Federation University

Institute of Innovation, Science and Sustainability

Bachelor of Science Honours Projects (SZ8)

&

SCCOR3001 - Research Projects

2026

Contact our Supervisors:

Students are encouraged to contact our supervisors to discuss projects, arrange a time to visit their lab and view our facilities.

Simply email the supervisor to arrange a time…..

Step 1: ***Find a Project and Supervisor***

Step 2: ***Apply for Honours***

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Information on how to enrol

Institute of Innovation, Science and Sustainability

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SCCOR3001 – Research Project Elective

In SCCOR3001, students will undertake a supervised research project involving research of a publishable standard which forms the basis of a final report presented at the end of the unit. A prerequisite for enrolment in this undergraduate unit is successful completion of two years full time equivalent of a Science-based degree.

SCCOR3001 is designed for students enrolled in Science Course to extend individual and independent learning skills. The course will explore current scientific problems in relevant fields of research. As part of the course, students are trained to develop a project with defined objectives, collate, evaluate, critically interpret experimental data using statistical analysis and communicate their results scientifically.

This Information Booklet contains a listing of Research projects that are suitable for BSc Honours and may be adapted for SCCOR3001 Research Project students in 2026. Note that this is not a complete list of available projects for 2026, so students are encouraged to directly contact academic staff to discuss possible projects.

Students interested in undertaking SCCOR3001 in Semester 1 or Semester 2 in 2026 should contact an academic supervisor (one of your lecturers or a contact listed in this booklet) who can provide guidance around a suitable project for you to undertake. More information is also available from the **SCCOR3001 Unit coordinator Dr Yutang Wang:** yutang.wang@federation.edu.au.

Bachelor of Science Honours

Students who excel in their undergraduate degree are eligible to apply for entry into the Bachelor of Science Honours program. Honours is an intensive research-based program requiring an extra year of full-time study (or 18 months part-time study) on top of your undergraduate degree.

What is Honours?

The Bachelor of Science Honours course (SZ8) is an additional fourth year of Undergraduate studies, completed over 9 months full-time (FT), or 18 months part-time (PT). The main objective of the program is to train students as professional research scientists.

Honours students engage in an individual research project under the close supervision of an academic staff member with relevant expertise in their chosen field. Students also complete theoretical coursework designed to complement their research and develop key skills in communication, critical analysis and project management, equipping them for independent research roles in the workplace or for entry into postgraduate research programs.

For more program information and link for application, please visit the Federation University Course Finder.

Why complete an Honours year?

For some students completing Honours is the first step towards building an academic research career and pursuing post graduate study. However, completing an Honours year also offers many benefits to those looking to boost their marketability in an increasingly competitive job market.

Honours gives you the opportunity to:

- Get experience in real scientific research
- Extend your knowledge in a specialist field of interest
- Contribute new knowledge to your field (with possibility of publication)
- Develop workplace skills attractive to employers
- Use advanced techniques and equipment and broaden your technical skill set

BSc Honours can be challenging, with a level of independence expected of students representing a significant change from previous undergraduate courses. However, most students find that their Honours year is an extremely rewarding experience.

The BSc Honours Research projects are available in the following discipline areas: Biomedical Science; Environmental Science; Environmental Sciences; Mathematical Sciences; Food Science; Information Technology; Science; Veterinary and Wildlife Science.

For further information on the **Bachelor of Science Honours Course**, feel free to contact the **SZ8 Science Honours coordinator** at your campus:

Berwick Campus
A/Prof Rob Bischof
r.bischof@federation.edu.au
(03) 4313 7930

Gippsland Campus
Dr David Smith
d.smith@federation.edu.au
(03) 5122 6023

Mt Helen Campus
Dr Nicholas Shultz
n.schultz@federation.edu.au
(03) 5327 9681

How to apply for Honours

As a guide, qualification for the BSc Honours Course generally requires students to have a GPA > 6.0 (or equivalent) in a relevant undergraduate degree, and the support of an academic supervisor. Students with a GPA < 6.0 are nevertheless encouraged to discuss options with their proposed supervisor, who may endorse your application for entry into the BSc Honours Course.

Part of completing the Online Application for entry to the Bachelor of Science (Honours) SZ8 course will require students to provide an outline of their intended research project, which will need to be co-signed by their chosen supervisor(s).

Step 1 Find a Project and Supervisor

The following link provides an introduction and scope of research available to students interested in applying for BSc Honours in 2026: Bachelor of Science Honours within the Institute (IISS).

You can also contact academic staff working in areas that interest you directly and ask them if they would consider supervising you.

This Information Booklet contains a listing of Research projects suitable for Honours students in 2026. Note that this is not a complete list of available projects for 2026, so students are encouraged to directly contact academic staff they are interested in working with to discuss possible Honours projects.

It is a good idea to talk to a number of prospective supervisors to assess whether their research focus aligns with your interests and whether you feel you could work well with their research group. If possible, talk to other students in the group or past students who have worked with them as well.

Some questions to help you refine what you want to work on:

- What aspects of your undergraduate degree have you found most interesting?
- Which courses did you enjoy the most?
- What topics or issues did you wish you could have studied in more depth?
- Which academic staff had a teaching style that you liked in undergraduate courses?
- Which academic staff are working in areas that interest you?

Step 2: Apply for Honours

FedUni students can complete an Online Application for entry into the BSc Honours Course (SZ8): this online application will request evidence of prior studies and requires you to fill in the Honours Research Proposal Form.

Students wanting to enrol in BSc Honours at FedUni, who completed their undergraduate degree elsewhere should contact the relevant **Science Honours Program Coordinator** to discuss eligibility requirements.

Closing date for Applications for entry into BSc Honours for Semester 1 2026 is 17 November 2025.

Step 3: Accept your offer

If you are offered a place in the BSc Honours SZ8 course you will need to formally accept your offer in writing. You should also get in touch with your supervisor to begin discussing any additional requirements (eg ethics approvals, laboratory safety training) for your project prior to starting your research work.

Semester 1 intake typically starts at the beginning of February, Semester 2 intake starts at the beginning of August. Additional discipline-based information sessions may also be run, dates and details to be advised by email to eligible students.

BSc Honours Scholarships

Several University scholarship opportunities may be available for BSc Hons candidates in 2026.

The Institute of Innovation, Science and Sustainability may also provide scholarship support for candidates for the BSc Hons program: details will be available prior to the deadline for Honours applications this year.

Find a Supervisor

Supervisor	Project title
Dr Leigh Achterbosch	Measuring childhood balance and coordination skills using augmented reality exergaming
Dr David Bean	Antibiotic resistance in bacteria from the environment Characterisation of *Staphylococci* from Australian mammals Elucidation of mechanisms of intrinsic polymyxin resistance in Gram-negative bacteria Hydration of yeast in brewing: adding value or unnecessary risk? Isolation and characterisation of yeasts from spontaneously fermented Victorian beer products Making a truly Australian beer: searching for native yeasts Thermal stress resistance of *Salmonella* in chocolate Micro v Macro: The role of macrophages in immunity to bacteria and evasion tactics used by *Salmonella*
Prof Stuart Berzins	Unconventional T cell Function in Chronic disease Age-related changes in immunity to vaccines
A/Prof Rob Bischof	Functional and phenotypic characterisation of airway macrophages Testing of novel therapeutics for the treatment of lung disease Understanding the lung microbiome in health and disease Prevalence and detection of *Mycoplasma ovipneumoniae* in Victorian sheep flocks and abattoirs Galectin 3 and 9 molecules from worms as new treatments for inflammatory diseases
Dr Habtamu Derseh	Functional and phenotypic characterisation of airway macrophages Testing of novel therapeutics for the treatment of lung disease Prevalence and detection of *Mycoplasma ovipneumoniae* in Victorian sheep flocks and abattoirs Microplastics in the environment
Dr Meagan Dewar	Microcontaminant impact on the microbiome of Victorian penguin populations
Prof Singarayer Florentine (Florry)	Habitat specificity and competitive traits of Australian acacias invaded to natural landscapes in Asia Pacific: a global review Investigating Plant Traits in the Climate Future Vegetation Plots – Dandenong, Knox and Maroondah
Dr Rebecca Gehling	Chemical compounds present in designer drugs previously known as 'legal highs' Chemical profiles of non-alcoholic fermented kombucha beverages Monitoring wastewater for the presence of emerging synthetic designer drugs of abuse Microplastics in the environment Bioaccumulation and effect of emerging contaminants in the environment
Dr Bill Grant	Effects of composting on organic carbon fractions

Dr Alison Green	Microplastics in the environment Monitoring wastewater for the presence of emerging synthetic designer drugs of abuse
A/Prof Andrew Greenill	Antibiotic resistance in bacteria from the environment Understanding the lung microbiome in health and disease Chemical and sensory analysis of Eucalyptus honey meads Hydration of yeast in brewing: adding value or unnecessary risk? Making a truly Australian beer: searching for native yeasts
A/Prof Muhammad Imran	Leveraging IoT Technology to Monitor and Model Plant Growth Responses to Climate Change in Australia Investigating Cybersecurity Adoption for Australian Small and Medium Enterprises (SMEs) Investigating Adoption of Generative AI in Australian SMEs from a Cybersecurity Risk Perspective
Prof Joarder Kamruzzaman	Investigating Cybersecurity Adoption for Australian Small and Medium Enterprises (SMEs)
Prof Gour Karmakar	Investigating Adoption of Generative AI in Australian SMEs from a Cybersecurity Risk Perspective
Dr Apurv Kumar	Developing high-value renewable energy electrodes by upcycling waste carbon Producing hydrogen from wastewater: Identifying organic compounds for value-added electrolysis
Dr Benjamin Long	Microplastics in the environment Microcontaminant impact on the microbiome of Victorian penguin populations Bioaccumulation and effect of emerging contaminants in the environment The Bush Medicine Project - Investigation of bioactive compounds in plants used in Indigenous Australian traditional medicine practices of south-eastern Australia Producing hydrogen from wastewater: Identifying organic compounds for value-added electrolysis
Dr Grant Meredith	Implementing AR into student nursing learning Virtual Reality English language training
Dr Ashley Olson	Exploring fossorial reptile diversity at Nanya arid-zone research station The influence of physiological performance on habitat selection by the banded velvet gecko, *Oedura cincta*, at Nanya Station Drivers of functional turnover and nestedness among Australian reptile communities Wildlife conservation and management - Wilsons Promontory National Park
Dr Grant Palmer	Understanding the habitat requirements of the squirrel glider population in the Northern Gariwerd/Grampians region
Prof David Piedrafita	Functional and phenotypic characterisation of airway macrophages Testing of novel therapeutics for the treatment of lung disease Understanding the lung microbiome in health and disease Prevalence and detection of *Mycoplasma ovipneumoniae* in Victorian sheep flocks and abattoirs Commercial feasibility of molecular tests for accurate diagnosis of *Haemonchus contortus* nematode infections in livestock Targeting saliva antibodies as a diagnostic test to detect encysted stages of small strongyle (cyathostomin) infection in horses

Dr Sarah Preston	Understanding the lung microbiome in health and disease Post release tracking of Echidnas, Koalas and Birds of Prey Released from Ballarat Wildlife Hospital Commercial feasibility of molecular tests for accurate diagnosis of *Haemonchus contortus* nematode infections in livestock Targeting saliva antibodies as a diagnostic test to detect encysted stages of small strongyle (cyathostomin) infection in horses Galectin 3 and 9 molecules from worms as new treatments for inflammatory diseases
Dr Jess Reeves	Ecology and Water Chemistry of the Morwell Wetlands Living Bung Yarnda (Lake Tyers) environmental stewardship plan Social Capital for Sustainable Farming
Ms Sharon Reid	Exploring fossorial reptile diversity at Nanya arid-zone research station The influence of physiological performance on habitat selection by the banded velvet gecko, *Oedura cincta*, at Nanya Station Wildlife conservation and management - Wilsons Promontory National Park
Dr Alicia Reynolds	Bioaccumulation and effect of emerging contaminants in the environment Chemical compounds present in designer drugs previously known as 'legal highs' Chemical profiles of non-alcoholic fermented kombucha beverages Developing bio-degradable membranes to replace Nafion-based proton conduction membranes in hydrogen fuel cells Developing high-value renewable energy electrodes by upcycling waste carbon Developing nano-structured carbons for CO_2 gas adsorption properties Effects of composting on organic carbon fractions Effects of oxidation conditions on humic and fulvic acids Chemical and sensory analysis of Eucalyptus honey meads Monitoring wastewater for the presence of emerging synthetic designer drugs of abuse Producing hydrogen from wastewater: Identifying organic compounds for value-added electrolysis Synthesis and catalytic properties of metal nanoparticles supported on processed lignite and other upcycled carbon supports
Dr Zil a Rubab	Comparative molecular characterization of eukaryotic genomic signatures from sheep blood and human oral rinse using biochemical and bioinformatic approaches Effect of time-restricted feeding on endogenous clock gene expression and polymorphism patterns in mice: implications for the reversal of type 2 diabetes Clock gene expression in oral rinse samples of healthy individuals: a non-invasive marker of circadian metabolic health
Dr Nick Schultz	Bioaccumulation and effect of emerging contaminants in the environment Making a truly Australian beer: searching for native yeasts Investigating Plant Traits in the Climate Future Vegetation Plots – Dandenong, Knox and Maroondah
A/Prof Surbhi Sharma	Developing bio-degradable membranes to replace Nafion-based proton conduction membranes in hydrogen fuel cells Developing high-value renewable energy electrodes by upcycling waste carbon Developing nano-structured carbons for CO_2 gas adsorption properties Producing hydrogen from wastewater: Identifying organic compounds for value-added electrolysis Synthesis and catalytic properties of metal nanoparticles supported on processed lignite and other upcycled carbon supports

Dr David Smith	Authenticating the quality of foods and beverages through colorimetric analysis Chemical and sensory analysis of Eucalyptus honey meads Data analysis of pollen trends in the Gippsland region
Dr Kushan Tennakoon	Leveraging IoT Technology to Monitor and Model Plant Growth Responses to Climate Change in Australia Habitat specificity and competitive traits of Australian acacias invaded to natural landscapes in Asia Pacific: a global review Application of novel UV-C radiation technology to minimize aquatic weeds and algae impacts in waterways Investigating Plant Traits in the Climate Future Vegetation Plots – Dandenong, Knox and Maroondah Building a strategic framework to inform cultivation and reintroduction methods in the endemic hemi parasitic plant *Exocarpos cupressiformis* (*Cherry Balart*)
Prof Peter Vamplew	Utility-based reinforcement learning
Dr Morgan Wallace	Unconventional T cell Function in Chronic disease Micro v Macro: The role of macrophages in immunity to bacteria and evasion tactics used by Salmonella Age-related changes in immunity to vaccines
Dr Yutang Wang	Comparative molecular characterization of eukaryotic genomic signatures from sheep blood and human oral rinse using biochemical and bioinformatic approaches Effect of time-restricted feeding on endogenous clock gene expression and polymorphism patterns in mice: implications for the reversal of type 2 diabetes Clock gene expression in oral rinse samples of healthy individuals: a non-invasive marker of circadian metabolic health Cardiovascular disease – the leading cause of mortality worldwide

List of Projects

Measuring childhood balance and coordination skills using augmented reality exergaming

Location: Mt Helen
Project Leaders: Dr Leigh Achterbosch
Email: l.achterbosch@federation.edu.au
Project Level: Honours; SCCOR3001

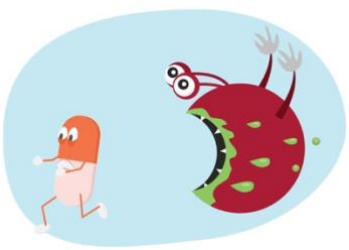
Project description: Augmented Reality (AR) has been used to encourage children to be more active and healthy when designed well and implemented correctly. A previous study at FedUni developed an AR exergame to facilitate such movements and exercise. The results were promising and well received by child participants. As a result many suggestions were given on how to make the proof of concept AR exergame better and more enjoyable to play. Feedback also indicated that more research and development was required in terms of how to measure balance skills and/or coordination skills from a sports science view. This project will involve the refinement of the AR games in terms of gameplay and how to measure balance/coordination points.

Antibiotic resistance in bacteria from the environment

Location: Mt Helen/Gippsland Campus
Project Leaders: Dr David Bean, A/Prof Andrew Greenhill
Email: d.bean@federation.edu.au; andrew.greenhill@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Antibiotic resistance is one of the greatest threats facing human medicine. Only one-third of antibiotics purchased in Australia are used in human medicine, the remainder being for mostly for veterinary and food production purposes. This gives the potential for antibiotic resistance to develop in the environment and eventually be transmitted to humans. This project aims to investigate the burden of antibiotic resistance in the environment and better understand the potential threat to human medicine. Bacteria will be recovered from diverse environment origins: wildlife, veterinary, food production animals and the environment itself, and be tested for the presence of antibiotic resistance. The project will provide important data on antimicrobial resistance in non-medical niches and potentially identify hotspots for the development of resistance in Australia.

Key words: *antibiotic-resistance, E. coli, Salmonella, wildlife*



Characterisation of Staphylococci from Australian mammals

Location: Mt Helen Campus
Project Leader: Dr David Bean
Email: d.bean@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: *Staphylococcus* species are frequently colonizers of the skin and upper respiratory tracts of mammals and birds. There are over forty species of staphylococci described, and some species specificity has been observed in host range: that is the *Staphylococcus* species observed on some animals appear more rarely on more distantly related host species. For example, our research group recently showed a difference in the *Staphylococcal* species carriage between companion dogs (generally *S. pseudintermedius*) and captive dingoes (generally *S. equorum*). This project aims to isolate and characterise staphylococci from other Australian mammals.

Elucidation of mechanisms of intrinsic polymyxin resistance in Gram-negative bacteria

Location: Mt Helen Campus
Project Leader: Dr David Bean
Email: d.bean@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: The rise of antibiotic resistance in pathogenic bacteria is a medical catastrophe – and it's only set to get worse. Bacteria that do not respond to any antibiotics are causing infections with increasing frequency, leaving clinicians few treatment options. One approach has been to re-introduce old, retired antibiotics, such as the polymyxins. The polymyxin drug, colistin, became the last resort drug for treating resistant Gram-negative infections. The use of polymyxin drugs has led to an increase in resistance to these drugs. This project aims to elucidate the molecular mechanisms of intrinsic polymyxin resistance in four organisms: *Hafnia paralvei*, *Aeromonas hydrophila*, *Myroides odoratus*, and *Alcaligenes faecalis*.

Hydration of yeast in brewing: adding value or unnecessary risk?

Location: Mt Helen/Gippsland Campus
Project Leaders: Dr David Bean, A/Prof Andrew Greenhill
Email: d.bean@federation.edu.au; andrew.greenhill@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: There has been great advancements in dry yeasts for the brewing industry in the past 10 – 15 years. Until recently there were relatively few brewing yeast strains available as dry yeast; though now there is a greater range and an increasing acceptance of dried yeast. However, there are still some reservations in some sectors of brewing fraternity, perhaps in part because large breweries have their own yeasts strains thus do not depend on dried yeast. However, amongst many in the craft brewing industry dried yeasts have gained acceptance. Dried yeast has many

advantages over liquid yeast, not the least the storage life of dried yeast. Craft brewing is a key potential market for dried yeast producers.
Beyond acceptability of dried yeast, there remains debate over the need to rehydrate dried yeast prior to pitching. Some manufacturers suggest pitching yeast directly, others recommend rehydrating the yeast first. To add to the confusion, texts and brewing websites (many targeting home-brewers) provide opinions, often conflicting. Currently, decisions are being made on whether to rehydrate yeast before pitching based on opinions rather than data. Moreover, many of the opinions are influenced by dried yeast characteristics of >10 years ago, not on the current product.

The value of rehydrating dried yeast is an important research question. Dried yeast is a highly convenient product; however, the need to rehydrate does detract from that convenience. Moreover, there may be quality risks associated with rehydration, not the least the risk of contamination. This study seeks to determine the value of re-hydrating various strains of brewer's yeast.

Isolation and characterisation of yeasts from spontaneously fermented Victorian beer products

Location: Mt Helen Campus
Project Leader: Dr David Bean
Email: d.bean@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Production of barrel-aged beers is currently a growth sector in Victorian breweries. Many of these rely on spontaneous fermentation: a reliance of native organisms in the environment to inoculate and ferment these products. This project will work with local Victorian breweries to look at the microorganisms present in these products, particularly the yeasts. This will involve isolation of the yeasts and subsequent phenotypic and genotypic characterisation. Population dynamics in active beer ferments may also be explored.

Making a truly Australian beer: searching for native yeasts

Location: Mt Helen/Gippsland Campus
Project Leaders: Dr David Bean, A/Prof Andrew Greenhill, Dr Nick Schultz
Email: d.bean@federation.edu.au; andrew.greenhill@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: While many beers are marketed in a way to embodied the "spirit" of Australia, they all lack one truly native ingredient: an Australian yeast. Like hidden treasure, this yeast remains to be found, somewhere in the Australian bushland. This project seeks to find this hidden gem and includes field work, microbiology, molecular biology and brewing. The research involves going in to the field to sample trees for yeast. *Nothofagus* seems to be the most desirable tree genus for yeast recovery. Yeasts would then be isolated from this environmental material and characterised by DNA sequencing (and maybe running gels). Lastly the usefulness of the recovered yeasts for brewing would be investigated (in small scale and potentially large scale too).

Thermal stress resistance of Salmonella in chocolate

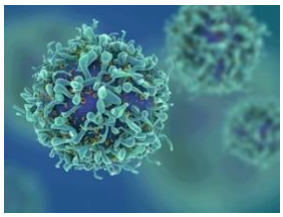
Location: Mt Helen Campus
Project Leader: Dr David Bean
Email: d.bean@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: *Salmonella* is a leading cause of gastroenteritis. Typically, the organism is inactivated by cooking, but in some low water activity foods (chocolate in particular) the thermal resistance of *Salmonella* is enhanced, making it difficult to irradicate the organism. This project aims to elucidate the mechanism behind this increase resistance to heat, and in particular understand the difference heat resistance observed between different *Salmonella* serotypes.

Unconventional T cell Function in Chronic disease

Location: Mt Helen Campus
Project Leaders: Prof Stuart Berzins, Dr Morgan Wallace
Email: m.wallace@federation.edu.au, s.berzins@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: There is growing interest in the function of the immune system and its role in diseases such as COVID-19, cancer and allergies. In many instances, a subset of immune cells called unconventional T cells are abnormal in these patients, but it is unclear whether this is a cause or an effect of the disease development. Unconventional T cells play important immunoregulatory roles by releasing large amounts of cytokines, and thus make attractive therapeutic targets. The function of these cells can be studied through *in vitro* culturing of cells isolated from human blood samples. The cultures can be manipulated to assess the role of immune stimulation and cytokine signals to study their functions following activation. This project will involve tissue culture techniques and flow cytometry to analyse unconventional T cell functions with a goal of identifying new ways to target these cells to treat chronic diseases, such as cancer and autoimmunity.



Key words: *immunology, T cells, immune responses, cancer, viruses*

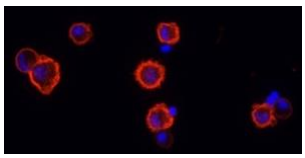
Functional and phenotypic characterisation of airway macrophages

Location: Berwick/Gippsland Campus
Project Leaders: A/Prof Rob Bischof, Prof David Piedrafita, Dr Habtamu Derseh
Email: r.bischof@federation.edu.au; david.piedrafita@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Airway macrophages are prominent immune cells that are known to play an important role in healthy and diseased lungs. Macrophage M1/M2 polarisation and functional differentiation is affected by a range of stimuli,

but we know very little about the 'altered' state of macrophages in the context of airway disease. The aim of these studies is to examine and better understand the characteristics of airway macrophages in healthy and inflamed lung tissues. This project will include immunohistology, microscopy, immunology and cell biology techniques.

Key words: *airway macrophages, inflammation*



Testing of novel therapeutics for the treatment of lung disease

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: A/Prof Rob Bischof, Prof David Piedrafita, Dr Habtamu Derseh
Email: r.bischof@federation.edu.au; david.piedrafita@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Inhaled drug delivery for administration of medications, especially for treating lung-related conditions, is gaining considerable global interest. The inhaled delivery of approved drugs at lower doses and formulated in a different way to those currently being delivered systemically (eg oral) is proposed to be an efficient way to maximise therapeutic drug concentration in the lungs and reduce side effects. This project will use sheep models developed in our laboratory to evaluate the efficacy and therapeutic benefits of drug delivery to the lungs. Several project options will be available, and methods will involve physiology, immunology, and *in vivo* and *in vitro* techniques. Research here will facilitate the development and clinical transition of more effective inhalable therapeutics.

Key words: *lung disease, translational model, sheep*

Understanding the lung microbiome in health and disease

Location: Berwick/Mt Helen/Gippsland Campus
Project Leaders: A/Prof Rob Bischof, Dr Sarah Preston, Prof David Piedrafita, A/Prof Andrew Greenhill
Email: r.bischof@federation.edu.au; sj.preston@federation.edu.au; david.piedrafita@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: It is widely accepted that the lungs contain a small but dynamic endogenous microbial population that plays an important role in normal lung physiology and function. Significant changes in the lung microbiome in response to inflammation and disease is also well recognised, although gaps remain in our understanding of how the lung microbiome, with or without a link to the gut, contributes to lung immunity and health. This project will examine the lung microbiome in healthy and inflamed/diseased lungs using genomics, bioinformatics, and *in vivo* and *in vitro* techniques, with a view to identify novel therapeutic targets for the treatment of lung disease.

Key words: *lung microbiome, airway disease, inflammation*

Prevalence and detection of Mycoplasma ovipneumoniae in Victorian sheep flocks and abattoirs

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: Dr Habtamu Derseh, A/Prof Rob Bischof, Prof David Piedrafita
Email: h.derseh@federation.edu.au
Project Level: Honours

Project description: Pneumonia is a major problem for the Australian sheep industry, costing an estimated $26 million/year. The disease is complex, arising from interactions between the host, pathogens, and environmental factors. Common pathogens associated with ovine pneumonia include *Mycoplasma ovipneumoniae, Mannheimia haemolytica*, and *Pasteurella multocida,* as well as the respiratory viruses parainfluenza virus 3 and respiratory syncytial virus. Among these, *M. ovipneumoniae* is recognised as the primary bacterial agent responsible for pneumonia in sheep. This project aims to determine the flock-level prevalence of *M. ovipneumoniae* in selected farms across Victoria and through abattoir surveillance. Nasal swabs and lung tissue samples will be collected and tested using Mycoplasma-specific PCR to assess the presence and distribution of *M. ovipneumoniae* within the surveyed populations.

Key words: *pneumonia, Mycoplasma, lung disease, sheep*

Chemical compounds present in designer drugs previously known as 'legal highs'

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: Dr Rebecca Gehling, Dr Alicia Reynolds
Email: r.gehling@federation.edu.au
Project Level: Honours

Project description: New psychoactive substances (NPS), previously known as 'legal highs', are any synthetic designer drug that mimics the physical and psychological effects of illicit substances such as MDMA, methamphetamine, LSD and cannabis. Whilst governments continue to add emerging NPS to the list of scheduled compounds, new compounds quickly appear on the market often with very similar chemical structures to those that have already been banned. As new 'legal highs' emerge, it is critical that the active ingredients within these products are identified to ensure they are complying with the law but also to identify any potential psychoactive substances that could cause harm to an individual when consumed. This project aims to identify the active constituents present in a range of readily available 'legal highs' and to determine if these compounds are structurally like their illicit counterparts via Gas Chromatography (GC) and/or High-Performance Liquid Chromatography (HPLC) coupled with Mass Spectrometry (MS).

Key words: *chemistry, forensic science, legal highs, drugs, GC-MS, HPLC-MS*

Chemical profiles of non-alcoholic fermented kombucha beverages

Location: Berwick/Gippsland Campus
Project Leaders: Dr Rebecca Gehling, Dr Alicia Reynolds
Email: r.gehling@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Kombucha is a popular non-alcoholic fermented beverage which has rapidly grown in popularity over the past 30 years. This sweet, fermented drink is believed to have a range of health benefits however there are still questions surrounding these purported health benefits and not enough is currently known about its chemical profile. This project aims to identify and quantify some of the key compounds produced during the fermentation of sweetened tea through the action of a symbiotic culture of bacteria and yeast (SCOBY). This is to provide a greater understanding of the chemical profiles of fermented Kombucha beverages and the differences between commercial and non-commercial fermentation.

Key words: *chemistry, fermentation, kombucha*

Monitoring wastewater for the presence of emerging synthetic designer drugs of abuse

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: Dr Rebecca Gehling, Dr Alison Green, Dr Alicia Reynolds
Email: r.gehling@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Since the early 1990's legal 'designer drugs', which mimic the physical and psychological effects of their illicit counterparts, have flooded the market and have rapidly gained in popularity. This rise in popularity can be attributed to the ease at which they can be obtained, but also due to public perception that they are a 'safer' option. One method to identify the prevalence of these new psychoactive substances within the community is to monitor wastewater for metabolised and un-metabolised drugs excreted in urine. This project aims to qualitatively identify the presence of designer drugs of abuse within wastewater in Victoria through Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC) and Mass Spectrometry (MS).

Key words: *chemistry, drugs, forensic science, wastewater, GC, HPLC, MS*

Microplastics in the environment

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: Dr Rebecca Gehling, Dr Alison Green, Dr Benjamin Long, Dr Habtamu Derseh
Email: r.gehling@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Microplastic analysis is crucial for understanding the widespread impact of plastic pollution on ecosystems and human health. Microplastics are tiny plastic particles less than 5 mm in size which can be found throughout the biosphere (soil, air, water, and animal tissues). These tiny particles originate from the breakdown of larger plastics or from products that contain "microbeads" like personal care products. Microplastics are readily transported throughout the environment and are a growing concern due their persistence, widespread distribution, and harmful impacts on wildlife and ecosystems.

This project is part of the broader M^2 Microplastics project which aims to explore and develop novel methods for the identification, classification, and quantification of microplastics present in environmental and/or biological samples using methods including density separation, organic and/or Soxhlet extraction, fluorescence microscopy, FTIR analysis and GC-pyrolysis.

Key words: *microplastics, Fluorescence, Emerging Contaminants, Detection, M^2 Project*

Investigating Cybersecurity Adoption for Australian Small and Medium Enterprises (SMEs)

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: A/Prof Muhammad Imran, Prof Joarder Kamruzzaman
Email: m.imran@federation.edu.au joarder.kamruzzaman@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Small and medium enterprises (SMEs) form the backbone of the Australian economy, representing over 97% of all businesses and contributing significantly to employment and innovation. However, their increasing reliance on digital technologies exposes them to growing cybersecurity threats, often without the necessary resources, knowledge, or strategies to mitigate these risks. This research project aims to investigate the factors influencing cybersecurity adoption among Australian SMEs and to identify barriers and enablers to effective cyber resilience.
The study will employ a mixed-methods approach, combining quantitative surveys and qualitative interviews with SME owners, managers, and IT professionals across various industries. It will explore organisational awareness, risk perceptions, financial and technical constraints, regulatory compliance pressures, and the role of external support and government initiatives. Additionally, the project will assess the effectiveness of current cybersecurity frameworks and propose practical, scalable solutions tailored to SMEs' unique needs and capacities.
The outcomes of this research will provide valuable insights for policymakers, industry associations, and SMEs themselves, informing targeted interventions, training programs, and policy development to strengthen the cybersecurity posture of the SME sector. Ultimately, the project seeks to bridge the gap between awareness and action, fostering a more resilient digital ecosystem within Australia's critical small business landscape.

Investigating Adoption of Generative AI in Australian SMEs from a Cybersecurity Risk Perspective

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: A/Prof Muhammad Imran, Prof Gour Karmakar
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Project Level: Honours; SCCOR3001

Project description: Generative Artificial Intelligence (GenAI) technologies are rapidly transforming business operations, offering Australian small and medium enterprises (SMEs) new opportunities for innovation, efficiency, and competitiveness. However, their adoption also introduces complex cybersecurity risks, including data leakage, prompt injection attacks, model manipulation, and exposure of sensitive business information. Despite these risks, there is limited empirical research on how Australian SMEs are adopting GenAI and the extent to which they understand, manage, and mitigate associated cybersecurity challenges.
This research project aims to investigate the drivers, barriers, and cybersecurity considerations influencing GenAI adoption among Australian SMEs. Using a mixed-methods approach, the study will combine quantitative surveys and qualitative interviews with SME decision-makers, IT managers, and cybersecurity practitioners to explore risk awareness, governance practices, regulatory compliance, and the effectiveness of current risk management strategies. The project will also assess existing frameworks and propose tailored guidelines to support secure and responsible GenAI integration in SME environments.
The findings will provide critical insights for SMEs, industry associations, and policymakers, enabling evidence-based strategies and targeted interventions to enhance cybersecurity resilience. Ultimately, this research seeks to bridge the gap between technological adoption and risk management, ensuring that Australian SMEs can leverage the transformative potential of GenAI while safeguarding their digital assets and maintaining trust in increasingly AI-driven business ecosystems.

Leveraging IoT Technology to Monitor and Model Plant Growth Responses to Climate Change in Australia

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: A/Prof Muhammad Imran, Dr Kushan Tennakoon
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Project Level: Honours; SCCOR3001

Project description: Australia, a continent characterized by its arid landscapes and unique biodiversity, faces profound and accelerating impacts from climate change. Observed trends indicate significant warming, increased extreme weather events, and altered rainfall patterns, placing immense pressure on native flora and ecosystems. Over 1,000 Australian plant species are already identified as highly vulnerable to these climatic shifts. Traditional environmental monitoring methods, often limited by scope and cost, are proving insufficient to capture the rapid, fine-scale changes occurring across the vast and remote Australian landscape.

This research will comprehensively examine the transformative potential of Internet of Things (IoT) technologies in monitoring and modelling plant growth responses to climate change in Australia. It will use an array of advanced sensors, sophisticated connectivity solutions, and powerful data analysis platforms, including Artificial Intelligence (AI) and Machine Learning (ML), that are revolutionizing environmental observation. While these technologies have seen significant uptake in precision agriculture, a critical gap exists in their widespread application for native ecological monitoring, stemming from underinvestment and a reliance on external data sources. Bridging this "measurement gap" is paramount for effective conservation.

This study will explore the profound implications of IoT for habitat restoration, highlighting how real-time data can enable adaptive management, inform climate-adjusted species selection, and optimize planting techniques. By embracing these technological advancements, Australia can build a more resilient environmental future, safeguarding its irreplaceable natural heritage.

In relation to the plant growth in Climate Ready plots at Dandenong, Knox and Maroondah, the IoT sensor/data focus at multiple soil depths in this Research Project will be on the following parameters: (1) Temperature; (2) Humidity; (3) Sunlight Exposure; (4) Atmospheric Pressure; (5) Moisture.

Microcontaminant impact on the microbiome of Victorian penguin populations

Location: Mt Helen/Berwick Campus
Project Leaders: Dr Benjamin Long, Dr Meagan Dewar
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Project Level: Honours; SCCOR3001

Project description: Pharmaceuticals as organic microcontaminants are an emerging problem in the environment. While these pharmaceuticals are well known to disturb the gut microbiome there is also increasing evidence to show that pharmaceuticals in environmentally relevant concentrations can exert the correct selective pressures to change bacterial community makeup and for bacteria to develop antimicrobial resistance genes. It is currently unknown if this effect extends to the gut microbiome of protected fauna such as little penguins. In this project, you will examine if a relationship exists between the makeup of gut microbiome communities and the concentration of pharmaceuticals found in penguin guano. You will become familiar with field sampling techniques, and wet analytical chemistry techniques such as solid phase extraction (SPE, QuEChERS) and HPLC-MS/MS, bioinformatics, and sequencing.

Key words: *pharmaceuticals, microbiome*

Bioaccumulation and effect of emerging contaminants in the environment

Location: Mt Helen/Berwick/Gippsland Campus
Project Leaders: Dr Benjamin Long, Dr Nick Schultz, Dr Rebecca Gehling, Dr Alicia Reynolds
Email: bm.long@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Emerging organic contaminants such as pharmaceuticals, pesticides and herbicides, PFAS and microplastics are known to be discharged to the environment. Little is known about the concentrations of these contaminants in the Australian environment and their penetration through the food web. In this project you will contribute to the characterisation of the problem and help measure the effects of these contaminants on the environment (through environmental sampling and or microcosm studies). You will become familiar with field sampling techniques, and wet analytical chemistry techniques such as sample preparation (SPE, QuEChERS, Density Separation and Digestion), chromatographic techniques (HPLC and GC), and sample detection (Mass Spectrometry, Fluorescence Microscopy, Infrared Spectroscopy).

Key words: *pharmaceuticals, microplastics, emerging contaminants, detection*

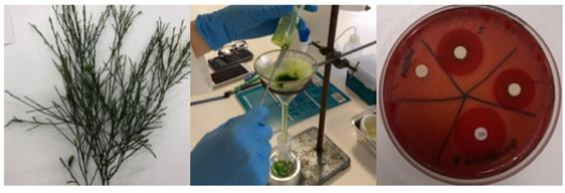
The Bush Medicine Project - Investigation of bioactive compounds in plants used in Indigenous Australian traditional medicine practices of south-eastern Australia

Location: Mt Helen/Gippsland/Berwick Campus
Project Leader: Dr Benjamin Long (+ additional campus specific supervisors)
Email: bm.long@federation.edu.au
Project Level: Honours

Project description: Indigenous Australian culture has at least 50,000 years of history and historical knowledge that has been preserved orally. Traditional medicine in indigenous Australian culture is holistic in nature and treats the person as a whole, rather than applying single curative measures. However, there were still many concoctions and herbal remedies in use. The Bush Medicine Project investigates the antimicrobial properties and toxicology of Australian native plants used in Indigenous Australian medicine practices (https://federation.edu.au/bush-medicine-project).

An honours level investigation in the Bush Medicine Project will further investigate “hits” from the undergraduate student program. Your project will be multidisciplinary and include aspects of chemistry, microbiology and cell biology tailored to your goals and expertise.

Key words: *pharmacognosy, antimicrobial, bush medicine*



Implementing AR into student nursing learning

Location: Mt Helen Campus
Project Leaders: Dr Grant Meredith
Email: g.meredith@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Augmented Reality (AR) has/is researched and implemented into a wide range of educational settings. The overlaying of virtual objects into real world environments lends itself to large range of uses. This study will involve the trialling of an existing AR system built for the project using the Hololens 2. The system enable the placement of virtual objects into a physical environment. Using the Mt. Helen-based simulated housing lab, nursing students will be invited to explore the setting including both physical and virtual objects in order to build an understanding of a community visit case study. Research would involve further refinement of the system, assessing nursing students perspectives about the technology and educational benefit.

Virtual Reality English language training

Location: Mt Helen Campus
Project Leaders: Dr Grant Meredith
Email: g.meredith@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: The project would involve creating and trialling a branching narrative system for 180-degree 3D video-based scenarios to play in a VR system (Oculus 3). At the Federation Information Engineering Institute (China) all FedUni degrees are delivered in English and as part of education standards our students there may show proficiency and attain certified English skills to be allowed to study. English is challenging to teach to such students from non-English speaking backgrounds, in fact is a global challenge, as is language acquisition for non-native speaker overall. This project would involve the creation of an app to facilitate video recorded scenarios such as job interviews, shop interactions and public speaking opportunities housed within a VR environment. These scenes would need to be produced as part of the project and include feasibility discussions concerning content creation. The app and technology would be provided to students in China to give supplementary English practice opportunities. They will be surveyed and interviewed concerning the educational worth of the platform and perceptions of how it may be affecting their English language skills.

Exploring Fossorial Reptile Diversity at Nanya Arid-Zone Research Station

Location: Gippsland/Berwick/Mt Helen Campus
Project Leaders: Dr Ashley Olson, Ms Sharon Reid
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Project Level: Honours; SCCOR3001

Project description: This project investigates the diversity of fossorial reptiles in the arid zone at Nanya Station, western New South Wales. Fossorial reptiles play important ecological roles as predators, prey, and ecosystem engineers, yet their secretive habits make them poorly understood. By using specialised survey methods, this study aims to determine species richness, abundance, and community composition across different habitat types and

disturbance histories. The findings will contribute to understanding how arid-zone ecosystems support subterranean reptile diversity and inform conservation management of these unique and vulnerable communities.

The influence of physiological performance on habitat selection by the banded velvet gecko, Oedura cincta, at Nanya Station

Location: Gippsland/Berwick/Mt Helen Campus
Project Leaders: Dr Ashley Olson, Ms Sharon Reid
Email: a.olson@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: The banded velvet gecko is a relatively large and arboreal species of gecko found at Nanya station, NSW. This species generally occupies belah woodlands and is rarely found in vegetation communities dominated by mallee eucalypts at Nanya Station. This study will investigate the role that physiological performance of traits associated with foraging play in habitat selection by banded velvet geckos. The performance of ecologically important traits such sprint speed and grip strength will be tested on different surfaces, such as the rough-barked belah and smooth barked mallee, to determine if movement on certain tree species is associated with sub-optimal performance. This project would require a mid-year start and will involve a significant amount of fieldwork during spring and summer at Nanya Station in remote western NSW. As geckoes are nocturnal, most fieldwork will be undertaken in the evening (6pm-midnight).

Drivers of functional turnover and nestedness among Australian reptile communities

Location: Gippsland/Berwick Campus
Project Leaders: Dr Ashley Olson
Email: a.olson@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Functional diversity reveals how different species contribute to ecosystem processes through their traits, such as diet, habitat use, and thermoregulation. By focusing on ecological roles rather than just species counts, researchers can identify how resilient lizard communities are to threats and disturbances such as climate change and altered fire regimes. This study will investigate changes in functional diversity across the Australian continent and identify the drivers of that change. This is a desktop project that is best suited to a student with strong interest in GIS and data analysis.

Understanding the habitat requirements of the squirrel glider population in the Northern Gariwerd/Grampians region

Location: Mt Helen Campus
Project Leaders: Dr Grant Palmer
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Project Level: Honours

Project description: The Northern Gariwerd/Grampians region hosts one of the only known sub-populations of the threatened Squirrel Glider (*Petaurus norfolcensis*) in western Victoria. This sub-population is likely a relic of a much greater population that once extended to the Murray Valley Plains and box-ironbark country east of Bendigo. The sub-population is primarily located in the Dadswell's Bridge area on roadsides, reserves and remnant patches on private land. The number of individuals and extent of the population is not understood. Project Platypus are currently undertaking a project with Central Biolinks Alliance to map the distribution of the population and identify priority areas for protection and enhancement, through revegetation. This honours project will be an integral part of the project and will:

1. Complete a literature review on habitat requirements of Squirrel Gliders.
2. Determine habitat characteristics including
   - Tree and shrub species present
   - Age of trees
   - Frequency and size of hollows
3. Develop a matrix that provides information for determining priority areas for future habitat protection and enhancement works.

Armed with this information, Project Platypus can map the habitat connections and improvements that the squirrel glider population need for protection.

Post release tracking of Echidnas, Koalas and Birds of Prey Released from Ballarat Wildlife Hospital

Location: Mt Helen Campus
Project Leaders: Dr Sarah Preston, Dr Adrienne Lavinia, Nikki Shanahan
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Project Level: Honours; SCCOR3001

Project description: Wildlife rescue, rehabilitation and release is vital in animal conservation. Post-release monitoring of released animals provides pivotal information on the success of the animal rescue and rehabilitation process but is seldom undertaken primarily due to limited/finite resources. Developments in tracking technology, particularly GPS enabled, can provide this information to wildlife organisations. By tracking animals post-release, information can be gathered that demonstrate the animals' successful integration back into the wild. This includes but is not limited to the animal's ability to recognise, hunt or forage for food, join social groups, and defend/maintain territories. In working with the Ballarat Wildlife hospital (https://ballaratwildlifehospital.org.au/) students would help release and track wildlife post release to collect data on the animal's ability to re-integrate back into the wild. They would become familiar with radio and GPS tracking technologies and analysis and observe animal behaviour to provide information back to the hospital regarding the success of the animal's integration back into the wild. The student would also be involved in helping care for the wildlife rescued by the wildlife hospital.

Commercial feasibility of molecular tests for accurate diagnosis of Haemonchus contortus nematode infections in livestock

Location: Mt Helen/Berwick/Gippsland Campus
Project Leaders: Dr Sarah Preston, Rebecca Farnell, Prof David Piedrafita
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Project Level: Honours; SCCOR3001

Project description: Gastrointestinal nematode (GIN) infections cause economic losses in livestock and remains a global challenge for farmers. Haemonchus contortus is one of the most pathogenic GIN of small ruminants, often leading to death. In Victoria (Australia), outbreaks of H. contortus infections have been sporadic and linked to years with high rainfall. However, changing climatic conditions suggest infections may become more endemic and rapid and specific diagnosis is critical for effective treatment. Currently, Faecal Egg Counts (FEC) and larval cultures are the gold standard commercial diagnostic method which are carried out largely in regional, low technology laboratories. FEC are rapid but are limited by confirming patent infections, not GIN species. Conversely, larval culture allow species identification but are slow taking 1-2 weeks. There are many molecular diagnostic techniques used routinely in research allowing specific and rapid identification of GIN species including polymerase chain reaction (PCR), Loop-mediated isothermal amplification (LAMP) and sequencing of the ITS-2 rDNA region (nemabiome). A student working on this project would acquire skills in collecting samples from saleyards, performing molecular test such as PCR, LAMP and ITS-2 sequencing.

Targeting saliva antibodies as a diagnostic test to detect encysted stages of small strongyle (cyathostomin) infection in horses

Location: Mt Helen/Berwick/Gippsland Campus
Project Leaders: Dr Sarah Preston, Tanya King, Prof David Piedrafita
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Project Level: Honours; SCCOR3001

Project description: Small strongyles (cyathostomin) infection in equines can cause clinical symptoms such as lethargy, sudden weight loss, debilitation, and diarrhoea. The encysted stages of cyathostomin can enter a dormancy stage called hypobiosis, which are not detected with a standard faecal egg count (FEC). Although a commercialised IgG(T) sera test identifying encysted larvae is available in the United Kingdom, the requirement for blood samples impedes its wide scale adoption. The aim of the study is to investigate whether saliva can be used as an alternative to blood to detect antibodies against encysted larvae. This would improve the diagnostics test available for horse owners and vets to accurately control worm infections. A student working on this project would acquire skills in collecting saliva from horses, running ELISA tests to measure antibodies in the lab and becoming very familiar with the faecal egg count test.

Key words: *parasites, immune system, worms, equine, saliva*

Galectin 3 and 9 molecules from worms as new treatments for inflammatory diseases

Location: Mt Helen/Berwick/Gippsland Campus
Project Leaders: Dr Sarah Preston, Elizabeth Mullens, A/Prof Rob Bischof
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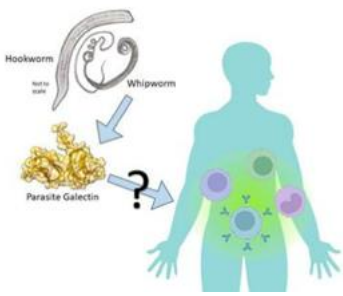
Project Level: Honours; SCCOR3001

Project description: The search for novel treatments for chronic inflammatory conditions has led to an increased interest in gastrointestinal nematodes and the molecules they produce to evade the human immune system. Particularly, those that alter the immune response to a more anti-inflammatory profile and can establish chronic infections while the host is asymptomatic. One molecule family of interest are galectins. Carbohydrate-binding proteins that are potent, multifunctional signalling proteins for the immune system. They are also a large component of the excretory/secretory molecules nematodes produce during infection.

The aim of this research is to determine if two human infecting nematodes, *Necator americanus* (Hookworm) and *Trichuris trichiura* (Whipworm), produced functional galectin homologues of human galectin 3 and 9, and to determine if they displayed anti-inflammatory properties. A student working on this project would look at the effect of the parasite galectin on cultured human cells, and donor immune cells using immunohistochemistry, cytokine analysis and flow cytometry. It would also examine the functionality of the galectins using Western blot and sugar binding assays.

Key words: *inflammation, nematodes, galectins*



Ecology and Water Chemistry of the Morwell Wetlands

Location: Gippsland Campus
Project Leader: Dr Jess Reeves
Email: j.reeves@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: This project will look at the seasonal water quality variability and ecology of the Morwell Wetlands. Depending on your interest, the project can either focus on the flora (aquatic vegetation, algal communities) or the fauna (invertebrate assemblages) of the wetlands. Sampling will be undertaken in March-April and again in August-September and related to both climatic events and discharge regimes of the local industries. There is scope to improve the ecological values of Morwell Wetlands, so this project will provide a 'before' study, to determine the current condition and variability of the wetland system, prior to changes in the flow of the Morwell, in light of the mine site rehabilitation project.

Key words: *wetlands, ecology, climate change, rehabilitation, water chemistry*

Living Bung Yarnda (Lake Tyers) environmental stewardship plan

Location: Gippsland Campus
Project Leader: Dr Jess Reeves
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Project Level: Honours; SCCOR3001

Project description: This project involves both the development of an integrated citizen science environmental program and analysis of the community and project development itself. The environmental aspect will include a review of existing monitoring programs including water quality, waterbugs, fish, birds, vegetation and mammal scats and scratchings. A database will be developed, specific to Lake Tyers, but contributing to larger, extant monitoring programs. It will also involve recruitment and training of volunteer participants and analysis of the first 6 months of data collected, to be presented at a community forum. The social science aspect of the project will map the process of recruitment, engagement and community outreach of the program, beyond the participants. It will also map the environmental values of the various interest groups around Lake Tyers, to assist in development of the Environmental Stewardship program.

Social Capital for Sustainable Farming

Location: Gippsland Campus
Project Leader: Dr Jess Reeves
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Project Level: Honours; SCCOR3001

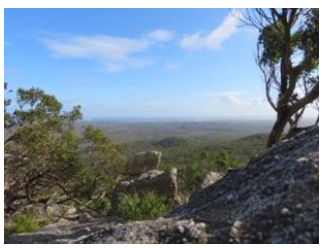
Project description: This project will look at the value of social capital in farming communities across Gippsland and the contribution this makes to community resilience. The project will involve both assessment of existing data and interviews with farmers from the Gippsland Agricultural Groups and the Bass Coast Landcare Network. This is a contribution to a funded project through the Soils CRC on the social and economic benefits of regenerative agriculture and will also make a contribution to the Gippsland Drought Adaptation Plan.

Key words: *social capital, agriculture, farming communities, resilience, regenerative agriculture*.

Wildlife conservation and management- Wilsons Promontory National Park

Location: Gippsland Campus
Project Leader: Ms Sharon Reid, Dr Ashley Olson
Email: sa.reid@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: This project focuses on wildlife conservation and management in the area surrounding Wilsons Promontory, a region of significant ecological importance. The Prom Sanctuary initiative, recently established to enhance protection and promote sustainable interactions with natural habitats, plays a central role in ongoing conservation efforts. The project aims to evaluate local wildlife populations, habitat quality, and potential environmental threats. By analysing these factors, the study seeks to provide insights into effective conservation strategies that can support the long-term health and resilience of the region's ecosystems. The outcomes will contribute to the broader understanding of sustainable wildlife management in protected natural areas.



Effects of oxidation conditions on humic and fulvic acids

Location: Gippsland Campus
Project Leaders: Dr Alicia Reynolds
Email: alicia.reynolds@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Humic and fulvic acids are important and complex fractions of soil organic carbon. Humic and fulvic acids are produced from Victorian brown coal and sold as high-value soil amendments and plant biostimulants. A recent PhD project used oxidation to produce new humic and fulvic

acids from coal. This Honours project uses new and established analytical techniques to find out more about the chemical structures of these new humic and fulvic acids. Focus areas could include organic acids (using ion chromatography and HPLC), other small organic compounds (using derivatisation, HPLC and GC/MS) or molecular weight (using dialysis and size exclusion HPLC). The effects of these products on seed germination could also be investigated.

Key words: *social license, renewable energy, just transition, community consultation.*

Photo. Ion chromatograph for measuring organic acids in fulvic acids

Effects of composting on organic carbon fractions

Location: Gippsland Campus
Project Leaders: Dr Alicia Reynolds, Dr Bill Grant
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Project Level: Honours; SCCOR3001

Project description: Composting is an important process for recycling organics, building soil organic carbon and improving soil productivity. Understanding the complex chemical and biological composting processes and how they are influenced by factors such as raw materials, microbial populations, heat transfer and mechanical processing are active areas of research. Mature products from well-managed thermophilic composting are typically rich in humic-like chemical structures that are resistant to further breakdown in soil.

This Honours project investigates changes in the humic-like structures from compost and could focus on compost maturation or different compost sources (eg domestic and commercial). The project will use simple soil-organic-carbon separation methods as well as analytical chemistry techniques (eg infra-red spectroscopy, nuclear magnetic resonance, elemental ratios (CHNSO), titrations and GC-MS (gas chromatography with mass spectrometry)) to understand the transformation in a group of structures. Focus areas could include:

- Transformation of overall chemical structures of humin, humic and fulvic fractions
- Transformation of key macromolecules such as carbohydrates, lignins, carboxylic acids or phenols
- Changes in biological activity using biomarkers like sterols, fatty acids and terpenoids as indicators of bacterial, fungi and plants (vascular, non-vascular etc)
- Changes in carboxylic and phenolic structures that are associated with cation exchange capacity and plant-hormonal effects
- Production of chemical structures that are expected to be resilient soil carbon (e.g. condensed aromatics)
- Anthropogenic inputs such as plasticisers, herbicides and pesticides
- Evaluating tests or procedures that could be used to assess compost quality, in terms of compost maturity and agricultural value.

Key words: *social license, renewable energy, just transition, community consultation.*

Photo. GCMS system used to characterise organic fractions during thermophilic composting

Comparative molecular characterization of eukaryotic genomic signatures from sheep blood and human oral rinse using biochemical and bioinformatic approaches

Location: Berwick/Mt Helen Campus
Project Leader: Dr Zil a Rubab, Dr Yutang Wang
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Yutang.wang@federation.edu.au
Project Level: Honours

Project description: This integrative molecular profiling project aims to establish a comparative framework for analyzing eukaryotic genomic signatures derived from two biologically distinct sample types: ovine whole blood and human oral rinse. By combining classical biochemical techniques with modern bioinformatics, the study will optimize DNA extraction protocols, assess nucleic acid purity and yield via spectrophotometry, and amplify conserved mitochondrial and nuclear loci using PCR. Downstream analysis will include gel electrophoresis for amplicon validation and in silico sequence alignment, phylogenetic tree construction, and variant annotation using tools such as BLAST, MEGA, and Ensembl VEP. The project is designed to generate a reproducible, student-friendly workflow that bridges wet-lab and computational biology, while offering insights into interspecies genomic conservation and divergence. Importantly, the inclusion of human oral rinse samples introduces a translational dimension, with potential applications in biomarker discovery, clinical diagnostics, and microbiome-host interaction studies. This work will contribute to the development of scalable pipelines for genomic analysis across biomedical, clinical, veterinary, and forensic contexts.

Key words: *genomic signatures, oral rinse, DNA extraction, PCR*

Effect of time-restricted feeding on endogenous clock gene expression and polymorphism patterns in mice: implications for the reversal of type 2 diabetes

Location: Berwick/Mt Helen Campus
Project Leader: Dr Zil a Rubab, Dr Yutang Wang
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Yutang.wang@federation.edu.au
Project Level: Honours

Project description: This project investigates the impact of Time-Restricted Feeding (TRF) on the expression of core circadian clock genes: *MTNR1B, CRY2, CLOCK, and PER3* in wild-type mice, without any genetic modification. The study aims to determine whether aligning feeding schedules with the circadian cycle can modulate gene expression in liver and pancreatic tissues, and whether naturally occurring polymorphisms in these genes influence the metabolic response to TRF. Mice will be divided into TRF and ad libitum feeding groups followed by metabolic assessments including glucose tolerance tests (GTT) and insulin tolerance tests (ITT). This project involves research animal handling. Molecular analysis will involve qPCR for gene expression and Sanger sequencing for SNP detection. This integrative approach bridges nutritional chronobiology and molecular genetics, offering insights into how dietary timing interacts with genetic background to influence Type 2 Diabetes risk. The findings may inform non-pharmacological, personalized interventions for metabolic disease prevention and treatment.

Key words: *time-restricted feeding (TRF), gene polymorphism, MTNR1B, CRY2, CLOCK, PER3*

Clock gene expression in oral rinse samples of healthy individuals: a non-invasive marker of circadian metabolic health

Location: Berwick/Mt Helen Campus
Project Leader: Dr Zil a Rubab, Dr Yutang Wang
Email: z.rubab@federation.edu.au
Yutang.wang@federation.edu.au
Project Level: Honours

Project description: This project explores the feasibility of using oral rinse samples as a non-invasive method to monitor circadian clock gene expression in healthy, non-diabetic adults. It focuses on the expression of *MTNR1B, CRY2, CLOCK, and PER3*, and investigates how chronotype, lifestyle and time of day influence gene expression patterns. Participants provide samples at multiple circadian time points, and data is correlated with sleep-wake cycles, dietary habits, and chronotype questionnaires. Laboratory techniques include RNA extraction, cDNA synthesis, and quantitative PCR (qPCR). The study aims to identify potential biomarkers for circadian metabolic health and understand how genetic and environmental factors interact to influence diabetes risk, offering insights into personalized prevention strategies.

Key words: *oral rinse, MTNR1B, CRY2, CLOCK, PER3, qPCR*

Developing high-value renewable energy electrodes by upcycling waste carbon

Location: Gippsland Campus
Project Leaders: A/Prof Surbhi Sharma,
Dr Alicia Reynolds, Dr Apurv Kumar
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Project Level: Honours; SCCOR3001

Project description: Solid organic wastes from agriculture, food processing and waste-water treatment facilities are expensive to manage and dispose in an environmentally friendly manner. Recycling and upcycling of these is a high priority for VIC govt as it essential for a sustainable circular economy.

This project will be focussed on upcycling waste carbon (sewage waste, biosolids, farm waste) and Lignite (low-value carbon, commonly available, in Victoria) into high-value electrode materials for applications in batteries, supercapacitors and fuel cells. Wet chemistry, hydrothermal processing, material characterisation studies (using techniques such as spectroscopy, microscopy and thermogravimetry) will be used to develop and study the materials. Electrochemistry studies may be involved.

Producing hydrogen from wastewater: Identifying organic compounds for value-added electrolysis

Location: Gippsland Campus
Project Leaders: A/Prof Surbhi Sharma, Dr Apurv Kumar,
Dr Alicia Reynolds, Dr Benjamin Long
Email: surbhi.sharma@federation.edu.au
Project Level: Honours; SCCOR3001

Project description: Producing hydrogen by electrolytically splitting water typically involves two reactions: reducing water to hydrogen and oxidising water to oxygen. Oxidising water to oxygen requires high potentials, limiting the energy efficiency of the system. Energy efficiency could be improved by oxidising small organic compounds (eg, aldehydes, alcohols and ammonia) instead of water. This approach also eliminates the need for valuable high-purity water, using waste- and process water instead.

This Honours project could focus on a range of water sources (eg, brewery, domestic, dairy or other wastewaters and organic-rich hydrothermal carbonisation process water). Chemicals present in the water will be determined using infra-red spectroscopy, chromatography and mass spectroscopy. There may be an opportunity to study electrochemical splitting of the water.

Synthesis and catalytic properties of metal nanoparticles supported on processed lignite and other upcycled carbon supports

Location: Gippsland Campus
Project Leaders: A/Prof Surbhi Sharma,
Dr Alicia Reynolds
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Project Level: Honours; SCCOR3001

Project description: Carbon supported metal nanoparticles are commonly used as catalysts in electrodes in electrochemical energy applications. Use of nanostructured

electrocatalysts (often precious metals) helps minimise the costs whilst achieving desired catalytic performance. Supporting carbon nanomaterials anchor the nanoparticles while providing a conductive mesh for electron flow amongst other properties assisting the electrochemical behaviour.

This project will explore the deposition of selected metal nanoparticles on various upcycled carbons using microwave polyol processing technique. The nanoparticles' shape, size, morphology will be studied using electron microscopy. Role of the nanostructured carbon on the growth mechanisms of the nanoparticles will also be studied. Thermogravimetry will be used to identify metal loading. There may be opportunities to test the electrochemical properties and behaviour of the as-developed metal nanoparticle-carbon catalyst-support systems for specific applications.

Developing nano-structured carbons for CO_2 gas adsorption properties

Location: Gippsland Campus
Project Leaders: A/Prof Surbhi Sharma, Dr Alicia Reynolds
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Project Level: Honours; SCCOR3001

Project description: A range of nano-structured carbon materials have been produced from lignite from the Gippsland coal mines. These materials have a range of potential applications, including battery electrodes, catalysts and gas adsorption. This Honours project explores the CO_2 adsorption properties of these materials.

CO_2 is used in a variety of industries including food and beverages, promoting plant growth in greenhouses, fertilizer production. With the need to reduce anthropogenic CO_2 emissions, opportunities are being developed to use CO_2 in polymers, building materials and aviation fuels. These activities require CO_2 separation and purification technologies that are suitable for a variety of sources including cement kilns and hydrogen production.

This Honours project uses thermogravimetric analysis to measure gas adsorption and desorption properties of a range of existing nano-structured carbon materials. This information will be used to assess the potential for lignite-derived materials to be used for CO_2 separation and purification applications. There may be opportunities to produce nano-structured carbon materials with improved CO_2 adsorption properties.

Developing bio-degradable membranes to replace Nafion-based proton conduction membranes in hydrogen fuel cells

Location: Gippsland Campus
Project Leaders: A/Prof Surbhi Sharma, Dr Alicia Reynolds
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Project Level: Honours; SCCOR3001

Project description: Proton exchange membrane fuel cells widely use Nafion membranes. These membranes serve diverse purposes in the PEMFC systems which include conducting protons and acting as a separator between the anode and cathode. PEMs also need to have adequate mechanical performance, gas tightness, dimensional and chemical stability against strong acidic and oxidative conditions, in a compressed stack operating at temperatures between 60-100◦C under highly-variable humidity conditions. Nafion, currently the most commercially viable membrane, is perfluorosulfonic acid-based membrane consisting of a hydrophobic fluorocarbon backbone and hydrophilic sulfonic pendant side chains. These polymers are non-biodegradable and release toxic, fluorinated compounds upon degradation.

Biodegradable alternatives for these membranes are therefore essential to explore to ensure sustainability of these "renewable energy" systems as we move towards global adoption of hydrogen fuel cells in our fight against climate crises.

This project will explore the development of nanocellulose based membranes from food waste to replace nafion-based membranes in direct methanol and PEM fuel cells. Water uptake, ion-exchange capacity and gas permeability tests and mechanical and thermal stability of the prepared membranes will be studied to determine their suitability for use in hydrogen and methanol fuel cells systems.

Authenticating the quality of foods and beverages through colorimetric analysis

Location: Gippsland Campus
Project Leaders: Dr David Smith
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Project Level: Honours; SCCOR3001

Project description: Colorimetric sensing arrays are an innovative chemical sensing technology that produce unique colour patterns – similar to a fingerprint – when exposed to complex mixtures like foods or beverages. These patterns can be used to rapidly identify or differentiate products based on their chemical profiles.

In this project you will develop a fast-response, low-cost sensing array using commercially available dyes that change colour in response to pH, metal ions, redox state, or solvent environment. The initial focus will be on honey authentication and identifying different honey varieties by their botanical origin. The project will later expand to include other foods and beverages such as beer and raw brewing materials.

Skills and techniques used in this project will include the preparation and testing of dye-based sensor arrays, UV-vis spectroscopy and digital image analysis, and the application of statistical tools to analyse patterns.

Key words: *chemistry, sensing, colorimetric analysis, food authentication*.

Chemical and sensory analysis of Eucalyptus honey meads

Location: Gippsland Campus
Project Leaders: Dr David Smith, A/Prof Andrew Greenhill, Dr Alicia Reynolds
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Project Level: Honours

Project description: Honey can be fermented to produce an alcoholic beverage known as mead. While mead flavour is heavily influenced by the type of honey used, little is known about how native Australian honeys, particularly those from Eucalyptus species, shape its taste and aroma.
This project will explore the flavour and aroma compounds produced during the fermentation of eucalypt honeys. You will carry out small-scale fermentations and analyse the resulting

products using techniques such as gas chromatography-mass spectrometry (GC-MS) to identify aroma compounds. Sensory evaluation will complement the chemical data to build a full picture of flavour development.

Skills and techniques used in this project include experimental design, GC-MS, sensory evaluation, and data analysis.

Key words: *chemistry, fermentation, aroma, GCMS*

Data analysis of pollen trends in the Gippsland region

Location: Gippsland/Berwick/Mt Helen Campus
Project Leaders: Dr David Smith
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Project Level: Honours

Project description: Pollen monitoring plays a vital role in understanding seasonal allergen exposure and its impact on public health, particularly in relation to events such like thunderstorm asthma. This project focuses on analysing pollen count data from the Gippsland monitoring site, with the goal of identifying patterns, seasonal trends, and potential environmental triggers.

Using datasets collected over recent years, you will explore how pollen levels fluctuate and how they may correlate with environmental factors such as weather conditions, air quality, and vegetation cycles. The analysis aims to provide insight into the drivers of high pollen events and their connection to thunderstorm asthma risk.

This is a data analysis-only project and skills used will be the analysis of pollen and environmental datasets, using statistical software or programming languages for data analysis and visualisation, and investigating and interpreting correlations between multiple data sources.

Key words: *pollen monitoring, public health, data analysis*.

Habitat specificity and competitive traits of Australian acacias invaded to natural landscapes in Asia Pacific: a global review

Location: Berwick/Mt Helen Campus
Project Leaders: Dr Kushan Tennakoon, Prof S. K. Florentine (Florry)
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Project Level: Honours; SCCOR3001

Project description: The genus *Acacia* (Family: Fabaceae; subfamily: Mimosoideae) commonly known as Wattles are native to both Australia and Africa. The *Acacia* lineage native to Australia comprise over 900 species are found in different habitats: from coastal to subalpine regions, from high rainfall to arid areas, in tropical, sub-tropical and temperate regions. Approximately 300 *Acacia* spp. of Australian origin have been introduced around the world as timber and ornamental plants and approximately 23 of them have become highly invasive in many terrestrial ecosystems and causing significant impact on biodiversity. Ten *Acacia* spp. (with six species of Australian origin *viz*. *A. longifolia* subsp. *sophorae*, *A. mangium*, *A. mearnsii*, *A. melanoxylon*, *A. retinodes*. and *A. saligna*) are listed in the Global Invasive Species Database with one species (*A. mearnsii*) being in the 100 most invasive species list. It is vital to identify a discrete set of characteristics which facilitate successful invasion by exotic plants such as Acacia species in non-original regions. It has been claimed that invasive plants typically possess novel traits or exhibit more extreme trait values which confer on their competitive advantage over native flora such characteristics: (i) rapid growth, (ii) high N–fixing ability, (iii) heteroblasty and (iv) high flexibility in physiological performance found in Australian *Acacia* spp. However, no clear separation of particular trait sets has been reported for either highly invasive or less invasive different environmental conditions. We found that plant invasion studies have been unevenly distributed biogeographically, with the majority conducted in either Temperate or Mediterranean climate regions. The Mediterranean climate is shared by the Mediterranean Basin, California, Chile, the Western Cape of South Africa and Southern Australia. In contrast, related studies in other climate types such as the seasonal tropics are still scarce. Thus, an assessment of the contribution of traits to success of Australian *Acacia* species' invasions under these largely unstudied conditions/climates in the Asia Pacific will help us to better understand invasive mechanisms and subsequently develop control approaches.

This project will aim to provide insights into Australian *Acacia* invasiveness for the more efficacious selection of management practices, including control.

Application of novel UV-C radiation technology to minimize aquatic weeds and algae impacts in waterways

Location: Berwick/Gippsland Campus
Project Leaders: Dr Kushan Tennakoon, A/Prof Gayan Kahandawa
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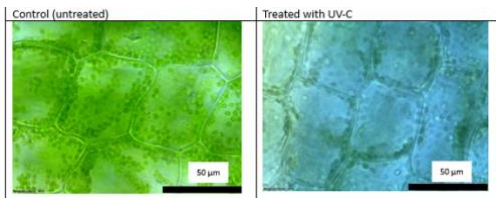
Project Level: Honours; SCCOR3001

Project description: We have partnered with Southern Rural Water (SRW) in co-designing UV-C radiation technology to efficiently combat submersed aquatic weeds and algae in the irrigation canals and reservoirs. Main aim of this investigation is to minimize current usage of hazardous chemicals and weedicides (Magnacide™ H) by introducing this technology.



This novel technology will create a more sustainable, cost-effective solution than using chemicals, and minimizing impact on irrigation systems during the chemical/ weedicide application seasons to treat weeds. This study pioneers the exploration of UV-C light for managing aquatic weeds, and it is anticipated that this new technology will help reduce the chemical pollution caused by synthetic herbicides currently used to control aquatic weeds in our irrigation channels. We expect to further investigate the potential of integrated use of

UV-C treatment with other ecofriendly management actions such as bioherbicides as a long-term solution over traditional synthetic herbicide applications.

The potential Hons student is expected to assess physiological and cellular changes of selected aquatic plants/ algae from UV-C radiation to gather conclusive evidence that aquatic plants and algae can be killed using this UV-radiation. After that, an application will be designed as an apparatus to be used in the field.

Investigating Plant Traits in the Climate Future Vegetation Plots – Dandenong, Knox and Maroondah

Location: Berwick/Gippsland/Mt Helen Campus
Project Leaders: Dr Kushan Tennakoon, Dr Nick Schultz, Prof S. K. Florentine (Florry)
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Project Level: Honours; SCCOR3001

Project description: Climate Future Plots for resilient vegetation under a changing climate is a strategy developed to evaluate revegetation outcomes in a changing climate. Mounting studies are suggesting that climate change is likely to have an increasingly negative impact on revegetated and remnant areas of vegetation in Australia. These predicted warmer and drier climates, combined with extreme weather events such as hotter days, decreased rainfall over winter and spring, a decline in frosts and an increase in fire events and sometimes even relatively wetter periods, will have significant detrimental impacts on the effectiveness of current management interventions. We have established 5 such plots in Dandenong, Knox and Maroondah city council areas. This is a collaborative project between Federation University and Melbourne Water using appropriately selected native and indigenous plant species from a range of provenances. These plants will be monitored long-term.

Project aims:
1. To determine the growth, physiological responses and survival of different native plant species from different provenances under a changing climate
2. To assess how climatic and environmental variables influence plant provenance growth and survival
3. To provide an example of a scientifically robust planting design that has Traditional Owner and community support and relevance for culture and biodiversity.

Sub-aims:
- To act as a seed production area for climate adjusted seeds
- To provide recreational and aesthetic value to the communities of that region

Other options: There is also scope to conduct broader vegetation or insect surveys in these plots along with additional campus specific supervisors.

Building a strategic framework to inform cultivation and reintroduction methods in the endemic hemi parasitic plant Exocarpos cupressiformis (Cherry Balart)

Location: Berwick/Churchill/Mt Helen Campus
Project Leaders: Dr Kushan Tennakoon, with Drs Megan Hirst, Naveed Davoodian & Hongxiang Zhang (Royal Botanical Gardens Victoria, RBGV)
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Project Level: Honours; SCCOR3001

Project description: *Exocarpos cupressiformis*, in the Sandalwood family, is commonly referred to as the Cherry Ballart and is one of the most common hemi-parasitic plants in Australia. Yet, for such an iconic species, little is known about its recruitment and establishment requirements, with most information appearing as anecdotal.

Identify host plants of Exocarpos: Undertake eDNA (ITS1) from soil samples to demarcate the E. cupressiformis canopy zone. Samples will be collected from the canopy edge to the rhizosphere.

Germination Protocol- Laboratory methods to assess seed biology from embryo identification, staining and imbibition testing to assessing the dormancy status. Use pretreatments (i.e., GA3), photoperiod and temperature settings to evaluate best responses.

Survival and Growth - Under glasshouse conditions sow Exocarpos seed using established laboratory methods, and undertake large scale propagation techniques involving vegetative material, including addition of host plants (seed), and creating a suitable growing medium. Potential Hons student is expected to work at the Royal Botanic Gardens Victoria (RBGV), at one of the Garden locations (Melbourne and Cranbourne) under the supervision of both RBGV and FedUni supervisors assessing some of the following, conducted as part of an ongoing project led by Megan Hirst in collaboration with Kushan and other researchers.

Utility-based reinforcement learning

Location: Mt Helen Campus or Online
Project Leader: Prof Peter Vamplew
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Project Level: Honours

Project description: In recent years reinforcement learning has been a hot topic in artificial intelligence research, achieving spectacular results such as defeating the human world champion at Go by learning from experience to maximise a reward signal. However, researchers have realised that the connection between the reward signal and the resulting behaviour may not be straightforward and so designing appropriate rewards is difficult. Multi-objective RL addresses this via multi-policy learning whereby the agent learns multiple policies for different interpretations of that

reward signal. We have proposed that the multi-policy concept can be adapted to conventional single-objective RL where scalar rewards are used (https://arxiv.org/abs/2402.02665). This project will implement and evaluate one or more of the approaches proposed in that paper.

Micro v Macro: The role of macrophages in immunity to bacteria and evasion tactics used by Salmonella

Location: Mt Helen Campus
Project Leaders: Dr Morgan Wallace, Dr David Bean
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Project Level: Honours; SCCOR3001

Project description: The activation of macrophages is key to mounting effective immune responses to bacterial pathogens. Macrophages detect bacteria using a variety of pathogen-specific receptors, and become activated, secreting proinflammatory cytokines and chemokines that recruit other immune cells to the site of infection. Macrophages also play a major role in pathogen clearance, through phagocytosis and digestion of bacteria in phagolysomes, and subsequently the activation of adaptive immune responses. Most pathogenic bacteria have evolved means of immune evasion that limit activation of and differentiation of macrophages, or inhibit digestion inside phagolysosomes. This project will utilise THP-1 cells, a human leukemia monocytic cell line to investigate the ability of *Salmonella* to infect human monocytes and evade macrophage-mediated immune mechanisms. As not all *Salmonella* are created equal, this project will compare different *Salmonella* subspecies and their effect on macrophages.

Key words: *macrophage, monocyte, immunity, salmonella*

Age-related changes in immunity to vaccines

Location: Mt Helen Campus
Project Leaders: Dr Morgan Wallace, Prof Stuart Berzins
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Project Level: Honours; SCCOR3001

Project description: Immune function is known to decrease with age and this decline has implications for vaccine efficacy in the elderly. Understanding how immune function changes over time, and how this correlates with protection and disease incidence, may enable us to better predict the risk of chronic disease and target treatments and vaccine doses more effectively. This project will study vaccine responses in people across a range of age groups, focusing on correlation of their immune cell frequency and function with their level of vaccine response. We will focus on individuals vaccinated against COVID-19 because older people are at high risk of serious illness from COVID-19 so understanding the immune response is critically important in this setting.

Key words: *immunology, adaptive immune response, immunosenescence*

Cardiovascular disease – the leading cause of mortality worldwide

Location: Mt Helen Campus
Project Leader: Dr Yutang Wang
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Project Level: Honours; SCCOR3001

Project 1: Investigating the impact of fasting on blood pressure
Hypertension is the primary contributor to cardiovascular disease and accounts for approximately 10 million deaths globally each year. Emerging evidence suggests that fasting may help reduce blood pressure. This project aims to evaluate the effects of fasting on blood pressure levels within the general population.

Project 2: Investigating the impact of fasting on blood glucose
Individuals with diabetes face a significantly elevated risk of cardiovascular complications and mortality. Fasting has been proposed as a potential strategy to lower blood glucose levels. This study seeks to assess the effects of fasting on blood glucose regulation in the general community.

Project 3: Sympathetic inhibition in the development of abdominal aortic aneurysm (AAA)
The aorta is richly innervated by sympathetic nerves, and increased sympathetic nerve activity has been observed in AAA. This project investigates whether activation of α2-adrenoceptors, which inhibit sympathetic nerve activity, can influence the formation of AAA. The study involves inducing AAA in mice via subcutaneous infusion of angiotensin II and employs techniques such as animal handling, histology, immunohistochemistry, and quantitative PCR.

Project 4: Effects of niacin on glucose metabolism
Niacin has demonstrated potential in reducing cardiovascular risk; however, its use has also been associated with a modest increase in the incidence of diabetes. The mechanisms underlying this paradox remain poorly understood. As the liver plays a central role in maintaining glucose homeostasis, this project aims to investigate the impact of niacin on the expression of genes related to glucose metabolism and diabetes in cultured liver cells.

Key words: *cardiovascular disease, hypertension, diabetes, aortic aneurysm, niacin*