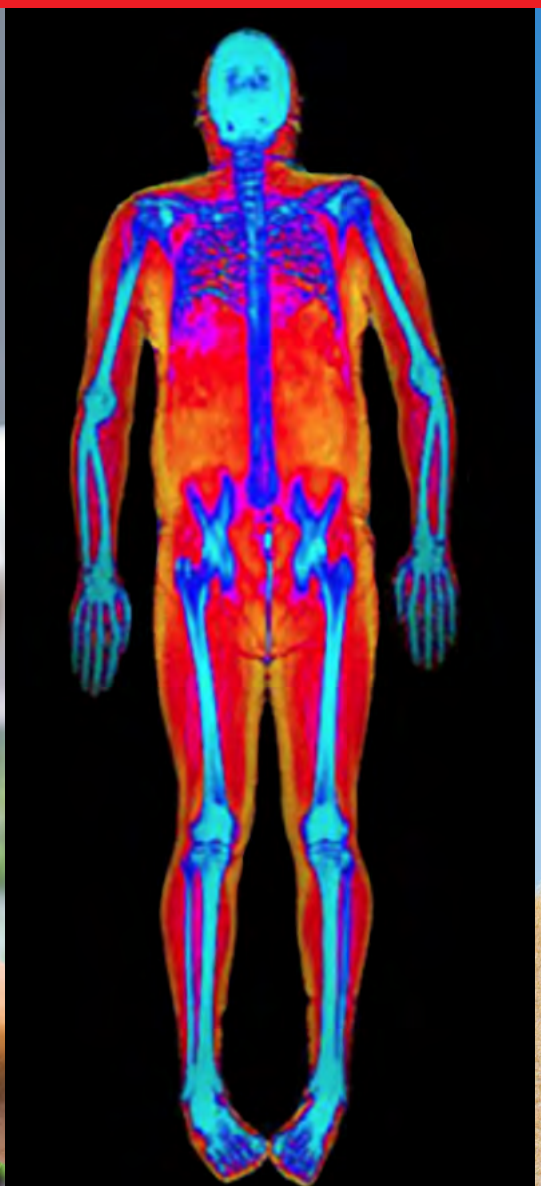
2023 Honours in the School of Agriculture, Biomedicine & Environment



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General Information

Welcome to SABE

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

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

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

Prof. Shaun Collin

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

Dr. Katrina Binger

Honours coordinator for SABE

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

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

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

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

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General information

What is Honours?

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

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

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

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

What are the entry requirements for Honours in SABE?

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

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

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

When is Honours in SABE offered?

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

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

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

Can I study full-time or part-time?

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

What is the time-requirement for Honours?

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

Where will my project be located?

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

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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. Also please see page 114 of this booklet for some further explanation and example study plans.

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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.

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Scholarships and financial aid

La Trobe Access Scholarships

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

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

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

Access scholarships are worth $5000 per year.

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

Applications for Semester 1, 2023

Applications for Access Scholarships and Bursaries for Semester 1, 2023 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, 2023

Applications for Access Scholarships and Bursaries for Semester 2, 2023 are processed by La Trobe scholarshops office:

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

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

Department of Environment and Genetics (EG) Scholarships

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

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

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

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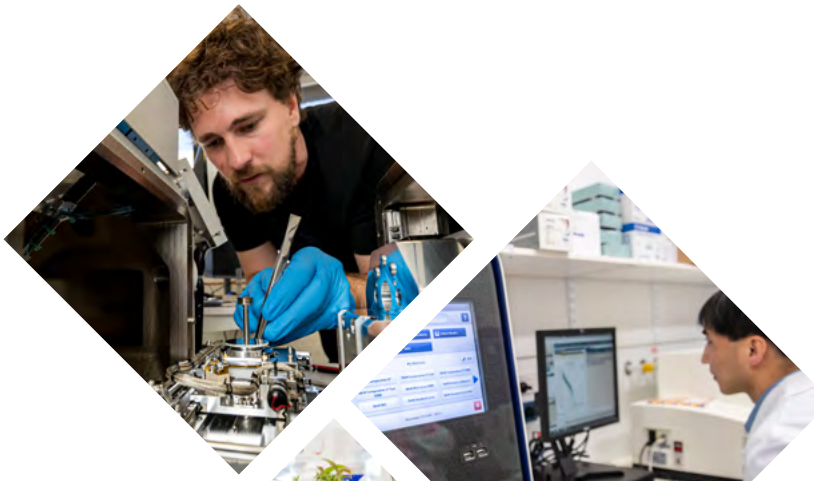
Career outcomes

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

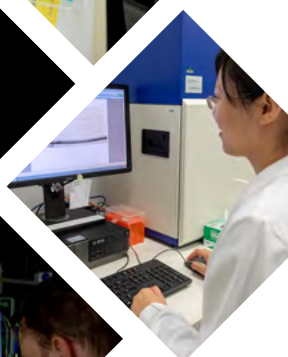
- Dr Nicole van der Weerden (Honours 2003, PhD 2007) is now the Chief Executive Officer of Hexima (a successful biotechnology company).
- David Bloomer (Honours 2012, PhD 2017) is also working in the biotechnology industry, within the recombinant proteins sector at CSL.
- Will Graf (Honours 2018) is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









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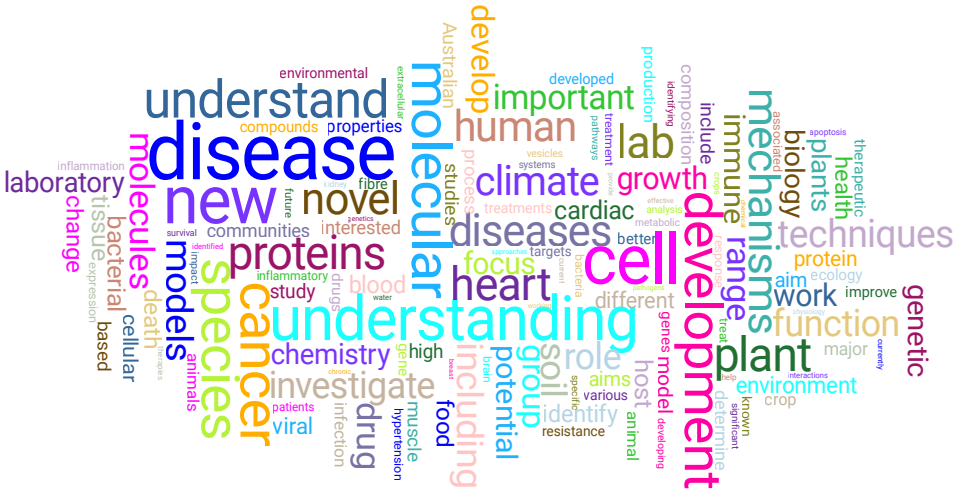
QIAGEN
applied biosystems

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.



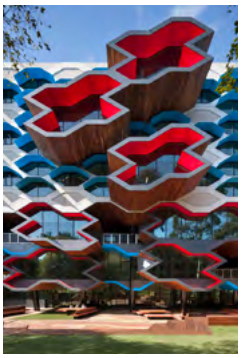
Location, location, location!

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

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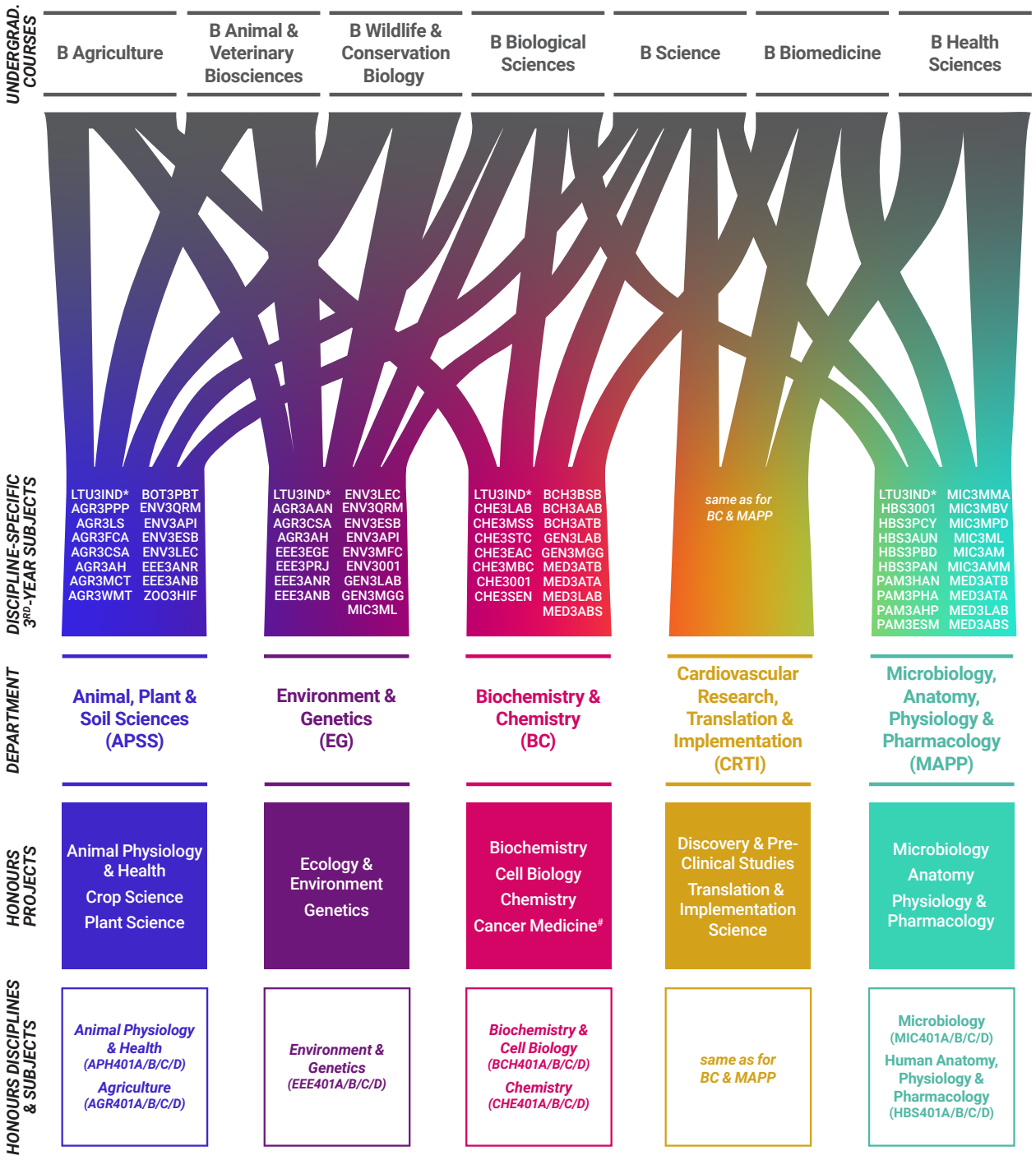
What was your major?

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 (i.e. your major). These subjects were probably in an area of science that most fascinated you. You are 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 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.



*LTU3IND 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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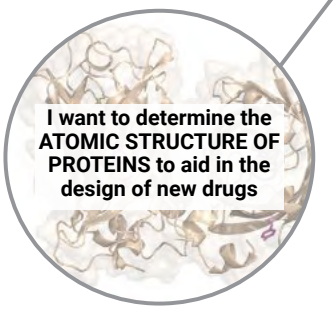
Finding your research project

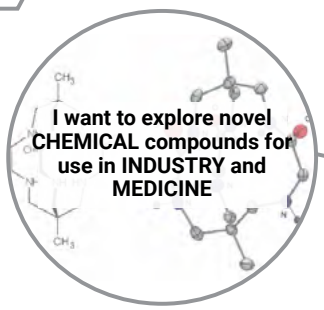
You have now identified the department(s) that is most appropriate to your undergraduate degree. Next, you want to narrow down and create a shortlist of research projects and supervisors that you would like to meet and discuss their project in more detail. This can still be quite an overwhelming process 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)

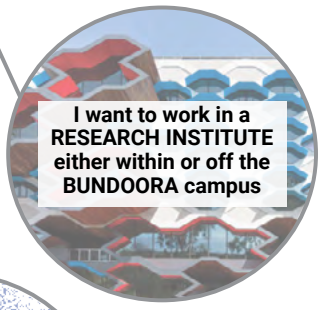
Ecology & Environment (EG)
Genetics (EG)
Animal Physiology & Health (APSS)
Crop Science (APSS)
Microbiology (MAPP)

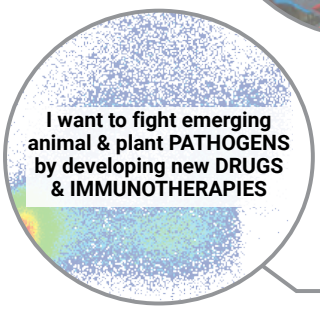


Chemistry (BC)
Biochemistry (BC)
Cancer Medicine (ONJCRI)

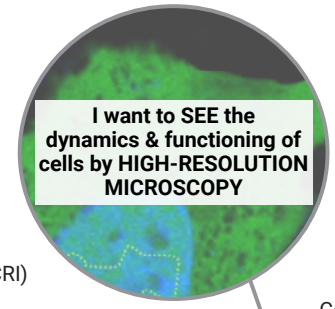
Plant Science (APSS)
Crop Science (APSS)
Ecology & Environment (EG)
Genetics (EG)

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)

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Projects Available in 2023

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.

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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 2023.

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 2023. 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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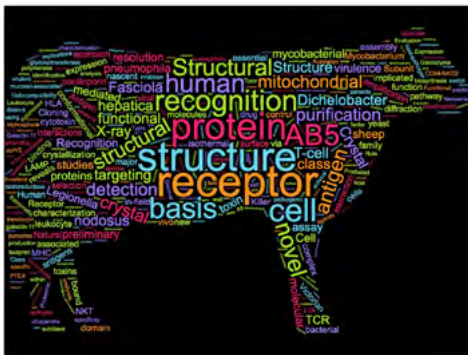
Prof. Travis Beddoe
AgriBio

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

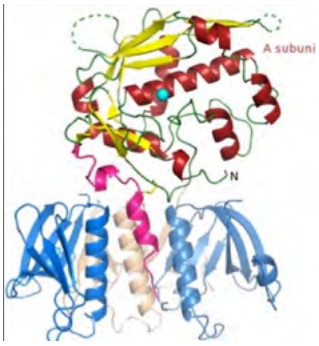
E-mail: t.beddoe@latrobe.edu.au
Website: click here

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

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



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



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

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

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I'm ready to apply! »

Prof. Shaun Collin
Bundoora

Whole organism bioimaging (CT)

Gene expression analyses

Field work

Bioinformatics

Animal handling

Light & electron microscopy

Animal behaviour studies

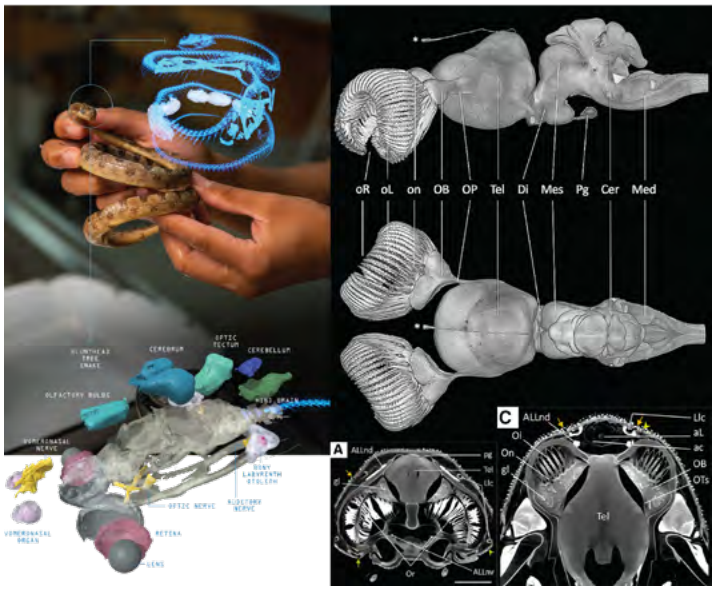
Flow cytometry

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

Number of projects: **4**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **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: Sensory system development in the Port Jackson shark. Elasmobranchs (sharks and rays) have a battery of highly refined senses that have been shaped by over 400 million years of evolution. Understanding the pattern of the sensory systems' embryonic development is essential for an appreciation of their respective function and roles through life history. The student will investigate the development of: (a) the lateral line, which allows elasmobranchs to detect and perceive the hydrodynamic and physical environment; or (b) the olfactory system, since it has been shown that sharks have the capacity to detect and differentiate between chemical odours early in development.



Project 2: Sensory evolution in the transition from land to sea in snakes. Sea snakes have recently evolved from terrestrial to aquatic habitats, raising many challenges for their senses to cope with the altered stimuli underwater. To understand how the aquatic environment influences sensory evolution, this project will investigate neural pathways and senses in land and sea snakes. Potential topics are chemoreception (tongue flicking and smelling), mechanoreception (touch and hearing) and photoreception (vision). Depending on the student's interests, the project will involve learning RNA sequencing, gene expression and bioinformatics analyses (including coding in R), neuroanatomical and morphological methods, and fieldwork in Western Australia (contingent on funding).

Project 3: Chemoreception in Australian ghost sharks. This project will focus on the sense of smell (olfaction) in a little-known group of cartilaginous fishes, the chimaeras. These deep-sea fishes occupy different depth ranges and use chemical cues to find food, avoid predation, find reproductive partners and even migrate over long distances to lay their eggs. Using preserved specimens, bioimaging and immunohistochemistry will be used to predict the relative importance of olfactory sensitivity in each species' life history and behaviour. The work will ultimately assist in assessing the vulnerability of these pelagic predators to chemical pollutants.

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I'm ready to apply! »

Dr. Travis Dutka
Bundoora

Field work

Microscopy

Photogrammetry

3D reconstructions

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

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

The Marine and Ecophysiology Groups seeks to address important research questions and issues relating to the passions of its members. In doing so, we actively encourage inter and intra-disciplinary research collaborations and industry partnerships to achieve translational outcomes. We undertake diverse research projects focusing on understanding the physiology of animals, and how physiology underpins their behaviour. Our recent work focusses on the Western Port Bryozoan Reefs which are global significant. Biogenic reefs are important habitat for a multitude of marine species including fish, mollusks, crustaceans etc. They provide food, attachment substrate for sessile organisms, shelter from wave action and strong currents as well as concealment from predators for both adult and larval stage organisms. These complex habitats are often biodiversity hotspots compared to the surrounding habitats. This multifactorial research engages Victorian Fisheries Authority (VFA) and our industry partner Fathom Pacific Pty Ltd. Our research team is currently working with key stakeholders in order to establish the conservation values of these communities, and to determine appropriate protective measures.

Project. Determining in situ growth rates of bryozoans in Western Port. Understanding the growth rate of the three species (T. munitum, T. moniliferum and C. foliata) that comprise these unique bryozoan biogenic reefs of Western Port (recently listed on the FFG Act) is of the utmost importance. Determining the rate of growth and repair of these unusually large colonies is central to understanding how they respond to damage and provide key information to manage them appropriately. Further, this will provide more clarity around how often monitoring should be conducted. This study will quantify the growth rate of the three differing bryozoan species that make up the Western Port bryozoan reef in the Rhyll sector. By understanding the growth rate of these three species we will be able to:

- Determine the volume of available habitat they produce per unit time.
- Determine if any colonial damage can be repaired,
- Reveal life history data for these three species which is unknown.

Taken together this will be invaluable information for conservation management of these reefs.

Note: Open water dive license would be desirable.

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I'm ready to apply! »

Dr. Kerry Fanson
Bundoora

Immunoassays

Field work

Animal handling

Microscopy

Animal behaviour studies

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

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

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

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

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

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

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I'm ready to apply! »

Dr. Garry Clark
AgriBio

Soil analysis

E-mail: g.clark@latrobe.edu.au
Website: click here

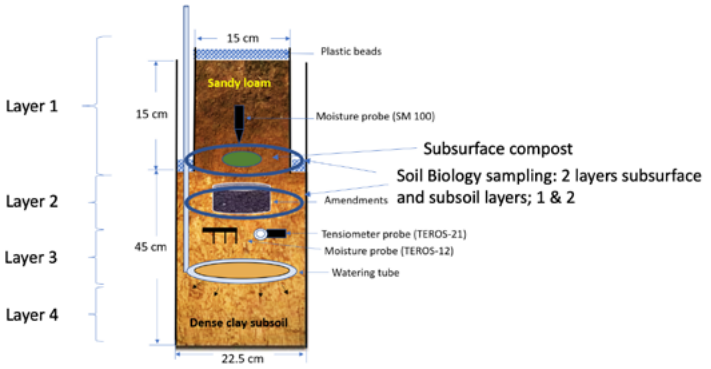
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Potentially**

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.

Our group has investigated the use of a range of organic amendments for incorporation into hostile subsoil. However, there has been limited application of biochars to overcome subsoil constraints. These are less cost effective, but we have some interesting results from the application of biochar together with organic amendment. In particular, the biochar/OA treatment resulted in greater water extraction from the subsoil in an irrigated corn trial.

A potential honours student will investigate the effect of biochar and organic amendment combinations for their water holding and extraction, and importantly plant growth. The student will be able to obtain experience in experiments of plant growth and analysis of soil and plant nutrients.

The Tang lab, situated in Agribo, has a wide range of equipment for measuring soil and plant chemistry, as well as soil physical properties.



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I'm ready to apply! »

Dr. Marisa Collins
AgriBio

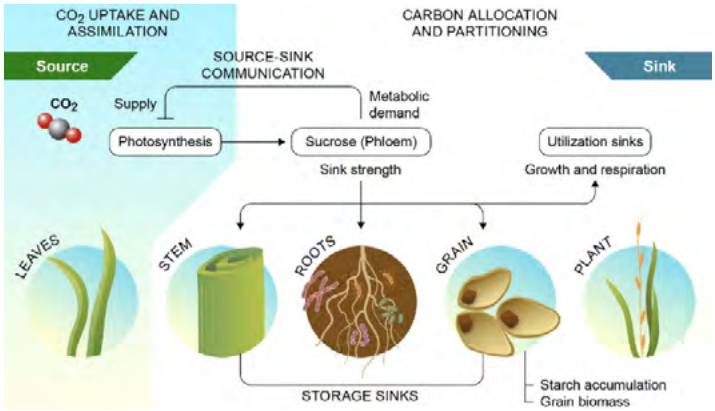
Field work

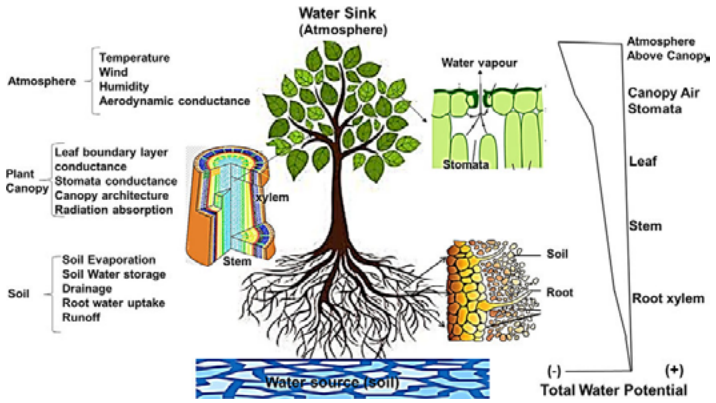
Glasshouse work

Crop physiology

E-mail: marisa.collins@latrobe.edu.au
Website: click here

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





Climate change impacts both current and future sustainable food production. The frequency of extreme weather events associated with climate change, such as high temperatures and drought are also expected to increase at the same time there is increasing demand for food production globally. Australian farmers will need to increase production in an increasingly challenging environment. 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. In particular, in legume crops (a key source of plant protein) 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?

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I'm ready to apply! »

Prof. Caixian Tang
AgriBio

Soil management

Industry experience

Analytical skills

Glasshouse trials

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

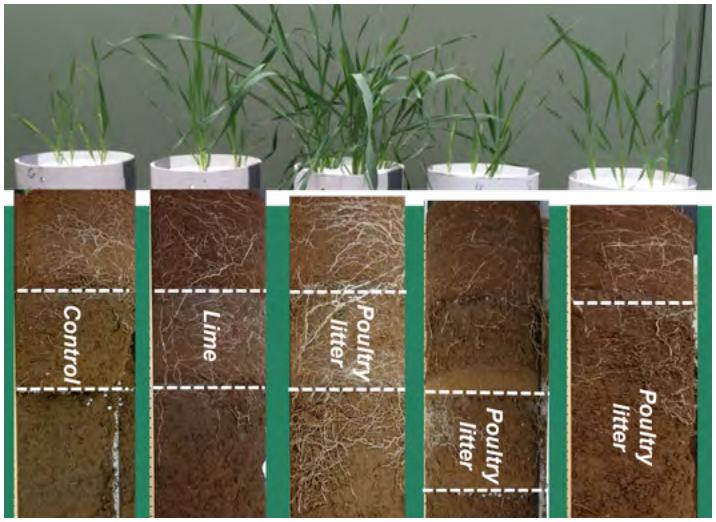
Number of projects: **3**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

Soils contribute $63 billion annually to the 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.

Project 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: The student will work closely with Environment Protection Authority Victoria. This project showcases rapid analysis techniques including portable X-Ray Fluorescence Spectrometry and RemScan to obtain reliable data on trace metals, petroleum hydrocarbon, soil carbon and texture composition in residential gardens. Data will be used to assess the status of contaminants in urban areas, inform regulatory approaches and educate community about their responsibilities under the General Environmental Duty.



Project 4: Use of recycled organics to ameliorate hostile subsoils-Working with Agriculture Victoria. The productivity of the Victorian grains industry is limited by soil physicochemical constraints. Recent research has shown the potential of different organic materials (plant and animal) to mitigate these constraints, resulting in improved crop water-use efficiency and grain yields. Currently there are large quantities of urban-sourced green 'wastes' that cannot be effectively disposed of. This project examines the relative effectiveness of different materials to overcome soil constraints, to turn 'wastes' into 'assets'.

Project 5: Phosphorus fertilizers are important in sustaining crop yields. Each year, Australian farmers use ~450,000 tonnes of P fertilizers. Only 10-30% is absorbed by crops, leaving unused P remaining in the soil. The project studies the impacts of crop species, soil type and farming practice on biochemistry at the soil-plant interface (rhizosphere) to understand how to enhance crop P-use efficiency and to reduce P-fertiliser use.

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I'm ready to apply! »

A/Prof. Monika Doblin
AgriBio

Electron microscopy

Glycomics analyses

Gene expression analyses

Histology

Metabolomics

E-mail: M.Doblin@latrobe.edu.au
Website: click here

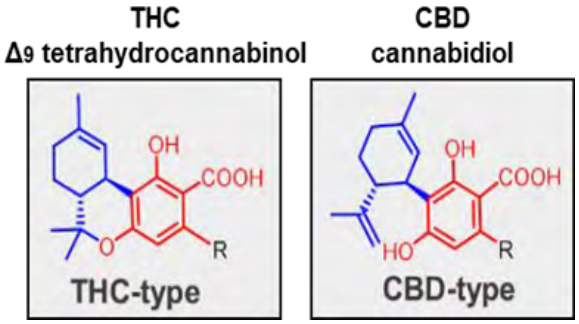
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Either**
Masters conversion: **Yes**

Hemp (Cannabis sativa) is an increasingly important crop in Australia and internationally due to its superior stem fibre and seed quality and more water-efficient growth that suits low water environments. The ability to modulate fibre wall composition in hemp has the potential to add significant value to this crop. Hemp (bast) fibres (see figure) are made in the outer region of the stem and have a strengthening function. It is widely accepted that the quality of hemp fibres is determined by the arrangement of the fibre bundles and the chemical composition of the fibre walls. The walls of bast fibres are made up of polysaccharides and variation in the levels and arrangement of these components influences fibre properties. No comprehensive investigation of bast fibre wall polysaccharides and their structures has been undertaken. Similarly, the carbohydrate composition of hemp seeds, a source of dietary fibre proposed to promote health and prevent disease, has not been well characterised. Hemp seeds are also a rich source of oils and are particularly beneficial for human diets due to their omega (ω) -3 and -6 fatty acids.

Using our expertise in cell wall analysis and metabolomics, the project will:

1. Investigate the composition and structure of hemp fibres (carbohydrate composition) and/or seeds (carbohydrate & oil compositions); and
2. Determine the features that contribute to differences in fibre and/or seed quality.

The natural variation in fibre and seed properties that exists in different hemp varieties will be exploited to identify these characteristics. Plants with variation in fibre and seed quality will be selected and the composition of stems (carbohydrates) and seeds (at maturity- carbohydrates & oils) will be evaluated using cell biology, chemistry and 'omics (e.g. metabolomics, glycomics) approaches.



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I'm ready to apply! »

Prof. Tony Gendall
AgriBio

- Plant biotechnology
- Gene expression analyses
- Bioinformatics
- Genetic sequencing (incl. RNAseq, microarrays)
- Molecular cloning and CRISPR-Cas9 gene editing

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

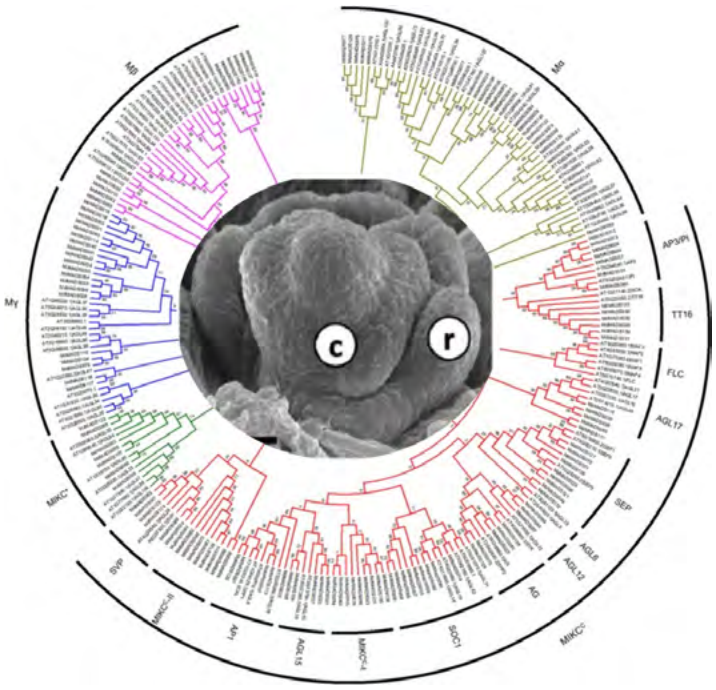
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

My lab using a wide range of genetics, molecular biology, and bioinformatics to investigate a broad range of plant physiology and development. We use a range of techniques, including gene cloning, T-DNA and CRISPR gene editing, transgenics, sequencing and bioinformatics in 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 2023, we will offer a project (co-supervised by Dr Scott Mattner, APSS) to conduct a survey of fungal pathogens of strawberry in Victoria using next-generation sequencing approaches.

We also have an interest in the proteins that fuel seed germination (seed storage proteins) and have a project to investigate the function of several proteases, using a combination of genetic analysis.



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I'm ready to apply! »

Prof. Tony Gendall
Dept. Ag, Water & Envn. (DAWE)

Animal or plant identification

Genetic sequencing (incl. RNAseq, microarrays)

Bioinformatics

PCR assays

E-mail: t.gendall@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**

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.

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I'm ready to apply! »

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Dr. Kim Johnson
AgriBio

Plant phenotyping

Gene expression analyses (incl. PCR , real-time qPCR)

Microscopy (light & electron)

Histology (cytochemistry & immunohistochemistry)

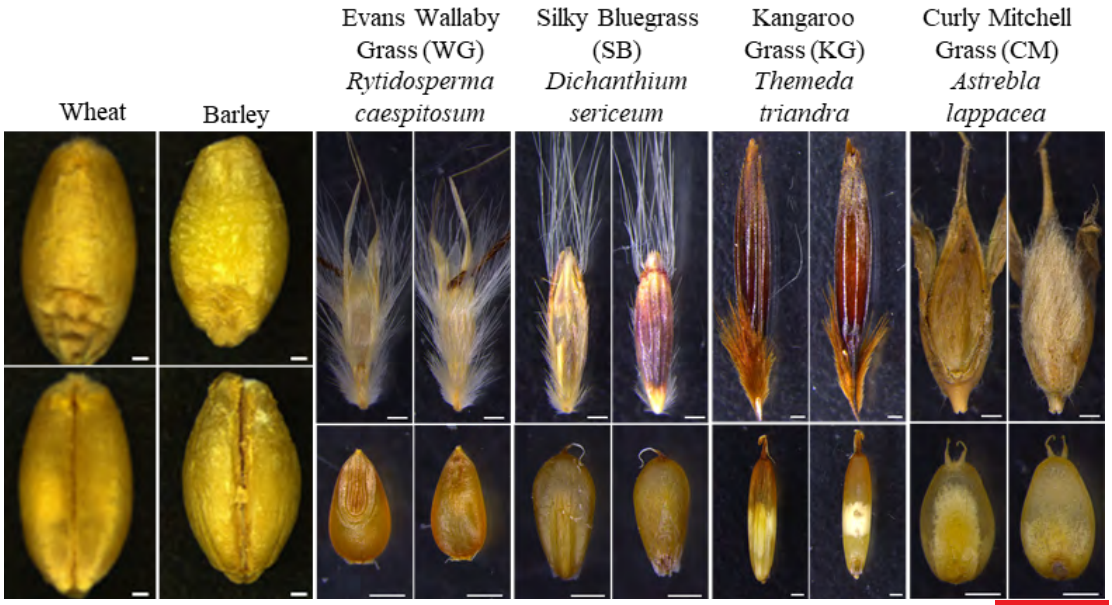
E-mail: k.johnson@latrobe.edu.au
Website: click here

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

The research aims of our group is to understand how plants alter their growth and development in response to stresses experienced at the cell surface, from cell growth or the external environment. These stresses are interpreted to 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 sustainability and nutrition qualities of native foods. Australian native species have been harvested for food by indigenous communities for millennia. Species including kangaroo grass and native millet are adapted to Australia's variable climate and soils. What has remained largely unexplored are the nutritional and functional properties of native foods, and their potential for crop production. The aims of the project are to undertake detailed macro- and micronutrient composition analyses, including dietary fibre, and assessment of key agronomic traits from a collection of Australian native species harvested from different regions/environments.

Project 2: Strength and length: investigating what makes a good plant fibre. Hemp has potential to be used as a sustainable crop for food, fibre and construction. This project will investigate how quality of hemp fibres and cell wall properties differ in a range of hemp varieties and in response to stress.



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I'm ready to apply! »

A/Prof. Mathew Lewsey
AgriBio

Light microscopy

PCR assays

Plant development analysis

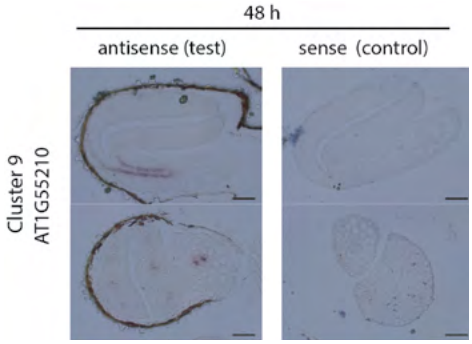
E-mail: m.lewsey@latrobe.edu.au
Website: click here

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

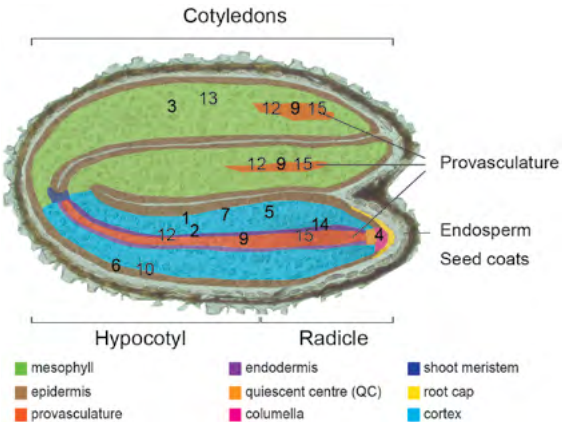
Seeds provide 70% of global food resources, being the most valuable output from plant production. They also play a critical role in agriculture because germination is the first step during a plant's lifecycle which involves extensive changes in gene expression. It is governed by nutrient resources, endogenous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

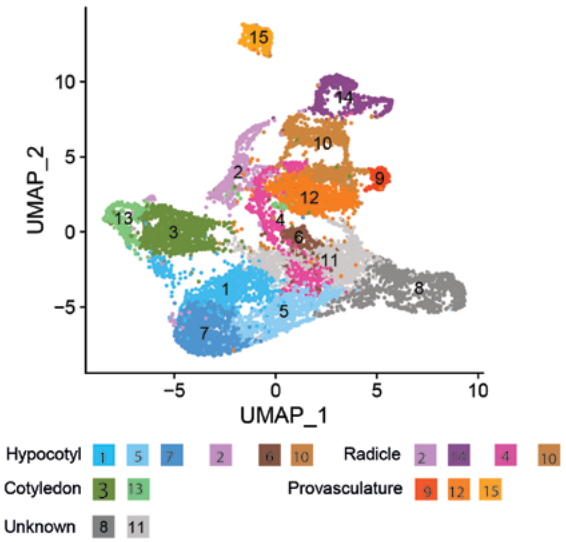
By understanding the fundamental genome regulation network during seed germination, we can develop practical solution to ensure germination happen at the right time uniformly. Uniform germination enables growers to achieve optimal plant-spacing and harvesting time and germination at correct time increase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



RNA in-situ hybridisation showed a marker gene specifically expressed within xylem of germinating embryo of 48h



Arabidopsis seed embryo showing different cell-types annotations



Identifying cell-types in Arabidopsis seed using single cell RNA sequencing

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I'm ready to apply! »

A/Prof. Penelope Smith
AgriBio

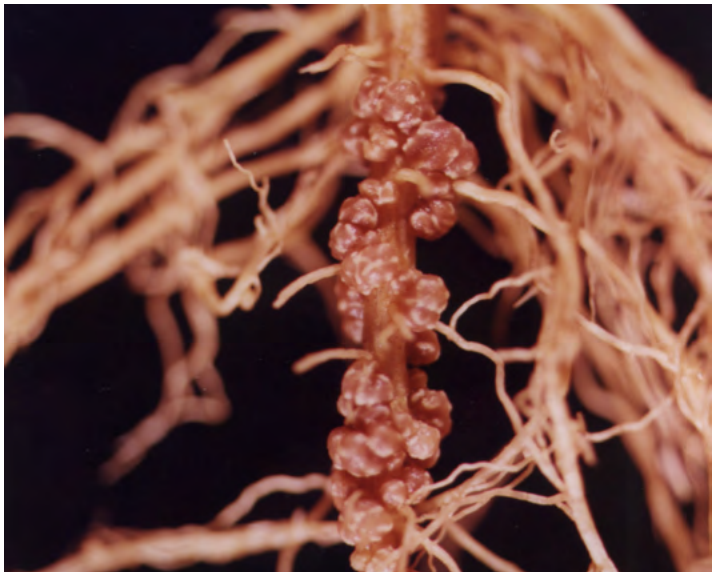
- Plant transformation
- Glasshouse trials
- Cell culture - prokaryotes, incl. bacteria & pathogens
- Cell culture - eukaryotes, incl. primary and cell lines
- Molecular cloning (e.g. expression vectors)
- Bioinformatics

E-mail: p.smith3@latrobe.edu.au
Website: click here

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

With the world's population increasing we need to produce more food sustainably, without contributing to global warming and other environmental problems. Legume crops provide an alternative protein source for human consumption reducing our reliance on meat production and they can form a symbiosis with rhizobia bacteria that allows them to be grown without use of nitrogen fertilizers. Nitrogen fertilizers are chemically synthesized and production requires a lots of energy which is expensive and contributes to carbon emissions and global warming. When applied in excess N 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, providing N for the legume crop and reducing the need for fertilizers in subsequent non-legume crops. We are investigating the interactions between legumes and rhizobia that allow nitrogen to be fixed. When rhizobia infect plant cells a new organ, the nodule, is developed. The bacteria in infected cells are surrounded by the symbiosome membrane and differentiate into their symbiotic form, the bacteroid. The plant provides the energy and nutrients required for the rhizobia to fix N and the nitrogen is provided to the plant. Our work focusses on characterizing plant transport proteins involved in these processes and identifying genes important for N-fixation.



Project 1. Metal transport in symbiosis. Metals need to be provided to rhizobia by the plant. We have recently characterized a transporter (GmVTL1a) that imports iron into the symbiosome (Brear et al. 2020 New Phytologist doi: 10.1111/nph.16734) but there are other metal transporters expressed in nodules that may be important for nitrogen fixation. This project uses yeast expression to investigate the amino acids in GmVTLa that are important for iron transport. It will also investigate a predicted Mn transporter and its role in N-fixation using gene silencing and expression in yeast.

Project 2. Can we identify more efficient N-fixing legumes? 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, 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.

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I'm ready to apply! »

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 2023.

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 2023. 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.

Ecology & Environment

Genetics

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A/Prof. Heloise Gibb
Bundoora

Field work

Ecological assays

Animal handling

Animal or plant identification

Animal behaviour studies

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

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **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, impacts of mammal reintroductions on food web structure and new methods for including invertebrates in ecological restoration.

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I'm ready to apply! »

Prof. Pete Green
Bundoora

Ecological assays

Experimental design

Field work

Data analysis

Animal or plant identification

E-mail: p.green@latrobe.edu.au
Website: click here

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

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 2023 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.

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I'm ready to apply! »

A/Prof. Alison King
Albury-Wodonga

Animal handling

Field work

Animal behaviour studies

Ecological statistics

Animal or plant identification

Light microscopy

E-mail: alison.king@latrobe.edu.au
Website: click here

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

Freshwater ecosystems are the most imperiled ecosystems on earth, with the use of water resources placing many systems under severe pressure. My research focuses on understanding how freshwater flows sustain and support aquatic systems, with the intent on improving the management and sustainability of these systems into the future.

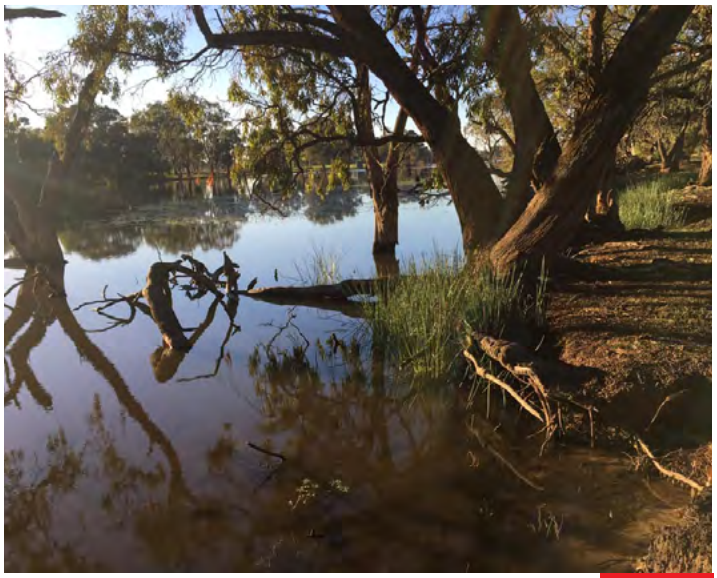
I am a freshwater ecologist, based at the Centre for Freshwater Ecosystems, Albury-Wodonga. My research focuses on investigating the importance of flows in riverine and wetland ecology, particularly focusing on the ecology of fish, fish recruitment, life history adaptations and traits, environmental flows and flow-ecology relationships.

My research is highly collaborative, working with a range of researchers at CFE, other research organisations, and with a range of Industry partners and stakeholders, including Government agencies, land owners and First Nations people.

I currently have research projects available exploring the following questions:

- *Can underwater video be used to estimate biomass of fish?* [collaborator: Qld Dpt of Environment & Science]
- *Do flow conditions influence food choice and the condition of young fish?* [Collaborator: NSW DPI Fisheries]
- *How important are carp as a food source in aquatic ecosystems?* [Collaborator: CSIRO]
- *Does watering history influence wetland fish assemblage?* [Collaborator: Ecology Australia, CMAs]

However, we have interest in a broad range of research questions and would be interested in discussing your ideas!



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I'm ready to apply! »

Dr. Luke McPhan
Albury-Wodonga

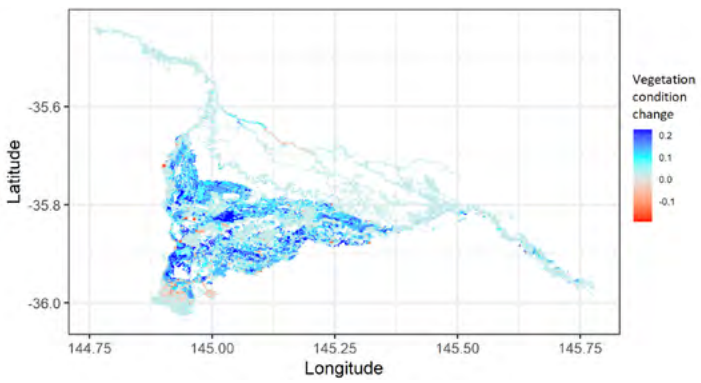
Ecological assays

Ecological modelling

E-mail: L.McPhan@latrobe.edu.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **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. Spatial analysis and environmental modelling are of growing importance for the management and monitoring of freshwater systems including for the modelling of species biodiversity, environmental impacts and distribution patterns. Members of this research theme conduct both scientific and applied research projects towards improving our understanding of the management and monitoring of freshwater systems and the ecology and species within them.



Project. 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.

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I'm ready to apply! »

Prof. John Morgan
Bundoora

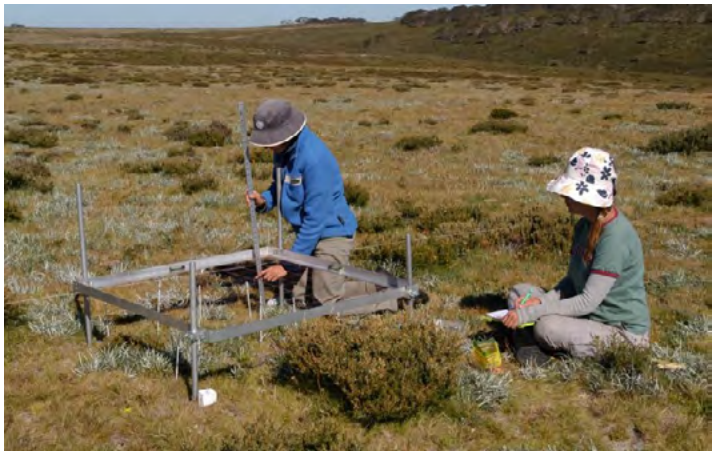
- Plant identification
- Botanical survey
- Seed biology
- Experimental design
- Data analyses
- Industry engagement

E-mail: J.Morgan@latrobe.edu.au
Website: click here

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

We focus on the factors that affect plant species distributions in nature, and the plant population dynamics that underpin changes over time. Understanding how plant species respond to ecosystem drivers (like fire, climate change, feral species) is fundamental to predict their future over coming decades. I have lots of project ideas as starting points for discussion with prospective students. I'm always interested in hearing from students who have their own ideas, particularly if they are variations on the themes listed here (or include topics such as extreme events, species distributions, historical ecology, floristic survey).

Project 1: Burning for grassland pollination: does timing of fire affect post-fire flowering and insect pollinators? Native grasslands are historically and evolutionarily associated with disturbances, such as fire, that drive biodiversity patterns and biotic interactions. In this study, we will investigate how post-fire plant flowering and flower insect visitor communities are affected by season of burning (spring, summer, autumn). Our work will inform managers about the effects of timing of fire on conservation values in a threatened ecosystem.



Project 2: Determining the germination microsite requirement of herbaceous high mountain species may help better understand their capacity to establish into new habitats as a result of climate change. Seed dispersal will be crucial if plants are to migrate to new places to keep pace with climate change. But what happens when those seeds arrive at new places? What is the likelihood that seedling establishment can occur, particularly where habitats are already occupied by other plants? We have quantified alpine plant species dispersal, but wish to now ask – what conditions are necessary for those seeds to be successful? What are hostile vs favourable microsites for establishment?

Project 3: Woody weed invasions threaten seabird breeding habitat on offshore islands. Woody weed invasion can threaten seabird bird breeding habitats on offshore islands because they change vegetation structure. At Wilsons Promontory National Park, invasion of offshore islands by Mirror Bush is a management priority because it is thought to be limiting access to habitat required by Short-tailed Shearwaters. This study aims to 1) quantify the current extent of Mirror Bush invasion at Doughboy Island (in Corner Inlet), 2) examine the relationship between invasion and Shearwater burrowing success in what was historically suitable habitat, and 3) examine invasion pathways (i.e. how are Mirror Bush arriving at the island – includes the use of genetic techniques to track this).

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I'm ready to apply! »

Dr. Ryan Phillips
Bundoora

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

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

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

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

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

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

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

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I'm ready to apply! »

Dr. Michael Shackleton
Albury-Wodonga

Field work

PCR assays & genetic sequencing

Ecological assays

Species distribution modelling

Animal behaviour studies

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

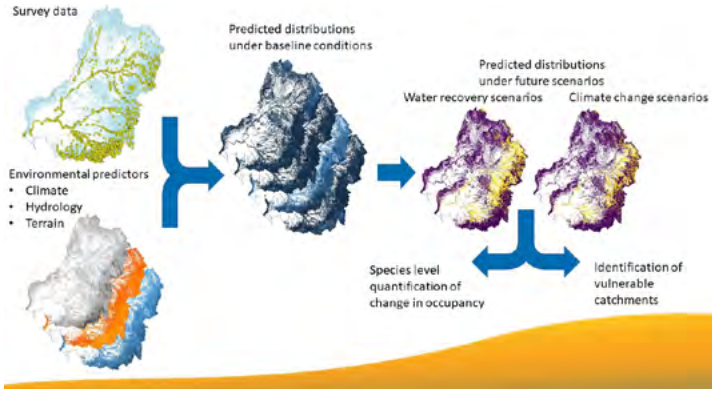
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

My lab is primarily interested in aquatic ecology, specifically are around understanding species distributions and responses to environmental parameters - especially those impacted by climate change. I use a 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 work, spatial analyses and modelling. I am open to discussing project areas that potential honours, masters of PhD students are interested in. However, projects that I am particularly wanting to pursue over the next year include:

Project 1. Quantifying the effect that invasive trout have on native communities of alpine invertebrates and fish. This project will involve surveying trout and invertebrates and/or galaxiid fishes in stream reaches impacted by various densities of trout in order to understand how trout impact communities and how communities are likely to respond following trout removal. This project will link in with Parks Victoria who are considering management option for trout in alpine headwater streams.

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, and mining and utilising data held in public repositories. It will help to develop a better understanding of how thermal niches and climate determines macroinvertebrate distributions and how these distributions are likely to change under projected climate change scenarios.



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I'm ready to apply! »

Dr. James Van Dyke
Albury-Wodonga

Animal handling

Ecological assays

Field work

Animal or plant identification

Animal behaviour studies

Ultrasonography

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

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

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I'm ready to apply! »

Prof. Bill Ballard
Bundoora

Animal handling & behaviour studies

Field work

Drosophila models

Gene expression & sequencing

Whole organism imaging

Live cell metabolism assays

Immunoassays

Mass spectrometry

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

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

The Ballard Lab studies everything from dingoes to fruit flies under the overlying paradigm of selection: artificial, unconscious and natural. We are a collaborative group who work with scientists around the globe, and at LTU, to make an impact.

Dingoes have probably been unconsciously selected by humans. But what does this mean and how can it help us understand dingo genetics, metabolomics morphology, and behaviour? All these unanswered questions and more surround the enigmatic canid - the 2022 Australian mammal of the year.

We have worked on a multitude of questions related to natural selection focusing on the influence of nutrition on bioenergetics in the fruit fly. The fruit fly is a great laboratory model system and particularly suited to Honours projects.

Domestic dogs represent the greatest morphological diversity of any single species. Through this process of domestication dogs have lost certain morphological features and gained others. We are interested in understanding the chain of events in domestication and in feralisation.

Honours is a demanding year and one that can help you decide your future directions. If you are up for a challenge, send me an email!

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I'm ready to apply! »

Prof. Warwick Grant
Bundoora

Classical gene mapping

Bioinformatics

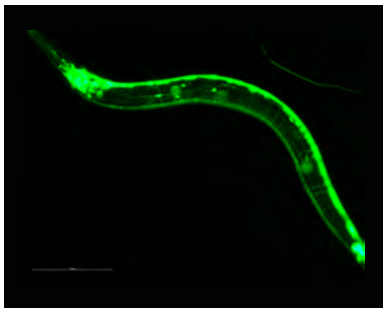
Chromosomal and/or nucleotide assays

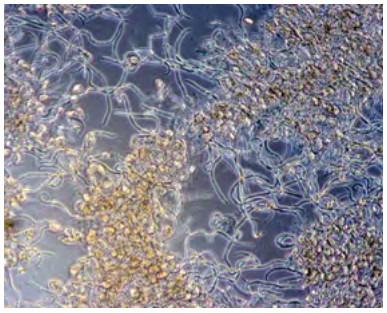
Animal models of disease

Genetic sequencing

E-mail: w.grant@latrobe.edu.au
Website: click here

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





Nematode parasites are responsible for a wide variety of diseases in humans and in wild, domestic, and companion animals. Nematode parasites rarely cause death but are a major cause of morbidity, inhibit child development and limit economic growth in the developing world, and . and are prominent amongst the WHO's "top 10" neglected diseases. Risks of severe disease outcome also include the possibility of recent host switch from wild to domestic animals or to people, from the introduction of disease from one area to another when hosts migrate, and from the evolution of resistance to the drugs used for control or treatment. We use classical genetics, genomics, and bioinformatic approaches to study the ecology 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 with Prof Warwick Grant. 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 also a nematode, to investigate the biology and genetics of macrocyclic lactones. The projects that are available will use classical genetic methods to map genes implicated in variation responses to ivermectin, and genome sequencing to define candidate genes.

Project 2. 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.

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I'm ready to apply! »

Dr. Susan Hoebee
Bundoora

Conservation genetics

Population genetics/ genomics

DNA extraction & PCR assays

Chromosome staining

Comparative morphology

Scanning electron microscopy

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

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

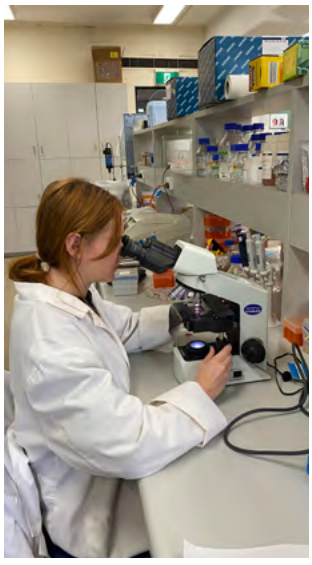
Project 1. One and the same but different: identifying pollinators and quantifying genetic diversity between populations of Grevillea montis-cole. Additional supervisors: Dr Ryan Phillips and Gareth Holmes (Royal Botanic Gardens Victoria).

Grevillea montis-cole is divided into two subspecies that are restricted to two adjacent mountain tops in Victoria: Mt. Cole and Mt. Langi Ghiran. Little is known about the breeding system and floral visitors except for expectations, based on floral colouration, that birds are likely the primary pollinators. However, one of the key differences between the subspecies is that they differ in terms of their pistil length, could this suggest different species are involved in pollination between the mountain tops? Additionally, phylogenetic research has suggested that the two subspecies are on different evolutionary trajectories. Using available molecular markers the student will assess gene flow between the subspecies, as well as overall population genetic structure. The results will inform both taxonomic treatment and conservation strategies for the species.

This project can be run as two separate honours (1= pollination-focused with a Jul start; 2 = genetic-focused), or one larger Masters study, depending upon interest.

Project 2. Morphological and genomic variation in Acacia paradoxa. Additional supervisors: Dr Daniel Murphy (Royal Botanic Gardens Victoria). Advisor: Simon Heyes

Aptly named for both its scientific and common names, *Acacia paradoxa*, or Hedge Wattle, is a species that is both highly variable and widely planted. Yet in a number of regions it is also now considered problematic and is actively being removed from the landscape. Based on historical notes and the morphological diversity of the species, there is a question regarding evidence for different forms (provenances), and whether such forms might perform differently when grown away from local sites – could the plants that are a becoming problematic be an example of an introduced, weedy provenance? Alternatively, polyploidy, which can occur in Acacia, is also known to lead to range expansion and variation in some plants. In collaboration with various land managers, we hope to explore these questions via morphological assessment and chromosome preparations from plants originating from different locations.



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I'm ready to apply! »

Dr. Nick Murphy
Bundoora

Phylogenetics

Environmental DNA

Population genetics

E-mail: n.murphy@latrobe.edu.au
Website: click here

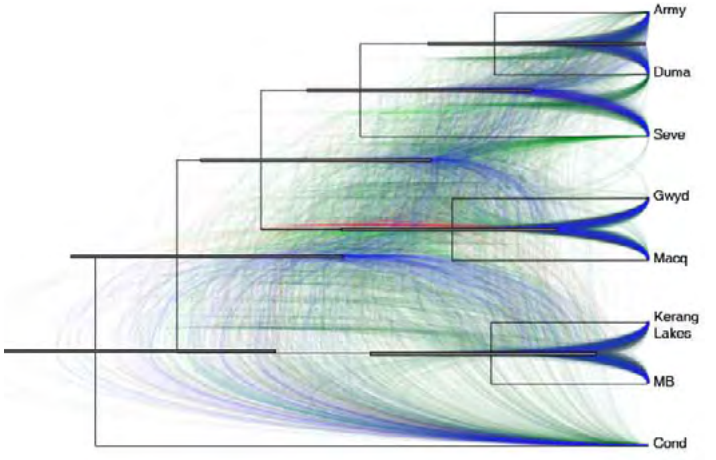
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

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 2023, 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.



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I'm ready to apply! »

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 2023.

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 2023. 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

Infection & Immunity

Flow cytometry

X-ray crystallography

Protein biochemistry

Mammalian cell culture

Prokaryote cell culture

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

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

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I'm ready to apply! »

A/Prof. Begona Heras
LIMS

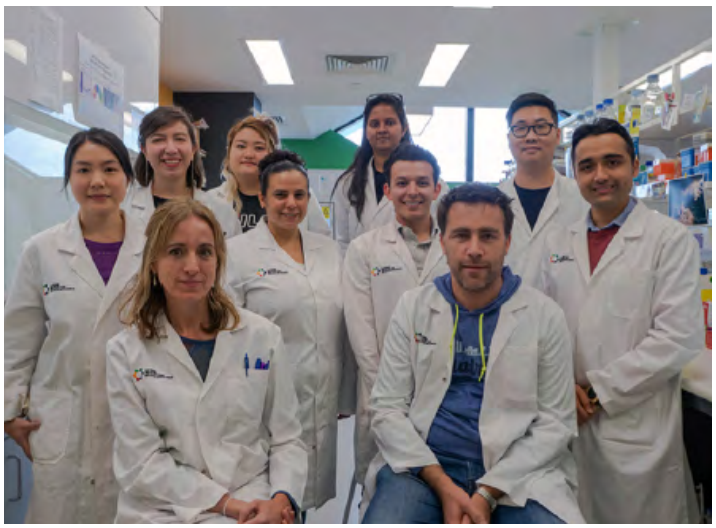
- Infection & Immunity
- X-ray crystallography
- Bacterial over-expression of protein
- Molecular cloning
- Biophysical characterisation of proteins
- Protein biochemistry incl. immunoprecipitation
- Computational/*in silico* analyses

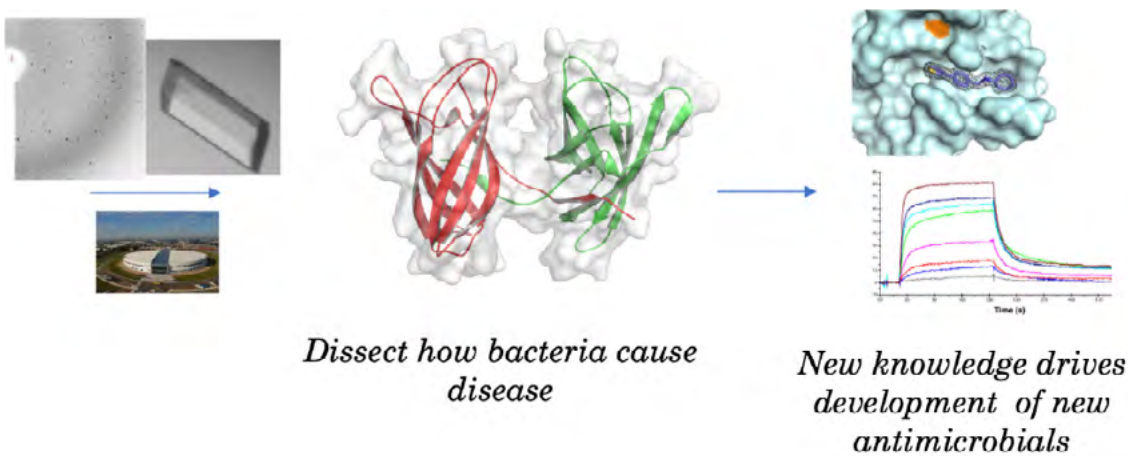
E-mail: b.heras@latrobe.edu.au
Website: click here

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

Bacterial infections are one of the greatest health threats of the 21st century. With the increase of bacterial resistance and a 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 with novel modes of action.

To address the growing problem of bacterial antimicrobial resistance we are developing pathoblockers, molecules that inhibit pathogenesis without killing bacteria. We are comprehensively studying and targeting Autotransporters, the largest group of cell-surface proteins responsible for colonisation and biofilm formation. The aims of this project are to investigate key virulence proteins in multidrug resistant pathogens. This project will use a multidisciplinary approach combining recombinant protein expression & purification, structural biology, molecular microbiology, AUC, CD, SPR and computational studies to dissect the structure and function of these important proteins. We also develop small drug-like molecules and antibodies that block their function (e.g. inhibit the formation of biofilms) as new antibacterial agents.





Dissect how bacteria cause disease

New knowledge drives development of new antimicrobials

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I'm ready to apply! »

Dr. Nick Reynolds
LIMS

- 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: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

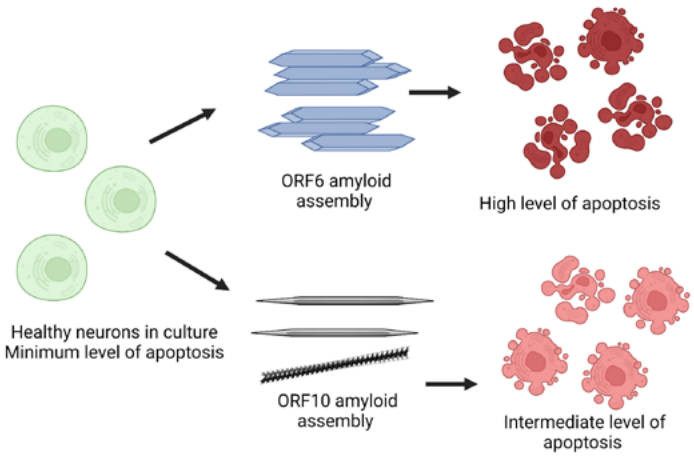
The research in my lab can be broadly defined as Bionanotechnology. I am interested in developing materials to help us better understand how immune cells behave (with Dr. Katrina Binger), in developing materials for tissue engineering (specifically cartilage tissue engineering), and in performing research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

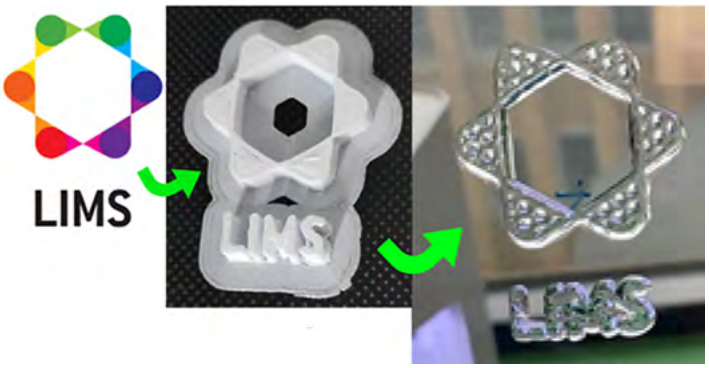
Depending on the students preferences and experience there are a number of potential project on offer, these are split into two broader themes.

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)).





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I'm ready to apply! »

Dr. Lakshmi Wijeyewickrema
LIMS

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

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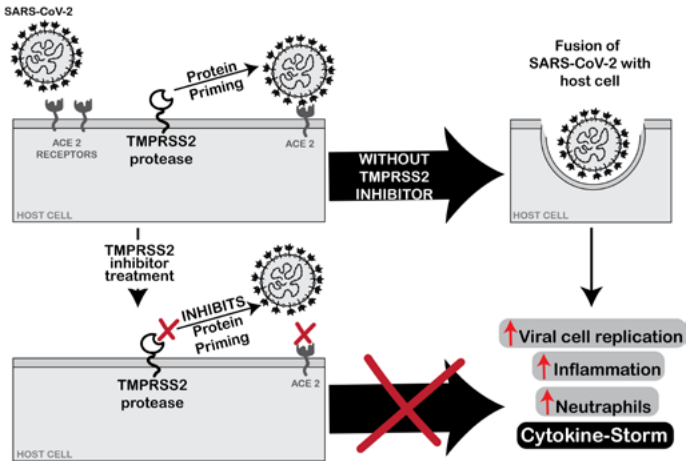
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

The focus of our research involves several of the enzymes in blood, involved in the immune response. What is so interesting about enzymes? Enzymes are the unsung heroes of the body: without them life would be impossible. Enzymes also play an essential role in inflammation and other functions of the immune system. Inflammation is one of the body's most important mechanisms for protecting itself against danger.

Therefore understanding how enzymes work, is so important to understanding how we can prevent and fight disease.

Project 1. The enemy within: targeting the viral entry facilitator of SARS-CoV2 as a therapeutic strategy.

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



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Dr. Amy Baxter
LIMS

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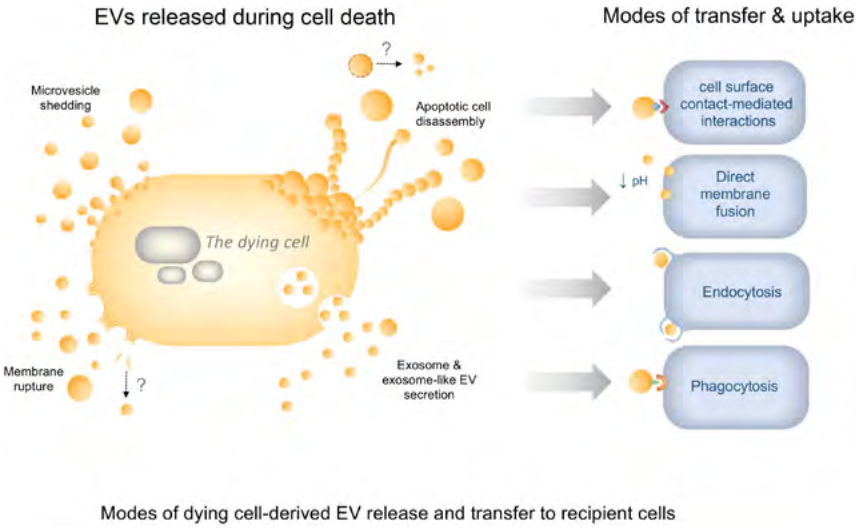
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

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

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I'm ready to apply! »

Dr. Katrina Binger
LIMS

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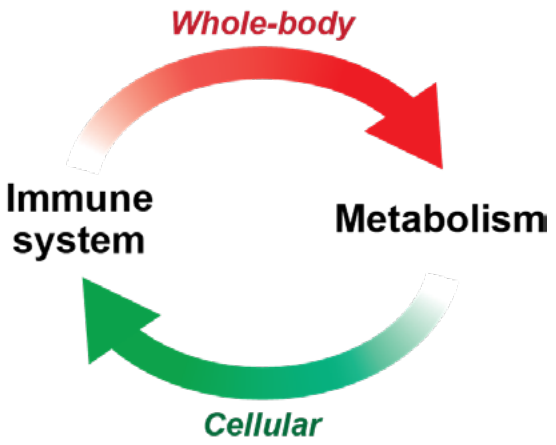
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

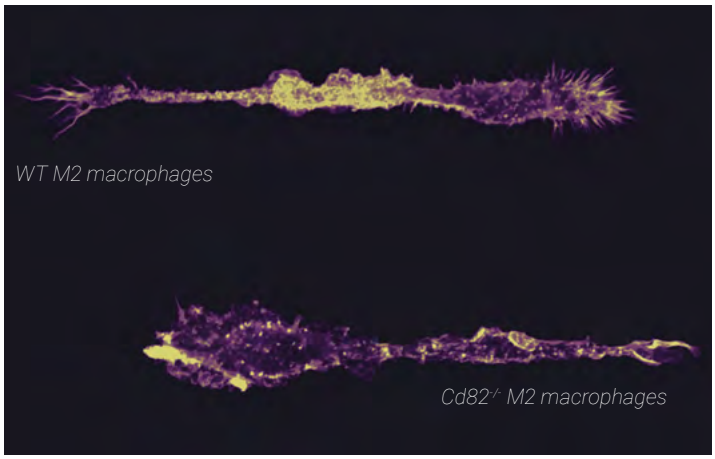
- Infection & Immunity
- Metabolism assays
- Mammalian cell culture
- Confocal fluorescence microscopy
- Flow cytometry
- Protein biochemistry
- Proteomics
- 3D cell culture

Every cell in our body requires energy to perform their specific functions. Generally, this is a well-controlled and ordered process. However, in some settings, the ways in which cells obtain this energy is altered and has important functional consequences. We are now learning that the metabolism of immune cells is intricately linked to their function, where distinct metabolic configurations are ascribed to different phenotypes.

Our research aims to understand the link between what immune cells 'eat' in our tissues and how this is connected to their normal biology and their response during sterile inflammation or infection.



Project 1. Mechanosensing metabolism. Macrophages are innate immune cells that are present in all our tissues; either residing there from embryonic development or infiltrating on command, for example during infections. Our recent data shows that the interaction of macrophages with the extracellular matrix (ECM) is important for their function. We think that this 'mechanosensing' is a critical, but underappreciated modulator of macrophage biology. In this project students will employ proteomics to identify proteins that regulate macrophage interaction with the ECM, and investigate their role in metabolism.



Project 2. Macrophages go 3D. With Dr. Nick Reynolds, we are interested in developing *in vitro* models that better mimic tissue environments. Using 3D printing, macrophages are suspended into different environments and the effect of this on their function is measured. We are particularly interested in modeling the lung microenvironment to better understand how macrophage function occurs in this specialised environment during infection with respiratory viruses such as Sars-CoV-2.

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I'm ready to apply! »

A/Prof. Christine Hawkins
LIMS

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

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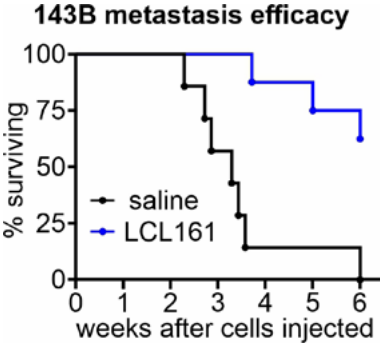
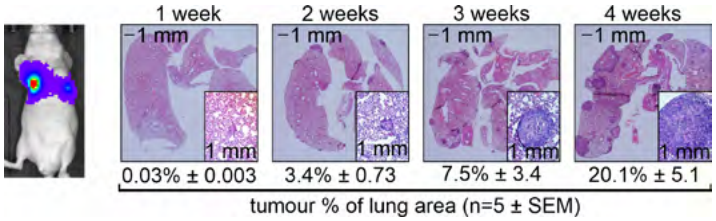
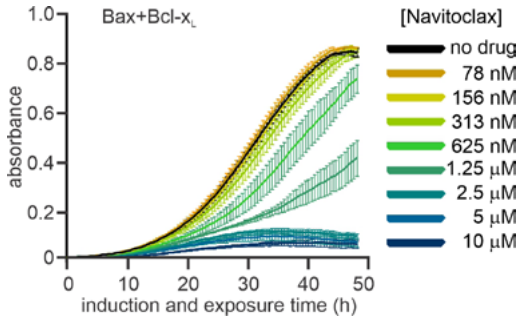
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

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.

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I'm ready to apply! »

Prof. Mark Hulett
LIMS

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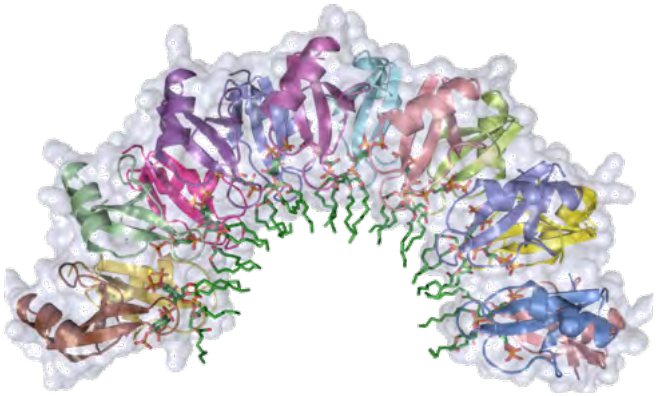
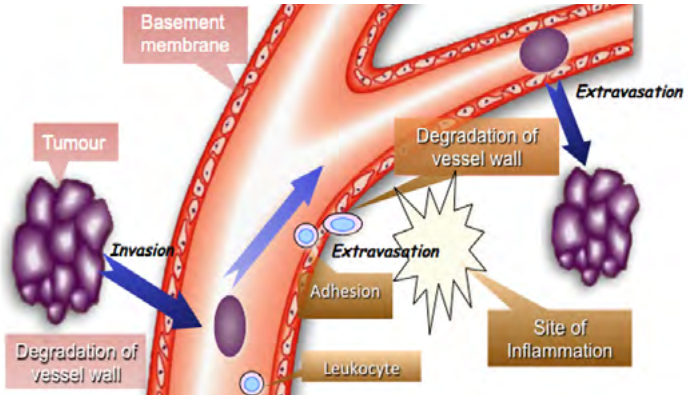
- Infection & Immunity
- Cancer
- Mammalian cell culture
- Flow cytometry
- Animal models of disease
- Microscopy - electron, confocal, light
- CRISPR-Cas9 gene editing
- Protein biochemistry

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





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

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

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

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I'm ready to apply! »

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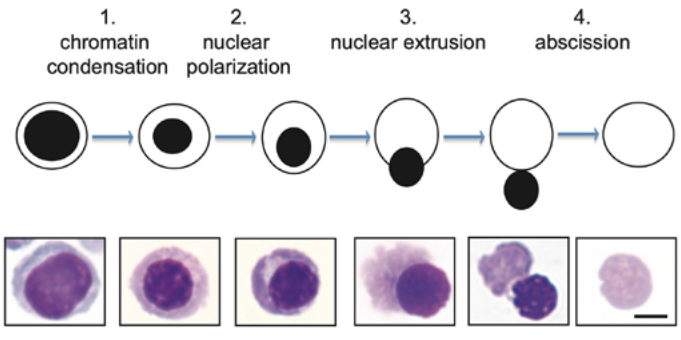
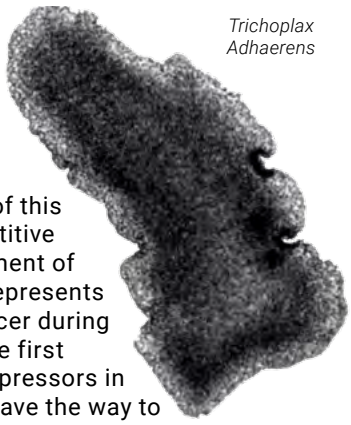
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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

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



Erythroid Enucleation



Trichoplax Adhaerens

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

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

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I'm ready to apply! »

Prof. Robyn Murphy
LIMS

Infection & Immunity

Protein biochemistry

Animal models of disease

Histology (incl. immunohistochemistry)

Microscopy - electron, confocal, light

Unbiased counting techniques

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

We focus on various aspects of skeletal muscle biochemistry in health and disease, using exercise and disease models in humans, as well as animal models. In particular, we measure proteins in segments of individual fibres allowing issues with the heterogeneity of skeletal muscle to be overcome. We also examine movement of proteins following micro-dissection of fibres, allowing us to quantitatively assess the redistribution of proteins following various interventions.

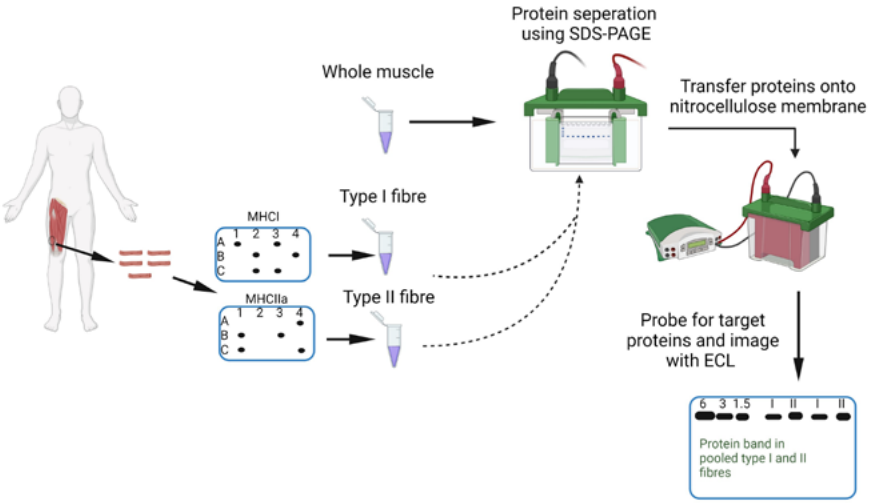
Project: Effect of age and fibre-type on the abundance of calcium-handling proteins in human skeletal muscle. (Co-supervisor: Dr Stefan Wette, Postdoctoral Researcher).

Muscle is heterogenous in nature, and its fibre type composition is dependent on age, disease state or fitness of a person. In the elderly, Type II fibres are substantially affected, whereby there is a reduction in the number of these fibres compared with Type I fibres, along with them being weaker than Type I fibres, leading to muscle atrophy. Further, many proteins important for muscle metabolism, contractility and growth are fibre-type specific. Therefore, the analysis of proteins in single fibres allows a thorough investigation of these proteins.

In this project you will assess the abundance of various calcium-handling proteins (e.g., dysferlin, STAC3, DHPR and RYR1) in skeletal muscle obtained from both young and older healthy individuals. It is hypothesised that the expression of these proteins will be fibre-type dependent and that there will be a change in the abundance of these proteins in the Type II fibres of older adults but not in Type I fibres.

This project will see you learning to dissect single fibres from human muscle samples, to use a new approach for rapid and efficient fibre typing of each individual fibre and then to use a specialised and highly sensitive quantitative Western blotting technique developed in the Murphy lab to determine the abundance of various calcium-handling proteins. In addition, the project may require you to learn whole muscle tissue preparation, cryosectioning of tissue and immunofluorescence techniques, depending on the research question you wish to address.

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



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I'm ready to apply! »

Dr. Jacquie Orian
LIMS

Infection & Immunity

Flow cytometry

Microscopy - electron, confocal, light

Histology (incl. immunohistochemistry)

Animal models of disease

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

The focus of the laboratory is multiple sclerosis (MS), an autoimmune and neurodegenerative disease of the central nervous system characterized by inflammation, loss of myelin (the membrane around nerves which facilitates electrical impulses) and nerve death throughout the brain and spinal cord. The cause of the disease is unknown and current treatments are of limited benefit, therefore improved understanding of mechanisms underpinning disease development is required to produce more effective treatments.

MS is commonly investigated by using the experimental autoimmune encephalomyeltis (EAE) model, generated in mice by autoimmunity against myelin proteins. The use of EAE has allowed us to demonstrate that blood cells known as platelets play a driving role in disease development. Platelets have historically been associated with blood clotting, but recent research has also identified non-canonical functions for these cells in inflammation and autoimmunity. Our evidence, therefore, is in keeping with current understanding of platelet biology. However, we have also demonstrated that the specific targeting of platelets with a novel drug (generated at the Baker Heart and Diabetes Institute, Melbourne) that blocks their aggregation results in both significant attenuation of inflammation and active restoration of myelin. While the first observation was anticipated, the second was unexpected, since there is no prior evidence of a role for platelets in myelin formation/repair.

To investigate the relationship between platelets and remyelination, we will turn to an additional animal model, generated by chemically-induced demyelination. This model, namely the 'cuprizone model' is generated by addition of the cuprizone reagent to rodent food over a 5-6 week period, which results in demyelination, but is followed by remyelination upon cuprizone removal. We hypothesize that specific platelet targeting during the recovery phase will (a) generate an environment conducive to repair and (b) accelerate the rate of remyelination.

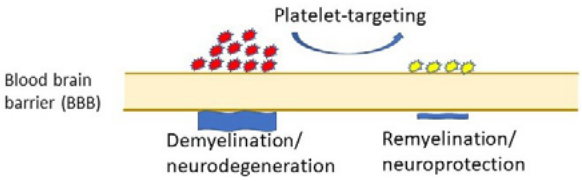
The specific aims are:

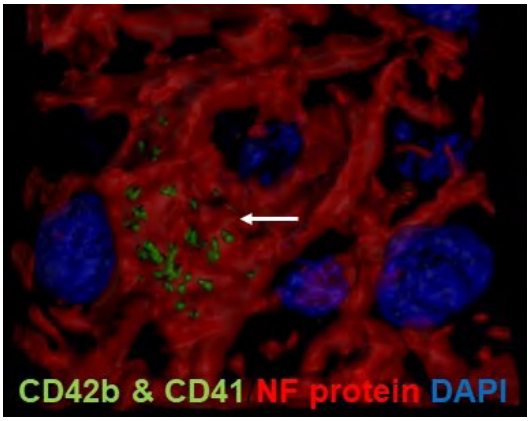
Aim 1. To establish the cuprizone demyelination model and estimate parameters of demyelination and remyelination, qualitatively and quantitatively.

Aim 2. To characterize the inflammatory environment (i.e. cytokine/chemokine profile) in defined brain regions in cuprizone-treated, recovering and drug-treated experimental groups, with healthy mice as controls.

Aim 3. To quantify parameters of myelin in the above groups. This project will allow you to acquire basic concepts of neurobiology and immunology and the validation of animal models to investigate human disease. Additionally, you will become proficient in immunochemical techniques, microscopy and unbiased counting techniques.

For more information on MS see https://www.msaustralia.org.au/





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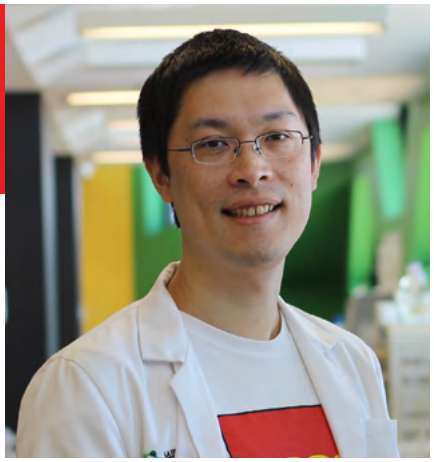
I'm ready to apply! »

Prof. Ivan Poon
LIMS



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

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

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 2023 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).

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I'm ready to apply! »

A/Prof. Hamsa Puthalakath
LIMS

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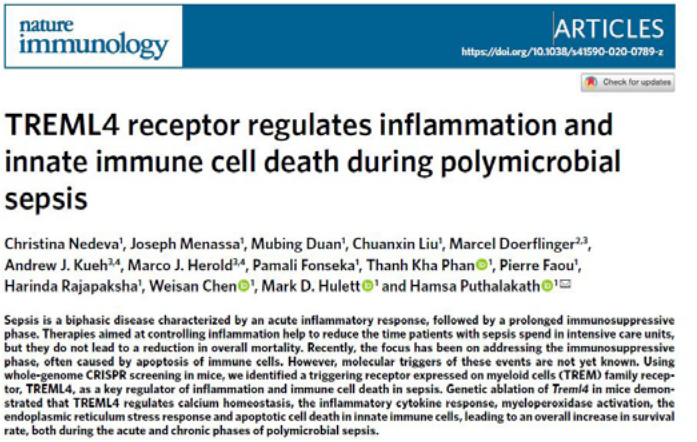
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

- Infection & Immunity
- Cell culture - eukaryotes & prokaryotes
- Molecular cloning & CRISPR-Cas9 editing
- Microscopy - light, fluorescence
- Animal handling & models of disease
- Analysis of reaction rates
- Gene expression analyses incl. sequencing
- Mass spectrometry

My lab investigates the molecular basis of various inflammatory pathologies and heart failure with the aim to develop therapies to combat these diseases. Inflammation is an essential step in alerting the immune system to the presence of an infection or a tissue injury so that the host white blood cells can quickly locate and combat the pathogen or engage in tissue repair. This response is typically tightly controlled, with inflammation waning after infection/injury is resolved – returning to basal levels with the host's white blood cells following suit. However, uncontrolled inflammatory response leads to various pathologies such as multiple organ failure in sepsis, psoriasis, systemic lupus erythematosus and inflammatory bowel disease etc. In our lab, we have identified upstream cell surface receptors regulating these various diseases and we aim to develop therapies by blocking these receptors' activation. Similarly, we have developed a novel drug to treat systolic heart failure and we are in the process of identifying its cellular targets.

Project 1. Understanding the role of Treml4 in inflammatory bowel disease. (Co-supervisor: Prof. Mick Foley). The honours student will be working together with a PhD student in establishing the IBD model, molecular characterization of various genes involved in inflammation and also in developing blocking antibodies to this receptor.

Project 2. Thermal Proteome Profiling to identify protein targets of BR43. (Co-supervisor: Prof. Mick Foley). Most protein modifications, including drug binding, can affect a protein's thermal stability. The change in thermal stability of proteins upon drug binding can be measured in a proteome-wide manner using multiplexed quantitative mass spectrometry (MS). This technique, termed Thermal Proteome Profiling (TPP), can be used to delineate target engagement, and identify direct interaction partners. Typically, this is achieved by utilizing neutron-encoded isobaric mass tagging reagents (TMT10plex) in conjunction with high resolution MS to monitor thermal stability of proteins across ten different temperatures. The honours student will be working together with scientists from the Mass spectrometry facility in identifying the cellular targets.



nature immunology — ARTICLES
https://doi.org/10.1038/s41590-020-0789-z

TREML4 receptor regulates inflammation and innate immune cell death during polymicrobial sepsis

Christina Nedeva[1], Joseph Menassa[1], Mubing Duan[1], Chuanxin Liu[1], Marcel Doerflinger[2,3], Andrew J. Kueh[2,4], Marco J. Herold[2,4], Pamali Fonseka[1], Thanh Kha Phan[1], Pierre Faou[1], Harinda Rajapaksha[1], Weisan Chen[1], Mark D. Hulett[1] and Hamsa Puthalakath[1]

Sepsis is a biphasic disease characterized by an acute inflammatory response, followed by a prolonged immunosuppressive phase. Therapies aimed at controlling inflammation help to reduce the time patients with sepsis spend in intensive care units, but they do not lead to a reduction in overall mortality. Recently, the focus has been on addressing the immunosuppressive phase, often caused by apoptosis of immune cells. However, molecular triggers of these events are not yet known. Using whole-genome CRISPR screening in mice, we identified a triggering receptor expressed on myeloid cells (TREM) family receptor, TREML4, as a key regulator of inflammation and immune cell death in sepsis. Genetic ablation of *Treml4* in mice demonstrated that TREML4 regulates calcium homeostasis, the inflammatory cytokine response, myeloperoxidase activation, the endoplasmic reticulum stress response and apoptotic cell death in innate immune cells, leading to an overall increase in survival rate, both during the acute and chronic phases of polymicrobial sepsis.

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Dr. Sarah Stewart
LIMS

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

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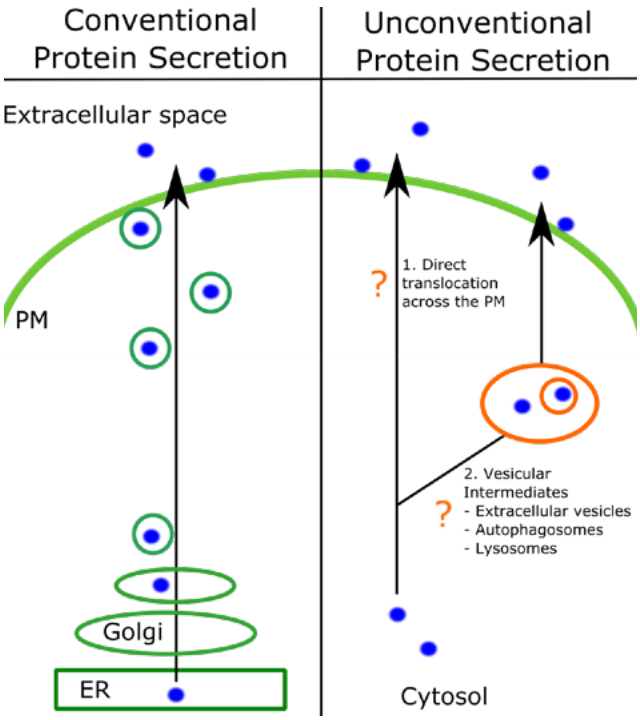
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **1 Feb; 1 Jul**
Masters conversion: **Yes**

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.



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I'm ready to apply! »

Prof. Coral Warr
LIMS

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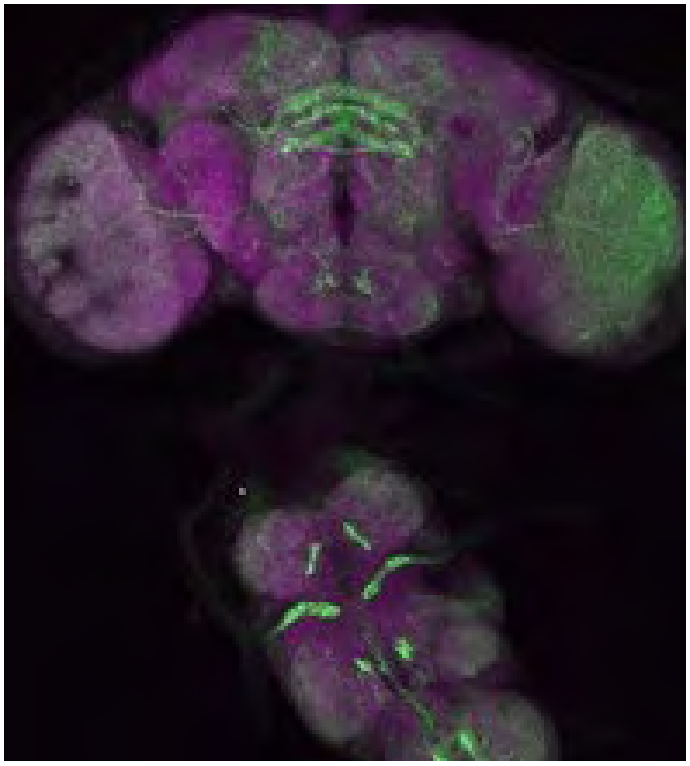
Website: click here

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **1 Feb; 1 Jul**
Masters conversion: **Yes**

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

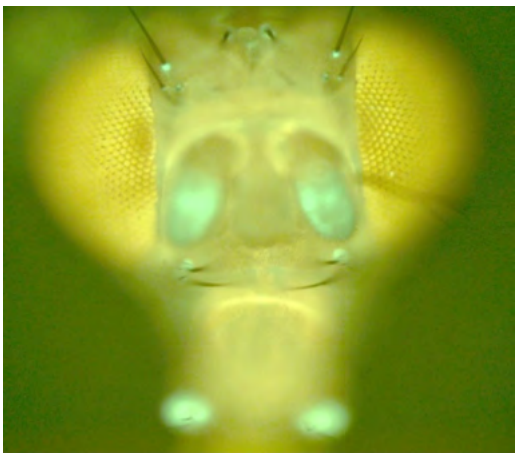
We are interested in how cells detect signals from the environment or from each other both during development and in the adult organism. Understanding this is critical because dysregulation of cell signalling underlies many of the major diseases that afflict society, including motor neuron disease, cancer 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.



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I'm ready to apply! »

A/Prof. Belinda Abbott
LIMS

Chemical synthesis - organic

NMR spectroscopy

Medicinal chemistry

Mass spectrometry (small molecules)

Chromatography (flash column, HPLC)

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

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

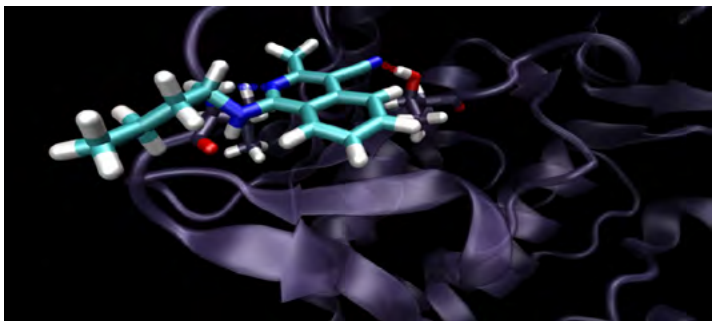
Project 1. Inhibiting P.falciparum in the search for a novel antimalarial agent. Malaria causes a significant impact on the health and economy of the developing world. Enzymes which are important in the life cycle of the malaria parasite could possibly be attractive targets for novel antimalarial agents.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

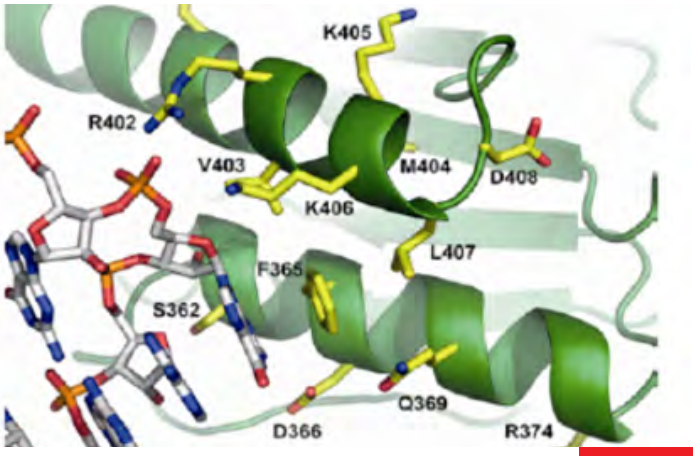
Project 2. Using fragment-based drug design to disrupt bacterial infection. The bacterial signal recognition particle (SRP) is an essential ribonucleoprotein complex responsible for the delivery of proteins to the plasma membrane in bacteria. Interrupting the interactions of SRP with its receptor represents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

Abbott Lab 2022

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

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





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I'm ready to apply! »

A/Prof. Peter Barnard
LIMS

Chemical synthesis - organic & inorganic

Nuclear magnetic resonance

Light microscopy

X-ray crystallography

Mass spectrometry

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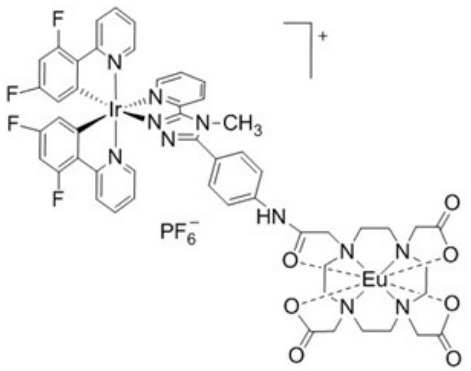
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Both**

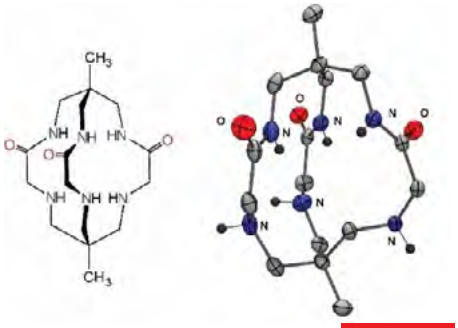
The main focus of the Barnard research lab is the synthesis and development of organic ligands and coordination complexes for medicinal and biological imaging applications. Organic and inorganic synthetic chemistry in combination with a wide range of analytical techniques are used for the generation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

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

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



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



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

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I'm ready to apply! »

Prof. Jason Dutton
LIMS

Chemical synthesis - organic & inorganic

Nuclear magnetic resonance

Mass spectrometry

X-ray crystallography

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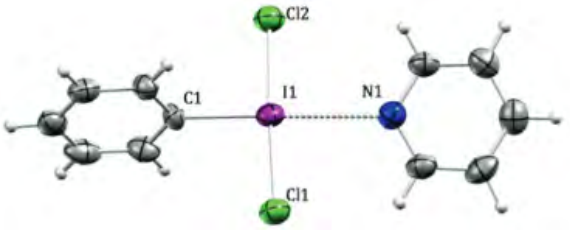
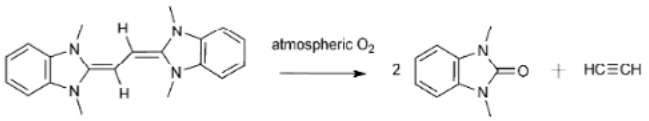
Website: click here

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

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



Specific projects that are on offer next year include in organic chemistry the generation of halogenation reagents (ie brominating reagents) that are stronger and faster than Br2 itself, yet much easier and safer to handle. For the inorganically inclined, we are looking at



methods of making metal-fluorine bonds more reactive for the purpose of direct transformations of cheap C-H bonds into value added C-F bonds. A student joining the Dutton lab can expect to learn a variety of synthetic chemistry techniques, a whole lot of NMR and mass spec and some X-ray crystallography. Interested students can also potentially learn how to analyze their systems with theoretical chemistry techniques. Most of all students in the Dutton lab learn that chance favours the prepared mind!

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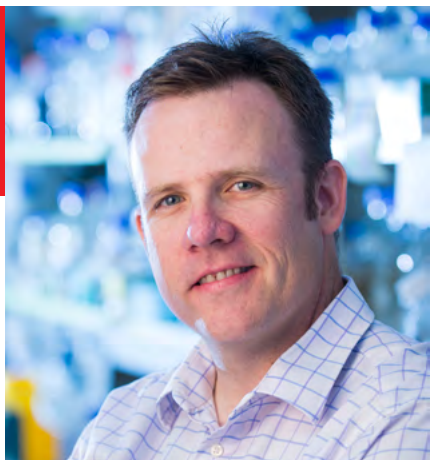
I'm ready to apply! »

Prof. Conor Hogan
LIMS



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

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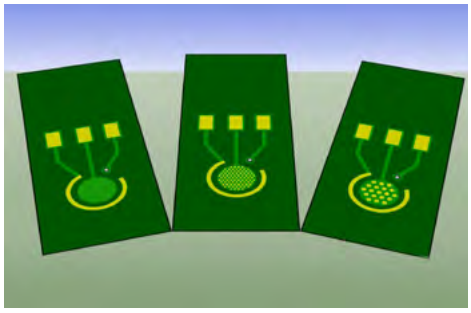
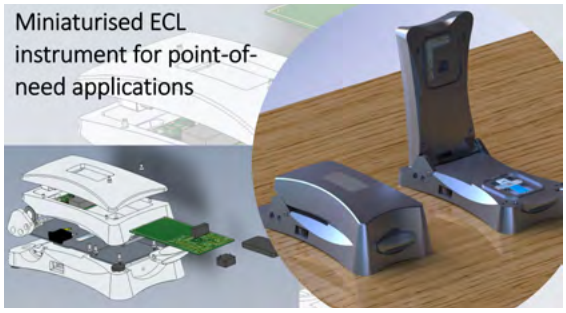
Website: click here

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





The development of simple, inexpensive (yet quantitative) sensors for environmental testing, medical diagnostics and other sensing applications is an extremely important emerging area because it has the potential make (bio) chemical analysis, usually confined to the lab, more widely available. Such technology would be transformational, particularly in remote areas and in the developing world, where levels of health expenditure are low.

Our group conducts a range of both fundamental and applied multidisciplinary research focused on expanding the bounds of Analytical Science. We pursue the development of new chemistries and new technologies which will result in exquisitely low detection limits and enhanced selectivity. Building on our fundamental science, we seek to develop novel sensing technologies and miniaturised instruments for use outside the laboratory setting.

Working at the interface of electrochemistry and photochemistry, we have pioneered several new approaches to detection science. Our group is a world leader in electrochemiluminescence (ECL) detection, mobile phone readable printed electrochemical sensors and the development of potential resolved multi-coloured ECL for multiplex analysis.

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A/Prof. Yuning Hong
LIMS

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

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Website: click here

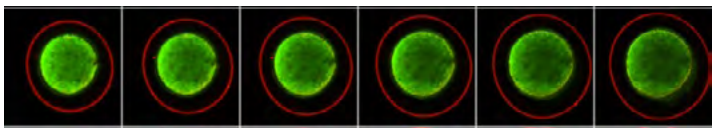
Number of projects: **3**
Full-time or part-time: **Full-time**
Feb or July start: **2 Feb, 1 Jul**
Masters conversion: **Yes**

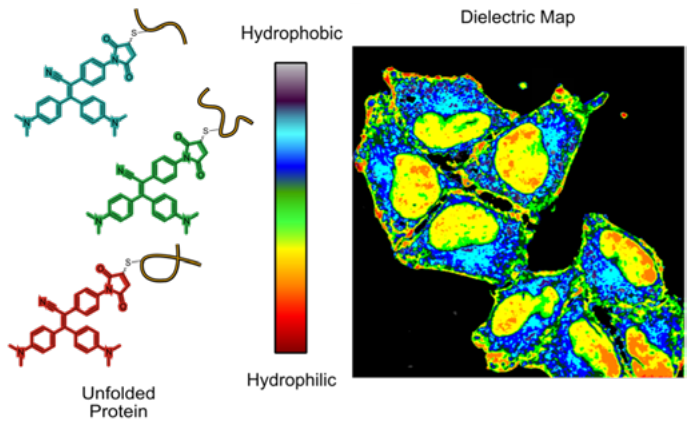
Our Group develops novel chemical compounds, usually with interesting fluorescent behaviors, to study how proteins changes in live cells under drug treatment and in cell models of Parkinson's, Huntington's and Motor Neuron Diseases. The molecules we create can selectively turn on their fluorescence or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

Prof. Adam Mechler
LIMS

Atomic force microscopy

Mass spectrometry

Biophysical characterisation of materials

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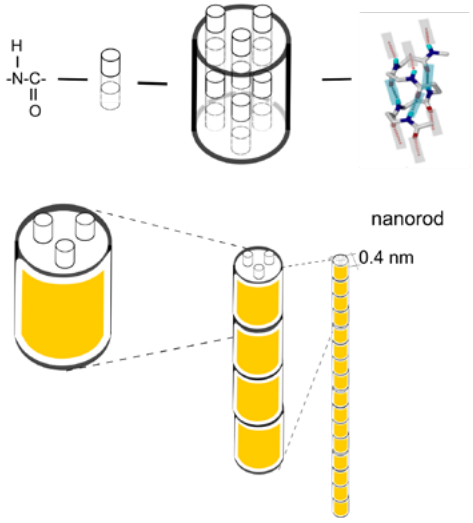
Website: click here

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

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.

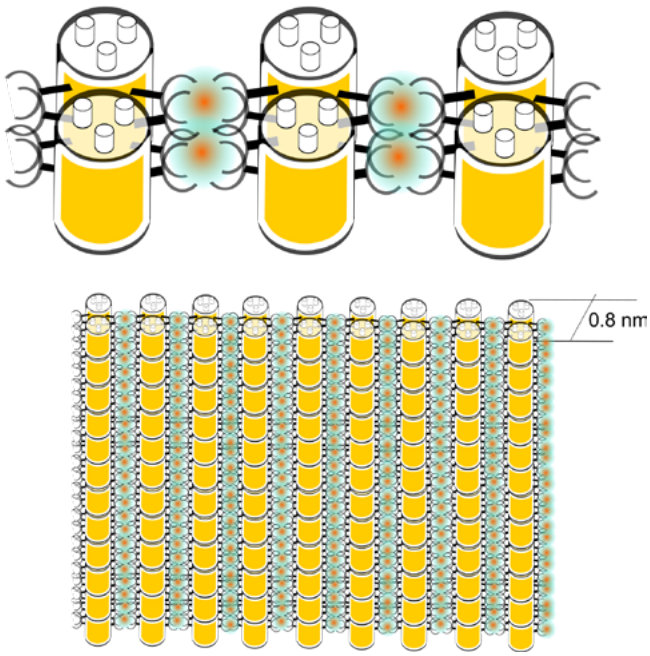
1D SUPRAMOLECULAR ASSEMBLY

assembly motif: three H-bonding donor/acceptor pairs



2D METALLOSUPRAMOLECULAR FRAMEWORK

Cu(I)/Cu(0) coordinate to imidazole and carboxylate moieties



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I'm ready to apply! »

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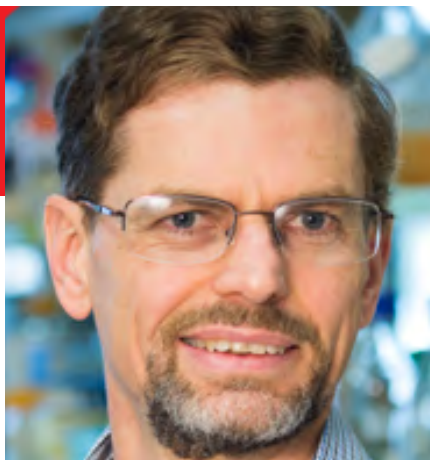
A/Prof. Evan Robertson
LIMS



IR spectroscopy

Raman spectroscopy

Pulsed ns lasers

Molecular modelling

Electronics

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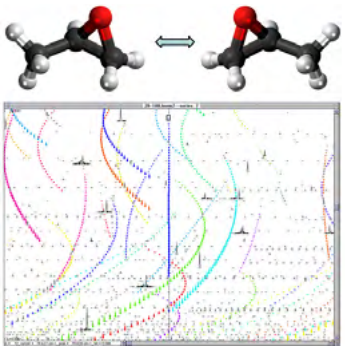
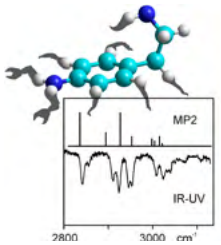
Website: click here

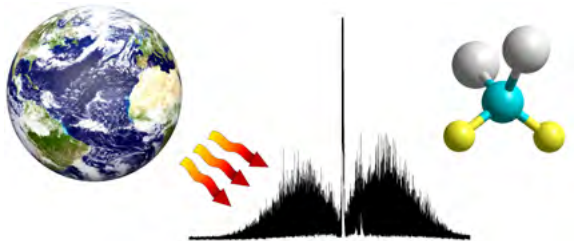
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

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

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







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

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

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I'm ready to apply! »

Dr. Keith White
LIMS

Chemical synthesis - inorganic

Thermogravimetric analysis

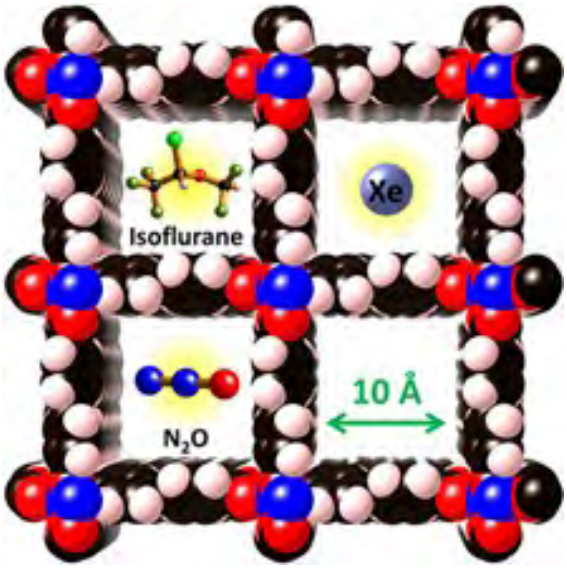
X-ray crystallography

E-mail: k.white2@latrobe.edu.au
Website: click here

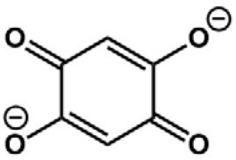
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

My research involves the synthesis of extended network materials that have open spaces. By considering the molecular components employed in the synthesis of extended network materials, the character of the open spaces may be tuned for selective capture of guests such as gaseous fuels, environmentally harmful substances, or redox-active compounds.

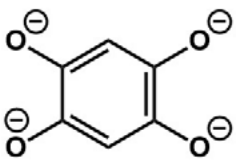
Project 1: Volatile inhalation anaesthetics are typically halogenated ether compounds. When used during medical procedures these anaesthetics are exhaled intact by the patient and evacuated from the operating theatre. I am interested in investigating materials that may be used for the scavenging and recovery of such volatile compounds. Recent article: https://doi.org/10.1002/chem.201700389



Project 2: Networks materials may be constructed using redox-active components. An example of one such redox-active component is the dianion of 1,4-dihydroxybenzoquinone (I). When part of a network material (I) has been shown to be able to undergo, one or two-electron reduction (II). This project will explore new metal-ligand networks in which I and its derivatives are combined with lithium ions and redox-active guests.

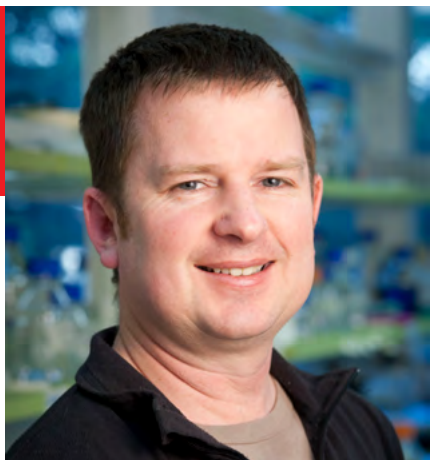


(I)



(II)

A/Prof. David Wilson
LIMS



Computational chemistry

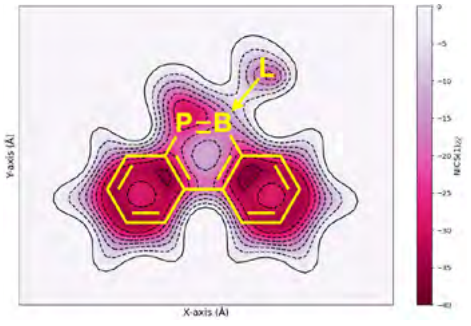
Molecular modelling

E-mail: david.wilson@latrobe.edu.au
Website: click here

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

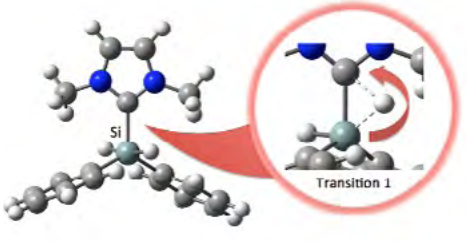
Our group does chemistry by computer – we use computers to understand the structures and properties of molecules and how they react. We produce results as good as sometimes better than experiment! We focus on important molecules and their applications, molecules with unusual bonding environments, and 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. One project is to investigate the properties of amino acids whereby the N is replaced by P.

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I'm ready to apply! »

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 2023.

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 2023. 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. Judy de Haan
Baker Institute

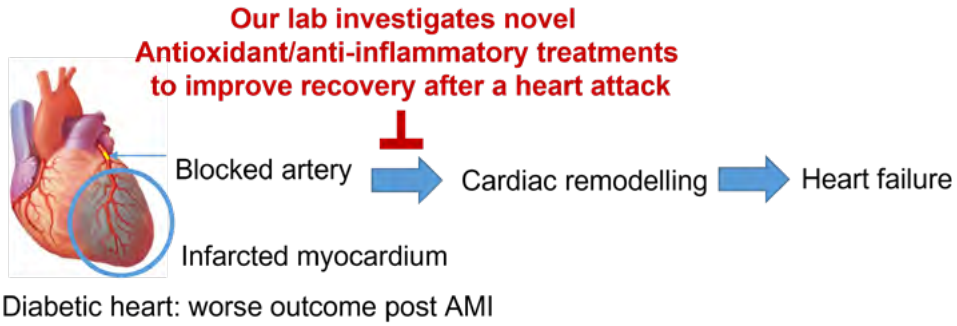
- Animal models of disease
- Cell culture - eukaryotes, incl. primary & cell lines
- Immunohistochemistry
- RT-PCR
- Flow cytometry
- Protein biochemistry (SDS-PAGE, western blotting)

E-mail: judy.dehaan@baker.edu.au
Website: click here

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

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 Institute

Mass spectrometry

Proteomics

Cell culture - eukaryotes incl. primary & cell lines

Light microscopy

Bioinformatics

Nanocarrier (cell-derived) generation

E-mail: david.greening@baker.edu.au
Website: click here

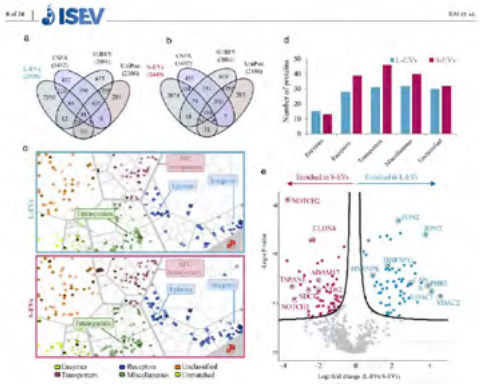
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

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



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I'm ready to apply! »

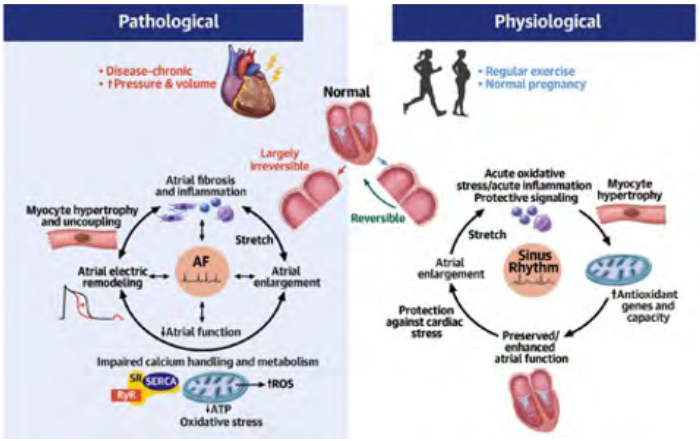
Prof. Julie McMullen
Baker Institute

- Animal models of disease
- Gene expression analyses
- Light microscopy
- Histology
- Whole organism bioimaging (PET/CT)
- Protein biochemistry (SDS-PAGE, western blotting)
- Genetic sequencing

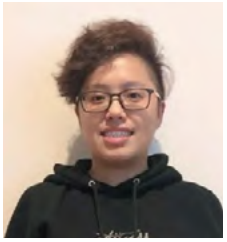
E-mail: Julie.McMullen@baker.edu.au
Website: click here

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

Our research aims to advance understanding of cardiovascular conditions such as heart failure at a molecular level to enhance treatments for this condition, which is rapidly increasing in Australia and globally. Our lab is recognised internationally for research which has defined the molecular distinction between physiological and pathological heart growth (cardiac hypertrophy) in preclinical models of health and disease.



Project 2. Application of Positron emission tomography/ computed tomography (PET/CT) to assess regional cardiac function and metabolism in models of pathological and physiological hypertrophy. Cardiac hypertrophy refers to an increase in heart size and is associated with nearly all forms of heart failure. Heart size alone is insufficient to provide mechanistic information about the myocardium itself, and an increase in heart size is not necessarily associated with cardiac dysfunction. In the past, cardiac imaging in mice was very difficult, due to the small size of the heart and their high heart rate. The use of molecular imaging in preclinical cardiovascular research has become possible because of advances in imaging techniques. At present, non-invasive in vivo imaging techniques such as 18F-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) can facilitate assessment of regional cardiac function and metabolism in mice. Our study is aiming to assess the capability of PET/CT to identify the metabolic difference between physiological and pathological cardiac hypertrophy in mouse models by visually and quantitatively determining FDG activity in the heart wall.



Note: This project will be supervised by Dr. Yi Ching (Peggy) Chen (pictured). Please email Peggy if you have any questions about this project.

Project 1. Atrial adaptations in physiological and pathological cardiac hypertrophy. Co-supervisor: Yi Ching (Peggy) Chen. Atrial fibrillation (AF) is the most common rhythm disorder of the heart, and is characterised by the high frequency excitation of the atrium, leading to dyssynchronous contraction of the atria and irregular excitation of the ventricles. One of the key features of AF is atrial enlargement but the critical mechanisms are mostly unknown. The key aim of this project is to characterize the atria from physiological and pathological cardiac hypertrophy mouse models. The chacterisation will include functional, morphological, histological and molecular analyses. Results from this project are expected to lead to the identification of new drug targets and strategies for AF.

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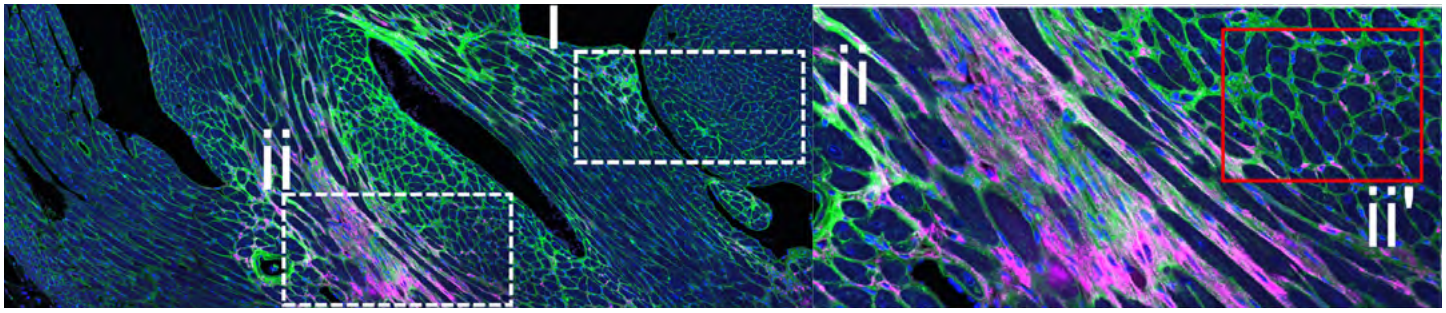
I'm ready to apply! »

A/Prof. Alexander Pinto
Baker Institute

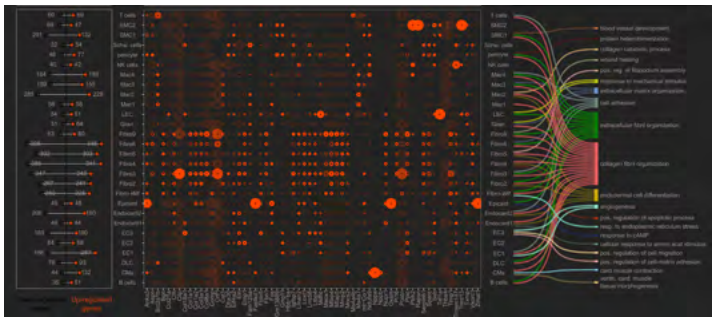
- Animal models of disease
- Genetic sequencing
- Cell culture - eukaryotes, incl. primary & cell lines
- Flow cytometry
- Confocal & super resolution fluorescence microscopy
- Bioinformatics

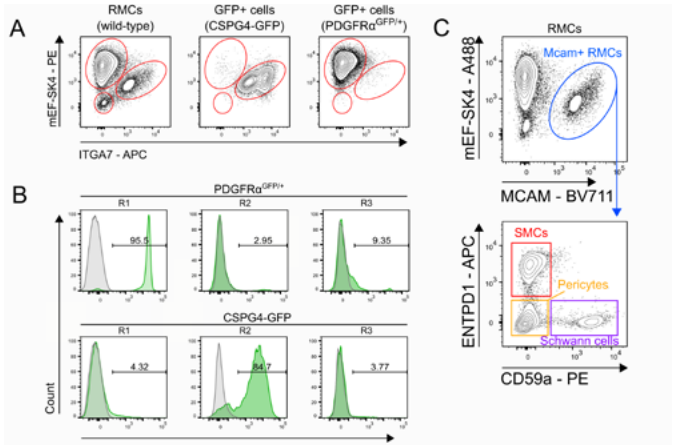
E-mail: alex.pinto@baker.edu.au
Website: click here

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





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I'm ready to apply! »

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 2023.

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 2023. 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

Anatomy

Physiology & Pharmacology

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Dr. Sarah Annesley
Bundoora

- 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)

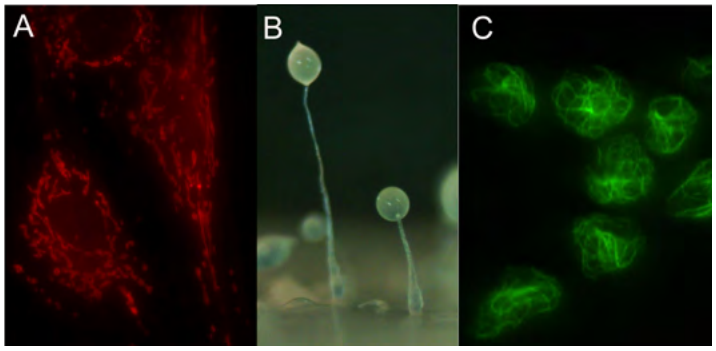
E-mail: s.annesley@latrobe.edu.au
Website: click here

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

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I'm ready to apply! »

Teresa Carvalho
Bundoora

- Cell culture - eukaryotes, incl. primary & cell lines
- Gene expression analyses & sequencing
- Microscopy - light, confocal & super resolution
- Bacterial overexpression of proteins
- Immunoassays
- Bioinformatics
- Proteomics

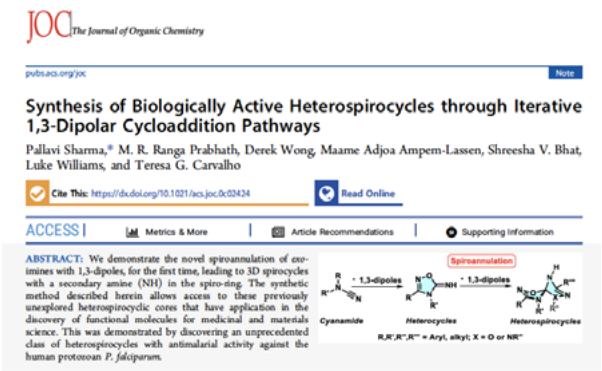
E-mail: tcarvalho@latrobe.edu.au
Website: click here

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

Parasitic organisms are very successful pathogens and a significant threat to human and animal health worldwide. Further, wildlife reservoirs of parasites created the potential for zoonotic transmissions to livestock and human populations. However, for the vast majority of parasites, vaccines are non-existing and drug treatments are limited and sub-optimal. Our research group studies the biology of medical parasite with the specific goal of identifying novel treatments. Further, we investigate pathogens in Australian wildlife to identify potential risks of transmission to livestock, domestic animals and humans. Honours projects are offered to study human malaria and wildlife parasites. Each project will allow the student to acquire a combination of skills including cell culture, molecular biology, bioinformatics, protein expression, drug screening, histology and fluorescence microscopy.

Project 1. Malaria drug discovery. Malaria is a significant global health burden against which an efficient vaccine has yet to be developed. The rise of antimalarial drug resistance and a plateau in new therapeutic trials, create an urgent demand for new treatment options. We have synthesised novel 3D-spiroheterocycle compounds with chemical connectivities never previously synthesised. The unique 3D architecture of these molecules allows them to reach biological domains otherwise not accessible to relatively flat structures, leading to increased efficiency in malaria parasites. This project will apply parasite cell culture, omics techniques and whole genome sequencing approaches to determine the mode of action of these novel anti-parasitic compounds.

Project 2. Parasites or Australian wildlife. Feral and wild populations of dogs represent a significant challenge for the agriculture industry. In Victoria, the opportunity cost of wild dogs to the livestock industry is estimated at $13-18 million per annum. Indirect impact, such as disease transmission, is also very high. Wild dogs are commonly considered to be responsible for maintaining the Neospora infection cycle in Australia, which causes an estimated loss of $100 million per annum nationwide. This parasite is likely one of the major causes of abortion in cattle, with serious impacts on production. There has been an alarming increase in Neospora seroprevalence in domestic dogs in Victoria in the last decade, with recent estimates as high as 30%. This project will use molecular tools to determine the prevalence of Neospora parasites in wild dogs in Victoria, as well as develop an in-house serology test by establishing in vitro cultures of Neospora parasites.



JOC The Journal of Organic Chemistry

Synthesis of Biologically Active Heterospirocycles through Iterative 1,3-Dipolar Cycloaddition Pathways

Pallavi Sharma,* M. R. Ranga Prabhath, Derek Wong, Maame Adjoa Ampem-Lassen, Shreesha V. Bhat, Luke Williams, and Teresa G. Carvalho

ORIGINAL ARTICLE

Transboundary and Emerging Diseases

WILEY

Active shedding of *Neospora caninum* detected in Australian wild canids in a nonexperimental context

Mikaeylah J. Davidson | Jose L. Huaman | Carlo Pacioni | Danielle Stephens | Yvette Hitchen | Teresa G. Carvalho

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I'm ready to apply! »

Prof. Ashley Franks
Bundoora

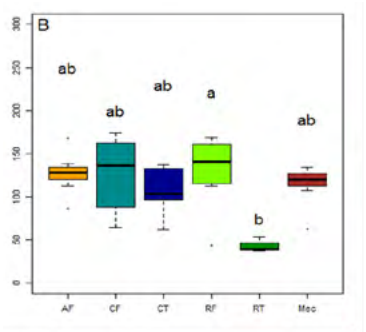
- Field work
- Ecological assays
- Cell culture - prokaryotes (incl. anaerobic)
- Molecular cloning
- Gene expression analyses (PCR assays)
- Genetic sequencing
- Bioinformatics
- Protease activity assays

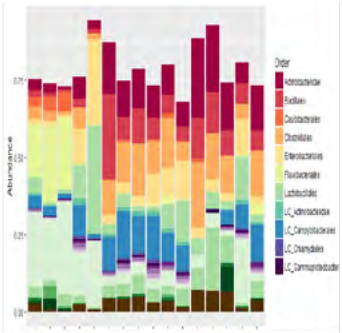
E-mail: A.Franks@latrobe.edu.au
Website: click here

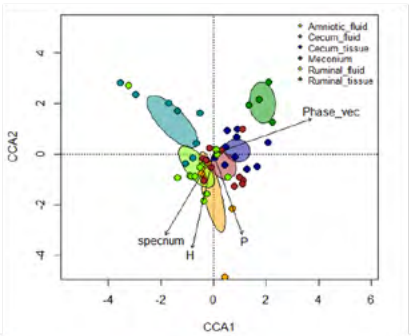
Number of projects: **2**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**

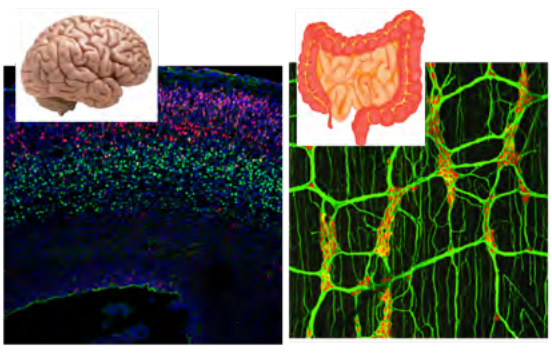
Environmental microbiology is the study of the composition and physiology of microbial communities in the environment. An understanding of these natural processes is fundamental for comprehension of ecosystem function and application to biotechnology, bioremediation and bioenergy. Honours projects will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

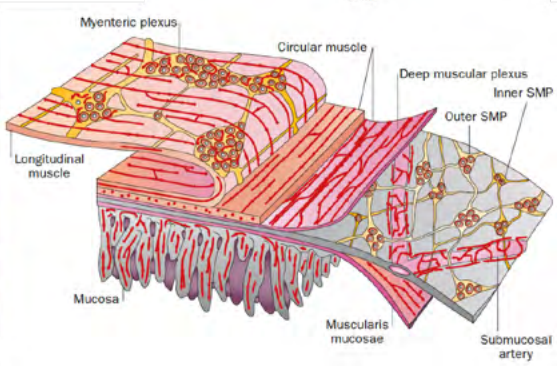
- Plant soil interactions: looking to improve soil health and diveristy of our landscape as well as improving resialiance to climate change.
- Microbiome interactions: working with ndustry partners on how to functionally improve the gut microbiome for better health outcomes. This project will interact with neurobiologists and hopital based partners.











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I'm ready to apply! »

A/Prof. Karla Helbig
Bundoora

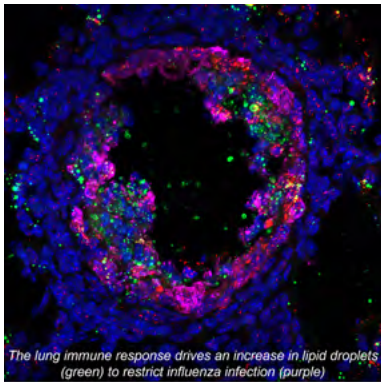
- Cell culture - eukaryotes incl. primary & cell lines
- Cell culture - prokaryotes
- Animal handling
- Animal models of disease
- Gene expression analyses
- Cell transfection
- Microscopy - confocal & super resolution
- Molecular cloning

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

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


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

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

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

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I'm ready to apply! »

A/Prof. Maria Liaskos
Bundoora

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

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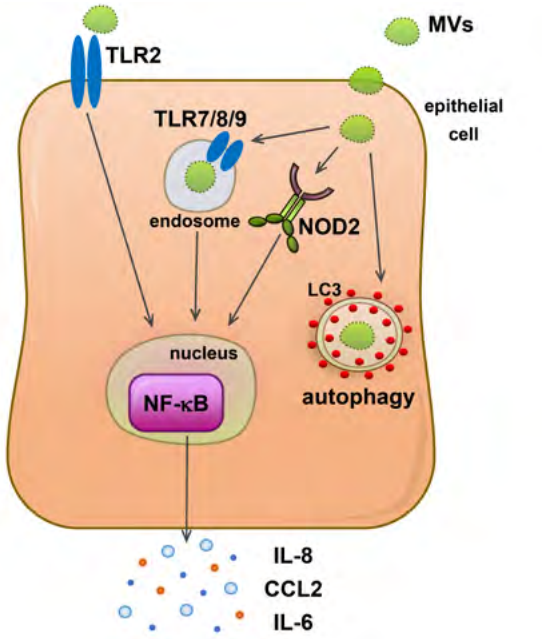
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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.

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I'm ready to apply! »

Dr. Steve Petrovski
Bundoora

- Genetic sequencing
- Bacterial overexpression of proteins
- Bioinformatics
- Protein biochemistry (incl. western blotting)
- Gene expression analyses (PCR assays)
- Cell transfection
- Microscopy - light & electron
- Molecular cloning

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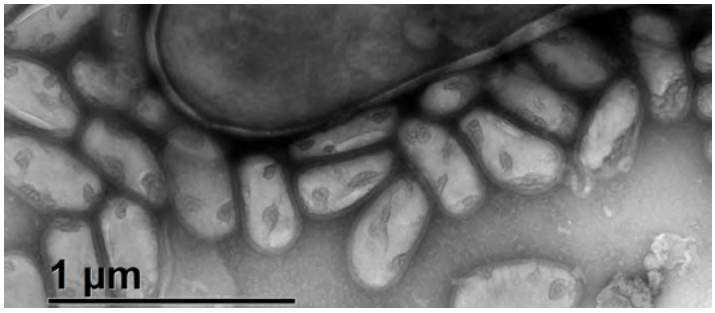
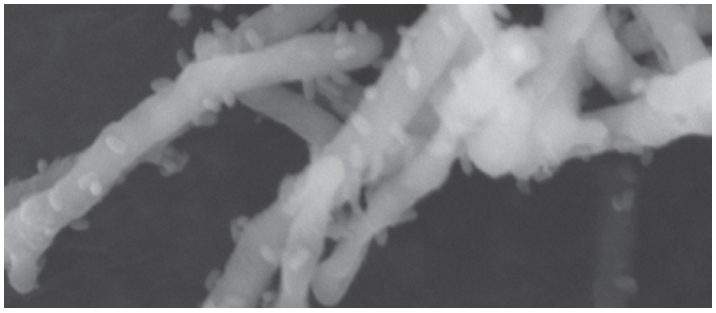
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**





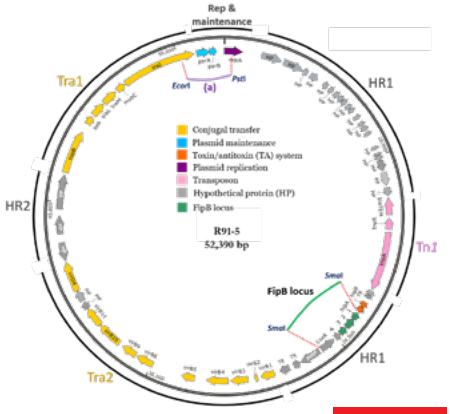
Horizontal gene transfer (HGT) is the mechanism of gene-swapping and genetic exchange between bacteria. HGT provides opportunities for bacteria to evolve over long and short timespans. The best-known contribution of HGT has been the rapid dissemination of numerous antimicrobial-resistance determinants 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. 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 2. 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 different host strains.

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



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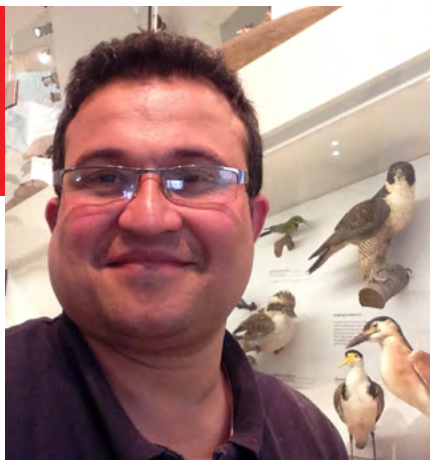
I'm ready to apply! »

Dr. Subir Sarker
Bundoora



- Next generation sequencing
- Gene expression analyses (PCR assays)
- Bacterial overexpression of proteins
- Protein purification
- Bioinformatics
- X-ray crystallography
- Protein biochemistry (incl. western blotting)
- Immunoassays

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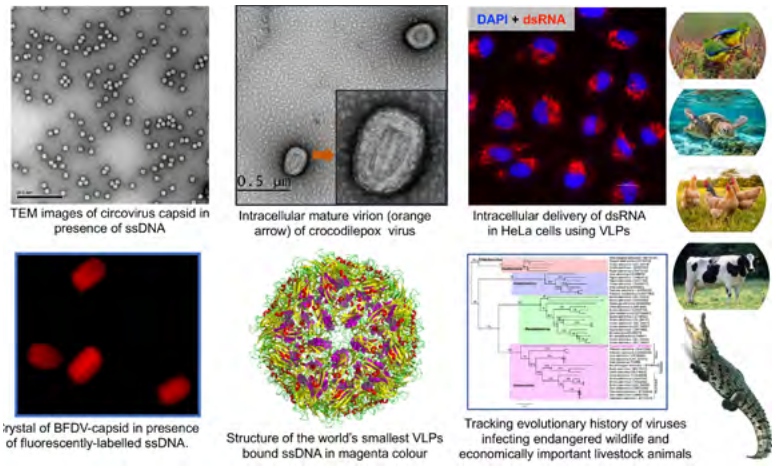
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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 discover and characterise unknown viral pathogens in animals. 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 threatened animals.

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

Project 1: Spotty liver disease (SLD) causes substantial egg production losses and chicken mortality; therefore, it is a disease that concerns Australian egg farmers. Over the last few decades, much research has been conducted to determine the etiologic agents of SLD and to develop therapeutics; however, SLD remains a major issue for the chicken industries globally and remained without the elucidation of potentially multiple pathogens involved. To help fill this gap, this proposed project is aimed at understanding the viral diversity in various organs of chicken and their relatedness to spotty liver disease in egg-laying chickens.

Project 2: 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 diagnostic tools for BFDV. Therefore, this proposed project is aimed at developing an enzyme-linked immunosorbent assay (ELISA) for the detection of antibodies against BFDV.



TEM images of circovirus capsid in presence of ssDNA

Intracellular mature virion (orange arrow) of crocodilepox virus

Intracellular delivery of dsRNA in HeLa cells using VLPs

rystal of BFDV-capsid in presence of fluorescently-labelled ssDNA.

Structure of the world's smallest VLPs bound ssDNA in magenta colour

Tracking evolutionary history of viruses infecting endangered wildlife and economically important livestock animals

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I'm ready to apply! »

Dr. Jennifer Wood
Bundoora

Ecological assays

Gene expression analyses (PCR assays)

Next generation sequencing

Bioinformatics

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Website: click here

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

The Applied and Environmental Microbiology harnesses the power of Next Generation Sequencing to understand the ecology and function of microbiomes associated with plant, human, and ecosystem health. The AEM group is co-led by Prof Ashley Franks and Dr Jennifer Wood. The lab's environmental research stream, led by Dr Wood, is pioneering the use of functional traits for understanding soil ecology with a focus on promoting plant productivity and ecosystem diversity. Current projects on offer include:

Project 1. Soil microbial recovery after wildfire and its impact on ecosystem function. The recovery of microbial communities within the soil after a wildfire is crucial to the recovery of other organisms such as plants and animals, particularly in the fire-prone Australian ecosystem. However, because wildfires pose significant risk to human settlement, the wildfire management technique known as prescribed burning is performed to reduce wildfire risk. Wildfire and prescribed burning differ considerably regarding seasonal occurrence, soil moisture and fire intensity. This project will focus on understanding how bacterial and fungal communities recover after wildfire versus prescribed burning and the impact on soil function. The student will analyse next-generation sequencing data from soil that has been experimentally brunt to simulate wildfire and prescribed burning. The student also will develop their own original soil burning experiment to further this research, with scope to focus on soil functional assays, molecular assays or omics techniques as appropriate to the research question.

Project 2. Hair waste as a soil supplement for gardens. Organic waste in landfills generates, methane, a potent greenhouse gas. Composting wasted organics benefits the environment by significantly reducing methane emissions while creating a product that can be used in agriculture to improve soil health and productivity. Human hair waste generated by barbershops typically would be disposed of at waste sites and landfill. Previous research has shown that clippings of human hair contains extremely high nutrient value which, when utilized and mixed with potting mix soil, will produce a higher quality plant food and soil enhancer than what is currently on the market. This project will investigate the use of human hair as a green fertilizer and the microbial ecology associated with its decomposition. The student will develop pot trials comparing different strategies for composting human hair. Soil microbial communities will be examined using next-generation sequencing and the impact on soil health and plant growth will be assessed.

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I'm ready to apply! »

Dr. Richard Fernandez
Bundoora

Anatomical dissection

Anthropometic measurements

CT analysis

Whole organism bioimaging

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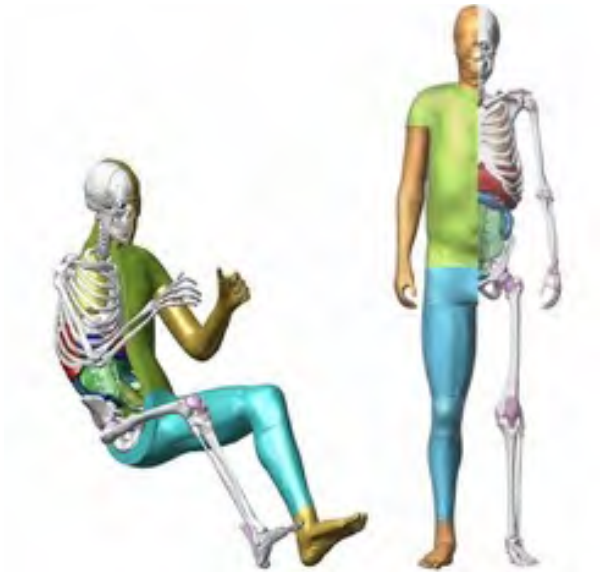
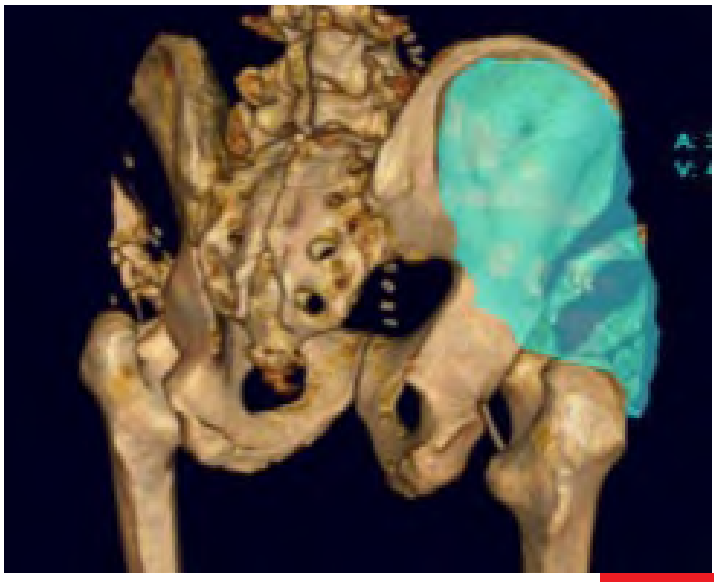
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Potentially**

The anatomy and impact biomechanics laboratory is a new and upcoming lab that focuses on the application of anatomical, anthropometric and biomechanical techniques to investigate injury prevention strategies. Ongoing research concentrates on hip fracture prevention, particularly developing anatomical and biomechanical specification for hip protectors. New research is looking into injury prevention in Motor Vehicle Accidents (MVA) and using anatomical and geometric techniques to develop new data to assist with forensic identification of skeletal remains. Our anthropometric studies have quantified variations in bony and soft tissue anatomy and morphometric maps have been developed 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 had 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 laboratory uses an array of anatomical techniques from human cadaveric dissection, anthropometric measurements and computer tomographic (CT scan) 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 so they can behave more realistically during simulations of biomechanical impacts.



Project. The Honours project offered for 2023 will investigate anatomical variations of the lateral hip region to influence hip protector positioning. This will involve taking measurements on living subjects, human skeletal analysis . Research may also include cadaveric dissection and computed tomography (CT) scan analysis.

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I'm ready to apply! »

Dr. Brooke Huuskes
Bundoora

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

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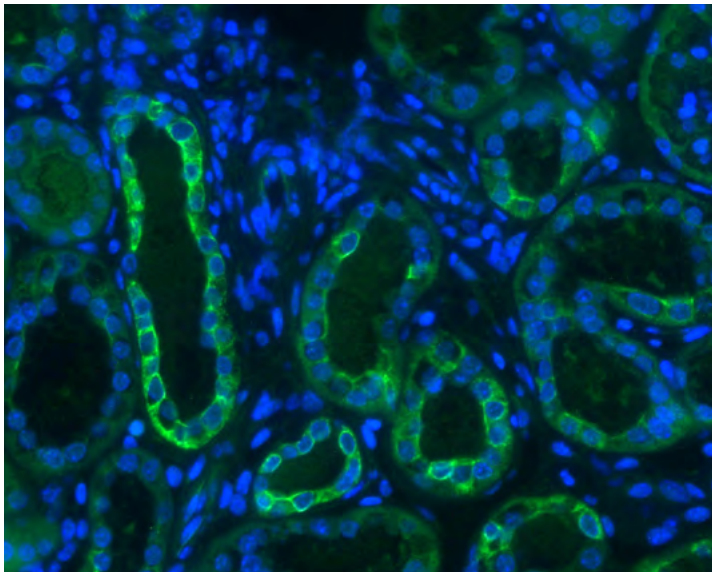
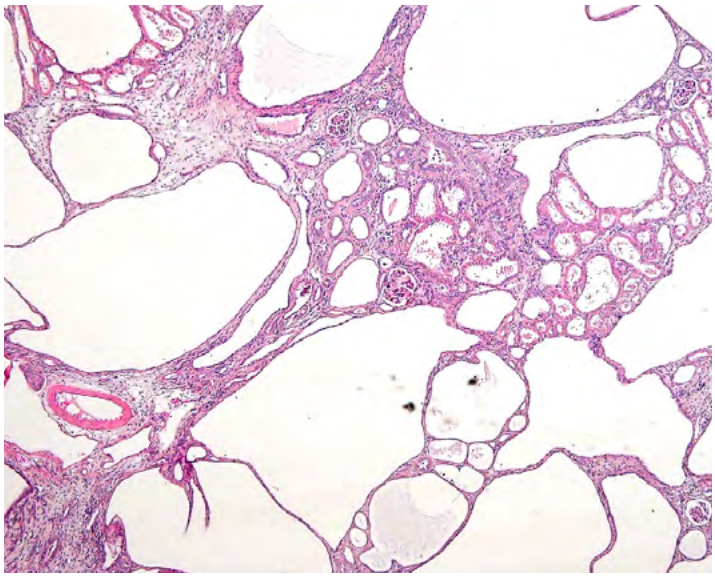
Website: click here

Number of projects: **3**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **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

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I'm ready to apply! »

Dr. James Bell
Bundoora

Cell culture - eukaryotes incl. primary & cell lines

Protein biochemistry (SDS-PAGE, western blotting)

Animal models of disease

Histology

Light microscopy

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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**

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

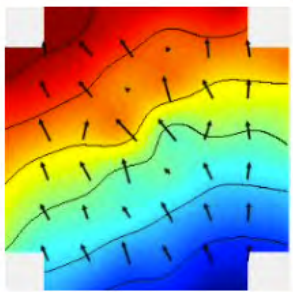
The lab has two primary research themes – specifically, the pathological influence of 'heart fat' as an emerging mediator of heart disease and the role of sex and sex steroids in determining heart health. The fat immediately surrounding the heart increases markedly in obesity, with aging, and post-menopause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

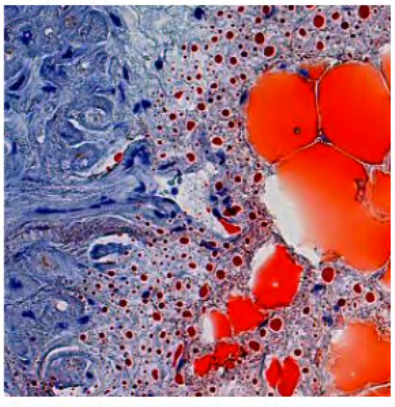
Honours projects include:

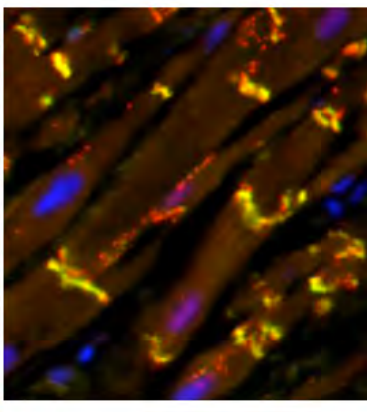
Project 1: Showing how a fatty heart drives cardiac pathologies

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

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







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I'm ready to apply! »

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

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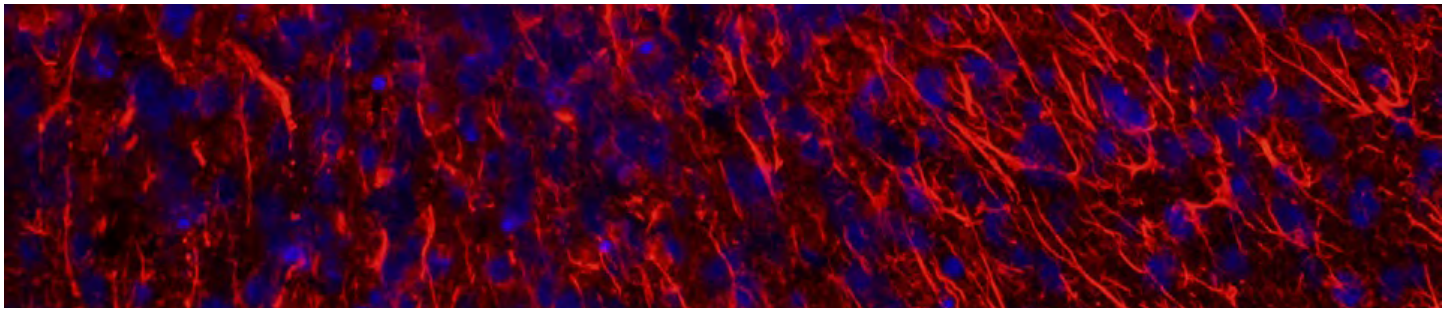
Website: click here

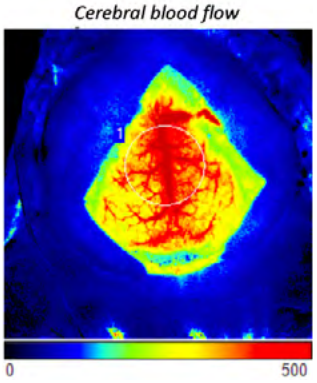
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**



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, anti-fibrotic, 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.



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I'm ready to apply! »

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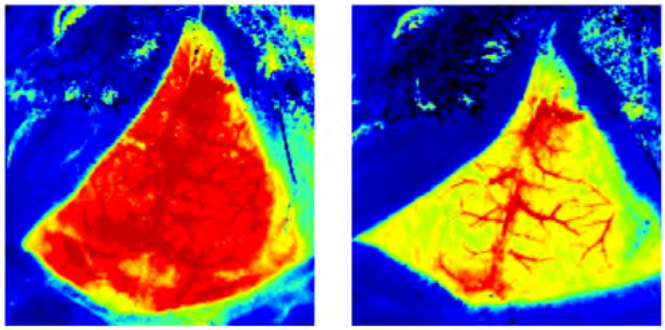
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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 1: Using colchicine to treat vascular dementia. Co-supervisor: Prof Thiruma (Garrie) Arumugam. Inflammation is emerging as a key contributor to the development of vascular dementia. Colchicine is a drug that has been found to target inflammatory pathways that may contribute to vascular dementia. This project will test colchicine as a potential therapeutic in a mouse model of vascular dementia.

Cerebral blood flow after induction of vascular dementia



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I'm ready to apply! »

Dr. Seb Dworkin
Bundoora

Animal handling

Animal models of disease

Zebrafish microinjection

CRISPR-Cas9 gene editing

Genetic sequencing & expression analyses

Microscopy - light, confocal & super resolution

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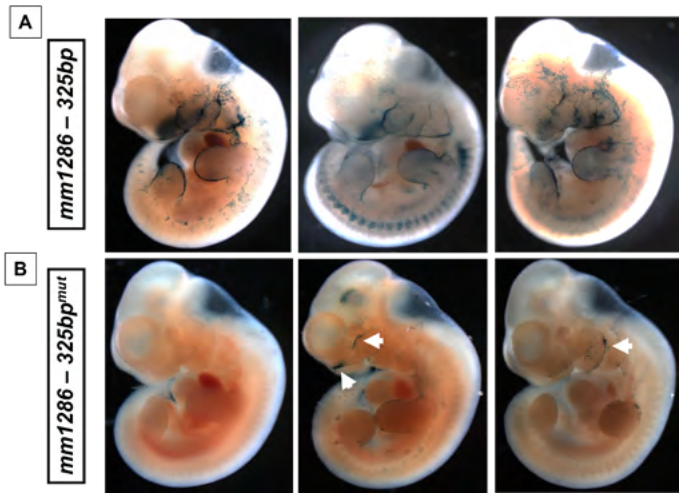
Website: click here

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

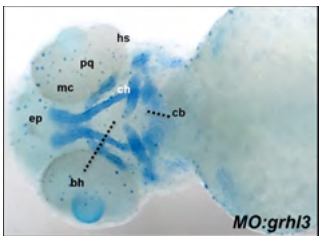
Understanding how a single, fertilised cell develops into an entire, fully functioning baby, is one of the most incredible fundamentals of life. It is also a process across the entire animal kingdom. Amazingly, this process usually works perfectly well - that is, the baby develops without any problems.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

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



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

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



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I'm ready to apply! »

Dr. Maria Jelinic
Bundoora

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

E-mail: m.jelinic@latrobe.edu.au
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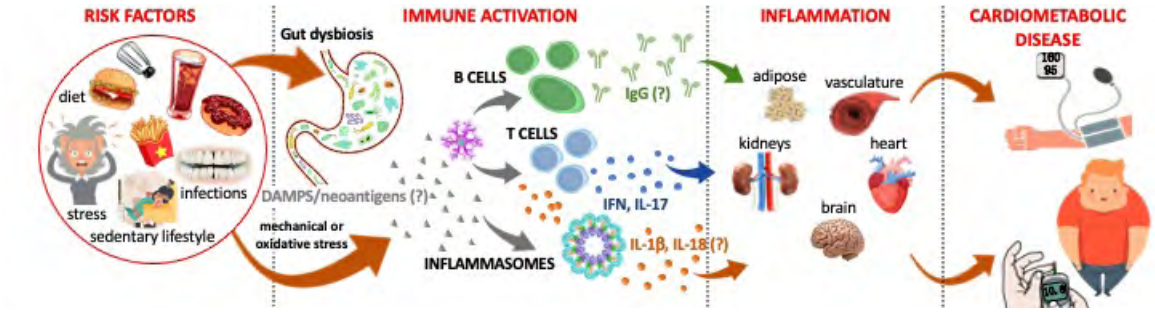
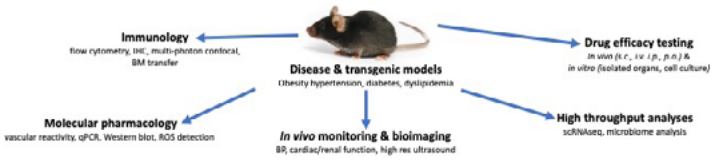
Number of projects: **1**
Full-time or part-time: **Either**
Feb or July start: **Both**
Masters conversion: **Yes**



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.



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I'm ready to apply! »

Prof. Chris Sobey
Bundoora

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

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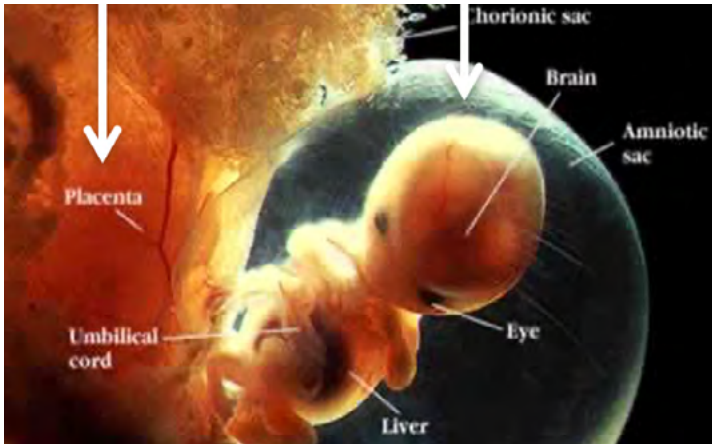
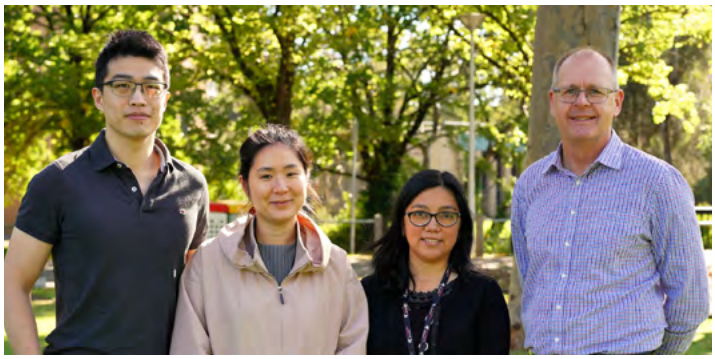
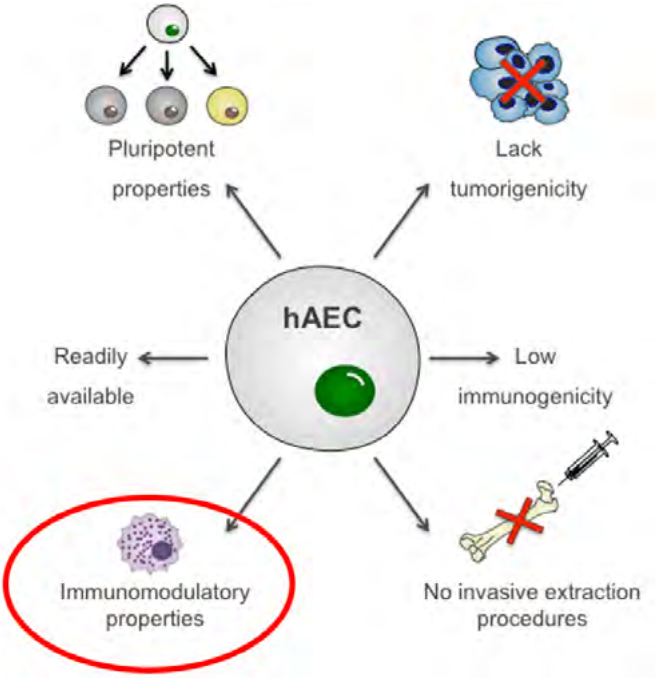
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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







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I'm ready to apply! »

A/Prof. Colleen Thomas
Bundoora

Animal handling

Histology

Animal models of disease

Genetic expression analyses

Zebrafish microinjection

Light microscopy

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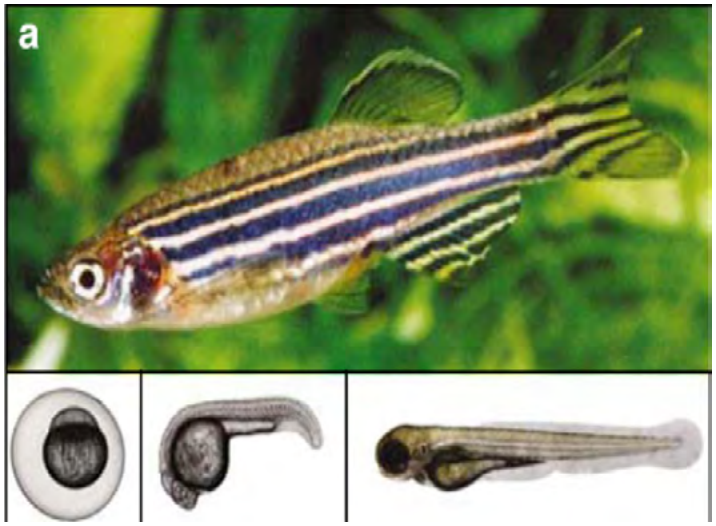
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

Research in this Laboratory 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 and heart failure 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 state-of the art wireless monitoring equipment. We conduct proof-of-concept studies in small animal models to screen and assess the potential of novel interventions/drugs, and large animal models, which have similar anatomy and physiology to humans and are critical to determine efficacy and safety in the translation discovery pipeline from rodents into clinical therapies. Our human studies focus on beneficial clinical outcomes. Functional components of diet to prevent and/or reverse chronic disease - especially cardiovascular disease and diabetes - are also a significant recent focus of this Division (anti-inflammatory and antioxidant mechanisms of action; role in maintaining healthy gut microbiota).



Project: The Nedd4 gene, highly expressed in the neural crest, regulates the formation of numerous organs in the mouse. Our interest lies in the role by which this gene regulates heart development. As congenital heart defects are one of the most common forms of birth anomalies, often persisting into adulthood and contributing to adult-onset heart disease, understanding the genetics of heart development is an important clinical approach to ameliorating the severity of these debilitating conditions. Using the zebrafish as our model, owing to the well-established genetic tools and rapid embryonic development, this project with Dr Seb Dworkin will employ cutting edge technology to identify the role played by Nedd4 in heart formation. This project will employ gene-knockdown, gene-deletion and gene-expression strategies in order to characterise the genetic mechanisms by which Nedd4 exerts its developmental function.

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I'm ready to apply! »

Dr. Chris van der Poel
Bundoora

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

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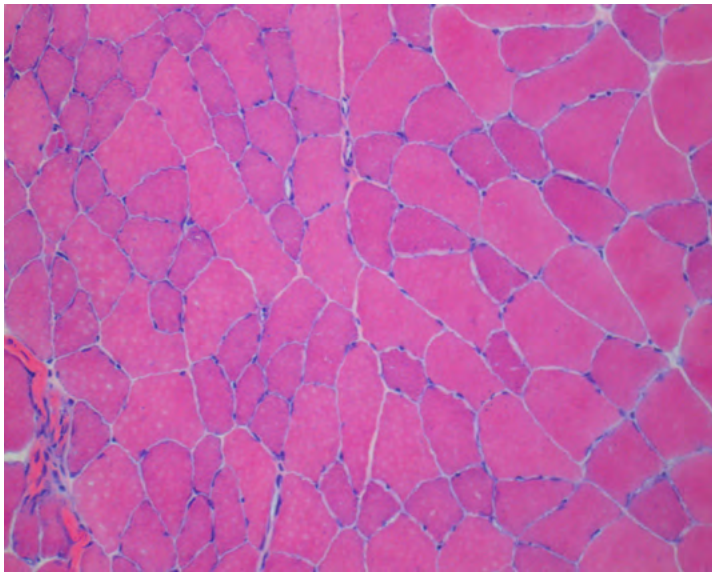
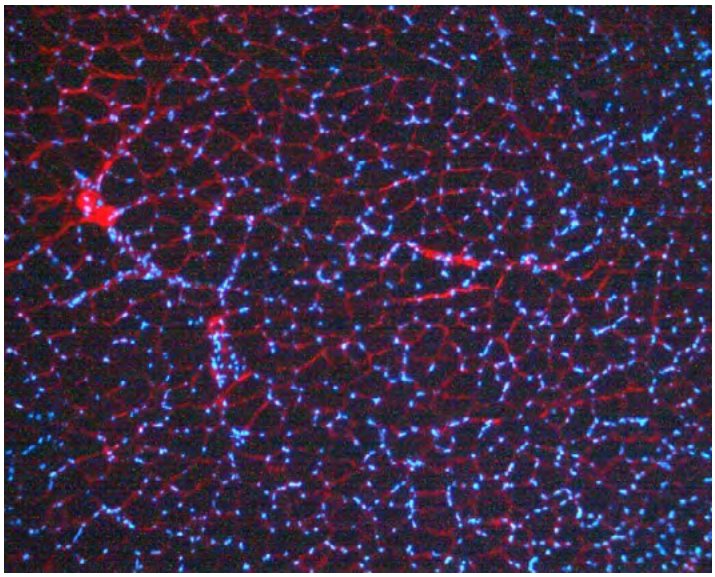
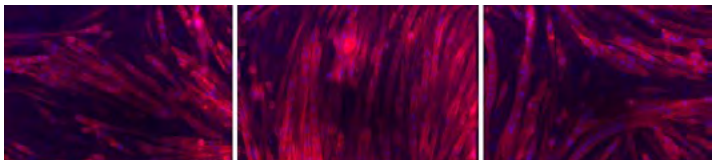
Number of projects: **1**
Full-time or part-time: **Full-time**
Feb or July start: **February**
Masters conversion: **Yes**

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.

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A/Prof. Antony (Bill) Vinh
Bundoora

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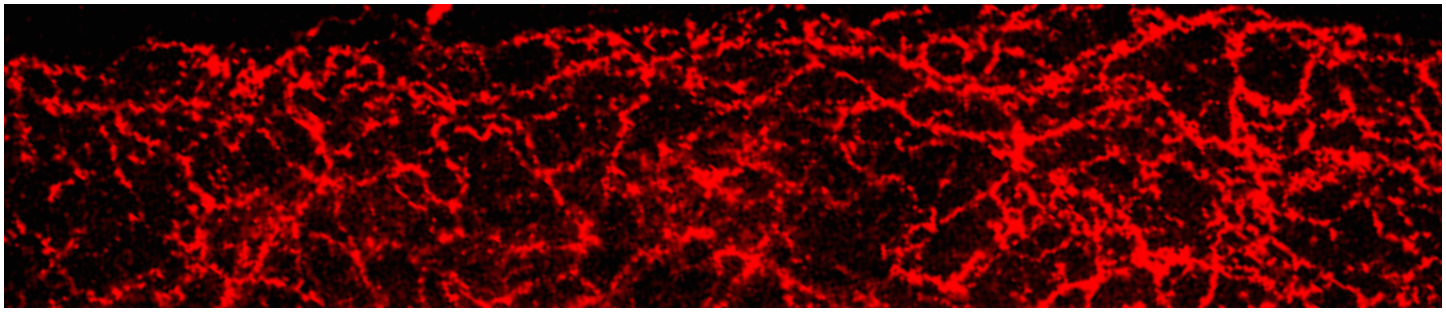
Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **Both**
Masters conversion: **Yes**

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



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.

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I'm ready to apply! »

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 2023. 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 2023. 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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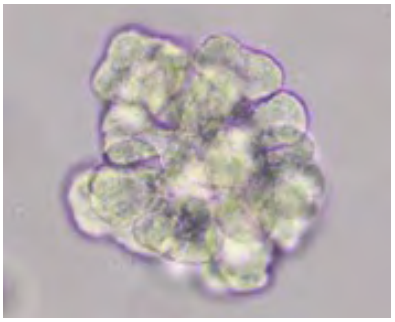
Website: click here

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

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.

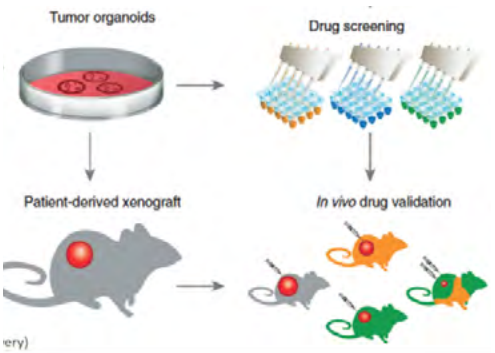
Organoids are three-dimensional (3D) cultures of normal tissue or cancer tissue that can be grown in a droplet of basement membrane that mimics the extracellular matrix of tumours. We are generating a bank of organoids derived from either normal breast tissue or from patients' breast cancer tissue. Their 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).

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I'm ready to apply! »

Dr. Moritz Eissmann
ONJCRI

- Cancer
- Animal models of disease
- Mammalian cell culture
- Protein biochemistry
- 3D cell culture
- Flow cytometry
- CRISPR-Cas9 gene editing
- Computational/*in silico* analyses

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

Our laboratory investigates the role of the tumour microenvironment in gastro-intestinal cancer formation, progression, and therapy resistance. We are especially interested in the crosstalk between cancer cells and immune and stromal cells present in stomach and colon cancers, and how they change the responsiveness to therapies such as chemotherapy as well as immunotherapy is a focus of our research. We employ a wide variety of standard to cutting-edge biochemical, molecular, and genetic assays in our research. To advance our translational investigations we utilize in vitro cultures of primary cancer cell, organoids and cell lines as well as generate and employ advanced genetically modified mouse models for gastro-intestinal cancer.

Project 1. Improving immunotherapy responses against gastric cancer. In this project you will use organoid primary cell cultures and unique gastric cancer mouse models to test the efficacy of combination immunotherapy in combination with targeted therapies against advanced and metastatic gastric cancers.

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A/Prof. Erinna Lee
ONJCRI

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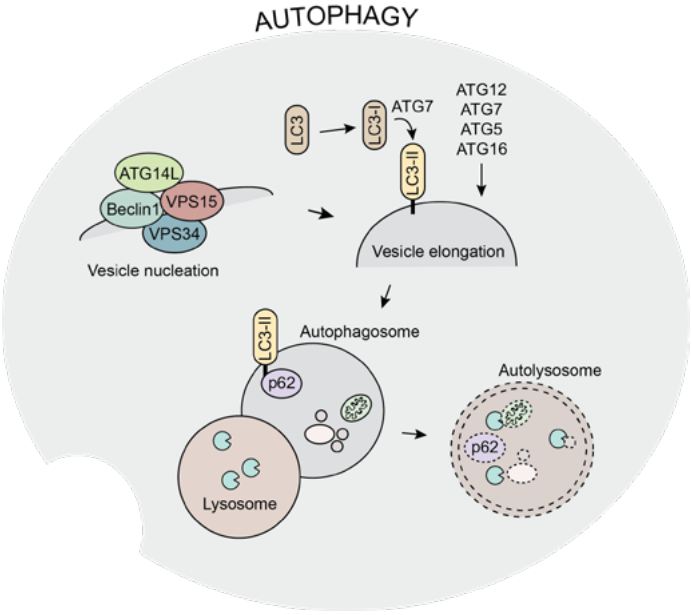
Website: click here

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

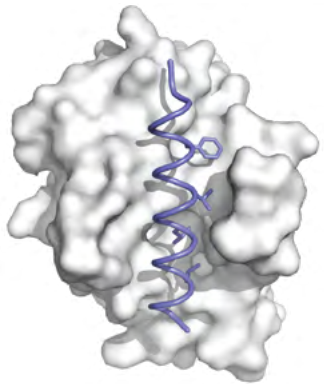
- Cancer
- Cell culture - eukaryotes incl. primary & cell lines
- Molecular cloning & CRISPR-Cas9 gene editing
- Cell transfection
- Protein biochemistry
- Flow cytometry

Our cells are constantly making decisions whether it is better to live or die in the context of the overall wellbeing of the organism. When this decision-making process goes awry, diseases such as cancer ensue. The Cell Death and Survival lab, based at the ONJCRI, are interested in understanding the molecular machineries that controls cell death and survival and how this leads to diseases such as cancer when it becomes dysfunctional. In turn, information on these control mechanisms reveal potential avenues by which we can help treat such pathologies. Indeed, our team has a strong background in the translation of basic discoveries into clinically applicable approaches, and work with multiple industry partners to achieve this.

This Honours project focusses on our cellular recycling program known as autophagy. Autophagy enables the removal of unwanted or deleterious material (e.g. damaged organelles, pathogens) by encapsulating these within vesicles for delivery to the lysosome for degradation. As a consequence, this process generates essential building blocks such as amino acids to help the cell survive and recover. Not unexpectedly, blocks in the autophagy pathway can lead to cell death, such as by apoptosis. Understanding how these two important cellular processes interconnect with each other is not only of biological interest, but also can inform new approaches to trigger cell death or enhance cell survival therapeutically.



Project. Identifying novel regulators of the crosstalk between cell survival and cell death (co-supervised by A/Prof. Doug Fairlie, doug.fairlie@onjcri.org.au). A key inducer of autophagy is the protein Beclin1. Removal of Beclin1 in cells leads to eventual apoptotic cell death. This exciting project aims to characterise and validate candidates that mediate the crosstalk between Beclin1-mediated autophagy and apoptosis identified from a genome-wide CRISPR screen.



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

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I'm ready to apply! »

Prof. John Mariadason
ONJCRI

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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**:

- 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

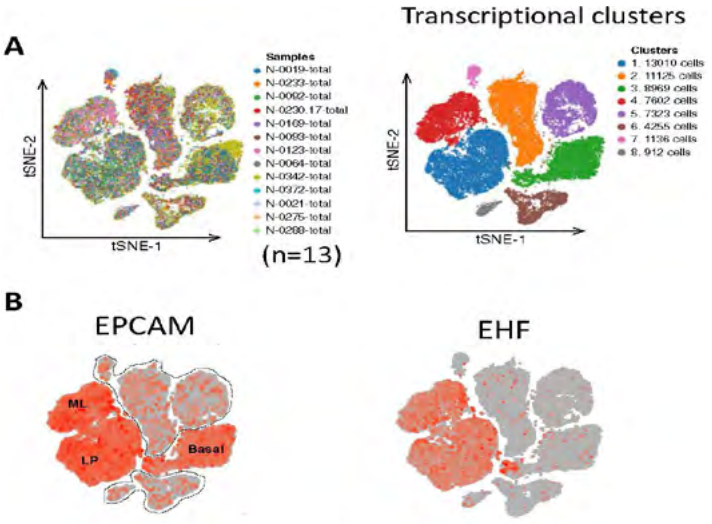
Our team is looking for new ways to treat colon (bowel), breast and liver cancers. We are particularly focused on identifying and targeting major proteins that enable tumour cells to survive in the body, and are testing whether drugs which work in other cancers can be re-purposed for treatment of gastrointestinal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

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

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

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

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



EHF expression in total cells from human breast tissue

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I'm ready to apply! »

Dr. Delphine Merino
ONJCRI

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

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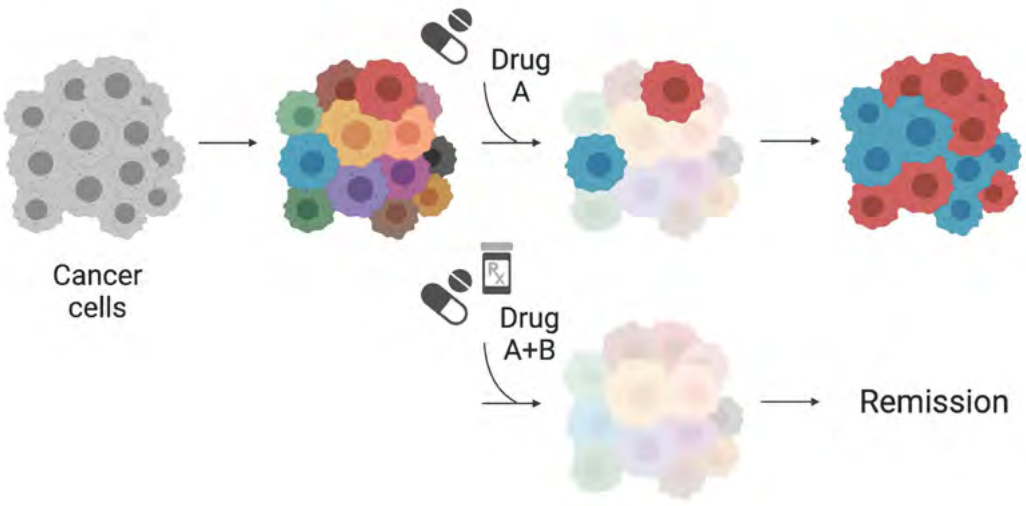
Website: click here

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

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

- 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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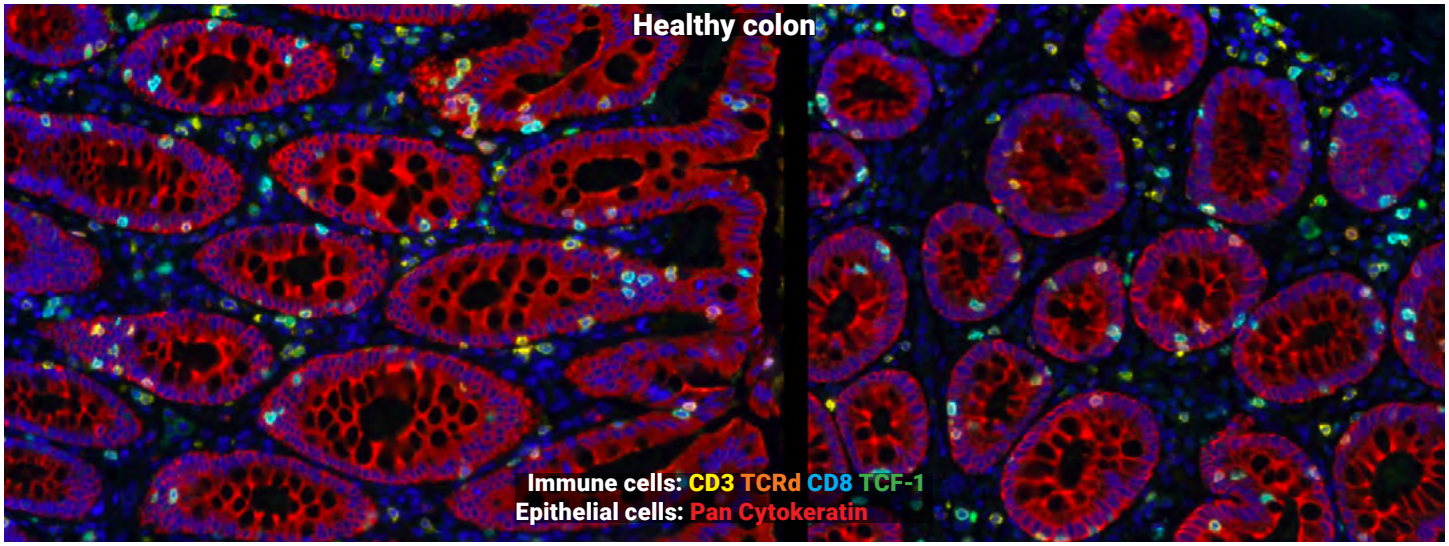
Website: click here

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **1 Feb; 1 July**
Masters conversion: **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.



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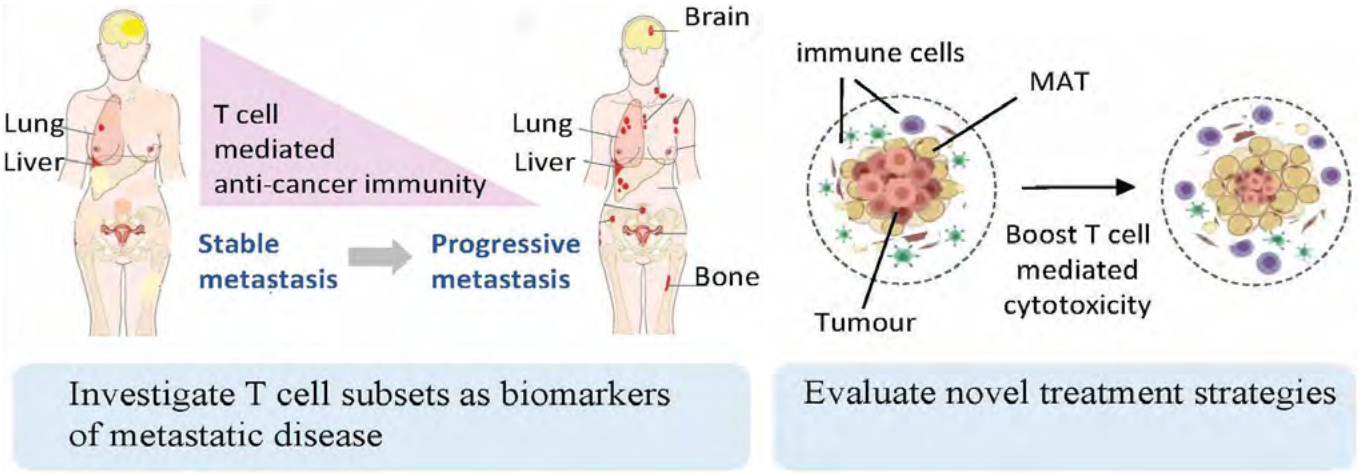
I'm ready to apply! »

Dr. Bhupinder Pal
ONJCRI

E-mail: Bhupinder.pal@onjcri.org.au
Website: click here

Number of projects: **2**
Full-time or part-time: **Full-time**
Feb or July start: **1 Feb; 1 July**
Masters conversion: **Yes**

- Cancer
- Animal models of disease
- Single-cell genomics
- 3D cell culture
- Mammalian cell culture
- Flow cytometry
- Histology
- Bioinformatics



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.

Cancer patients develop metastasis, where cancer cells spread to multiple organs, including the lung, liver, bone and brain. Our goal is to find a cure for metastatic disease and detect it at an early, treatable stage. The proposed projects are built on exciting discoveries made by our lab and are designed to improve current cancer treatments including immunotherapies. The projects offer the opportunity to learn the latest molecular techniques and study mouse tumour models.

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I'm ready to apply! »

Application Process

Important dates

	February 2023 Entry	July 2023 Entry
Perusal of project booklet; Attend information sessions; Interviews with potential research supervisors	**Semester 2, 2022**	**Semester 1, 2023**
Submission of "SABE Honours Application Form" to School Honours Coordinator	**6th November 2022 (Semester 2 exam period)**	**4th June 2023 (end Semester 1 SWOT Vac)**
Submit online application to La Trobe University via ApplyDirect	**by 3rd December 2022**	**by 18th June 2023**
Formal cut-off for all applications (no exceptions)	**22nd January 2023**	**25th June 2023**
Start of Honours	**Week of 30th January 2023**	**Week of 3rd July 2023**

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. Steve Petrovski
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.

Prof. Jason Dutton
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 13-15.
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.

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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 112).
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

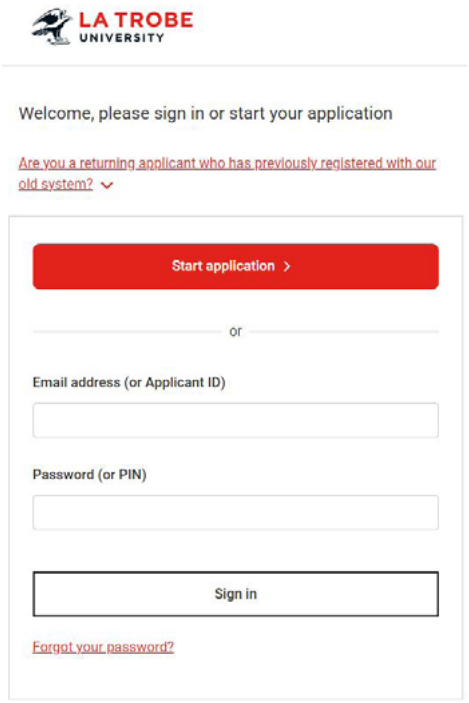
1. **After you have had one-on-one meeting(s)** with research supervisor(s), you can identify up to eight you would like to be considered for ranked entry.
2. You must complete the "SABE Honours Application Form" and complete Option B. The form can be downloaded by clicking on this link.
3. The completed form needs to be emailed to the SABE Honours coordinator by the cut-off date (see page 112).
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.



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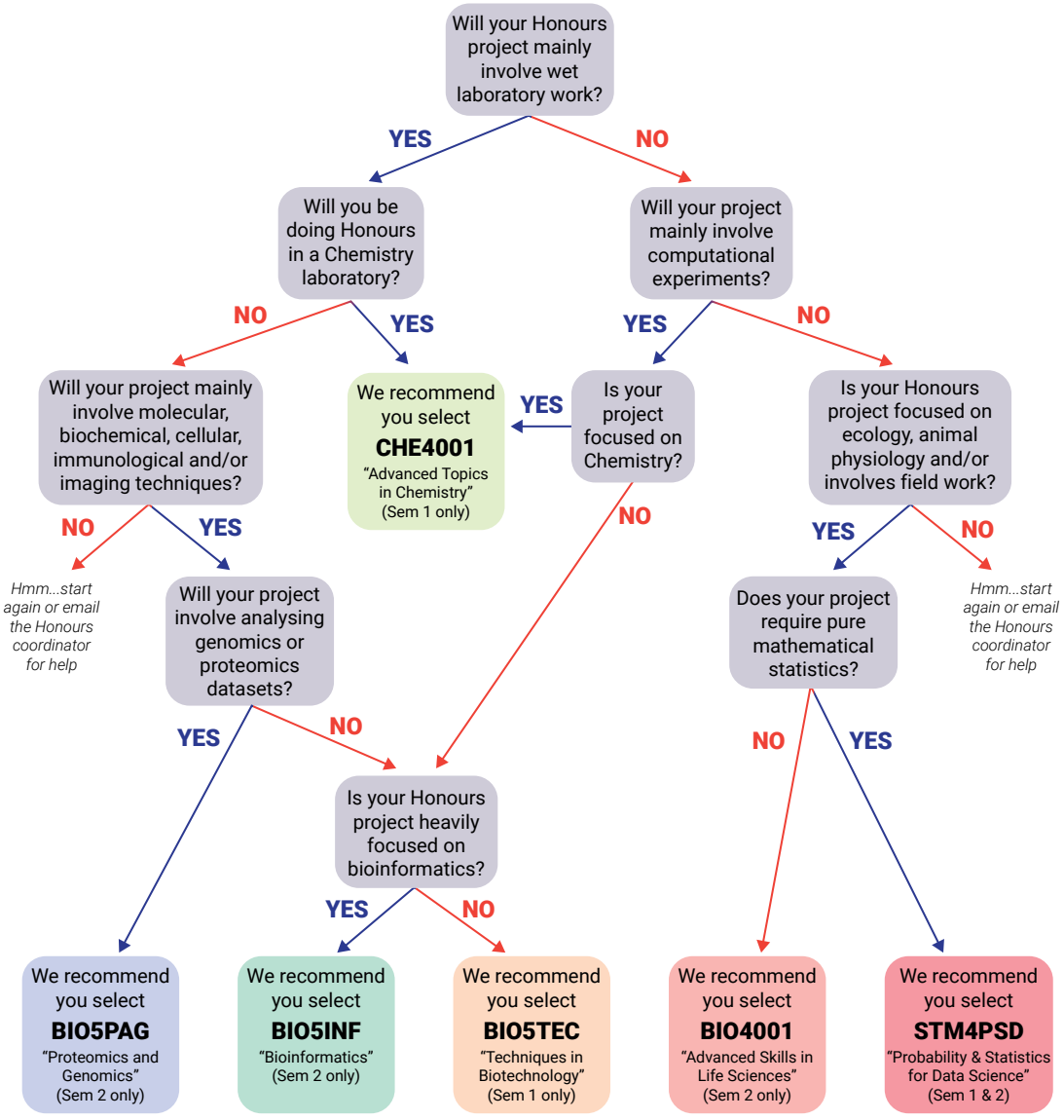
Study plans

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.

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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, 2023	Research subject A (15CP) Research subject B (15CP)	SCI4001 (15CP) Elective coursework (15CP) *(e.g. BIO5TEC/CHE4001)*
Sem 2, 2023	Research subject C (30CP) Research subject D (30CP)	

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

	Research	*Coursework*
Sem 1, 2023	Research subject A (15CP) Research subject C (30CP)	SCI4001 (15CP)
Sem 2, 2023	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, 2023		
Sem 2, 2023	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, 2023		
Sem 2, 2023	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, 2023	Research subject A (15CP)	SCI4001 (15CP)
Sem 2, 2023	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, 2023	Research subject A (15CP)	SCI4001 (15CP)
Sem 2, 2023	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, 2023		
Sem 2, 2023	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, 2023		
Sem 2, 2023	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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