Summer Research Program 2027

Research Projects offered by Schools in the Faculty of Science

School of Agriculture and Food Sustainability 2
School of Chemistry and Molecular Biosciences 34
School of the Environment 52
School of Mathematics and Physics 74
School of Veterinary Science 103

Next Steps

Step 1: Browse the Projects

- You can browse by School by clicking on the table of contents above.

Step 2: Obtain Supervisor Endorsement

You are encouraged to contact your preferred supervisor to seek their endorsement for undertaking their project.

Discussing the project and your suitability with the supervisor can help you determine whether the project aligns with your interests, skills and background. It also allows the supervisor to learn more about your interest in the project and your potential contribution to the research team. Applicants who engage with supervisors before applying often submit stronger applications, as supervisors can better assess their suitability for the project.

When contacting the supervisor, we suggest your email includes:

- an introduction to yourself and why you are interested in the project,
- your motivation for participating in the program,
- what you hope to gain from the research experience, and
- the skills, knowledge, experience or perspectives you could contribute to the project team.

If you receive supervisor endorsement, upload the email from the supervisor as part of your Student Hub application. Endorsement confirms that the supervisor considers you a suitable candidate and supports your application progressing through the selection process.

You may reuse the message you provided to the supervisor as your personal statement in your Student Hub application.

Please note that supervisor endorsement does not guarantee a place in the program or allocation to a specific project.

Step 3: Submit your application via StudentHub

School of Agriculture and Food Sustainability

Project title	**UAV-based phenotyping to improve rice breeding under water-saving conditions**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	Gatton campus
Project description	Rice production commonly relies on flooded conditions and substantial water inputs. Aerobic rice, grown under non-flooded conditions, offers a potential water-saving alternative, but efficient phenotyping methods are needed to develop varieties adapted to this system. This project will investigate whether unmanned aerial vehicle (UAV)-based phenotyping can accurately measure important traits in diverse long-grain rice grown under aerobic conditions at The University of Queensland's Gatton campus. UAV-derived measurements, including plant height, canopy temperature, vegetation indices, and crop vigour, will be compared with manual field measurements. The project will provide experience in field experimentation, crop phenotyping, UAV data collection, image-based measurements, data management, and statistical analysis, while contributing to the development of improved water-saving rice varieties.
Expected outcomes and deliverables	The student will gain: • An understanding of rice production under aerobic, water-saving conditions. • Experience with field-based crop phenotyping. • Practical experience collecting and interpreting UAV-derived plant measurements. • Experience comparing manual and image-based phenotypic data. • Skills in data organisation, quality assessment, and statistical analysis. • An understanding of how high-throughput phenotyping can support rice breeding.
Suitable for	This project is suitable for students studying or interested in: • Agricultural science • Plant biology • Agronomy • Crop physiology • Plant breeding • Remote sensing • Geographic information systems • Data science or statistics Previous experience with fieldwork, plant measurements, UAVs, image analysis, or R programming would be advantageous but is not essential. The project will be tailored to the successful student's skills, academic background, and research interests.

Supervisor	Professor Jaquie Mitchell (primary) Dr Shona Wood
Contact for further information	Professor Jaquie Mitchell: jaquie.mitchell@uq.edu.au
Additional information	The project will involve fieldwork at the Gatton campus and may include regular crop observations, manual plant measurements, UAV image collection, data processing, and statistical analysis. Students should be prepared to work outdoors in variable weather conditions and undertake physically active field activities.
School	School of Agriculture and Food Sustainability

Project title	**Traits of importance for lodging resistance in Australian rice**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	Gatton campus
Project description	There is an opportunity to conduct short term experiment in relation to lodging resistance in the field (Gatton) experiments. Lodging, the bending or collapse of rice stem, can hinder efficient harvesting and cause substantial yield losses. Our AgriFutures-funded project aims to address this challenge by identifying lodging-resistant rice varieties and the key traits that underpin lodging resistance. In this study, we will characterise genotypic variation for lodging, plant height, and culm morphological traits associated with lodging resistance within an Australian rice population. Short experiments (6 weeks) can be conducted to fit into course plans.
Expected outcomes and deliverables	An understanding of lodging resistance in rice; experimentation and research strategies for field conditions
Suitable for	Suitable for students studying or interested in plant biology, agricultural science (crop physiology, agronomy or quantitative genetics). If you are interested in this or similar projects contact us to explore where your skills and interests can be applied. All projects will be tailored to suit the successful candidate.
Supervisor	Professor Jaquie Mitchell (primary) Dr Ricky Vinarao
Contact for further information	Professor Jaquie Mitchell: jaquie.mitchell@uq.edu.au
Additional information	The project will involve fieldwork at the Gatton campus and may include regular crop observations, manual plant measurements, data processing, and statistical analysis. Students should be prepared to work outdoors in variable weather conditions and undertake physically active field activities.
School	School of Agriculture and Food Sustainability

Project title	**Uncovering the Genetic Architecture of Anaerobic Germination Tolerance in Australian Rice**
Project duration	6 weeks
Hours of engagement	The project will run for 6 weeks from 11 January – 19 February 2027, with approximately 28–36 hours per week.
Location	Gatton campus
Project description	Direct-seeded rice (DSR) is increasingly important for developing more water- and labour-efficient rice production systems. However, successful crop establishment can be compromised when heavy rainfall, irrigation or temporary flooding creates low-oxygen conditions shortly after sowing. Most rice varieties germinate poorly under these conditions, resulting in uneven crop establishment, increased weed competition and potential yield loss. Anaerobic germination (AG) tolerance, the ability of rice seeds to germinate, emerge and establish under low-oxygen conditions, offers a promising genetic solution. AG-tolerant varieties could improve crop establishment following temporary flooding while also creating opportunities to use early water management for weed suppression. Despite its potential, AG tolerance has received limited attention in Australian rice breeding, particularly in temperate long-grain germplasm. This project aims to identify and characterise the genetic architecture underlying AG tolerance in Australian rice germplasm. A panel of advanced breeding lines will be phenotyped under controlled anaerobic and aerobic conditions to assess emergence, survival and early seedling vigour. These phenotypic data will be integrated with genome-wide marker data using genome-wide association studies (GWAS) to identify genomic regions and candidate genes associated with AG tolerance. The findings will help identify promising germplasm and genetic targets for breeding rice varieties with more reliable establishment under waterlogged or temporarily flooded conditions, supporting more resilient and weed-competitive direct-seeded rice systems. The student will establish a controlled glasshouse experiment at the UQ Gatton campus between 11 January and 19 February 2027. The study will involve two treatments: (i) an anaerobic condition, where seeds are submerged at a depth of 10 cm of water for 21 days, and (ii) an aerobic control. Key traits associated with crop establishment and early vigour will be measured, including days to emergence, emergence percentage, seedling survival, plant height and dry matter. The student will gain experience in experimental design, rice phenotyping, data management and statistical analysis. Phenotypic data will be quality-checked and analysed using approaches including ANOVA, trait correlations and genotype comparisons. Phenotypic responses will then be integrated with available genome-wide marker data to conduct GWAS, identifying marker-trait associations and genomic regions associated with AG tolerance. Promising genomic regions and potential candidate genes will be explored where appropriate. The student will interpret the results in the context of AG tolerance and crop establishment and communicate the findings through a short research report and presentation at the Summer Research showcase.

Expected outcomes and deliverables	The student will gain: • Practical skills in glasshouse-based experimental design, seed handling, and phenotyping under stress conditions. • Experience with data entry, quality control, and basic statistical analysis. • An SOP (Standard Operating Procedure) for anaerobic germination screening. • A ranked list of Australian advance breeding lines with AG tolerance potential. • Final outputs: a cleaned dataset, short research report (3–5 pages), and poster/oral presentation.
Suitable for	This project is suitable for: • 3rd–4th year students in Agriculture, Plant Science, or Biotechnology. • Students with an interest in rice physiology, crop establishment, or plant breeding. • Desirable skills include basic statistics (Excel, R) and attention to detail in experimental work.
Supervisor	Professor Jaquie Mitchell (primary) Dr Jhoana Opena
Contact for further information	Professor Jaquie Mitchell: jaquie.mitchell@uq.edu.au
Additional information	Students will be required to complete UQ glasshouse and HSW inductions. The work involves handling seed trays and working in warm, humid environments. PPE and training will be provided
School	School of Agriculture and Food Sustainability

Project title	**Agribusiness in Asia: a review of current activity and impacts**
Project duration	6 weeks
Hours of engagement	Approximately 36 hours per week.
Location	The work can largely be completed remotely, with regular check-ins.
Project description	Agribusiness is a major driver of food security, livelihoods and economic development across Asia, spanning highly diverse economies, commodities and stages of development. The volume of activity and research is large and varied, which makes it valuable to take stock of the current landscape and draw out common themes. This project does so through a review of secondary sources. The primary aim is to conduct a literature review of agribusiness and agricultural activity in Asia, drawing together published research, reports and other secondary material. Students will identify key themes, reported impacts, gaps and opportunities. Rather than covering every country or topic in detail, the review will build a broad, representative picture of the region. A secondary component involves working with data. Students will assist with organising and analysing a dataset and integrating relevant findings into the overall report. The project is exploratory and does not test a fixed hypothesis. Methods include a structured literature review, thematic synthesis of secondary sources, and basic data analysis. The main output is a written report.
Expected outcomes and deliverables	Students can expect to build skills in conducting literature reviews, sourcing and synthesising secondary data, basic data analysis, and report writing, along with a broad understanding of agribusiness in Asia. Deliverables include: a summary of relevant sources; a written review report covering the current landscape, reported impacts and key themes; a short contribution to data analysis; and a brief presentation of findings to the research team.
Suitable for	This project may suit students with an interest in agribusiness, agricultural economics, international development or Asian studies. Useful qualities include strong written communication, the ability to search and synthesise literature, attention to detail, and comfort working with data. No advanced statistics are required. Open to Master's students in their second year.
Supervisor	Dr Ahitya Kiloes (primary) Dr Md. Ali Akber
Contact for further information	Dr Ahitya Kiloes: a.kiloes@uq.edu.au
Additional information	This is a desk-based, review-focused project. Students will be part of a small research team, and findings may inform future work.

School	School of Agriculture and Food Sustainability

Project title	**Agribusiness in Africa: a review of current activity and impacts**
Project duration	6 weeks
Hours of engagement	Approximately 36 hours per week.
Location	The work can largely be completed remotely, with regular check-ins.
Project description	Agribusiness contributes significantly to food security, livelihoods and economic development across Africa, but activity is spread across many actors and the evidence base is fragmented. This project takes stock of the current landscape through a review of secondary sources. The primary aim is to conduct a literature review of agribusiness and agricultural activity in Africa, drawing together published research, reports and other secondary material. Students will identify common themes, reported impacts, gaps and opportunities. Rather than covering every country or topic in detail, the review will build a broad, representative picture of the region. A secondary component involves working with data. Students will assist with organising and analysing a dataset and integrating relevant findings into the overall report. The project is exploratory and does not test a fixed hypothesis. Methods include a structured literature review, thematic synthesis of secondary sources, and basic data analysis. The main output is a written report.
Expected outcomes and deliverables	Students can expect to build skills in conducting literature reviews, sourcing and synthesising secondary data, basic data analysis, and report writing, along with a broad understanding of agribusiness in Africa. Deliverables include: a summary of relevant sources; a written review report covering the current landscape, reported impacts and key themes; a short contribution to data analysis; and a brief presentation of findings to the research team.
Suitable for	This project may suit students with an interest in agribusiness, agricultural economics, international development or African studies. Useful qualities include strong written communication, the ability to search and synthesise literature, attention to detail, and comfort working with data. No advanced statistics are required. Open to Master's students in their second year.
Supervisor	Dr Mokaddes Ahmed Dipu (primary) Dr Julius Kotir
Contact for further information	Dr Mokaddes Ahmed Dipu: s.dipu@uq.edu.au
Additional information	This is a desk-based, review-focused project. Students will be part of a small research team, and findings may inform future work.
School	School of Agriculture and Food Sustainability

Project title	**Agribusiness in the Pacific: a review of current activity and impacts**
Project duration	6 weeks
Hours of engagement	Approximately 36 hours per week
Location	The work can largely be completed remotely, with regular check-ins.
Project description	Agribusiness contributes significantly to food security, livelihoods and economic development across the Pacific, but activity is spread across many actors and the evidence base is fragmented. This project takes stock of the current landscape through a review of secondary sources. The primary aim is to conduct a literature review of agribusiness and agricultural activity in the Pacific, drawing together published research, reports and other secondary material. Students will identify common themes, reported impacts, gaps and opportunities. A secondary component involves working with data. Students will assist with organising and analysing a dataset, with relevant findings written up separately. The project is exploratory and does not test a fixed hypothesis. Methods include a structured literature review, thematic synthesis of secondary sources, and basic data analysis. The main output is a written report.
Expected outcomes and deliverables	Students can expect to build skills in conducting literature reviews, sourcing and synthesising secondary data, basic data analysis, and report writing, along with a broad understanding of agribusiness in the Pacific. Deliverables include: a summary of relevant sources; a written review report covering the current landscape, reported impacts and key themes; a short contribution to data analysis; and a brief presentation of findings to the research team.
Suitable for	This project may suit students with an interest in agribusiness, agricultural economics, international development or Pacific studies. Useful qualities include strong written communication, the ability to search and synthesise literature, attention to detail, and comfort working with data. No advanced statistics are required. Open to Master's students in their second year.
Supervisor	Dr Julia Checco (primary) Professor Ammar Abdul Aziz
Contact for further information	Dr Julia Checco: j.checco@uq.edu.au
Additional information	This is a desk-based, review-focused project. Students will be part of a small research team, and findings may inform future work.
School	School of Agriculture and Food Sustainability

Project title	**Germination ecology of sweet summer grass**
Project duration	6 weeks
Hours of engagement	24-30
Location	Gatton campus
Project description	This project will investigate the germination ecology of sweet summer grass (Brachiaria eruciformis) to understand the environmental factors influencing its emergence and establishment. Students will examine the effects of temperature, moisture and other relevant factors on seed germination and determine conditions that favour or restrict emergence. The findings will improve understanding of SSG emergence patterns and support the development of effective integrated weed management strategies.
Expected outcomes and deliverables	Expected outcomes: Students will gain practical experience in seed germination experiments, experimental design, data collection and analysis, and develop an understanding of factors influencing SSG emergence. Deliverables: Students will conduct a controlled germination experiment, analyse and interpret the results, and prepare a scientific report/presentation summarising the findings and their implications for SSG management.
Suitable for	MS students with a background in agriculture
Supervisor	Prof Bhagirath Chauhan (primary)
Contact for further information	Prof Bhagirath Chauhan: b.chauhan@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Herbicide options for sweet summer grass**
Project duration	6 weeks
Hours of engagement	24-30
Location	Gatton campus
Project description	This project will evaluate the efficacy of post-emergence herbicide options for the control of sweet summer grass (Brachiaria eruciformis) in summer cropping systems. It will assess a range of herbicide modes of action and application strategies across different growth stages of the weed. The research will identify effective and reliable herbicide options and determine factors influencing control, including weed size and application timing. Findings will support the development of integrated weed management recommendations for sweet summer grass.
Expected outcomes and deliverables	Expected outcomes: Students will gain practical experience in herbicide efficacy testing, experimental design, data collection and analysis, and develop an understanding of post-emergence herbicide options for managing sweet summer grass. Deliverables: Students will complete a pot herbicide efficacy experiment, analyse and interpret the results, and prepare a scientific report/presentation with recommendations for sweet summer grass management.
Suitable for	MS students with a background in agriculture
Supervisor	Prof Bhagirath Chauhan (primary)
Contact for further information	Prof Bhagirath Chauhan: b.chauhan@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**StomataScope - Transfer Learning for Stomata Segmentation on Digital Microscope Imagery**
Project duration	6 weeks
Hours of engagement	25
Location	St Lucia campus
Project description	Background Stomata are the microscopic pores on plant leaf surfaces that regulate gas exchange and water loss, and their number, size, and shape are important traits for plant phenotyping. Measuring these traits manually is slow and labour-intensive, which motivates the use of deep learning-based instance segmentation to automate the process. While segmentation models have been applied to similar plant phenotyping tasks, adapting them to work reliably on new imaging platforms remains a technical challenge. Research Aims This project aims to adapt and evaluate deep learning-based instance segmentation models for counting wheat stomata and measuring the dimensions of stomata and their sub-components. The objective is to review the existing literature, leverage open datasets from similar crops and pre-trained models where possible, and evaluate and refine model performance on images captured with our custom digital microscope-based imaging setup (DINO-Lite). Methods / Approach While the primary focus of the project is computer vision-based method development and software, this is an end-to-end project spanning the full imaging and modelling pipeline, including: • Setting up and evaluating image capture conditions and image quality • Image annotation and labelling • Model development, adaptation, and evaluation The project may require travel to UQ's Gatton campus to participate in imaging setup and image capture.
Expected outcomes and deliverables	What students can expect to gain or learn: Students will gain practical, hands-on experience developing and adapting deep learning-based instance segmentation models for real-world biological imaging data. They will build skills in constructing automated, reproducible image-analysis pipelines suited to scientific batch processing, as well as experience conducting a structured literature review and communicating technical work through written reporting. The project also offers exposure to the intersection of computer vision and plant phenotyping, an active and growing area of agricultural research.

	What students will be expected to complete: As part of the project, students will be expected to deliver: • A deep learning-based instance segmentation model to count and measure wheat stomata from digital microscope images. • A software pipeline (A polished front-end/UI framework is not required) that analyses images via an automated, batched process and exports results with relevant metadata. • A results report outlining the literature review undertaken, dataset description, training pipeline and model parameters, and evaluation performance.
Suitable for	This project is best suited to students studying computer science, ideally with some hands-on experience applying deep learning models and working with basic knowledge of image analysis techniques. A working familiarity with UQ's Research Computing Centre (RCC) platforms is favourable, given that model development and evaluation will largely be carried out in that environment, and general coding experience is highly valued. That said, students from other backgrounds are also encouraged to apply, especially if they are eager and have some experience in coding and working with imaging data. Applicants should be in or beyond their second year of study. Given the literature review and reporting components of the project, students should also be comfortable conducting an organised, structured literature review and communicating their findings clearly through written reports.
Supervisor	Dr Chrisbin James (primary) Dr Daniel Smith
Contact for further information	Dr Chrisbin James: chris.james@uq.edu.au
Additional information	This project will be undertaken within the Australian Plant Phenomics Network (APPN), a multidisciplinary research group working at the intersection of computer vision, machine learning, and crop science to develop tools and methods for plant phenotyping. Students will be primarily supervised by Dr Chris James, Postdoctoral Platform Fellow in Computer Vision and Machine Learning at APPN, with co-supervision from Dr Daniel Smith, Postdoctoral Research Fellow in Crop Science and APPN Project Lead. Students will have the opportunity to work with an engaging multidisciplinary team and develop both technical computer vision skills and an understanding of how these methods are applied in a real plant phenotyping research context.
School	School of Agriculture and Food Sustainability

Project title	**Antimicrobial spray coating for chopped fruits**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Fresh-cut fruits are highly susceptible to microbial contamination and quality deterioration because cutting damages the protective surface and increases exposure to microorganisms and oxygen. This project aims to develop a food-grade antimicrobial spray coating that can be applied directly to chopped fruits to improve microbiological safety and extend shelf life. The study will investigate edible coating formulations containing selected natural or food-compatible antimicrobial agents. Key formulation parameters, including antimicrobial concentration, coating composition and spray application conditions, will be optimised to achieve uniform surface coverage without adversely affecting fruit appearance, texture or flavour. The antimicrobial effectiveness of the coatings will be evaluated against relevant foodborne microorganisms during refrigerated storage. In parallel, changes in fruit quality, including colour, texture, moisture loss, weight loss and sensory characteristics, will be monitored. The project will establish relationships between coating formulation, antimicrobial activity and fresh-cut fruit quality, providing a practical basis for developing a scalable spray-coating technology for fresh-cut fruit products.
Expected outcomes and deliverables	Development of a food-grade antimicrobial spray coating suitable for chopped fruits. Identification of an effective antimicrobial formulation and spray application conditions. Quantification of microbial reduction and shelf-life extension during refrigerated storage. Evaluation of effects on colour, texture, moisture loss and overall fruit quality. Determination of coating uniformity and stability during storage. Identification of formulations that provide antimicrobial protection without negatively affecting sensory quality. Generation of preliminary data for scale-up, industry application and future research funding. Preparation of data for a peer-reviewed publication.
Suitable for	Food Science and Technology Master's students
Supervisor	Dr Alberto Baldelli (primary) Dr Thaiza Serrano

Contact for further information	Dr Alberto Baldelli: a.baldelli@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Digestibility of seaweed proteins**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Seaweed is an increasingly important sustainable source of protein with potential applications in functional foods and alternative protein products. However, the nutritional value of seaweed proteins is influenced not only by their protein content but also by their digestibility, amino acid composition and interactions with other components of the seaweed matrix. Compounds such as polysaccharides, phenolics and minerals may limit protein accessibility and enzymatic hydrolysis. This project aims to investigate the digestibility of proteins extracted from selected seaweed species and determine how processing and extraction conditions influence protein accessibility and hydrolysis. Seaweed biomass will be characterised for protein content and composition before protein extraction using appropriate food-compatible extraction methods. The resulting protein fractions will be characterised in terms of protein recovery, solubility and physicochemical properties. Protein digestibility will then be evaluated using a simulated gastrointestinal digestion model incorporating sequential gastric and intestinal conditions. Changes in protein hydrolysis will be monitored throughout digestion using measurements such as soluble protein, degree of hydrolysis and peptide profiles. Where appropriate, SDS-PAGE and chromatographic or mass-spectrometry approaches can be used to investigate changes in protein molecular size and peptide composition. The influence of processing conditions, including extraction method and potential pretreatments, will be evaluated to determine whether protein accessibility and digestibility can be improved. The relationship between seaweed composition, protein structure and gastrointestinal digestion will be established. Expected Outcomes and Deliverables The project is expected to: • quantify the protein content and recovery from selected seaweed species; • determine the in vitro gastrointestinal digestibility of seaweed proteins; • identify factors limiting protein accessibility and enzymatic hydrolysis; • determine how extraction and processing conditions influence digestibility; • establish relationships between protein structure, seaweed matrix composition and digestibility; and • identify processing strategies to improve the nutritional value of seaweed protein ingredients.

	Key deliverables will include an optimised protein extraction approach, a comprehensive in vitro digestibility dataset, characterisation of digestion products and preliminary recommendations for developing seaweed-based protein ingredients for functional foods. The research will provide a foundation for future work on seaweed protein extraction, bioactive peptides, sustainable alternative proteins and the development of novel food products.
Expected outcomes and deliverables	Quantification of protein content and recovery from selected seaweed species. Determination of in vitro protein digestibility under simulated gastric and intestinal conditions. Identification of factors limiting protein accessibility and enzymatic hydrolysis. Evaluation of how extraction and processing conditions affect protein digestibility. Characterisation of peptides and protein fractions generated during digestion. Identification of processing strategies to improve the nutritional quality of seaweed proteins. Generation of data for a peer-reviewed publication and future research funding.
Suitable for	Food Science and Technology Master's students
Supervisor	Dr Alberto Baldelli (primary) Dr Thaiza Serrano
Contact for further information	Dr Alberto Baldelli: a.baldelli@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Extraction of omega 3 from microalgae**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Omega-3 fatty acids, particularly EPA and DHA, are important bioactive lipids with applications in functional foods, nutraceuticals and health products. Conventional commercial sources of omega-3 fatty acids rely heavily on marine fish oils, creating concerns regarding sustainability, resource availability, oxidation and supply-chain variability. Microalgae represent a promising alternative because they can produce significant quantities of long-chain polyunsaturated fatty acids without relying directly on fish-derived resources. This project aims to develop and optimise a sustainable process for the extraction of omega-3 fatty acids from microalgal biomass. The research will investigate how microalgal species, biomass characteristics and extraction conditions influence lipid recovery, omega-3 concentration and product quality. The project will begin with the preparation and characterisation of selected microalgal biomass, including determination of moisture, total lipid content and fatty-acid composition. Different extraction approaches will then be investigated, with particular attention to the influence of solvent system, temperature, extraction time, solid-to-liquid ratio and biomass pretreatment on lipid recovery. Where appropriate, mechanical and physical pretreatments such as milling, homogenisation or cell disruption will be evaluated to improve the accessibility of intracellular lipids. The project will also investigate opportunities to reduce solvent consumption and energy requirements through more sustainable extraction approaches. The extracted lipid fraction will be characterised to determine total lipid recovery and the concentration and composition of omega-3 fatty acids. Analytical techniques such as gas chromatography will be used to quantify individual fatty acids, including EPA and DHA where present. Oxidative stability will also be assessed because polyunsaturated fatty acids are particularly susceptible to oxidation during extraction, processing and storage. A key objective will be to establish the relationship between extraction conditions and the quality of the recovered omega-3-rich lipid fraction. The optimal process will therefore not simply be defined by maximum extraction yield, but by achieving high omega-3 recovery while minimising oxidation, solvent use and degradation. The most promising omega-3-rich extracts could subsequently be incorporated into food-grade emulsions or encapsulation systems to improve their oxidative stability, dispersibility and suitability for functional food applications. This provides a potential pathway from microalgal biomass to a stable, food-compatible omega-3 ingredient.

	Significance The project combines microalgal biotechnology, lipid extraction and food-process engineering to develop a sustainable alternative to conventional fish-derived omega-3 sources. Improving the recovery and stability of microalgal omega-3 fatty acids could support the development of plant- and algae-based functional ingredients while contributing to more sustainable approaches to the production of high-value lipids.
Expected outcomes and deliverables	The project is expected to establish an efficient and sustainable process for recovering omega-3-rich lipids from microalgal biomass. It will determine how biomass characteristics, pretreatment and extraction conditions influence lipid yield, omega-3 recovery, fatty-acid composition and oxidative stability. The research will provide a clear process–structure–quality relationship and identify extraction conditions that maximise omega-3 recovery while minimising oxidation, solvent consumption and energy requirements. The resulting omega-3-rich extract will be assessed for its suitability as a food or nutraceutical ingredient and as a potential feedstock for subsequent encapsulation. Deliverables Optimised extraction process for recovering omega-3-rich lipids from selected microalgal biomass. Quantitative lipid and omega-3 recovery data, including total lipid yield and EPA/DHA content where applicable. Comprehensive characterisation of the extracted lipid fraction, including fatty-acid composition and oxidative stability. Evaluation of biomass pretreatment and extraction parameters and their effects on lipid recovery and product quality. Assessment of process sustainability, including solvent use, energy requirements and potential for process optimisation. Food-grade omega-3-rich extract suitable for subsequent formulation and encapsulation studies. At least one manuscript for submission to a peer-reviewed journal, with additional publications depending on the results. Preliminary data for future funding and industry collaboration focused on sustainable omega-3 production, microalgal bioprocessing and functional food ingredients.
Suitable for	Food Science and Technology Master's students
Supervisor	Dr Alberto Baldelli (primary) Dr Yilun Weng
Contact for further information	Dr Alberto Baldelli: a.baldelli@uq.edu.au
Additional information	

School	School of Agriculture and Food Sustainability

Project title	**Extraction of chitin from mushroom**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Chitin is a naturally occurring structural polysaccharide with significant potential for applications in food, biomaterials, packaging, encapsulation and wastewater treatment. Commercial chitin is predominantly obtained from crustacean shells, creating opportunities to investigate alternative and more sustainable sources. Mushroom biomass and processing residues contain chitin within their fungal cell walls and represent a promising renewable source that is currently underutilised. This project aims to develop and optimise a process for the extraction of chitin from mushroom biomass and to characterise the resulting material. The research will investigate how mushroom species, biomass preparation and extraction conditions influence chitin recovery, purity and physicochemical properties. The proposed process will involve initial preparation of the mushroom biomass, including drying, milling and appropriate pretreatment, followed by chemical or environmentally improved extraction steps to remove proteins, minerals, pigments and other non-chitin components. Key processing parameters such as temperature, extraction time, reagent concentration and solid-to-liquid ratio will be systematically investigated to maximise chitin recovery while minimising degradation of the polymer. The extracted chitin will be characterised using techniques such as Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermal analysis and microscopy. Where appropriate, molecular weight, degree of acetylation, crystallinity and surface properties will also be determined. These analyses will establish the relationship between extraction conditions and the structural and functional properties of the recovered chitin. A particular focus will be placed on developing a more sustainable extraction process. Conventional chemical extraction can require substantial quantities of strong acids and bases and generate significant waste streams. Therefore, the project will investigate opportunities to reduce chemical consumption, solvent use and energy requirements while maintaining acceptable chitin purity and recovery. The project will generate a process–structure–property relationship linking mushroom biomass and extraction conditions to the characteristics of the recovered chitin. The most promising material can subsequently be investigated for conversion into chitosan or incorporation into functional materials, encapsulation systems, biodegradable films or adsorbents for environmental applications. Expected Outcomes and Deliverables The project is expected to:

	• establish a reproducible method for extracting chitin from mushroom biomass; • determine the influence of extraction conditions on chitin yield and purity; • characterise the structural, thermal and physicochemical properties of the extracted chitin; • identify processing conditions that balance recovery, purity and sustainability; • assess the potential of mushroom-derived chitin as an alternative to conventional crustacean-derived chitin; and • generate preliminary data for subsequent development of chitosan, encapsulation materials, biodegradable packaging or wastewater-treatment applications. Key deliverables will include an optimised extraction protocol, a comprehensive characterisation dataset, a process–structure–property relationship and a research manuscript suitable for submission to a peer-reviewed journal. Significance The project combines food processing, biopolymer engineering and sustainable resource utilisation. By recovering a valuable biopolymer from mushroom biomass or processing residues, the research supports the development of circular approaches to food waste valorisation while providing an alternative source of chitin for higher-value applications.
Expected outcomes and deliverables	The project is expected to establish a reproducible and sustainable approach for recovering chitin from mushroom biomass. It will determine how extraction conditions influence chitin yield, purity, chemical structure and functional properties, providing a clear relationship between processing conditions and material characteristics. The research will also establish the feasibility of mushroom biomass as an alternative, non-crustacean source of chitin and assess its potential for higher-value applications in food, biomaterials, encapsulation and environmental technologies. Deliverables Optimised chitin extraction process for selected mushroom biomass, including key operating conditions such as temperature, extraction time, reagent concentration and solid-to-liquid ratio. Quantitative assessment of chitin recovery, including extraction yield, purity and mass balance. Comprehensive characterisation of the extracted chitin, including chemical structure, crystallinity, thermal stability, morphology and degree of acetylation where applicable. Process–structure–property relationships linking extraction conditions with the physicochemical and functional properties of the recovered chitin.

	Sustainability assessment comparing chemical consumption, processing requirements and waste generation between alternative extraction approaches. Demonstration of the potential for downstream applications, such as conversion to chitosan, encapsulation materials, biodegradable films or wastewater-treatment adsorbents. At least one manuscript for submission to a peer-reviewed journal, with additional publications depending on the scope and outcomes of the work. Preliminary data for future funding and collaborative projects focused on mushroom waste valorisation, sustainable biopolymers and circular food-processing technologies.
Suitable for	Food Science Master's students
Supervisor	Dr Alberto Baldelli (primary) Dr Thaiza Serrano
Contact for further information	Dr Alberto Baldelli: a.baldelli@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Novel platform for the encapsulation of aroma compounds**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Background and Rationale Aroma compounds are essential contributors to food quality and consumer perception, but many are highly volatile and susceptible to evaporation, oxidation and chemical degradation during processing and storage. These challenges can lead to substantial losses in aroma intensity and reduce product shelf life. Nanoencapsulation provides a promising approach to improve the protection, stability and controlled release of volatile compounds. Emulsion-based nanoencapsulation is particularly attractive because it can provide a high interfacial area and allow the physicochemical environment surrounding the aroma compound to be tailored through the selection of oils, surfactants and stabilising materials. However, the relationship between emulsion structure, surfactant composition and aroma retention remains poorly understood. This project aims to develop a novel emulsion-based nanoencapsulation platform for improving the stability and controlled release of aroma compounds. Aim The overall aim is to develop a food-compatible nanoencapsulation platform based on emulsification and surfactant-mediated stabilisation to improve the retention, stability and controlled release of volatile aroma compounds. Objectives Develop nanoemulsion-based systems for the encapsulation of selected aroma compounds. Investigate the influence of surfactant type, concentration and formulation on nanoparticle and droplet formation. Characterise particle size, size distribution, ζ-potential, morphology and encapsulation efficiency. Determine the influence of emulsion structure and surfactant composition on aroma retention and chemical stability. Investigate the release behaviour of encapsulated aroma compounds under controlled conditions. Methodology Selected food-relevant aroma compounds will be incorporated into an oil phase and dispersed into an aqueous phase containing appropriate food-

	compatible surfactants. Nanoencapsulation will be achieved through controlled emulsification, with systematic variation of surfactant type and concentration, oil-to-water ratio, aroma concentration and processing conditions. The resulting nanoemulsions will be characterised in terms of droplet size distribution, polydispersity, ζ-potential, morphology, physical stability and encapsulation efficiency. These measurements will be used to establish relationships between formulation conditions and nanoemulsion structure. Aroma retention will be investigated during processing and storage to determine the extent of volatile loss and chemical degradation. Where appropriate, real-time volatile organic compound analysis will be used to monitor aroma release and changes in the volatile profile. This will enable differentiation between physical release, volatilisation and chemical degradation. Controlled release experiments will subsequently investigate how changes in surfactant composition, interfacial structure and particle size influence aroma release. The resulting data will be used to identify formulations that provide high aroma retention while allowing predictable release when required. Expected Outcomes The project will establish a novel food-compatible platform for the nanoencapsulation of volatile aroma compounds and provide a better understanding of how surfactant chemistry and emulsion structure influence aroma stability. Expected outcomes include: • optimised nanoemulsion formulations for selected aroma compounds; • improved retention and stability of volatile compounds; • quantitative relationships between surfactant composition, droplet structure and aroma retention; • controlled aroma-release profiles; and • formulation principles that can be applied to other volatile food ingredients. Significance and Future Impact The proposed research will combine food chemistry and colloidal engineering to develop a more rational approach to aroma encapsulation. Rather than relying solely on empirical optimisation, the project will investigate how surfactant-mediated interfacial structures control the behaviour of volatile compounds. The resulting platform could be applied to flavours, essential oils, volatile bioactive compounds and other sensitive food ingredients. The research could also provide a foundation for future development of targeted delivery systems and functional foods where controlled gastrointestinal release of volatile or bioactive compounds is required.

Expected outcomes and deliverables	The project is expected to generate a mechanistic understanding of how surfactant composition, emulsion structure and formulation conditions influence the nanoencapsulation, stability and release of volatile aroma compounds. The research will identify formulation conditions that maximise aroma retention while maintaining suitable nanoemulsion stability and controlled release. The project is expected to demonstrate that manipulation of the interfacial environment can be used to control the partitioning, protection and release of volatile compounds. The resulting knowledge will provide a basis for designing nanoencapsulation systems for a wider range of sensitive food ingredients, including flavours, essential oils and other volatile bioactive compounds. Deliverables Optimised nanoencapsulation formulation for selected food-relevant aroma compounds using food-compatible oils and surfactants. Comprehensive physicochemical characterisation, including droplet size distribution, polydispersity, ζ-potential, morphology, physical stability and encapsulation efficiency. Quantitative aroma-retention data demonstrating the influence of surfactant composition and nanoemulsion structure on volatile compound stability and loss. Volatile-release profiles generated under controlled conditions, providing information on the relationship between formulation characteristics and aroma release. Structure–function relationships linking surfactant properties and interfacial structure with aroma retention, stability and release. At least one manuscript for submission to a peer-reviewed journal, with the potential for additional publications depending on the results. Preliminary data for future collaborative research and funding applications, particularly in the areas of food-grade nanoencapsulation, flavour delivery and controlled-release systems. A transferable nanoencapsulation platform that can subsequently be adapted to other volatile compounds and food applications.
Suitable for	Food Science, Engineering Master's students
Supervisor	Dr Alberto Baldelli (primary) Dr Yilun Weng
Contact for further information	Dr Alberto Baldelli: a.baldelli@uq.edu.au
Additional information	

School	School of Agriculture and Food Sustainability

Project title	**Functional characterisation of novel components required for the development and control of legume nodules**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Nitrogen fertiliser use in agriculture is inefficient, costly and can be environmentally damaging. Legume crops represent an economically and environmentally sound alternative to nitrogen inputs, as their symbiotic relationship with nitrogen-fixing soil bacteria that are housed in specialised organs, called root nodules, enables the host plant to thrive in the absence of nitrogen fertiliser. Identifying critical components of legume nodulation is now needed to optimise the process and improve agriculture sustainability. This project aims to discover and functionally characterise novel factors that act in the development and control of legume nodule numbers. Various approaches, such as using bioinformatic tools and performing cutting-edge genome editing (CRISPR) approaches could be used. Findings will considerably enhance the current nodulation model and could help underpin strategies to reduce the reliance on nitrogen fertiliser use in agriculture.
Expected outcomes and deliverables	Techniques will include growing and maintaining legume plants and compatible rhizobia bacteria, and will incorporate additional, cutting-edge, methods that could include genetically transforming soybean plants using Agrobacterium for overexpression or genome editing (CRISPR), promotor::reporter fusions to visualise gene expression, bioinformatic analyses, primer design and quantitative RT-PCR to confirm the regulation of candidate genes, etc. This will depend on what can fit into the limited time available, but it often is possible to extend the work into subsequent research projects for courses, Honours and/or PhD.
Suitable for	A strong interest in plant science and molecular biology/biotechnology. Those looking to pursue Honours and/or PhD in this area of research will be prioritised.
Supervisor	Brett Ferguson (primary)
Contact for further information	Brett Ferguson: b.ferguson1@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**How extreme events (bushfire and flood) impacts water quality and algal growth in Moreton Bay**
Project duration	6 weeks
Hours of engagement	30-36
Location	St Lucia campus
Project description	Bushfires can increase the transport of sediment, nutrients, and organic matter from catchments to aquatic environments by altering soil properties and reducing vegetation cover. While post-fire impacts on freshwater systems are well studied, less is known about how bushfire-derived materials behave during the freshwater–seawater transition and influence downstream ecosystems. Estuarine mixing can alter nutrient release, transformation, microbial activity, and bioavailability. However, it remains unclear how nutrients from bushfire-affected soils change during transport from catchments to estuaries and whether these changes stimulate algal growth. This project will compare bushfire-affected and unburned soils using laboratory incubations that simulate freshwater–seawater transition. Changes in nutrients and microbial activity will be monitored, while algal bioassays (Lyngbya from Moreton Bay) will assess nutrient bioavailability and potential effects on algal growth . The findings will improve understanding of how bushfires influence nutrient cycling and ecological responses from catchments to estuarine environments.
Expected outcomes and deliverables	Students will need to analyse the data, conduct statistical analyses, and summarise the results in a report.
Suitable for	This project is suitable for students with a background in chemistry, soil science, or microbiology who want to gain hands-on experience in soil sample processing, water quality monitoring, and algal growth experiments.
Supervisor	Dr Leslie Huang (primary)
Contact for further information	Dr Leslie Huang: leslie.huang@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Fine-sediment and nutrient interactions influencing water quality in Logan City**
Project duration	6 weeks
Hours of engagement	30-36
Location	St Lucia campus
Project description	This project investigates how fine sediment, particulate nutrients, and organic matter from the Logan–Albert catchment transform along the catchment–estuary pathway to inform more effective water-quality monitoring and restoration efforts. The Logan–Albert River system, the third-largest catchment in South East Queensland, is under increasing pressure from soil erosion, channel instability, and rising sediment loads. Fine sediment carries organic matter and particulate nutrients that can release bioavailable nitrogen and phosphorus, promoting algal growth, reducing oxygen levels, and degrading water quality. These impacts affect recreation, fisheries, aquatic habitats, and increase long-term waterway management costs. Much of this sediment is mobilised during major rainfall and flood events, with sediment export from the Logan–Albert system estimated to be around 100 times higher than pre-European levels. While sediment sources are relatively well understood, little is known about how nutrients and organic matter are released from sediment as it moves from the upper catchment to the estuary. This project will investigate these processes along the catchment–estuary pathway, helping the City of Logan identify key drivers of nutrient release and eutrophication. The findings will support targeted riverbank and riparian restoration, improved water-quality monitoring and modelling, and ultimately cleaner waterways and healthier aquatic ecosystems.
Expected outcomes and deliverables	Analyse and summarise the data, write a short report based on the data
Suitable for	This project is suitable for students with some background in chemistry who want to gain hands-on skills in soil sample processing and water quality monitoring.
Supervisor	Dr Leslie Huang (primary) Dr Allie Zheng
Contact for further information	Dr Leslie Huang: leslie.huang@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

Project title	**Breaking Down the Egg: Understanding Protein Digestibility**
Project duration	6 weeks
Hours of engagement	30
Location	**St Lucia campus**
Project description	Eggs are a high-quality source of dietary protein, but individual egg proteins differ substantially in their structure, stability and susceptibility to gastrointestinal digestion. Understanding how egg proteins are broken down during digestion is important for evaluating their nutritional quality, bioavailability and potential functional properties. This project will investigate the gastrointestinal digestion of egg proteins using an in vitro digestion model that simulates key stages of human digestion. The student will prepare and characterise egg samples, conduct simulated gastric and intestinal digestion, and monitor changes in protein profiles and the extent of protein hydrolysis using biochemical and analytical techniques. Depending on project progress, selected samples may also be examined using chromatographic or mass spectrometry-based approaches to investigate peptide release during digestion. Particular attention will be given to proteins with high structural and digestive stability, including ovomucoid, to understand how changes in egg protein composition may influence overall protein digestion. The project will provide insight into how different egg proteins respond to digestion and contribute to a broader understanding of the nutritional quality and functionality of egg proteins.
Expected outcomes and deliverables	Through this project, the student will gain practical experience in experimental design, food protein analysis and simulated gastrointestinal digestion. They will develop laboratory skills in sample preparation, protein analysis and data interpretation, together with experience in scientific record keeping and research communication. By the end of the project, the student is expected to: • establish and perform an in vitro digestion workflow for egg samples; • generate and analyse protein digestion profiles; • compare the digestibility of selected egg samples and/or individual egg proteins; • interpret the results in the context of protein structure and nutritional quality; and • prepare a concise research summary and present the key findings at the completion of the project.
Suitable for	This project is suitable for undergraduate or coursework postgraduate students with a background in food science, nutrition, biochemistry, biotechnology, biological sciences or a related discipline. Previous laboratory experience would be advantageous but is not essential. Students should have an interest in food proteins, nutrition and analytical science and be willing to undertake hands-on laboratory work involving sample preparation, simulated digestion and basic biochemical analysis.

	Attention to detail, good record keeping and the ability to work independently after training are desirable.
Supervisor	Professor Nidhi Bansal (primary) Dr Xiaoying Xiong
Contact for further information	Professor Nidhi Bansal: n.bansal@uq.edu.au
Additional information	
School	School of Agriculture and Food Sustainability

School of Chemistry and Molecular Biosciences

Project title	**Organic semiconductor materials for quantum-based optoelectronics**
Project duration	6 weeks
Hours of engagement	6 weeks (36 hrs/week)
Location	St Lucia campus
Project description	The objective of this project is to develop highly efficient organic chromophores suitable for quantum-based optoelectronic devices, which include organic light-emitting diodes (OLEDs) intended for future displays, lighting solutions, and augmented reality applications, as well as organic lasers. Organic semiconductor materials present several significant advantages over their inorganic counterparts, such as being lightweight, highly tunable, cost-effective, and straightforward to synthesise and fabricate. There is a growing interest and demand for highly luminescent organic chromophores, particularly in the fields of lasers and bio-applications like bio-imaging and sensing, in addition to quantum-based optoelectronics. However, the challenge remains to produce organic semiconductors that demonstrate strong luminescence in both solution and solid states while also maintaining suitable energy levels for charge injection in devices. This project will focus on the development of novel organic semiconductors and the investigation of their properties to assess their potential for next-generation quantum-based optoelectronics.
Expected outcomes and deliverables	Students will acquire skills in the design, synthesis, purification, and characterisation of organic materials, along with a comprehension of the operational principles and applications of quantum-based optoelectronic devices, equipping them for future Honours research. Additionally, they will have the chance to delve into advanced photophysics and device physics through collaborative projects with physics experts at QU's School of Mathematics and Physics.
Suitable for	Suitable for 3-year undergraduates who have completed CHEM3001/CHEM3016 or displayed a high level of competency in CHEM2050 and CHEM2054. Students have a strong interest in organic synthesis and material development as well as learning how organic semiconductors work and play roles in our next-generation nano- and quantum technologies.
Supervisor	A/Prof Shih-Chun Lo (primary) A/Prof Ebinazar Namdas
Contact for further information	A/Prof Shih-Chun Lo: s.lo@uq.edu.au

Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Advancing Cryo-EM technology for the study of bacterial toxins and other macromolecular structures**
Project duration	6 weeks
Hours of engagement	36hrs per week
Location	St Lucia campus
Project description	Over the past decade, cryo-EM has revolutionised the study of macromolecular structure. Our lab uses cryo-EM to investigate the structure of novel macromolecular assemblies include pore-forming bacterial toxins. In this project, you will develop and utilise new technological approaches that have the potential to improve the quality and volume of data we can obtain using cryo-EM, which will in turn lead to an enhanced understanding of mechanisms of disease and pathogenesis. This information is crucial for developing new drugs and biotechnologies and understanding mechanisms of disease. Techniques you will obtain experience in may include protein expression and purification, electron microscopy sample preparation, 3D image processing, and protein structure determination, visualisation and interpretation
Expected outcomes and deliverables	Scholars will gain skills in various lab techniques mentioned above and have an opportunity to contribute to publications from their research. Students may also be asked to produce a report or oral presentation at the end of their project.
Suitable for	Suited to students studying in fields or with an interest in Biochemistry & Molecular Biology, Biophysics, Bioinformatics, Chemistry, Computational Science, Microbiology.
Supervisor	A/Prof Michael Landsberg (primary)
Contact for further information	A/Prof Michael Landsberg: m.landsberg@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Exploring student engagement with representations of molecular structure in Augmented Reality tools**
Project duration	6 weeks
Hours of engagement	20-25
Location	St Lucia campus
Project description	This study will explore student engagement with interactive 3D representations of molecular structure that are used as part of an existing bespoke Augmented Reality tool. The work aims to explore several research questions that have arisen from both a current HDR project and a completed Masters thesis, therefore builds on this work. The activities in the project will involve collection and analysis of student interview data regarding how students interact with the AR technology and their perceptions of the representations that are displayed. The overarching aim of this project is to improve usability of the app and accessibility to learning through embedded multimodal resources.
Expected outcomes and deliverables	This research, supervised by advisors from chemistry and computer science, builds on existing projects in our research groups so offers the potential for multidisciplinary teamwork/collaboration. There is also the opportunity for potential co-authorship on any publication that arises from the work.
Suitable for	This project would best suit a student who has completed at least two 1st year chemistry courses and who is also interested in programming/coding applications for AR in education.
Supervisor	Prof Gwen Lawrie (primary) Dr Nell Baghaei
Contact for further information	Prof Gwen Lawrie: g.lawrie@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Linking Metagenomics and Metatranscriptomics to Uncover Carbohydrate-Degrading Enzymes**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	In this project, you will work with samples from continuous bioreactors inoculated with mixed microbial communities derived from diverse environmental sources and fed with lignin-rich substrates. Many microorganisms possess specialised enzymes capable of transforming lignin-derived compounds, yet the diversity and function of these enzymes remain poorly understood, particularly under oxygen-limited conditions. By analysing the genetic potential of these communities, you will identify key carbohydrate-degrading enzymes that may play important roles in carbohydrate depolymerisation and aromatic compound metabolism. A key focus of the project is integrating metagenomic and metatranscriptomic data to determine not only which carbohydrate-degrading enzymes are present, but also which are actively expressed under low-oxygen conditions. You will identify candidate enzyme-encoding genes from metagenomic datasets and overlay transcriptomic information to pinpoint the enzymes and metabolic pathways that respond to carbonhydrate feeding. This combined approach will link microbial identity, genomic potential, and functional activity, providing insights into how complex microbial communities adapt to and transform recalcitrant carbon sources. This project offers hands-on experience in microbial ecology, bioinformatics, and enzyme discovery. You will develop skills in analysing large-scale sequencing datasets, genome-resolved metagenomics, metatranscriptomics, functional annotation, and comparative genomics. Through this work, you will contribute to the discovery of novel carbohydrate-transforming enzymes and advance our understanding of microbial carbon cycling, while exploring opportunities to apply these biological processes to biotechnology and sustainable biomanufacturing.
Expected outcomes and deliverables	Here you will build valuable skills in microbial ecology, DNA sequence analysis, and computational biology, all highly sought-after in both research and industry. You will gain hands-on experience with bioinformatics pipelines, protein classification and functional pathway prediction. These skills will not only prepare you for careers in microbiology, genomics, and biotechnology by understanding the processes involved in carbohydrate degradation.
Suitable for	This project is open to applicants who have: • A background in either genetics, microbiology or bioinformatics at a 3rd or 4th year level. • Familiarity with Linux operating systems and command-line tools. • Experience with in silico protein characterisation. • A strong ability to self-learn; has a good work ethic; able to present and discuss data.

Supervisor	Dr Paul Evans (primary)
Contact for further information	Dr Paul Evans: p.evans3@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Oxidative fluorination of boronic acids using fluorocyclohexadienes**
Project duration	6 weeks
Hours of engagement	30
Location	St Lucia campus
Project description	Previously, oxidative fluorination of aryl boronic acids has been achieved via palladium catalysis using electrophilic fluorination agents such as Selectfluor. We have recently developed methods allowing the palladium catalysed oxidative 'mining' of fluorine from fluorocyclohexadienes. This project aims to extend this approach to allow the formation of new carbon-fluorine bonds through formal transfer fluorination.
Expected outcomes and deliverables	Students will be training in organometallic and organic chemistry. They will learn to use glovebox and Schlenk line apparatus and to purify compounds under inert atmosphere. They will conduct all analysis and structural determination
Suitable for	Chemistry focused majors ideally after completed a range of 3rd year chemistry courses
Supervisor	Dr Rowan Young (primary)
Contact for further information	Dr Rowan Young: rowan.young@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**New Metallosupramolecular Materials**
Project duration	6 weeks
Hours of engagement	20-36 hours per week
Location	St Lucia campus
Project description	We prepare new materials from both metallic and organic components for use in molecular separations. By using self-assembly the inherent physical and chemical properties of simple metallic and organic (ligand) components are brought together to form beautiful complex and functional architectures. In particular, we are interested in the design and synthesis of new materials with central cavities that are capable of selectively binding smaller molecules. Our goals are to: • Design and synthesise new materials • Apply these materials to industrial problems • Better understand self-assembly processes
Expected outcomes and deliverables	Students will gain new laboratory, characterisation, analytical and problem solving skills.
Suitable for	Students who have completed at least CHEM2054 (but ideally CHEM3016).
Supervisor	Professor Jack Clegg (primary)
Contact for further information	Professor Jack Clegg: j.clegg@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Characterising the Functional Impact of Cold Atmospheric Plasma on Cell Fate Regulation in Cutaneous Squamous Cell Carcinoma**
Project duration	6 weeks
Hours of engagement	35
Location	Frazer Institute, Dutton park, UQ
Project description	Background: Cutaneous squamous cell carcinoma (cSCC) is the second most common form of skin cancer and can exhibit aggressive behaviour, particularly in advanced or treatment-resistant disease. Cold Atmospheric Plasma (CAP) is an emerging anti-cancer technology that generates reactive oxygen and nitrogen species capable of inducing cellular stress and tumour cell death. Although CAP has shown promising anti-tumour effects in several cancer models, the mechanisms by which it influences cell fate decisions and cell cycle dynamics in cSCC remain poorly understood. Hypothesis: We hypothesise that CAP alters cell fate decisions in cSCC by disrupting normal cell cycle progression, leading to cell cycle arrest, apoptosis, senescence, or other stress-induced cellular outcomes. These effects can be visualised and quantified in real time using the Fluorescent Ubiquitination-based Cell Cycle Indicator (FUCCI) system. Research Aims: Aim 1: Determine the effects of CAP on cell cycle progression in cSCC cells using the FUCCI live-cell imaging system. Aim 2: Characterise CAP-induced cell fate outcomes, including proliferation arrest, apoptosis, and senescence, following treatment. Aim 3: Investigate molecular mechanisms underlying CAP-mediated effects through assessment of DNA damage, oxidative stress responses, and cell cycle regulatory pathways. Methods and Approach: The student will utilise established FUCCI-labelled cSCC models to monitor real-time changes in cell cycle dynamics following CAP treatment using live-cell fluorescence microscopy. Quantitative image analysis will be performed to evaluate alterations in cell cycle distribution and progression. Complementary assays may include cell proliferation measurements, viability assays, immunofluorescence staining, flow cytometry, and molecular analyses of DNA damage and stress-response pathways. The project will generate novel insights into how CAP regulates tumour cell behaviour and

	may identify mechanisms that can be exploited to improve therapeutic strategies for cSCC. This project offers training in advanced live-cell imaging, cancer cell biology, image analysis, and translational oncology research while contributing to the development of innovative treatments for skin cancer.
Expected outcomes and deliverables	By the completion of this project, the student will have generated novel insights into how Cold Atmospheric Plasma (CAP) influences cell cycle dynamics and cell fate decisions in cutaneous squamous cell carcinoma (cSCC). The project is expected to establish whether CAP induces specific cell cycle perturbations and determine the downstream cellular consequences, including cell cycle arrest, apoptosis, senescence, or recovery. Expected Outcomes: Characterization of CAP-induced alterations in cell cycle progression using FUCCI-labelled cSCC models. Quantitative assessment of CAP effects on cellular proliferation and fate decisions at single-cell resolution. Identification of key molecular pathways associated with CAP-mediated cellular responses, including DNA damage and oxidative stress signalling. Improved mechanistic understanding of the anti-tumour effects of CAP in skin cancer. Deliverables: Generation of high-quality live-cell imaging datasets using the FUCCI system. Quantitative image analysis and statistical evaluation of cell cycle and cell fate responses following CAP treatment. Presentation of findings at laboratory meetings and student research symposia. Preparation of a written research report or thesis summarising the project's findings. Contribution to a manuscript suitable for submission to a peer-reviewed scientific journal, subject to project outcomes and data quality. The project will provide the student with hands-on experience in advanced live-cell imaging, quantitative image analysis, cancer biology, and translational research, while contributing to the development of innovative therapeutic approaches for cutaneous squamous cell carcinoma.
Suitable for	Master's student looking for 16-unit research course.
Supervisor	Dr. Debottam Sinha (primary) A/Prof. Graham Leggatt

Contact for further information	Dr. Debottam Sinha: d.sinha@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Electrocatalysed Functionalisation of Organic Molecules**
Project duration	6 weeks
Hours of engagement	20-36
Location	St Lucia campus
Project description	Synthetic organic electrochemistry and electrocatalysis are gaining importance as a safe and sustainable technology to prepare organic molecules. Electro-organic reactions use electrical current instead of chemical reagents to promote chemical change, thus reducing the cost and generation of waste during the manufacturing of pharmaceuticals. This project will study the synthesis of medicines or their intermediates using electrocatalysis
Expected outcomes and deliverables	The student will gain hands-on experience in organic synthesis and electrocatalysis research
Suitable for	Students with a strong background in chemistry
Supervisor	Dr David Cantillo (primary)
Contact for further information	Dr David Cantillo: d.cantillo@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Structural studies of proteins involved in infection and immunity**
Project duration	6 weeks
Hours of engagement	Physically in the lab at St Lucia 20-36 h/week (flexible).
Location	St Lucia campus
Project description	The aim of this project is to use structural biology to understand the molecular basis of processes involved in infection and immunity. The work has implications for treating a range of infectious and inflammatory diseases and cancer, or for minimizing plant disease. We are focusing in particular on the proteins involved in cytoplasmic signalling by Toll-like receptors, and effector-triggered immunity by plants. The main techniques will involve protein expression, purification, crystallization and structure determination, molecular interaction analyses and characterization of functional effects of site-directed mutants.
Expected outcomes and deliverables	Scholars will gain skills in various lab techniques mentioned above and have an opportunity to contribute to publications from their research. Students may also be asked to produce a report or oral presentation at the end of their project.
Suitable for	Suitable for: Students with background in biochemistry, biophysics and other relevant areas are most suitable. We are looking for motivated students with interest in research in the areas the lab works in.
Supervisor	Prof Bostjan Kobe (primary) Dr Natsumi Maruta
Contact for further information	Prof Bostjan Kobe: b.kobe@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**New Therapies to Combat Deadly Spider Bites**
Project duration	6 weeks
Hours of engagement	36 hrs per week on-site only this is a laboratory based project.
Location	St Lucia campus
Project description	This chemistry project, in collaboration between the Professors Robertson and King labs, uses synthetic organic chemistry to develop novel therapeutics to prevent disfiguring dermonecrotic lesions, hemolytic anemia, renal failure & mortality from Loxosceles spider envenomation. Spiders are one of the most successful animals on the planet, with 100,000 extant species, and all but a few are venomous. However, despite their notorious reputation, only four types of spiders can kill humans. One of these is the recluse spider. Although endemic to tropical and subtropical regions of Africa, Asia, southern Europe, India, the Middle East, and North, Central and South America, recluse spiders are considered one of the most invasive spiders in the world, and they are making ground in Australia. Bites from recluse spiders can cause dermonecrotic skin lesions or a severe systemic syndrome involving haemolysis, renal failure, and potentially death. Loxosceles spiders are a major medical problem in Brazil, with about 8,000 cases annually, which is 150-fold more than the number of funnel-web spider bites reported each year in Australia.
Expected outcomes and deliverables	Medicinal chemistry; synthetic organic chemistry, purification and analytical skills contributing to our series for future patent and/or publication.
Suitable for	Chemistry students who are interested in medicinal chemistry and who have completed synthetic organic chemistry courses ideally to second or third year level.
Supervisor	Professor Avril Robertson (primary)
Contact for further information	Professor Avril Robertson: a.robertson3@uq.edu.au
Additional information	This project can have 1-2 students and although it is a chemistry project there is a multidisciplinary team therefore there are options to branch towards the biology if there is interest.
School	School of Chemistry and Molecular Biosciences

Project title	**Computer Modelling of Molecular Behaviour**
Project duration	6 weeks
Hours of engagement	20-36 hours per week
Location	St Lucia campus
Project description	Using computer simulations, this project offers the opportunity to explore hidden factors that control molecular behaviour in a variety of different environments. By learning how to perform molecular modelling techniques, the student will gain the ability to visualise molecules in 3D and simulate reactions in atomic-level detail. Depending on the student's specific interests, a variety of research directions are available, studying different areas of chemistry such as catalysts, drugs, and transition-state modelling.
Expected outcomes and deliverables	The student will gain skills in molecular modelling using high-performance computing and in applying simulations to understand chemical reaction mechanisms. They will also learn about the activities of the broader research group (e.g. by participating in group meetings and activities) and will be asked to produce a short written and/or oral report at the end of their project.
Suitable for	This project is open to applications from UQ enrolled students majoring in Chemistry who have taken at least one of CHEM2050/2901, CHEM2060/2902, and/or CHEM3011 (or equivalent).
Supervisor	Professor Elizabeth Krenske (primary)
Contact for further information	Professor Elizabeth Krenske: e.krenske@uq.edu.au
Additional information	Please contact the supervisor by email at e.krenske@uq.edu.au prior to submitting an application.
School	School of Chemistry and Molecular Biosciences

Project title	**Synthesis of L-AltNAcA, a rare sugar found in the surface antigen of the pathogenic bacterium Shigella sonnei**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	This project will explore new light-promoted radical chemistry as a means of gaining synthetic access to a specific rare L-sugar, L-AltNAcA. Such rare sugars are key components of bacterial capsular polysaccharides and are important for vaccine development. The project will utilize recently developed reactions in our lab: the purple light-promoted Ferrier photobromination, and a fluorine-directed C-5 epimerization which has previously been instrumental to accessing other rare L-sugars.
Expected outcomes and deliverables	Students will learn how to synthesize, purify and characterize compounds of biological interest. Students will also learn modern photochemistry and radical chemistry techniques.
Suitable for	This project is open to applications from UQ enrolled students only with a major in (organic) chemistry. Must have completed CHEM3001 and CHEM3016 as a minimum. Previous research experience, e.g., SCIE3121, an advantage.
Supervisor	Prof Vito Ferro (primary)
Contact for further information	Prof Vito Ferro: v.ferro@uq.edu.au
Additional information	Interested students must contact the supervisor prior to submitting an application.
School	School of Chemistry and Molecular Biosciences

Project title	**Advanced organic materials**
Project duration	6 weeks
Hours of engagement	6 weeks (36 hrs/week)
Location	St Lucia campus
Project description	The aim of this project is to study novel classes of organic semiconductors for cutting-edge optoelectronic devices. Organic semiconductor materials present significant advantages over their inorganic counterparts, including being lightweight, highly customizable, cost-effective, and easy to process. Despite the growing interest and demand for highly efficient organic chromophores, particularly in the fields of lasers and quantum technologies, the development of new efficient organic semiconductors continues to pose challenges. This project will focus on the innovation of organic semiconductors and assess their properties for potential applications in quantum-based systems.
Expected outcomes and deliverables	In addition to enhancing their communication skills, students will learn to design, synthesise, purify, and characterize organic materials. They will also develop an understanding of the working principles and applications of quantum-based optoelectronic devices. Moreover, they will have the chance to delve into advanced photophysics and device physics through collaborative projects with physics experts at UQ's School of Mathematics and Physics, along with our international partners.
Suitable for	Most suitable for 3-year undergraduates who have completed CHEM3001/CHEM3016 or showed high-level competency in CHEM2050 and CHEM2054 and have a strong interest in organic materials chemistry.
Supervisor	A/Prof Shih-Chun LO (primary) A/Prof Ebinazar Namdas
Contact for further information	A/Prof Shih-Chun LO: s.lo@uq.edu.au
Additional information	
School	School of Chemistry and Molecular Biosciences

Project title	**Generative modelling for realistic evolutionary histories**
Project duration	6 weeks
Hours of engagement	36 hours per week (flexible)
Location	St Lucia campus
Project description	The simulation of biological sequences is an essential task in molecular biology as it enables the benchmarking and evaluation of the most fundamental methodology of bioinformatics applications as multiple sequence aligners, phylogenetic analysis and models for inferring insertion and deletion events. A fundamental challenge is that simulated alignments are clearly distinguishable from real alignments, compromising the validity of benchmarking tools with simulations due to their systematic biases. Recent advancements in deep generative models of molecular sequences and structures have allowed the exploration of synthetic molecular data. We propose that with a more flexible and complex parameterisation offered by generative models may allow us to generate more realistic simulated evolutionary histories.
Expected outcomes and deliverables	The student will gain specific skills in biological sequence analysis, deep learning, and using high-performance computing resources. The student will also be involved in project design and planning, developing a strong scientific basis which can be applied to a diverse range of future research projects.
Suitable for	This project is entirely computational (no lab component). The Candidate should possess intermediate programming skills in the Python language and ideally have an understanding of molecular biology having taken bioinformatics and/or machine learning courses. Some aspects of the project may be tailored to the interests of the successful candidate.
Supervisor	Professor Mikael Boden (primary) Mr William Rieger
Contact for further information	Professor Mikael Boden: m.boden@uq.edu.au
Additional information	Prospective students should contact w.rieger@uq.edu.au or s.porras@uq.edu.au to discuss this project before applying.
School	School of Chemistry and Molecular Biosciences

School of the Environment

Project title	**Coagulotoxic effects of snake venoms**
Project duration	6 weeks
Hours of engagement	28
Location	St Lucia campus
Project description	This project will use advanced robotic coagulation analysers to determine the pathophysiological effects of snake venom upon the human blood clotting cascade, and to ascertain the relative efficacy of antivenoms and enzyme inhibitors in neutralising these actions.
Expected outcomes and deliverables	This project will teach advanced biochemical analytical skills.
Suitable for	Suitable for science students.
Supervisor	Professor Bryan Fry (primary)
Contact for further information	Professor Bryan Fry: bgfry@uq.edu.au
Additional information	
School	School of the Environment

Project title	**Olfactory responses of Mallada signatus larvae to different prey on host plants**
Project duration	6 weeks
Hours of engagement	30+. the project will require almost full time commitment to ensure that insect cultures and plant are maintained and available for experiments.
Location	St Lucia campus
Project description	The project will investigate the olfactory responses of M. signatus larvae to prey (aphids and/ or lepidopteran larvae) on different host plants. Responses of M. signatus will be investigated in laboratory olfactometer studies. The student will need to help rear the M. signatus and prey insects as well as the different plants required for the work.
Expected outcomes and deliverables	Students will gain valuable experience in insect rearing, and designing and executing behavioural experiments. They will need to be very organised to ensure that prey insects are produced on time
Suitable for	The project will suit students with experience in entomology and ecology. It is only suitable for 3rd and 4th year students
Supervisor	Professor Mike Furlong (primary)
Contact for further information	Professor Mike Furlong: m.furlong@uq.edu.au
Additional information	
School	School of the Environment

Project title	**Digital Twin for Circular Green Hydrogen Production: Flexible electrolysis, resource recovery and sustainability decision support**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration through scheduled video meetings. The project is desk-based and computational. Professor Halog will provide at least one hour of direct supervision each week, in person or by video call.
Project description	Green hydrogen produced by renewable-powered electrolysis can support industrial decarbonisation, energy storage and low-carbon fuels. Its performance varies with renewable-electricity availability, electrolyser technology and loading, water supply, equipment degradation and the use or disposal of oxygen and waste heat. Conventional static assessments can miss these time-dependent interactions and the feedbacks that determine cost, emissions, water demand and resilience. This project will develop a transparent prototype digital twin for a flexible green-hydrogen production system. The model will represent hourly or representative-period renewable electricity, electrolyser operation and selected circular strategies: oxygen valorisation, useful heat recovery and water reuse. Depending on data quality and the student's background, one primary electrolyser technology - proton-exchange membrane, alkaline or solid-oxide electrolysis - will be modelled in detail, with one alternative included as a benchmark rather than attempting a full industrial process simulation. The central research question is: when do flexible operation and circular recovery of oxygen, heat and water materially improve the environmental and economic performance of green hydrogen? The working hypothesis is that circular strategies can reduce impacts and create value, but their benefit will depend on renewable-electricity variability, electrolyser efficiency and degradation, local demand for co-products, recovery infrastructure and the counterfactual production of displaced oxygen, heat or water. The student will undertake a structured evidence review; define the system boundary, functional unit and performance indicators; compile open operational, engineering, environmental and cost data; and build a reproducible model in Python, R, MATLAB, Excel or another agreed platform. A system-dynamics or time-stepped simulation will calculate hydrogen output, electricity and water use, oxygen and recoverable heat, indicative cost and greenhouse-gas performance. Scenario and sensitivity analysis will compare operational flexibility, renewable profiles, electrolyser assumptions and circular-resource configurations. If suitable data are available, a simple explainable machine-learning surrogate or rule-based controller may be

	added; AI will support, not replace, transparent process and sustainability reasoning. The project is desk-based and will use published and openly available information. It will not require laboratory experiments, confidential industrial data or human-participant research. The prototype is intended for research screening and will not control physical equipment or make safety-critical decisions. Results will identify high-value circular configurations, trade-offs, influential assumptions and the data required for later validation.
Expected outcomes and deliverables	The student will gain experience in international collaborative research, green-hydrogen systems, process and material-flow modelling, digital-twin design, life-cycle and indicative techno-economic methods, scenario analysis, reproducible decision support and communication with an interdisciplinary research team. The student will complete: 1. A documented evidence and data inventory covering electrolyser performance, renewable-electricity profiles, water use, degradation, oxygen and heat recovery, lifecycle factors and indicative costs. 2. A system architecture and causal or stock-flow map showing physical flows, operating decisions, circular feedbacks, inputs, outputs and performance indicators. 3. A reproducible prototype digital twin with transparent equations, assumptions, validation checks and a concise user guide. 4. Scenario and sensitivity results comparing renewable variability, flexible operation, electrolyser assumptions and oxygen, heat and water recovery configurations, with an optional explainable AI component where justified by the data. 5. A two-page research and industry brief identifying promising configurations, circularity trade-offs, influential variables, validation needs and potential next-stage applications. 6. A technical report of approximately 3,000-4,000 words, a final 10-minute presentation, and a manuscript-ready methods/results package. Authorship on later outputs will follow normal contribution-based academic criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is particularly suitable for students in chemical, process, environmental, mechanical or electrical engineering, environmental science or management, energy studies, computer or data science, economics, business analytics, or a related discipline. • Interest in green hydrogen, electrolysis, renewable energy, circular economy, process systems, digital twins, industrial ecology, life-cycle assessment or AI-enabled sustainability. • Ability to locate, evaluate and synthesise academic, government, industry and technical sources and maintain a transparent data and assumptions record. • Basic quantitative and spreadsheet skills; experience with Python, R, MATLAB, LCA software, techno-economic analysis, GIS, material-flow analysis, multicriteria analysis or explainable machine learning is desirable but not essential.

	• Capacity to work independently, document equations and assumptions, handle uncertain data carefully and communicate progress clearly across engineering and sustainability disciplines. • Undergraduate applicants must have completed at least 16 units. Postgraduate applicants must be enrolled in a relevant coursework program or hold a relevant undergraduate degree. Previous UQ Summer Research Program participants are ineligible under Faculty guidance.
Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au
Additional information	This is an unpaid work-experience opportunity supported by the Summer Research Program grant and cannot be completed for course credit. The project is designed for one student. The electrolyser focus, temporal resolution and model complexity will be selected in Week 1 according to evidence quality and the student's background; a robust, transparent prototype is preferable to an overextended process simulation or opaque AI application. The project will not attempt real-time plant control, hardware-in-the-loop testing, detailed equipment design or safety certification. All required software will be open source or available through UQ. No prior specialist hydrogen, digital-twin, LCA or AI experience is required. Students are encouraged to contact Professor Halog before applying, noting that endorsement does not guarantee selection.
School	School of the Environment

Project title	**Sustainable Aviation Fuel from Regional Biomass Residues**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration through scheduled video meetings. The project is desk-based and computational. Professor Halog will provide at least one hour of direct supervision each week, in person or by video call.
Project description	Aviation is difficult to electrify directly, so sustainable aviation fuel (SAF) is expected to play an important role in reducing fossil-carbon use. Biomass-to-liquid pathways using agricultural and forestry residues could produce drop-in fuel while creating value from underused biological resources. Their sustainability, however, depends on feedstock availability, competing uses, collection and transport, conversion efficiency, hydrogen and energy supply, carbon accounting and the scale and location of production facilities. This project will develop a transparent supply-network and sustainability-screening model for SAF produced from regional lignocellulosic residues through gasification and Fischer-Tropsch synthesis. It is a focused student work package within the UQ-TUM collaboration initiated through Erasmus+ teaching and research exchange. The central research question is: under what feedstock, logistics, process-energy and scale conditions could residue-based SAF deliver credible environmental and resource benefits in Queensland and Bavaria? The working hypothesis is that residues can support substantial greenhouse-gas reductions, but performance will be highly sensitive to recoverable feedstock share, transport distance, moisture and pre-processing, conversion yield, electricity and hydrogen source, treatment of co-products and the counterfactual use of the biomass. The student will undertake a structured evidence review; define a common functional unit and system boundary; select one representative residue portfolio for each region; compile open feedstock, logistics, conversion, energy and cost data; and build a reproducible decision-support model in Python, R, Excel or another agreed platform. Material and energy flow accounting, simplified life-cycle assessment and indicative techno-economic screening will compare scenarios such as centralised versus distributed pre-processing, alternative collection radii, different hydrogen or electricity supplies, and conservative versus higher feedstock mobilisation. A simple facility-location or supply-allocation analysis may be included if the selected student's skills and available spatial data permit. The project will use published and openly available information and will not involve laboratory experiments, confidential company data or human-participant research. The Australian and German cases will be harmonised around the same fuel output and indicators, while regional differences in residues, transport, energy supply and competing uses will be represented transparently. Uncertainty will be explored through sensitivity ranges rather than false precision. Results will identify feedstock and logistics bottlenecks, environmental hotspots, promising configurations and priority evidence gaps.

Expected outcomes and deliverables	The student will gain experience in international comparative research, sustainable aviation fuels, biomass supply-chain analysis, material and energy balances, life-cycle and indicative techno-economic methods, scenario modelling, sensitivity analysis, reproducible decision support and communication with an international research team. The student will complete: 1. A documented evidence and data inventory covering residue availability, competing uses, collection, transport, pre-processing, conversion yields, energy and hydrogen requirements, co-products and indicative costs. 2. A harmonised functional unit, system boundary and SAF value-chain map for the selected Queensland and Bavarian residue portfolios. 3. A reproducible supply-network, material/energy-flow, life-cycle and indicative cost-screening model with transparent assumptions, validation checks and a concise user guide. 4. Scenario and sensitivity results comparing feedstock mobilisation, collection radius, pre-processing configuration, facility scale and electricity or hydrogen supply. 5. A two-page research and policy brief identifying promising SAF configurations, feedstock and logistics constraints, environmental hotspots, evidence gaps and bilateral opportunities. 6. A technical report of approximately 3,000-4,000 words, a final 10-minute presentation, and a manuscript-ready methods/results package. Authorship on later outputs will follow normal contribution-based academic criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is particularly suitable for students in environmental science or management, chemical/process or environmental engineering, energy studies, agricultural science, forestry, transport, economics, data science, business analytics, or a related discipline. • Interest in sustainable aviation, biofuels, circular bioeconomy, biomass residues, industrial ecology, life-cycle assessment, renewable energy or regional supply chains. • Ability to locate, evaluate and synthesise academic, government, industry and technical sources and maintain a transparent data and assumptions record. • Basic quantitative and spreadsheet skills; experience with Python, R, MATLAB, LCA software, techno-economic analysis, GIS, material-flow analysis or operations research is desirable but not essential. • Capacity to work independently, compare international cases fairly, handle uncertain assumptions carefully and communicate progress clearly across disciplines. • Undergraduate applicants must have completed at least 16 units. Postgraduate applicants must be enrolled in a relevant coursework program or hold a relevant undergraduate degree. Previous UQ Summer Research Program participants are ineligible under Faculty guidance.

Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au
Additional information	This is an unpaid work-experience opportunity supported by the Summer Research Program grant and cannot be completed for course credit. The project is designed for one student. The final residue portfolios and level of network detail will be selected in Week 1 according to data quality and the student's background; a robust screening model is preferable to an overextended process simulation. The project will not attempt aircraft-engine testing, fuel certification or detailed Aspen design. All required software will be open source or available through UQ. No prior specialist SAF/LCA experience is required; English-language sources, training and methodological templates will be provided. Students are encouraged to contact Dr. Halog before applying, noting that endorsement does not guarantee selection.
School	School of the Environment

Project title	**Closing the Loop for Rare-Earth Permanent Magnets: Australia-Japan Material-Flow and Life-Cycle Screening**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration via scheduled video meetings. The project is desk-based and computational. Professor Halog will provide at least one hour of direct supervision each week by video or in person.
Project description	Rare-earth permanent magnets are essential components of electric motors, wind turbines, robotics and other low-carbon technologies. Demand for neodymium-iron-boron magnets is increasing, yet their supply chains are geographically concentrated and associated with material losses, energy use, emissions and limited end-of-life recovery. Australia has significant resource potential, while Japan has advanced manufacturing, resource-efficiency and urban-mining capabilities. Connecting these strengths could support more resilient and circular clean-technology supply chains. This project will develop a transparent material-flow and life-cycle screening model for selected rare-earth elements used in permanent magnets, focusing on neodymium and, where data permit, dysprosium. It is a focused student work package on circular economy and critical-resource systems. The central research question is: where are the most important material losses and environmental hotspots in a potential Japan-Australia rare-earth magnet value chain, and which circular strategies could most effectively improve resource security and environmental performance? The working hypothesis is that improved collection, component reuse, higher recycling recovery and strategic use of secondary materials can reduce primary resource demand, but their relative benefits depend on product lifetimes, collection rates, recovery yields, material substitution and the electricity used in processing. The student will undertake a structured evidence review; define a functional unit and system boundary; compile open data on production, trade, manufacturing, use and end-of-life flows; and build a reproducible model using Python, R, Excel or another agreed platform. Material-flow analysis will quantify inputs, stocks, losses and recovery opportunities. Simplified life-cycle indicators will screen greenhouse-gas emissions, energy demand and resource use. Scenario and sensitivity analysis will compare a baseline with options such as improved end-of-life collection, direct component reuse, higher recovery efficiency and increased recycled content. The project will use published and openly available information and will not involve laboratory experiments, confidential company data or human-participant research. Uncertain or incomplete data will be documented explicitly and tested through ranges rather than treated as exact values. The outputs will identify priority evidence gaps, circularity interventions and next steps for a higher-resolution bilateral model and future collaborative publication or funding proposal.

Expected outcomes and deliverables	The student will gain practical experience in critical-material research, international supply-chain analysis, material-flow and life-cycle methods, scenario modelling, uncertainty analysis, reproducible research and communication. The student will complete: 1. A documented evidence and data inventory for selected rare-earth elements, permanent-magnet applications, trade, product lifetimes, collection and recovery processes. 2. A clearly defined functional unit, system boundary and Japan-Australia value-chain map showing material inputs, stocks, losses, trade links and end-of-life pathways. 3. A reproducible material-flow and life-cycle screening model with transparent assumptions, validation checks and a concise user guide. 4. Scenario and sensitivity results comparing improved collection, component reuse, recycling recovery and recycled-content strategies. 5. A two-page research and policy brief identifying major hotspots, data gaps and priority bilateral opportunities for improving circularity and resource security. 6. A technical report of approximately 3,000-4,000 words, a final 10-minute presentation, and a manuscript-ready methods/results package. Authorship on later outputs will follow normal contribution-based academic criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is particularly suitable for students in environmental science or management, mining or minerals engineering, chemical/process or environmental engineering, materials science, energy studies, economics, data science, international trade, or a related discipline. • Interest in critical minerals, clean-energy technologies, circular economy, industrial ecology, resource security, recycling, life-cycle thinking or international supply chains. • Ability to locate, evaluate and synthesise academic, government, trade and technical data and maintain a transparent source record. • Basic quantitative and spreadsheet skills; experience with Python, R, MATLAB, LCA software, material-flow analysis, input-output analysis or data visualisation is desirable but not essential. • Capacity to work independently, handle uncertain data carefully, communicate progress clearly and collaborate across disciplines and cultures. • Undergraduate applicants must have completed at least 16 units. Postgraduate applicants must be enrolled in a relevant coursework program or hold a relevant undergraduate degree. Previous UQ Summer Research Program participants are ineligible under Faculty guidance.
Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au

Additional information	
School	School of the Environment

Project title	**Circular and Renewable EV Battery Manufacturing: Scenario and Policy Analysis**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration via scheduled video meetings. The work is desk-based and computational. Dr. Halog will provide at least one hour of direct supervision each week, in person or by video call.
Project description	Electric-vehicle battery manufacturing is expanding rapidly to meet growing demand for low-emission transport. However, battery production is energy- and material-intensive and can generate substantial greenhouse gas emissions, resource pressures, pollution and waste. Renewable electricity, recycled materials and improved recovery systems may reduce these impacts, but their effectiveness depends on battery chemistry, electricity sources, recycled-content levels, recovery efficiency and other operating assumptions. This project will develop a transparent scenario model to evaluate how renewable-energy and circular-economy strategies could improve the environmental performance of EV battery manufacturing. The student will compare a manageable set of scenarios, including conventional grid-powered production, renewable-electricity supply, increased recycled-material content, and an integrated circular-and-renewable pathway. The research will involve a structured literature review, secondary-data collection, material and energy flow mapping, simplified life-cycle and emissions accounting, and scenario and sensitivity analysis. The student will build a reproducible model using Python, R, Excel or another agreed modelling platform. The analysis will identify which technical and energy-related factors most strongly influence greenhouse gas emissions, energy demand, resource consumption and waste generation. The project will use published and openly available information and will not involve laboratory experiments, confidential industry data or human-participant research. Its outputs will provide practical evidence on how battery manufacturing can be supported by cleaner energy, greater material circularity and more resource-efficient production systems.
Expected outcomes and deliverables	The student will gain practical experience in comparative research, emissions and material-flow accounting, scenario design, sensitivity analysis, policy benchmarking, reproducible modelling and communication for academic and policy audiences. The student will complete: 1. A documented evidence and data inventory for representative battery manufacturing, electricity supply, recycled-material inputs and key policy instruments. 2. A clear functional unit, system boundary and systems map linking electricity, materials, emissions, waste and policy levers.

	3. A functional and reproducible scenario model comparing current-grid, renewable-electricity, circular-material and integrated circular-plus-renewable pathways. 4. Sensitivity results identifying which technical, energy and policy assumptions most strongly influence pathway performance. 5. A structured policy benchmark and a concise two-page policy options brief. 6. A technical report of approximately 3,000-4,000 words, a final 10-minute presentation, and a manuscript-ready methods/results package. Authorship on later outputs will follow normal contribution-based academic criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is especially suitable for students in environmental science or management, chemical/process or environmental engineering, energy studies, economics, public policy, data science, business analytics, or a related discipline. • Interest in climate policy, renewable energy, EV batteries, circular economy, industrial decarbonisation, critical minerals or life-cycle thinking. • Ability to find, evaluate and synthesise academic, government, industry and policy sources and document evidence carefully. • Basic quantitative and spreadsheet skills; experience with Python, R, MATLAB, LCA software, energy modelling or policy analysis is desirable but not essential. • Capacity to work independently, compare different national policy settings fairly, communicate uncertainty and collaborate across disciplines and cultures. • Undergraduate applicants must have completed at least 16 units. Postgraduate applicants must be enrolled in a relevant coursework program or hold a relevant undergraduate degree. Previous UQ Summer Research Program participants are ineligible under Faculty guidance.
Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au
Additional information	This is an unpaid work-experience opportunity supported by the Summer Research Program grant and cannot be completed for course credit. The project is designed for one student and can be calibrated to the selected student's disciplinary background while preserving the core outputs. All required software will be open source or available through UQ. No prior battery-LCA, energy-modelling is required; English-language data and policy sources will be prioritised and methodological templates will be supplied. Students are encouraged to contact Professor Halog before applying, noting that endorsement does not guarantee selection.
School	School of the Environment

Project title	**Digital Twin for Circular EV Batteries: Comparing Reuse and Recycling Pathways**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration via scheduled video meetings. The work is desk-based and computational. Dr. Halog will provide at least one hour of direct supervision each week, in person or by video call.
Project description	The rapid growth of electric mobility is increasing demand for lithium, nickel, cobalt, graphite and other battery materials. Extending battery life through second-use applications and recovering materials through recycling could reduce primary resource demand and environmental impacts, but the benefits depend on battery chemistry, remaining capacity, electricity mix, transport, processing efficiency and the application displaced. This project will develop a minimum viable digital-twin and decision-support prototype to compare circular pathways for end-of-first-life electric-vehicle batteries. It is a focused student work package on AI-enabled circular mobility and energy systems. The principal research question is: under what conditions do battery life extension, stationary second use, and alternative recycling pathways provide the strongest environmental and resource-circularity benefits? The working hypothesis is that there is no universally preferred pathway: rankings will change with battery chemistry, state of health, grid carbon intensity, recovery yield, transport distance, displaced product and assessment horizon. The student will undertake a structured review and secondary-data collection; define a functional unit and transparent system boundary; map battery stocks, flows and decision points; and build a reproducible prototype using Python, R, Excel or an agreed modelling platform. A manageable set of representative battery chemistries and pathways will be screened using material-flow analysis, simplified life-cycle assessment and circularity indicators. Scenario and sensitivity analysis will identify thresholds at which reuse or recycling becomes preferable. Indicative cost or social indicators may be included where reliable comparable data are available, but they are not mandatory for successful completion. The project requires no laboratory work, confidential company information or human-participant research. It will rely on published and open data, clearly document uncertainty and avoid false precision. Results will provide a comparative evidence base, identify priority data gaps and create a model architecture.
Expected outcomes and deliverables	The student will gain experience in comparative research, data-quality assessment, material-flow and life-cycle modelling, scenario design, uncertainty analysis, reproducible computational work and communication. The student will complete:

	1. A documented evidence and data inventory covering selected battery chemistries, first-life characteristics, second-use options, recycling processes and regional electricity and transport assumptions. 2. A comparative system boundary, decision map and battery material-flow model. 3. A functional minimum viable digital-twin or decision-support prototype with reproducible model files, validation checks and a concise user guide. 4. Scenario and sensitivity results identifying the parameters and thresholds that drive the relative performance of reuse and recycling pathways. 5. A technical report of approximately 3,000-4,000 words, a two-page policy and research brief, and a final 10-minute presentation. 6. A manuscript-ready methods/results package and recommendations for extending the work. Authorship on subsequent outputs will follow normal contribution-based academic criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is particularly suitable for students in environmental science or management, chemical/process or environmental engineering, energy studies, data science, computer science, mathematics, economics, business analytics, or a related discipline. • Interest in electric mobility, batteries, circular economy, industrial ecology, life-cycle thinking, critical materials, energy transitions or digital modelling. • Ability to locate, evaluate and synthesise academic, government and technical sources and maintain a careful data record. • Basic quantitative and spreadsheet skills; experience with Python, R, MATLAB, LCA software, material-flow analysis or systems modelling is desirable but not essential. • Capacity for independent work, transparent documentation, interdisciplinary collaboration and clear written and oral communication. • Undergraduate applicants must have completed at least 16 units. Postgraduate applicants must be enrolled in a relevant coursework program or hold a relevant undergraduate degree. Previous UQ Summer Research Program participants are ineligible under Faculty guidance.
Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au
Additional information	This is an unpaid work-experience opportunity supported by the Summer Research Program grant and cannot be completed for course credit. The project is designed for one student and can be calibrated to the selected student's background without changing its core outcomes. All required software will be open source or available through UQ. No prior battery-LCA or digital-twin experience is required; introductory training, templates and methodological guidance will be provided. Students are encouraged to

	contact Professor Halog before applying to discuss suitability, noting that endorsement does not guarantee selection.
School	School of the Environment

Project title	**Digital Twin for Circular Carbon: Screening Waste-to-Bioplastic Pathways**
Project duration	6 weeks
Hours of engagement	36 hours per week
Location	St Lucia campus, with hybrid collaboration via scheduled video meetings. The project is primarily desk-based and computational. Dr. Halog will provide at least one hour of direct supervision each week, in person or by video call.
Project description	Plastics and other carbon-intensive materials remain heavily dependent on fossil feedstocks, while agricultural, food-processing and municipal biogenic residues are often underused. This project will develop a minimum viable digital-twin and decision-support prototype to compare selected waste-to-bioplastic pathways. It forms an early student-led work package on AI-enabled circular carbon systems and will establish an evidence base for subsequent research activities. The research asks: which combinations of waste feedstock, conversion pathway and operating assumptions appear most promising when environmental performance, resource circularity, technical feasibility and indicative cost are considered together? The working hypothesis is that pathway rankings will change across regions and decision criteria; therefore, integrated scenario and sensitivity analysis will provide more useful guidance than a single environmental or economic metric. The student will undertake a structured literature and data review; define a transparent system boundary and functional unit; map material, energy and carbon flows; and build a reproducible prototype in Python, R, Excel or an agreed systems-modelling platform. Two or three representative pathways will be screened using simplified life-cycle assessment, material-flow analysis, circularity indicators and indicative techno-economic parameters. Scenario and sensitivity testing will examine influential assumptions such as feedstock availability, conversion yield, energy mix, transport distance, product substitution and end-of-life route. If data quality permits, a small machine-learning component may be explored, but it is not required for successful completion. The project uses published and open secondary data and does not require laboratory experiments, confidential industry data or human-participant research. The emphasis is on transparent assumptions, reproducibility and defensible interpretation rather than false precision. Results will identify evidence gaps, priority pathways and a practical roadmap for extending the prototype into a higher-fidelity digital twin.
Expected outcomes and deliverables	The student will gain practical experience in interdisciplinary research design, systematic evidence gathering, data quality assessment, material-flow and life-cycle thinking, scenario modelling, sensitivity analysis, reproducible research and communication. By the end of the program, the student will be expected to complete:

	1. A documented evidence and data inventory for two or three selected waste-to-bioplastic pathways, including sources, assumptions, units and data-quality notes. 2. A system boundary, process map and material/energy/carbon flow model for the selected pathways. 3. A functional minimum viable digital-twin or decision-support prototype with a clear user guide and reproducible files. 4. Scenario and sensitivity results comparing environmental, circularity and indicative economic performance. 5. A concise technical report of approximately 3,000-4,000 words and a final 10-minute presentation. 6. A two-page manuscript-ready methods/results brief identifying the next research steps, suitable for incorporation into a joint publication or funding proposal. Authorship on later outputs will depend on contribution and normal academic authorship criteria.
Suitable for	The project is open to eligible undergraduate, honours and master's-by-coursework students. It is especially suitable for students in environmental science or management, chemical/process engineering, environmental engineering, data science, computer science, mathematics, economics, business analytics, or a related discipline. • Interest in circular economy, industrial ecology, life-cycle thinking, sustainable materials, bioeconomy or digital modelling. • Ability to search and critically synthesise academic and technical literature and to document data sources carefully. • Basic quantitative skills and confidence using spreadsheets; experience with Python, R, MATLAB, LCA software or systems modelling is desirable but not essential. • Capacity to work independently, communicate progress clearly, collaborate across disciplines and learn unfamiliar methods quickly. • Students should have completed at least one year of an undergraduate degree (minimum 16 units), or be enrolled in a relevant postgraduate coursework program. Prior participants in a UQ summer research program are ineligible under the Faculty guidance.
Supervisor	Dr. Anthony Halog (primary)
Contact for further information	Dr. Anthony Halog: a.halog@uq.edu.au
Additional information	
School	School of the Environment
Project title	**Coagulotoxic effects of snake venoms**

Project duration	6 weeks
Hours of engagement	28
Location	St Lucia campus
Project description	This project will examine the effects of snake venoms upon blood coagulation, and the ability of antivenoms to neutralise these pathophysiological effects. This will contribute to the body of knowledge necessary for evidence-based design of clinical management strategies.
Expected outcomes and deliverables	The student will learn how to use advanced-robotics coagulation analysers of the types used in modern hospital pathology laboratories. The data may lead to a first-author paper for the student.
Suitable for	As this is a short-term project, it requires familiarity with coagulation measuring techniques and basic biochemistry.
Supervisor	Professor Bryan Fry (primary)
Contact for further information	Professor Bryan Fry: bgfry@uq.edu.au
Additional information	
School	School of the Environment

Project title	**Exploring the triggers of recent explosive eruptions in Indonesia**
Project duration	6 weeks
Hours of engagement	30 h per week (approx 6h per day but can be distributed flexibly)
Location	St Lucia campus
Project description	Volcanic eruptions pose major hazards to almost one in ten people around the world living in close proximity of active volcanoes. Volcanoes also impact air traffic and can have short term climatic effects. We have an outstanding sequence of samples of volcanic ash from the 2024 explosive eruptions at Mt Lewotobi in Indonesia, and this project will aim to characterise the ash particles under the microscope and prepare them for geochemical analysis. A better understanding of the recent 2024 Lewotobi products will help better forecast volcanic activity into the future.
Expected outcomes and deliverables	The student will join the vibrant, diverse and inclusive #UQmagmateam led by Ubide, and will gain skills in volcanology, microscopy, microanalysis and teamwork. Under the supervision of Ubide and Olfindo, the student will describe and characterise the volcanic ash particles produced by Mt Lewotobi through 2024, classify them into juvenile glass, lithic fragments and a range of mineral phases, and explore their textural and chemical variations through time, aiming to better understand magmatic processes driving volcanism at Lewotobi. The student will undertake preliminary microscope observations and then mount the ash particles in resin mounts for further microscope examination with SEM-EDS, followed by geochemical analyses.
Suitable for	Bachelor of Science or Bachelor of Advanced Science students with a strong background in Earth Science and Igneous Petrology (completed ERTH2006 and ideally also completed ERTH1005 and/or ERTH2205).
Supervisor	A/Prof Teresa Ubide (primary) Ms Valerie Olfindo
Contact for further information	A/Prof Teresa Ubide: t.ubide@uq.edu.au
Additional information	
School	School of the Environment

Project title	**Uncovering trends in reef disturbance and recover across the Great Barrier Reef**
Project duration	6 weeks
Hours of engagement	**20-25**
Location	St Lucia campus
Project description	Coral reef rubble fields are dynamic. Storms, bleaching events, and bioerosion generate rubble in pulses, and the speed at which that rubble stabilizes, gets bound together, and is recolonised by coral recruits largely determines whether a reef recovers or slides into a persistent degraded state. Yet standard image-based monitoring often fails to track this process well, because rubble is frequently misclassified by its most visible surface cover-turf algae, cyanobacteria, or a thin veneer of sediment-rather than being recognised as unstable rubble underneath. This obscures the true extent and mobility of rubble fields in long-term datasets. Re-annotating archival monitoring images with rubble as multiple, explicit classes (e.g., loose rubble, consolidated rubble) rather than letting it default to whatever is growing on top - can reveal these hidden dynamics: how rubble extent has changed over time, how long it takes to stabilise in different reef zones, and whether recovery trajectories are being systematically underestimated. This kind of relabeling effort turns years of existing imagery into a much richer record of reef structural recovery, which is critical for distinguishing reefs that are truly regenerating from those where surface algal cover is masking an unstable, rubble-dominated seafloor. This project uses ReefCloud to reannotate images taken over the past 30 years as part of the Long Term Monitoring Program on the Great Barrier Reef, led by the Australian Institute of Marine Science, who are partners on this project.
Expected outcomes and deliverables	We expect that in this amount of time, the student will be able to annotate images from at least 6 different reefs, which have been identified as undergoing major disturbances over the past 30 years. The student will be able to analyse the data to compare trends in disturbance and recover before and after their annotation efforts, seeing their work pay off immediately. This data will go into a large body of work for the whole of the GBR.
Suitable for	Suitable for students interested in coral reef ecology and conservation. If you have experience snorkelling on diving on coral reefs, your experience will be particularly valuable, as you will have the 'eyes' needed to pick out important things on the reef benthos. Knowledge of sessile reef organisms is also a massive plus. If you have used any sort of photo annotation before, that would also be helpful.
Supervisor	Dr Tania Kenyon (primary) Dr Daniel Harris
Contact for further information	Dr Tania Kenton: tania.kenyon@uq.edu.au

Additional information	
School	School of the Environment

School of Mathematics and Physics

Project title	**Optical Trapping, Stretching, and Coalescing of Protein Condensates**
Project duration	6 weeks
Hours of engagement	30
Location	St Lucia campus
Project description	This project aims to use optical tweezers to study the physical properties of protein condensates. These condensates have been implicated in motor neuron disorders, including Alzheimer's, Parkinson's, and Chronic Traumatic Encephalopathy (CTE). Understanding the physical properties of these condensates under different conditions should provide much-needed insight into their role in these diseases. This project will involve optical tweezers and structured light to trap and stretch individual condensates to measure their stiffness. Similarly, several condensates can be isolated with multiple traps and forced to coalesce and provide information on their relative stiffnesses. Part of this project will be optimising the methodology to provide robust results that we can draw biological conclusions from.
Expected outcomes and deliverables	Students will be expected to learn how to use optical systems, perform experiments, and collect and analyse data. At the end of the project, students will need to prepare a short report and present their findings to our research group.
Suitable for	Physics students entering their third or fourth year of studies who are interested in gaining experimental skills in optics while working on a cross-disciplinary project.
Supervisor	Dr Mark Watson (primary) Prof Halina Rubinsztein-Dunlop
Contact for further information	Dr Mark Watson: mark.watson@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Model of a combined quantum chemical and heat engine**
Project duration	6 weeks
Hours of engagement	20-36 hours per week, by negotiation.
Location	St Lucia campus
Project description	Quantum thermodynamics is a field of research that examines how thermodynamics applies at the nanoscale. Quantum thermal machines are an emerging branch of quantum technology that utilise quantum effects to convert heat into useful work. From the perspective of information theory, this is equivalent to transforming disordered information from a reservoir into ordered information, and hence is intimately linked to quantum information theory and quantum computing. Quantum thermal machines could offer quantum advantages in work extraction, such as going beyond the Carnot limit and extracting work from a single heat bath. Furthermore, a major obstacle to quantum computing is that they thermalize with the environment, introducing errors into the computation. A greater understanding of quantum thermal machines offers a possibility to circumvent, or even utilise, interactions with an environment in quantum computers. A review article on quantum thermodynamics can be found here: https://arxiv.org/abs/1508.06099
Expected outcomes and deliverables	The goal of this project is to derive an analytic model, and implement a simple numerical model, of a heat engine that exchanges particles and heat with reservoirs. It will examine the regimes of operation as a function of the two reservoir properties. Following the successful completion of the first part of the project, the next step will be to implement the concepts in the analytical model to a interacting quantum degenerate gas at nanokelvin temperatures using the Gross-Pitaevskii equation.
Suitable for	Self-motivated students interested in physics and/or mathematics who are interested in gaining experience in research in theoretical and computational quantum physics.
Supervisor	Professor Matthew Davis (primary)
Contact for further information	Professor Matthew Davis: mdavis@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Nonequilibrium superfluid flows**
Project duration	6 weeks
Hours of engagement	20-36 hours per week by negotiation.
Location	St Lucia campus
Project description	Superfluidity arises when an atomic gas is cooled using laser cooling and evaporative cooling to nanokelvin temperatures. Below a critical velocity they flow without viscosity. The UQ Bose-Einstein condensation laboratory works with these superfluids, and are interested how their nonequilibrium dynamics lead to persistent currents that never decay. The aim of this project is to make a connection between classical mechanics and quantum mechanics - looking for the signatures of classical trajectories in the quantum wave functions. This is potentially interesting for superfluids, as to some extent they behave as classical fluids. This would require adding the effects of particle interactions - an additional nonlinear term in the Schrodinger equation. A brief introduction to the field can be found here: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5468603/
Expected outcomes and deliverables	Students will learn how to solve the linear and nonlinear Schrodinger equation computationally with sources and sinks. The results will influence the UQ experimental program on Bose-Einstein condensates. A successful project will potentially lead to publishing a paper describing the model and its results.
Suitable for	Self-motivated students interested in physics and/or mathematics who are interested in gaining experience in research in theoretical and computational quantum physics.
Supervisor	Professor Matthew Davis (primary)
Contact for further information	Professor Matthew Davis: mdavis@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Parking lot optimisation**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Optimising the layout of parking lots is an important and difficult optimisation problem. In this project the student will build upon previous work to implement a Benders Decomposition based approach to parking lot design, including generating a draft of a paper.
Expected outcomes and deliverables	Students will become familiar with the process of taking a working idea, completing and documenting it to the level of a draft paper.
Suitable for	Students should have completed MATH3205/7202
Supervisor	Associate Professor Michael Forbes (primary)
Contact for further information	Associate Professor Michael Forbes: m.forbes@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Applications of precision optomechanical magnetometers**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Precision optical sensors such as acoustic, inertial, and magnetic sensors. These sensors have a host of applications from defence to geological surveying to navigation. Despite many promising in-lab proof-of-principle experiments, the application of this technology to deployment environments has posed significant and longstanding technical hurdles Such deployment environments may include attachments to autonomous aerial or undersea vehicles all of which present challenges for sensor compatibility. This project will be working directly with a team of post-doctorate and postgraduate researchers on state-of-the-art nanofabricated optomechanical sensors and investigating their performance. It will involve all elements of deployment technologies such as designing small footprint vacuum compatible housing and packaging hardware, support electronics miniaturization, and environmental/vehicular noise characterization and mitigation strategies.
Expected outcomes and deliverables	This project will provide students with hands on experience in precision sensing and translational research. It will cover a background on photonic characterization, electronics and hardware design for various applications. Upon successful completion the student shall have the ability to produce a roadmap for full-scale field research.
Suitable for	This project is open to applications from students with a good understanding in physics. Knowledge of optical technology, electronics, CAD design, and/or programming will be beneficial. 3rd or 4th year students preferred.
Supervisor	Dr Benjamin Carey (primary)
Contact for further information	Dr Benjamin Carey: benjamin.carey@uq.edu.au
Additional information	
School	School of Mathematics and Physics
Project title	**Classical or quantum? Exploring single-bubble sonoluminescence**

Project duration	6 weeks
Hours of engagement	20–36
Location	St Lucia campus
Project description	Sonoluminescence (SL) is an intriguing phenomenon where the collapse of a single bubble emits a picoseconds long pulse of blue light. First observed in the 1930s, there are multiple theories as to why it occurs, all with one common factor: none of them explain all the observed phenomena. As just one example, the blue light appears to be a tail of a blackbody spectrum: if that is the case, then the bubble temperature at collapse is 19,000K, three times hotter than the surface of the sun, and should emit X-rays. We have built an experiment that reproducibly produces sonoluminscent bubbles: in this project you will improve the apparatus, and develop experimental methods to make observations of the bubble. These may include single-photon measurements to look for X-rays, and quantum correlation measurements to test proposed theories such as the light is Unruh radiation. Those who love open-ended experiments and theory, and a bloody good mystery, are strongly encouraged to apply!
Expected outcomes and deliverables	You will gain experience in designing and building an open-ended experiment, with the aim of using sophisticated quantum optics equipment, as well as being exposed to classical and quantum field theories you probably have not yet encountered. You will get to work with an enthusiastic and friendly team of researchers, see quantum.technology/people/index.html. Welcome aboard!
Suitable for	Students entering into their third or fourth in 2027, with good experimental skills, and having taken at least second-year fields and quantum.
Supervisor	Professor Andrew White (primary) Dr Laura Serino
Contact for further information	Professor Andrew White: andrew.white@uq.edu.au
Additional information	There was only room for one additional supervisor on the form, but there will in fact be two. The third person is: Dr Markus Rambach, m.rambach@uq.edu.au
School	School of Mathematics and Physics

Project title	**Fundamental groups of knot complements**
Project duration	6 weeks
Hours of engagement	25
Location	St Lucia campus
Project description	Explore the fundamental groups of knot complements through different presentations and representations, combining theoretical techniques with computational tools. Investigate how algebraic and geometric information about knots can be extracted from and encoded by their associated groups.
Expected outcomes and deliverables	Students will learn how fundamental groups are used to study knots, develop computational and algebraic techniques for analysing knot groups, and complete a theoretical and computational investigations.
Suitable for	Suitable for students with some background in topology and, ideally, basic programming experience.
Supervisor	dr Daniele Celoria (primary)
Contact for further information	dr Daniele Celoria: d.celoria@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Marstrand projection theorem for the parabolic metric**
Project duration	6 weeks
Hours of engagement	21
Location	St Lucia campus
Project description	Hausdorff dimension provides a way of measuring sizes of sets whose dimension is not an integer. For example, the Cantor set has dimension log 2/ log 3, because for any n the number of intervals (balls) of length (1/3)^n required to cover the Cantor set is about 2^n. If we have a fractal set in R^2 or R^3, orthogonal projection in some direction may reduce its dimension, but the Marstrand projection theorem tells us that for "most" orthogonal projections the dimension does not decrease. This project aims to understand whether or not this remains true if "dimension" is defined through the non-Euclidean parabolic distance, so that the number of balls required to cover the set is with respect to the parabolic metric. The question is solved in R^2 and R^3, and we believe that the proof should generalise to all dimensions, but there is still some work to be done. The project would involve learning a little about Grassmannians, the orthogonal group and its Haar measure, spherical coordinates in n-dimensions, basic Fourier analysis such as Plancherel's theorem, and some basic geometric measure theory such as Kaufman's (short) proof of the Marstrand projection theorem.
Expected outcomes and deliverables	The student would get an introduction to current topics in geometric measure theory and Fourier analysis. If successful the project may result in a paper that is publishable, which would be sole-authored by them, but the main goal is to gain an understanding of these topics. The student would be expected to write a report, at most 10 pages, explaining results they obtain (or explaining key obstructions if the generalisation turns out to be too difficult).
Suitable for	The most directly useful background would be Math4408 (measure theory). Other analysis courses such as 2400/2401, 3402/7432, 3401/3901, would be useful too. Students would not be expected to have prior knowledge of geometric measure theory.
Supervisor	Dr Terry Harris (primary)
Contact for further information	Dr Terry Harris: terry.harris@uq.edu.au
Additional information	Either zoom meeting or in-person is OK.
School	School of Mathematics and Physics

Project title	**How Small Can a Neural Network Be and Still Learn Modular Arithmetic?**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	This project studies neural networks trained to compute addition modulo a prime number. The central question is: how many hidden units are actually needed for a network to represent this operation exactly? For small primes, the student will combine computational experiments with algebraic methods to study the space of exact solutions and look for patterns that may lead to theoretical bounds. The project connects to AI interpretability and safety because simple arithmetic tasks provide a controlled setting in which the internal structure of a neural network can be understood mathematically. By characterising which network structures can implement a known algorithm, we gain tools for analysing how learned computations are represented internally — a basic ingredient of mechanistic interpretability.
Expected outcomes and deliverables	Students will gain experience at the interface of algebra, computation and neural networks. They will learn how modular arithmetic can be represented by small neural networks, how algebraic structure can be used to analyse exact solutions, and how computational experiments can guide mathematical conjectures. Expected deliverables: a reproducible computational study for several small primes; a mathematical analysis of the resulting solution spaces or width bounds; and a short written report summarising the methods, results and possible directions for further work.
Suitable for	a strong undergraduate background in linear algebra and some abstract algebra; confidence with proofs; and enough programming ability to run experiments in Python or learn the necessary computational tools.
Supervisor	Professor Masoud Kamgarpour (primary)
Contact for further information	Professor Masoud Kamgarpour: masoud@uq.edu.au
Additional information	
School	School of Mathematics and Physics
Project title	**Developing Protocols for Quantum Networks**
Project duration	6 weeks

Hours of engagement	36
Location	St Lucia campus
Project description	Quantum communication uses the unique properties of quantum mechanics to enable highly secure information transfer. This project will explore the design of protocols for establishing and preserving quantum information across noisy communication channels. Using mathematical modelling and computer simulations, students will investigate how quantum states of light are transmitted through realistic optical components and noisy channels. This is a theoretical quantum optics project and will involve modelling quantum systems, communication channels, and sources of noise, and analysing protocol performance.
Expected outcomes and deliverables	Students will gain experience in theoretical quantum optics, mathematical modelling and computer simulation. They will learn to model realistic quantum communication systems and design and assess protocols for preserving quantum information in the presence of noise.
Suitable for	Third or fourth year physics students
Supervisor	Dr Josephine Dias (primary)
Contact for further information	Dr Josephine Dias: j.dias@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Why Do Neural Networks Learn Particular Representations?**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Neural networks trained on addition modulo an integer n can internally organise their computations using Fourier representations of the cyclic group n. In this project, the student will study a very small network with only two neurons and investigate which representations the neurons learn, how this depends on initialisation, and which outcomes are stable under training. This is an open problem in the mathematical underpinning of neural networks, see, e.g.: https://github.com/lionellevine/MAIS/blob/main/open-problems/MAIS-O59.md The problem has a direct connection to mechanistic interpretability and AI safety. If we want to understand or audit the internal computations of larger AI systems, we need to know whether interpretable features arise reliably and predictably during training. This project studies that question in a mathematically transparent model where the representations are known exactly.
Expected outcomes and deliverables	Students will learn how ideas from Fourier analysis, representation theory and dynamical systems can be used to understand the internal representations learned by neural networks. They will investigate how training and initialisation affect which mathematical structures emerge inside a small network and how stable these structures are. Expected deliverables: a reproducible set of training experiments for the mod-n model; an analysis of the representations learned under different initial conditions, including numerical or theoretical stability results where feasible; and a short written report explaining the findings and their relevance to mechanistic interpretability and AI safety.
Suitable for	Strong linear algebra and multivariable calculus, together with some programming experience. Familiarity with differential equations, Fourier analysis, group theory or machine learning would be helpful but is not required.
Supervisor	Professor Masoud Kamgarpour (primary)
Contact for further information	Professor Masoud Kamgarpour: masoud@uq.edu.au
Additional information	Full time commitment. Student should be independent and driven.
School	School of Mathematics and Physics

Project title	**Fast Nanoscale Temperature Mapping with Diamond Quantum Sensors**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Nanodiamonds containing nitrogen-vacancy (NV) centres can be used as nanoscale temperature sensors by measuring changes in their optically detected magnetic resonance (ODMR) spectra. This project will investigate the use of nanodiamonds for temperature measurements with a wide-field fluorescence microscope and fast optical readout. The main goal is to improve the signal-to-noise ratio and accuracy of temperature measurements while maintaining high temporal resolution. The project will involve optimisation of the optical detection and measurement protocol, analysis of fluorescence and ODMR data, and investigation of the main sources of noise and systematic uncertainty. The work will provide experience in optical microscopy, nanodiamond-based quantum sensing, experimental optimisation, data analysis, and precision temperature measurement.
Expected outcomes and deliverables	The student will gain practical experience in wide-field fluorescence microscopy, nanodiamond-based quantum sensing, optical measurements, and quantitative data analysis. They will learn how to optimise an experimental measurement, identify sources of noise and systematic error, and improve the signal-to-noise ratio and accuracy of temperature measurements.
Suitable for	The project is suitable for a motivated student with a background in physics. Students who have completed at least second year are welcome to apply. An interest in experimental optics, imaging, quantum sensing, or precision measurement would be particularly useful. Experience with scientific programming and data analysis, for example using Python or MATLAB, would be an advantage. Previous experience with optical detectors, camera readout, or optimisation of EMCCD measurements would be especially relevant to the project.
Supervisor	A/Prof Taras Plakhotnik (primary)
Contact for further information	A/Prof Taras Plakhotnik: uqtplakh@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Continuous-State Branching Processes via the Lamperti Transform**
Project duration	6 weeks
Hours of engagement	25 hours per week on St Lucia campus (remotely from 11 January to 31 January)
Location	St Lucia campus
Project description	Stochastic processes describe systems that evolve randomly over time, and their theory is widely used in biology, engineering, finance, insurance, and operations research. This project focuses on continuous-state branching processes, which are nonnegative stochastic processes possessing a natural branching structure. They can be viewed as continuous-state analogues of classical branching processes, but their applications extend well beyond population modelling. For example, the Feller branching diffusion and its extensions are closely related to square-root and affine processes used in finance to model quantitiessuch as interest rates and asset prices. A central tool studied in this project is the Lamperti transform, which represents a continuous-state branching process as a time-changed Lévy process. Lévy processes are continuous-time extensions of random walks and include Brownian motion and the Poisson process. This connection allows techniques developed for Lévy processes to be used to analyse continuous-state branching processes. The main aim of the project is to develop analytical and computational methods for evaluating important characteristics of these processes, such as extinction and first-passage probabilities, hitting times, long-term behaviour, and distributions of accumulated quantities. These characteristics have interpretations in applications ranging from population dynamics to financial risk modelling.
Expected outcomes and deliverables	Students will develop a solid understanding of continuous-time stochastic process models, learn how to formulate and analyse probabilistic models arising from real-world systems, and apply both analytical and computational methods to evaluate key quantities of interest.
Suitable for	3rd and 4th year Mathematics students, having completed STAT3004 and preferably advanced analysis courses.
Supervisor	Dr Kazutoshi Yamazaki (primary)
Contact for further information	Dr Kazutoshi Yamazaki: k.yamazaki@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Studying Ebola outbreaks**
Project duration	6 weeks
Hours of engagement	20 hours per week
Location	St Lucia campus
Project description	Epidemic outbreaks can have severe social and economic consequences, particularly when they result in unusually large numbers of infections or deaths. The WHO has declared the current Ebola outbreak in the Democratic Republic of Congo (DRC) and Uganda as a Public Health Emergency of International Concern on May 17, 2026. Outbreak of Ebola is an extreme event and it can have lasting and outsized impacts. Studying the associated model can help predicting the extent of number of infections and deaths even in the peak outbreaks and when do they occur. It is therefore important to correctly estimate their likelihood. This project aims at simulating the data sets available for different values of parameters and analysing the possibility of Ebola outbreaks in near future using the techniques that have been developed in Extreme value theory(EVT), a branch of statistics concerned with rare and high-impact events. Using the data for Ebola available with the Mathematical ecology group at SMP, the student will do simulations for a given range of parameters to understand the outcomes, and then implement the extreme value theory on these data sets to understand the future outbreaks and their frequencies. Possible tasks include: 1.Understanding the associated SEIRD model and its interpretation; 2. Simulating trajectories for different parameter regimes; 3. Identifying and analysing extreme outbreak events from simulated data; 4. implementing the Extreme value theory to quantify the frequency and severity of outbreaks. Contact details: Please contact Sakshi Jain at sakshi.jain@uq.edu.au and/or Luz Pascal at l.pascal@uq.edu.au for any queries.
Expected outcomes and deliverables	1. Understanding the real-world data and its associated Mathematical model; 2. Produce and analyse simulations using R/Python (or another programming language of choice); 3. Learn basic techniques for analysing rare and extreme events in data; 4. Prepare a brief report and possibly an oral presentation at the end.
Suitable for	Student requirements: 1. Undergraduate-level knowledge of analysis and calculus; 2. Working-level proficiency in R/Python or any programming language;

	3. Knowledge of probability theory advantageous but not required.
Supervisor	Dr Sakshi Jain (primary) Dr. Luz Pascal
Contact for further information	Dr Sakshi Jain: sakshi.jain@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Understanding and Estimating Extreme Events**
Project duration	6 weeks
Hours of engagement	20 hours a week, for 6 weeks (11 January – 19 February)
Location	St Lucia campus
Project description	Extreme events can have impacts that are far greater than their frequency would suggest. Whether volcanic eruptions, long periods of drought, or sudden flooding, such events can have lasting and outsized impacts. It is therefore important to correctly estimate their likelihood. This project aims to investigate a new approach for analysing data sets and estimating indicators for extreme events. Using computer simulations, the student will implement a new approach under development at UQ and QUEX on toy models and analyse the results. Depending on the progress of the project, real-world data may also be analysed. Possible tasks include: • Comparison with classical approaches • Fine-tuning parameters to improve accuracy • Iterating on the algorithm to obtain more robust results
Expected outcomes and deliverables	• Understand the role of extreme events and likelihood estimates • Produce and analyse simulations using Python (or another programming language of choice) • Prepare a brief report and possibly an oral presentation at the end
Suitable for	• Working-level proficiency with Python or another programming language of choice • Undergraduate-level skills in analysis (at least 1st year) • Knowledge of statistics & probability theory advantageous but not required
Supervisor	Dr Max Auer (primary) Prof Meagan Carney
Contact for further information	Dr Max Auer: m.auer@uq.edu.au

Additional information	Please contact Max Auer at m.auer@uq.edu.au for further information.
School	School of Mathematics and Physics

Project title	**Superconducting qubits: design and simulation**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Superconducting circuits are one of the most mature platforms for quantum computing, with qubits realised from Josephson junctions embedded in microwave circuits. This project offers an introduction to the design, fabrication considerations, and simulation of superconducting qubits, from the underlying circuit QED theory to the development of circuits for quantum computing hardware. In this project, students will help to design and simulate circuit components for superconducting multi-qubit devices.
Expected outcomes and deliverables	Students will gain understanding in the physics of superconducting microwave circuits, and experience in circuit design, Hamiltonian design, and electromagnetic simulation of superconducting qubits. Students will be expected to contribute towards the design of superconducting multi-qubit devices.
Suitable for	Suitable for students comfortable working in python, and who have done third year quantum.
Supervisor	Dr. Zachary Degnan (primary)
Contact for further information	Dr. Zachary Degnan: z.degnan@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Superconducting qubits: control and measurement**
Project duration	6 weeks
Hours of engagement	20
Location	St Lucia campus
Project description	Superconducting qubits are among the leading platforms for building scalable quantum computers, but their performance is fundamentally limited by gate errors arising from decoherence, crosstalk, and imperfect control pulses. This project will experimentally investigate methods for optimising the control pulses used to drive single- and two-qubit gates on a superconducting multi-qubit device in our lab, with the overall aim of improving gate fidelity.
Expected outcomes and deliverables	This project is suitable for students who are eager to gain lab experience working with superconducting qubits. Gain experience in the working principles and measurement of superconducting qubits, in particular on control and readout of multi-qubit devices. Students will be expected to perform experiments concerning optimal qubit control, analyse experimental data, and work towards improving the fidelity of single- and two-qubit gate operations through the optimisation of control pulses.
Suitable for	Applicants should be comfortable working in python, have third year lab experience, and have studied at least second year quantum.
Supervisor	Dr. Zachary Degnan (primary)
Contact for further information	Dr. Zachary Degnan: z.degnan@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Machine-learning interatomic potentials for next-generation perovskite nanocrystals**
Project duration	6 weeks
Hours of engagement	32
Location	St Lucia campus
Project description	Semiconductor nanocrystals were recognised by the 2023 Nobel Prize in Chemistry for their unique size-dependent properties and transformative technological potential. The next generation of nanocrystal-based technologies, however, will require not only control over their size and composition, but also a detailed understanding and control of their complex surface chemistry. This project aims to investigate perovskite nanocrystals, a particularly promising class of semiconductor nanomaterials, using state-of-the-art machine-learning interatomic potentials (MLIPs). The student will explore how recently developed foundation models can describe the diverse atomic environments found in nanocrystals, including facets, edges, corners and surface defects. Particular attention will be given to assessing where these models succeed or fail in describing nanocrystal surfaces and to identifying the configurations required to improve their accuracy. The project will provide hands-on experience with modern machine-learning potentials, atomistic simulations and high-performance computing, at the interface between computational materials science and artificial intelligence.
Expected outcomes and deliverables	The student will gain experience in generating and analysing atomistic datasets, running machine-learning interatomic potentials, and benchmarking their predictions against first-principles calculations. They will investigate the transferability of foundation models to complex perovskite nanocrystals and identify the structural and chemical environments that require additional training data. Depending on progress, the project may also involve fine-tuning a foundation model and applying it to larger nanocrystal structures beyond the scale accessible to conventional quantum-mechanical calculations.
Suitable for	This project is suitable for students with a background in physics, chemistry, materials science, computational science, or related disciplines. Some knowledge of Python is desirable; prior experience with machine learning or atomistic simulations is useful but not essential.
Supervisor	Dr Carla Verdi (primary)
Contact for further information	Dr Carla Verdi: c.verdi@uq.edu.au
Additional information	

School	School of Mathematics and Physics

Project title	**Role of electron-phonon coupling in the optoelectronic performance of halide perovskite**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	Experimentally evaluate the electron-phonon coupling strength in emerging inorganic solution-processed perovskite thin films. The work will develop temperature-dependent optical probes (0-500 K) using a helium cryostat to probe the T-dependent Raman scattering and steady-state photoluminescence spectra of clean and doped thin films, to quantify lattice-carrier interaction and directly link them to observed carrier transport measurements (low temperature Hall effect measurements).
Expected outcomes and deliverables	Technical skills: - Laser and free-space optical instrument design and development. - Low temperature cryostat operations, using liquid nitrogen and liquid helium. - Materials modelling of experimental data to extract quantitative values for physical properties of materials. - The physical parameter related to electron-lattice interactions will be measured in new perovskite semiconductors for the first time. A written report, in the style of a research article, is expected upon completion.
Suitable for	Condensed matter and solid state physics students. 2nd or 3rd year level is preferred.
Supervisor	Dr Julian Steele (primary)
Contact for further information	Dr Julian Steele: julian.steele@uq.edu.au
Additional information	High quality results and reports will be further developed for submission in a peer-reviewed scientific journal.
School	School of Mathematics and Physics

Project title	**Quantum dynamics, correlations, and entanglement in Fermi-Bose gas collisions**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	The aim of this project is to develop a quantitative theory for Fermi-Bose gas collisions in mixtures of metastable helium, quantifying the strength and spatial structure of Fermi-Bose, Fermi-Fermi, and Bose-Bose atom-atom correlations generated through the s-wave scattering process and mediated by the other species. The project is directly linked to the ongoing dual-species collision experiments with metastable helium (^{4}He* and ^{3}He*) at the ANU, in the laboratory of Andrew Truscott and Sean Hodgman. The quantitative theory developed through this project will enable the characterisation of mass-dependent entanglement in dual-species collisions for potential tests of the weak equivalence principle in the quantum regime and Bell-inequality violations for entangled atoms of different masses (^{4}He* and ^{3}He*). Both tests represent experimental frontiers in quantum foundations and may provide insights into future theoretical constructs of quantum gravity.
Expected outcomes and deliverables	Students will learn advanced theoretical and computational techniques of quantum many-body physics, including second quantisation, hydrodynamics, and utilising supercomputing cluster facilities. They will have an opportunity to generate results that may lead to publications from their research. Students may also be asked to produce a report or oral presentation at the end of their project.
Suitable for	This project is open to applications from students with background in 2nd and 3rd year physics and maths.
Supervisor	Professor Karen Kheruntsyan (primary)
Contact for further information	Professor Karen Kheruntsyan: karen.kheruntsyan@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Quantum thermodynamics with ultracold atomic gases**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	The Second Quantum Revolution is currently underway, and represents the merging of thermodynamic concepts of heat and work, born during the Industrial Revolution, with quantum concepts of information processing and entanglement. But how do the classical ideas on the nature of heat and work translate to quantum devices? Do the laws of classical thermodynamics also dictate the behaviour of processes at a quantum level, or whether new laws are needed? The project intends to shed light on these fundamental questions by developing state-of-the-art computational models of quantum-scale machines and heat engines using the platform of ultracold atomic gases. Such gases represent archetypical examples of interacting many-body systems, however, characterising their equilibrium and nonequilibrium properties is a challenging problem. The knowledge arising from the project is expected to underpin experimental breakthroughs in this emerging field and aid the development of new quantum technologies.
Expected outcomes and deliverables	Students will learn advanced theoretical and computational techniques of quantum many-body physics, including second quantisation, hydrodynamics, and utilising supercomputing cluster facilities. They will have an opportunity to generate results that may lead to publications from their research. Students may also be asked to produce a report or oral presentation at the end of their project.
Suitable for	This project is open to applications from students with background in 3rd year physics and maths.
Supervisor	Professor Karen Kheruntsyan (primary)
Contact for further information	Professor Karen Kheruntsyan: karen.kheruntsyan@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Out-of-equilibrium dynamics of quantum fluids**
Project duration	6 weeks
Hours of engagement	36
Location	St Lucia campus
Project description	The project aims to develop theoretical tools to model and understand out-of-equilibrium behaviour of quantum fluids. Such fluids are formed in interacting many-particle systems at ultra-low temperatures, and understanding how these complex systems evolve dynamically when driven out of equilibrium remains a grand-challenge of modern quantum physics. The project intends to study the intriguing dynamical properties of quantum fluids formed by ultra-cold atomic gases, in particular, by atomic Bose and Fermi gases in one-dimensional (1D) waveguides. In such 1D waveguides, and more generally in systems of reduced dimensionality, the effects of quantum and thermal fluctuations are enhanced, compared to three-dimensional systems. As such, theoretical modelling of these systems confronts the challenges of quantum many-body physics heads on. Systems of reduced dimensionality are expected to play an increasingly important role in future quantum technologies, with its ever evolving trend in miniaturisation of electronic devices and precision measurement instruments. The expected outcomes of the project are the knowledge and theoretical tools required to underpin advances in quantum engineering applications, such as the design of quantum heat engines, the control of heat conduction in quantum nanowires and carbon nanotubes, and the fabrication of new energy-efficient materials. Specific sub-projects include: * Development of new hydrodynamic theories of 1D quantum fluids at Euler and Navier-Stokes scales * Whitlam modulation theory for propagation of 1D quantum shock waves * Collective modes of 1D quantum fluids from the theory of Generalised Hydrodynamics (GHD) * Quantum transport in 1D quantum fluids * Quantum heat engines with ultra-cold atomic gases
Expected outcomes and deliverables	Students will learn advanced theoretical and computational techniques of quantum many-body physics, including second quantisation, hydrodynamics, and utilising supercomputing cluster facilities. They will have an opportunity to generate results that may lead to publications from their research. Students may also be asked to produce a report or oral presentation at the end of their project.
Suitable for	This project is open to applications from students with background in 3rd year physics and maths.
Supervisor	Professor Karen Kheruntsyan (primary)

Contact for further information	Professor Karen Kheruntsyan: karen.kheruntsyan@uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Where does the energy go when photons are redshifted by the expansion of the universe?**
Project duration	6 weeks
Hours of engagement	25
Location	St Lucia campus
Project description	Usually we describe the cause of photons being redshifted as a sum of infinitesimal Doppler shifts along the line of sight. In this scenario energy is not lost, the light is just being observed by galaxies that are receding from it, so the redshifting is only an apparent loss of energy. This project will explore whether a coordinate change can reveal a different interpretation is also valid. Namely, we will explore whether a change in the definition of the time coordinate can result in a change in the interpretation of the source of the redshift. This is similar in concept to the explanation of the Pound-Rebka experiment showing the equivalence principle works for light falling in a gravitational field.
Expected outcomes and deliverables	A write-up of the mathematics of cosmology in different coordinate systems.
Suitable for	Upper level physics or mathematics students. Ideally have already taken PHYS3080 (extragalactic astrophysics and cosmology).
Supervisor	Prof Tamara Davis (primary)
Contact for further information	Prof Tamara Davis: tamarad@physics.uq.edu.au
Additional information	
School	School of Mathematics and Physics

Project title	**Machine-learning interatomic potentials for next-generation perovskite nanocrystals**
Project duration	6 weeks
Hours of engagement	32
Location	St Lucia campus
Project description	Semiconductor nanocrystals were recognised by the 2023 Nobel Prize in Chemistry for their unique size-dependent properties and transformative technological potential. The next generation of nanocrystal-based technologies, however, will require not only control over their size and composition, but also a detailed understanding and control of their complex surface chemistry. This project aims to investigate perovskite nanocrystals, a particularly promising class of semiconductor nanomaterials, using state-of-the-art machine-learning interatomic potentials (MLIPs). The student will explore how recently developed foundation models can describe the diverse atomic environments found in nanocrystals, including facets, edges, corners and surface defects. Particular attention will be given to assessing where these models succeed or fail in describing nanocrystal surfaces and to identifying the configurations required to improve their accuracy. The project will provide hands-on experience with modern machine-learning potentials, atomistic simulations and high-performance computing, at the interface between computational materials science and artificial intelligence.
Expected outcomes and deliverables	The student will gain experience in generating and analysing atomistic datasets, running machine-learning interatomic potentials, and benchmarking their predictions against first-principles calculations. They will investigate the transferability of foundation models to complex perovskite nanocrystals and identify the structural and chemical environments that require additional training data. Depending on progress, the project may also involve fine-tuning a foundation model and applying it to larger nanocrystal structures beyond the scale accessible to conventional quantum-mechanical calculations.
Suitable for	This project is suitable for students with a background in physics, chemistry, materials science, computational science, or related disciplines. Some knowledge of Python is desirable; prior experience with machine learning or atomistic simulations is useful but not essential.
Supervisor	Dr Carla Verdi (primary) Dr Juliette Zito
Contact for further information	Dr Carla Verdi: c.verdi@uq.edu.au
Additional information	

School	School of Mathematics and Physics

School of Veterinary Science

Project title	**Equine respiratory microbiome sampling and preservation**
Project duration	6 weeks
Hours of engagement	20–36 hours per week
Location	Gatton campus
Project description	Respiratory disease is a financially significant issue challenging the global equine industry. The respiratory microbiota refers to all the microbes, namely bacteria, archaea, protists, fungi, and viruses, that are found in the respiratory environment. The lung microbiota of asthmatic humans is different in both diversity and composition, compared to healthy individuals. A limitation of the methodology employed in published microbiota investigations (16S sequencing) is the ability to accurately identify microbes to a clinically relevant taxonomic level. It has been suggested that future studies consider using metagenomic shotgun sequencing for enhanced detection of bacterial species, increased detection of diversity, and improved accuracy of species detection. Central to respiratory microbiome studies, and the development of future diagnostic tests utilizing this technique, is the ability to accurately preserve respiratory tract samples prior to processing. Due to the high-sensitivity of the techniques employed, if samples are not collected or preserved appropriately - resulting in contamination or compromise of sample constituents - subsequent community analyses will produce inaccurate conclusions. Currently, a study using culture-based methods is used to justify sample collection techniques. Given the sensitivity of metagenomic shotgun sequencing, it is necessary to update this work. This study aims to validate the optimal technique for the collection and preservation of equine respiratory samples for microbiota studies.
Expected outcomes and deliverables	What you'll do: Clinical examination of horses, percutaneous transtracheal lavages, transendoscopic tracheal lavages, bronchoalveolar lavages, and nasopharyngeal swabs will be collected from healthy horses to optimize respiratory sample collection and preservation techniques for microbiome studies. Shotgun metagenomics will be used to rigorously evaluate the technical and compositional reproducibility of multiple room temperature microbial stabilization methods, compared to the best practice of flash-freezing at -80ºC. You will assist with data analysis and manuscript preparation. Project outcomes: Development of a manuscript that will be submitted to a peer-review journal.
Suitable for	You should apply if you have experience handling horses. Prior experience in equine research with demonstrated proficiency in basic clinical techniques (TPR) will be viewed favourably. Personal qualities that will ensure a good fit include a positive team-member with a strong work ethic.
Supervisor	Dr Stephanie Bond (primary)

Contact for further information	Dr Stephanie Bond: steph.bond@uq.edu.au
Additional information	You will receive exposure to equine clinical and research techniques. You will receive mentorship and support in clinical techniques, and develop an awareness of research logistics while adhering to safety protocols. You'll learn how to analyse respiratory microbiome data, and how to write a scientific manuscript. Data from this study could be presented at a national conference (such as Bain Fallon) depending on the interest of the student. You would have the possibility of being either first or co-author on the publication arising from this work depending on your contribution and effort. Must undertake animal ethics training.
School	School of Veterinary Science

Project title	**Equine gastric pH stratification**
Project duration	6 weeks
Hours of engagement	20–36 hours per week
Location	Gatton campus
Project description	Equine Gastric Ulcer Syndrome is the most common disease of the equine stomach, with a prevalence of up to 100%, depending on performance discipline. Intragastric pH stratification is present, due to acid secretion by the glandular mucosa and fibrous mat formation. Previous reports have demonstrated a pH gradient from 6 to 7 at the cardia to 1-3 in the ventral fundus, however, precise measurement is important as previous methods to measure gastric pH have limitations. This project will continuously wirelessly measure gastric pH at a series of fixed, known locations in the stomach concurrently, under normal management conditions.
Expected outcomes and deliverables	What you'll do: Clinical examination of horses, assist with gastric pH capsule implantation during gastroscopic procedures, assist with data analysis and manuscript preparation. Project outcomes: Development of a manuscript that will be submitted to a peer-review journal.
Suitable for	You should apply if you have experience handling horses. Prior experience in equine research with demonstrated proficiency in basic clinical techniques (TPR, pass nasogastric tube) will be viewed favourably. Personal qualities that will ensure a good fit include a positive team-member with a strong work ethic.
Supervisor	Dr Stephanie Bond (primary) Dr Jessica Wise
Contact for further information	Dr Stephanie Bond: steph.bond@uq.edu.au
Additional information	Data from this study could be presented at a national conference (such as Bain Fallon) depending on the interest of the student. You would have the possibility of being either first or co-author on the publication arising from this work depending on your contribution and effort. You will receive exposure to novel clinical/research techniques. You will receive mentorship and support in clinical techniques, and develop an awareness of research logistics while adhering to safety protocols. You'll learn how to analyse gastric pH data, and how to write a scientific manuscript. Must undertake animal ethics training.
School	School of Veterinary Science

Project title	**The effect of feed on gastric pH during exercise in elite dressage horses**
Project duration	6 weeks
Hours of engagement	20–36 hours per week
Location	Gatton campus
Project description	This project will investigate the effect of different feed protocols prior to exercise on squamous gastric pH and acid exposure during Grand Prix exercise in horses. Equine Gastric Ulcer Syndrome is the most common disease of the equine stomach, which is subcategorised into Equine Squamous Gastric Disease (ESGD) and Equine Glandular Gastric Disease. Exercise-related acid splash on the squamous mucosa is a significant risk factor for the development of ESGD. Management strategies are important to reduce risk, particularly for ongoing prevention. It is widely accepted that feeding prior to exercise creates a fibre mat within the stomach which reduces acid splash. The results of this study could be used to inform optimal pre-exercise feeding regimens in dressage horses to reduce squamous mucosal acid exposure and thus the risk of ulceration.
Expected outcomes and deliverables	What you'll do: Clinical examination of horses, assist with gastric pH capsule implantation during gastroscopic procedures, give pre-exercise feed to horses prior to exercise, observe Grand Prix dressage tests, assist with data analysis and manuscript preparation. Project outcomes: Development of a manuscript that will be submitted to a peer-review journal. It is anticipated that results of this study will also be used to develop educational materials targeted at horse owners and trainers.
Suitable for	You should apply if you have experience handling large performance horses. Prior experience in equine research with demonstrated proficiency in basic clinical techniques (TPR, pass nasogastric tube) will be viewed favourably. Personal qualities that will ensure a good fit include a positive team-member with a strong work ethic that is prepared to represent the university and SVS in a field environment.
Supervisor	Dr Stephanie Bond (primary) Dr Jessica Wise
Contact for further information	Dr Stephanie Bond: steph.bond@uq.edu.au
Additional information	You will gain industry experience and connections, and receive exposure to novel clinical/research techniques. You will receive mentorship and support in clinical techniques, and develop an awareness of research logistics in a field-work environment while adhering to safety protocols. You'll learn how to analyse gastric pH data, and how to write a scientific manuscript. Data from this study could be presented at a national conference (such as Bain Fallon) depending on the interest of the student. You would have the possibility of being either first or co-author on the publication arising from this work

	depending on your contribution and effort. Drivers licence required for field work. Must undertake animal ethics training.
School	School of Veterinary Science

Project title	**Animal-Focused One Health Research: A Systematic Review of Human and Environmental Health Inclusion**
Project duration	6 weeks
Hours of engagement	The project is designed for approximately 15 to 20 hours per week to ensure completion within 6 weeks. A typical allocation will involve dedicating time in the first week to finalising the protocol scope, developing and running searches, and beginning ini
Location	While occasional meetings at the Gatton Campus will be necessary, most of the work can be carried out remotely, subject to access to the required library resources.
Project description	One Health is intended to connect animal health, human health, and environmental health within a single research framework. In practice, studies that describe themselves as “One Health” may place primary emphasis on animals, with human and environmental considerations appearing only as context, or general discussion. This project aims to systematically evaluate how animal focused One Health studies incorporate human health and environmental health, both in frequency and in strength of integration. The project will be conducted as a systematic review following PRISMA principles. Eligibility decisions will be based on explicit inclusion criteria. Papers will need to claim One Health in an identifiable way and must have animal health as the primary focus. After identification and screening, structured information will be extracted into a data spreadsheet. This will include publication details, topic area, country or region if reported, study design type, animal species, and the presence and nature of human and environmental components. The key deliverable is an original, practical integration scoring of human and environmental inclusion strength. Thus, a rubric will be applied that assigns an integration level to the human and environmental component. Findings will be synthesised into a narrative supported by summary tables and into a report and draft publication.
Expected outcomes and deliverables	Students will gain experience in building a reproducible systematic review workflow from search strategy through selection, data extraction, and synthesis. Students will learn how to operationalize a conceptual framework for One Health into measurable criteria that can be applied across publications. At completion, students will be expected to deliver a documented search strategy, a screening and selection record with reasons for exclusion, a completed extraction spreadsheet containing the integration rubric scoring for each included paper. A PRISMA-aligned report will be developed and research publication drafted.
Suitable for	This project is suitable for students who are comfortable reading scientific articles and extracting study features. It is particularly appropriate for students in the early-to-mid years of an undergraduate degree who have interest in One Health, public health, veterinary science, epidemiology, or evidence synthesis. Students should be willing to apply decision rules consistently during screening and to learn a structured approach to critical reading. Prior experience with systematic reviews, qualitative coding, or basic epidemiological concepts would be helpful but is not required.

Supervisor	Prof Joerg Henning (primary)
Contact for further information	Prof Joerg Henning: j.henning@uq.edu.au
Additional information	
School	School of Veterinary Science

Project title	**Wildlife Communities and Interactions in Areas With and Without Red Imported Fire Ants**
Project duration	6 weeks
Hours of engagement	20-36
Location	Largely remotely. Meetings via Zoom or Gatton campus
Project description	Red imported fire ants (Solenopsis invicta; RIFA) are an invasive species with the potential to affect native wildlife and ecological communities. This project will use an existing dataset of camera-trap images and videos collected from locations with and without known RIFA presence to investigate wildlife activity, species diversity and interactions. The student will review and classify camera-trap imagery and video, identify wildlife species where possible, and record relevant behaviours and interactions. These data will be used to compare wildlife communities between RIFA and non-RIFA locations and explore whether patterns of species occurrence, diversity or behaviour differ between the two site types. Depending on the dataset and student interests, analyses may include comparisons of species richness, relative activity or detection rates, community composition, and particular types of interspecific or behavioural interactions.
Expected outcomes and deliverables	The student will gain experience in camera-trap research, wildlife species identification, ecological data collection and management, and the analysis and interpretation of wildlife monitoring data. The student will be expected to: • systematically review and classify camera-trap images and/or videos; • identify and record wildlife species and relevant behaviours or interactions; • maintain a clean and consistent project dataset; • undertake exploratory and/or statistical analyses comparing RIFA and non-RIFA locations; and • prepare a summary of the major findings, including appropriate tables, figures and/or visualisations.
Suitable for	This project would suit a student with an interest in wildlife ecology, conservation biology, invasive species or animal behaviour. Students should have good attention to detail and be comfortable working systematically with large numbers of images and videos. Previous experience with camera-trap data, wildlife identification, data management or statistical analysis would be useful but is not essential. Training will be provided in the relevant image-review and data-recording methods.

Supervisor	Dr Kate Dutton-Regester (primary)
Contact for further information	Dr Kate Dutton-Regester: k.duttonregester@uq.edu.au
Additional information	This project primarily involves analysis of an existing camera-trap dataset rather than fieldwork. Students should be aware that camera-trap datasets can contain a large number of images and videos, and careful, consistent classification is an important component of the project. The project provides an opportunity to contribute to research addressing an important and rapidly emerging invasive-species threat in Australia. Field work may be possible depending on scheduling.
School	School of Veterinary Science

Project title	**Estimation of efficacy of various dewormers against hookworm infection in dogs**
Project duration	6 weeks
Hours of engagement	15 hours/week
Location	Gatton campus
Project description	The project will involve: • Collection of faecal samples from dogs and examination of the faecal samples in the Parasitology Lab at Gatton campus. • Running lab-based drug efficacy tests. • Prepare worm samples for molecular testing • Data collection and record keeping.
Expected outcomes and deliverables	Students will receive hands on experience in running faecal egg counts to estimate worm burdens in dogs and will learn to run various drug efficacy testing. Students will learn to use GraphPad statistical software.
Suitable for	The project is suitable for students doing BVSc, BVT or Biology degree. The students should be comfortable around dogs and working with faecal samples.
Supervisor	Dr Swaid Abdullah (primary)
Contact for further information	Dr Swaid Abdullah: swaid.abdullah@uq.edu.au
Additional information	
School	School of Veterinary Science

Project title	**Prevalence and distribution of gastrointestinal parasites in wild canids in Queensland Australia**
Project duration	6 weeks
Hours of engagement	15 hours/week
Location	Gatton campus
Project description	The project will involve postmortem collection of gastro-intestinal tract from the wild canid cadavers. Screening gut contents for various internal parasites. Identification of parasite to genus and species level using various parasitology identification keys.
Expected outcomes and deliverables	Students will receive hands on experience in examining animal organs and tissues for worm burdens and will learn to store and identify different parasite species infecting canines. Students will learn to use different statistical software.
Suitable for	The project is suitable for students doing BVSc, BVT or Biology degree. The students should be comfortable working on cadavers and working with faecal samples.
Supervisor	Dr Swaid Abdullah (primary) Ms Grace Reeves
Contact for further information	Dr Swaid Abdullah: swaid.abdullah@uq.edu.au
Additional information	The project will provide an opportunity for a research publication, and the student would be given co-authorship depending on the amount and ownership of the work conducted by the student. The student will get hands on experience in data analysis and writing scientific manuscripts
School	School of Veterinary Science

Project title	**Prevalence and distribution of sarcocystis infection in bovine carcasses within various regions of Queensland.**
Project duration	6 weeks
Hours of engagement	12 hours/week flexible
Location	Gatton campus
Project description	The project will involve working on data available from screening bovine muscle samples for sarcocystis infection and writing up a journal article.
Expected outcomes and deliverables	This study will provide valuable data on prevalence of various species of sarcocystis infection in bovine carcasses and the spatial distribution of the infection.
Suitable for	The project is suitable for students having data analysis skills. The students should have skills in statistical packages like R and Strata.
Supervisor	Dr Swaid Abdullah (primary) Dr Nicholas Yuen
Contact for further information	Dr Swaid Abdullah: swaid.abdullah@uq.edu.au
Additional information	The project will provide an opportunity for a research publication, and the student would be given co-authorship depending on the amount and ownership of the work conducted by the student. The student will get hands on experience in data analysis and writing scientific manuscripts
School	School of Veterinary Science

Project title	**What Happens When Dogs Switch to a Whole-Food Diet? Exploring Skin, Gut Health and Vitality**
Project duration	6 weeks
Hours of engagement	30–36 hours per week | On campus | Veterinary Medical Centre, UQ Gatton The project will involve a combination of hands-on clinical research activities with client-owned dogs, laboratory and sample processing, data management and research meetings. Studen
Location	Gatton campus
Project description	Diet can influence many aspects of canine health, but we still have much to learn about how different types of diets affect the skin, gut and overall wellbeing of healthy dogs. This project is part of a prospective dietary intervention study involving 25 healthy, client-owned dogs. The study will investigate what happens when dogs transition from a predominantly kibble-based diet to a minimally processed, whole-food diet over 12 weeks. We will take an integrated approach to health, examining skin barrier function, coat quality, skin and gut microbiota, gastrointestinal health, blood biomarkers, physical activity and quality of life. The dogs will remain in their normal home environments throughout the study and will attend scheduled research visits at UQ. This makes the findings particularly relevant to real-world veterinary practice and nutritional decision-making. The summer research student will be directly involved in the clinical research program, helping with dog handling, study visits, clinical measurements, sample collection and processing, and research data management. They will work alongside the research team to help generate a detailed picture of how a whole-food dietary intervention may influence multiple aspects of canine health and vitality.
Expected outcomes and deliverables	This project will provide practical experience in conducting a prospective veterinary clinical research study using client-owned dogs. You will develop skills in animal handling, clinical research procedures, biological sample collection and processing, accurate record keeping and research data management. You will also gain experience with a range of techniques used in veterinary nutrition and dermatology research, including skin barrier assessment, microbiome sampling, activity monitoring, quality-of-life assessment and collection and processing of samples for blood biomarker analysis. Working alongside the research team will also help you understand how clinical visits are planned and coordinated, how animal welfare and owner participation are managed within a research study, and how different clinical, laboratory and owner-reported measures are brought together to answer a research question. The project will provide a useful introduction to multidisciplinary veterinary and animal health research.

	By the end of the project, the student will have made a direct contribution to the clinical delivery of the whole-food dietary intervention study, including collection, processing and organisation of research samples and data. Depending on the timing of recruitment and study visits, the student may also contribute to preliminary summaries of outcomes such as skin barrier function, coat health, gastrointestinal measures, activity or quality of life. Their work will contribute to a broader dataset evaluating the effects of a minimally processed whole-food diet on skin, gut and systemic health in healthy dogs and will help inform the design of future larger dietary intervention studies.
Suitable for	This project would particularly suit students in veterinary science, veterinary technology, animal science, biomedical science, microbiology, nutrition, physiology or related disciplines who are interested in hands-on animal research. Applicants should be comfortable working directly with dogs and biological samples and should enjoy a project that combines clinical activity with laboratory and data-based work. Previous research experience is not required. However, students should be reliable, organised and attentive to detail, with good communication skills and a willingness to work as part of a team. An interest in canine health, nutrition, dermatology, microbiomes or clinical research would be an advantage.
Supervisor	Assoc Prof Justine Gibson (primary)
Contact for further information	Assoc Prof Justine Gibson: gibson.j@uq.edu.au
Additional information	The student will be supervised by Associate Professor Justine Gibson, Veterinary Bacteriology and Mycology, UQ School of Veterinary Science, and will work within a multidisciplinary research team that includes a postdoctoral researcher, PhD student, veterinarians and veterinary technicians. The project will be based at the Veterinary Medical Centre (VMC), UQ Gatton, within the Small Animal Hospital environment. During clinical study visits, the student will work closely with the research team to assist with dog handling, clinical measurements and sample collection and processing. As this is a client-owned dog study, the student will also interact with participating owners and their dogs throughout the project. Students will be required to complete relevant UQ research, laboratory and animal-handling inductions, including the Animal Ethics training module, before undertaking practical activities. The project involves direct contact with client-owned dogs and handling of biological samples, including blood, faeces and skin microbiome samples. Students should therefore be comfortable working with animals and biological material under supervision.

	Clinical study activities will occur at scheduled times, so some flexibility in working days and hours may be required to coincide with dog appointments, sample collection and immediate sample processing.
School	School of Veterinary Science

Project title	**Characterisation of shelter dogs for olfactory perception and detection**
Project duration	6 weeks
Hours of engagement	up to 36h per week
Location	Gatton campus
Project description	Background If you're interested in animal behaviour, then this project is for you! Dogs (Canis lupus familiaris) possess an exceptional sense of smell and have been successfully trained to detect a wide range of biological conditions and diseases in humans and animals. Despite proven ability in both medical and veterinary contexts, including oestrus detection in cattle 1–3, limited research has explored canine detection of pregnancy. Shelters have a consistent supply of dogs, many of which display traits unsuitable for pet households. Therefore, utilising their ability as detection workers can provide a guaranteed pool of candidates for working platforms. Although many dogs do not display the qualities needed, there is a handful that show promise. By analysing shelter dogs, we can begin to profile potential detection candidate based on certain behavioural traits. While this does not guarantee them a working career, it can aid in rehoming success by better understand the dogs' needs and motivations. This research project subset looks to analyse those dogs considered suitable for detection work, to ensure they are suitable trained and offered the best chance to have a successful career. Over time, it is interesting to note which traits observed during initial selection contribute to long term success, and how they vary over time. Research Questions The aim of the project is to develop a characteristics description of a scent focused dog, with the potential for scent detection, using olfactory-based tasks and activities to 1) identify dogs in shelters who may benefit from scent focused enrichments at rehoming or adoption, and 2) find strategies to combat under-stimulated dogs in shelters. What the successful applicant(s) will be doing: 1. Assisting with practical aspects of dog handling, behavioural testing and kennel video footage collection (where applicable), including conducting cognitive, olfactory, environmental, emotional reactivity, motivation, and search assessments. 2. Apply a purpose-built ethogram to record dog behaviours from kennel video footage. 3. Organising and analysing behavioural data, including activity patterns and behaviours associated with stress response. 4. Learning how behavioural observations can be applied to animal welfare, enrichment planning, adoption matching, and detection dog selection.

	5. Gaining exposure to canine olfactory research and participate in a project investigating application of canine scent detection for non-invasive cattle pregnancy detection.
Expected outcomes and deliverables	The student will be learning how behavioural observations can be applied to animal welfare, enrichment planning, adoption matching, and detection dog selection, and gain exposure to canine olfactory research and participate in a project investigating application of canine scent detection for non-invasive cattle pregnancy detection. The student will be working in a team and will complete a written report and presentation based on the research findings.
Suitable for	We are looking for a student who is interested in animal, particularly dog behaviour. Some experience in dog handling and behaviour assessment, and description or characterization of animal behaviour would be preferred.
Supervisor	Ass prof Gry Boe-Hansen (primary)
Contact for further information	Ass prof Gry Boe-Hansen: g.boehansen@uq.edu.au
Additional information	
School	School of Veterinary Science

Project title	**Putting Toxoplasma Genes on a Switch: Preparing Conditional Control of α-Tubulin**
Project duration	6 weeks
Hours of engagement	11 January – 19 February 2027 | 32 hours/week | On campus – UQ Gatton.
Location	Gatton campus
Project description	Toxoplasma gondii is an important intracellular parasite and a powerful model for studying gene function in apicomplexan organisms. Our laboratory has recently developed a new rapamycin-responsive Conditional Transcription Factor (CTF) that provides exceptionally tight and reversible control of gene expression in Toxoplasma. The system has so far been validated using a fluorescent reporter gene, and the next major step is to apply it to native parasite genes. This project will help establish the molecular and cellular resources required to place the endogenous α-tubulin gene of T. gondii under conditional transcriptional control. The student will focus on two foundation objectives: producing and molecularly validating large quantities of the plasmid vectors required for the CTF system and expanding a genetically engineered Toxoplasma line carrying the CTF system. Alongside this work, the student will learn how the α-tubulin locus and its regulatory regions can be redesigned for future integration with the CTF system. Together, these activities will provide the essential starting materials for a broader molecular genetics project investigating conditional control of endogenous Toxoplasma genes.
Expected outcomes and deliverables	By the end of the project, we aim to establish validated, research-grade stocks of the plasmid constructs required for the CTF system and expand and preserve the genetically engineered CTF-expressing Toxoplasma line required for subsequent experiments. The project will also generate the preliminary molecular-design framework needed to adapt the CTF system to the endogenous α-tubulin locus. These resources will directly enable the next phase of the research program, in which conditional regulation of native Toxoplasma genes will be experimentally tested. Students whose work contributes substantially to subsequent experiments and publications will be appropriately recognised, including authorship where relevant authorship criteria are met.
Suitable for	This project would suit students from veterinary science, biomedical science, molecular biology, biotechnology, genetics, microbiology or related disciplines who are interested in molecular genetics, infectious disease or parasite biology.

	Previous experience with Toxoplasma or molecular cloning is not required, as appropriate training will be provided. The ideal student will be careful, reliable and enthusiastic about hands-on laboratory research. Because the project involves both molecular biology and cell culture, students should be comfortable with precise laboratory work, maintaining detailed experimental records and repeating procedures where necessary to optimise results. An interest in genetic engineering and gene regulation would be particularly valuable.
Supervisor	Dr Mohammad Farouq Sharifpour (primary)
Contact for further information	Dr Mohammad Farouq Sharifpour: mohammad.sharifpour@uq.edu.au
Additional information	This project provides hands-on experience across molecular cloning, genetic engineering and parasite cell biology. You will follow a research problem from plasmid design and DNA preparation through to maintenance of a genetically engineered eukaryotic parasite. You will also learn how transcriptional control systems are designed and how promoter architecture, DNA-binding sites and regulatory sequences can be manipulated to control endogenous gene expression. Main skills the student will develop: • Molecular cloning using E. coli • Bacterial transformation and plasmid propagation • Plasmid midi- and maxi-preparation • DNA quantification and quality assessment • Restriction enzyme digestion • Agarose gel electrophoresis • Plasmid and gene design using molecular-design software • Mammalian cell culture and aseptic technique • Propagation of genetically modified T. gondii • Experimental planning, troubleshooting and scientific record keeping
School	School of Veterinary Science

Project title	**Developing Plant-Derived Extracellular Vesicle (EV) Controls for Host–Pathogen Research**
Project duration	6 weeks
Hours of engagement	11 January – 19 February 2027 | 32 hours/week | On campus – UQ Gatton and St Lucia. The project will run across the full six-week 2027 UQ Summer Research Program.
Location	Gatton campus
Project description	Extracellular vesicles (EVs) are membrane-bound nanoparticles that carry proteins, lipids and nucleic acids between cells and can strongly influence host responses. This creates a challenge when studying EVs released by parasites and other pathogens: an appropriate negative control should account for the presence of vesicles and the purification process itself, rather than relying only on buffer controls. This project will develop a reproducible pipeline to isolate and characterise EVs from oranges (Citrus sinensis) and grapes (Vitis vinifera) as candidate non-pathogen controls for future in vitro and in vivo studies. The goal is to generate highly purified, well-characterised EV preparations with minimal baseline immunostimulatory activity, enabling more rigorous comparison with biologically active pathogen-derived EVs. The student will reproduce and optimise published fruit-EV isolation approaches, compare yield, purity and physicochemical properties between orange and grape EVs, and build a bank of standardised EV preparations for future experiments. The project therefore combines practical EV biomanufacturing with molecular characterisation and experimental quality control, while contributing directly to a broader research program investigating how pathogen-derived EVs interact with host cells and the immune system.
Expected outcomes and deliverables	The primary outcome will be a substantial bank of purified, quality-controlled orange- and grape-derived EVs that can be used as candidate negative-control vesicles in future in vitro and in vivo studies of pathogen-derived EVs. The project will also establish reproducible laboratory workflows and comparative data on EV yield, size, concentration, purity and morphology across multiple preparation batches. These materials and datasets will directly support subsequent studies in the laboratory. Students whose generated EV preparations or experimental data contribute substantially to future research outputs will be appropriately recognised, including authorship on resulting publications where their contribution meets authorship criteria.
Suitable for	This project would suit students in veterinary science, biomedical science, biotechnology, molecular biology, microbiology, biochemistry or related disciplines who are interested in laboratory research, extracellular vesicles, nanobiotechnology, infectious disease or host–pathogen interactions. Previous EV experience is not required, as training will be provided. The ideal student will be careful, reliable and comfortable with hands-on laboratory work requiring repeated sample-processing steps and good record keeping. Basic experience with molecular or cell-biology laboratory

	techniques would be useful but is not essential. Applicants should be curious, willing to troubleshoot experiments, and able to work both independently and collaboratively.
Supervisor	Dr Mohammad Farouq Sharifpour (primary)
Contact for further information	Dr Mohammad Farouq Sharifpour: mohammad.sharifpour@uq.edu.au
Additional information	The student will gain hands-on experience across the extracellular-vesicle workflow, from biological sample preparation through purification, characterisation and data interpretation. Techniques will include: • Differential centrifugation • Membrane filtration • Ultracentrifugation • Size-exclusion chromatography and, • Density-gradient purification. For EV characterisation, the student will learn approaches used in the supporting studies, including: • Nanoparticle tracking analysis (NTA) and/or tunable resistive pulse sensing (TRPS) for particle size and concentration, and • Exposure to TEM or cryo-TEM for vesicle morphology and membrane structure. • Depending on project progress and facility access, the student may also gain exposure to proteomic/mass-spectrometry analysis. Beyond technical skills, the student will learn: • Experimental design • Batch-to-batch quality control and troubleshooting • Quantitative data analysis and, • The importance of appropriate negative controls in EVs and host–pathogen research.
School	School of Veterinary Science

Project title	**Determination of dosage for a herbal spray to treat QLD Itch in horses**
Project duration	6 weeks
Hours of engagement	20 -36 hours per week. Must be on campus or visit a farm in Laidley to treat the horses each day. A roster will be managed between 2-3 students. Some data management-ie- entering data into spreadsheets
Location	Gatton campus
Project description	Insect bite hypersensitivity is the most common allergic skin condition of horses due to the salivary proteins from Culicoides midges and other insects. We will perform a dose determination study to determine the effectiveness of 3 different dosages of a herbal spray to control clinical signs of QLD itch. Horses will be randomised to 3 different dosages and require treatment on a daily basis for 3 weeks per dose with a 3 week washout period. Blood and skin biopsies will be collected at the end of each treatment phase and skin scoring will be performed weekly.
Expected outcomes and deliverables	Horse handling, physical exams, IV sedation, blood collection, skin biopsy, photo and scoring lesions. Must have excellent organisation skills to maintain photos and skin scores on horses.
Suitable for	Must be a BVSc student ideally a 3rd or second year student with an interest in equine medicine and have previous horse handling experience.
Supervisor	Dr Allison Stewart (primary) Dr Noman Naseem
Contact for further information	Dr Allison Stewart: allison.stewart@uq.edu.au
Additional information	Possibility of using the data generated for a VETS5017 research elective project resulting in a publication and conference presentation.
School	School of Veterinary Science

Project title	**Pharmacokinetics of a potassium competitive acid blocker in horses**
Project duration	6 weeks
Hours of engagement	20 -36 hours per week. Must be on campus to treat the horses each day. A roster will be managed between 2-3 students. Some data management-ie-entering data into spreadsheets
Location	Gatton campus
Project description	To determine the dosage of a medication pharmacokinetic analysis must be performed. Blood samples are collected throughout the day on several occasions and effects of feeding can be determined. Horses are prone to gastric ulcers. Potassium competitive acid blockers are used in people to treat gastric ulcers. The effect on gastric pH of these drugs in horses is unknown. The students will assist the equine medicine resident in the daily physical examinations, treatment, gastroscopies to score gastric lesions, placement of pH probes, continuous monitoring of gastric pH, IV catheter placement blood sample collection.
Expected outcomes and deliverables	Become proficient in Horse handling, physical examination, sedation, placement of IV catheters, blood collection and gastroscopies
Suitable for	BVSc or BVetTech students only. Ideally students should have previous horse handling experience or interest in equine medicine. Students must be able to work independently, be reliable, excellent data recording skills. Some weekend work will be required.
Supervisor	Dr Jessica Wise (primary) Dr Allison Stewart
Contact for further information	Dr Jessica Wise: jessica.wise@uq.edu.au
Additional information	Some weekend work may be required.
School	School of Veterinary Science

Project title	**Determining the gastric pH in horses after administration of a potassium blocker**
Project duration	6 weeks
Hours of engagement	20 -36 hours per week. Must be on campus to treat the horses each day and when horses are having appointments. A roster will be managed between 2-3 students. Some data management-ie- entering data into spreadsheets
Location	Gatton campus
Project description	Horses are prone to gastric ulcers. Potassium competitive acid blockers are used in people to treat gastric ulcers. The effect on gastric pH of these drugs in horses is unknown. The students will assist the equine medicine resident in the daily physical examinations, treatment, gastroscopies to score gastric lesions, placement of pH probes, continuous monitoring of gastric pH and blood sample collection.
Expected outcomes and deliverables	Horse handling, physical examination, become proficient in blood collection and gastroscopies
Suitable for	BVSc or BVetTech students only. Ideally students should have previous horse handling experience or interest in equine medicine. Students must be able to work independently, be reliable, excellent data recording skills. Some weekend work will be required.
Supervisor	Dr. Allison Stewart (primary) Dr Jessica Wise
Contact for further information	Dr. Allison Stewart: allison.stewart@uq.edu.au
Additional information	Some weekend work may be required.
School	School of Veterinary Science