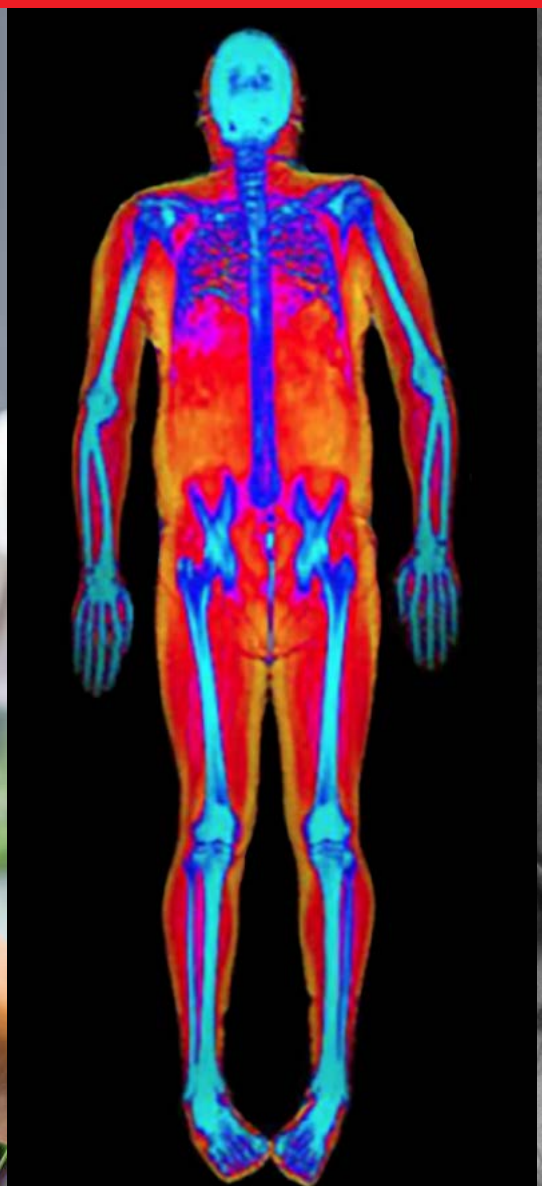
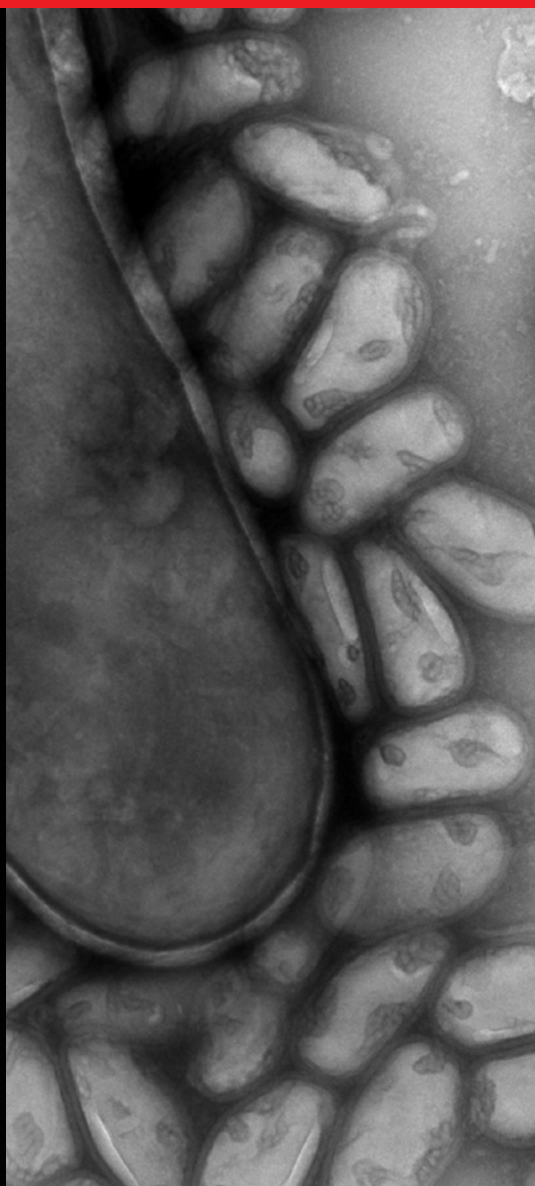
2024 Honours in the School of Agriculture, Biomedicine & Environment





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

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.

Course structure

How long is Honours?

Honours in SABE is a one-year (full-time) or two-year (part-time) course equalling a total of 120 credit points (CP). This consists of 90CP of research and 30CP of coursework.

What course will I enrol in?

SABE coordinates five different Honours courses:

- Bachelor of Science (Honours) (SHS)
- Bachelor of Biomedicine (Honours) (SHMD)
- Bachelor of Biological Sciences with Honours (SHBIS)
- Bachelor of Animal and Veterinary Biosciences with Honours (SHAVB)
- Bachelor of Science (Wildlife and Conservation Biology) with Honours (SHSWCB)

You will enrol in a course that best aligns with your undergraduate Bachelor's degree.

How is the course structured?

The **research** project is the major component of the SABE program. This consists of 90CP, split between four Honours research subjects. You will enrol in subjects that match the discipline of your chosen project. This will reflect on your academic transcript to your future employers that you have obtained specialised skills in a specific field of research. The SABE Honours disciplines are:

Honours disciplines (=subject name as appears on transcript)	*Subject code*	*Credit points (CP)*	*Total (CP)*
Honours in Animal Physiology & Health	APH401A APH401B APH401C APH401D	15 15 30 30	90
Honours in Agriculture	AGR401A AGR401B AGR401C AGR401D	15 15 30 30	90
Honours in Biochemistry & Cell Biology	BCH401A BCH401B BCH401C BCH401D	15 15 30 30	90
Honours in Chemistry	CHE401A CHE401B CHE401C CHE401D	15 15 30 30	90
Honours in Environment & Genetics	EEE401A EEE401B EEE401C EEE401D	15 15 30 30	90
Honours in Human Anatomy, Physiology & Pharmacology	HBS401A HBS401B HBS401C HBS401D	15 15 30 30	90
Honours in Microbiology	MIC401A MIC401B MIC401C MIC401D	15 15 30 30	90

The **coursework** conducted in the SABE Honours program will give you additional skills that are complementary to your research program. All SABE Honours students will completed two coursework subjects, each worth 15CP (15CP + 15CP = 30CP total).

All SABE Honours students must complete a core school coursework subject, ***SCI4001 (15CP)***. This subject must be taken in the first semester of the Honours program. This subject will teach skills in research ethics, critical analysis and communication; all essential for a career in the contemporary scientific world.

Students will also select one ***elective subject (15CP)*** that equips you with complementary, discipline-specific skills. You will select this subject in consultation with your chosen research supervisor (more info on page 113 of this booklet).

What will my study plan look like?

The SABE Honours program is designed to have maximal student flexibility. However, this is conditional on the nature of the research project (full-time or part-time) and willingness of the supervisor for students to commence in February or July. As you read this booklet, please pay attention to when the project is offered and whether it is full-time or part-time. Please see page 135 of this booklet for some further explanation and example study plans.

Assessments

Throughout the year you will conduct independent research, with the close mentorship and support of your research supervisor. Your supervisor will give you feedback early in the project to let you know your progress and give guidance on areas in which you can improve or consolidate your skills. Throughout the year, your supervisor will also mentor you in the preparation of presentations and writing your thesis, which is due at the end of your Honours course. All SABE Honours students will have the same **research** assessment tasks. As already described, you will also complete two **coursework** subjects that will give you additional and complementary skills for a career in research and beyond. Coursework assessment tasks are specific to the student's chosen study plan.

A general summary of the Honours assessments and approximate dates is as follows:

	Overall assessment weighting	**Approximate dates - February entry**	**Approximate dates - July entry**
Orientation	hurdle	early-February	mid-July
Core coursework subject (15CP)	12.5%	Semester 1	Semester 2
Elective coursework subject (15CP)	12.5%	Can be taken Semester 1 or 2	Can be taken Semester 1 or 2
Research subjects (90CP)			
Draft literature review	hurdle	mid-Semester 1	mid-Semester 2
Supervisor mark	10%	end-Semester 2	end-Semester 1
Oral presentation of research findings	10%	end-Semester 2	end-Semester 1
Written thesis and oral exam	55%	End October	Early June

Note: Precise submission dates will be provided at the start of each semester.

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, 2024

Applications for Access Scholarships and Bursaries for Semester 1, 2024 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, 2024

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.

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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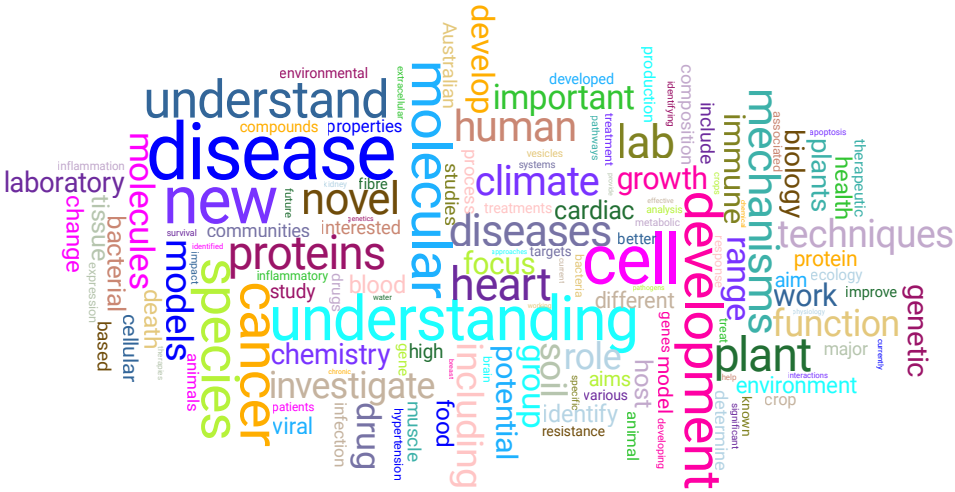
How do you choose a project?

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 research booklet - you can see how many things we research! On the next two pages, we will help you identify areas of science or 'research discipline(s)' that are most appropriate to your undergraduate degree and interests.



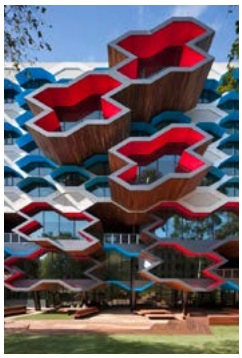
Location, location, location!

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

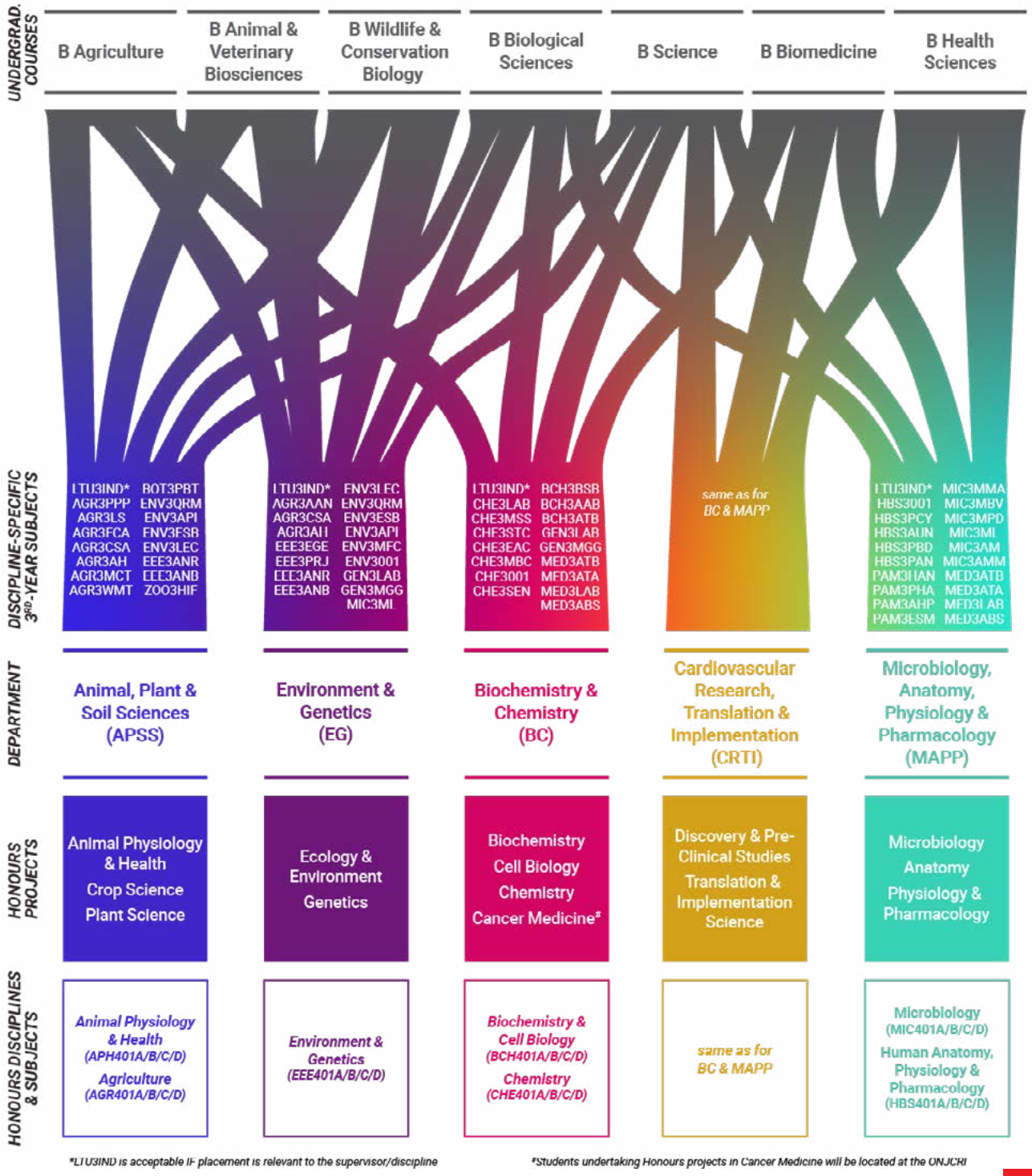
Centre for Freshwater Ecosystems
La Trobe University
Albury-Wodonga campus

Baker Institute
Prahran, Melbourne

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

What topic(s) did you enjoy most in your undergraduate degree?

SABE coordinates seven undergraduate degrees. In the final year of your degree, you would have taken a number of 3rd year subjects pertaining to a specific 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, first 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 SABE departments, thereby identifying the department(s) which will have Honours projects in a research discipline that is most appropriate for you.



*ITU3IND is acceptable if placement is relevant to the supervisor/discipline

#Students undertaking Honours projects in Cancer Medicine will be located at the ONJCRI

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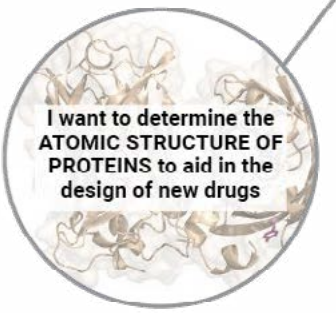
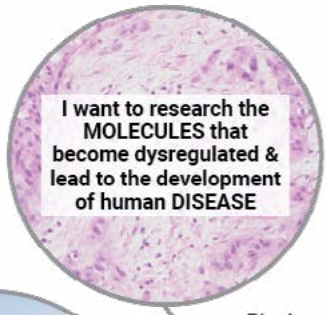
Finding your research project

You have now identified the department(s) that is most appropriate to your undergraduate degree. Next, you want to narrow down and create a shortlist of research projects and supervisors that you would like to meet and discuss their project in more detail. This can still be quite an overwhelming process as each department has a diverse range of research projects on offer. Consider the following statements: if any of them align with your interests, we have indicated which department/discipline/institute that you should focus your shortlist on.

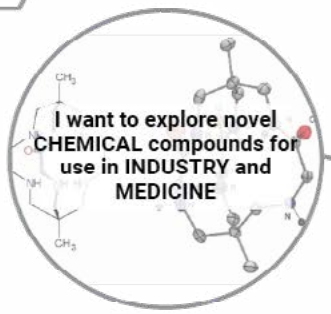


Biochemistry (BC)
Chemistry (BC)
Cancer Medicine (ONJCRI)
Plant Sciences (APSS)



Biochemistry (BC)
Cell Biology (BC)
Cancer Medicine (ONJCRI)
Discovery & Pre-Clinical Studies (CRTI)
Translation & Implementation (CRTI)
Anatomy (MAPP)
Physiology & Pharmacology (MAPP)
Microbiology (MAPP)

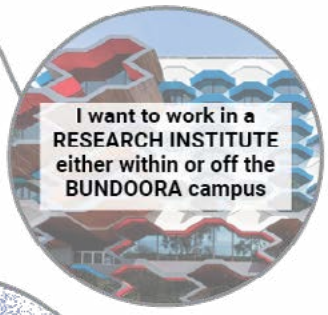
Ecology & Environment (EG)
Genetics (EG)
Animal Physiology & Health (APSS)
Crop Science (APSS)
Microbiology (MAPP)

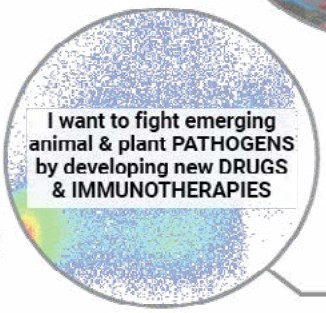


Chemistry (BC)
Biochemistry (BC)
Cancer Medicine (ONJCRI)

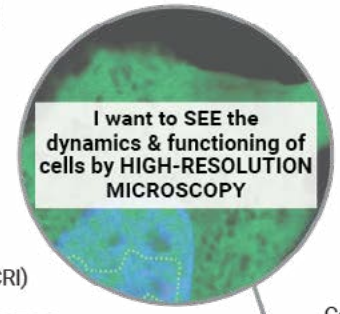
Plant Science (APSS)
Crop Science (APSS)
Ecology & Environment (EG)
Genetics (EG)

LIMS (BC)
ONJCRI (Cancer Medicine)
AgriBio (Plant Sciences)
Baker Institute (CRTI)
Centre for Freshwater Ecosystems (CFE)





Biochemistry (BC)
Cell Biology (BC)
Chemistry (BC)
Animal Physiology & Health (APSS)
Crop Science (APSS)
Plant Science (APSS)
Microbiology (MAPP)
Genetics (EG)



Cell Biology (BC)
Cancer Medicine (ONJCRI)
Plant Science (APSS)
Discovery & Pre-Clinical Studies (CRTI)
Microbiology (MAPP)
Physiology & Pharmacology (MAPP)

Animal Physiology & Health (APSS)
Ecology & Environment (EG)
Genetics (EG)
Anatomy (MAPP)

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.

Key dates

Teaching Period	*Semester Dates*	*Placement Application Deadline*
Sem 1, 2023	27 Feb 2023 - 26 May 2023	Wed 8th March 2023
Sem 2, 2023	31 Jul 2023 - 27 Oct 2023	Wed 9th August 2023
Term 6, 2023	6 Nov 2023 - 15 Dec 2023	Wed 25th October 2023

Note: LTU3IND placements do not guarantee entry into the SABE Honours program. This is purely an elective subject that may help you identify if honours is for you, and/or what sort of honours projects you would like to pursue.

Projects Available in 2024

SABE departments

As already mentioned, there are five research departments in SABE. In addition, the SABE Honours program hosts students who wish to undertake projects through the School of Cancer Medicine. In this case, students are located in the Olivia Newton-John Cancer Research Institute (ONJCRI) and all students undertake Honours in Biochemistry and Cell Biology.

We have sorted the research projects on offer in SABE into these five departments plus the ONJCRI, and further organised them based on their research disciplines. Warning: there are a lot of projects and information in this booklet! But by now, you should have narrowed your search to a particular department(s) and research discipline(s). We suggest you first click on the name of the department which seems like it fits your scientific interests. This will take you to the Department's table of contents page. Here, you will see a list of potential research supervisors who are offering Honours projects this year, grouped according to the research discipline that the project is on. You can go straight to the research discipline you are most interested in, or go through all of the research projects in that department.

page:

Animal, Plant & Soil Sciences (APSS) 21

Research disciplines: Animal Physiology & Health; Crop Science; Plant Science

Environment & Genetics (EG) 39

Research disciplines: Ecology & Environment; Genetics

Biochemistry & Chemistry (BC) 58

Research disciplines: Biochemistry; Cell Biology; Chemistry

Microbiology, Anatomy, Physiology & Pharmacology (MAPP) 89

Research disciplines: Microbiology, Anatomy, Human Physiology & Pharmacology

Cardiovascular Research, Translation & Implementation (CRTI) 112

Research disciplines: Discovery & Pre-Clinical Studies; Translation & Implementation Science

Olivia Newton-John Cancer Research Institute (ONJCRI) 119

Research disciplines: Cancer Medicine

Animal, Plant and Soil Sciences (APSS)

Research projects in the Department of Animal, Plant & Soil Sciences (APSS)

The following list are research supervisors in APSS who are offering projects in 2024.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

Animal Physiology & Health

	page:
Prof. Travis Beddoe	23
Prof. Shaun Collin	24
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Plant & Crop Sciences

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Prof. Travis Beddoe
AgriBio

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

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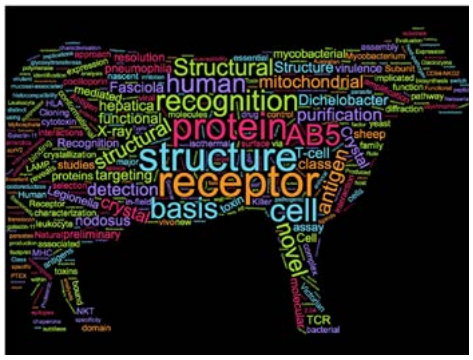
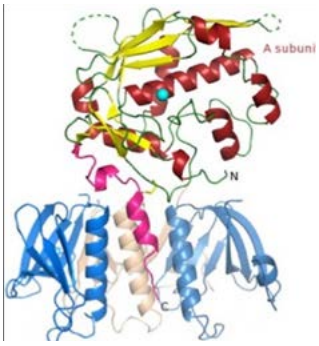
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Feb only**
Masters conversion: **Yes**
LTU3IND placement: **No**

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.

Prof. Shaun Collin
Bundoora

available for **LTU3IND** placement

- Whole organism bioimaging (CT)
- Flow cytometry
- Field work
- Histology
- Animal handling
- Light microscopy

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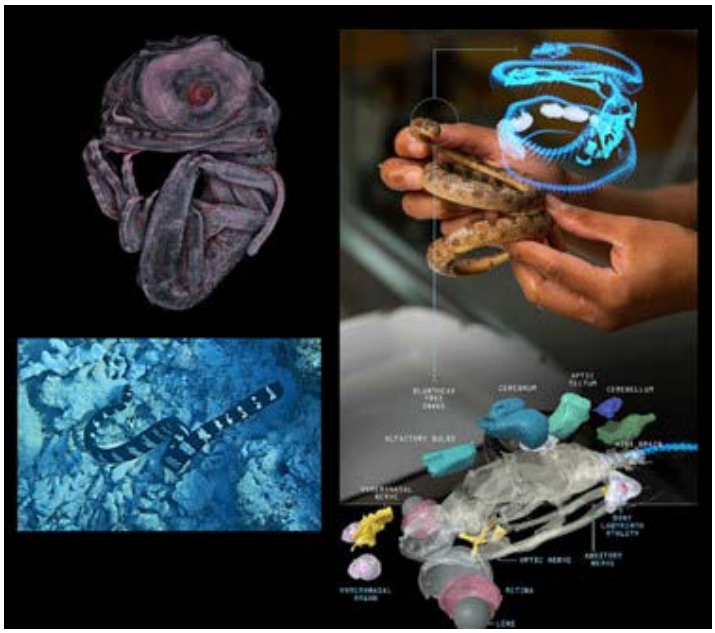
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The 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.



Project 1: Brain adaptations to changing environments in snakes and lizards. This project aims to understand how the brains of Australian snakes and lizards change as they adapt to environmental and climate change. Studying brains can help us understand how animals interact with their environment (via senses and behaviour) and predict how adaptable these species are to future environmental change. Yet, studies of evolutionary adaptation have rarely assessed brains, especially in reptiles. In this project, reptile specimens from Australian museum collections will be imaged using high-resolution bioimaging (e.g., microCT scanning, Australian synchrotron beamlines) to create a digital 3D replica of brains for morphometric analyses. Brain size and shape will be compared i) within species to track brain growth over individual lifetimes (ontogenetic change), and/or ii) between species to infer how selection (e.g., ecology, latitude, life history) influence brains over millennia (evolutionary change). This project will provide new insights into the ecological and evolutionary lability of reptilian brains, generating data-rich digital specimens for future research, education, and outreach, and inform conservation actions by revealing how the largest components of Australian terrestrial diversity (reptiles) responds to environmental change.

Dr. Kerry Fanson
Bundoora

available for LTU3IND placement

Immunoassays

Microscopy

Animal handling

Animal behaviour studies

Field 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**

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.

A/Prof. Kylie Robert Bundoora

- Animal behaviour studies
- Animal or plant identification
- Animal handling
- Whole animal physiology
- Field work
- Ecological assays

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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**

Research in the Robert Lab is broadly focused on reproductive ecology and conservation biology. Current reproductive research examines parental effects on offspring phenotypes, sex allocation and the physiological and endocrinological basis for the variation in life history. While our conservation research address questions on endangered species, anthropogenic disturbance, captive breeding and reintroduction biology. The group uses a multidiscipline approach to question oriented research using a diverse range of taxa, including but not limited to reptiles, birds, bats and mammals. Other La Trobe researchers we collaborate with include but are not limited to; Dr Richard Peters (reptiles & behaviour), Dr James Van Dyke (reptiles & energetics), Dr Kerry Fanson (endocrinology), Dr Katherine Harrison/Dr Nick Murphy (genetics), Dr Jen Wood (microbiology), Dr Robert Ross (engineering), Dr John Lesku (animal physiology).

Topic 1: Ecological impacts of artificial lighting on wildlife
Artificial lighting has fundamentally changed the earth's night-time environment, with a wide range of biological effects on animals. Over billions of years organisms have evolved to respond to natural light cues to control or modulate behaviour, activity, reproductive timing and physiological function. Our research has focused on the impact of artificial light on different species (inc. bats, marsupials, & insects) and testing different wavelength lights to mitigate the negative effects of light at night.

Topic 2: Climate change and physiological impacts of extreme weather events. Current climate change scenarios for southern Australia predict mean temperatures to rise 2.7 – 4.2°C by 2090. Increased maximum temperatures, higher frequency of hot days and longer duration of heat waves are already being observed. Despite this, the consequences of climate warming are poorly understood for many organisms. Our work in this field includes the energetic costs of thermoregulation, the thermal biology of artificial roosts for hollow dependant fauna, and the impact of thermal extremes during gestation in viviparous reptiles.

Topic 3: Understanding the mechanisms and adaptive advantage of sex allocation. Sex allocation theory predicts parents should bias their investment into the sex that maximises their fitness. Current theories aim to explain adaptive adjustments in offspring sex ratios and have provided some compelling examples. However, offspring sex ratios in many taxa (especially mammals) have proven difficult to understand and would be better facilitated by a mechanistic understanding. Our research has been focused on unravelling mechanistic underpinnings of adaptive sex allocation from paternal contribution in ejaculate to maternal condition at the time of conception and the role of sex steroid and glucocorticoid hormones.

Dr. Gary Clark
AgriBio

Soil analysis

Chemical analyses

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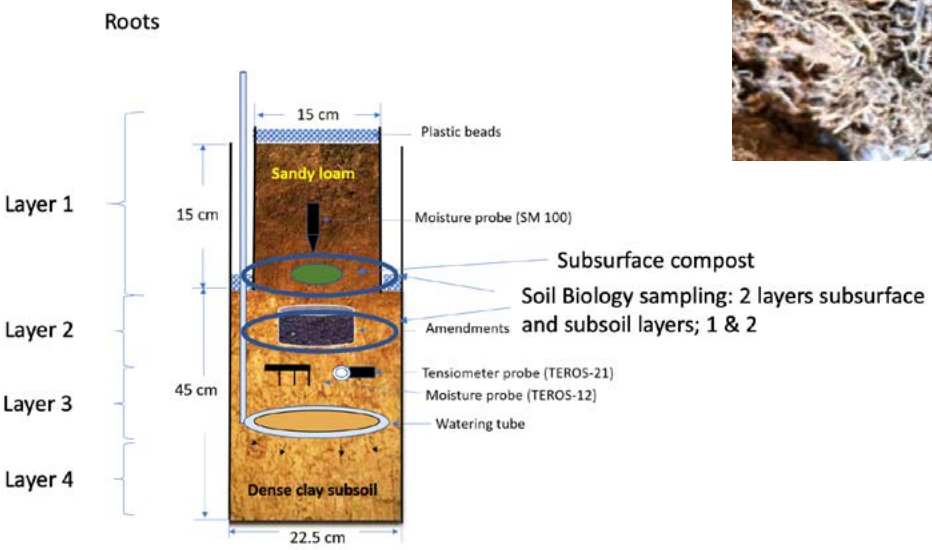
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Working in collaboration with Professor Tang, our work aims to provide solutions to crop and pasture production on soils with subsoil constraints. These subsoils may be sodic clay, or low pH with possibly high contents of plant-available aluminium and are often of poor structure hence leading to waterlogged soils in winter. The aim is to improve plant root penetration into the soil profile and increase the soil water extracted by the plant. Overcoming these constraints will improve the resilience of farming faced with future climate warming. In addition, there is a strong publishing record of processes linked to changes in soil carbon. For example, soil structure and soil carbon priming.

In 2024, I will be investigating Regenerative Agriculture with a focus on what are the benefits for the soil. This has been stimulated by the lack of substantial scientific evidence for the improvement in 'soil health'. The aim is to guide farmers who are interested in adopting the practices of regenerative agriculture.



Dr. Marisa Collins
AgriBio

available for **LTU3IND** placement

Field work

Crop physiology

Glasshouse work

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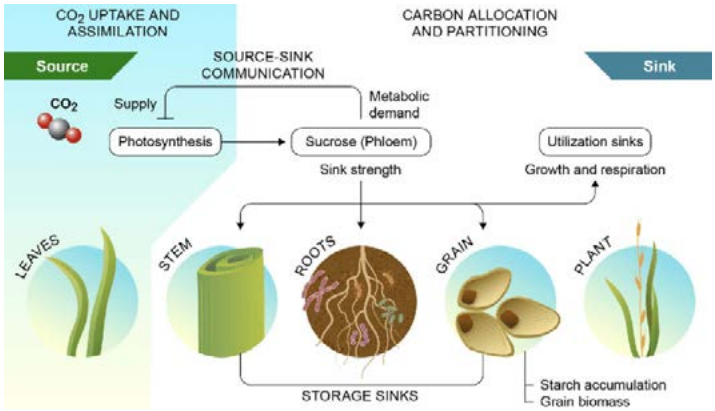
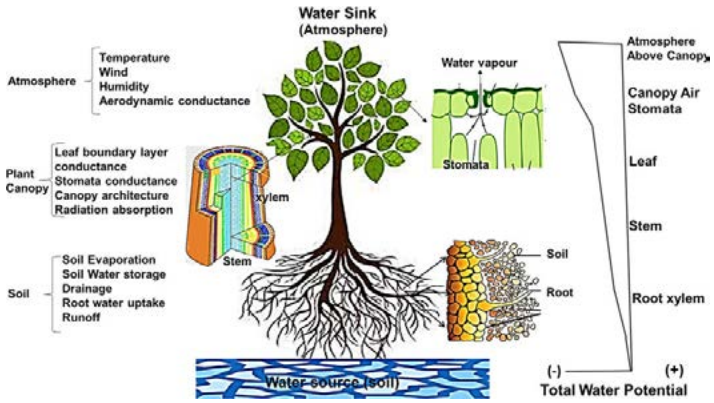
Website: click here

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**





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.

A/Prof. Monika Doblin
AgriBio

available for **LTU3IND** placement

- Light & electron (TEM, SEM) microscopy
- Proteomics
- Gene expression analyses (incl. PCR, qPCR)
- Protein biochemistry (SDS-PAGE, western blotting)
- Bioinformatics
- Plant tissue culture

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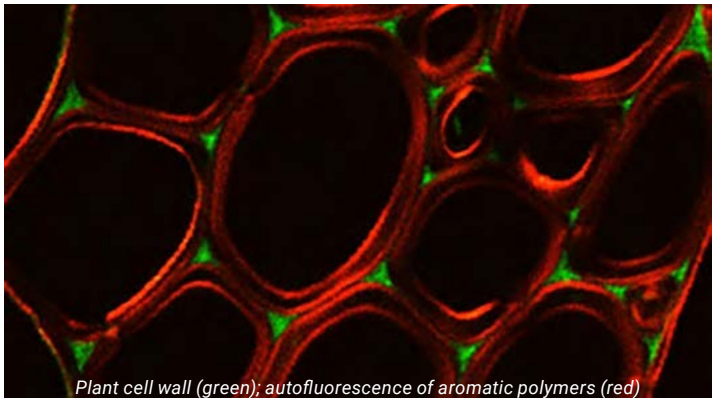
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

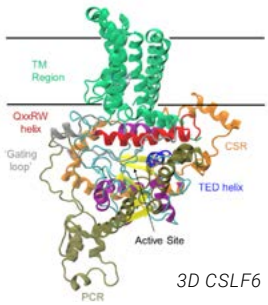
The Plant Cell Walls and Bioactive Secondary Metabolite Group aims to understand how biopolymers are made and regulated. Biopolymers and secondary metabolites include some of the most abundant and renewable carbon-based molecules on Earth and have a range of applications for biomaterials, food and medicines. 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 Medicinal Agriculture Hub that aims to improve production of plant-derived 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 these 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.



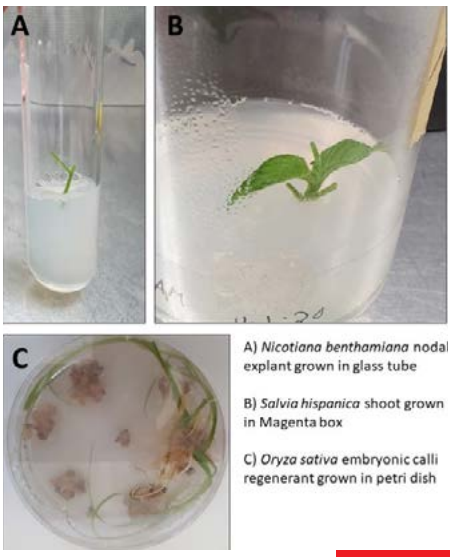
Plant cell wall (green); autofluorescence of aromatic polymers (red)

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 molecular biology, biochemistry and cell biology techniques.



3D CSLF6

Project 2: Using Tissue Culture for Plant Conservation. Some plant species containing valuable biomolecules do not display good longevity with cold temperature storage in seed biobanks. Therefore, to practically maintain such species into the future, alternative approaches are required. This project will explore and assess the use of tissue culture techniques to address this issue. In addition, DNA sequencing will be used to identify any viruses and/or endophytes for which these plants are a host. Endophytes are typically bacteria or fungi that can improve a plant's ability to grow, acquire nutrients and enhance a/biotic stress tolerance. This knowledge is valuable as it provides a biotechnological tool for enhancing climate change resilience amongst established and future crops.



A) *Nicotiana benthamiana* nodal explant grown in glass tube

B) *Salvia hispanica* shoot grown in Magenta box

C) *Oryza sativa* embryonic calli regenerant grown in petri dish

Dr. Peter Dracatos
AgriBio

- Molecular cloning and CRISPR-Cas9 gene editing
- Genetic sequencing (incl. RNAseq, microarrays)
- Plant disease phenotyping
- Chromosomal and/or nucleotide extraction assays
- Gene expression analyses

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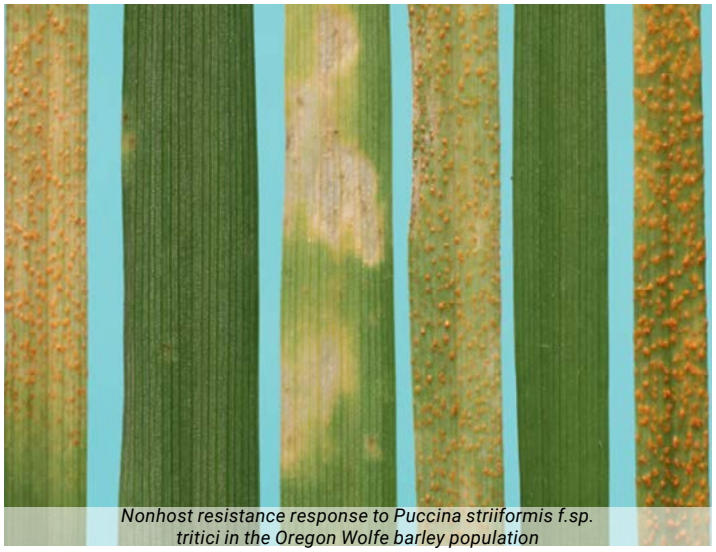
Website: click here

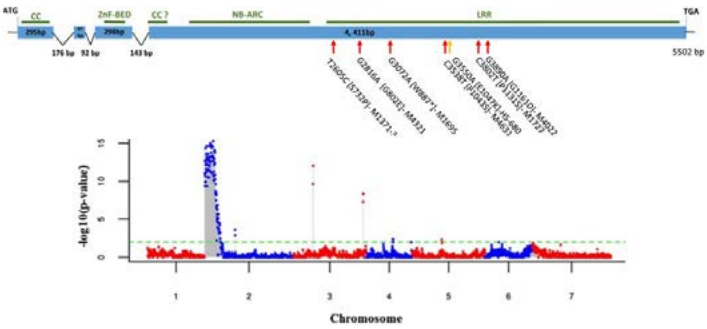
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Whole-grain cereals including wheat, barley and rye are rich sources of calories, essential vitamins, minerals, and phytochemicals that both nourish and protect humans and animals from ailments such as heart attack and cancer. Of these, wheat is the most widely consumed globally, while barley is the world's fourth most important cereal, used primarily in malt production for alcoholic beverages and as grain feed for livestock and human food. Wheat and barley are hosts for a myriad of pests and diseases that decrease projected yield and threaten crop production targets. For example, approximately 20% of global wheat production is lost to infection by pests and diseases. Monoculture and climate change favor the emergence of new, highly virulent pathogen variants that reduce yield, posing a serious threat to global food security.

My lab's research interests include identifying and characterising diverse mechanisms of genetic resistance and novel approaches to control foliar diseases in cereal grain crops as an alternative to synthetic chemical controls such as fungicides. We use a wide range of genetics, genomics, molecular biology, and bioinformatics to investigate how the plant immune system can protect cereal crop grain yield when challenged with biotic stresses such as fungal pathogen infection. My lab aims to mine new genetically diverse gene pools available through the Australian Grains Gene Bank to identify rare broadly effective disease resistance genes and unravel the molecular mechanisms of resistance to disease.



Nonhost resistance response to Puccina striiformis f.sp. tritici in the Oregon Wolfe barley population



Project 1. In collaboration with Associate Professor Anthony Gendall's group as part of the ARC Sustainable Crop Protection Hub, the project will involve assisting in the development of a novel double-stranded RNA (dsRNA) approach to control various damaging rust diseases in cereals. The project will involve training in plant microbe interactions, plant pathology and molecular biology. (Feb 2024)

Project 2. Assessment and genetic characterisation of resistance to fungal diseases in barley using digital phenotyping. There are several damaging fungal pathogens that consistently reduce yield potential in barley during the cropping season. Some barley varieties however are able to fight off these diseases because they carry naturally occurring tolerance that is heritable. This project will involve detailed phenotyping of a core collection of barley lines using a newly developed barley phenotyping platform and involve training in host pathogen genetics, plant pathology and microscopy. (July 2024)

Prof. Tony Gendall
AgriBio

available for LTU3IND placement

Plant biotechnology

Genetic sequencing (incl. RNAseq, microarrays)

Gene expression analyses

Bioinformatics

Molecular cloning and CRISPR-Cas9 gene editing

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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**

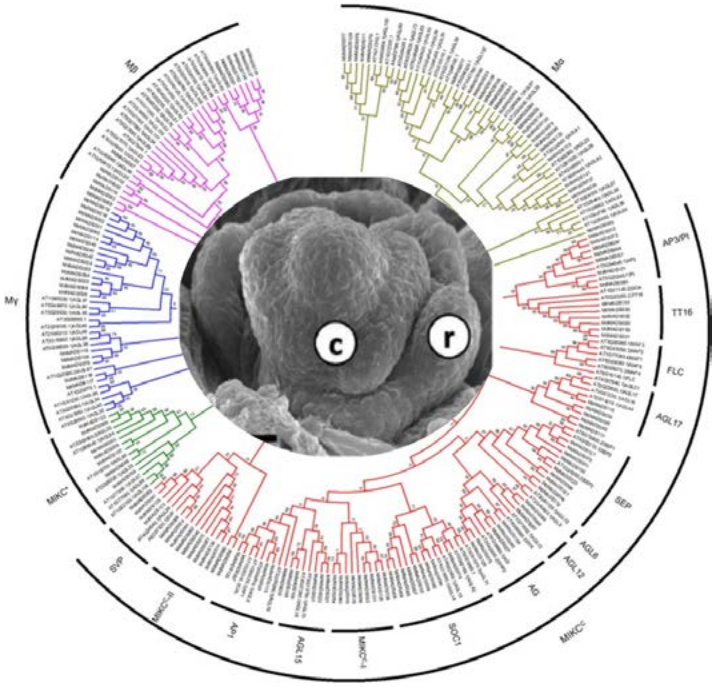
My lab using a wide range of tools, including genetics, molecular biology, and bioinformatics to investigate several aspects of plant biology, physiology and development. We use a range of techniques, including gene cloning, T-DNA mutants and CRISPR gene editing, transgenics, sequencing and bioinformatics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

As part of the ARC Research Hub for Medicinal Agriculture, we have a project to investigate the regulation of flowering time in Cannabis. In collaboration with Dr Susan Hoebee (Ecology and Genetics) we have projects in the area of plant breeding, pollination and flower development in horticultural and native plants, and welcome enquiries from students with interests in these areas.

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. Aligned with this, in 2024, in collaboration with Drs Peter Dracatos and Donovan Garcia-Ceron, we will offer a project on the control of cereal rust pathogens using double-stranded RNA. With Dr Donovan Garcia-Ceron we will also offer a project to investigate the role of fungal extracellular vesicle (EVs) in plant pathogenesis.

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.

Strawberry disease assays



Dr. Kim Johnson
AgriBio

available for LTU3IND placement

Plant phenotyping

Gene expression analyses

PCR assays

Microscopy (light & electron)

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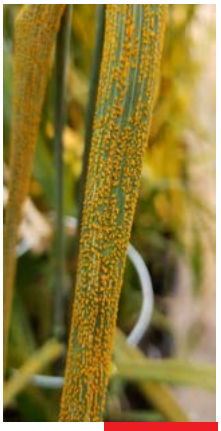
Number of projects: **2 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

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.



Prof. Mathew Lewsey
AgriBio

available for **LTU3IND** placement

- Gene expression analyses
- PCR assays
- Plant development analysis
- Light microscopy
- Bioinformatics

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Website: click here

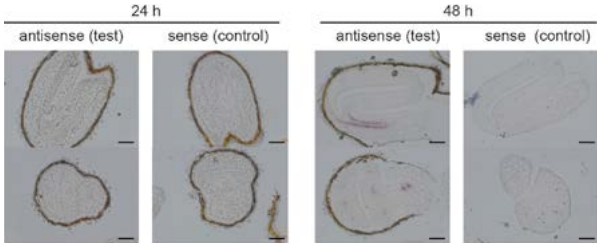
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

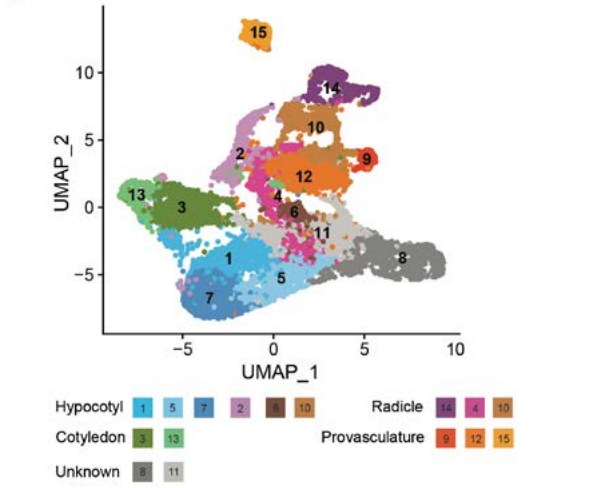
My lab studies how plants perceive the world around them and interact with their environments by regulation of their genomes. We apply this work with commercial partners who grow a range of agricultural crops including cannabis, opium poppies, barley, oats and peas. In a project co-supervised with senior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

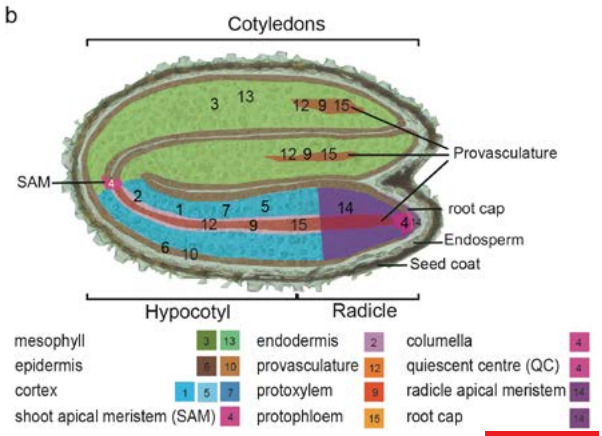
Seeds provide 70% of global food resources, being the most valuable output from plant production. They also play a critical role in agriculture because germination is the first step during a plant's lifecycle which involves extensive changes in gene expression. It is governed by nutrient resources, endogenous 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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I'm ready to apply! »

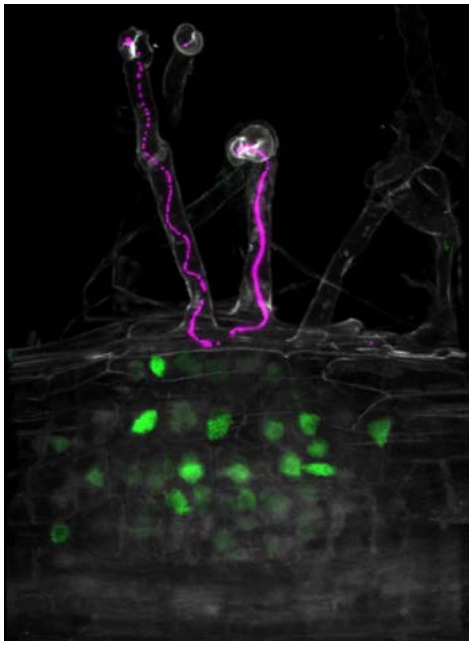
Dr. Dugald Reid
AgriBio

available for LTU3IND placement

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

E-mail: dugald.reid@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**



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.

A/Prof. Penelope Smith
AgriBio

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

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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**

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. Assessing the efficiency of N fixation. A reference set of chickpea lines representative of the genetic diversity in the ICRISAT chickpea collection will be assessed for their ability to fix nitrogen in a glasshouse experiment. Biomass production, 15N natural abundance, nodule characteristics and N content of plant material will be measured after plants are grown with or without nitrogen fertilizer and rhizobia. The results can be used as the basis for genome wide association studies to identify genes important for nitrogen fixation.

Project 2. 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.

Prof. Caixian Tang
AgriBio

Soil management

Analytical skills

Industry experience

Glasshouse trials

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Website: click here

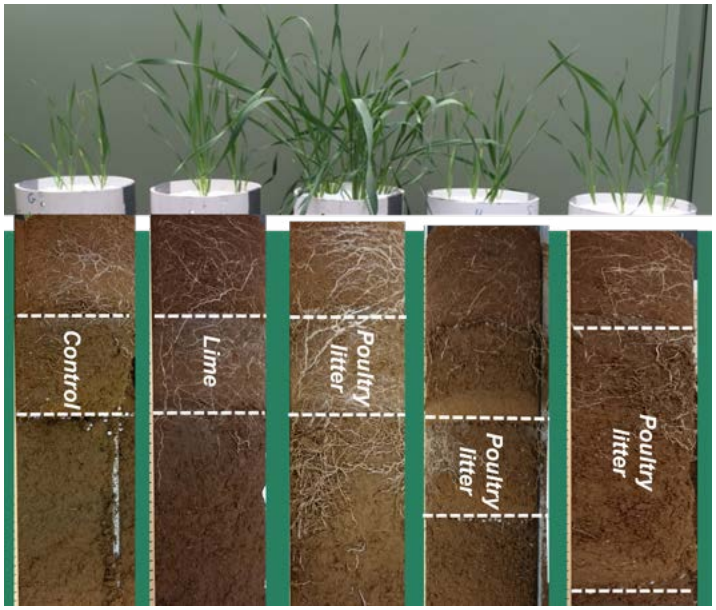
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Feb only**
Masters conversion: **Yes**
LTU3IND placement: **No**

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.



ARC Center of Excellence - Plants for Space (AgriBio)

available for LTU3IND 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: **4**
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.

Dept. Ag, Water & Envn. (DAWE) PEQ Facility, Mickleham

- Animal or plant identification
- Bioinformatics
- Genetic sequencing (incl. RNAseq, microarrays)
- PCR assays

E-mail: t.gendall@latrobe.edu.au
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Number of projects: **4**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

The national Post-Entry Quarantine (PEQ) facility at Mickleham, Victoria, opened in 2016 and includes a world class, state of the art laboratory complex and biosecurity greenhouse infrastructure. This facility gives the Australian Government, Department of Agriculture Water and Environment (DAWE) the opportunity to investigate and conduct RD&E trials to address a range of plant biosecurity challenges. PIC@PEQ conduct operationally focused biosecurity research projects, both in-house and in collaboration with external providers, to ensure the department's services remain efficient and effective. The PIC@PEQ team have significant scientific expertise and experience across a broad range of disciplines including: Plant Pathology; Diagnostics; Molecular Biology; Microbiology; Biotechnology; Irradiation. Projects will be co-supervised by LTU and PIC@PEQ staff.

Students will need to:

- Be professional, motivated and self-driven with a 'positive can do' attitude and open mind
- Meet with the PIC@PEQ team as part of the selection process
- Undergo a Federal Police check
- Be able to provide 100 points of certified ID
- Complete an induction process
- Complete several online e-learning modules (equivalent to roughly 0.5-1 week of time)
- Abide by all quarantine and WHS requirements applicable to working in a Biosecurity Activity Zone

We offer:

- Industry exposure to a leading employer of scientists across multiple disciplines
- Opportunity to work in a state-of-the-art biosecurity containment facility and experience working with professional, leading scientists in their fields.
- Modern, well-equipped laboratories
- Network building with a large, national government dept.
- Pathways to real employment opportunities and prospects
- Student stipends (up to $5000) may be available.

Environment and Genetics (EG)

Research projects in the Department of Environment & Genetics (EG)

The following list are research supervisors in EG who are offering projects in 2024.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

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Prof. Nick Bond
Albury-Wodonga

available for LTU3IND placement

Field work

Ecological assays

Animal handling

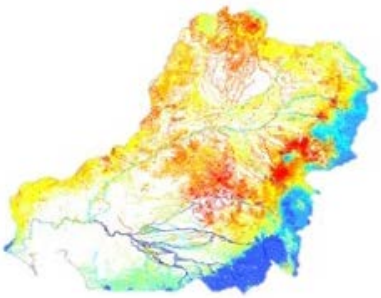
Animal behaviour studies

Ecological modelling (GIS)

E-mail: n.bond@latrobe.edu.au
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**

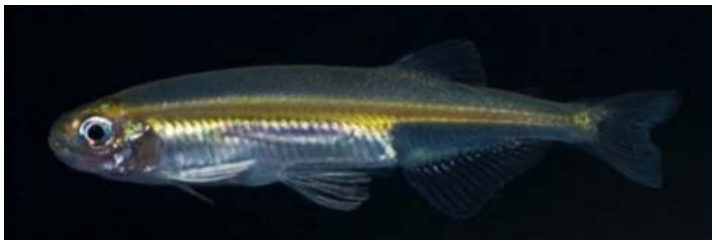
My research focusses on understanding the influence of biotic and abiotic drivers on the structure and function of aquatic ecosystems. A major focus for this work is understanding the effects of climate and hydrologic variability on population dynamics and on ecosystem processes, including ecosystem 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.



Prof. Heloise Gibb
Bundoora

available for LTU3IND placement

Field work

Ecological assays

Animal handling

Animal behaviour studies

Animal or plant identification

E-mail: h.gibb@latrobe.edu.au
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**

Our research investigates how species respond to environmental change and how to conserve species. We focus on terrestrial invertebrates, such as ants, spiders, amphipods and velvet worms. We often collaborate with Nick Murphy's molecular ecology group. Current projects focus on understanding endemism in fire-affected landscapes, understanding the ecological strategies of ants, impacts of mammal reintroductions on food web structure and new methods for including invertebrates in ecological restoration.

Project 1. Ecological strategies of ants. This project will focus on an aspect of the ecological strategies of ants. Organisms are often considered to have strategies on a spectrum from "fast" (short-lived, low investment, high metabolic rate species) to "slow" (long-lived, high investment, low metabolic rate) life strategies. This project will test the role of environment in determining ant ecological strategies.

Project 2. Species turnover across landscapes in forest invertebrates. This project will explore the drivers of change in species composition across forested landscapes, using litter invertebrates as model organisms. It will examine the role of vegetation and landscape barriers in restricting the distribution of dispersal-restricted species, such as amphipods, millipedes or velvet worms.

Prof. Pete Green
Bundoora

Ecological assays

Experimental design

Field work

Animal or plant identification

Data analysis

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Website: click here

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

I'm an ecologist with a broad range of interests in how ecological communities are assembled and what determines their dynamics. I work mostly with plants, invertebrate animals and the interactions between them, how they change through time, and how they're affected by disturbances and invasive species. If you have an idea for a project, I'm happy to chat.

In 2024 I'm offering two projects around the ecology of sodium in terrestrial food webs. Sodium is vital for maintaining osmotic balance, muscle activity and nervous system function in animals, but it plants typically occurs in plants at 10 to 100 lower times concentrations than is needed for normal physiological function in animals. From a consumer's point of view, sodium is relatively scarce in the environment it could shape population, community and ecosystem processes. The underlying hypothesis of both projects is that sodium limitation in the 'green food web' of tree canopies is greater than in 'brown food web' on the ground below. In tree canopies green food webs are based on living leaves and on sugary exudates like plant nectar and honeydew from sap-sucking insects, whereas the in the brown food web on the ground, decomposers concentrate sodium from leaf-litter and invertebrates feed directly or indirectly on them.

One project will focus on ants. They are a dominant group of insects in most terrestrial ecosystems in Australia, and most species have a diversified diet that includes plant-derived food (e.g. sugary nectar from flowers, or honeydew produced by sap sucking insects like aphids) and animal prey (e.g. insect prey). Many lines of evidence indicate that ants are generally sodium-limited, and this project will compare the attractiveness of sodium baits to canopy ants, vs ants of the ground. This could be done in mallee habitats where canopies are within easy reach, or we could possibly use canopy walkways such as the Otway Fly to do this work in much taller forest.

The other project (co-supervised with Dr Denise Fernando, Dept. of Animal Plant and Soil Science) will focus on insect communities associated with one particular species, the black box Eucalyptus largiflorens. Black box accumulates sodium in its foliage but there are differences in the degree to which individual trees do this within and between sites, potentially providing a natural system within which to test ideas about sodium limitation and its impacts on the assemblages of invertebrates that live in their canopies and in the leaf litter below.

Dr. Caitlin Gionfriddo
Albury-Wodonga

Genetic sequencing & gene expression analyses

Mass spectrometry

Environmental DNA

Bioinformatics

Cell culture - prokaryotes

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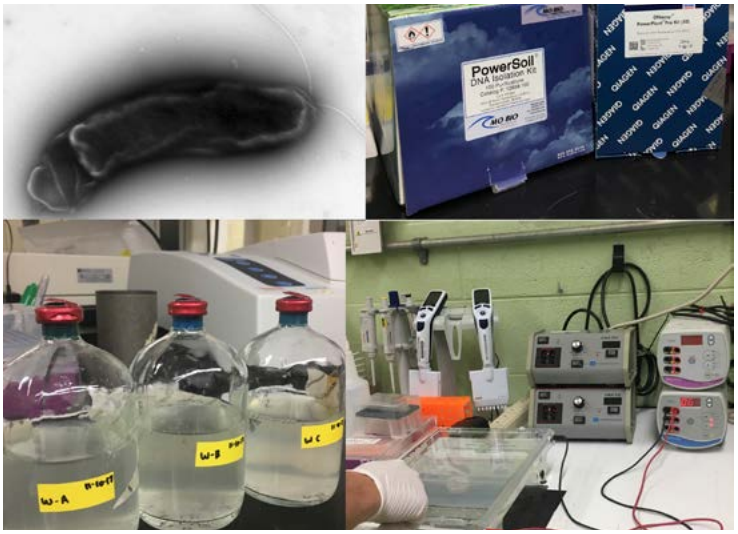
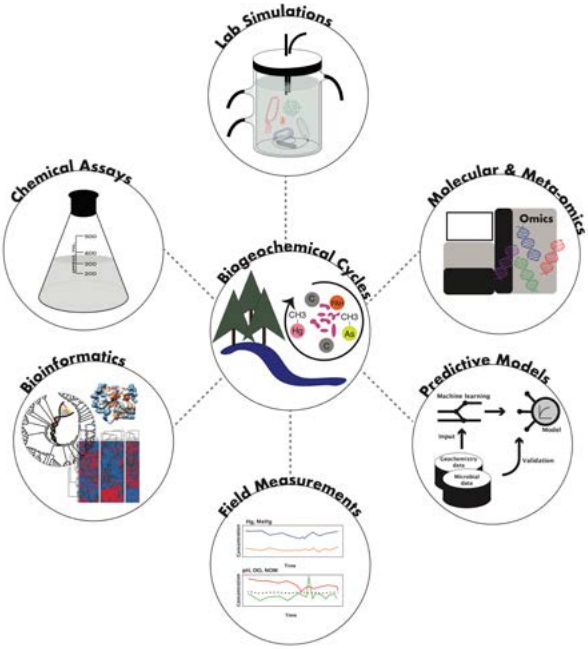
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

In my research, I explore how microbial dynamics may be used to better predict the fate of contaminants in aquatic ecosystems. I am an environmental microbiologist and biogeochemist who studies how microbes shape and are shaped by their environment. I utilise molecular and meta-omic techniques with chemical assays to connect microbial mechanisms to biogeochemical processes. My current research is primarily focused on the environmental drivers of mercury methylation. Methylmercury is a highly toxic organic form of mercury produced by microbes that accumulates in the aquatic food web, posing a threat to human and ecosystem health. I am interested in understanding why microbes produce this more toxic form of mercury and how we may limit its production in aquatic environments.





I can supervise research projects focussed on studying the role microorganisms play in regulating biogeochemical cycles in aquatic ecosystems. I am particularly interested in understanding how microbial transformations of emerging contaminants and toxic metals affect their accumulation in ecosystems and food webs. My current research is focussed on microbial transformations of arsenic and mercury in freshwater and marine ecosystems. My broader research interests span an array of topics in environmental microbial ecology, including how microbiome structure contributes to ecosystem functioning and understanding the response of microbial communities to climate change or disturbance.

Dr. Aleicia Holland
Albury-Wodonga

available for **LTU3IND** placement

- Field work
- Ecological assays
- Animal handling
- Animal or plant identification
- Cell culture - eukaryotes incl. primary & cell lines
- Flow cytometry
- Environmental DNA
- Toxicity bioassays

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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**

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. We use a range of field and laboratory techniques to address research questions. Our field sites span tropical, temperate and alpine environments including streams, rivers, lakes and wetlands, where we explore interactions of aquatic biota with their environment such as fish/microbe interactions, the influence of dissolved organic matter (DOM) on microbial communities and food webs 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 the following topics:

Project 1. Fish/microbe interactions. Microbiomes of Flathead and Fiddler ray and response to contaminants in Port Phillip Bay. Do certain microbes allow fish to live in naturally acidic blackwaters?

Project 2. Toxicity and bioavailability of contaminants. Mechanisms behind metal toxicity to fish, invertebrates, coral or algae. Influence of dissolved organic matter on metal toxicity and bioavailability.

Project 3. Aquatic ecology. Influence of dissolved organic matter on productivity and food webs in freshwaters. Effect of fire on alpine streams.

Dr. Vanessa Kellerman
Bundoora

available for LTU3IND placement

Field work

Ecological assays

Animal handling

Drosophila melongaster models

PCR assays

E-mail: v2kellermann@ltu.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**

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, the highly tractable (lab-based) Drosophila system and (field based) native bees.

Project 1. The role of biotic interactions such as competition in shaping adaptation to different environments. Most research that aims to predict the impacts of climate change on insects does so with species in isolation. However, species evolve in communities and it is these communities that will shape how species respond to changing environments. This research project will explore how temperature and competition interact in different Drosophila species to shape evolutionary responses in fitness and thermal traits.

Project 2. The extent of facultative endothermy in native bees. Insects are often considered ectothermic but some large flying insects have the capacity to generate heat in their flight muscles. Honeybees and bumblebees are known to be facultative endothermic but whether Australian native bees have the capacity is less certain. This research project will examine whether native bees are facultative endothermic by examining how native bees regulate their body temperatures in the wild.

I am also open to discussions with students about projects that loosely fit within the research themes described above.

Prof. Melodie McGeoch Bundoora

Field work

Bioinformatics

R-coding/modelling

E-mail: m.mcgeoch@latrobe.edu.au
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: **No**

Prof. Melodie McGeoch is an ecologist that works on biodiversity theory and the measurement and monitoring of biodiversity status and trends. Our lab focuses on how biodiversity is responding to climate and other environmental changes, and how it is predicted to respond in the future, using plant and animal populations and communities (see melodiemcgeoch.com).

Our research includes projects on biological invasions, climate change, community ecology, ecological theory, biodiversity informatics – in terrestrial ecosystems. Our research often feeds into environmental policy and management. Some of the research questions we are interested in are:

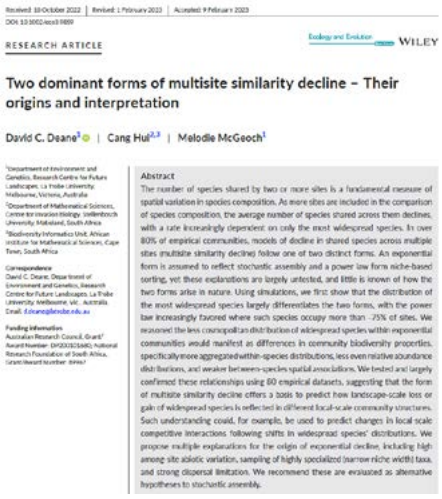
How does biodiversity change over space and time, how can we better model and predict this and what does it mean for conservation?

How do we identify priority sites and priority species to act against the negative impacts of biological invasions?

What does the future of Antarctic biodiversity look like under climate change?

What approaches can be developed to make biodiversity information more relevant and accessible to decision-makers?

The McGeoch Research Group is also affiliated with SAEF, which is an Antarctic research program, funded by the Australian Research Council as a Special Research Initiative. Established in 2021, our mission is to understand the changes taking place across the Antarctic region – to its climate and its biodiversity – and develop innovative ways to forecast, mitigate and manage these changes. We also collaborate with policymakers to identify conservation priorities and help make the right decisions for Antarctica's future. Please do get in touch with Melodie if you are interested in working with us – especially if have some experience using R and enjoy analysing data.



RESEARCH ARTICLE

Ecology and Evolution WILEY

Two dominant forms of multisite similarity decline – Their origins and interpretation

David C. Deane[1] | Cang Hui[2,3] | Melodie McGeoch[1]

Abstract

The number of species shared by two or more sites is a fundamental measure of spatial variation in species composition. As more sites are included in the comparison of species composition, the average number of species shared across them declines, with a rate increasingly dependent on only the most widespread species. In over 80% of empirical communities, models of decline in shared species across multiple sites (multisite similarity decline) follow one of two distinct forms. An exponential form is assumed to reflect stochastic assembly and a power law form niche-based sorting, yet these explanations are largely untested, and little is known of how the two forms arise in nature. Using simulations, we first show that the distribution of the most widespread species largely differentiates the two forms, with the power law increasingly favored where each species occupy more than ~75% of sites. We measured the less cosmopolitan distribution of widespread species within exponential communities would manifest as differences in community biodiversity properties, specifically more aggregated within-species distributions, less even relative abundance distributions, and weaker between-species spatial associations. We tested and largely confirmed these relationships using 80 empirical datasets, suggesting that the form of multisite similarity decline offers a basis to predict how landscape-scale loss or gain of widespread species is reflected in different local-scale community structures. Such understanding could, for example, be used to predict changes in local scale competitive interactions following shifts in widespread species' distributions. We propose multiple explanations for the origin of exponential decline, including high among site abiotic variation, sampling of highly specialized (narrow niche width) taxa, and strong dispersal limitation. We recommend these are evaluated as alternative hypotheses to stochastic assembly.

Dr. Luke McPhan
Albury-Wodonga

Ecological assays

Ecological modelling

Field work

Animal behaviour studies

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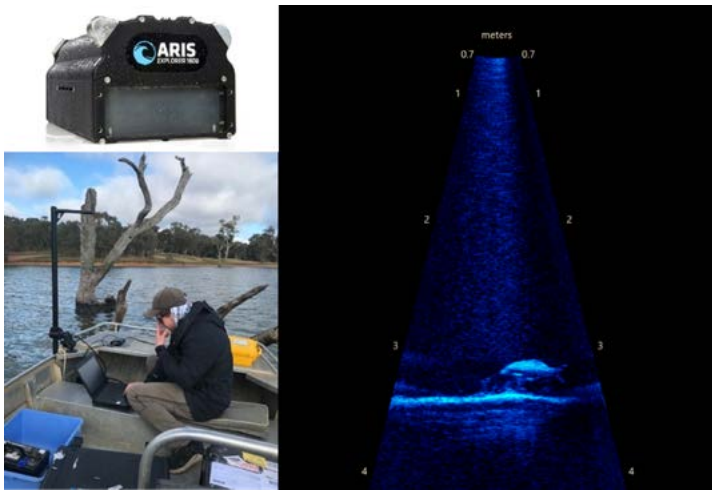
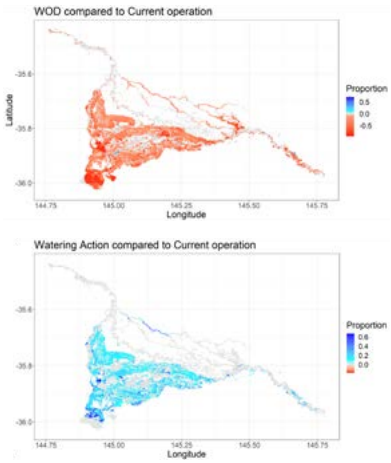
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The Centre for Freshwater Ecosystems (CFE) brings together a wealth of expertise in freshwater science and water management to understand and help solve the significant challenges in sustaining healthy freshwater ecosystems. Members of this research group aim to accurately understand freshwater systems by modelling species biodiversity, environmental impacts and distribution patterns of native and introduced biota. Researchers conduct both fundamental scientific and applied research projects, improving our ability to manage freshwater systems and the ecology and species within them.

Project 1: Seeing through mud: Estimating freshwater fish population densities with SONAR (ARIS Explorer). Co-supervisors: Sam Lewis and Prof. Nick Bond. Non-intrusive visual methods commonly used in marine and estuarine environments such as BRUVS, RUVS, and diver operated video or survey lack compatibility in many lowland freshwater environments given the generally turbid nature of Australian freshwaters. This has influenced the method of fish population assessments towards representative sampling via nets and electrofishing, both of which have specific biases based on the behaviour and habitat (e.g structure, water depth, water clarity, physico-chemical conditions). Aiming to measure densities of moderate to large sized fish (> 150 mm) independent of most gear biases this project is focussed on developing methods for surveying fish using an ARIS (Adaptive Resolution Imaging Sonar) Explorer 1800 SONAR unit (Sound Metrics Corp, Bellevue, WA, USA) in experimental and field conditions to identify appropriate methods (e.g. Max N measurements, pseudo-random temporal sampling) of accurately measuring fish abundance, size structure and biomass.



Project 2: Flow response of floodplain vegetation in the southern Murray Darling Basin. Co-supervisor: Prof. Nicholas Bond. Globally, floodplain vegetation communities have been heavily impacted by altered flow regimes due to river regulation and water extraction for off-stream use. These impacts are likely to be exacerbated under an increasingly variable climate. Current models of floodplain vegetation have difficulty predicting future changes under a variable climate. Our understanding of the impacts and responses of vegetation communities to changes in floodplain inundation regimes is still developing in the Murray Darling Basin and is critical to predictions of future changes in vegetation extent and health. This project would focus on using satellite imagery and previously known floodplain vegetation distributions to develop empirical relationships between floodplain vegetation communities and attributes of inundation (e.g. duration, time of year, frequency). This model would then be used to simulate alternative future scenarios of floodplain vegetation under a changing climate with higher flow variability.



Dr. Sally Maxwell
Albury-Wodonga

available for LTU3IND placement

- Ecological assays
- Field work
- Plant or animal identification
- Animal handling
- Light microscopy
- Policy-management translation

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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**

Potential opportunities exist to look response of invertebrates and/or foodwebs to the effects of flow and temperature modification under climate change and other potential drivers in upland rivers. These systems are poorly understood compared to larger rivers of the Murray Darling basin. Mesocosm experiments replicating field conditions, may also be designed to assess more specific driver-response relationships. Several projects may exist exploring empirical relationships and/or the broader policy and management contexts depending on student interest.

Prof. John Morgan Bundoora

Field work

Plant identification

Ecological assays

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Number of projects: **3**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

In the Plant Ecology lab, 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 2024, I offer four projects (but am very happy to hear your own ideas, and can discuss other ideas I have too).

Project 1. What is causing recruitment failure in the endangered Button Wrinklewort? The Button Wrinklewort is in serious decline. In Victoria, wild diploid plants only occur at two location. At these locations, seed quality is known to be good, but recruitment is failing. There are too few young plants to replace the ageing adults. What is causing this recruitment failure? Our leading hypotheses are predation by slugs, snails, millipedes or mites. This project will investigate these hypotheses using field and glasshouse experiments involving seed addition and micro- predator exclusion plots, along with direct field observation. The results of this study are urgently needed to guide management of the wild populations.

Project 2. Measuring the impact of over-browsing on forest flora. The long-term impacts of over-browsing and overgrazing have received little scientific attention in south-east Australian forests and woodlands. Exclosures in Dry Grassy Woodlands have been erected (at St Andrews, 30 mins from LTU); these prevent grazing by all mammalian herbivores and exhibit marked differences in their plant species composition and biomass compared to overgrazed surrounding areas. Project questions include: How do plant species composition, number of individuals, plant height (surrogate for biomass) differ between exclosures of different ages and their adjacent control areas? What are the differences in plant species recolonisation or recovery times between the exclosures of different ages? How does ant (and other insect eg pollinators?) diversity and activity vary between exclosures of different ages compared to adjacent control sites? Is leaf litter more rapidly incorporated into the soil layer within exclosures than adjacent overgrazed control sites?

Project 3. Allee effect of seed predation in Ptilotus macrocephalus. Seed collectors have said this plant always seems to suffer from heavy rates of seed predation from an unknown seed predator. This may be a type of Allee Effect where small populations have their seed predated because they cannot satiate the predators. An obvious hypothesis is that seed predation rates are linked to population size or density, with large populations able to spread predation risk across a larger number of individuals compared to smaller populations. Understanding Allee Effects has conservation implications - if there is total seed predation, all the time, when does the species recruit? Or is this an example of a species having an extinction debt?

Project 4. Why do you find grassy balds in dry eucalypt forests? Abrupt vegetation structural boundaries can form between forests and grasslands in several places in Australia but the reasons for such patterning remain poorly understood. Alternate hypotheses typically invoke sharp resource gradients (soil moisture in summer) versus frequent fires that exclude trees. Field survey work will be conducted in dry forests of the Dandenong Ranges to quantify floristic, regeneration traits, and structural patterning across grassland-forest transitions to test resource- and disturbance-models. Questions asked in this study might include: Do patch types defined by grassland or eucalypt forest dominance differ in species and life form composition? Are these differences due to soils? Are transitions stationary or dynamic, that is, do boundaries mainly reflect disturbance gradients? A better understanding of grasslands in forests sheds light on their origins.

A/Prof. Richard Peters
Bundoora

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

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

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.

Dr. Ryan Phillips
Bundoora

- Ecological assays
- Animal or plant identification
- Field work
- Experimental design
- Plant reintroduction
- Animal behaviour studies

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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**

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).

A/Prof. Jim Radford
Bundoora

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

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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**

Our lab undertakes research that is focused on how to conserve species, ecosystems and biodiversity 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 employ a 'whole of landscape' approach, in which we compare the flora and fauna of 'whole landscapes' that differ in the extent, configuration and composition of native vegetation. We have used this approach, often in collaboration with land-management agencies, to identify factors and attributes of landscapes that are most likely to sustain wildlife in regions experiencing change associated with agricultural land-use, wildfire, and urban development.

Major research topic areas include:

a. Landscape change and nature conservation (especially birds) in agricultural environments
b. Fire ecology and the relationship between fire regimes and conservation of species and communities
c. Conservation biology of wildlife species (especially birds) and communities
d. Provision of ecosystem services by wildlife in agricultural landscapes

Honours project. Farmland conservation: validating predictions of biodiversity on farms. Agriculture is the most widespread land-use on earth. Biodiversity conservation, globally, hinges on the ability of agricultural lands to sustain species and ecological communities. Natural Capital Accounting, which involves a 'spatial inventory' of all the types of ecosystems present on a farm, has emerged as a promising tool that farmers can use to identify areas of high biodiversity value on their farm and track changes in the ecological integrity of the farm over time. This has economic implications for farmers including, for example, access to emerging 'biodiversity friendly' markets.

However, uncertainties remain around how the Natural Capital on a farm, as captured in Natural Capital Accounts, relates to the biodiversity sustained by the farm. We have developed models to predict and map the biodiversity values of farms based on the type and configuration of Natural Capital assets and biodiversity survey data. This project will expand this work by validating spatial predictions of biodiversity (birds, plants) for farms that have not yet been surveyed. The project will involve 1) generating maps of predicted biodiversity value across a range of farms in southern NSW and VIC and 2) conducting field surveys of either birds or plants (depending on the student's interest and skills) to determine how our spatial predictions align with 'on ground' observations.

Dr. Michael Shackleton
Albury-Wodonga

available for LTU3IND placement

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

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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**

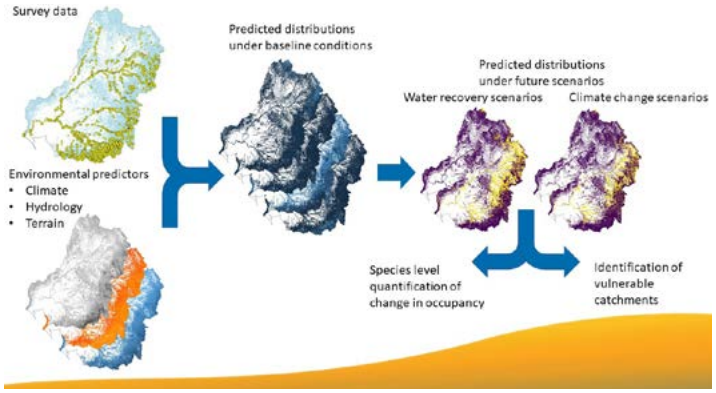
My lab is primarily interested in aquatic ecology, specifically around understanding species distributions and responses to environmental parameters - especially those impacted by climate change. I use traditional and molecular (i.e. metabarcoding) survey techniques to characterise communities and model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



A/Prof. James Van Dyke Albury-Wodonga

available for LTU3IND placement

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

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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**

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 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. The main aim is to develop, test, and implement new ways of protecting turtle nests from foxes, which destroy turtle nests. Honours projects could focus on that, but as a result of the work we will also be able to do other ecological projects on adult and hatchling turtles. The projects are funded through 2024, so there is ample time available to convert a successful honours project into a Masters degree also.

Please note that I am based at the Wodonga campus, which is close to some of my field sites. I currently supervise a students who live in Melbourne, so there is no requirement to move for honours. However, the downside is that my supervision is conducted remotely, via Zoom. I work with my students face-to-face whenever possible, but rely on local collaborators to provide support in Melbourne. If you prefer more direct contact and supervision, then finding a place to live in Albury-Wodonga may be beneficial.

Prof. Warwick Grant
Bundoora

Genetic sequencing

PCR assays

Bioinformatics

Animal models of disease

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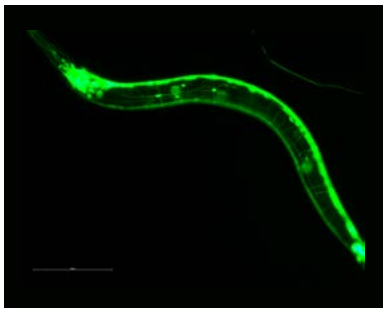
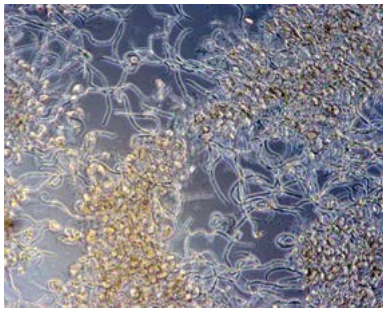
Number of projects: **3**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**





Nematode parasites are responsible for a wide variety of diseases in humans and in wild, domestic, and companion animals. They rarely cause death but are a major cause of morbidity and are prominent amongst the WHO's "top 10" neglected diseases. We use classical genetic, genomic, and bioinformatic approaches to study the biology and evolution of nematode parasites and of the vectors that transmit them. We are interested in questions such as how landscape ecology, host migration, host switching, and management decisions affect a parasite species' genetic diversity, and how that in turn affects important characteristics such as a parasite's response to drugs or the severity of the pathology they cause.

The lab's vision is to provide tools to aid in the elimination of parasitic 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. Nematode genetics. The macrocyclic lactone drugs such as ivermectin and moxidectin have been the mainstay of nematode parasite control in humans and livestock for more than 40 years but the mechanisms of action and of resistance to these drugs are not well understood. We use the model organism *Caenorhabditis elegans*, which is a non-parasitic nematode, to investigate the biology and genetic basis of macrocyclic lactone responses. The projects that are available will use classical genetic methods to map genes implicated in variation in responses to ivermectin, and genome sequencing to define candidate genes.

Project 2. Filarial parasite reproduction biology. Filarial nematodes include parasites that cause river blindness and elephantiasis (lymphatic filariasis) in humans and heartworm disease in dogs. This project will use a combination of phenotypic characterisation and genome mapping to investigate the genetic determinants of fecundity in filarial nematodes from dogs and cattle as models for filarial parasites of humans.

Project 3. Bioinformatics (with Dr Shannon Hedtke). Parasite evolution is characterized by frequent host shifts as well as rapid evolution of host specificity. In the filarial nematodes, human-specific parasites have evolved multiple times and cause diseases with significant morbidity, including onchocerciasis (river blindness) and lymphatic filariasis. This project uses the power of comparative genomics to explore within- and between-species evolution of genes associated with host disease.

Dr. Susan Hoebee
Bundoora

Field work

Pollinator & breeding systems

Ecological assays

Bioinformatics

Light microscopy

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Website: click here

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

The research in my lab typically combines pollination and plant conservation genetic studies, sometimes mixing both.

I have the possibility of two projects of offer that both investigate the connectivity between population of threatened Grevillea species (can be started Feb, or if pollination is included Jul); and one dealing with understanding the genetic processes the may underpin why a native Acacia species is now becoming 'weedy' (date TBC; this project links strongly with land management concerns). The design of each of the projects can be somewhat sculpted to suit individual research passions and timelines.

Please reach out if you're interested and feel free to meet and speak with current students in my lab!

Dr. Nick Murphy
Bundoora

available for **LTU3IND** placement

Phylogenetics

Population genetics

Environmental DNA

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Website: click here

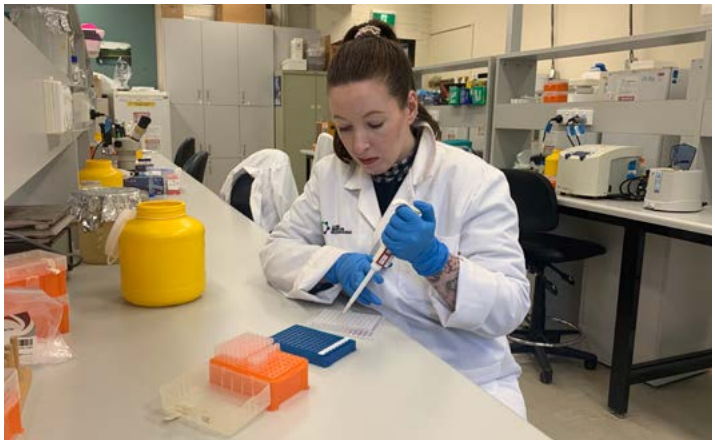
Number of projects: **1**
Full-time or part-time: **Both**
Feb or July start: **Either**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

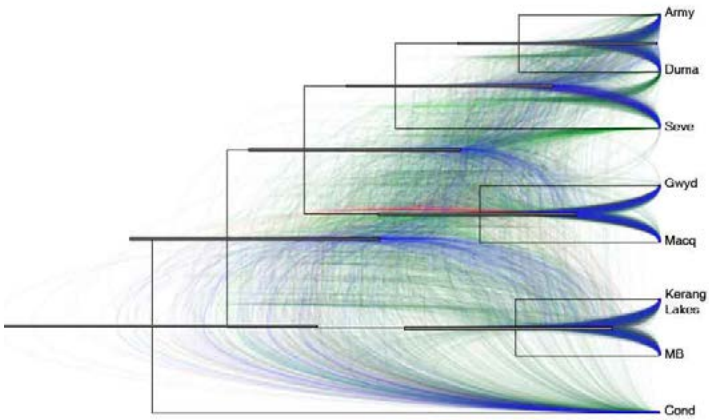
My lab uses genetic tools to better understand biodiversity. We try and utilise advances in genomic techniques to improve our knowledge of poorly understood aspects of biodiversity. We work on a range of species, from invertebrates to large mammals, mostly with an aim to determine why species are found where they are, and how changes in environment may impact on that.

My lab's research ranges from advancing population genetics and phylogenetic studies, using environmental DNA to better monitor biodiversity, and using genetic approaches to understand diet. There are no set projects in my lab for 2024, but I'm keen to speak with anyone who has research interests that intersect with mine. Areas that I'm interested in further developing honours projects are:

- Incorporating genetic markers for sex and age into population genetic studies
- Advancing eDNA monitoring of terrestrial biodiversity
- Speciation and evolution in Victorian invertebrates

For each of these areas I have a range of projects in mind across different species, some with a mix of field and lab work, others that are purely lab based, and I like to tailor honours projects to be suited to the skills development of individual students.





Biochemistry and Chemistry (BC)

Research projects in the Department of Biochemistry & Chemistry (BC)

The following list are research supervisors in BC who are offering projects in 2024.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

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Prof. Stephanie Gras
LIMS

available for **LTU3IND** placement

- Infection & Immunity
- Flow cytometry
- X-ray crystallography
- Protein biochemistry
- Mammalian cell culture
- Prokaryote cell 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**

Viruses and pathogens are part of the 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 are able to mutate in order to escape the immune system surveillance. If we were to develop better vaccine and drugs, or even vaccine against viruses like influenza and 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. We discover new potential targets for therapeutics and vaccine development.

Students can choose to study a specific technique, or a combination of techniques, that can then be applied to different viral infections and projects highlighted below.

Project 1. Influenza virus is able to generate a high number of mutation and so more likely to escape the immune system surveillance. We use X-ray crystallography to make 3D structures of viral peptides bound to immune system proteins (HLA molecule) in complex with T cell receptor (TCR).

Project 2. HIV has very high mutation rates and despite the dramatic longevity provided by current anti-retroviral therapy, HIV-AIDS is still a health burden. To tackle these issues, our work focuses on a subset of individuals known to control HIV infection and/or delay AIDS progression. We use X-ray crystallography to make 3D structures of HIV epitopes to observe the details of the interaction between peptide and the TCR, and link those observations with the function of the T cell carrying this particular TCR.

Project 3. SARS-CoV-2 virus is responsible for COVID-19 disease and our previous work on viral immunology allows us to provide understanding of the T cell immune response to this new virus. 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-19 vaccines.

Project 4. Discovering the role of non-classical HLA molecule. While CD8+ T-cells are essential for viral clearance, the development of CD8+ T-cell mediated vaccines is challenged by high diversity of their target molecules, (HLAs) with over 22,000 distinct HLA molecules described to date. We have discover new epitope for an unconventional HLA molecule, called HLA-E. Understanding CD8+ T-cell responses towards the non-classical HLA-E allele could have significant implications for the design of future vaccines or therapeutics, knowledge that is likely applicable to many intracellular pathogen.

A/Prof. Begona Heras
LIMS

available for **LTU3IND** placement

- Infection & Immunity
- X-ray crystallography
- Bacterial over-expression of protein
- Molecular cloning
- Biophysical characterisation of proteins
- Protein biochemistry incl. immunoprecipitation
- Confocal & Super resolution fluorescence microscopy
- Cell culture - eukaryotes incl. primary & cell lines

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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**

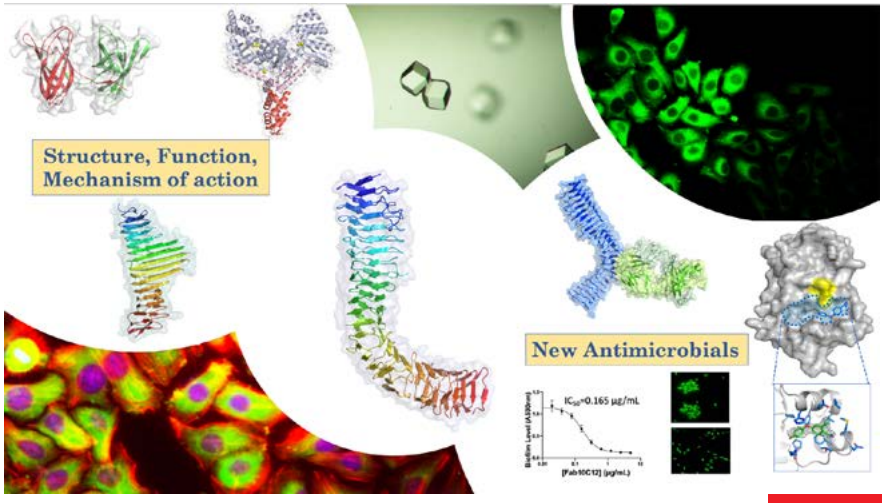
Bacterial infections are one of the greatest health threats of the 21st century. Antimicrobial resistant super-bugs are projected to cause over 10 million annual deaths globally by 2050, becoming the major cause of death in humans. With the increase of bacterial resistance and the lack of new drugs coming into the market, there is an urgent need to increase our understanding of the mechanisms underlying bacterial pathogenesis to identify new targets for therapeutic intervention.

In the Heras laboratory we investigate virulence mechanisms in Gram-negative bacteria to develop antibiotics that disarm rather than kill bacteria. We particularly focus on World Health Organization (WHO) listed critical high priority pathogens such as Escherichia coli, Serratia, Salmonella, and Neisseria ssp. The ultimate aim of our work is to develop new "resistance proof" antimicrobials.

Students working in the Heras laboratory can choose to study a combination of techniques, that will be applied to the projects highlighted below.

Project 1. Investigation of bacterial autotransporters, the largest group of cell-surface proteins responsible for host colonisation and biofilm formation. This project will combine recombinant protein expression and purification, structural biology, molecular microbiology and biophysics (SPR, CD, AUC), to dissect the structure and function of these important bacterial proteins. This project will also develop molecules that block their function (e.g. inhibit the formation of biofilms) as new pathogenesis blocking agents.

Project 2. Elucidate the mechanisms underlying bacterial resistance development. We use X-ray crystallography combined with biochemistry, molecular microbiology and computational studies, to understand how bacteria become resistant to antibiotics. We progress this research to develop small druglike inhibitors that block these resistance processes as new antibacterials.



Prof. Marc Kvansakul
LIMS

available for LTU3IND placement

- X-ray crystallography
- Isothermal calorimetry
- Circular dichroism
- Protein biochemistry (SDS-PAGE, western blotting)
- Molecular cloning
- Bacterial over-expression of protein
- Cell culture - prokaryotes

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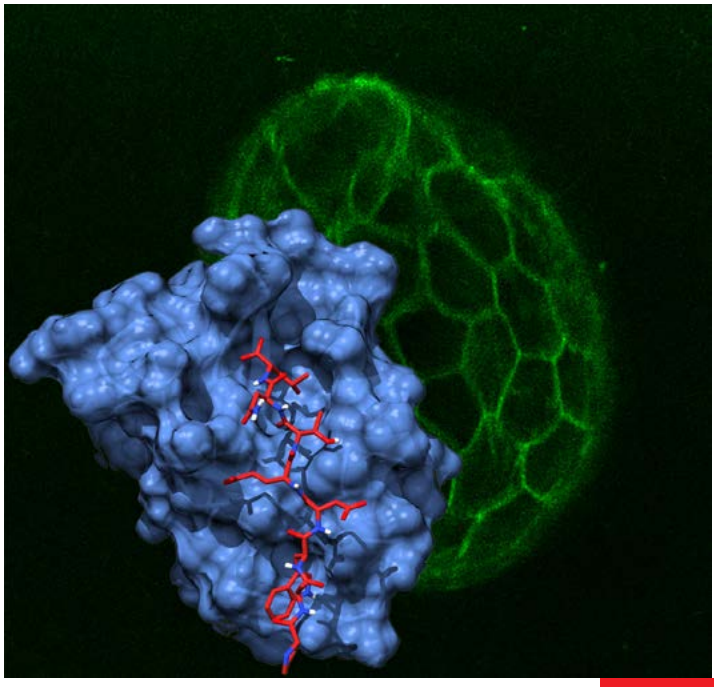
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The lab is looking for students in two different areas, host defence proteins as well as cell polarity signalling.

Project 1. Host defence proteins. Defensins are small cationic proteins that are involved in innate immune processes in plants as well as humans. In plants, defensins have been shown to deliver significant resistance against plant pathogens such as fungi, however their precise molecular mechanism of action is currently not fully understood. Furthermore, defensins are also able to target cancer cells.

We are currently investigating how defensins are able to attack and perforate cell membranes of pathogens as well as cancer cells. Recognition of phospholipids has been shown to be critical for the ability of defensins to attack target cells, and we are interested in understanding the structural basis for phospholipid recognition as well as membrane attack. Using X-ray crystallography we recently showed that defensins form large oligomeric complexes with phospholipids, thus for the first time shedding light onto the detailed molecular mechanism employed by defensins during innate defence. We are now examining defensins in other species such as insects, crocodiles and trichoplax to understand the evolution of these host defence molecules.

Project 2. Cell polarity. The establishment of cell polarity, and correct definition of where top and bottom, front and back as well as left and right are in a cell, is critically important for the formation of tissues in multicellular organisms. Dysregulation of this process is associated with the development of birth defects, more mobile and aggressive cancers as well as viral infections. Correct establishment of the different polarity axis is controlled by a network of scaffolding proteins that integrate signals from a host of cellular signalling pathways. We are interested in understanding the molecular mechanism underlying cell polarity regulation using a range of structural biology techniques including X-ray crystallography, cryo-electron microscopy and small-angle X-ray scattering. We are particularly interested in the evolution of cell polarity, and plan to study the protein interactions that govern cell polarity in ancient metazoans such as trichoplax and hydra.



A/Prof. Erinna Lee
LIMS and ONJCRI

- 3D cell culture
- Flow cytometry
- Cell transfection
- Cell culture - eukaryotes incl. primary & cell lines
- Protein biochemistry (SDS-PAGE, western blotting)

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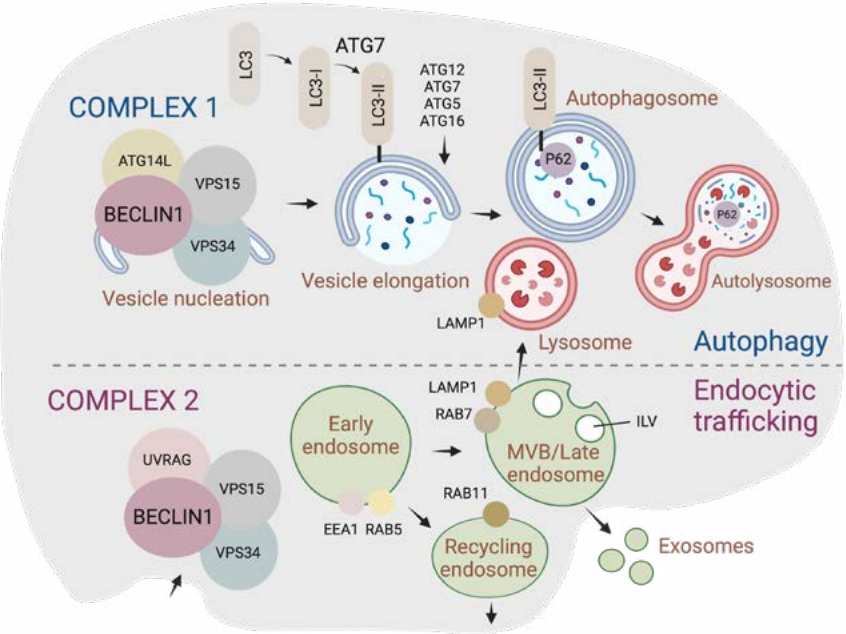
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

Our cells are constantly making decisions as to whether it is better to live or die in the context of the overall wellbeing of the organisms. Defects in these decision-making processes can lead to diseases such as cancer and inflammatory bowel disease.

The Cell Death and Survival Lab, based at the ONJCRI, is interested in studying the molecular machineries responsible for these cell death and survival decisions. In particular, what the specific defects are in cancer and how we can fix these problems for the development of new therapeutic options. Indeed, our team has a strong background in the translation of basic discoveries into clinically applicable approaches, and we currently also work with multiple industry partners to achieve this.

This Honours project will focus on understanding how our gut microbiome contributes to cancer. The pathway of interest is the cellular recycling program of autophagy. Autophagy removes unwanted or damaged material (e.g. damaged organelles, invasive bacteria) by encapsulating these within vesicles for delivery to the lysosome for degradation. These degraded products are then recycled to generate new building blocks of life.

There is now increasing evidence that autophagy can alter the composition of our gut microbiome, which in turn can impact cancer development. This project will utilise cell biology, biochemistry and animal approaches to investigate the mechanisms by which this occurs.



Dr. Nick Reynolds
LIMS

available for LTU3IND placement

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

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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**

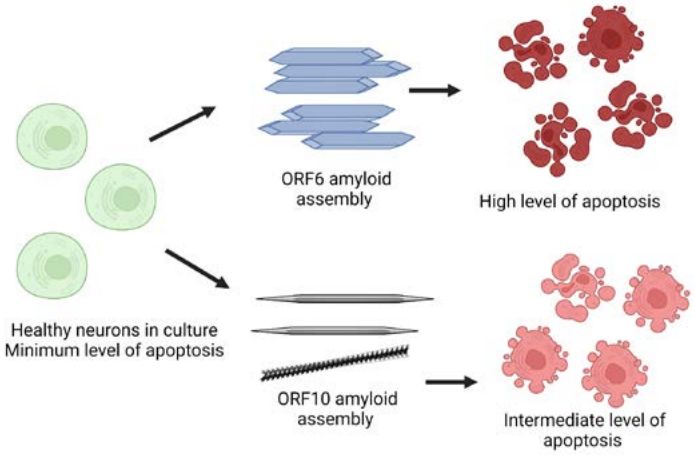
The research in my lab can be broadly defined as Bionanotechnology. I am interested in developing materials to help us better understand how immune cells behave (with Dr. Katrina Binger), in developing materials for tissue engineering (specifically cartilage tissue engineering), and in performing research to better understand the origin of neurological symptoms in diseases such as COVID-19.

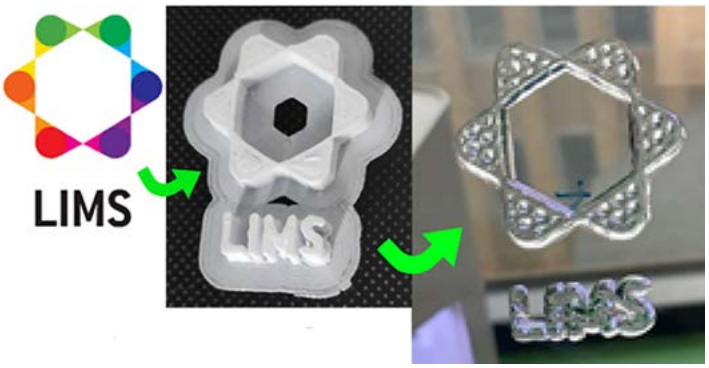
Depending on the students preferences and experience there are a number of potential project on offer, these are split into two broader themes.

Theme 1: Investigating the role that protein self-assembly plays in COVID-19. Research from our lab recently published in Nature Communications (https://www.nature.com/articles/s41467-022-30932-1) suggests that the neurological symptoms that can occur in COVID-19, such as brain fog, inflammation, and stroke, maybe due to proteins from SARS-CoV-2 clumping together to form nanofibrillar aggregates. To further this work there are a number of projects on offer which will use biochemical, biophysical and nanotechnological analytical techniques to answer questions such as:

- What is the function of these protein aggregates (collaboration with A/Prof. Karla Helbig (MAPP)).
- What are the molecular mechanisms of cell toxicity (collaboration with Prof. Yuning Hong (Chemistry) & Dr. Sarah Annesely (MAPP)).
- Further investigations into the molecular mechanisms of protein aggregation.

Theme 2: 3D Bioprinting for Cartilage Tissue Engineering or Macrophage Biology. 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 Katina Binger (BC)).





Dr. James Tsatsaronis
LIMS

available for LTU3IND placement

Pedagogy

Qualitative analysis

3D printing

3D modelling

Interviewing

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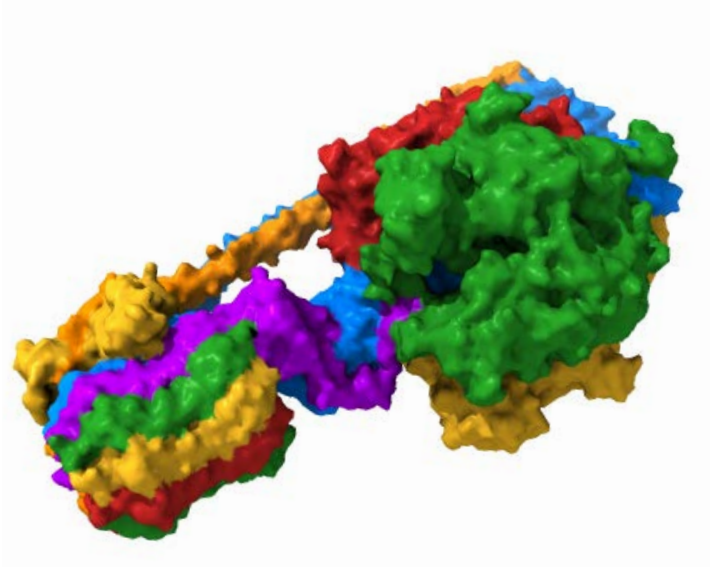
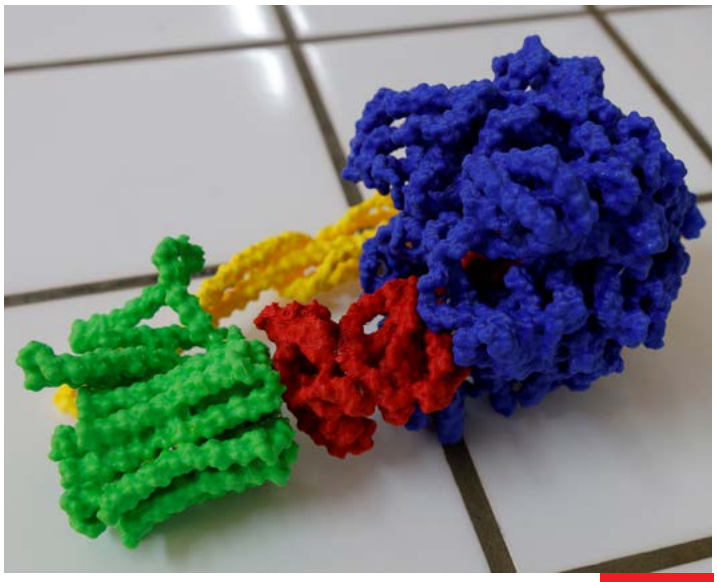
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My educational research focuses on how technology can be used to enhance student learning in scientific disciplines. Technology enhanced learning (TEL) is a central aspect of modern higher education, and provides opportunities to engage learners in ways not possible previously. In particular, I am interested in how technology can bridge gaps between learners and educators in online environments, and technologies that facilitate learning about cellular and molecular life and processes.

Project 1: Evaluating the use of 3D printing of molecular structures in biochemistry teaching. 3D printing is an emergent technology for creating "one of a kind" models, such as the intricate molecular complexes formed by proteins, DNA and RNA. This project aims to build a library of 3D models based on molecular coordinators, and evaluate the effectiveness of these for teaching core biochemistry and molecular biology concepts.





Dr. Lakshmi Wijeyewickrema LIMS

available for LTU3IND placement

Infection & Immunity

Molecular cloning

Protease activity assays

Bacterial over-expression of protein

Protein biochemistry

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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**

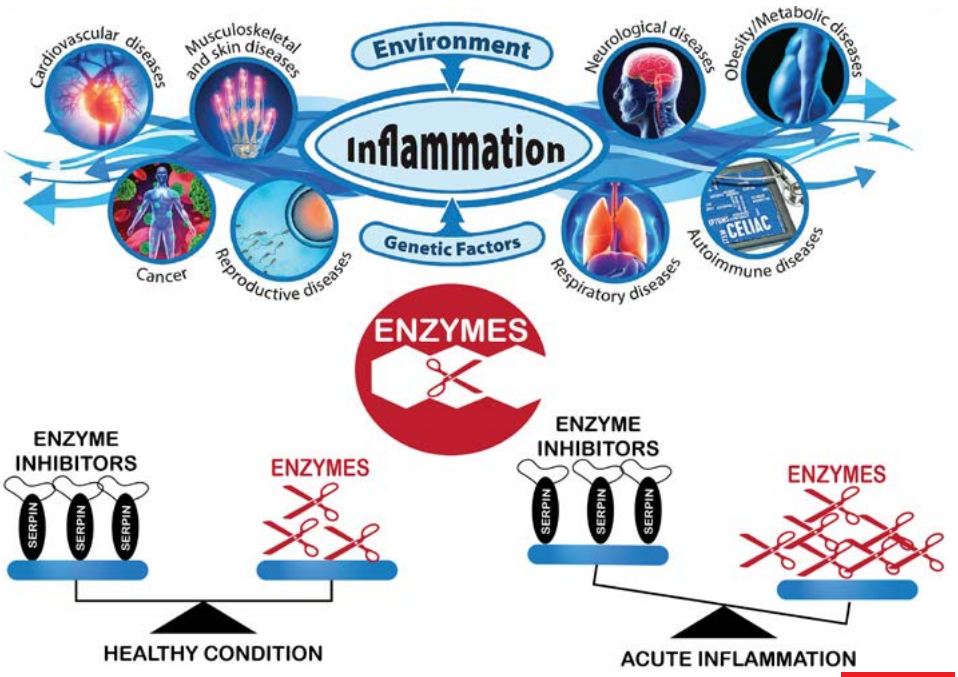
Enzymes are truly remarkable molecular machines that operate tirelessly within our bodies, allowing us to carry out even the most basic biological functions. These unsung heroes keep us healthy and functioning by catalysing essential chemical reactions. But enzymes are not just vital for basic survival – 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.

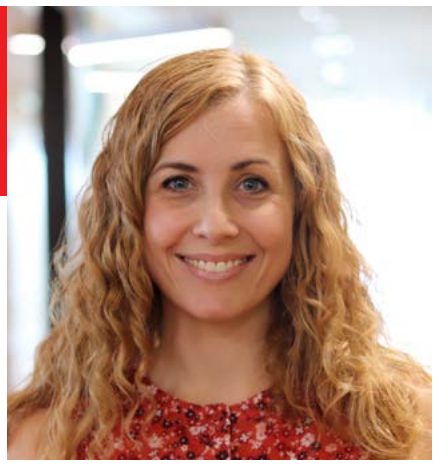
Project 1. The enemy within: targeting the viral entry facilitator of SARS-CoV-2 as a therapeutic strategy.

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



Dr. Amy Baxter
LIMS

available for LTU3IND placement



- Cell culture - eukaryotes, incl. primary & cell lines
- Protein biochemistry
- Confocal & super resolution fluorescence microscopy
- CRISR-Cas9 gene editing of cells
- Flow cytometry
- Cell transfection

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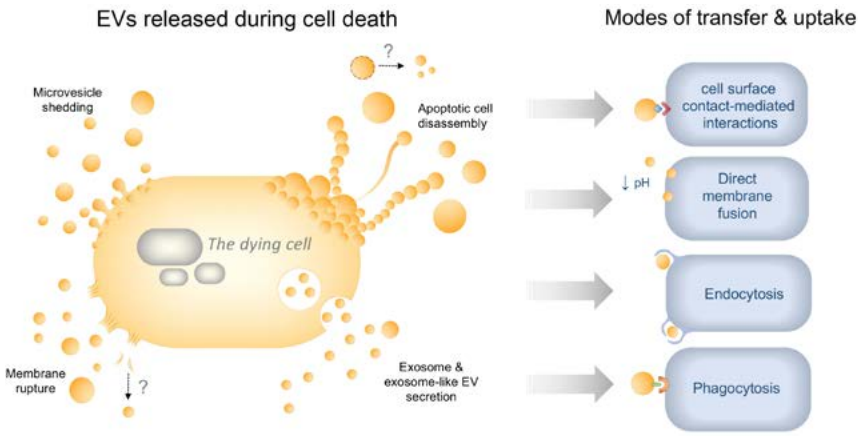
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The removal of dying cells by phagocytes (a type of cell capable of engulfing other cells or particles) is a critical process required to replenish healthy cells and maintain tissue homeostasis. In order to achieve this, important messages from dying cells in the form of proteins, metabolites, nucleic acids and lipids are targeted to phagocytes to initiate their clearance. During apoptosis, a major type of programmed cell death, cells undergo a fragmentation process resulting in the release of particles or fragments from dying cells, collectively termed 'apoptotic extracellular vesicles' or 'ApoEVs'. Recent evidence suggests the fragmentation of dying cells may assist in their clearance by phagocytes, while impaired cell clearance is closely linked to inflammatory disorders including cardiovascular and autoimmune diseases. Our research group investigates the how the fragmentation of dying cells contributes to intercellular communication, including cell clearance, within the vascular system. Utilising in vitro and in vivo models of cell clearance we aim to understand how dying cells within the vasculature communicate with phagocytes (e.g. via ApoEV trafficking) and the impact of inflammation on their clearance and downstream tissue homeostasis. Through our work we hope to identify novel therapeutic targets for the treatment of inflammatory disorders.

Project 1: Cell communication and clearance in blood vessels
Understanding cell clearance has important implications for inflammatory disorders. This project will determine how endothelial cells (cells that line the blood vessels) communicate with surrounding tissues via the expression of pro-inflammatory proteins (e.g. cytokines, adhesion molecules) during cell death, and how this can impact their clearance by phagocytes. This project will offer a diverse range of cellular, molecular and extracellular vesicles biology training and utilise advanced flow cytometry, confocal microscopy and CRISPR-Cas9 technology.



Modes of dying cell-derived EV release and transfer to recipient cells

Dr. Katrina Binger
LIMS

- 3D cell culture
- Metabolism assays
- Mammalian cell culture
- Confocal fluorescence microscopy
- Flow cytometry
- Protein biochemistry
- Proteomics
- Tissue preparations

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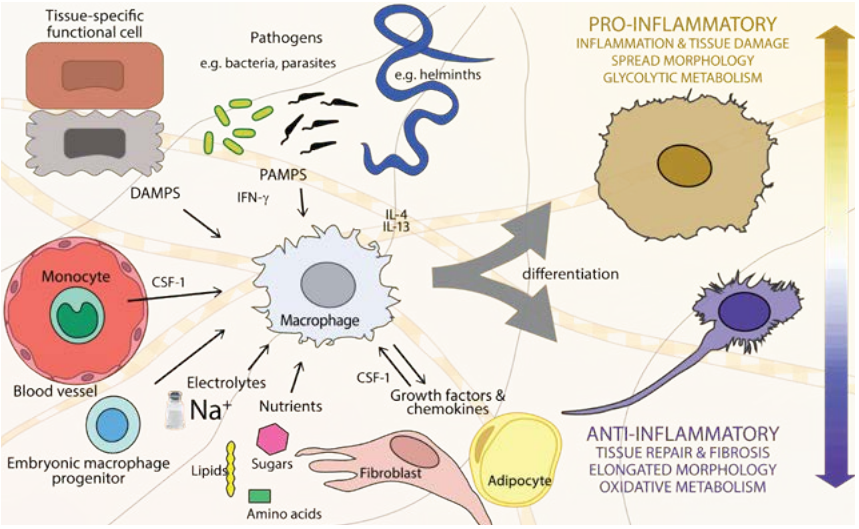
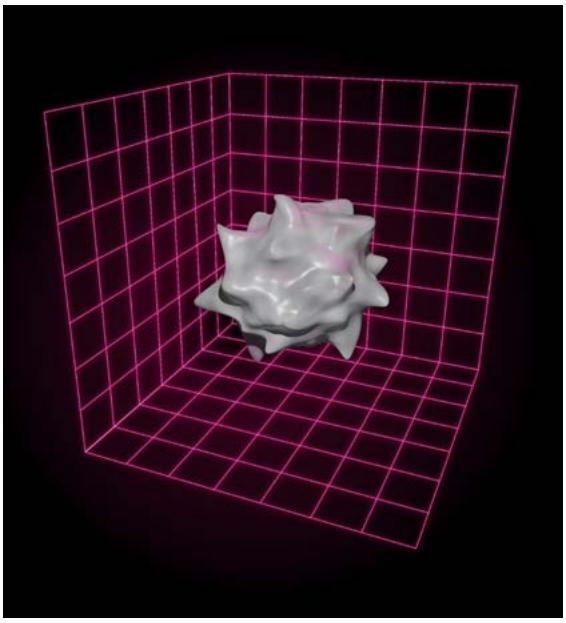
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **July**
Masters conversion: **Yes**
LTU3IND placement: **No**

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. Vitronectin: an extracellular matrix protein that promotes tissue-resident function? We have recent data shows that the interaction of macrophages with the 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.

Project 3. Salty heparin: does this affect macrophage function? One of the most abundant molecules in our tissues are proteoglycans, including heparin. We know that eating too much salt (NaCl) results in an accumulation of sodium in tissues, which bind to proteoglycans. We also know that sodium increases macrophage inflammatory functions. In this project, students will culture macrophages in 3D cultures containing heparin and test if high salt modulates their function.

Dr. Lesley Cheng
LIMS

- 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

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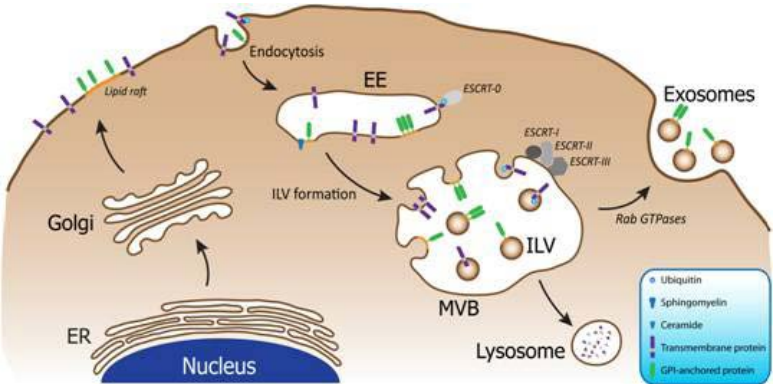
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

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.

A/Prof. Christine Hawkins
LIMS

available for **LTU3IND** placement

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

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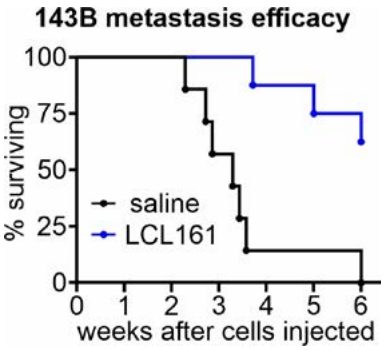
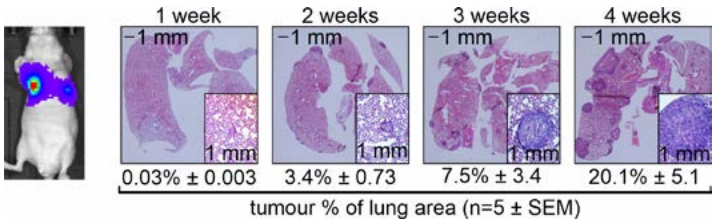
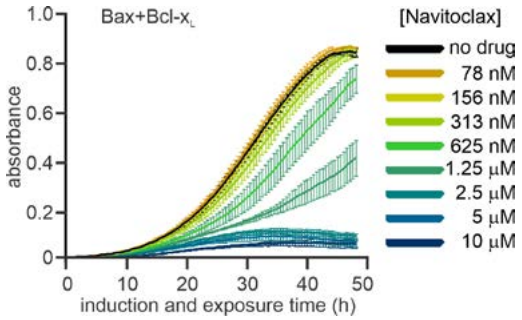
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Although some types of cancers can be cured using surgery, radiotherapy and/or chemotherapy, other cancer types are still often fatal. Our research focusses on exploiting molecular differences between cancerous and non-cancerous cells, and our understanding of the processes that control cell survival and death, to develop more effective treatments for cancer types with poor prognoses.

Project 1: Smac mimetic combination therapies for bone cancer. Unfortunately, only 60% of people diagnosed with the bone cancer osteosarcoma survive more than five years after diagnosis. Once the cancer spreads from the bones to the lungs, only around a quarter of patients can be cured. These survival rates have not improved in decades, despite numerous trials of various chemotherapy combinations. New treatments, which act via distinct mechanisms from chemotherapy drugs, are seemingly needed to improve outcomes. We identified members of the "Smac mimetic" class of molecularly targeted therapies as promising potential new agents for treating osteosarcoma. More recently, we developed mouse models of metastatic osteosarcoma, and have used these to compare the efficacy of Smac mimetics with existing therapies in vivo. These new drugs were effective in these models, prolonging survival to a greater extent than the best of the currently-used chemotherapy drugs and even eliminating the tumours in some animals' lungs. These data suggest that Smac mimetics may help treat osteosarcoma patients, especially those whose cancer has spread to their lungs. This project will investigate whether combining Smac mimetics with other anti-cancer agents can further improve survival rates in mice bearing lung osteosarcoma metastases. This information will be used to design a clinical trial to test Smac mimetic treatment, alone or with another drug, in osteosarcoma patients.







Project 2: Identifying drugs and proteins that can inhibit cell death. Several "programmed" cell death processes have been described in recent decades. In each pathway, activation of proteins within a cell trigger its destruction. This can remove cancerous or infected cells from the body, preventing disease, but excessive cell death can contribute to illness through loss of cells that play important roles, or by stimulating chronic inflammation. Understanding how various modes of cell death are regulated, and identifying drugs that can promote or suppress them, will hopefully help prevent and/or treat diseases such as cancer, infections and inflammatory conditions. Hawkins laboratory researchers have reconstituted cell death pathways in yeast, and have established methods for using these yeast platforms to screen for small molecules or proteins that can enhance or inhibit the activity of cell death regulators. We have also developed cell culture and biochemical systems for testing candidate cell death modulators. This project will identify cell death pathway regulators and validate and quantitate their activity.

Prof. Mark Hulett
LIMS

available for LTU3IND placement

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

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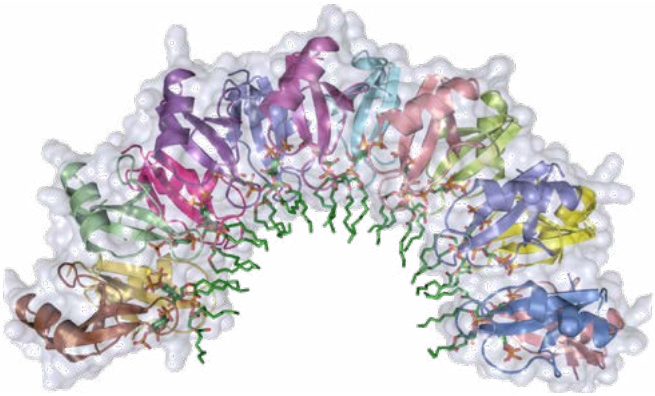
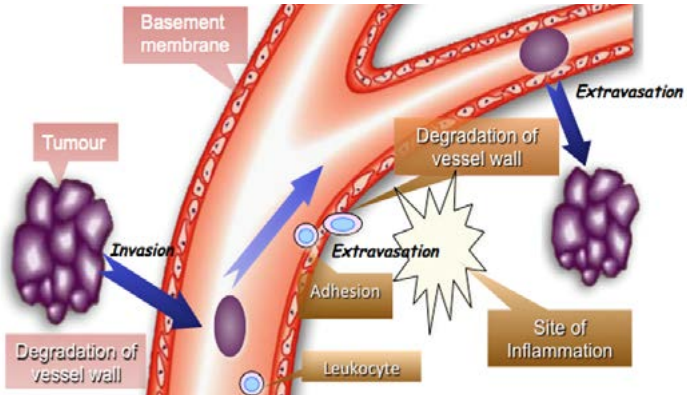
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**





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.

Prof. Patrick Humbert
LIMS

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

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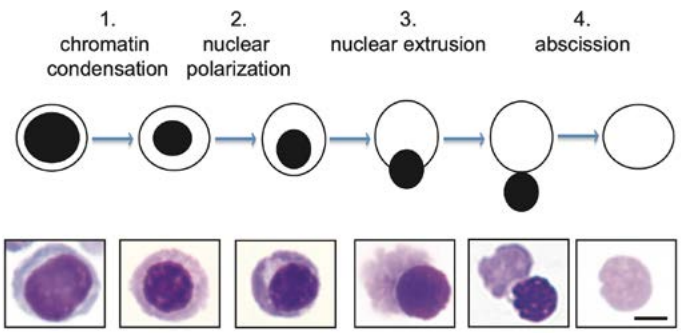
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

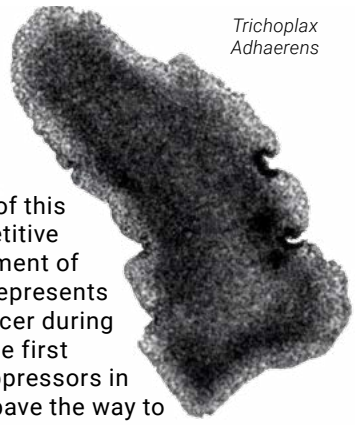
We are interested in the origins of cancer, both how cancer begins in humans but also when cancer first arose in multicellular organisms during evolution. One of the very first changes that drives cancer is a change in the organisation of cells in tissue, these are regulated by genes known as cell polarity 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

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.



Trichoplax Adhaerens

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.

Dr. Travis Johnson
LIMS

- 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

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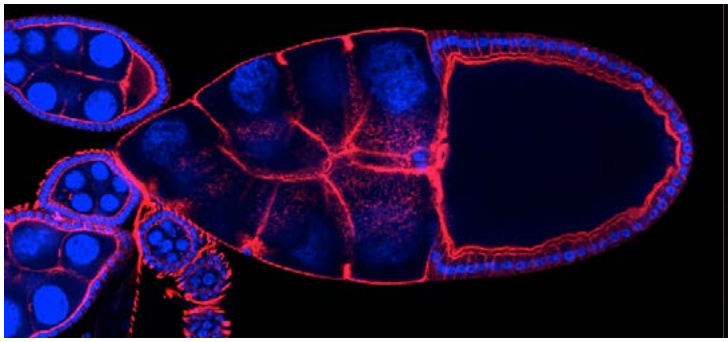
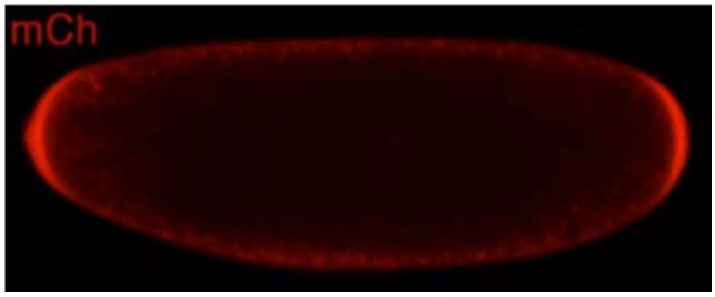
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**



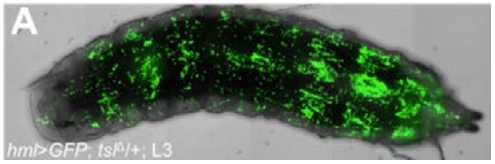
The Johnson Lab uses the powerful genetic model organism, the fruit fly (Drosophila melanogaster), to understand the actions of critical developmental and environmental factors that are involved in cellular decision making processes (growth, proliferation and differentiation). His lab uses sophisticated 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.



Prof. Robyn Murphy
LIMS

available for LTU3IND placement

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

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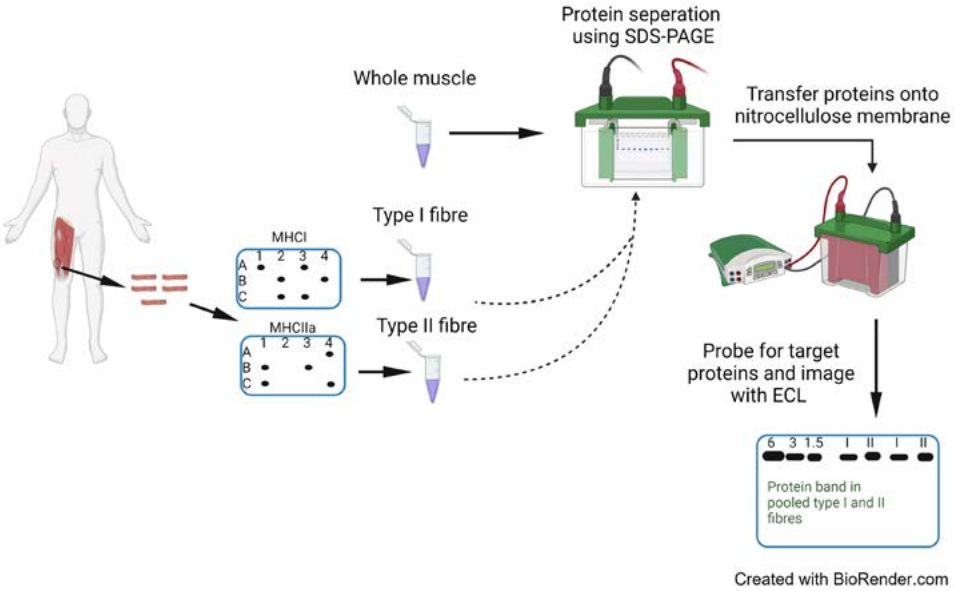
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

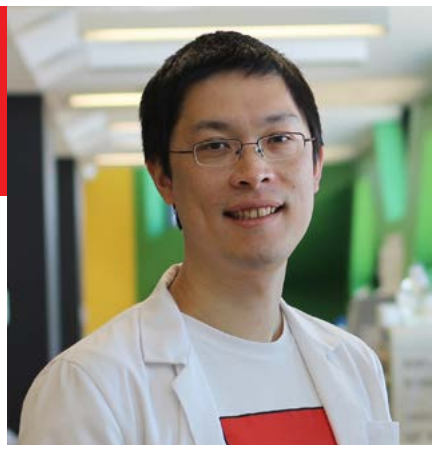
Our laboratory is interested in understanding how skeletal muscle functions. We address many problems at a cellular level, allowing the differences that exist between cells (muscle fibres) that sit side by side in a whole muscle. We have discovered that a protein, metallomatrix protein 9 (MMP9) that 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.

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.



Prof. Ivan Poon
LIMS

available for LTU3IND placement



- 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

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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**

In humans, billions of cells will 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 neighboring cells to engulf. Furthermore, certain cellular components can be packaged selectively into these fragments to regulate tissue repair and immunity.

The honours project on offer in 2024 aims to understand the machinery that controls how dying cells can disassemble into smaller pieces, as well as to investigate the importance of cell disassembly in certain disease settings (e.g. during viral infection and atherosclerosis).

A/Prof. Hamsa Puthalakath
LIMS

available for **LTU3IND** placement

- Cell culture - eukaryotes & prokaryotes
- Animal handling & models of disease
- Flow cytometry
- Protein purification & biochemical assays
- Molecular cloning & CRISPR-Cas9 editing
- Gene expression analyses incl. sequencing
- Microscopy - light, fluorescence
- Mass spectrometry incl. proteomics

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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**

Apoptosis is a process of programmed cell death that occurs in our bodies to remove old, damaged, or unwanted cells. This process is essential for maintaining the health of our tissues and organs. Dysregulation of apoptosis can lead to a variety of human diseases.

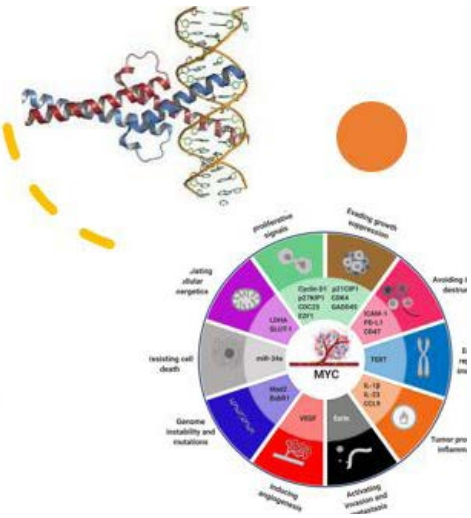
One of the most well-known diseases where apoptosis plays a critical role is cancer. Normally, when cells become damaged or abnormal, they undergo apoptosis to prevent them from multiplying and becoming cancerous. However, in some cases, the apoptotic process is disrupted, leading to uncontrolled cell growth and the formation of tumors. Understanding how apoptosis is regulated in cancer cells can help researchers develop new treatments that target these cells while sparing normal cells.

Apoptosis also plays an important role in infectious diseases. When our bodies are invaded by pathogens, such as viruses or bacteria, the immune system activates various defense mechanisms, including apoptosis. By inducing apoptosis in infected cells, the immune system can limit the spread of pathogens and prevent them from causing further damage. However, some pathogens have evolved mechanisms to evade apoptosis and survive within host cells. Understanding how pathogens interfere with the apoptotic process can help researchers develop new strategies to combat infectious diseases.

In addition to cancer and infectious diseases, dysregulated apoptosis has been implicated in a wide range of human diseases, including neurodegenerative disorders, autoimmune diseases, and cardiovascular diseases. My lab is working on developing targeted therapies for cancer, inflammatory sepsis and heart failure.

c-Myc is responsible for about 70% of all human cancers!

- Extremely difficult to target!
- We developed a drug that targets Myc!!
- Honours students will be part of this very exciting project, further characterizing this drug, its metabolism and pharmacokinetics!!!



Dr. Sarah Stewart
LIMS

available for LTU3IND placement

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

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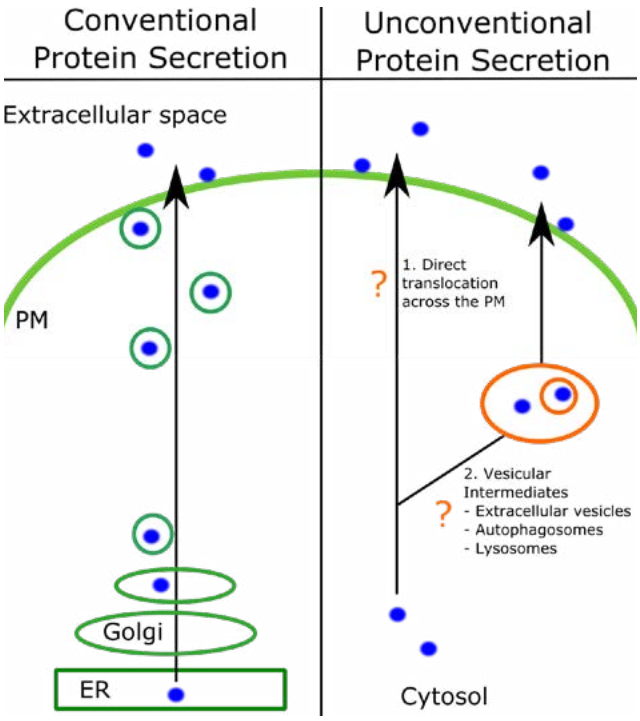
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

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.



Prof. Coral Warr
LIMS

available for LTU3IND placement

- Infection & Immunity
- Genetic breeding experiments
- Eukaryote cell culture
- Confocal fluorescence microscopy
- Computational/in silico analyses
- Protein biochemistry
- Histology (incl. immunohistochemistry)

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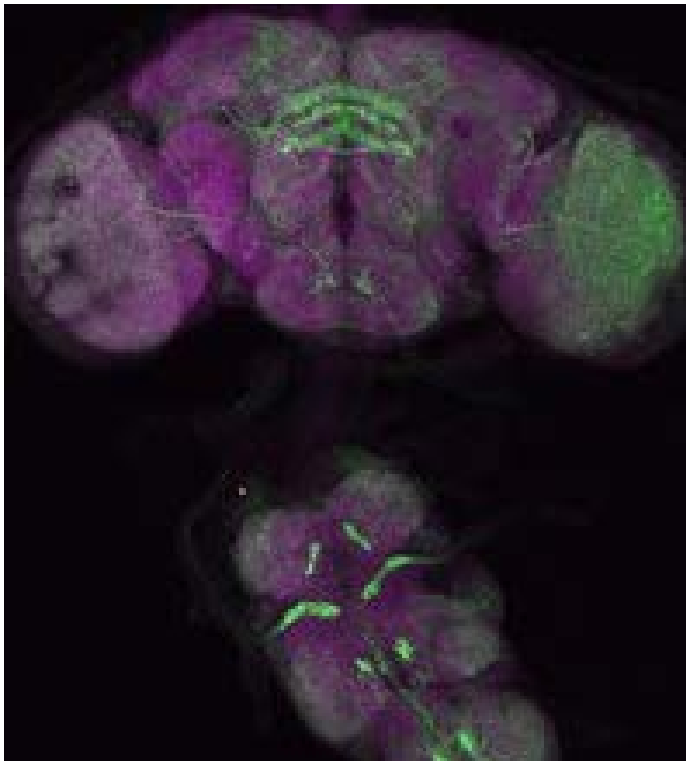
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

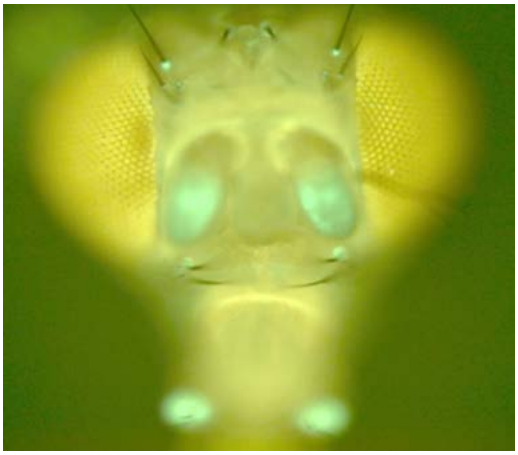
We are interested in how cells detect signals from the environment or from each other both during development and in the adult organism. Understanding this is critical because dysregulation of cell signalling underlies many of the major diseases that afflict society, including motor neuron disease, cancer and obesity. Many of these signalling pathways are highly conserved between the fruit fly *Drosophila* and humans, and indeed many of the known molecular players were first identified using the powerful genetic approaches possible in *Drosophila*. Thus our findings are highly likely in the longer term to be translatable to humans and to understanding human growth disorders and cancer.



Available Honours projects are focused on studying cell signalling in insect olfaction and in models of motor neuron disease.

Project 1. Evolution and function of insect odorant receptors. Insects use their olfactory system to detect host plants and animals. In this project you will use both the lab model insect *Drosophila* and pest insect Australian sheep blowfly to study aspects of how odorant receptors detect odors. The findings will contribute to future efforts to develop novel methods of pest control for the sheep blowfly.

Project 2. Determining the mechanism of altered neuronal excitability in motor neuron disease. In this project you will use Drosophila models to determine which cell types underly the altered neuronal excitability seen prior to onset of symptoms in motor neuron disease. Understanding this will help determine intervention points and may identify novel therapeutic approaches.



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: **2**
Full-time or part-time: **Full-time**
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.

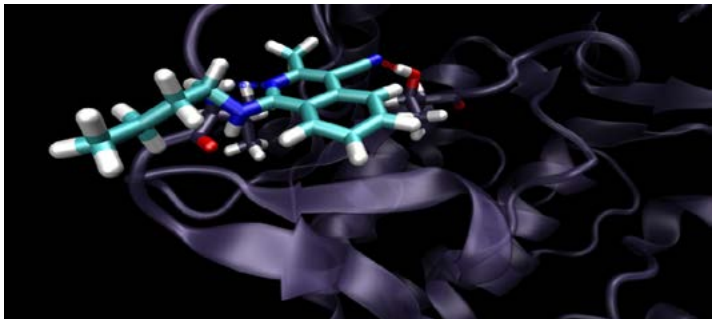
Project 1. Inhibiting P.falciparum in the search for a novel antimalarial agent. Malaria causes a significant impact on the health and economy of the developing world. Enzymes which are important in the life cycle of the malaria parasite could possibly be attractive targets for novel antimalarial agents. 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.

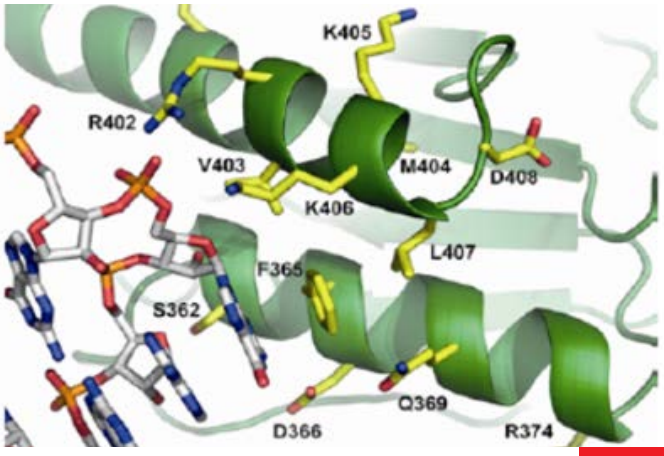
Project 2. Using fragment-based drug design to disrupt bacterial infection. The bacterial signal recognition particle (SRP) is an essential ribonucleoprotein complex responsible for the delivery of proteins to the plasma membrane in bacteria. Interrupting the interactions of SRP with its receptor represents 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.





A/Prof. Peter Barnard
LIMS

available for LTU3IND placement

Chemical synthesis - organic & inorganic

Nuclear magnetic resonance

Light microscopy

Mass spectrometry

X-ray crystallography

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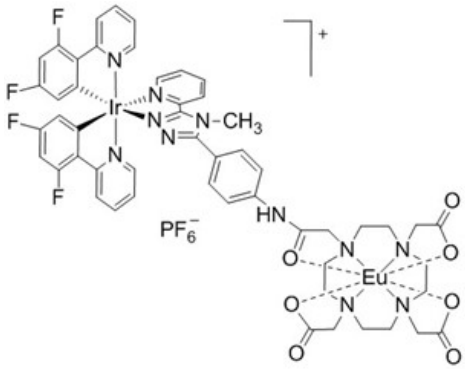
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The 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.

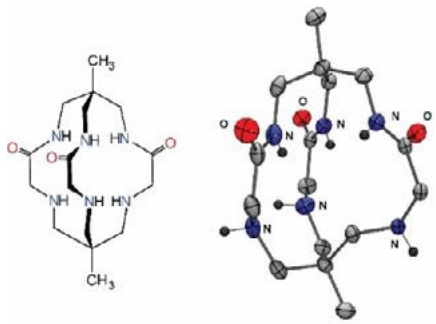
*Project 1. Synthesis and Studies of Luminescent Gold, Ruthenium, Iridium and Lanthanide Complexes.*We are interested in the synthesis of new luminescent coordination compounds of gold, ruthenium, iridium and the lanthanide metals. Current efforts are being directed at tuning the luminescent properties 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.



Prof. Jason Dutton
LIMS

available for LTU3IND placement

Chemical synthesis - organic & inorganic

Mass spectrometry

Nuclear magnetic resonance

X-ray crystallography

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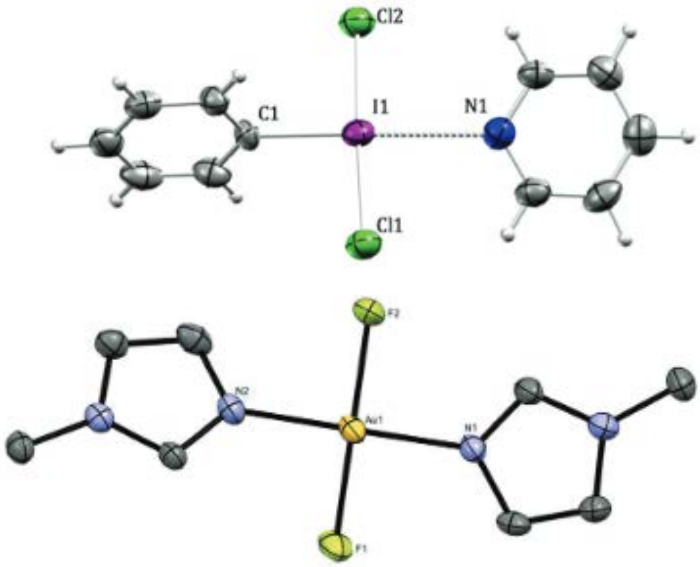
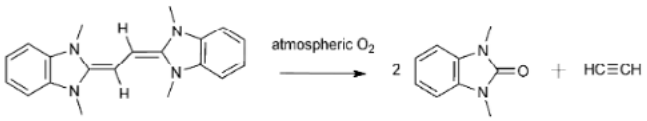
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The 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!

Dr. George (Wren) Greene
LIMS

available for LTU3IND placement

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

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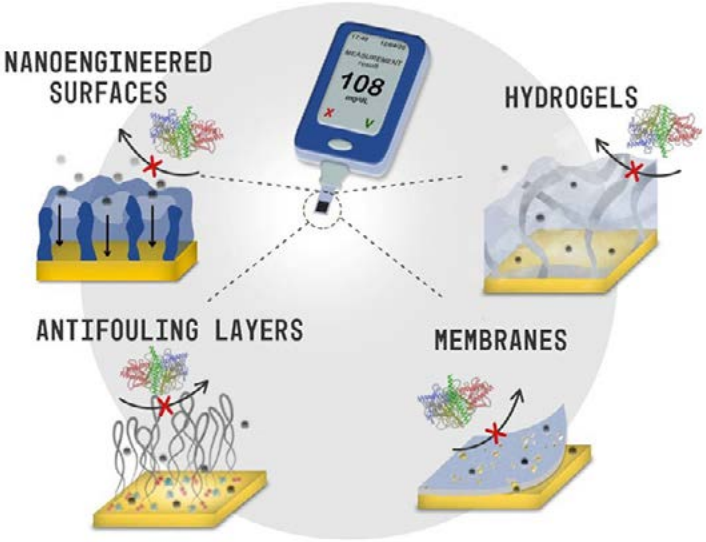
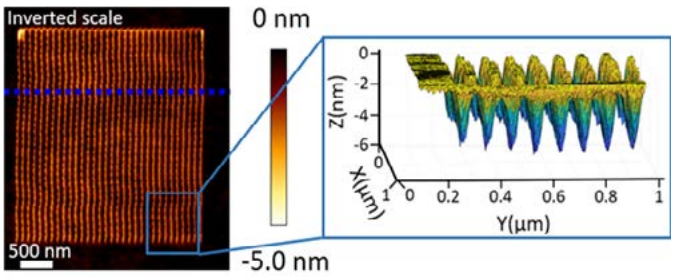
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

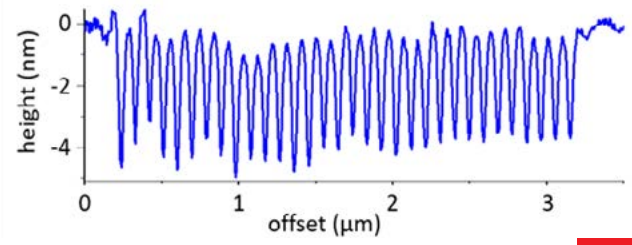
Our lab utilizes the physical chemistry of interfaces to engineer innovative materials and surfaces that exhibit multifunctional and responsive properties. Utilizing a multidisciplinary approach which draws on principles from biology, electrochemistry, inorganic chemistry, and geology, we control intermolecular 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.

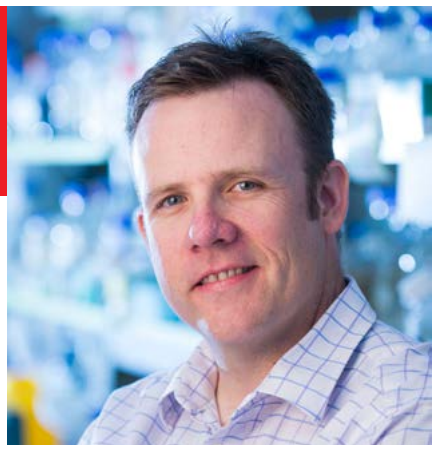
Project 2: Geologically inspired nanofabrication. This project is inspired by 'pressure solution' (PS); a fundamental 'deformation' and mass transfer mechanism in Geology. At its heart, PS describes the enhanced dissolution rate observed when two minerals are pressed together at high pressure in an electrolyte. 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.







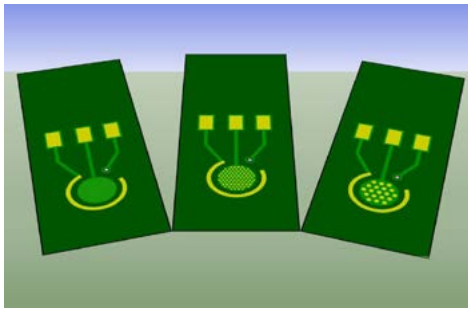
Prof. Conor Hogan
LIMS



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

E-mail: c.hogan@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 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.

A/Prof. Yuning Hong
LIMS

available for LTU3IND placement

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

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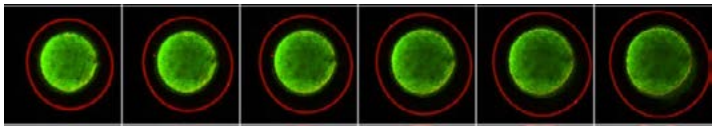
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

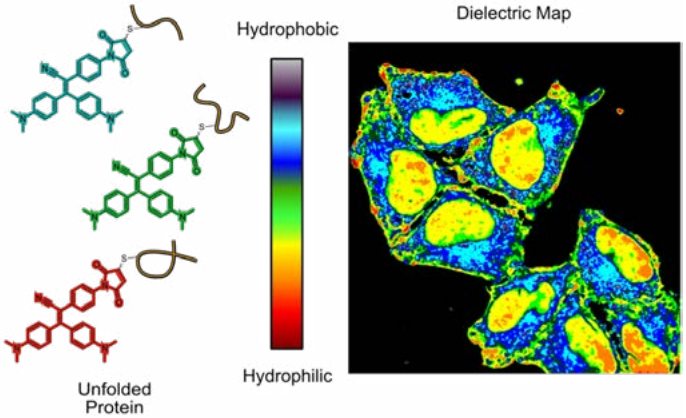
Our Group develops novel chemical compounds, usually with interesting fluorescent behaviors, to study how proteins changes in live cells under drug treatment and in cell models of Parkinson's, Huntington's and Motor Neuron Diseases. The molecules we create can selectively turn on their fluorescence or 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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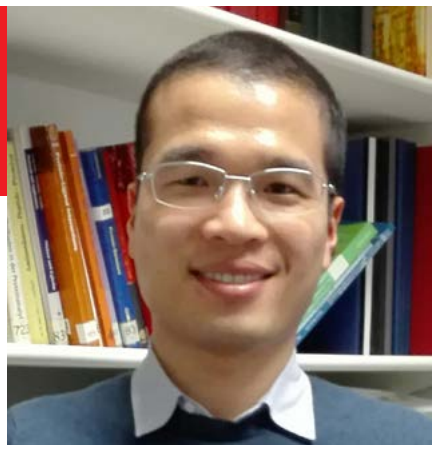
I'm ready to apply! »

Dr. Wenyi Li
LIMS

available for **LTU3IND** placement



- Chemical synthesis - organic
- Biophysical characterisation of materials
- Cell culture - eukaryotes incl. primary & cell lines
- Cell culture - prokaryotes
- Mass spectrometry

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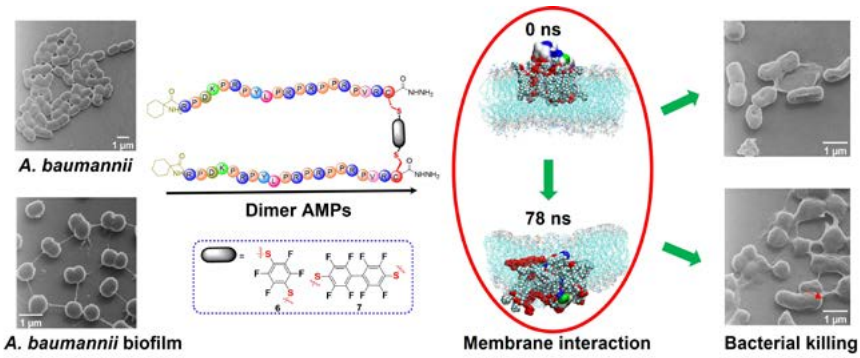
Website: click here

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

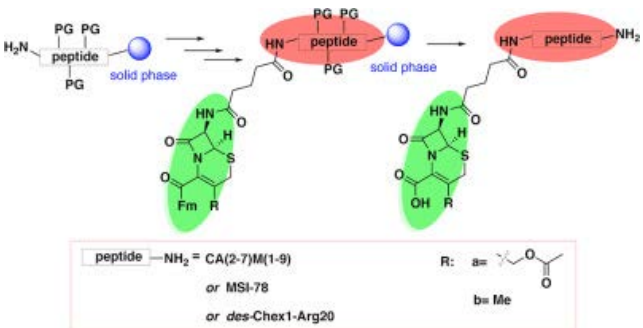
Antimicrobial resistance has become a growing concern due to the potential lethality of infections caused by resistant bacteria. To address this problem, Dr Li's research focuses on the use of antimicrobial peptides (AMPs), which are part of the host's natural defense system and have potent antimicrobial 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.



Prof. Adam Mechler
LIMS

available for **LTU3IND** placement

Atomic force microscopy

Biophysical characterisation of materials

Mass spectrometry

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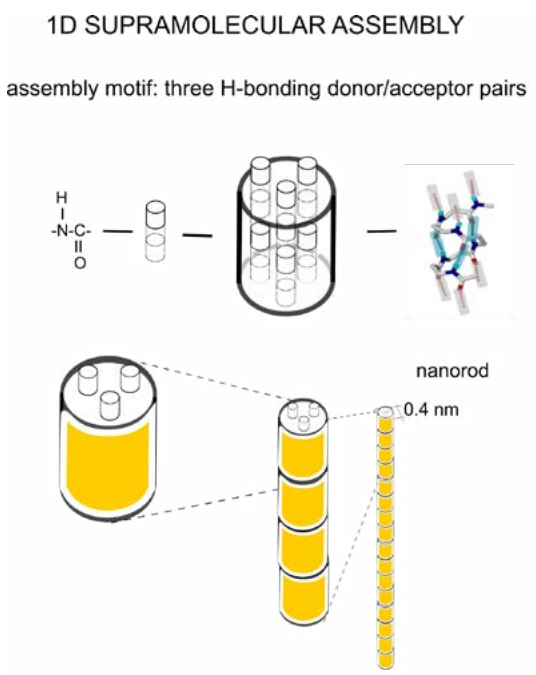
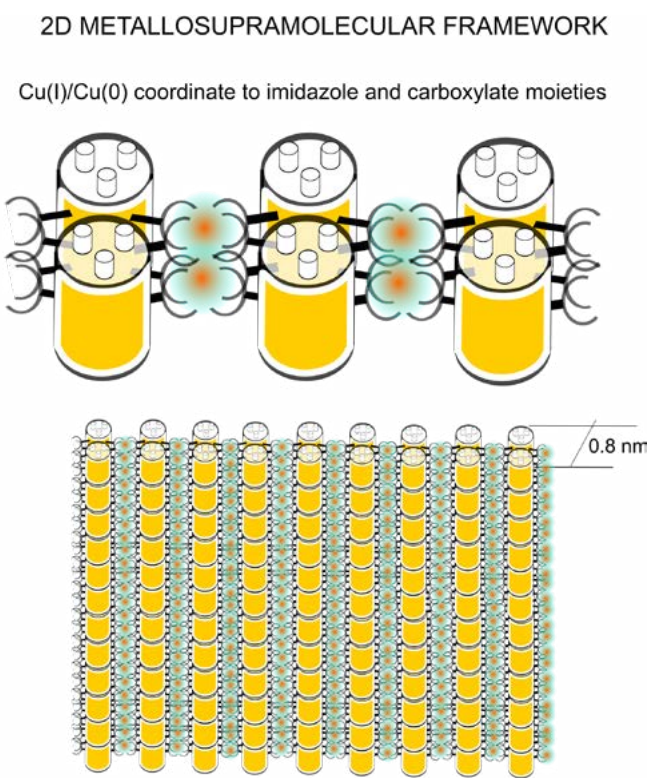
Website: click here

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.





A/Prof. Evan Robertson
LIMS

IR spectroscopy

Molecular modelling

Raman spectroscopy

Pulsed ns lasers

Electronics

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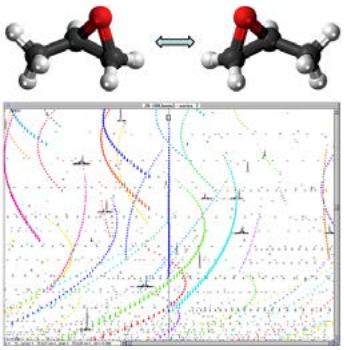
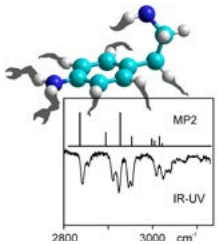
Website: click here

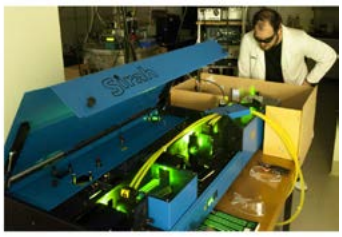
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

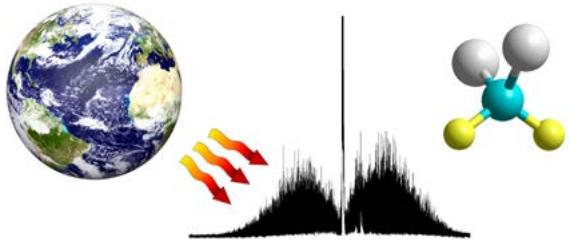
We exploit powerful light sources such as infrared, visible and ultraviolet lasers, or the Australian Synchrotron's infrared beamline to study molecules relevant to pharmaceutics, atmospheres and astrochemistry. Life on earth is intrinsically chiral. In the building block molecules such as proteins and 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.

Dr. Saimon M. Silva
LIMS

Analytical chemistry

Electrochemical sensing

Sensors & Biosensors

Point-of-care diagnostics

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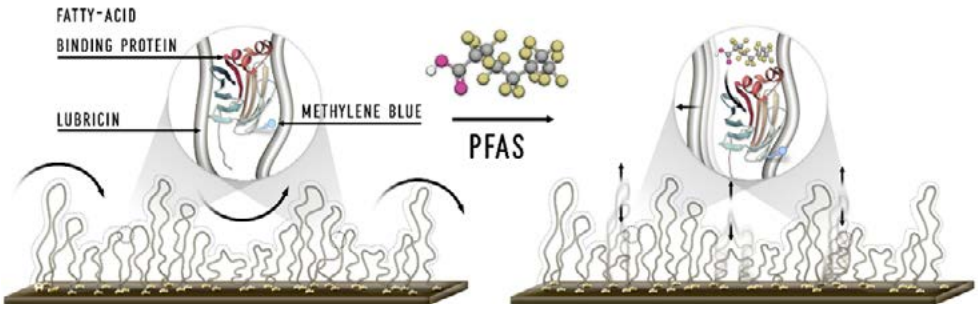
Website: click here

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



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.

Dr. Keith White
LIMS

available for LTU3IND placement

Chemical synthesis - inorganic and organic

X-ray crystallography

Thermogravimetric analysis

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Website: click here

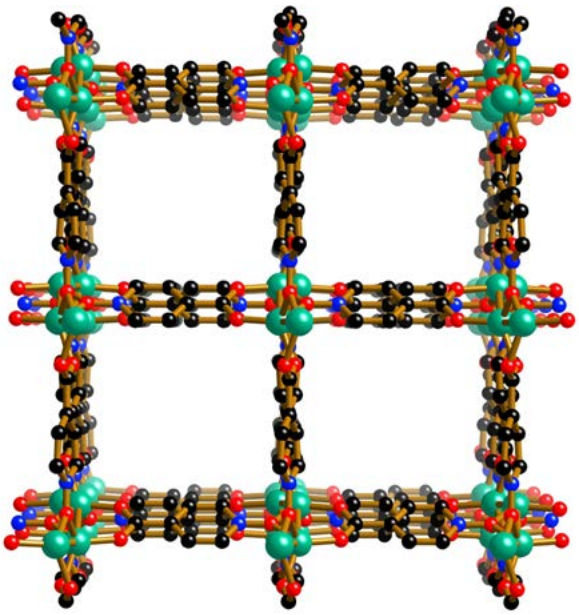
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

My research involves the synthesis of crystalline metal – ligand network materials that have open spaces. By careful selection of the network building blocks, the character of the open spaces may be tuned to capture and store a specific guest of interest, including: H2 as a fuel, environmentally harmful substances like CO2, or chemically useful compounds like ethene.

In this chemistry, we get to make pretty crystals, shoot X-rays at the crystals to determine their structure and then dose them with interesting volatile substances.

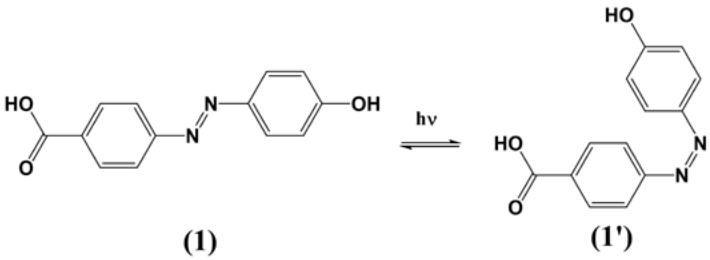
Typical research tasks:

- Synthesis of crystalline materials
- Crystal X-ray diffraction analysis
- Thermogravimetric analysis
- Gas sorption
- UV absorption and emission analysis
- NMR



A metal-ligand network with square shaped open spaces

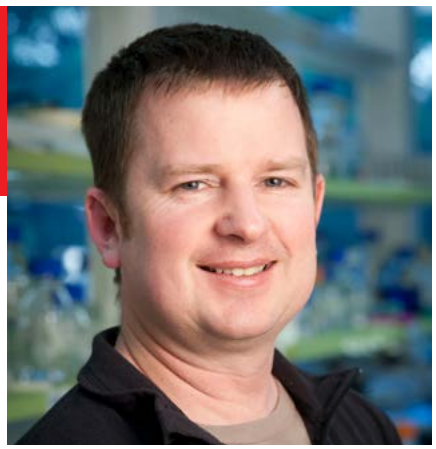
Honours project. Some metal – ligand networks can undergo physical or chemical change in response to external input. If reversible, suc h properties offer the prospect of a 'switching' material. I am interested in the synthesis of 'switching' metal – ligand networks that contain azobenzenes. Azobenzenes are known to undergo reversible 'E/Z' isomerization when irradiated with UV-light. This project will investigate the synthesis and structure of metal-ligand networks composed of azobenzene ligands like (1). The 'photo-switching' properties and guest storage capacity of such networks will be then explored.



Reversible E/Z photoisomerization of an azobenzene

A/Prof. David Wilson
LIMS

available for LTU3IND placement



Computational chemistry

Molecular modelling (computational incl. AI)

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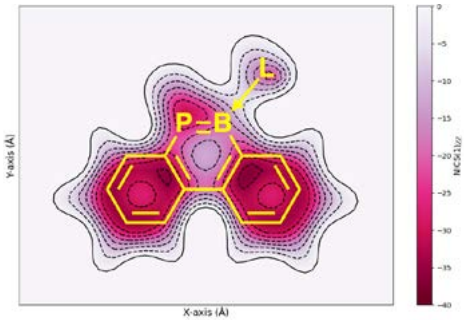
Website: click here

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

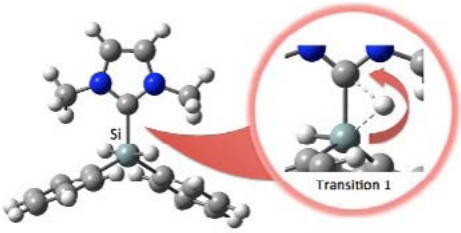
Our group does chemistry by computer – we use computers to understand the structures and properties of molecules and how they react. We produce results as good as sometimes better than experiment! We focus on important molecules and their applications, molecules with unusual bonding environments, and the prediction of new chemistry. All students will develop an advanced understanding of chemical structure and reactivity, with the likelihood of publication of your research in an international chemistry journal. In each project you will develop enhanced analysis and problem-solving skills. Several projects include collaboration with international scientists.

Project 1. Predicting new chemistry and probing novel bonding environments. For example, we recently reported the first Be=N double bond and the first Be aromatic molecule. In many cases carbenes are instrumental; we will utilize carbenes to discover new main-group chemistry. These molecules often have a donor-acceptor bonding form (like a metal coordination complex). There are projects on (i) Beryllium chemistry, which is chemically poisonous but perfectly safe on a computer! (ii) Novel boron-containing PAHs that exhibit novel bonding and optical (luminescence) properties, and (iii) using carbene ligands to enable new main-group bonding.



Project 2. Modelling reaction mechanisms to understand reactivity. Projects include reactions with PhICl2 – published mechanisms are wrong. This is an industrially useful reagent however the mechanism is unknown and will be investigated. We will explore new boron-containing systems that are ambiphilic – they can act as both electrophiles and nucleophiles.

Project 3. Luminescent molecules. We investigate optical properties of molecular systems, including boron-doped PAHs and metal-based (ruthenium, iridium) complexes. These are purely computational projects, but are carried out in collaboration with experimentalists. We model luminescence, UV-Vis spectra, molecular orbital and redox properties, to understand how emission of light can be tuned and optimised.



Project 4. High-accuracy energetics and properties. Projects are focused on producing experimentally accurate energies and properties to the limits of computing. It is possible to calculate reaction energetics to an accuracy of 1 kJ/mol, and NMR shifts to better than 1 ppm. Projects include (i) the accurate calculation of NMR shielding, (ii) correct inaccurate experimental energetics, and (iii) investigate the requirements for the accurate calculation of redox and acid/base properties of luminescent materials.

Project 5. Modelling organic and biomolecules in the gas phase. Gas-phase properties of biologically important molecules (amino acids, neurotransmitters) links high-level computational methods with new experimental techniques.

Microbiology Anatomy, Physiology and Pharmacology (MAPP)

Research projects in the Department of Microbiology, Anatomy, Physiology & Pharmacology (MAPP)

The following list are research supervisors in MAPP who are offering projects in 2024.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

Microbiology

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Dr. Sarah Annesley Bundoora

available for LTU3IND 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)

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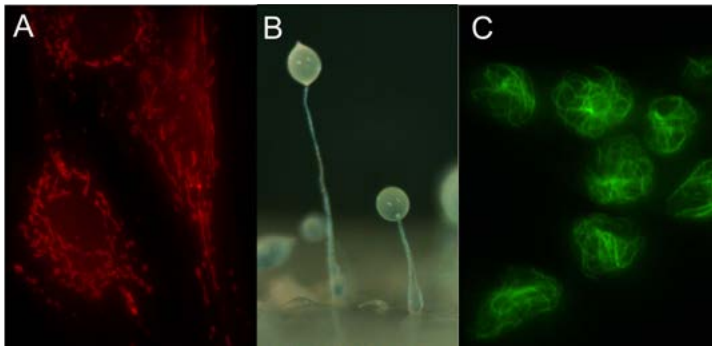
Website: click here

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

We are using Dictyostelium discoideum and human cells as models to study the cytopathologies associated with certain neurological disorders – specifically mitochondrial diseases, Parkinson's Disease and Myalgic Encephalitis/Chronic Fatigue Syndrome (ME/CFS).

Project 1. Mitochondria in disease in the Dictyostelium model. Genetic disorders that affect the mitochondria vary in their severity and in humans produce a bewildering variety of signs and symptoms that hinder diagnosis and understanding. In Dictyostelium, mitochondrial disease can be studied without the complexities and constraints imposed by human biology. Apart from overtly mitochondrial diseases (involving mutations in mitochondrial genes or genes encoding mitochondrial proteins), we also use Dictyostelium to study the role of mitochondrial dysfunction in other diseases (see below).

Project 2. 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 and Dictyostelium genetic models 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 3. 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. There are currently no cure, no clear treatments and no diagnostic test 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 as well as Dictyostelium, we are now working to further characterise these defects, understand disease mechanisms, identify disease biomarkers and develop a diagnostic test.

Project 4. 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.

Dr. Sean Bay
Bundoora

available for **LTU3IND** placement

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

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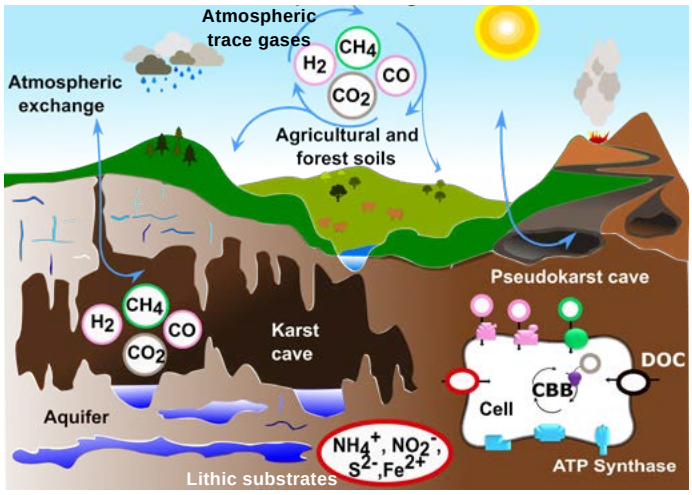
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Welcome to the Bay Lab, a dynamic research laboratory dedicated to advancing our understanding of the intricate relationship between microbial life and the environment. Our lab pushes the boundaries of microbial ecology to uncover how microorganisms persist in extreme ecosystems and interact with global biogeochemical cycles. We focus our research on three themes: 1) The limits of life, 2) Healthy Soils, and 3) Global Cycles to advance fundamental research and develop innovative solutions to address climate change and environmental challenges.

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.

Prof. Ashley Franks
Bundoora

- Field work
- Metagenomics
- Ecological assays
- Bioinformatics
- Cell culture - prokaryotes (incl. anaerobic)
- Gene expression analyses (PCR, qPCR)

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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**

Environmental microbiology is the study of the composition and physiology of microbial communities in the environment. An understanding of these natural processes is fundamental for comprehension of ecosystem function and application to biotechnology, bioremediation and bioenergy. Honours projects will be offered in:

- The interactions of mixed microbial communities with plants, soils, microbiome, electrodes, sewer systems and submarines.

A/Prof. Karla Helbig
Bundoora

available for **LTU3IND** placement

- 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

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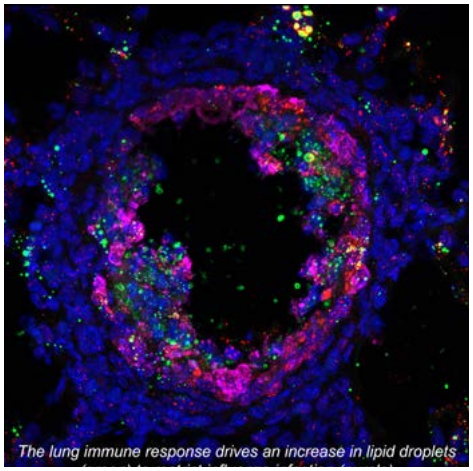
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Feb**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

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.



The lung immune response drives an increase in lipid droplets

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.

A/Prof. Maria Liaskos
Bundoora

available for LTU3IND placement

- Cell culture - eukaryotes incl. primary & cell lines
- Gene expression analyses (PCR assays)
- Cell culture - prokaryotes
- Cell transfection
- Flow cytometry
- Microscopy - electron, confocal & super resolution
- Protein biochemistry (incl. western blotting)
- Molecular cloning

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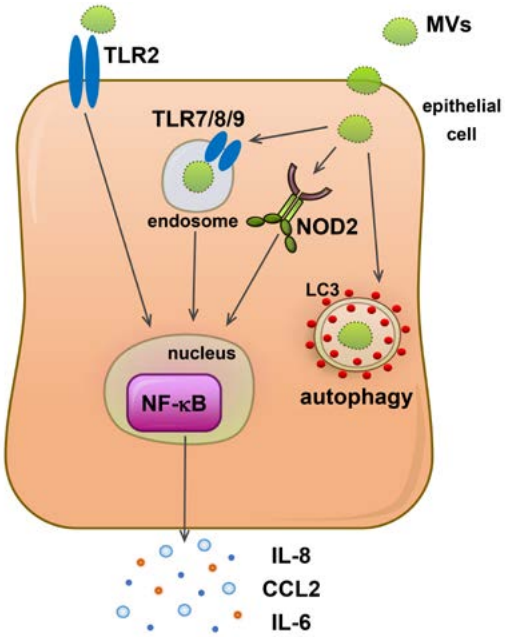
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

Our laboratory focuses on trying to understand how bacterial pathogens and their products interact with our body in a variety of ways to ultimately cause disease. Therefore, research in our laboratory focuses on answering two fundamental questions: 1) How do bacteria and their products interact with the host to cause disease, and 2) How does the host detect and respond to these bacterial pathogens and their products? Our primary research interests are focused on understanding the cellular and molecular mechanisms of host-pathogen interactions with particular focus on Helicobacter pylori and bacterial membrane vesicles.

Project 1: This project aims to examine the mechanisms whereby bacteria use membrane vesicles to transfer antibiotic resistance genes between bacteria and promote pathogenesis. Bacterial membrane vesicles (MVs) are spherical, bi-layered membrane nanostructures ranging from 20 to 300 nm in size that are naturally produced by all bacteria as part of their normal growth. Until recently, bacterial MVs were dismissed as an artefact of bacterial growth. However, bacterial MVs have now been identified to contain many of the components present within their parent bacterium of origin in a non-replicative form, including peptidoglycan, lipopolysaccharide, toxins, DNA, proteins and enzymes. This project focuses on examining the contribution of bacterial membrane vesicles to promoting pathogenesis and bacterial survival in various environments and conditions, in addition to elucidating the ability of bacterial membrane vesicles to mediating horizontal gene transfer.



Project 2: This project aims to understand how H. pylori and bacterial membrane vesicles can manipulate the human immune system to promote disease. Helicobacter pylori is a Gram negative bacterium that infects more than 3 billion people worldwide. Infection with H. pylori almost always persists within the host for life, and results in a spectrum of diseases ranging from gastritis, to gastric ulcers and gastric cancer. H. pylori manipulates the host's immune system into mounting an ineffective, chronic and mildly inflammatory immune response, which creates an environment in which the bacterium can survive almost indefinitely. This facilitates the destruction of host cells and tissues by H. pylori, leading to gastric pathology and ultimately cancer. Despite extensive research, the exact mechanism(s) whereby H. pylori manipulates the host immune system, ultimately facilitating chronic H. pylori colonisation remain unknown. This project will examine the mechanisms whereby H. pylori and their products manipulates the human immune system to facilitate colonisation and pathogenesis in the host.

Dr. Katelyn Mroczek
Bundoora

available for **LTU3IND** placement

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

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

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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I'm ready to apply! »

Dr. Steve Petrovski
Bundoora

available for LTU3IND placement

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

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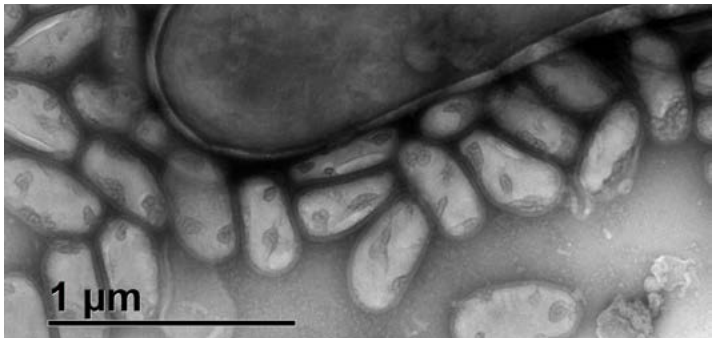
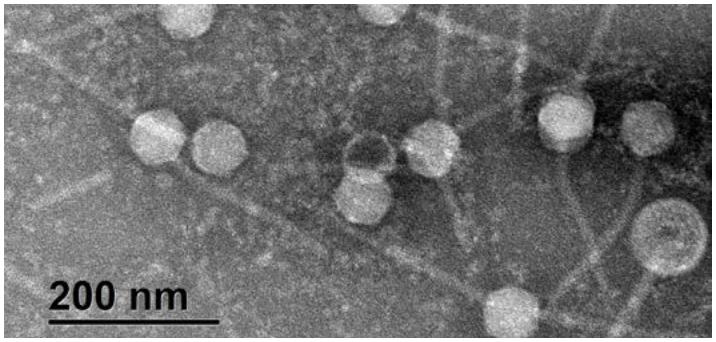
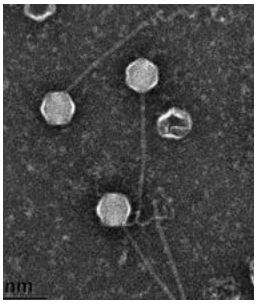
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**





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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I'm ready to apply! »

Dr. Subir Sarker
Bundoora

available for LTU3IND placement

- Genetic sequencing & gene expression analyses
- Electron microscopy (TEM, SEM)
- Bacterial overexpression of proteins
- Protein purification
- Bioinformatics
- X-ray crystallography
- Protein biochemistry (incl. western blotting)
- Immunoassays

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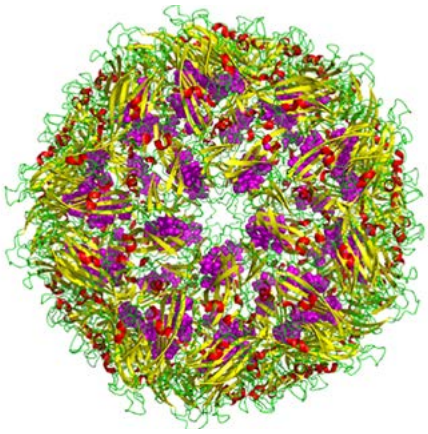
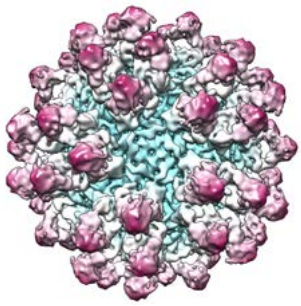
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The primary focus of my laboratory is to better understand the viruses that infect wildlife, livestock and companion animals. Over the past several decades has seen the emergence of novel viruses increased steadily in wildlife populations globally. Viral diseases are acknowledged as a growing trend of threats to wildlife and act as the source of a series of high-impact diseases in animals and humans. However, our understanding of the diversity of viruses in animals has always been challenging due to the lack of appropriate technologies and sampling methods. To resolve these ongoing issues, my lab has excellent experience to use more advanced next-generation sequencing technologies combined with high-resolution microscopy and X-ray crystallography to understand host-pathogens interaction. This information is not only crucial for informing the government to take appropriate management policy to mitigate disease spread but indeed plays a pivotal role in the development of future antiviral drugs to benefit livestock and threatened animals.

Students can choose to study a specific technique or a combination of techniques, that can then be applied to different projects described next.



Project 1: Understanding nuclear trafficking of alphaherpesviruses infecting animals.



Alphaherpesviruses, such as herpes simplex virus type 1 (HSV-1) in human and infectious laryngotracheitis virus (ILTV) in chickens, establish lifelong latent infections in their host. Nuclear trafficking of alpha-herpesviruses plays a crucial role in their lifecycle, from the entry of the viral genome into the nucleus to the establishment of latency. However, the mechanisms involved in this process are not fully understood in many alphaherpesviruses infecting livestock's and endangered wildlife. Understanding the molecular mechanisms involved in nuclear trafficking of alphaherpesvirus is crucial for developing new therapies to prevent or treat viral infections.

Project 2: Understanding trafficking of infectious bronchitis virus (Gammacoronavirus) infecting chickens. Infectious bronchitis virus (IBV, genus- Gammacoronavirus) is a highly contagious and economically important pathogen of poultry. IBV infections result in respiratory disease, which can lead to decreased egg production and reduced growth rates in chickens. Despite the significant impact of IBV on the poultry industry, the mechanisms of IBV replication and pathogenesis are still not fully understood. In particular, the mechanisms by which IBV traffics within host cells are not well characterized.

Project 3: Constructing infectious clone of BFDV for a potential vaccine candidate. Beak and feather disease virus (BFDV) is the smallest known pathogenic DNA virus, the causative agent of psittacine beak and feather disease, and one of the first threatening diseases to be recognised under the Endangered Species Protection Act 1992. Currently, >38 of the 50 Australian native parrot species have been reported to be infected by BFDV. Moreover, BFDV is recognised by the Australian Government as the single most important disease threat to at least 16 other endangered or vulnerable bird species. However, there is a lack of availability of vaccine for BFDV. Therefore, this proposed project is aimed at developing an BFDV infectious clone to be used in the vaccine trial.

Dr. Jennifer Wood
Bundoora

- Ecological assays
- Field work
- Next generation sequencing
- Cell culture - prokaryotes
- Gene expression analyses (PCR, qPCR)
- Bioinformatics

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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**

Microbial communities are the foundation of all ecosystems. My research group, the Applied and Environmental Microbiology (AEM) group, offers a broad range of projects that seek to understand the ecology and function of microbiomes associated with plant, human, and ecosystem health. Key research questions include:

How does microbial community ecology impact carbon storage and cycling? We know microorganisms are key to the carbon cycle. They create soil carbon through their biomass but they can also remove carbon from soils through consumption and respiration. Further, not all carbon inputs (i.e. plant root exudates, compost, fallen wood ect.) are processed in the same way by microbial communities. So what are the traits of a microbial community that determine whether they build of deplete soil carbon, and how does this relates to the different carbon inputs? The answers to these questions have far reaching implications for the role of soil health in both ecosystem restoration and sustainable farming as well as global implications for climate change mitigation.

How do soil microbial interactions promote rainforest diversity and how will climate impact these systems? Multiple lines of evidence indicate soil microorganisms have a role in 'engineering' rainforest plant diversity from the ground up. This project attempts to develop a mechanistic understanding of how microbes create rainforest diversity and to determine the resilience of these key ecosystem processes to climate change. The end goal is to incorporate our findings into holistic conservation and management strategies.

A/Prof. Hayder Al-Aubaidy Bundoora

- Animal models of disease
- Pedagogy
- Animal handling
- Interviews & qualitative analyses
- Flow cytometry
- Immunoassays (inc. I-Ps, ELISAs)

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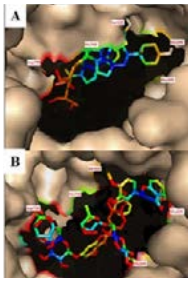
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

We have two major themes of research: in higher educational learning and teaching, and biomedical research where we investigate diabetic kidney disease. In 2024, we offer a project in each theme, described below.

Project 1. The effectiveness of online workshops in a post-pandemic world. Following Covid-19 pandemic, several universities moved to online teaching across various courses. However, there are several factors which may affect the transition to online teaching in anatomy. This project aims to evaluate the effectiveness of the use of the online workshops versus face-to-face workshops in selected three anatomy subjects offered to students in non-clinical based courses at La Trobe University. Students will have the option to enrol in either the online instance or the blended instance.

Both instances share common content but differ in the delivery of the workshops. We hypothesize that the online workshops will be as effective as the traditional blended workshops because students will still be able to apply the new anatomical content into clinical scenarios in small groups, will be integrating content presented in the online videos and will also be getting feedback as to whether they have the correct answers or not (and therefore understand the content). This study will be of importance in providing an insight based on students' perception on the best future approach to teach anatomy subjects at undergraduate level, identify the current barriers for the online teaching. Outcome from this study will inform the potential to increase students' engagement and maximise success across both instances. At a society level, a better understanding of the influence of teaching formats on students' experiences and learning outcomes will have significant benefits to all tertiary students and educators.

Project 2. Investigating the anti-diabetic activity of citrus bioflavinoids. Diabetic kidney disease (DKD) is the leading cause of end stage kidney disease (ESKD), and it is recognised as an independent risk factor for the development of cardiovascular disease (CVD). There is an emerging interest in the anti-diabetic activity and lipid lowering effects of citrus bioflavonoids found in dietary plants and fruits. Our recent discovery revealed that hesperidin, a citrus bioflavonoid, can lower blood glucose levels by mimicking the action of DPP-4 inhibitors. As an affordable and low-risk antioxidant supplement, hesperidin has great potential as an alternative treatment for T2DM.



To investigate the potential of hesperidin supplementation as a natural medication to improve blood glucose levels and renal health in diabetic patients, our proposed study will examine the effect of hesperidin supplements on blood glucose levels and renal function in a mouse model with DKD. We will use doses that fall within the range of antioxidant effects and anticipate that this study will also demonstrate additional protective actions by reducing vascular oxidative stress and inflammation, both of which contribute to poor outcomes in DKD. If successful, this research could pave the way for the use of natural supplements as primary or complementary therapies for achieving glycaemic control and maintaining renal health in patients with diabetic nephropathy.

The primary objective of this project is to determine if the intake of citrus bioflavonoids – hesperidin improves renal function, lower DPP-4 activity, minimise oxidative stress and inflammation, and ultimately, enhance glycaemic control in mouse model with diabetic kidney disease.

This clinical project will require the students to use basic chemical skills, taking care of animals in laboratory (mice model), how to deal with blood sampling and analysis as well as acquire new skills on the use of an advanced biochemical equipment like the use of ultraperformance liquid chromatography. In addition, the student will learn how to write an appropriate clinical paper and surf the web for the relevant scientific information to support the data.

Dr. Richard Fernandez
Bundoora

Anatomical dissection

CT analysis

Anthropometic measurements

Whole organism bioimaging

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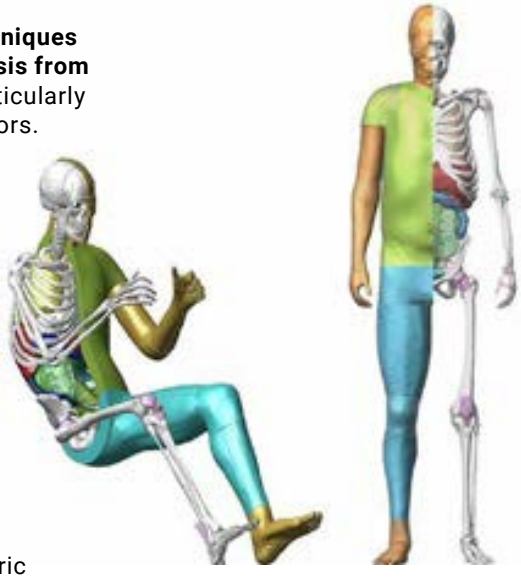
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

The anatomy and impact biomechanics laboratory focuses on the application of anatomical, anthropometric and biomechanical techniques to investigate injury prevention strategies and perform forensic analysis from trauma. Ongoing research concentrates on hip fracture prevention, particularly developing anatomical and biomechanical specification for hip protectors. Anatomical and geometric techniques are also under development to assist with forensic identification of skeletal remains. New research is looking into skeletal blunt force trauma in Motor Vehicle Accidents.



Our anthropometric studies have quantified variations in bony and soft tissue anatomy and developed morphometric maps to improve the design of hip protectors and prosthetic devices. The biomechanical studies conducted have developed novel methods to measure the material properties of skeletal muscle under dynamic impact loading. This laboratory has a number of collaborations, including those within La Trobe University and the Transport and Road Safety Research Centre (University of New South Wales). There is a strong ongoing collaboration with the Victorian Institute of Forensic Medicine.

This anatomy and impact biomechanics laboratory uses an array of anatomical techniques from human cadaveric dissection, anthropometric measurements and computer tomographic analysis to cutting edge Finite Element Modelling. The latter involves using engineering techniques to modify three-dimensional computer models of the human body making them more anatomically accurate, thereby enabling more realistic simulations of biomechanical impacts.

Project 1. To investigate anatomical variations of the lateral hip region to influence hip protector positioning. Work will involve developing measurement protocols on living subjects and include human skeletal analysis. Research may also include cadaveric dissection and medical imaging analysis.

Project 2: To investigate connections, slings and topography of the human fascial system. This project will be region specific, have a clinical and functional application and form the foundation of further work involving kinematics and biomechanics of movement and injury. Cadaveric dissection will be used and may also include medical imaging.

Both Honours projects have a strong foundation in human topographic anatomy and will provide support and training in dissection and other advanced topographic anatomical techniques. However, there is also flexibility to include biomechanics and forensic applications. This provides a very unique opportunity for students seeking to learn more about multidisciplinary research.

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I'm ready to apply! »

Dr. Brooke Huuskes
Bundoora

available for LTU3IND placement

- Cell culture - eukaryotes incl. primary & cell lines
- Gene expression analyses
- Animal models of disease
- Histology
- Animal handling
- Microscopy - light, confocal & super resolution
- Immunoassays
- Protein biochemistry (SDS-PAGE, western blotting)

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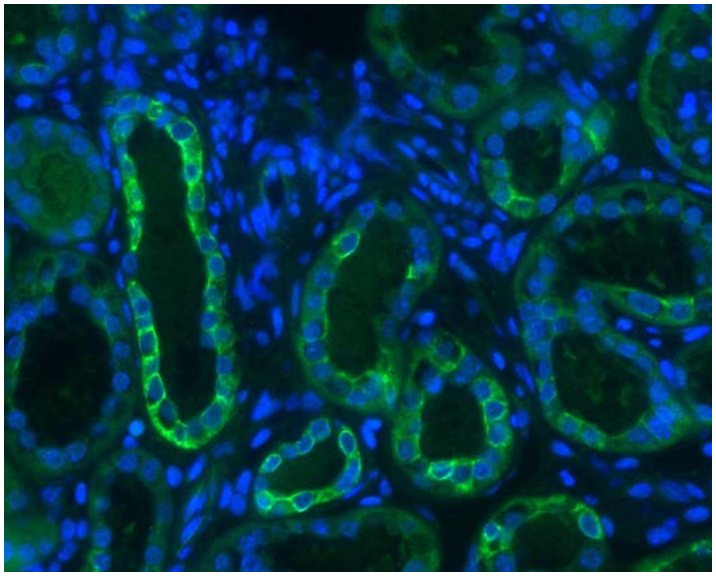
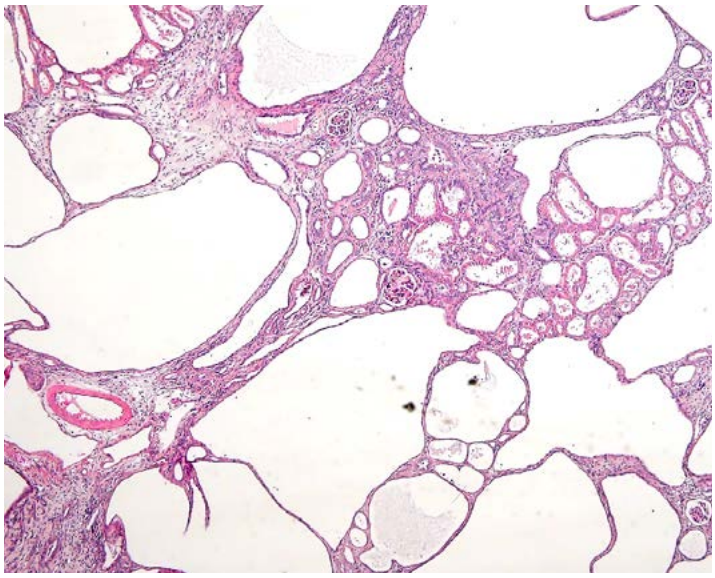
Website: click here

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 chronic kidney disease (CKD), which affects more that 10% of the worlds 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 understand the perspectives of those living with chronic kidney disease. This research helps inform practice and policy for improved patient-centred outcomes.





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

Project 2. Targeting the downstream effects of inflammasome activation in models of kidney disease

Project 3. Gaining an understanding of the perspectives of kidney transplant patients throughout the COVID-19 pandemic

Dr. James (Jim) Bell
Bundoora

- Cell culture - eukaryotes incl. primary & cell lines
- Protein biochemistry (SDS-PAGE, western blotting)
- Animal models of disease
- Histology
- Light microscopy

E-mail: j.bell@latrobe.edu.au
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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**

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.

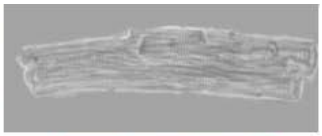
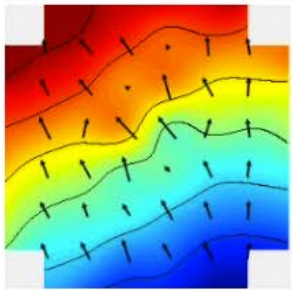
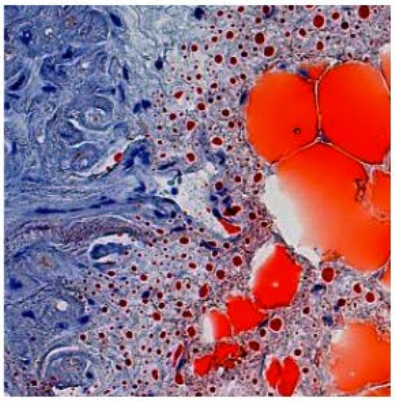
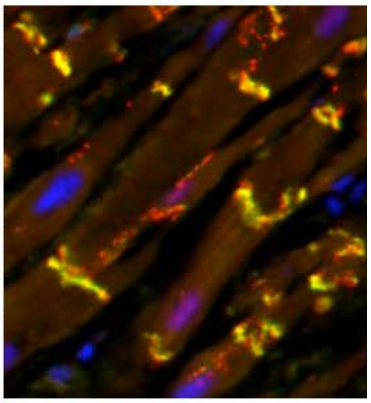
The lab has two primary research themes – specifically, the pathological influence of 'heart fat' as an emerging mediator of heart disease and the role of sex and sex steroids in determining heart health. The fat immediately surrounding the heart increases markedly in obesity, with aging, and post-menopause – 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).

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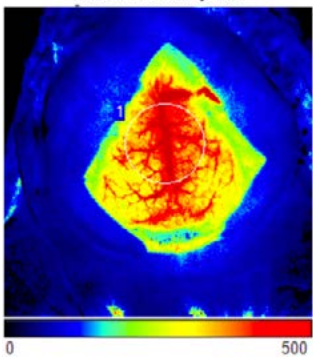
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

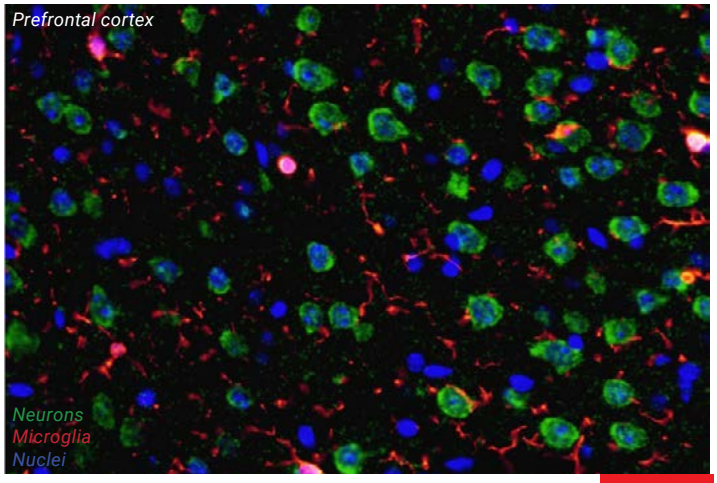
Cerebrovascular diseases (stroke, dementias) are a major health concern in Australia and throughout the world. The brain is and its circulation are particularly sensitive to disease. Cardiovascular diseases disrupt the function of cerebral arteries which leads to a dysregulation of cerebral blood flow. 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.





Dr. Seb Dworkin
Bundoora

available for **LTU3IND** placement

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

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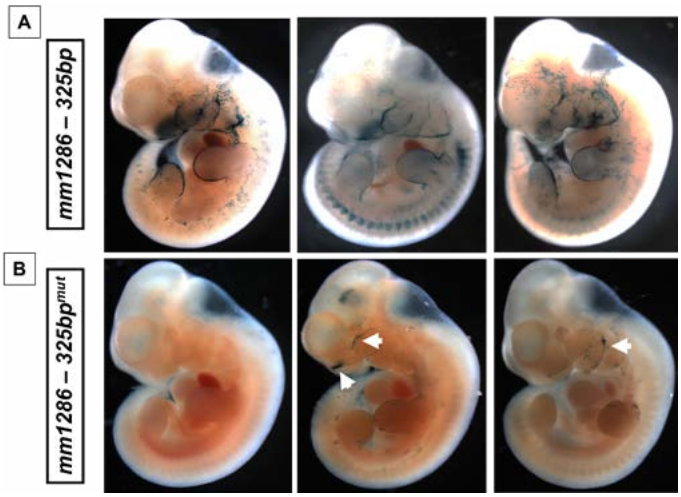
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

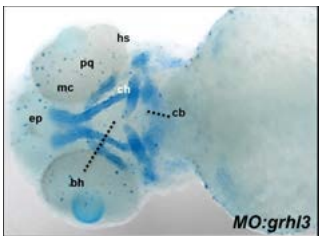
Understanding how a single, fertilised cell develops into an entire, fully functioning baby, is one of the most incredible fundamentals of life. It is also a process across the entire animal kingdom. Amazingly, this process usually works perfectly well - that is, the baby develops without any problems. 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.



Dr. Maria Jelinic
Bundoora

available for **LTU3IND** placement

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

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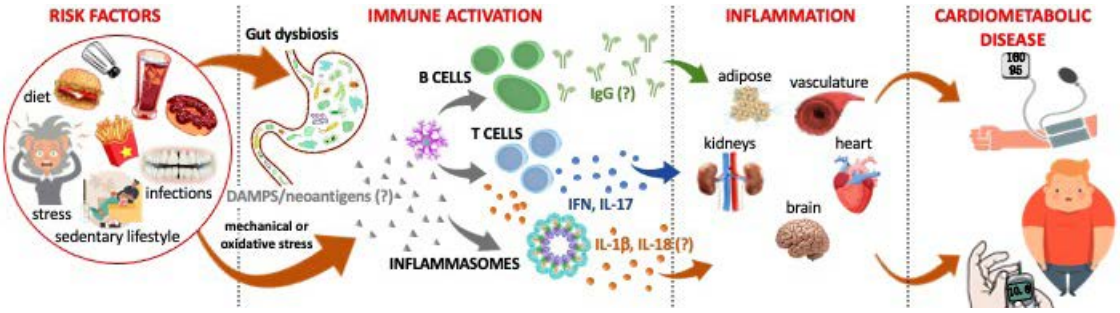
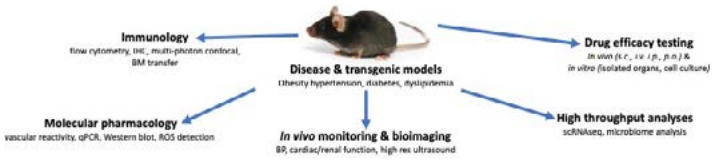
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**



The 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 (some described below).

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 of metabolic syndrome, this study aims to characterise the 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. Determining the role of para- and peri-renal adipose in obesity-related chronic kidney disease. The global obesity epidemic has led to a 10-fold increase in obesity-related chronic kidney disease, highlighting the need for improved understanding of the pathogenesis. Pararenal and perirenal fat capsules that surround kidneys are thought to promote obesity-related renal damage to a greater extent compared to other visceral fats. The thickness of these fat depots is a known independent predictor of chronic kidney disease in type-2 diabetes patients. Whether pararenal and perirenal fat directly causes renal inflammation and damage in obesity remains undefined. Therefore, in this project, we are characterising the inflammatory profiles of these adipose depots and determining the effects of their removal on renal and metabolic outcomes in obesity.



Dr. Quynh Nhu Dinh
Bundoora

- Animal handling
- Animal models of disease
- Animal behaviour studies
- Protein biochemistry (SDS-PAGE, western blotting)
- Genetic sequencing & expression analyses
- Histology
- Microscopy - light, confocal & super resolution

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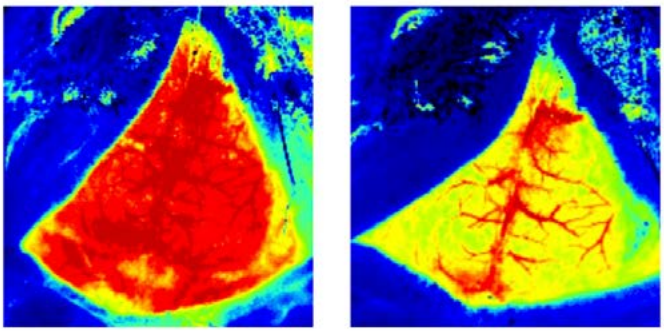
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

Dementia is a debilitating condition that affects ~55 million people worldwide and is expected to triple by 2050. Vascular dementia is the second most common form of dementia. Vascular dementia occurs when there is reduced blood flow to the brain leading to brain injury and cognitive impairment. Currently, there are no treatments that can stop or reverse the progression of vascular dementia. Our lab focuses on understanding the underlying pathology of vascular dementia to develop new and effective treatments.

Project. Understanding the role of the inflammasome in vascular dementia. Co-supervisor: Prof Thiruma (Garrie) Arumugam. Inflammation is emerging as a key contributor to the development of vascular dementia. Inflammasomes activate powerful inflammatory responses and has been implicated in the pathophysiology of brain diseases such as stroke and Alzheimer's Disease. This project will study the contribution of the inflammasome in the development of vascular dementia.

Cerebral blood flow after induction of vascular dementia



Before After

Prof. Chris Sobey
Bundoora

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

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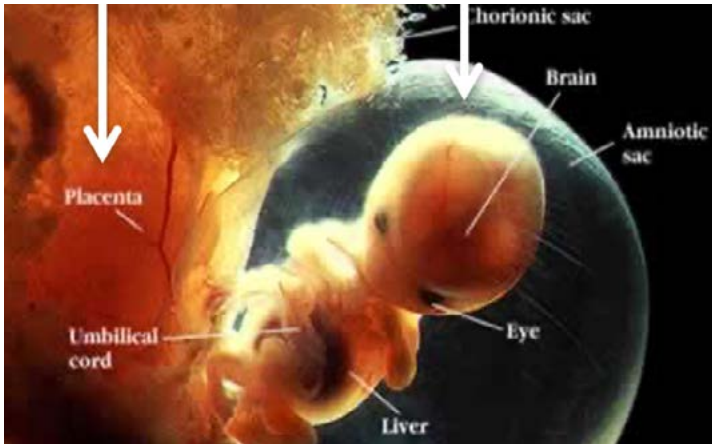
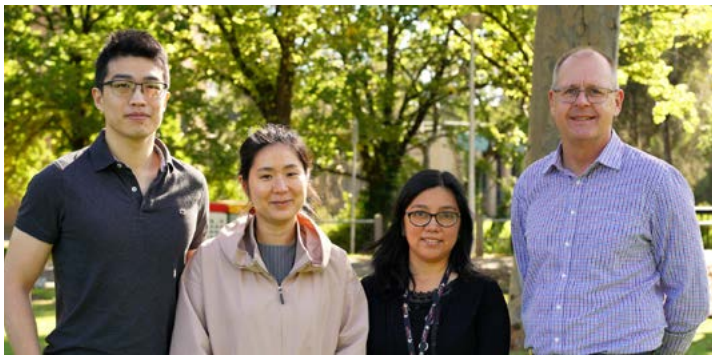
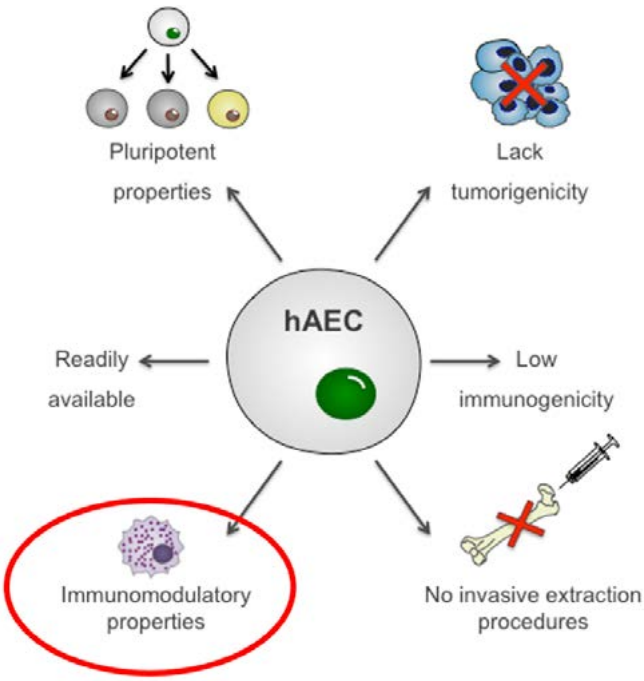
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

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.







A/Prof. Colleen Thomas Bundoora

available for LTU3IND placement

- Animal handling
- Microbiome analyses
- Animal models of disease
- Zebrafish microinjection
- Histology
- Light microscopy

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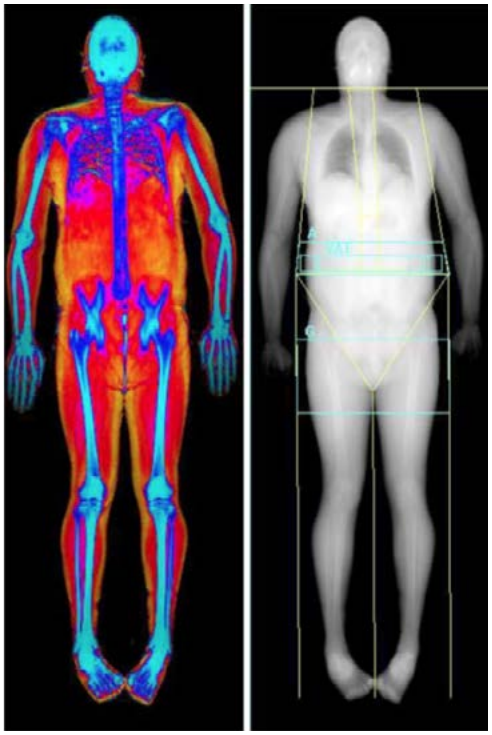
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

The Cardiovascular Physiology Division, within the Cardiovascular Biology and Disease Research Centre, features multi-disciplinary local, national and international collaborations to translate findings from basic research through to clinical trials and successful industry partnerships. Laboratory-based research in coronary heart disease features an integrated approach of monitoring cardiovascular variables such as blood pressure, heart rate and blood flow simultaneously for extended periods of time via indwelling or wireless monitoring equipment. We conduct proof-of-concept studies in small animal models to screen and assess the potential of novel interventions/ medical devices/drugs, and large animal models, which have a similar anatomy and physiology to humans and are critical to determine efficacy and safety in the translation discovery pipeline from rodents to clinical therapies.

We are interested in how genes regulate heart development (zebrafish model). Our human studies focus on beneficial clinical outcomes using biomarker and self-report (survey) data. Functional components of diet to prevent and/or reverse chronic disease – especially cardiovascular disease and diabetes – are also a significant recent focus of this laboratory (anti-inflammatory and antioxidant mechanisms of action; role in maintaining a healthy gut microbiota). We investigate how laparoscopic bariatric surgery in patients with morbid obesity beneficially impacts the gut microbiome.



Dr. Chris van der Poel
Bundoora

available for LTU3IND placement

- Animal handling
- Histology
- Cell culture - eukaryotes incl. primary & cell lines
- Light microscopy
- Genetic expression analyses

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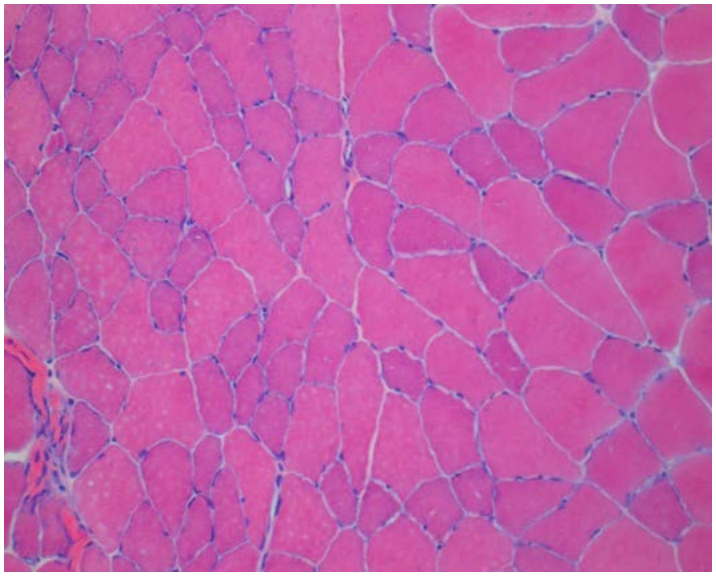
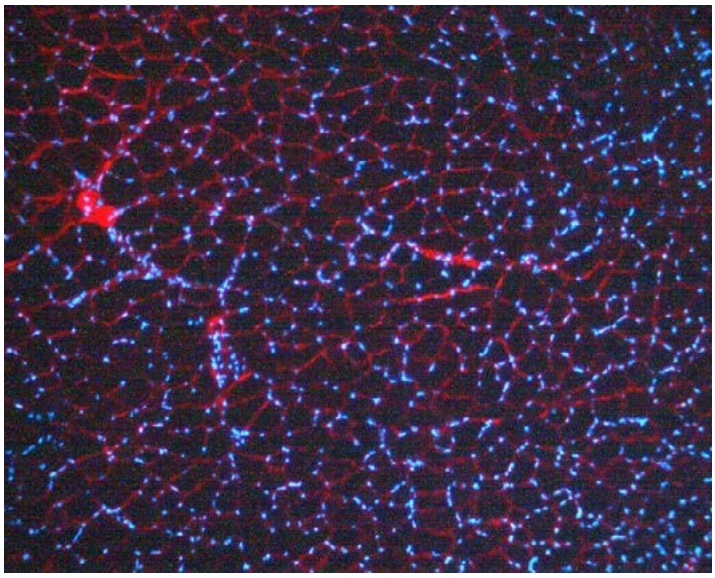
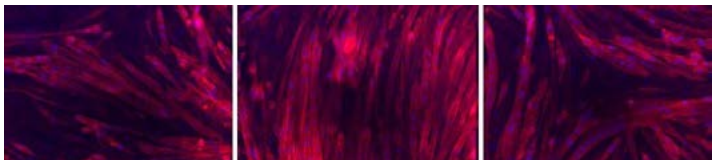
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **Yes**

An ergogenic aid is any training technique, mechanical device, nutritional ingredient or practice, pharmacological method, or psychological technique that can improve exercise performance capacity or enhance training adaptations. Ergogenic aids may help prepare an individual to exercise, improve exercise efficiency, enhance recovery from exercise, or assist in injury prevention during intense training. Our laboratory is interested in the role that pharmacological ergogenic aids have on muscle contraction, adaptation to physical training and recovery post muscle injury.

Pycnogenol, a dietary supplement extracted from French maritime pine bark, is widely marketed for its health effects. Benefits purported for pycnogenol include improved cognitive function, endothelial function, and blood pressure regulation. Pycnogenol has also been promoted to have significant effects on exercise performance. Specifically, consumption of pycnogenol has been shown to increase metabolic capacity of muscle and reduce oxidative stress.







Substantially more investigation into the influence of pycnogenol on exercise and muscle performance is needed to understand how pycnogenol changes muscle function.

This project will use a mouse model of muscle contraction and muscle fatigue to test the hypothesis that pycnogenol supplementation will reduce onset of muscle fatigue. Additional measures of the pathophysiology and effectiveness of pycnogenol will include histological and biochemical (gene and protein) analysis of muscle tissue. This project will involve animal handling, animal procedures under anaesthetic and tissue dissections.

A/Prof. Antony (Bill) Vinh
Bundoora

available for LTU3IND placement

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

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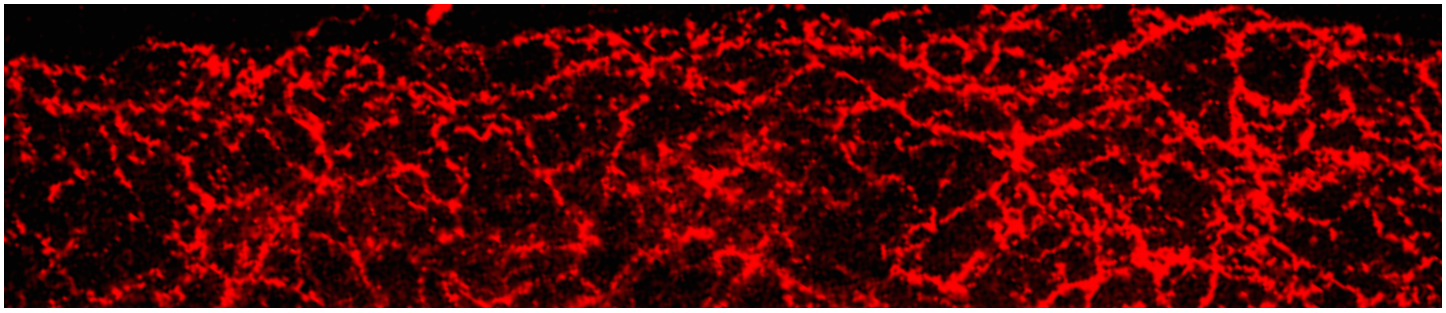
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**



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.

Project 1. Role of the adaptive immunity during hypertension. The adaptive immune system, namely T and B cells have been shown to be prerequisites for elevations in blood pressure. However, the activation of T and B cells during the development hypertension remains understudied. Using mouse models of hypertension, coupled with single cell transcriptomic analyses, this project aims to characterise the temporal relationship between T and B cell activation during the development of hypertension. Techniques and skills that will be learnt include animal handling and BP detection, flow cytometry and bioinformatic analysis.

Project 2. CTHRC1 in aortic fibrosis: Friend or foe? Stiffening of the aorta is major risk factor for end-organ damage such as stroke and kidney disease. Using single cell RNA-sequencing, we have identified novel pro-fibrotic fibroblast that can be uniquely identified by a gene Cthrc1 and is only present during aortic stiffening. The aim of this project is to determine whether CTHRC1 protein directly drives fibrosis measured through collagen production in human aortic adventitial fibroblasts. Techniques and skills that will be learnt include cell culture, flow cytometry, ELISA and immunocytochemistry.

Cardiovascular Research, Translation and Implementation (CRTI)

Research projects in the Department of Cardiovascular Research, Translation & Implementation (CRTI)

The following list are research supervisors in CRTI who are offering projects in 2024.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

Cardiovascular Research

	page:
Prof. Judy de Haan	117
Prof. David Greening	118
Dr. Tin Kyaw	119
Prof. Peter Meikle	120
A/Prof. Alexander Pinto	121

Translation & Implementation Science

	page:
none available in 2024	

Prof. Judy de Haan
Baker Heart & Diabetes Institute

- Animal models of disease
- Cell culture - eukaryotes, incl. primary & cell lines
- Immunohistochemistry
- RT-PCR
- Flow cytometry
- Protein biochemistry (SDS-PAGE, western blotting)

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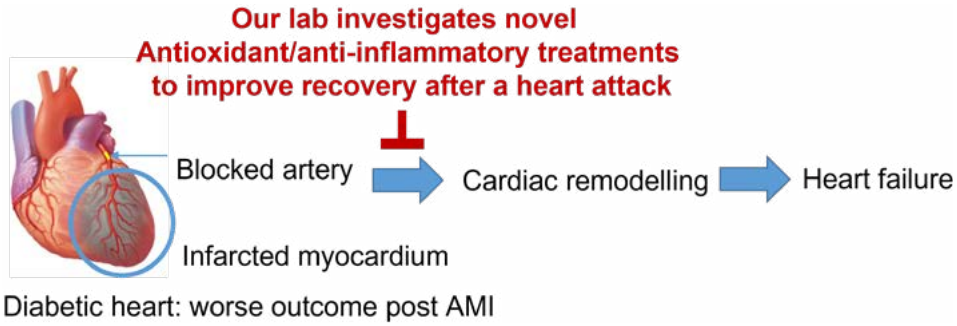
Number of projects: **1 Feb, 1 Jul**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

The lab focusses on understanding the mechanisms that lead to diabetic cardiovascular complications. We are particularly interested in how oxidative stress and inflammation interact to drive the pathogenesis associated with elevated glucose levels. We are offering projects related to endothelial dysfunction, atherosclerosis and cardiac remodelling after a heart attack.

Project 1: Understanding the role of the NLRP3-axis in sterile inflammation associated with diabetic cardiac remodelling. This project builds on the existing knowledge that inflammatory cells such as neutrophils and macrophages respond to the injury sustained after a heart attack to try to stem the damage. Inadvertently, these cells cause more damage and need to be "switched off". This project uses specific treatments to temper the inflammatory response to lessen cardiac injury.



A/Prof. David Greening
Baker Heart & Diabetes Institute

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

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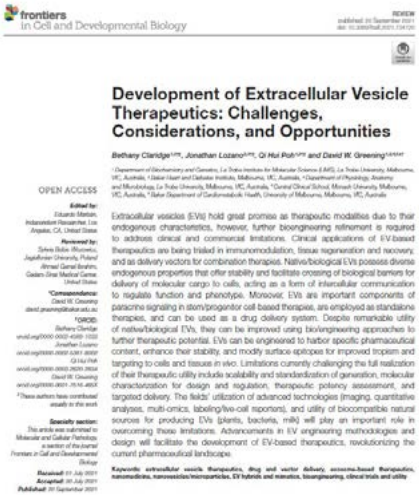
Website: click here

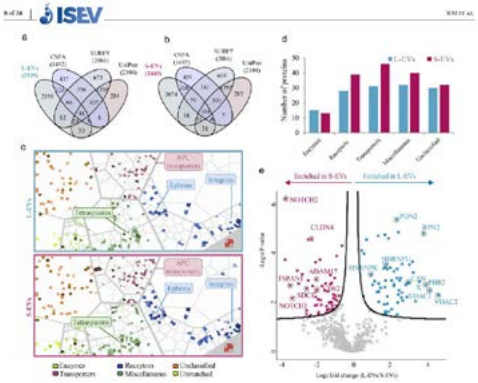
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

The Molecular Proteomics laboratory is focused on understanding the molecular function of extracellular vesicles (EVs) and how their intercellular signalling is important in normal physiology and pathologies; including cardiometabolic disease with the goal of identifying new deliverable therapeutic targets. We apply quantitative proteomics and various functional and molecular approaches to understand the composition, signalling, and function of EVs. 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. 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.


frontiers in Cell and Developmental Biology

Development of Extracellular Vesicle Therapeutics: Challenges, Considerations, and Opportunities



«Back to CRTI project contents
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I'm ready to apply! »

Dr. Tin Kyaw
Baker Heart & Diabetes Institute

available for LTU3IND placement

- Animal models of disease
- Cell culture - eukaryotes, incl. primary & cell lines
- Histology & immunoassays
- Mass spectrometry & proteomics
- Molecular cloning & PCR assays
- Flow cytometry
- Microscopy - light & confocal fluorescence

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

The Inflammation and Cardiovascular laboratory provides state-of-the art postgraduate training in medical science with major focus on important health questions using advanced technologies in disciplines that include pathology and immunology as well as biochemistry, physiology and pharmacology.

Theme 1. Directly Targeting B cells to Prevent Heart Attacks and Strokes. Cholesterol lowering agents have been shown to reduce the incidence of heart attacks and strokes, but the incidence of death in survivors is high after a first heart attack and it is not clear which patients are at high risk. There are no therapies that prevent a second or third heart attack/ stroke, which are frequently fatal. We have strong evidence that B cells, in particular those that produce antibodies are largely responsible. Projects are available to study B cells and their role in atheroclerosis, heart attack and stroke prevention, and targeting B cells with nanoparticle therapies.

Theme 2. Protecting the Heart from Heart Attacks by Preventing Immune Cell Mediated Rupture of Atherosclerotic Plaques. Rupture of advanced atherosclerotic plaques within arteries of the heart are responsible for heart attacks, but the mechanisms are poorly understood and there are no therapies that specifically target plaque rupture. We have obtained new data that gamma delta T cells in atherosclerotic plaques may contribute to heart attacks. This project is highly focused on gamma delta T cell immunology and atherosclerosis pathophysiology and may help prevent heart attacks in the future.

Theme 3. CD8+ Regulatory T Cells, a Strategy to Prevent Rapid Progression of Established Atherosclerosis. We have shown in atherosclerosis that B cells produce pathogenic antibodies that enhance the progression of lesions towards clinically significant plaques. Currently, there are no therapeutic interventions that target B cells to suppress atherosclerosis. This project will focus on CD8+ regulatory T cells, whose suppressive actions prevent B cells from producing pathogenic antibodies. The project will determine whether CD8+ regulatory T cells suppress the initial stages of atherosclerosis development, the progression of established atherosclerosis and define their mechanisms of action.

Theme 4. Preventing Cross-Talk between cytotoxic memory CD8+ T cells and Stress Heart Cells to inhibit Development of Stiff Hearts due to fibrosis. High blood pressure and diabetes are both associated with poor heart function due to the stiffening of the heart due to excessive collagen accumulation, known as cardiac fibrosis. This condition contributes significantly to heart failure and premature death, but there are currently no effective treatments available. Recent research has shown that cytotoxic memory CD8+ T cells play a role in initiating fibrosis in mice with high blood pressure. This project aims to evaluate our proposed therapeutic strategy to prevent cardiac fibrosis by inhibiting the release of DNA from stressed cardiomyocyte mitochondria and reduce the risk of cardiac fibrosis.

Theme 5. Inhibiting Early Lymphocyte Inflammation to Prevent Cardiomyocyte Loss during Myocardial Infarction and Development of Premature Heart Failure. Myocardial infarction, or heart attack, is a leading cause of death due to loss of cardiomyocytes. Current treatments that unblock coronary arteries have increased patient survival, but heart failure remains a major problem. Recent studies have shown that cytotoxic gamma delta T cells contribute to the large loss of cardiomyocytes following a heart attack. This project aims to prevent inflammatory cell death mediated by gamma delta T cells by preventing pyroptosis and necroptosis. The project will also focus on developing inhibitory antibodies to prevent gamma delta T cell activation, which is expected to reduce cardiomyocyte loss and heart failure in humans.

Theme 6. Immune Mechanisms Responsible for Development of Checkpoint Mediated Myocarditis. Immune checkpoint inhibitors (ICIs) have revolutionized cancer treatment by reactivating exhausted cytotoxic CD8+ T cells and enhancing their ability to eliminate cancer cells. However, combination therapies with anti-PD-1 and anti-CTLA-4 ICIs can lead to adverse effects such as inflammation of the heart (myocarditis). Currently, there are no effective treatments for this condition. This project aims to generate a mouse model that mimics human myocarditis by transplanting melanoma or breast cancer tumors into mice and treating them with anti-PD-1 and anti-CTLA-4 antibodies.

Prof. Peter Meikle
Baker Heart & Diabetes Institute

- Animal models of disease
- Cell culture - eukaryotes, incl. primary & cell lines
- Metabolomics (incl. lipidomics)
- Immunoassays (I-P, ELISAs)
- Gene expression analyses (PCR, qPCR)
- Flow cytometry
- Bioinformatics

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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**

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. Integration of population level 'omics' data to target cardiometabolic disease. Co-supervisor: Dr Corey Giles
2. A novel approach in improving lipidomics throughput for population profiling. Co-supervisor: Dr Kevin Huynh
3. Unravelling the role of breast milk ether lipids in modulating immune function in early life. Co-supervisors: Dr Sudip Paul, Dr Satvika Burugupalli, Dr Alexandra George
4. Development and validation of a high throughput clinical lipidomics platform. Co-supervisor: Dr Thomas Meikle
5. Identification of biomarkers of ferroptosis using mass spectrometry. Co-supervisor: Dr Kevin Huynh
6. Plasmalogen modulation as a therapeutic approach for fatty liver disease. Co-supervisors: Dr Graeme Lancaster, Dr Sudip Paul

A/Prof. Alexander Pinto
Baker Heart & Diabetes Institute

available for LTU3IND placement

- Animal models of disease
- Flow cytometry
- Cell culture - eukaryotes, incl. primary & cell lines
- Bioinformatics
- Confocal & super resolution fluorescence microscopy
- Genetic sequencing

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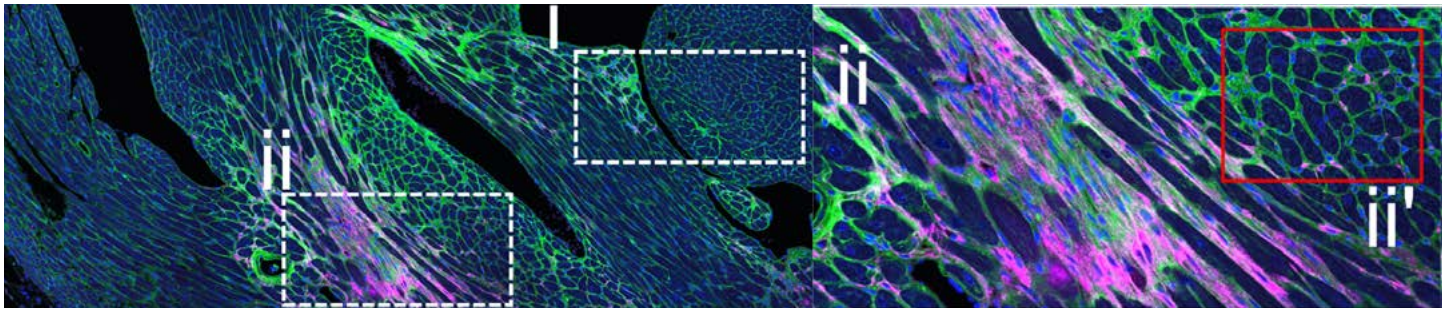
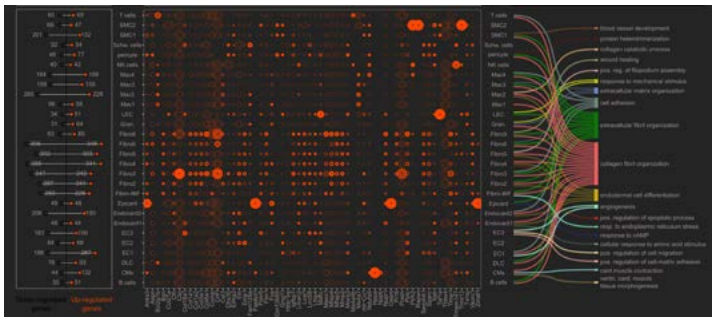
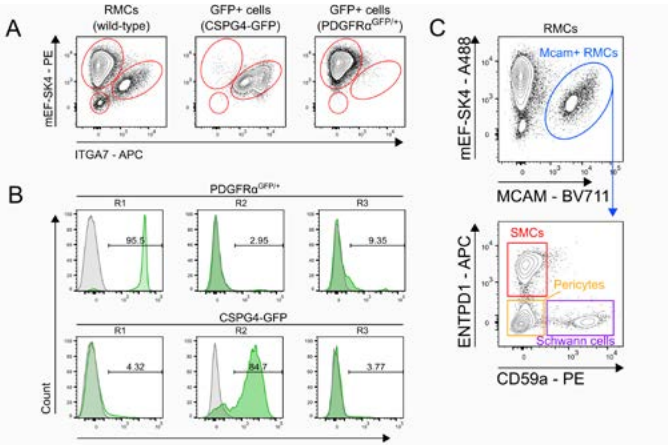
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **Yes**



The mammalian heart is comprised of a diverse range of cell types. These include cardiac muscle cells (cardiomyocytes)—the cells that contract to pump the heart—and other non-myocytes (non-muscle) cell types that support heart function. Non-myocyte cell types include endothelial cells, fibroblasts and macrophages. Recently, we characterized the cellular composition of the heart which was previously undefined. Building on this work, our research now has an overarching goal to identify factors governing the cellular composition of the heart during development, homeostasis (steady-state), disease and aging. Identifying molecular pathways that regulate cardiac cellular composition may have profound implications for human health. These include treatment of a wide array of cardiac disorders that constitute heart disease—the leading cause of death in the Australia—which may be attributed to pathological alterations in cardiac cellular composition. Pathways identified as agonistic or antagonistic toward pathologically altering cardiac cellular composition, may point to novel therapeutic targets to allay the morbidity and mortality associated with heart disease.





Olivia Newton-John Cancer Research Institute

Research projects in the Olivia Newton-John Cancer Research Institute (ONJCRI)

The following list are research supervisors in ONJCRI who are offering projects in 2024. As mentioned, all ONJCRI supervisors are affiliated with the School of Cancer Medicine, La Trobe University. Students who do Honours at the ONJCRI will enrol in Honours in Biochemistry and Cell Biology.

You simply need to click on their name to be taken directly to their respective information page. On each page, you will find a list of the techniques you will gain experience in; a brief description of the general theme of the lab; some details about the specific project(s) on offer in 2024. You will also find information as to where the project will be located, links to their website, and email addresses so that you can contact them to arrange an interview.

Cancer Medicine (ONJCRI)

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Prof. Robin Anderson
ONJCRI

- Cell culture - eukaryotes incl. primary & cell lines
- Light microscopy
- 3D cell culture
- Genetic sequencing
- Metabolomics

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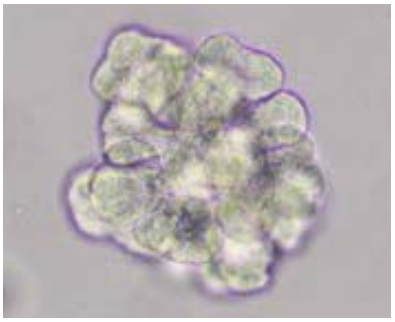
Website: click here

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

Finding cures or at least better treatments for cancer remains a significant goal to reduce the burden of this suite of diseases on human society. One in 7 women and one in 1000 men will develop breast cancer, making it one of the highest-incidence and thus highest mortality rate cancers globally.

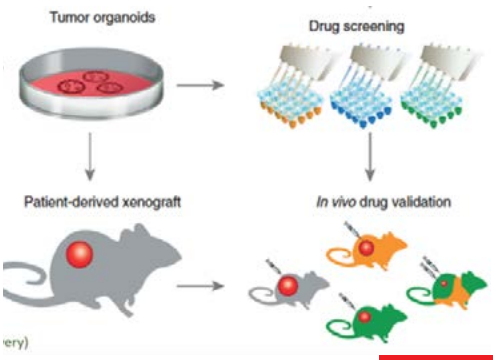
Organoids are three-dimensional (3D) cultures of normal tissue or cancer tissue that can be grown in a droplet of basement membrane that mimics the extracellular matrix of tumours. We are generating a bank of organoids derived from either normal breast tissue or from patients' breast cancer tissue. Their responses to therapeutic agents more closely align to responses of intact tumours compared to simple 2D cultures on plastic. In addition, cells maintain many of the histological, genetic and transcriptomic features of the original tumour. These features make organoids a useful model for drug discovery screening as they are cheaper than drug testing directly in tumour-bearing mice.

Cannabinoids are a set of specialised metabolites derived from cannabis (Cannabis sativa). The major cannabinoids are delta9 tetrahydrocananbinol (THC) and cannabidiol (CBD). These and other cannabinoids have been purported to have many health-promoting properties. However, there are significant gaps in knowledge as to how effective cannabinoids are in cancer treatment, and whether other molecules within cannabis extracts may also be beneficial.



Our bank of breast organoid cultures represents the different subtypes (luminal ER+/PR+, Her2 positive and triple negative) of breast cancer. Access to a range of medicinal cannabis extracts of different chemical composition will be through our collaboration with the ARC Medicinal Agriculture Research Hub (https://medagriculture.com/).

This project aims to determine the ability of a series of purified compounds or defined mixtures of compounds derived from cannabis to inhibit growth of organoids derived from tumours recovered from breast cancer patients. For those compounds or mixtures that show promising results, the mechanisms of action will be explored through transcriptomic and/or metabolomic analyses. These data would then inform the selection of compounds for future testing in animal models of cancer for anti-tumorigenic efficacy.



The expected outcomes are:

- Discovery of cannabis-derived compounds that inhibit growth of organoids derived from human cancers.
- Identification of cannabis-derived compounds that have the potential to be developed as anti-cancer agents.

Note: Students in the MedAg Hub are required to meet the ODC requirements for Suitable Persons. The background information on these requirements can be found at Guideline: Fit and Proper Persons and Suitable Staff | Office of Drug Control (odc.gov.au) and as set out in Narcotic Drugs Act 1967 (Cth).

Dr. Michael Buchert
ONJCRI

- Cancer
- Animal handling
- Animal models of disease
- Flow cytometry
- Gene expression analysis (sequencing & PCR)
- Histology & immunoassays

E-mail:
Website: click here

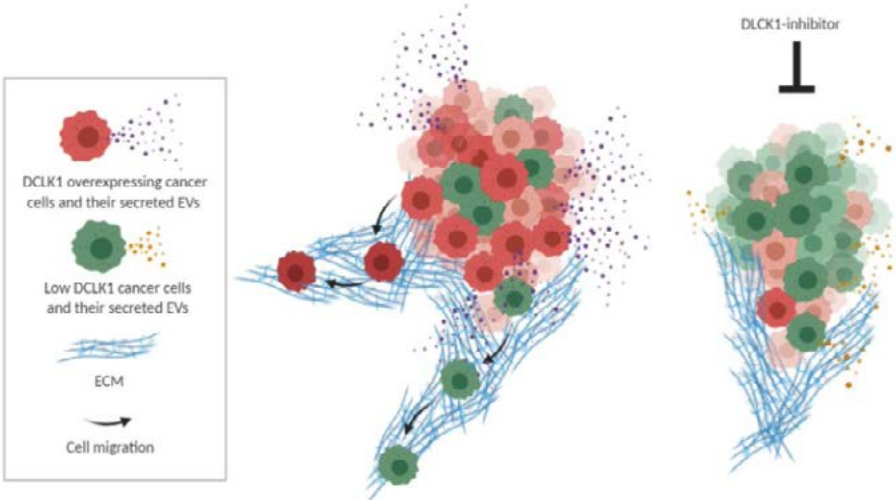
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**
LTU3IND placement: **No**

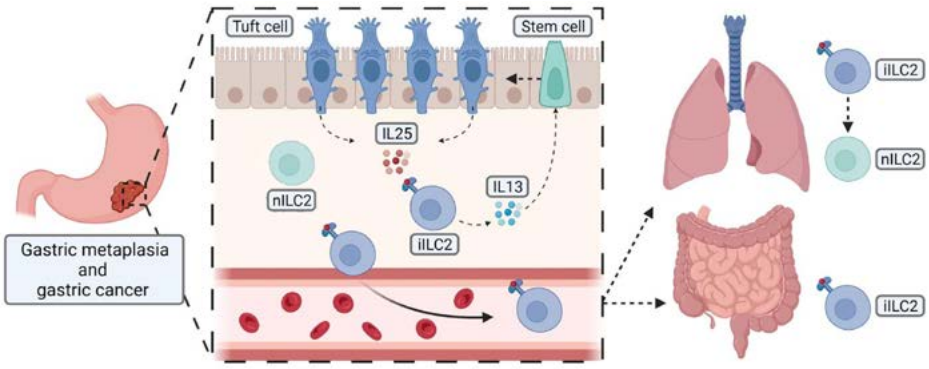
My lab conducts basic cancer research with a focus on stomach and colon cancers. The aim is to better understand how these cancers develop, what they need to progress and how we best interfere with these processes.

My lab offers two honours projects:

Project 1. To analyse the cellular changes that take place in the tumour microenvironement (TME) after treatment with a kinase inhibitor that blocks the kinase activity of a gastric oncokinase. We will investigate the TME changes in both primary and metastatic tumours using flow cytometry and multiplex immunohistochemistry.

Project 2. To investigate the growth of primary and secondary tumours in the stomach and the liver in the absence or presence of certain immune cells or cytokines. Tumour tissues will then be further analysed using flow cytometry, multiplex IHC, RT-qPCR and ELISA.





A/Prof. Doug Fairlie
ONJCRI

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Website: click here

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

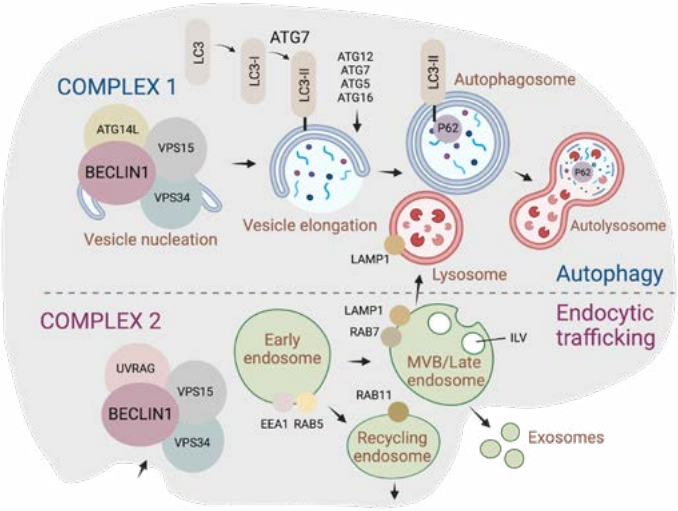
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**
LTU3IND placement: **No**

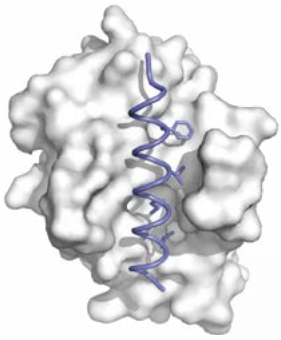
Inflammatory bowel disease (IBD, including Crohn's disease and ulcerative colitis) refers to a debilitating group of diseases caused by impaired intestinal homeostasis and unwanted chronic inflammation due to aberrant exposure to bacteria in our gut. Our lab has found that the protein Beclin1 is absolutely essential for maintaining a healthy gut in mice. Without Beclin1, mice die within 7 days due to severe intestinal disruption and loss of homeostasis.

International genome wide-association studies have propelled the identification of over 200 risk loci in IBD. One IBD risk locus, which contains 47 single nucleotide polymorphisms (SNPs), is associated with decreased expression of Beclin1. This is of particular interest given the disrupted intestinal phenotype of our mice when Beclin1 is lost.

This Honours project now aims to translate our findings in mice to understand an unprecedented role for Beclin1 in IBD. By using the newly established CRISPR-editing facility here at the ONJCRI, this project will use state-of-the-art CRISPR technologies to interrogate the IBD risk locus of interest to identify which of the 47 variants is responsible for regulating Beclin1 levels. We will also learn about the mechanisms by which this risk locus leads to decreased Beclin1 expression.

The expected outcome is a better understanding of the underlying disease mechanisms in IBD and the potential to identify novel therapeutic targets or biomarkers for this incurable group of diseases.





Crystal structure of a fragment of the pro-autophagic protein Beclin1 (blue) bound to the anti-apoptotic protein BCL-2 (white).

Prof. John Mariadason
ONJCRI

available for **LTU3IND** placement

- 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

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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**

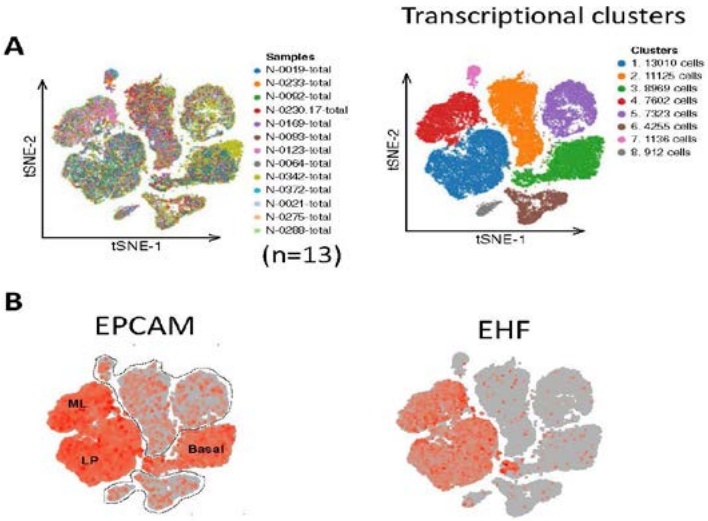
Our team is looking for new ways to treat colon (bowel), breast and liver cancers. We are particularly focused on identifying and targeting major proteins that enable tumour cells to survive in the body, and are testing whether drugs which work in other cancers can be re-purposed for treatment of gastrointestinal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

Dr. Delphine Merino
ONJCRI

available for LTU3IND placement

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

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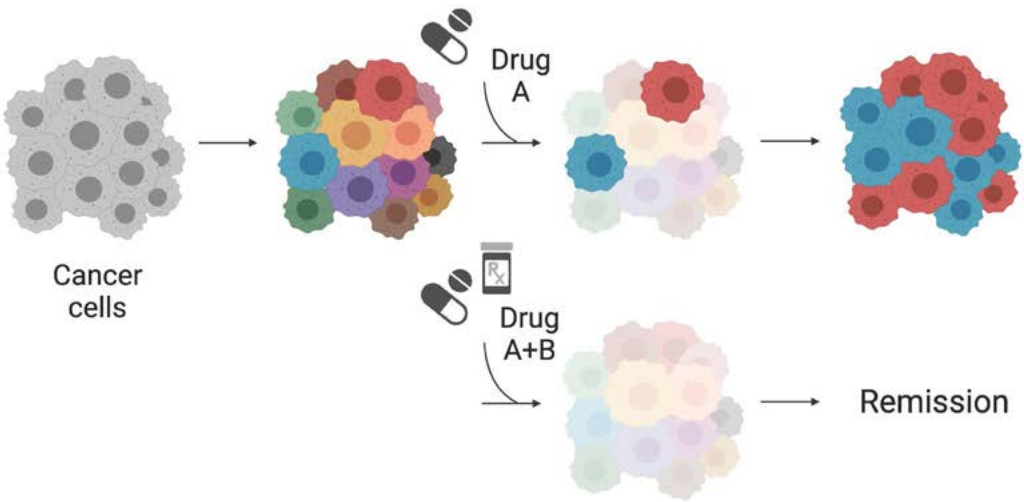
Website: click here

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

Our laboratory is interested in finding new strategies to treat aggressive breast cancer. We are using innovative techniques of cellular barcoding, imaging and single-cell sequencing to study disease progression and drug resistance. Indeed, patients' tumours can be composed of a multitude of cancer clones with different genetic characteristics, associated with specific behaviours. Some of these clones are more likely to spread or resist standard therapy. In this Honours project, we are proposing to use pre-established models to study resistance to chemotherapy. Sensitive and resistant clones will be sequenced, and this information will be used to develop and refine diagnostic tools to predict drug sensitivity. In the longer term, by identifying the molecular characteristics of the clones associated with drug failure, we are hoping to design new combinational therapies to treat cancer cells that are likely to cause disease recurrence.

Studying the molecular characteristics of cancer clones responsible for drug failure to propose new treament combinations



Dr. Lisa Mielke
ONJCRI

available for LTU3IND placement

- Cancer
- Cell culture - eukaryotes incl. primary & cell lines
- Confocal fluorescence microscopy
- Histology (incl. immunohistochemistry)
- Animal models of disease
- Flow cytometry
- RNA sequencing

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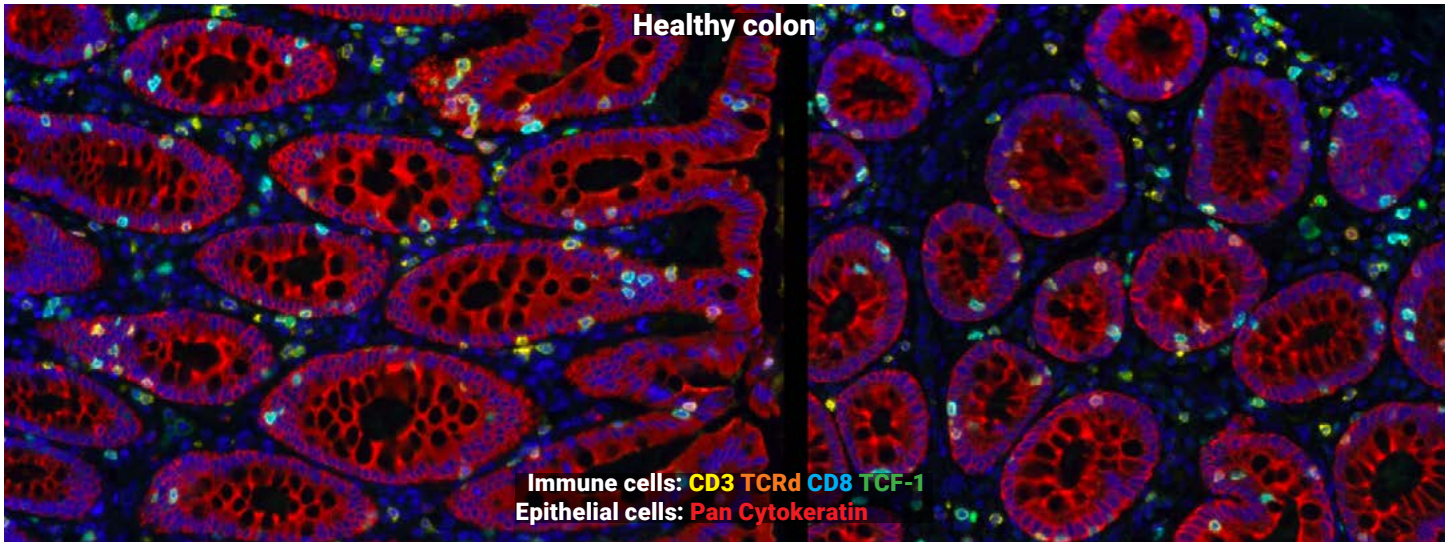
Website: click here

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

Intraepithelial lymphocytes (IELs) are immune cells which continually survey intestinal epithelial cells for infection or damage. Bowel cancer forms when the epithelial cells become damaged and change, growing in an uncontrolled manner. The role of IELs in this process, and whether or not they play a role in tumour cell growth or killing tumour cells, has not been studied in detail. Our laboratory aims to understand these cells, including the molecules that regulate their function in normal homeostasis and development of cancer.

Project 1. Enhancing tumour immunity in the gastrointestinal tract to treat bowel cancer. We aim to develop new immunotherapy drugs to specifically target IELs at mucosal surfaces to enhance their killing of tumor cells.



Dr. Bhupinder Pal
ONJCRI

available for **LTU3IND** placement

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

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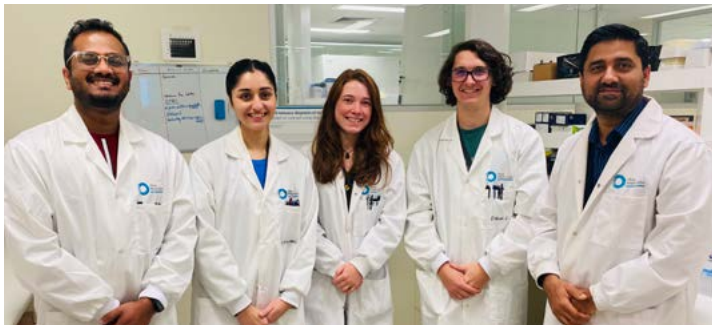
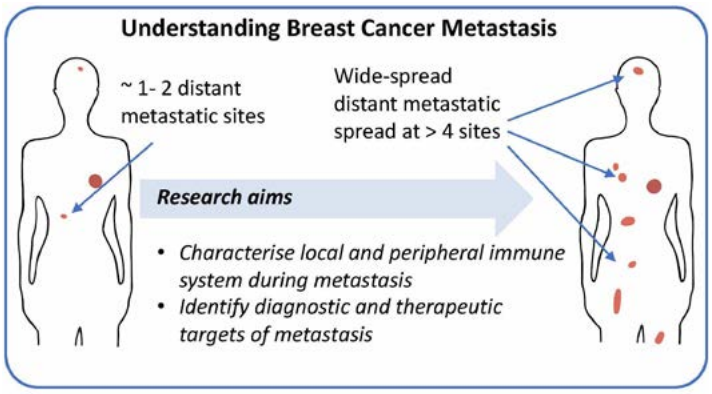
Website: click here

Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
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 Metastasis. Most breast cancer-related deaths are due to metastasis, where cancer spreads to multiple organs, including the lung, liver, bone and brain. We aim 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 the blood and the tumour microenvironment during metastasis. Our project offers the opportunity to learn cutting-edge molecular techniques (Single-cell RNAseq/ Spatial transcriptomics) and utilise mouse mammary tumour models to test candidate immunotherapy targets.

Application Process

Important dates

	February 2024 Entry	July 2024 Entry
Perusal of project booklet; Attend information sessions; Interviews with potential research supervisors	**Semester 2, 2023**	**Semester 1, 2024**
Submission of "SABE Honours Application Form" to School Honours Coordinator	**20th November 2023 (end Semester 2 exam period)**	**17th June 2024 (Semester 1 SWOT Vac)**
Submit online application to La Trobe University via ApplyDirect	**by 10th December 2022**	**by 30th June 2024**
Formal cut-off for all applications (no exceptions)	**21st January 2024**	**30th June 2024**
Start of Honours	**Week of 5th February 2024**	**Week of 8th July 2024**

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
General SABE Honours enquiries, course & subject selection, advice on Biochemistry & Cell Biology Honours projects.

Dr. Jarrod Church
MAPP Honours coordinator
Advice on Microbiology, Anatomy, Human Physiology & Pharmacology Honours projects.

Dr. Travis Dutka
APSS Honours coordinator
Advice on Animal Physiology & Health, Crop Science and Plant Science Honours projects.

A/Prof. Erinna Lee
ONJCRI Honours advisor
Advice on Honours projects located at the ONJCRI.

Dr. Nick Murphy
EG Honours coordinator
Advice on Environment & Ecology and Genetics Honours projects.

Prof. Judy de Haan
CRTI Honours advisor
Advice on Honours projects located at the Baker in the CRTI department.

A/Prof. Belinda Abbott
Chemistry Honours coordinator
Advice on Chemistry Honours projects.

How to Apply - Part 1

The first part of the Honours application process is:

1. Identify a preferred Honours research project
2. Meet to discuss the Honours research project and your intentions with prospective supervisor(s)

How to identify a research supervisor and arrange a meeting:

1. Create a shortlist of research departments and disciplines by using the information about SABE research in this booklet on pages 14-16.
2. Conduct detailed reading of your shortlisted project descriptions provided in this booklet.
3. **Attend one or more Honours information sessions in Semester 2 (for February-entry) or Semester 1 (for July-entry). These will include**:
    a. The subject coordinator will go over how the Honours program is run.
    b. Past-honours students will be on hand to provide their experience.
    c. Research supervisors who are offering projects will be in attendance to meet and ask questions. The subject coordinator and past students will help make these introductions if you feel a bit overwhelmed!
4. **After attending an Honours information session**, you should directly email the research supervisor(s) who you are most interested in working with:
    a. Your email should express your interest in their specific Honours project.
    b. Your email should request an appointment with them to discuss the project in more detail (this could be online or in-person).
    c. You should attach a copy of your academic transcript to your email so that the supervisor can assess your suitability to the project.
5. **At the one-on-one meeting** with the research supervisor:
    a. You should ask questions about the project: what you would be doing, what the project is about.
    b. You should ask questions about the lab and supervisory arrangements: how many people are in the lab, who would be your direct supervisor in the lab, are there any special requirements.
    c. The research supervisor may also ask you questions about why you're interested in their project, and why you want to do honours, so it might be good to think beforehand your answer to these questions.

Advice and further notes:

1. Start the process of meeting with supervisors immediately after the Honours information session – **don't wait**. Research supervisors only have a limited number of positions available and if you wait you are likely to miss out to another (more organised) student.
2. Don't organize meetings with all available supervisors without any thought – be specific and only approach supervisors that you really are interested in working with.

How to Apply - Part 2

The second part of the Honours application process is:

A. Select one Research Project (*you will formalise an agreement with one supervisor and **guarantee** your place in a laboratory*)

B. Nominate up to 8 preferred supervisors (*based on your preferences and academic marks you **may** be selected by nominated supervisors.*)

Option A. Select one Research Project (most common)

1. **After you have had one-on-one meeting(s)** with research supervisor(s).
   a. If you decide YES you would like to do Honours with them.
   b. **YOU should directly email** the research supervisor to express your interest in being supervised by them.
   c. The supervisor may say yes immediately, or they may have meetings with other students and will provide you with a date by which they will make their final decision.
2. Once you have an agreement finalised, you must complete the "SABE Honours Application Form" and complete Option A. The form can be downloaded by clicking on the link.
3. The completed form needs to be emailed to the SABE Honours coordinator by the cut-off date (see page 126).
4. The SABE Honours coordinator will return the form to you with additional information on how to formally apply to La Trobe University via ApplyDirect.

Note: If the research supervisor has agreed to supervise you, you are obliged to continue in that laboratory. Considerable work and effort goes into preparing projects and bench supervision. Agreements need to be honoured.

Option B. Rank up to eight research supervisors

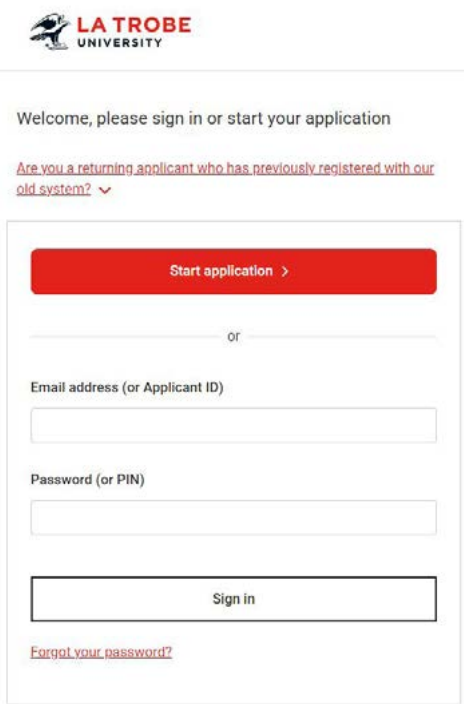
1. **After you have had one-on-one meeting(s)** with research supervisor(s), you can identify up to eight you would like to be considered for ranked entry.
2. You must complete the "SABE Honours Application Form" and complete Option B. The form can be downloaded by clicking on this link.
3. The completed form needs to be emailed to the SABE Honours coordinator by the cut-off date (see page 126).
4. The SABE Honours committee will assess whether students are eligible. Based on your preferences, students will be selected by any available supervisors.
5. If you are successful, the SABE Honours coordinator will return the form to you with additional information on how to formally apply to La Trobe University via ApplyDirect.

Note: There is no guarantee with Option B that students will be placed in an Honours lab as it is ultimately up to the supervisors to agree to accept the student.

How do you place a formal application?

After the SABE Honours coordinator has returned your form to you, the last step is to put in a formal application to La Trobe University. This is via our online application portal, ApplyDirect: https://apply.latrobe.edu.au/content/forms/af/direct-applications/home.html

If you run into any problems please give ApplyDirect a call on 1300 135 045.

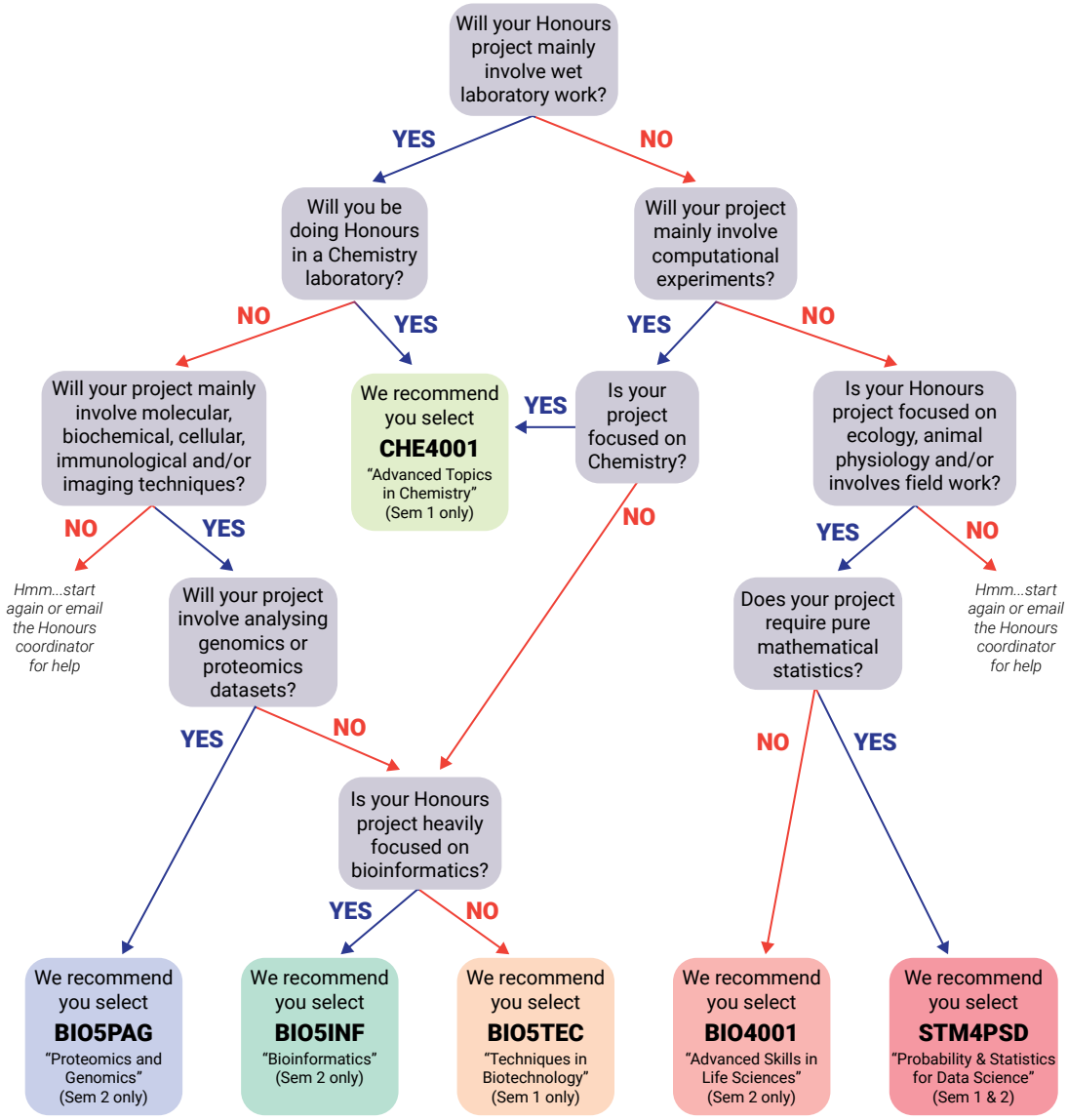


Choosing your subjects: elective coursework (15CP)

Once you have successfully enrolled into your Honours course, you will be required to self-enroll into your desired research and coursework subjects. As described on page 7, you will enroll in two, 15CP, coursework subjects.

CORE = SCI4001 "Introduction to Research" (15CP) (taken in first semester of Honours).
ELECTIVE = you may choose one 15CP subject that complements your particular project.

For your elective, we recommend that you choose a subject that complements your chosen project and research discipline. There are 7 subjects available for you to choose from. Students should consult with their research supervisor as to which subject is most appropriate to their research project. The following decision tree is designed to help both students and supervisors with this process.



Please see the La Trobe University handbook for detailed subject descriptions, SILOs and assessments.

Study plans

Choosing your subjects: research (15CP + 15CP + 30CP + 30CP = 90CP total)

Students will also enroll in their desired research subjects based on their undergraduate major and research focus of their chosen supervisor. There are four research subjects, ending with "A" (=15CP), "B" (=15CP), "C" (=30CP) or "D" (=30CP).

The following Honours research disciplines are available (corresponding subjects are indicated in brackets):

- Animal Physiology & Health (APH401A, APH401B, APH401C, APH401D)
- Agriculture (AGR401A, AGR401B, AGR401C, AGR401D)
- Biochemistry & Cell Biology (BCH401A, BCH401B, BCH401C, BCH401D)
- Chemistry (CHE401A, CHE401B, CHE401C, CHE401D)
- Environment & Genetics (EEE401A, EEE401B, EEE401C, EEE401D)
- Human Anatomy, Physiology & Pharmacology (HBS401A, HBS401B, HBS401C, HBS401D)
- Microbiology (MIC401A, MIC401B, MIC401C, MIC401D)

No matter which Honours research discipline you choose, students will always start with research subject A and finish with research subject D. The order in which you take research subjects B and C depends on whether your coursework elective is available in Semester 1 or 2.

Example study plans

Depending on whether students commence their Honours program in February or July, study full-time or part-time, and if their elective is taken in Semester 1 or 2, they will have one of the following study plans. Note that research subject A and the core coursework subject SCI4001 **must** be taken in the first semester of the Honours program. As mentioned, the order in which students take research subjects B and C is dependent on what elective is chosen.

Study plan 1: Full-time, February entry, Semester 1 elective

	Research	*Coursework*
Sem 1, 2024	Research subject A (15CP) Research subject B (15CP)	SCI4001 (15CP) Elective coursework (15CP) *(e.g. BIO5TEC/CHE4001)*
Sem 2, 2024	Research subject C (30CP) Research subject D (30CP)	

Study plan 2: Full-time, February entry, Semester 2 elective

	Research	*Coursework*
Sem 1, 2024	Research subject A (15CP) Research subject C (30CP)	SCI4001 (15CP)
Sem 2, 2024	Research subject B (15CP) Research subject D (30CP)	Elective coursework (15CP) *(e.g. BIO4001/BIO5INF/BIO5PAG)*

Study plan 3: Full-time, July entry, Semester 1 elective

	Research	*Coursework*
Sem 1, 2024		
Sem 2, 2024	Research subject A (15CP) Research subject C (30CP)	SCI4001 (15CP)
Sem 1, 2024	Research subject B (15CP) Research subject D (30CP)	Elective coursework (15CP) *(e.g. BIO5TEC/CHE4001)*

Study plan 4: Full-time, July entry, Semester 2 elective

	Research	*Coursework*
Sem 1, 2024		
Sem 2, 2024	Research subject A (15CP) Research subject B (15CP)	SCI4001 (15CP) Elective coursework (15CP) *(e.g. BIO4001/BIO5INF/BIO5PAG)*
Sem 1, 2024	Research subject C (30CP) Research subject D (30CP)	

Study plan 5: Part-time, February entry, Semester 1 elective

	Research	*Coursework*
Sem 1, 2024	Research subject A (15CP)	SCI4001 (15CP)
Sem 2, 2024	Research subject C (30CP)	
Sem 1, 2024	Research subject B (15CP)	Elective coursework (15CP) *(e.g. BIO5TEC/CHE4001)*
Sem 2, 2024	Research subject D (30CP)	

Study plan 6: Part-time, February entry, Semester 2 elective

	Research	*Coursework*
Sem 1, 2024	Research subject A (15CP)	SCI4001 (15CP)
Sem 2, 2024	Research subject B (15CP)	Elective coursework (15CP) *(e.g. BIO4001/BIO5INF/BIO5PAG)*
Sem 1, 2024	Research subject C (30CP)	
Sem 2, 2024	Research subject D (30CP)	

Study plan 7: Part-time, July entry, Semester 1 elective

	Research	*Coursework*
Sem 1, 2024		
Sem 2, 2024	Research subject A (15CP)	SCI4001 (15CP)
Sem 1, 2024	Research subject B (15CP)	Elective coursework (15CP) *(e.g. BIO5TEC/CHE4001)*
Sem 2, 2024	Research subject C (30CP)	
Sem 1, 2025	Research subject D (30CP)	

Study plan 8: Part-time, July entry, Semester 2 elective

	Research	*Coursework*
Sem 1, 2024		
Sem 2, 2024	Research subject A (15CP)	SCI4001 (15CP)
Sem 1, 2024	Research subject C (30CP)	
Sem 2, 2024	Research subject B (15CP)	Elective coursework (15CP) *(e.g. BIO4001/BIO5INF/BIO5PAG)*
Sem 1, 2025	Research subject D (30CP)	

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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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