.
Treg development and function are mediated by the lineage-specific transcription factor Foxp3. Tregs are localized in various tissues and organs under steady-state conditions and infiltrate inflamed tissues and tumours. Tregs isolated from different tissues and tumours exhibit unique site- or tissue-specific transcriptional signatures. Although Foxp3 is expressed in all Tregs regardless of their tissue location, the precise role of Foxp3 in shaping the transcriptional signature of tissue- and tumor-infiltrating Tregs remains unclear. We have developed a transgenic mouse model in which Foxp3 can be selectively deleted in Tregs using tamoxifen. By utilising this model in combination with RNA sequencing, ATAC sequencing, and ChIP sequencing, we aim to elucidate the transcriptome and chromatin landscape of Tregs regulated by Foxp3.



A. Transgenic mouse models deficient or sufficient for Blimp1 transcription factor expressing Tregs
B. Chromatin immune precipitation analysis shows co-binding of IRF4 and Foxp3 transcription factors to the intronic enhancers of *Gata3* gene.
C. Heat map shows gene expression differences between three different Treg types.

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If you have any further questions please don't hesitate to email us at sabehonours@latrobe.edu.au.

We look forward to seeing you in SABE!

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