UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Advanced Ion Exchange Membranes for Electrochemical Decarbonisation**
Hours of engagement & delivery mode	**6 weeks** 11 Jan – 19 Feb 2027 On site – St Lucia
Description:	Ion exchange membranes (IEMs) are a distinctive class of semi-permselective membranes with a market value of approximately 1000–2000 AUD per square meter, nearly 100 times higher than conventional desalination membranes. As charge conductors and reactant separators, they are key components in a range of energy-related applications, including hydrogen (H_2) production via water splitting, electrochemical CO_2 reduction, fuel cells, and flow batteries. With the continued growth in global energy demand, the need for advanced IEMs is expected to increase at a compound annual growth rate (CAGR) of around 9.5% over the next decade. Despite this, IEM technologies are still at an early stage, creating strong opportunities for research and commercialization. In this project, we will develop next-generation ion exchange membranes based on novel covalent organic polymer (COP)-derived polymers and advanced membrane fabrication techniques. The research will focus on designing materials with improved ion conductivity, selectivity, and stability, and tailoring membrane performance for different application scenarios such as water electrolysis and electrochemical energy systems.
Expected learning outcomes and deliverables:	Students will gain introductory research experience in ion exchange membrane preparation, characterisation, data collection, and result analysis. They will assist with selected laboratory tasks and learn how membrane properties relate to applications such as water electrolysis and electrochemical energy systems. By the end of the project, students will be expected to maintain laboratory records, analyse their results, and complete a short-written report or oral presentation summarising their work.
Suitable for:	This project is suitable for undergraduate and Master's students interested in materials science, renewable energy, and decarbonization technologies, especially those aiming for academic research. Students will gain hands-on research experience and work closely with Dr. Jindi Yang, with additional guidance from Prof. Xiwang Zhang.
Primary Supervisor:	Jindi Yang
Further info:	If you would like applicants to contact your unit for further information, please provide the relevant contact details here. jindi.yang@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Lead-free perovskite Indoor Photovoltaics for Wearable and Healthcare Electronics
Hours of engagement & delivery mode	**6 weeks only** 11 Jan – 19 Feb 2027 On-site: St Lucia
Description:	This project aims to develop an efficient and low-cost power device for indoor wearable electronics by directly harvesting and converting ambient indoor light energy. High-quality and low-toxicity solution-processible halide perovskite semiconductor thin films will be developed for fabricating efficient indoor photovoltaics. Prototypes that integrate indoor photovoltaic and wearable electronic devices will be developed in collaboration with our industry partner. The scholar will be involved in the fabrication of semiconductor films and assembly of indoor solar cells, as well as performance testing and analysis.
Expected learning outcomes and deliverables:	This project aims to address the key challenge of developing efficient and low-cost power supply for indoor Internet-of-Things (IoT) devices by directly harvesting and converting ambient indoor light energy. High quality and low-toxicity solution-processible halide perovskite semiconductor thin-film will be developed by a low-temperature and cost-effective strategy for fabricating efficient indoor photovoltaics. Prototypes that integrate indoor photovoltaic and IoT electronic devices will be developed.
Suitable for:	Position is open to applicants with a background in chemistry, material science or chemical engineering in their 3rd-4th year. Coursework master students in these disciplines will also be considered if available.
Primary Supervisor:	Miaoqiang Lyu
Further info:	Please send your CV and transcripts to m.lyu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**High performing gas separation membranes**
Hours of engagement & delivery mode	**6 weeks** 11 Jan – 19 Feb 2027 On site – St Lucia
Description:	The big picture Separating gases — stripping CO_2 from flue gas, purifying hydrogen, upgrading biogas — swallows close to a tenth of the world's energy, and most of it is still done by boiling mixtures apart. Membranes do the same job cold: gas is simply pushed through a thin film, and the film decides what gets through. The catch has always been the material. The best molecular sieves are crystalline powders — beautiful, but almost impossible to turn into a continuous, defect-free film. MOF glass solves this. Melt a metal–organic framework, quench it, and you get a glass that flows into a seamless membrane while keeping pores the size of a single molecule. No grain boundaries, no leaks, and openings tight enough to tell H_2 from CO_2. Our group has already used this to make membranes only a few nanometres thick. There is a lot left to figure out. What you'll actually do Make ZIF-based MOF glass, via both classic melt-quench and our new room-temperature sol–gel route Fabricate thin-film membranes on porous supports — and learn first-hand what makes them fail Characterise them: XRD, SEM, DSC/TGA, gas sorption Run single-gas and mixed-gas permeation (H_2/CO_2, CO_2/N_2, CO_2/CH_4) and benchmark your membranes against the Robeson upper bound
Expected learning outcomes and deliverables:	What you'll take away Real hands-on skills in materials synthesis, membrane fabrication and gas transport measurement Your own dataset and a short report — strong summer projects here often grow into a co-authored paper or an Honours/PhD project An honest look at research life before you commit to it Daily mentoring from PhD students and postdocs inside an ARC Centre of Excellence — you'll be part of the team, not parked in a corner
Suitable for:	Suitable for Undergraduate students in chemical engineering, chemistry, materials science, nanotechnology or a related discipline. Enthusiasm and careful hands matter more than prior lab experience — the rest we'll teach you.
Primary Supervisor:	Jingwei Hou
Further info:	Jingwei.hou@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Performance properties of novel starch-based food packaging films**
Hours of engagement & delivery mode	**6 weeks** 11 Jan – 19 Feb 2027 On site – St Lucia
Description:	This project will link closely with a PhD project in the ARC Industry Transformation Training Centre (ITTC) on bioplastics and bioocomposites - on developing new biobased food packaging films. Specifically, this project would aim to characterise key film material and barrier properties.
Expected learning outcomes and deliverables:	Experience with biobased materials characterisation. Links with Plantic our industry partner. Overview of biobased materials performance.
Suitable for:	Lab experienced students. Polymer or biobased materials knowledge preferred but not required.
Primary Supervisor:	Peter Halley
Further info:	

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Evaluating HCl Circularity in Molten Chloride Salt PVC Recycling Processes
Hours of engagement & delivery mode	**6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Polyvinyl chloride (PVC) is one of the most widely used plastics globally, resulting in vast amounts of the material ending up in waste streams or polluting the environment. Plastics can be diverted from landfill through thermal treatment (combustion, pyrolysis, gasification). However, thermal treatment of PVC presents a significant challenge due to the release of HCl which must be captured to prevent environmental impacts or health hazards. While HCl recovery is technically feasible, it is likely a waste stream due to an oversupplied market associated with the chlor-alkali process, reducing the economic attractiveness of PVC recycling technologies. Recent studies have shown that chloride salts are reasonable catalysts for the destruction of methane, and therefore, it is postulated that these salts are strong catalysts for mixed plastics destruction. Notably, chloride salts are also HCl resistant. Furthermore, preparation and replenishment of chloride salts (e.g. $MgCl_2$, $ZnCl_2$, $MnCl_2$, and $FeCl_3$) require chloride-containing feedstocks, presenting a potential opportunity for utilisation of recovered HCl from PVC destruction processes. This project will evaluate the circularity of the proposed recycling of PVC containing mixed plastics streams in the context of molten salt pyrolysis. The student will develop mass flow and block flow diagrams describing the generation, recovery, and utilisation of HCl throughout the system. Using mass balance principles developed in key courses such as CHEE3020 the project will quantify flows and identify pinch points or bottlenecks that may limit the practical integration of PVC destruction and salt production.
Expected learning outcomes and deliverables:	The student participating in this project will gain experience across: mass balance calculations, literature review, and sustainable waste-management technologies. The student will be expected to: - Provide a brief review of the literature for the project - Develop a process block flow diagram for the discussed concept - Identify key mass flow constraints - Recommend a salt for catalytic destruction of PVC and co-production, and - Provide a final report / presentation to share with research partners The project will provide valuable training for students interested in circular technologies and research.
Suitable for:	Students who have completed CHEE3020.
Primary Supervisor:	Mark McConnachie
Further info:	Yes m.mcconnachie@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Scaling Porous Separator-Based CO2 Electrolyzers
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Electrochemical CO2 reduction can convert captured carbon dioxide into valuable chemicals using renewable electricity. However, scaling CO2 electrolyzers beyond small laboratory cells remains challenging because changes in gas and liquid flow, electrical contact and mass transport can reduce efficiency and stability. This project will investigate porous separator-based CO2 electrolyzers, an emerging cell design that may simplify device architecture and improve mass transport. The student will assemble and test laboratory-scale electrolyzer cells, vary selected operating conditions such as flow rate and current density, and evaluate the effect on cell voltage, product selectivity and stability. The work will contribute to ongoing research on scalable electrochemical technologies for carbon utilisation and sustainable chemical production. Training in laboratory safety and electrochemical methods will be provided.
Expected learning outcomes and deliverables:	The student will gain hands-on experience in safe laboratory practice, CO2-electrolyzer assembly, electrochemical testing, troubleshooting, experimental design and data analysis. They will learn to relate operating conditions to electrolyzer performance and communicate scientific results clearly. The student will maintain experimental records, prepare a short final report, and deliver an oral presentation to the research group. Depending on the outcomes, the work may contribute to an internal report, conference presentation or future publication.
Suitable for:	This project is suitable for motivated undergraduate students in chemical engineering, materials science, chemistry, mechanical engineering or a related discipline. An interest in clean energy, electrochemistry, separations or sustainable chemical production is desirable. Prior laboratory experience is helpful but not essential. Applicants should be willing to learn new experimental techniques, work carefully and safely in a laboratory, analyse data, and contribute independently and as part of a research team.
Primary Supervisor:	Dr Min Liu
Further info:	Min.liu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Thin-Film Composite Membranes for CO_2 Separation**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Membrane-based CO_2 separation is an energy-efficient approach for reducing emissions from industrial processes and upgrading gas streams. Thin-film composite membranes are especially promising because they combine a very thin selective layer with a porous support, enabling high gas throughput while maintaining separation performance. This project will investigate the fabrication and performance of thin-film composite membranes for CO_2 separation. The student will prepare membrane materials, fabricate selective thin films on porous supports, and evaluate their gas-separation performance. The work will explore how membrane composition and fabrication conditions influence CO_2 permeability, selectivity and stability. The project will contribute to ongoing research on advanced membrane materials for carbon capture. Training in laboratory safety, membrane fabrication and gas-permeation testing will be provided.
Expected learning outcomes and deliverables:	The student will gain practical experience in polymer and membrane fabrication, gas-separation testing, experimental design and data analysis. They will learn how membrane structure and processing influence gas-transport properties and develop skills in troubleshooting and scientific communication. The student will keep clear experimental records, analyse the results, prepare a short final report, and deliver an oral presentation to the research group. Depending on the outcomes, the work may contribute to an internal report, conference presentation or future publication.
Suitable for:	This project is suitable for motivated undergraduate students in chemical engineering, materials science, chemistry or a related discipline. Students with an interest in polymers, membranes, carbon capture or sustainable energy technologies are encouraged to apply. Prior laboratory experience is helpful but not essential. Applicants should be willing to learn new techniques, work carefully and safely in a laboratory, analyse data, and contribute independently and collaboratively within a research team.
Primary Supervisor:	Dr Min Liu
Further info:	Min.liu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Mesoporous metal-organic frameworks for efficient gas storage**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Hydrogen is a promising clean-energy carrier, but storing it safely and efficiently remains a major challenge. Porous materials called metal-organic frameworks (MOFs) can store hydrogen within their internal pores, potentially reducing the pressure required compared with conventional gas-storage systems. This project will develop MOFs with larger internal channels, known as mesopores, to improve hydrogen transport and usable storage capacity. The student will assist with the synthesis of porous materials, vary selected fabrication conditions, and characterise their structure and porosity. The project will explore how pore structure influences material performance and contribute to research on safer, more practical hydrogen-storage technologies. Training in laboratory safety and materials-characterisation methods will be provided.
Expected learning outcomes and deliverables:	The student will gain practical experience in porous-material synthesis, safe laboratory practice, sample preparation and materials characterisation. They will learn how pore structure, crystallinity and material form influence gas-storage performance, while developing skills in experimental planning, data analysis and scientific communication. The student will maintain experimental records, prepare a short final report, and deliver an oral presentation to the research group. Depending on project outcomes, the work may contribute to an internal report, conference presentation or future publication.
Suitable for:	This project is suitable for motivated undergraduate students in chemical engineering, materials science, chemistry or a related discipline. Students with an interest in clean energy, porous materials, nanomaterials or sustainable technology are encouraged to apply. Prior laboratory experience is helpful but not essential. Applicants should be willing to learn new experimental techniques, work carefully and safely in a laboratory, analyse data, and contribute independently and as part of a research team.
Primary Supervisor:	Dr Min Liu
Further info:	Yes, contact min.liu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Glass That Glows: Turning Metal–Organic Frameworks into Luminescent Hybrid Glasses**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Everyone knows window glass and optical fibre glass. Almost nobody knows that a metal-organic framework - a crystalline sponge built from metal ions and organic linkers - can also be melted and quenched into a completely new kind of glass. These hybrid glasses are transparent, mouldable, and, unlike conventional glasses, they carry organic molecules inside their network. That means their light emission can be engineered chemically rather than just by doping a rigid oxide melt. This project asks a simple question with a lot of unknowns behind it: what actually controls how brightly, and in what colour, a hybrid glass glows? Our working hypothesis is that emission efficiency and colour are governed by two handles the student can control directly - the choice and loading of emissive centres (linker-based emission, or lanthanide ions such as Eu^{3+} and Tb^{3+} introduced during synthesis), and the thermal history of the melt-quenching step, which sets how rigidly those emitters are locked into the amorphous network and therefore how much energy is lost non-radiatively. Over six weeks you will make your own small library of hybrid glass samples, melt-quench them under controlled conditions, and then measure what you made. Synthesis and thermal work come first (solvothermal synthesis, thermal analysis to find the melting and decomposition window, then quenching at different rates). Optical characterisation follows: absorption, steady-state photoluminescence, emission lifetime, and quantum yield, from which you will extract CIE colour coordinates and build a composition-processing-property map. You will be working shoulder-to-shoulder with a PhD student in the group, on samples nobody has measured before, which means genuine ownership of a small piece of a real research problem. This is an on-site, laboratory-based project running at approximately 30 hrs per week for the six weeks of the program.
Expected learning outcomes and deliverables:	By the end of the project, you will have hands-on competence in a set of techniques that transfer directly to materials, energy and pharmaceutical research: solvothermal synthesis and sample handling, thermogravimetric analysis and differential scanning calorimetry, melt-quench processing, powder X-ray diffraction and FTIR for structural confirmation, and UV-vis plus photoluminescence spectroscopy including lifetime and quantum yield measurement. You will also build practical data skills - processing spectra in Python or Origin, fitting decay curves, calculating colour coordinates, and keeping a research-grade electronic lab notebook. Deliverables are a characterised sample library with its full dataset, a written report in the format of a short journal manuscript (introduction, methods, results, discussion), and a 10-minute oral presentation to the research group at the end of the program. Students who generate reproducible, high-quality data will be considered for co-authorship on a

	resulting publication, and this project is a natural entry point into an honours or final-year thesis project in the group.
Suitable for:	This project is open to 2nd and 3rd year students in chemical engineering, chemistry, materials engineering or nanotechnology. You should have completed introductory chemistry and be comfortable with basic thermodynamics; prior research experience is not required, and prior experience with any of the instruments above is definitely not expected - you will be trained. What matters more is that you enjoy careful hands-on lab work, that you are willing to repeat a measurement when the result looks strange rather than ignoring it, and that you are curious about why a material behaves the way it does. Students must complete the School's laboratory safety inductions before commencing.
Primary Supervisor:	Jingwei Hou.
Further info:	Yes, jingwei.hou@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	The generation gap in AI: do engineering academics understand how their students are actually using gen AI, and what it means for their learning?
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Generative AI, particularly Large Language Models (LLMs) are revolutionizing how students learn and how engineers practice, and universities need to keep up. There are two key challenges. The first, preventing cheating, is addressed by increased use of secure assessments, such as exams. The larger challenge, however, remains: how do we adapt our pedagogy to maximise learning for students who routinely use AI? To develop and apply effective teaching practices in this brave new world, we need to understand how our students use generative AI in their studies and how this use is changing over time. The first step is to compare what engineering academics believe about how their students are using gen AI, with how it is actually being used by engineering students. This project explores how to characterise the gen AI gap.
Expected learning outcomes and deliverables:	Participants will gain experience in educational research, including data collection, analysis, and interpretation of findings on generative AI use in engineering education. They will develop insights into how AI is influencing student learning and academic practice. Participants will assist with research activities such as surveys, interviews, and data analysis, and may have opportunities to contribute to conference or journal publications. At the end of the project, they will submit a short report and deliver a brief presentation on their work and findings.
Suitable for:	This project is suitable for undergraduate engineering students with an interest in engineering education, learning technologies, generative AI, or research methods. Strong communication skills, curiosity about how students learn, and an interest in data collection and analysis will be advantageous. No prior research experience is required, although experience with surveys, interviews, or data analysis would be beneficial.
Primary Supervisor:	Gloria Milena Monsalve Bravo
Further info:	g.monsalvebravo@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Bioplastics in a circular economy: Techno-economic assessment of recycling PHA bioplastics
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	With growing concerns over plastic pollution and the continued reliance on fossil-based plastics such as polypropylene (PP), low-density polyethylene (LDPE), and polyethylene terephthalate (PET), biodegradable polymers are attracting increasing attention as sustainable alternatives. Among these, PHAs are a unique family of bio-based and biodegradable polymers with great potential to reduce reliance on conventional plastics in applications such as packaging films and coatings. As with conventional plastics, PHAs can be mechanically recycled, but to date there have been no assessments of the techno-economics for doing so. As part of the ARC Centre for Bioplastics and Biocomposites, the student will have the opportunity to investigate existing plastic recycling systems and assess the potential for PHA to be recycled in much the same way conventional plastics are. Through this project, the student will develop an understanding of the systems that need to be in place to facilitate a move to a more circular economy.
Expected learning outcomes and deliverables:	Learning outcomes: • Understanding plastic material flows in a circular economy. • Develop an understanding of (PHA) biodegradable • Gain skills in techno-economic assessment. Deliverables: • A short-written summary report (scope to be discussed). • A short oral presentation as part of the Summer Research Program.
Suitable for:	Second-year undergraduate students or above studying Chemical Engineering – focusing on environmental engineering. (Reach out to chat and learn more!)
Primary Supervisor:	Steven Pratt (s.pratt@uq.edu.au)
Further info:	

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Microdroplets or Microbubbles for Ambient CO_2 Conversion to Pharmaceutically Relevant Products
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Taking advantage of the exceptional reactivity at gas–water interfaces within micron-sized droplets and bubbles, substrates such as phenol pollutants in wastewater and CO_2 are converted under ambient conditions into the value-added active pharmaceutical ingredients salicylic acid and aspirin (providing a mild alternative to the conventional Kolbe–Schmitt reaction, which requires high temperature and pressure), two widely used nonsteroidal anti-inflammatory drugs.
Expected learning outcomes and deliverables:	This interdisciplinary project will enable the participants gain knowledge in establishing a circular economy with sustainable development. An oral presentation may be produced at the end of the summer research.
Suitable for:	This project is open to applications from students with background in chemistry, chemical engineering, environmental, engineering, material science and Metallurgical engineering, 3rd - 4th year students.
Primary Supervisor:	Dr. Ping Chen
Further info:	Ping.chen@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Designing high-performance CO2 reduction electrolysers
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Are you passionate about tackling climate change and interested in how science and engineering can shape a cleaner future? This summer, join our lab for a hands-on research experience focused on transforming carbon dioxide into valuable products using renewable electricity. As part of the ARC Centre of Excellence for Green Electrochemical Transformation of CO2 (GETCO2), our team is working on innovative electrolysers that convert CO2 into fuels and chemicals. These technologies are at the heart of Australia's efforts to build a low-carbon, circular economy. In this program, you will: • Help design and test CO2 electrolyser systems in a research lab • Work with emerging materials and simple diagnostic tools • Gain practical skills in experimental design, problem-solving, and teamwork • Learn from researchers developing real-world solutions to climate challenges No prior experience in electrochemistry is needed. We welcome curious and motivated students from science, engineering, and related fields who are eager to learn and contribute. Take this opportunity to make a difference, explore cutting-edge research, and discover how you can be part of the global shift toward a net-zero future.
Expected learning outcomes and deliverables:	Hands-on laboratory experience in assembling and testing CO2 electrolyser cells • Basic understanding of electrochemical CO2 conversion principles and system design • Development of practical skills, including safe lab practices, data collection, and troubleshooting • A short written report or presentation summarising the your experiments, observations, and insights • Improved confidence in conducting research and interpreting scientific results • Opportunity to contribute to ongoing research, with potential inclusion in internal reports or future publications
Suitable for:	No prior experience in electrochemistry is needed. We welcome curious and motivated students from science, engineering, and related fields who are eager to learn and contribute. Only curiosity is what we need!!!!
Primary Supervisor:	Mike Tebyetekerwa
Further info:	m.tebyetekerwa@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Solar-Driven Carbon Dioxide Conversion into Fuels
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	The conversion of carbon dioxide (CO2) into valuable chemicals using solar energy offers a sustainable approach to reducing carbon emissions while producing renewable fuels. This project aims to investigate solar-driven CO2 conversion by developing and testing advanced materials for photothermal reactions. The student will gain hands-on experience in materials synthesis, laboratory experimentation, and characterisation techniques, as well as performance evaluation under reaction conditions. They will also learn how to analyse experimental data and interpret research results. This project is suitable for students interested in chemical engineering, materials science, renewable energy, and catalysis, and provides an excellent opportunity to develop practical research skills in a supportive laboratory environment.
Expected learning outcomes and deliverables:	The student(s) will gain hands-on research experience in materials synthesis, photothermal reaction testing, and a range of materials characterization techniques. They will work closely with PhD students and postdoctoral researchers on day-to-day laboratory activities and receive regular guidance through discussion and meetings with the project supervisor. They will develop practical laboratory skills, learn how to analyse and interpret experimental data, and gain an understanding of sustainable energy research and CO2 conversion technologies. By the end of the project, students are expected to complete a small experimental study, analyse and present their results, and prepare a short written report. High-performing students may also have the opportunity to contribute to conference presentations or scientific publications and be considered for future Honours, PhD scholarship, or research opportunities within the group.
Suitable for:	This project is open to applications from 3rd and 4th year undergraduate students. Multiple positions may be available depending on applicant suitability. A background in chemical engineering, chemistry, materials science, or a related discipline, and previous laboratory or research experience are preferred but not essential. Applicants with an interest in renewable energy, catalysis, or materials characterisation are encouraged to apply.
Primary Supervisor:	Haijiao Lu
Further info:	haijiao.lu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	AI-Driven CFD-DEM for Hydrogen Ironmaking
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 Conducted remotely.
Description:	The transition towards low-carbon ironmaking requires the development of efficient hydrogen-based direct reduction processes. Shaft furnaces are an important technology for hydrogen direct reduction, where the interaction between reducing gas and iron-bearing particles strongly influences gas distribution, particle residence time, and overall reactor performance. Computational Fluid Dynamics-Discrete Element Method (CFD-DEM) provides a powerful physics-based approach for resolving gas-solid flow behaviour at the particle scale. However, CFD-DEM simulations are computationally intensive and typically require substantial manual effort for model setup, simulation management, monitoring and post-processing. This project will investigate an agentic CFD-DEM framework in which artificial intelligence (AI) and Large Language Model (LLM) agents assist with and progressively automate the CFD-DEM simulation workflow. The project will focus on the hydrodynamics of gas-solid flow in a hydrogen shaft furnace, with particular emphasis on automated simulation setup, real-time monitoring, identification of key hydrodynamic behaviours, and intelligent interpretation of simulation results. The overarching aim is to develop and demonstrate an AI-assisted workflow capable of autonomously interacting with CFD-DEM simulations and providing meaningful insights into gas-solid flow behaviour.
Expected learning outcomes and deliverables:	Students will gain hands-on research experience in CFD-DEM modelling, gas-solid flow analysis, Python-based scientific computing, and AI-assisted simulation workflows. During the project, students will: • Run CFD-DEM simulations of gas-solid flow relevant to hydrogen shaft-furnace ironmaking. • Explore how AI agents can assist with CFD-DEM simulation setup, monitoring and interpretation of simulation results. • Develop practical skills in scientific computing, high-performance computing, data analysis, and research methodology. • Prepare a final research report and oral presentation summarising the project outcomes. • Subject to the quality and scope of the results, there may also be an opportunity to contribute to a conference presentation or research publication.
Suitable for:	This project is suitable for 3rd- or 4th-year undergraduate students with an interest in computational engineering, multiphase flow, processing engineering, or artificial intelligence. Applicants with basic knowledge of fluid mechanics or numerical modelling, programming experience in Python or a similar language, and an interest in AI, or LLMs are particularly encouraged to apply. Prior experience with CFD or DEM is desirable but not essential.
Primary Supervisor:	Dr. Erlei Li

Further info:	Yes, erlei.li@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Critical metals recovery from bauxite residue
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	This project aims to use hydrometallurgical methods to recovery critical metals from bauxite residue, supporting sustainable critical metals production. Experimentation will test the effect of acid types, pH, solid loading, reaction time and temperature. This project follows on the previous research projects on synthesis of low-cost adsorbents from mine tailings and clay minerals for critical metal recovery. We aim to conduct proof-of-concept study on synthesis flowsheet and also technical-economic analysis.
Expected learning outcomes and deliverables:	The student will gain skills in experimental skills in sample synthesis and adsorption test. There will likely be liquid and solid sample characterisation by in-house ICP and XRD. The student will present project outcomes to the hydrometallurgy research group.
Suitable for:	This project is most suited to metallurgical/chemical/environmental engineering students with an interest in the environmental engineering and critical metal recovery.
Primary Supervisor:	Dr Hong Peng
Further info:	If you are interested, please meet with Dr Hong Peng (h.peng2@uq.edu.au) to discuss the project.

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Modelling and simulation of Return Sludge Sidestream (RSS) - EBPR for wastewater treatment**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	This project focuses on the use of process modelling to evaluate innovative approaches for improving wastewater treatment plant performance. Specifically, the project will investigate the Return Sludge Sidestream (RSS) process, a promising technology that has demonstrated significant reductions in sludge production and improving biological nutrient removal. The RSS process involves diverting a small portion of return activated sludge to an anaerobic sidestream reactor to promote beneficial biological activity. Recent pilot-scale studies have shown encouraging results, highlighting the potential for RSS to improve treatment plant performance without major infrastructure upgrades. During the program, the student will work with the wastewater process modelling software SUMO to investigate how RSS systems can be represented and evaluated within a whole-plant modelling framework. Activities may include reviewing existing models, analysing pilot-scale datasets, developing and testing simulation scenarios, and interpreting modelling results. This work forms part of a larger industry-funded research project and may contribute to future conference papers, journal publications, and honours or thesis-based research projects. The project is primarily desktop-based and is suitable for students interested in environmental engineering, wastewater treatment, process modelling, and digital tools for infrastructure planning and optimisation.

Expected learning outcomes and deliverables:	Through participation in this project, students will gain practical experience in wastewater process modelling, simulation, and research data analysis. Students will develop skills in: • Wastewater treatment process fundamentals and biological nutrient removal. • Process modelling using SUMO simulation software. • Interpretation and analysis of pilot-scale operational datasets. • Model setup, calibration, and scenario evaluation. • Technical reporting and scientific communication. Students will contribute to a defined modelling task within an active research project investigating RSS implementation for wastewater treatment plants. At the conclusion of the project, students will prepare: • A short technical report summarising project objectives, methods, results, and recommendations. • A presentation outlining key findings and future research opportunities. • Documentation of modelling scenarios and simulation outcomes. Students may have the opportunity to continue the work through an Honours, Thesis, or research project course following completion of the Summer Research Program. The project may also contribute towards future conference or journal publications.
Suitable for:	Chemical & Bioprocess Engineering students, experience with process simulation software (e.g. SUMO, BioWin, Aspen, or similar tools) is desirable but not essential. Preference will be given to motivated students interested in pursuing a future Honours, Thesis, or HDR pathway in wastewater and environmental engineering research.
Primary Supervisor:	Albie Gan
Further info:	Albie Gan, z.gan@uq.edu.au, Adrian Oehmen a.oehmen@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Development and scale-up of microbial entrapment technology for wastewater treatment**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	This project focuses on the scale-up and pilot-scale deployment of Microbial Entrapment Technology (MET) that immobilises beneficial microorganisms within a durable polymer matrix. By enhancing microbial stability, retention, and activity, the technology has significant potential for wastewater treatment, resource recovery, and other environmental biotechnology applications. Students will contribute to a range of activities associated with advancing the technology from lab-scale research to pilot-scale demonstration. Key tasks include wet laboratory testing of wastewater treatment performance using MET, experimental evaluation of microbial entrapment technology, process monitoring, data collection, and analysis of treatment outcomes. Students will also be involved in the manufacturing, optimisation, and quality assessment of MET to support pilot-scale production. In addition, students will participate in the design, setup, and commissioning of manufacturing and control systems for a pilot-scale production facility. This may include equipment integration, process control development, system testing, and preparation of infrastructure required for large-scale beads manufacturing and application trials. The project provides an opportunity to gain hands-on experience across environmental biotechnology, bioprocess engineering, and pilot-scale technology development while contributing to the advancement of a novel treatment technology towards commercial implementation.
Expected learning outcomes and deliverables:	The student will gain hands-on experience in conducting an applied research project and develop an understanding of the challenges and opportunities associated with translating laboratory-scale innovations into pilot-scale environmental biotechnology applications. The student will gain practical skills in wastewater treatment testing, microbial entrapment technology, pilot-scale manufacturing, process monitoring, data analysis, and engineering system implementation. - Participation in wet lab testing and performance evaluation of MET-based wastewater treatment processes - Contribution to the setup, commissioning, and operation of pilot-scale manufacturing and control systems for BioBead production. - Collection, analysis, and interpretation of experimental and operational data. - A final report and presentation to relevant audiences.

Suitable for:	Chemical engineering, Chemical+Bioprocess engineering and Chemical+Environmental engineering UQ students. Preference will be given to motivated students interested in pursuing a future Honours, Thesis, or HDR pathway in wastewater and environmental engineering research.
Primary Supervisor:	Albie Gan
Further info:	Albie Gan, z.gan@uq.edu.au, Adrian Oehmen a.oehmen@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Convert waste polymer into useful chemicals**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Waste polymer has become a great concern for the society development due to its intrinsic stability. We are now developing new technology to break down the waste polymer into useful chemical feedstocks. Novel catalyst will be developed for this project.
Expected learning outcomes and deliverables:	Through this project, the student will learn how to synthesis materials and implement scientific research and data analysis. Moreover, the students will also have the chance to access to the world-class facility for polymer analysis
Suitable for:	Students above Year 3
Primary Supervisor:	Dr. Zhiliang Wang
Further info:	Zhiliang.wang@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Understanding Greenhouse Gas Emissions from Full-Scale Wastewater Treatment Plants**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 Hybrid arrangement.
Description:	Wastewater treatment is an essential public service but can also be a significant source of greenhouse gas emissions. In particular, nitrous oxide (N_2O) generated during biological nitrogen removal can contribute substantially to the carbon footprint of wastewater treatment plants. However, N_2O emissions can vary considerably over time and under different operating conditions, making full-scale monitoring data particularly valuable for understanding when and why elevated emissions occur. This project will analyse an existing dataset collected from a full-scale wastewater treatment plant in Australia as part of a broader research program investigating greenhouse gas emissions from wastewater treatment systems. The project aims to characterise N_2O emission patterns and investigate their relationships with plant operating and environmental conditions. The student will work with existing N_2O monitoring and plant operational datasets and undertake data processing, visualisation and statistical analysis. Depending on the available data and progress, the project may investigate temporal and event-based emission patterns, relationships between N_2O emissions and key process parameters, and potential operational factors associated with elevated emissions. The findings will contribute to a better understanding of N_2O emissions under real-world operating conditions and support future development of practical monitoring and mitigation strategies for the wastewater sector.
Expected learning outcomes and deliverables:	The student will gain hands-on experience working with real-world data from a full-scale wastewater treatment facility and develop practical skills in data processing, visualisation, statistical analysis and interpretation. The project will also provide exposure to wastewater treatment processes, greenhouse gas monitoring and the challenges associated with analysing complex environmental and operational datasets. During the six-week project, the student will be expected to: * process, organise and quality-check existing N_2O monitoring and operational data; * conduct exploratory and statistical analyses to identify emission patterns and potential influencing factors; * develop clear visualisations of key trends and relationships; * interpret findings in the context of wastewater treatment operation; and * prepare a short research report and oral presentation summarising the key findings. The outcomes may contribute to the broader research program and future research outputs.
Suitable for:	This project is suitable for 3rd- and 4th-year undergraduate students with basic knowledge of wastewater treatment processes, mass balance, process engineering and process control. Applicants should have good quantitative and analytical skills, with some experience in data processing, statistical analysis and data visualisation. Familiarity with Python, MATLAB, R or similar data analysis tools would be highly desirable. An interest in

	wastewater treatment, greenhouse gas emissions and working with real-world process data would be advantageous.
Primary Supervisor:	Dr. Kaili Li
Further info:	Kaili Li kaili.li@uq.edu.au Liu Ye l.ye@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Halophilic biotechnology for the next-gen bioplastic production
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Polyhydroxyalkanoates (PHAs) are plastics that present attractive mechanical properties for numerous industry applications, and have the benefit of being biodegradable in the environment. The wide production and application of PHAs is currently constrained by the relatively high cost compared with conventional plastics. The project examines how bioplastic upstream fermentation and/or downstream process parameters, such as feedstocks, temperature, extraction solid:liquid ratio, impact PHA production yield and extraction efficiency. Particularly, osmotic shock method may be focused, where halophilic cells can be ruptured using fresh water to extract the bioplastic from cells. The student will get experience with biotechnology of pure culture at the a laboratory scale, and with extraction vessel operation, process design and optimisation.
Expected learning outcomes and deliverables:	The student will learn how to conduct an applied research project and appreciate the challenges and perspectives associated with industry-focussed research. Key deliverables are: - At least one presentation to the relevant audiences. - A final report for the summer research project summarising the outcome from study results analysis.
Suitable for:	Chemical engineering, Chemical + Bioprocess engineering and Chemical + Environmental engineering UQ students
Primary Supervisor:	Dr Lisa Bai
Further info:	x.bai@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Engineering extruded snacks from Australian sorghum and amaranth: linking powder properties to product quality
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Australia is the world's fourth-largest exporter of sorghum, producing over 1.5 million tonnes annually yet almost none of it enters the domestic snack food market. Meanwhile, amaranth, a protein-rich gluten-free pseudocereal, is gaining global attention but fundamental properties of it are understudied. This project investigates how these two underexploited grains behave when blended with tapioca starch and processed through twin-screw extrusion. You will compare how sorghum and amaranth affect every stage of production: from dry powder flow through processing equipment, to molecular-level transformations during cooking, to the final product's expansion, density, and texture. You will have the opportunity to gain hands-on experience with some or all of the below: Schulze ring-shear tester (powder flow), Anton Paar Rheometer (rheology), FTIR spectroscopy (molecular structure), Mastersizer 3000 (particle sizing), and twin-screw extrusion (industrial food processing). No prior experience required, only curiosity about how food is engineered. Results have potential to contribute directly to a peer-reviewed publication with potential co-authorship opportunity.
Expected learning outcomes and deliverables:	• Hands-on training in ring-shear powder rheometry, FTIR spectroscopy, Mastersizer particle sizing, and texture analysis • Experience in twin-screw extrusion and understanding of formulation effects on product quality • Skills in experimental design, data collection, and statistical analysis • Written research report in journal-paper format • Opportunity for co-authorship on a peer-reviewed publication
Suitable for:	Open to students in 2nd, 3rd, or 4th year with a background in chemical engineering, food science or related disciplines. Students curious about food manufacturing, who enjoy hands-on lab work, and who want industry-relevant skills in advanced materials characterisation will find this project particularly rewarding. This project may appeal to students interested in Australia's grain industry, sustainable food processing, or careers in food manufacturing R&D.
Primary Supervisor:	Toby McKinnon
Further info:	Yes, t.mckinnon@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Comparative Analysis of Whipping Properties of Dairy and Plant-based Creams**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Whipping transforms liquid cream into a semi-solid foam with desirable texture and stability. This transformation involves complex structural changes, including air incorporation, protein adsorption at the air-water interface, and the formation of a fat network that stabilises the whipped cream structure. Design of recombined whipping cream requires a careful balance between maintaining stability during storage and allowing controlled destabilization during whipping. Quality attributes, such as overrun, firmness, rosette quality and stability, microstructure, particle size distribution, and rheological properties, are used to compare the texture and stability of whipped cream. Growing demand for dairy alternatives motivates development of plant-based whipping creams with desirable functionality. The student will compare the whipping process and quality attributes of dairy and plant-based whipping creams and investigate how variations in plant-based formulations affect their whipping behaviour and overall functionality.
Expected learning outcomes and deliverables:	Students may gain knowledge/skill in concepts/measurement of emulsion design, microscopy, and rheology. A written report and an oral presentation are required at the end of the project. Results from this project may contribute or partly contribute to a publication and opportunity of authorship or coauthorship. Student will attend weekly meetings with Prof Jason Stokes' group.
Suitable for:	This project is suitable for 2nd to 4th year undergraduate student or course work post-graduate student majoring in Chemistry, Chemical Engineering or its varieties. It is expected that undergraduate applicants have finished all compulsory courses listed for their program up to the year of their study.
Primary Supervisor:	Jason Stokes; Shuting Xu
Further info:	Shuting.Xu@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	**Gritty or smooth; how does shear affect the structure of high protein yoghurt?**
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	It has previously been shown (Javanmard et al 2018 10.1016/j.jfoodeng.2017.11.031) that for model yoghurt-like systems the measured characteristic size of aggregates formed by shearing a ‘pot-set’ gel is directly proportional to a structural parameter (λ) obtained from rheological measurements. However, it is not known whether this structure parameter relationship holds in high protein gels (≥ 10 % protein) sheared using commercially viable two stage high-pressure homogenization. The aim of this project is to investigate the hypothesis that the rheological structural parameter (λ) provides quantification of shear process-structure-property relationships for high protein yoghurt produced under industry-relevant conditions. To complete this project you will work alongside an industry-based PhD student from Fonterra NZ preparing and homogenizing model yoghurts and measuring their rheology and particle size distribution. The outcomes of this project are expected to inform processing and ingredient development for high protein yoghurts in industry*.*
Expected learning outcomes and deliverables:	Students may gain skills and knowledge in rheology, microstructure and particle properties, data collection and analysis techniques. Results from this project may contribute to publication. Hence, there may be an opportunity of an authorship or co-authorship of scientific manuscript. At the end of the project, students are required to deliver a written report and an oral presentation
Suitable for:	Students may gain skills and knowledge in rheology, microstructure and particle properties, data collection and analysis techniques. Results from this project may contribute to publication. Hence, there may be an opportunity of an authorship or co-authorship of scientific manuscript. At the end of the project, students are required to deliver a written report and an oral presentation.
Primary Supervisor:	Heather Shewan
Further info:	Heather h.shewan@uq.edu.au or Sunny xinyan.deng@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	Engineering Stem Cell Metabolism for Better Cell Therapies
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus.
Description:	Mesenchymal stem cells (MSCs) are the most widely trialled cell therapy in history, yet they remain largely unapproved for chronic inflammatory disease. This is because their immunosuppressive potency varies unpredictably between cell batches. This summer project tests whether cell's metabolism can play a role in making cell therapy potency consistent and reliable.
Expected learning outcomes and deliverables:	You will build gain knowledge and skill in mammalian cell culture, metabolic analysis and standard molecular biology techniques. By the end you will have: • a developed skill set in strong demand across the cell and gene therapy sector. • a better understanding of cell therapy manufacturing.
Suitable for:	This project is open to students from diverse backgrounds, including engineering, biotechnology, and molecular biosciences. The most important qualities are motivation, curiosity, and a willingness to learn new skills at the interface of engineering and biology.
Primary Supervisor:	Dr Mauro Torres
Further info:	mauro.torres@uq.edu.au

UQ Summer Research Project Description – 2027
School of Chemical Engineering

Project title:	AI-driven Cu electrocatalyst design for CO2 electrolysis
Hours of engagement & delivery mode	**Summer Research Program - 6 weeks only** 11 Jan – 19 Feb 2027 On site at St Lucia campus – Hybrid arrangement
Description:	Copper (Cu) catalysts undergo dynamic surface reconstruction during electrochemical CO_2 reduction, which can strongly influence catalytic activity, selectivity and long-term stability. Understanding how Cu atoms migrate and reorganise under realistic reaction conditions is therefore essential for designing more durable electrocatalysts. This project will investigate dynamic Cu surface reconstruction using a combination of density functional theory (DFT), ab initio molecular dynamics (AIMD) and machine-learning molecular dynamics. DFT and AIMD datasets containing energies, atomic forces and representative interfacial configurations will be used to train a **Deep Potential interatomic potential using the DeePMD-kit framework**. The trained potential will enable substantially longer-timescale and larger-scale molecular dynamics simulations than conventional AIMD, while retaining near-DFT accuracy. The simulations will resolve **Cu atomic migration and surface reconstruction, modifier–Cu interactions, interfacial water structure, ion distributions and modifier solvation** under electrochemical conditions. Where required, an active-learning workflow will be used to identify poorly represented configurations for additional DFT calculations and iterative improvement of the potential. Atomic trajectories will be analysed using structural and dynamical descriptors, including **mean squared displacement (MSD)**, coordination numbers and atomic displacement distributions, to quantify collective Cu motion and reconstruction behaviour. The project aims to identify the molecular-level factors governing Cu surface stability and establish mechanistic insights for the rational design of more stable CO_2-reduction catalysts.
Expected learning outcomes and deliverables:	The student will gain hands-on experience in computational materials modelling and machine-learning-accelerated molecular dynamics for electrochemical systems. They will develop practical skills in preparing and analysing DFT/AIMD datasets, training and validating Deep Potential interatomic potentials using DeePMD-kit, running molecular dynamics simulations, and analysing atomic trajectories using descriptors such as mean squared displacement, coordination numbers and surface reconstruction metrics. The student will be expected to complete a defined modelling workflow for Cu surface reconstruction, generate and interpret simulation results, and identify key factors governing Cu atomic mobility and interface stability. At the end of the project, the student will prepare a concise research report and deliver an oral presentation summarising the methodology, results and main conclusions. Strong outcomes may also contribute to a conference presentation or future research publication.

Suitable for:	This project is suitable for **3rd- or 4th-year undergraduate students** with a strong interest in computational modelling, materials science, electrochemistry or machine learning. Applicants should have a **decent coding background**, preferably with experience in Python or another scientific programming language. Previous experience with DFT, molecular dynamics, Linux/HPC environments or machine learning would be advantageous but is not essential. Students should be motivated, self-directed and comfortable working with computational data and learning new modelling tools.
Primary Supervisor:	Dr Feng Li
Further info:	feng.li1@uq.edu.au