THE UNIVERSITY OF SYDNEY

Project List

2027 Science Summer Research Program (Denison Scholarship)

Faculty of Science

The Science Summer Research Program is a 6-week program that takes place during the Intensive January-February study session, which will run from 11 January to 19 February 2027.

The Denison Research Scholarship provides students with an opportunity to engage in research whilst completing their undergraduate studies, which enhances their student experience and provides insight into potential further research studies. This year we have 100 scholarships to award students who will be paid $3,000 for 6 weeks, full-time participation (equivalent to 35 hours per week) in a supervised research project run by a science academic.

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School of Chemistry

CHEM01: Merging Worlds: Gas Accumulation and the Dynamics of Droplet Coalescence

Project Subject Area: Chemistry

Have you ever wondered what happens when two tiny emulsion droplets meet and merge? What if there's gas involved—how does that change the story?

This project exposes you to the microscopic world of droplet coalescence, focusing on how gas accumulation influences the way droplets deform, drain, and finally combine. You'll use a high-speed imaging setup to capture these rapid, subtle events in real time.

Project Details

Supervisor(s): Professor Chiara Neto
Contact: chiara.neto@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Background in physical chemistry, nanoscience or physics is a bonus
- Interest in experimental work relating to surface science and nanoscience expected

Student Preparation:
- It would be beneficial for the student to undertake an orientation session in December.

Attendance Mode:
On Campus

Attendance Details:
Students are expected to conduct lab work in the School of Chemistry most of the week and will be supervised by a postdoc during their time in the lab. Data analysis and report preparation will take about ½-1 day/week and can be undertaken remotely or in the office space provided in the School.

Location Details:
School of Chemistry, Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM02: Biosynthesis of complex microbial natural products

Project Subject Area: Chemistry

Natural products are the source of most of our key pharmaceuticals. Many come from microorganisms. Research in my lab focuses on identifying biosynthetic pathways that make important compounds like antibiotics, characterising these biosynthetic pathways, and generating sufficient amounts for development through bioengineering approaches. This project will mix organic chemistry and biotechnology to focus on developing some of the new cures for "superbug" infections.

Project Details

Supervisor(s): Dr Constance Bailey
Contact: constance.Bailey@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Some knowledge of chemistry (first year and second year would be helpful).
- Some knowledge of molecular biology.

Student Preparation:
- Attend safety trainings and inductions as well as our group meeting on Fridays.

Attendance Mode:
On Campus

Attendance Details:
100% on site

Location Details:
Molecular Bioscience Building (G08)

Ethics Protocol Requirement:
Biosafety training, GMO training, chemical safety training

CHEM03: Exploring AI-Enhanced 3D Visualisation for Chemistry Education

Project Subject Area: Chemistry

Understanding how molecules look, move and interact in three-dimensional space is essential in chemistry and other STEM disciplines, yet building a strong understanding of these concepts can be challenging for students. In this project, you will help develop an interactive 3D visualisation platform built in Unity and integrated with generative AI, allowing students to manipulate molecular structures and discuss their understanding with an AI tutor. You will gain experience in Unity, coding, user-interface design, educational design and AI-assisted development using tools such as Codex. By the end of the project, you will have helped build a real educational tool and gained practical experience using generative AI as part of the development process.

Project Details

Supervisor(s): Dr Pierre Naeyaert & Dr Henry Matovu
Contact: pierre.naeyaert@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Either completion of a 1000-level chemistry unit or experience with coding, particularly in Unity.
- The project can be tailored to the student's background, with students contributing through either chemistry expertise or software development and feature design.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Fully remote or hybrid options are available

Location Details:
School of Chemistry Building (F11) or remote

Ethics Protocol Requirement:
N/A

CHEM04: Making hydrogen great again

Project Subject Area: Chemistry

Hydrogen is viewed as a potential clean energy vector, but the hype is gone. This project aims to develop a public-facing digital campaign to communicate on the importance of hydrogen research and its relevance to society in a world affected by a rapidly changing climate and increasing geopolitical tensions. The students will work with hydrogen researchers to translate complex scientific concepts into engaging, accessible, and visually compelling content for broad public audiences.

Project Details

Supervisor(s): Professor Francois Aguey-Zinsou
Contact: f.aguey@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- No assumed knowledge is required although experience is digital social media and science would be preferred

Student Preparation:
- Preparation will be required in developing sound technical knowledge on hydrogen technologies

Attendance Mode:
Hybrid

Attendance Details:
40% online and 60% on-site with the expectation that regular discussions/meetings will be needed to progress the project in a timely manner.

Location Details:
Molecular Bioscience Building (G08), Level 8

Ethics Protocol Requirement:
N/A

CHEM05: New electrolyte additives for lithium-ion batteries

Project Subject Area: Chemistry

Sustainable lithium-ion batteries require new electrolytes to enable high performance and long-term stability. This project will focus on understanding the behaviour of new electrolyte additives in next-generation lithium-ion or sodium-ion batteries, involving electrochemical cell testing, operando gas analysis, and post-test analysis of materials using NMR spectroscopy, X-ray photoelectron spectroscopy, and/or GC-MS.

Project Details

Supervisor(s): Dr Wesley Dose
Contact: wesley.dose@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- No assumed knowledge is required although an interest in materials chemistry and hands-on experience is preferred.

Student Preparation:
- Induction online and onsite (Chemistry Building, F11)

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM06: Developing operando X-ray diffraction and spectroscopy techniques to decipher the reaction mechanisms of battery materials

Project Subject Area: Chemistry

X-ray techniques are commonly used to study materials for rechargeable batteries. Operando X-ray diffraction (XRD) and X-ray absorption spectroscopy (XAS) provide real-time insights into the crystal structure, local electronic structure, oxidation states, and coordination environments of materials. This project will develop operando X-ray methods to study lithium-ion and sodium-ion batteries, leveraging the single-layer pouch cell fabrication facility in the Dose Lab, Sydney Analytical's most advanced laboratory powder diffractometer, and the only lab-based XAS in the southern hemisphere.

Project Details

Supervisor(s): Dr Wesley Dose
Contact: wesley.dose@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- No assumed knowledge is required although an interest in materials chemistry and hands-on experience is preferred.

Student Preparation:
- Inductions both online and onsite (Chemistry Building, F11)

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM07: New Light-Responsive Fluorophores for Cellular Imaging

Project Subject Area: Chemistry

With the continual advancement of fluorescence imaging techniques, new and more sophisticated fluorescent molecules are highly sought after. In this project, you will learn about the design and synthesis of new fluorescent entities in which OFF/ON emissive properties are controlled with light. The development of robust synthetic methodology, as well as the tuning of photophysical and physiochemical properties through structural modification will be of particular interest.

Project Details

Supervisor(s): Dr Cassandra Fleming
Contact: cassandralee.fleming@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Assumed knowledge from second year chemistry units.

Student Preparation:
- Inductions both online and onsite (Chemistry Building, F11)

Attendance Mode:
On Campus

Attendance Details:
100% onsite

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM08: Antioxidant drug release in the mitochondria using a fluorescent rhodamine drug conjugate

Project Subject Area: Chemistry

Mitochondrially-targeted antioxidants are of great interest for applications from therapeutic agents to cosmetics, but in many cases, these agents actually cause damage to mitochondria. This project investigates a new approach to antioxidant delivery to the mitochondria involving a stimuli-responsive linker that is cleaved once it reaches the organelle, leaving the harmless antioxidant behind. The plan for this six-week research project is to investigate the photophysical properties of new mitochondrially-targeted drug delivery systems and to evaluate these drugs in cellular studies, investigating whether the increase inherent oxidant level can release the drug in mitochondria and improve the cellular health. The project will involve spectroscopy and biological studies.

Project Details

Supervisor(s): Professor Elizabeth New
Contact: elizabeth.new@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- First year chemistry or biology units

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
Chemistry Building (F11) and Madsen Building (F09)

Ethics Protocol Requirement:
N/A

CHEM09: Synthesis and Evaluation of a Coumarin-Based Fluorescent Probe for Hypoxia Detection

Project Subject Area: Chemistry

Hypoxia is a key hallmark of tumours, and fluorescent imaging offers a rapid, sensitive and non-invasive method to detect hypoxia in cancer. In this project, you will synthesise a novel coumarin-based fluorescent probe that emits light under hypoxic conditions. You will characterize the probe through photophysical studies and reduction potential measurements, before testing its ability to selectively detect hypoxia in tumour cells. You will gain hands-on experience in organic synthesis, compound characterisation and fluorescence imaging. Through this work, you will contribute to the development of new chemical tools for improved cancer imaging.

Project Details

Supervisor(s): Dr Rebecca Farrell
Contact: rebecca.farrell@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- 12 credit points of CHEM1 and CHEM2521/CHEM2921/CHEM2991 are favourable

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
Chemistry Building (F11), Level 4, Rooms 410 and 418

Ethics Protocol Requirement:
N/A

CHEM10: Dynamic covalent chemistry for the construction of anion-binding macrocycles

Project Subject Area: Chemistry

This project will involve hands-on experience in an organic and supramolecular chemistry lab, exploring a novel method to make large macrocycles, and then evaluating them as sensors for biologically important anions. Students will gain key skills in molecular design, reaction development, and organic synthesis, as well as skills in a range of analytical techniques.

Project Details

Supervisor(s): Dr Stephen Butler
Contact: stephen.butler1@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Basic organic synthesis skills
- The ability to analyze characterization data such as NMR spectra is preferred.

Student Preparation:
- Completion of School of Chemistry online inductions before January is preferred.

Attendance Mode:
On Campus

Attendance Details:
90% on campus. Some data analysis may be conducted from home.

Location Details:
Chemistry Building (F11), Lab 528

Ethics Protocol Requirement:
N/A

CHEM11: Photo-physical oxidation: a new atmospheric source of HO2 radicals

Project Subject Area: Chemistry

OH and HO2 are the most important radicals in the atmosphere as they oxidise all emitted carbon containing molecules to, eventually CO2. Our best current atmospheric models, however, underestimate their concentrations by up to an order of magnitude, with available evidence suggesting missing photochemical sources of OH and/or HO2. We have recently proposed that one such source is 'photo-physical oxidation', where molecules excited by sunlight have enough energy to directly react with atmospheric oxygen molecules to make HO2.

We have demonstrated this reaction occurs in formaldehyde – the most abundant carbonyl in the atmosphere (https://doi.org/10.1038/s41557-023-01272-4). This project will use theoretical techniques to investigate the feasibility and importance of photo-physical oxidation in other atmospherically important molecules and it can also potentially involve collaboration with experiment and global atmospheric modelling.

Students will have the opportunity to investigate an important atmospheric chemistry problem and, depending on their interests, can learn a range of skills including high performance computing, electronic structure and kinetics calculations, atmospheric modelling and gas phase experimental techniques.

Project Details

Supervisor(s): Professor Meredith Jordan
Contact: meredith.jordan@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- A solid background in first year chemistry.
- Experience in a scripting language, such as python, is useful but not required.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Theoretical calculations can be performed online and, with appropriate training and support, can be unsupervised.

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM12: Open source drug discovery to treat Mycetoma infections in developing nations.

Project Subject Area: Chemistry

Open source drug discovery allows anyone to contribute to a global effort to treat or cure a targeted disease. In this project, you will develop the chemistry that can be adopted by high schools and Universities around the globe to prepare novel drug candidates that will be tested against Mycetoma - a debilitating infection prevalent in developing nations. During this project, you will develop an array of laboratory skills as you synthesise a series of novel antifungals and utilise spectroscopy (NMR, MS, IR) to confirm their successful synthesis.

Project Details

Supervisor(s): Dr Shane Wilkinson
Contact: shane.wilkinson@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Completion of CHEM1 units is desirable

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
90% on campus (in the laboratory) and 10% remote (to complete paperwork - safety assessments, spectra interpretation)

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM13: Hydrothermal synthesis, crystal structure, and magnetic properties of Ni oxyhydroxide

Project Subject Area: Chemistry

The project aims to reinvestigate the crystal structure of nickel oxyhydroxide, an important material with applications in energy storage and catalysis.

You will learn how to extract crystallographic data from the Inorganic Crystal Structure Database (ICSD), visualise crystal structures, and gain hands-on experience in hydrothermal synthesis. You will also develop practical skills in X-ray diffraction analysis using the Rietveld method and in magnetic property measurements.

These techniques are fundamental tools in inorganic solid-state chemistry and are widely used in both academic research and industrial R&D environments.

Project Details

Supervisor(s): Professor Maxim Avdeev
Contact: maxim.avdeev@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Completion first year units in chemistry, materials science, physics, or a related discipline.
- A basic understanding of chemical bonding and crystal structures is desirable.
- No prior experience with crystallography, diffraction data analysis, or materials synthesis is required, as training will be provided.

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
Mostly onsite. At the data analysis stage, some days may be online.

Location Details:
Chemistry Building (F11)

Ethics Protocol Requirement:
N/A

CHEM14: pH-Triggered Release of Anti-Cancer Drugs from Polymer-Stabilised Nanoparticles

Project Subject Area: Chemistry

This project develops next-generation nanomedicine carriers by engineering polymer-stabilised superparamagnetic iron oxide nanoparticles that release anti-cancer drugs specifically in response to the acidic pH found in tumour tissue. Students will synthesise iron oxide nanoparticle cores by chemical co-precipitation and design steric stabiliser copolymers by RAFT polymerisation, engineering pH-sensitive linkages into the coating so that drug payloads stay locked away in healthy tissue but release on demand inside a tumour. Along the way, students will gain hands-on experience in controlled radical polymerisation, nanoparticle synthesis, and a full suite of characterisation techniques, while building a practical understanding of how nanoparticle design connects to real-world cancer diagnostics and therapeutics. This project offers a genuine taste of interdisciplinary research at the interface of polymer chemistry, materials science, and nanomedicine.

Project Details

Supervisor(s): Dr Vien Huynh
Contact: vien.huynh@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Fundamentals of organic and inorganic chemistry (first- and second-year level)
- Basic understanding of polymer chemistry (monomers, polymerisation concepts)
- Familiarity with standard laboratory techniques (weighing, solution preparation, use of a fume hood, basic glassware handling)
- General chemistry laboratory safety practices

Student Preparation:
- Students will complete the necessary lab and building inductions, as well as a literature review related to the project.

Attendance Mode:
On Campus

Attendance Details:
Research will be conducted entirely on campus. Students will first be trained, then carry out independent research.

Location Details:
School of Chemistry (F11), Key Centre for Polymers and Colloids (KCPC) labs

Ethics Protocol Requirement:
N/A

School of Geosciences

GEOS01: Climate finance and climate debt in the Global South

Project Subject Area: Geography

Mobilizing finance capital has become the dominant response to climate change, framed around a persistent “gap” between projected mitigation and adaptation costs, and existing investment flows. Yet this “Wall Street Consensus” is driving a widening climate debt crisis across the global south: Many indebted countries now pay far more to creditors than they receive in climate finance. As states are retooled as derisking agents for private capital, rising climate debts are entrenching fossil fuel production while heightening climate vulnerability.

In this project, the student will examine select increasingly complex instruments of climate finance to understand how the schemes work, who the key actors are and how they benefit, and the implications on the ground. Students will gain an introduction to the politics of climate finance, its increasing complexity and the implications for socioecological relations on the ground.

Project Details

Supervisor(s): Associate Professor Sophie Webber
Contact: sophie.webber@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Students will have completed some Geography and Environmental Studies Unit, such as GEOS2X21, GEOS3X20 or others.
- An interest in climate finance justice.

Student Preparation:
- Lab induction, pre-reading

Attendance Mode:
Hybrid

Attendance Details:
This project will involve desk-based research including communicating with climate debt social movements who will receive the information produced. There is flexibility in meeting with me online or in-person to guide the project, as well as in conducting the research on campus or elsewhere.

Location Details:
Masden Building (F09)

Ethics Protocol Requirement:
N/A

GEOS02: The Birth of a Plate Boundary: Insights from the New Caledonia Metamorphic Sole

Project Subject Area: Geology and Geophysics

Subduction initiation marks the birth of a new plate boundary, yet the processes that transform a stable oceanic plate into a self-sustaining subduction zone remain poorly understood. Recent studies suggest that this transition may be driven by fundamental changes in the rheology of the plate interface, where metamorphism, fluid flow, grain-size reduction, and deformation mechanisms interact to promote strain localisation and weakening. This project will examine how the structural and metamorphic evolution of the New Caledonia sole records the transition from the earliest stages of convergence to the onset of mature subduction. The student will investigate how mineral assemblages, microstructures, and deformation mechanisms evolved through time and how these changes influenced the strength and mechanical behaviour of the plate interface. The project will combine metamorphic petrology and quantitative microstructural analysis, and is ideal for students interested in tectonics.

Project Details

Supervisor(s): Dr Vasileios Chatzaras
Contact: vasileios.chatzaras@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- GEOS2114 and GEOS2124.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
The analytical component of the project (70%) needs to be conducted on campus. The remaining 30% can be completed online.

Location Details:
Masden Building (F09)

Ethics Protocol Requirement:
N/A

GEOS03: Historical Landscape Transformations in Southeast Asia using Landsat

Project Subject Area: Geography

Traditional agricultural practices in tropical Southeast Asia have seen a marked shift towards monoculture cash crops over recent decades which can have significant environmental and socio-economic impacts. Tracking these transformations spatially is an important source of evidence for assessing the impact of policy on landscape use. In this project, you will use lean how to use Google Earth Engine to analyse historical Landsat satellite images to map changing agricultural practices for a small case study area in Southeast Asia.

Project Details

Supervisor(s): Dr Kevin Davies
Contact: kevin.davies@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- OLET2612 or GEOS301 or have equivalent experience with GIS, remote sensing, and a scripting language (e.g. Python or Javascript).

Student Preparation:
- The student will need to complete the following online workshop: http://morethanmaps.earth/mangrove-gulf-workshop.html

Attendance Mode:
Hybrid

Attendance Details:
40% on campus (Madsen Building), the remaining 60% will be unsupervised.

Location Details:
Masden Building (F09), Room 435

Ethics Protocol Requirement:
N/A

GEOS04: Lesson from coral reefs systems on the edge: investigating the impact of rapid environmental change on reef development.

Project Subject Area: Marine Science

The Denison Summer Scholarship student will contribute to a newly funded ARC Discovery project investigating how coral reefs have responded to major environmental changes over the past 500,000 years. Working with fossil reef records from across the Indo-Pacific, the student will generate and analyse sedimentological, geochemical and paleoecological data to reconstruct past changes in reef environments, water quality, climate, and reef growth. These results will be integrated with the wider project's datasets and modelling to identify the environmental conditions associated with reef growth, stress, collapse, and recovery. Based within the University of Sydney's Geocoastal Research Group, the student will work alongside Australian and international collaborators and contribute directly to improving our understanding of coral reef resilience under future climate change.

Project Details

Supervisor(s): Professor Jody Webster
Contact: jody.webster@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Basic computer literacy and data management skills
- Familiarity with spreadsheets (e.g. Excel)
- Basic experience with data analysis and visualisation
- Willingness to learn new analytical software and techniques
- Willingness to learn basic laboratory techniques
- No specialist programming or machine-learning experience required

Student Preparation:
- Basic laboratory/WHS induction.
- Laboratory and sample-handling training as required.
- Brief project orientation and background reading.
- Any additional training will be provided during the project.

Attendance Mode:
Hybrid

Attendance Details:
20% online, 80% on campus

Location Details:
Masden Building (F09), GeoReef Lab, Room 206

Ethics Protocol Requirement:
N/A

School of History and Philosophy of Science

SHPS01: History and philosophy of microbiome research

Project Subject Area: History and Philosophy of Science

The project involves historical and philosophical analysis of texts on microbiome research. The aim will be to contribute to a database of materials, analyse those materials, and draw connections between elements of the materials. Students will gain an appreciation of the history and philosophy of microbiome research, as well as literature analysis skills. There may be an opportunity to contribute to a publication.

Project Details

Supervisor(s): Professor Maureen O'Malley
Contact: maureen.omalley@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Some basic history and philosophy of science knowledge
- Interest in microbiome science

Student Preparation:
- Lab induction, pre-reading

Attendance Mode:
Hybrid

Attendance Details:
60% online, 40% on campus
The work online will be supervised but carried out independently.
Weekly visits to campus are essential.

Location Details:
Carslaw Building (F07), Level 3 and online

Ethics Protocol Requirement:
N/A

School of Physics

PHYS01: Exploring Machine Learning for Dark Matter Searches

Project Subject Area: Physics

The nature of dark matter is one of the biggest mysteries in Physics. Direct detection experiments in underground laboratories, deep under the earth's surface, try to shed light on this mystery. As experiments become larger, backgrounds become more complicated. In this project you will use machine learning methods to help distinguish backgrounds from a possible signal. Depending on your interest, you would also build a signal chain test in the lab to take your own data for analysis development.

Project Details

Supervisor(s): Dr Theresa Fruth
Contact: theresa.fruth@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Some coding experience is necessary (python)

Student Preparation:
- Lab induction, pre-reading

Attendance Mode:
On Campus

Attendance Details:
It is expected that the student will come to the lab most days. However, there might be times when work can be progressed online.

Location Details:
School of Physics, Brennan Maccallum Building (A28)

Ethics Protocol Requirement:
N/A

PHYS02: Critical strain in optical soliton crystals

Project Subject Area: Physics

Optical solitons are nonlinear waves that underpins numerous modern photonics applications such as telecommunications, short pulse generation in lasers, spectroscopy and optical clocks.
It has been recently shown that in optical resonators, solitons can behave like atoms and form self-organized ensembles, called soliton crystals.
In this project, using numerical simulations, you will study the formation and dynamics of soliton crystals. Analogous to solid-state physics, you will evaluate the critical strain at which the crystal structure breaks.

Project Details

Supervisor(s): Dr Antoine Runge
Contact: antoine.runge@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Basics of coding
- Wave physics / optics

Student Preparation:
- Reading a few scientific articles in advance if possible.

Attendance Mode:
Hybrid

Attendance Details:
The project is mostly theoretical and numerical. It is based on Matlab, which is available for every University of Sydney student. Most work can be done remotely and meetings / scientific discussions can be done in-person at the University if possible.

Location Details:
School of Physics, Brennan Maccallum Building (A28)

Ethics Protocol Requirement:
N/A

PHYS03: A time-series pipeline to detect strange nonchaotic attractors (SNAs)

Project Subject Area: Data Science

Strange nonchaotic attractors are fractal but non-chaotic, typically arising under quasiperiodic forcing. These fascinating dynamical structures may be present in the world around us, but we lack strong methods to detect them from data. This project will implement and test a periodic-prior approach to phase reconstruction, and validate against known synthetic SNA systems (as well decoys). The student should have a quantitative background and be interested in dynamics.

Project Details

Supervisor(s): Associate Professor Ben Fulcher
Contact: ben.fulcher@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Some background in quantitative disciplines, and some familiarity with coding.

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
Open to negotiating split of onsite and online (but minimum 2 days per week onsite)

Location Details:
Madsen Building (F09)

Ethics Protocol Requirement:
N/A

PHYS04: Mapping galaxy spins across cosmic time with the Wide-field Spectroscopic Telescope

Project Subject Area: Astronomy and Astrophysics

Galaxies are not randomly oriented in the Universe, and their spins are influenced by the cosmic web. The next-generation Wide-field Spectroscopic Telescope (WST) will provide an unprecedented opportunity to measure galaxy kinematics over vast cosmological volumes, but a key question remains: how far back in cosmic time can WST reliably measure galaxy spins? In this project, the student will investigate how spatial resolution, signal-to-noise ratio, and exposure time affect our ability to recover galaxy angular momentum at different redshifts, and explore how a future WST kinematic survey could be integrated within broader cosmological and galaxy evolution programs. The results will contribute directly to the scientific planning and survey design of WST, helping define the observational strategy required to study the growth of angular momentum across cosmic time. The student will develop skills in astronomical data analysis, Python programming, survey design, cosmology, and scientific communication while contributing to the development of a major next-generation international astronomy facility.

Project Details

Supervisor(s): Dr Stefania Barsanti
Contact: stefania.barsanti@sydney.edu.au

Maximum number of places available: 1
Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Python

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
50% online and 50% onsite - but it can be flexible according to the needs of the student.

Location Details:
School of Physics, Brennan Maccallum Building (A28), Room 328

Ethics Protocol Requirement:
N/A

PHYS05: Lightsails for interstellar exploration - how stable can they be?

Project Subject Area: Physics

The Breakthrough Starshot Initiative (https://breakthroughinitiatives.org/initiative/3) aims to send a light sail to our neighbouring star system: Alpha-Centauri at a distance of 4.2 light years from Earth. To do this, a reflective light sail is to be accelerated using an Earth-based laser array to 20% of the speed of light. One of the many challenges of the project is to keep the sail in the beam – which can, in principle, be achieved using clever photonic design and using the Doppler effect. How well can this design operate? This theoretical and numerical project will look at bounds of stability taking into account imperfections and diffraction effects.

Project Details

Supervisor(s): Professor Boris Kuhlmey
Contact: boris.kuhlmey@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- PHYS2911 and PHYS2912
- PHYS3935 is desirable
- Python knowledge is desirable.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Most of the work can be done from home, but a few on-campus meetings will be desirable.

Location Details:
School of Physics, Brennan Maccallum Building (A28) and online

Ethics Protocol Requirement:
N/A

PHYS06: Muon detector for weather forecast

Project Subject Area: Physics

This project explores how cosmic-ray muons can be used to improve weather forecasting. Students will work with compact muon detectors, analyse how the measured muon rate changes with atmospheric conditions, and investigate how this information could be incorporated into weather forecast models. Through the project, students will gain hands-on experience in particle detection, data analysis and modelling, while working on a real-world problem at the intersection of physics, atmospheric science and technology. They will also learn how fundamental physics can be translated into applications with potential value for industries such as aviation, agriculture, shipping and renewable energy.

Project Details

Supervisor(s): Dr Laura Manenti
Contact: laura.manenti@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Experimental labs
- Advanced math
- Python
- Geant4

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
100% onsite

Location Details:
School of Physics, Brennan Maccallum Building (A28), Level 4, Room 429

Ethics Protocol Requirement:
N/A

PHYS07: The cosmos in our brains: using astrophysical algorithms to study dementia.

Project Subject Area: Neuroscience

Recent advances in astronomy have enabled the reconstruction of the large-scale structure of the Universe and the identification of filamentary networks connecting galaxies. This project will investigate whether similar techniques can be applied to diffusion MRI maps of the human brain to identify a structural backbone of white matter connections. Students will explore how measures of fibre alignment with this backbone can be used to characterise healthy brain organisation and probe neurodegenerative diseases such as dementia. The student will be exposed to astrophysics, data science, network analysis, neuroscience, and medical imaging.

Project Details

Supervisor(s): Dr Stefania Barsanti
Contact: stefania.barsanti@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Python

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
60% onsite is required for analyzing some medical data due to the processing software available only in the lab.

Location Details:
School of Physics, Brennan Maccallum Building (A28) and the Brain and Mind Centre (BMC)

Ethics Protocol Requirement:
N/A

PHYS08: Exploring One of Astronomy's Newest Mysteries: Long-Period Transients

Project Subject Area: Astronomy and Astrophysics

Long-Period Transients (LPTs) are a newly discovered type of radio source that emit bright bursts of radio waves every few minutes to hours, and astronomers still do not know what produces them. In this project, students will investigate potential progenitor systems, such as compact binary stars, using archival observations from ASKAP and other radio telescopes to test whether they could be LPTs. They will also compare known LPTs with emerging theoretical frameworks to better understand the physical processes that may be driving their unusual behaviour. Because this is a rapidly developing field with many unanswered questions, students will contribute to genuinely novel research while building skills in Python programming, data analysis, and the use of scientific literature to tackle open scientific problems.

Project Details

Supervisor(s): Dr Iris de Ruiter
Contact: iris.deruiter@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Some python knowledge is preferred

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Apart from meetings (once or twice a week), students will mainly work independently either from campus or from home. Further support will be available via email/Slack otherwise.

Location Details:
School of Physics, Brennan Maccallum Building (A28) and online

Ethics Protocol Requirement:
N/A

PHYS09: Rotation rates of tiny exoplanet hosts

Project Subject Area: Astronomy and Astrophysics

To date, over 6000 exoplanets have been found, around many different types of stars. Recently, some tentative correlations between the ages of stars and the properties of their constituent planets, have been found.

This project aims to test these correlations using known Age-Rotation relations to calculate ages for rotating stars which host planets. The stellar rotation will be calculated using state-of-the art data from TESS, the Transiting Exoplanet Space Satellite. Data reduction and analysis techniques will be learned, alongside an understanding of exoplanet and stellar science.

Project Details

Supervisor(s): Dr Angharad Weeks
Contact: angharad.weeks@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Some knowledge of Python and study of physics modules are desirable.
- A strong interest in astrophysics is essential.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Regular meetings will be required, which are recommended to be in-person, if possible. Research between meetings will be carried out independently, alongside support from the supervisor. Meetings can be held remotely if needed.

Location Details:
School of Physics, Brennan Maccallum Building (A28) and online

Ethics Protocol Requirement:
N/A

PHYS10: Optoelectronic characterisation of integrated PIN photodetectors for a bidirectional neurophotonic interface

Project Subject Area: Astronomy and Astrophysics

Our lab is building a neurophotonic interface: a photonic chip that communicates with living neurons in both directions, using light to stimulate them and to read out their activity. Reading is the hard part, because the optical signal from a single neuron is extremely faint, so the integrated photodetectors set the performance ceiling of the entire platform. We have fabricated a series of PIN photodetectors spanning a range of dimensions, and this project will measure their optoelectronic properties: dark current, responsivity, quantum efficiency, junction capacitance, speed and noise floor. You will establish how each of these scales with detector geometry and identify the design that gives the best signal-to-noise ratio for single-neuron readout, a result that will feed directly into the next generation of the chip. You will gain hands-on experience in semiconductor device physics, optical and probe-station measurement, low-noise electronics and automated data acquisition, working alongside an active photonics research team.

Project Details

Supervisor(s): Associate Professor Stefano Palomba
Contact: stefano.palomba@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- First year (and ideally second year) physics units

Student Preparation:
- Learn fundamentals of semiconductor optoelectronics focusing on PIN photodetectors

Attendance Mode:
On Campus

Attendance Details:
This project will basically require about 80% on campus work and 20% literature research and report writing.

Location Details:
Sydney Nanoscience Hub (A31)

Ethics Protocol Requirement:
N/A

PHYS11: Examining convection-pulsation interactions using line-profile asymmetries

Project Subject Area: Astronomy and Astrophysics

Line profile asymmetries in solar oscillations are assumed to provide diagnostic information regarding the location of their convective forcing near the solar photosphere. In stars other than the Sun, line profiles also potentially become asymmetric whenever they are obtained from pressure and gravity modes undergoing near-resonance avoided crossings. This may be used as a direct probe of the location in these stars where convective flows couple most strongly to stellar oscillations. This project will examine, both theoretically and observationally, the potential of using this probe to study the physics of convection. The student will learn both about observational data analysis of space-based photometry, and about the theoretical properties of mode excitation and damping which underpinning the models required to describe this data.

Project Details

Supervisor(s): Dr Joel Ong
Contact: joel.ong@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Student will require working knowledge of functional analysis and linear algebra (normed Hilbert spaces), inhomogenous differential equations (Green's functions), and ability to use the numpy/scipy Python libraries, as most astronomical data analysis is conducted in that language.
- An operational understanding of stellar astrophysics would be useful, and highly desirable, but not essential at this stage.

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
School of Physics, Brennan Maccallum Building (A28)

Ethics Protocol Requirement:
N/A

PHYS12: Using erbium atoms to distribute entanglement

Project Subject Area: Physics

Erbium ions in crystals are able to efficiently and effectively store quantum information in their optical/near-infrared, electron spin and nuclear spin transitions. This provides opportunities to use them as interfaces to distribute photonic entanglement and connect microwave qubits with fibre networks. This project will involve working with the Quantum Integration Laboratory team at the University of Sydney to couple optical and microwave photons to erbium ions to characterise devices for quantum interfaces. Participants will have the opportunity to be hands-on in the lab to improve our measurements of erbium for new qubits, hybrid microwave-optical interconnects and long-term quantum memories.

Project Details

Supervisor(s): Associate Professor John Bartholomew
Contact: john.bartholomew@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- This project can be tailored to any level of background knowledge in physics or engineering.

Useful (but not essential) knowledge and skills include:
- Background knowledge of quantum physics or quantum computing
- Knowledge or experience in electronics
- Experience in building things (hardware or software).

Student Preparation:
- Complete safety induction modules for the Sydney Nanoscience Hub, Laser safety and the QIL safety induction (including a 1.5 hour in-person component).

Attendance Mode:
On Campus
We areable to tailor projects for students who may need to be remote for some part of the project duration. Students will receive relevant onboarding including building and lab safety training. Students will work closely with Quantum Integration Laboratory staff on experiments and together we will identify opportunities for the student to complete independent tasks such as experiment design, data collection, simulation, theory, data process, etc.

Attendance Details:
100% on campus

Location Details:

Sydney Nanoscience Hub (A31), SNH2018 and SNH2020 (labs) & Level 4 office area

Ethics Protocol Requirement:
N/A

School of Life and Environmental Sciences

SOLE01: Using artificial intelligence to design and understand protein

Project Subject Area: Molecules, Cells and Organisms

This project will explore how artificial intelligence and computational biology can be used to understand and design protein interactions, with potential applications in biotechnology, biomedical and agriculture research. The student will work with protein sequence and structural data, and learn to use modern protein language models, structure-prediction tools, and computational analysis pipelines to evaluate candidate protein or peptide interactions. Through the project, the student will gain practical experience in bioinformatics, Python-based data analysis, scientific interpretation, and AI-assisted protein research.

Project Details

Supervisor(s): Dr Wenze Ding
Contact: wenze.ding@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Basic Python programming
- Basic understanding of molecular biology, biochemistry, bioinformatics, or a related discipline
- Prior experience with machine learning, protein structure prediction, or advanced bioinformatics is helpful but not required.

Student Preparation:
- No formal preparation is required before the program. The successful student may be provided with introductory reading and optional online materials on protein structure, bioinformatics, and computational protein modelling prior to commencement.

Attendance Mode:
Hybrid

Attendance Details:
The project will be delivered in a hybrid format, approximately 20% on campus (F22 LEES building) and 80% online.

On-campus activities will include supervision meetings, research discussions, training, and collaborative data analysis, while computational work may also be undertaken remotely.
Students may undertake independent computational analyses between supervision meetings, with regular access to the supervisor for guidance and troubleshooting.

Location Details:
Primary onsite activities will take place within Life and Environmental Sciences (LEES) Building (F22).

Ethics Protocol Requirement:
N/A

SOLE02: Rates of molecular evolution: testing the molecular clock

Project Subject Area: Ecology, Evolution, and Conservation

The molecular clock hypothesis asserts that the rate of DNA or protein sequence evolution is constant over time and among evolutionary lineages. Molecular clocks are widely used to estimate evolutionary rates and timescales from genetic data, yielding insights into evolutionary processes and mechanisms and providing a framework for further biological analyses. In analyses of population-level data a strict clock is usually assumed, on the grounds that there should be little among-lineage rate variation within a species, and that such data rarely contain enough variation to reject a strict clock in any case. This project will test that assumption across a range of datasets: the student will assemble population-level sequence data from public databases and published studies, and test if the strict clock can be rejected. They will gain experience in sequence alignment and phylogenetic analysis, an understanding of molecular clock theory and rate variation, and practice in curating data for a comparative study. No prior bioinformatics experience is needed, and the specific focus can be shaped around the student's interest.

Project Details

Supervisor(s): Dr Manuela Cascini
Contact: manuela.cascini@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Some background in phylogenetic theory.

Student Preparation:
- Some readings.

Attendance Mode:
Hybrid

Attendance Details:
Hybrid

Location Details:
Life and Environmental Sciences (LEES) Building (F22), Level 5

Ethics Protocol Requirement:
N/A

SOLE03: Do Australia's invasive varroa mites look different?

Project Subject Area: Ecology, Evolution, and Conservation

The invasive parasitic mite Varroa destructor, a serious pest of honey bees, first arrived in Australia in 2022. Recently a new strain of mite has been identified to have reached Australia, which is resistant to many of the pesticides beekeepers use to treat mite-infested hives. This project will compare the original and new mite strains using microscopy, morphology and genetic techniques to determine whether they look different, and whether they can hybridise.

Project Details

Supervisor(s): Dr Emily Remnant
Contact: emily.remnant@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- It is assumed the student will be studying their degree broadly within an area of Biology

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
100% on-campus

Location Details:
Life and Environmental Sciences (LEES) Building (F22), Level 5

Ethics Protocol Requirement:
N/A

SOLE04: Tree masking Australia with computer vision

Project Subject Area: Data Science

This project involves developing computer-vision methods to identify trees and woody vegetation from freely available satellite imagery. Isolated trees are common in agricultural fields and shelterbelts which provide habitat and biodiversity in highly modified landscapes. The aim is to create a scalable approach which can be applied across Australia to support both agricultural mapping and ecological monitoring. This project offers students a real-world challenge to develop their skills in Python or R, accessing remote sensing data, geospatial analysis and computer vision/deep learning models.

Project Details

Supervisor(s): Dr Si Yang Han
Contact: siyang.han@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Some experience with coding in Python or R, GIS and modelling.

Student Preparation:
N/A

Attendance Mode:
Online

Attendance Details:
90% online, 10% on campus (troubleshooting only, or technology limitations)

Location Details:
Biomedical Building (C81), Level 3, Room 347 (when on campus)

Ethics Protocol Requirement:
N/A

SOLE05: The challenge of pasture biomass

Project Subject Area: Agriculture and Food

Estimation of pasture biomass is important for efficient pasture management and carbon accounting programs in livestock production. This project aims to evaluate different methods for pasture dry biomass production including satellite-based modelling and device-based technique (rising plate meter). The project will enhance students learning of the methodological estimation of pasture production and evaluate the accuracy of the commercial products.

Project Details

Supervisor(s): Dr Bahareh Bicharanloo
Contact: bahareh.bicharanloo@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Statistical analysis in R

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
60% on campus and 40% data analysis and writing

Location Details:
Camden Campus, Centre for Carbon, Water and Food (C02F), 380 Werombi Rd, Camden, NSW 2570, Australia
This will involve some field sampling (Mayfarm, John Pye farm), and lab work in the CCWF Building.

Ethics Protocol Requirement:
N/A

SOLE06: Critics and Criticality: How do science students evaluate the work of GenAI?

Project Subject Area: Science Education

This project will examine how students evaluate GenAI output to infer what factors influence learning. Students will analyse existing qualitative data from think-aloud interviews to develop themes that describe student interactions with GenAI. Students will also contribute to designing and/or piloting questionnaire items to explore these themes at scale using surveys.

Completing this project will give students exposure to interdisciplinary, education-based research using quantitative and qualitative methodologies. Students will gain an appreciation for how the contemporary issue of GenAI is impacting their own studies and learning.

Project Details

Supervisor(s): Dr James Tsatsaronis
Contact: james.tsatsaronis@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Completion of DATA1001
- Highly regarded: Completion of PSYC1001 and/or PSYC1002

Student Preparation:
- Completion of human ethics training module

Attendance Mode:
Hybrid

Attendance Details:
20% onsite (for in-person meetings and collaborative data analysis), 80% online. More onsite time can be accommodated if desired.

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
Students completing this project will be added to the HEC000196 human research ethics protocol. Prior to commencing this project, students will complete a human ethics training module on Canvas.

SOLE07: Making greenhouse gas monitoring more affordable: validation of low-cost gas sensors

Project Subject Area: Environmental Sciences

Automated chambers are used to monitor greenhouse gas fluxes from agricultural ecosystems, but research grade analysers required for these measurements are expensive and have relatively high power requirements. This project will investigate whether low-cost gas sensors can provide accurate and reliable measurements for automated greenhouse gas monitoring. This project requires assessing the gas sensors against a research grade analyser under field conditions and evaluate their accuracy and stability. Measurement error and agreement with the reference analyser will be quantified using statistical methods. The project will provide practical experience in environmental sensor technology, experimental design, greenhouse gas measurements, data processing and statistical analysis.

Project Details

Supervisor(s): Dr Milad Bagheri Shirvan
Contact: milad.bagherishirvan@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Statistical analysis in R (basic)

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
20% of the time to calibrate the sensor in the lab (Centre for Carbon, Water, and Food).
50% of the time in the field to test and collect the data (Mayfarm in Camden campus).
30% of the time data analysis in the Centre for Carbon, Water and Food, Camden campus.

Location Details:
Camden Campus, Centre for Carbon, Water and Food (labwork), and Mayfarm, Camden (fieldwork).

Ethics Protocol Requirement:
N/A

SOLE08: Chasing carbon dioxide in the paddock: validating a portable carbon dioxide monitoring system

Project Subject Area: Environmental Sciences

Pastures are an important component of the global carbon cycle, and measuring carbon dioxide fluxes can provide valuable information about the dynamic of carbon fluxes and ecosystem processes. Conventional methods using static chambers and manual gas sampling are reliable but labour intensive and time consuming, thus limiting measurements across large areas. This project will investigate and validate a portable system using a chamber and low-cost carbon dioxide sensor to rapidly measure fluxes across pastures. The project requires comparing the portable system with the established reference method and evaluating its accuracy, precision and practical performance. The project will provide practical experience in field greenhouse gas measurements, environmental instrumentation, sensor technology, experimental design, data processing, and statistical analysis.

Project Details

Supervisor(s): Dr Milad Bagheri Shirvan
Contact: milad.bagherishirvan@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Statistical analysis in R (basic)

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
20% labwork (Centre for Carbon, Water, and Food).
50% fieldwork (Mayfarm in Camden campus).
30% statistical analysis (Centre for Carbon, Water and Food)

Location Details:
Camden Campus, Centre for Carbon, Water and Food

Ethics Protocol Requirement:
N/A

SOLE09: Developing novel lead molecules to fight antibiotic resistance

Project Subject Area: Molecules, Cells and Organisms

Antibiotic resistance continues to pose as a major health issue in the 21st century. Resistance to currently available antibiotics is increasingly responsible for deaths globally and one key contributor is the lack of discovery of new classes of antibiotics. Our project aims to alleviate this issue by developing novel classes of antimicrobials that targets essential bacterial proteins. In this project, you will learn techniques such as protein production and characterisation, as well as bacterial growth assays.

Project Details

Supervisor(s): Associate Professor Ann Kwan
Contact: ann.kwan@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- BIOL1997 or any BCMB2/3 (or co-badged) units covering wet-lab skills in molecular biology, biochemistry, etc.

Student Preparation:
- Building and lab induction (onsite, a day) will need to be completed at least one week before the start. Exact date/time to be confirmed.

Attendance Mode:
On Campus

Attendance Details:
Mostly on campus

Location Details:
Molecular Bioscience Building (G08)

Ethics Protocol Requirement:
N/A

SOLE10: Supercharging digital soil mapping and precision agriculture in cotton growing areas of New South Wales

Project Subject Area: Agriculture and Food

The irrigated cotton industry operates within various catchments in the Murray-Darling Basin (MDB). Farmers are under pressure to improve practices to minimise off-farm pollution, while at the same time improve fertiliser (e.g. lime) and amelioration (e.g. gypsum) efficiency to maximise productivity. While the biggest driver of variation is rainfall, differences in soil condition affect yield and farmers need to know its variation.

For example, knowledge about soil cation exchange capacity (CEC – cmol(+)/kg) is important because it is a measure of how many exchangeable (exch.) cations (i.e. calcium [Ca], magnesium [Mg]) can be retained on soil surfaces and because it influences soil stability, nutrient availability, pH and reaction to fertilisers.

If no action is taken to map these soil properties and manage different soil conditions, opportunities to sustainably improve application of fertilisers and ameliorants in a cost-effective way will be foregone as well as an opportunity to make a meaningful, economically viable contribution to reducing impacts of cotton growing in the MDB.

One of the largest costs, is the time-consuming nature and therefore expense in laboratory analysis. This project aims to undertake case studies in various cotton growing areas to enable the development of soil spectral libraries that can be used to estimate laboratory measured soil properties. This will be achieved by developing relationships between soil properties and either visible infrared (VISir) or mid-infrared (Mir) data, using machine learning and using R-coding.

Project Details

Supervisor(s): Dr Liana Pozza and Associate Professor John Triantafilis
Contact: liana.pozza@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
N/A

Student Preparation:
Familiarise themselves with:
- the soil property data
- theory of visible- (VISir) and mid-infrared (Mir) applications
- the literature in the application of soil data with VISir and Mir
- R-coding and application of machine learning algorithms

Attendance Mode:
On Campus

Attendance Details:
The mode of attendance will be hybrid and dependent on office-based laboratory analysis and independent work. Weekly in-person meetings will be used to ensure aims and objectives are being met as well as student laboratory skills and R-coding training expectations are being met.

Location Details:
Biomedical Building (C81)

Ethics Protocol Requirement:
N/A

SOLE11: DNA shape as a regulatory element in transcription factor activity

Project Subject Area: Molecules, Cells and Organisms

Proper regulation of the genome relies on the ability of the transcription factors (TF) to recognise and activate specific genes, a process that remains poorly understood. An essential aspect of TF activity involves interactions with context-specific co-factors, which mediate downstream gene activation, but it is generally not known how TFs choose the 'right' co-factor at each gene. These observations suggest that factors beyond the primary DNA sequence must influence TF binding specificity and activity. The current project tests the hypothesis that a TF adopts different conformations when bound to DNA with a similar sequence but a different shape. Using FOXO3 as a model, students will express and purify the protein, then test its binding to a panel of DNAs via fluorescence binding assays and NMR.

Project Details

Supervisor(s): Dr Serafima Guseva
Contact: serafima.guseva@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Basic biochemistry

Student Preparation:
- Online inductions on Canvas: Biosafety, Chemical Safety, WHS, G08 Building Induction
- Complete the Faculty Induction Form
- Sign up for the in-person G08 building induction

Attendance Mode:
On Campus

Attendance Details:
100% onsite

Location Details:
Molecular Bioscience Building (G08), Level 6, Room 680

Ethics Protocol Requirement:
N/A

SOLE12: Annotating immune genes in Australian birds

Project Subject Area: Biology

Highly pathogenic avian influenza has devastated bird species across the world, and it has now arrived in Australia. You will learn how to characterise immune genes in high-quality reference genomes to determine if species are able to recognise a novel pathogen like bird flu. Your results will be used to inform government policy in relation to managing this disease outbreak.

Project Details

Supervisor(s): Professor Carolyn Hogg
Contact: carolyn.hogg@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Technical skills such as R
- Basic knowledge of gene architecture (open reading frame, exon, intron)

Student Preparation:
- Initial meeting with the project team in early December

Attendance Mode:
Hybrid

Attendance Details:
60% on campus, 40% online

Location Details:
RMC Gunn Building (B19), Room 223

Ethics Protocol Requirement:
N/A

SOLE13: Talking to Learn: investigating how students experience and prepare for Interactive Oral Assessment in STEM subjects

Project Subject Area: Science Education and Assessment Analytics

Interactive Oral Assessment (IOA) replaces the written exam with a real-time, unscripted conversation between student and assessor, and it is now running in STEM units of 500+ students at Sydney. This project analyses the second wave of data from this rollout, including closed and open-ended survey responses, focus group transcripts, and logs of students using an AI practice bot to prepare. You will learn qualitative coding and reflexive thematic analysis alongside quantitative survey analysis, work with a mixed-methods dataset, and see how education research questions are turned into evidence that informs teaching and assessment decisions. The first wave of this data has already been analysed; your analysis will extend it and contribute to a manuscript in preparation. You will join an active multidisciplinary team spanning microbiology, data science, and educational innovation.

Project Details

Supervisor(s): Dr Angela Sun and Dr Andy Tran
Contact: angela.sun@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Interest in education, learning, and assessment - this is pedagogical research, not laboratory science
- Comfort working with qualitative text data: interview or focus group transcripts, open-ended survey responses, conversation logs
- Familiarity with qualitative coding or thematic analysis (e.g. through psychology, education, sociology, linguistics, or human-centred computing coursework) is highly valued
- Careful, systematic attention to detail and willingness to apply a coding framework consistently
- R or Python useful but not essential; students with strong data or AI/computer science backgrounds are equally welcome
- Suitable for students from psychology, science, data science, or combined science degrees with an arts, education, or social science component

Student Preparation:
- Ethics training and personnel amendment (as above), completed by December 2026
- One online orientation meeting in December 2026 (1 hour) to meet the team and receive background reading
- Two short readings on IOA and reflexive thematic analysis, completed before 11 January 2027

- No onsite induction required

Attendance Mode:
Hybrid

Attendance Details:
Approximately 25% onsite (Carslaw building), 75% online.
On campus time covers coding calibration sessions, team meetings, and supervision. Independent coding and analysis may be completed remotely. Weekly supervision meetings with Dr Angela Sun (lead supervisor) and Dr Andy Tran (Co-supervisor, School of Mathematics and Statistics). All data handling occurs on University-approved systems. No part of the research is conducted unsupervised in a physical fieldwork or laboratory setting.

Location Details:
Carslaw Building (F07) and online

Ethics Protocol Requirement:
Students will be added as personnel to approved HREC protocol. Before commencing, students must: (1) complete the University's research integrity and human research ethics online training; (2) sign a confidentiality agreement covering de-identified student data; (3) be named on a personnel amendment submitted by the supervisor. The amendment is a low-risk administrative variation and is submitted once the student is confirmed. Students work only with de-identified data.

SOLE14: Ecological outcomes of Nature-based Solutions

Project Subject Area: Environmental Sciences

Nature-based solutions (NbS), such as mangrove restoration, reforestation, and ecosystem rehabilitation, are increasingly promoted as a holistic strategy to respond to climate change and biodiversity loss in ways that benefit both ecosystems and people, but knowledge of the social conditions under which they can reliably provide ecological benefits remains scarce. This project will contribute to a global review examining the interactions between NbS, ecological outcomes, and social conditions (particularly conflict) as part of a research project supported by the UNESCO Ocean Decade and WWF Education for Nature. The student will contribute to screening and systematically coding a global database of NbS studies to identify their reported ecological outcomes, including changes in biodiversity, ecosystem condition, and ecosystem services. Through the project, the student will gain hands-on experience in systematic review methods, interdisciplinary environmental research, and data coding and synthesis while contributing to research at the intersection of climate change, biodiversity, and conflict.

Project Details

Supervisor(s): Associate Professor Michele Burns
Contact: michele.barnes@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project Report (1-2 pages)

Assumed Knowledge:
- Students should have basic proficiency in R, including the ability to run and work with existing R scripts, as an established R-based workflow will be used to support the screening process.
- Familiarity with reading scientific literature and a foundational understanding of ecology, environmental science, biodiversity, conservation, climate change impacts on ecosystems, social-ecological systems, or a related field is required to support the identification and classification of ecological outcomes reported in the literature.
- Experience working with datasets and/or systematic review methods is desirable but not essential
- Project-specific training and a detailed coding protocol will be provided

Student Preparation:
N/A

Attendance Mode:
Online

Attendance Details:
100% online

Supervision will include an initial online induction meeting to introduce the project, research methods, and coding protocol, followed by three online progress meetings during the program to review progress, address questions, and provide feedback. Research activities will therefore be undertaken independently between scheduled supervision meetings, with guidance and support available as required. Students will also have the opportunity to attend the research group's biweekly lab meetings, held twice per month, but this is optional. These meetings provide opportunities to learn about academic and professional development topics and research activities.

Location Details:
Online

Ethics Protocol Requirement:
N/A

SOLE15: Eroding resilience? Quantifying resistance and recovery of coral reef communities across successive disturbance events

Project Subject Area: Marine Science

Coral reefs are increasingly under threat from cyclones, marine heatwaves and crown-of-thorns outbreaks arriving in quick succession, and a central question for their future is whether reefs that have been disturbed repeatedly become slower to bounce back than reefs hit only once. This project will use the Australian Institute of Marine Science's Long-Term Monitoring Program, one of the world's longest continuous coral reef time series spanning three decades and hundreds of reefs, to quantify how much coral is lost during each disturbance event and how completely it returns before the next one arrives, and then test whether reef fish communities track that recovery or lag behind the coral. Working remotely and desk-based, the student will be trained in the quantitative workflow of wrangling and visualising a large, real-world ecological time series in R, fitting and interpreting models of loss and recovery, and translating the results into conclusions that matter for reef management. They will also gain experience with using a national monitoring dataset. Some familiarity with R is an advantage, but an interest in quantitative ecology and marine systems is essential.

Project Details

Supervisor(s): Dr Amanda Pettersen
Contact: amanda.pettersen@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project Report (1-2 pages)

Assumed Knowledge:

- No single unit of study is required, but the project will be most accessible to students who have completed some introductory statistics or data analysis, e.g., BIOL2022 Biology Experimental Design and Analysis, ENVX1002 Statistics in Life and Environmental Sciences, or DATA1001 Foundations of Data Science, together with at least one ecology or marine unit such as BIOL2024/2924 Ecology and Conservation, BIOL3007/3907 Ecology, BIOL3013/3913 Marine Biology, or BIOL3016/3916 Coral Reef Biology.

Technical skills:

- Basic familiarity with R and RStudio (reading in data, manipulating data frames, plotting) is an advantage.
- Comfort with linear regression is helpful, but the modelling approaches used in the project will be taught.
- No prior experience with large monitoring datasets, spatial data, or coding beyond introductory level is expected.

Relevant knowledge or experience:

- An interest in marine ecology, biodiversity and conservation, and a willingness to work independently on computer-based analysis.
- Experience with reproducible reporting (R Markdown or Quarto) or version control (Git/GitHub) is a bonus, but not an expectation.

Student Preparation:
N/A

Attendance Mode:
Online

Attendance Details:
90% online, 10% onsite

Location Details:
Heydon Laurence Building (A08), Room 225A

Ethics Protocol Requirement:
N/A

SOLE16: Shelter feline ringworm recovery and emotional wellbeing

Project Subject Area: Animal Health and Veterinary Science

Ringworm infection, in shelter cats, can have serious consequences for the outcome of cats. It is a zoonotic skin disease that can take many weeks to clear, extending shelter stays significantly. Immune competence plays a role in recovery times and, therefore, the emotional wellbeing of cats during treatment may be a significant variable in their recovery. Using retrospective data collated from RSPCA shelter systems we propose to examine the ringworm recovery times of cats housed in different environments and any association with their average Fear Anxiety Stress (FAS) as collated over their period of care. Students will have the opportunity to use data analysis techniques to build evidence for real world approaches in shelter medicine .

Project Details

Supervisor(s): Dr Sabrina Lomax
Contact: sabrina.lomax@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project Report (1-2 pages)

Assumed Knowledge:
- Understanding and knowledge of animal management and behaviour
- Completion of AVBS1003 and/or AVBS1002 is desirable
- Computer literacy and understanding of basic statistics (introduction to R coding) is a requirement.
- Suitable for students in the Bachelor of Animal and Veterinary Bioscience or Bachelor Agricultural Science degrees

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Attendance mode is flexible. Approximately 80% online and 20% onsite

Location Details:
RSPCA NSW Adoption Centre 201 Rookwood Road, Yagoona

Ethics Protocol Requirement:
N/A

School of Mathematics and Statistics

MATH01: Special Directions in Differential Forms

Project Subject Area: Mathematical Sciences

Many of the fundamental laws of physics can be expressed using mathematical objects called differential forms. They provide a flexible way of describing quantities such as area, volume, flux, and conservation laws in a coordinate-independent way. In this project, you will investigate when there is a vector field that can be used to decompose a differential form into a product of simpler pieces. This question is motivated by multisymplectic geometry, a modern framework that aims to extend the geometry underlying classical mechanics to physical theories involving several interacting quantities or Hamiltonians. No prior knowledge of differential geometry or physics is required: you will develop the necessary ideas from multilinear algebra, including vectors, dual spaces, wedge products, contractions, and decomposability, while gaining experience with a genuine research-level mathematical question.

Project Details

Supervisor(s): Dr Nathan Duignan
Contact: nathan.duignan@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- MATH2922 - Linear and Abstract Algebra
- MATH2921 - Vector Calculus
- *MATH3977 - Lagrangian and Hamiltonian Mechanics (useful but not necessary:)*

Student Preparation:
- Lab induction, pre-reading

Attendance Mode:
Hybrid

Attendance Details:
Attendance is flexible. At least one day a week on campus, preferably two.

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH02: Hyperbolic geometry of 3-dimensional spaces

Project Subject Area: Mathematical Sciences

Imagine a giant triangle on the surface of the Earth, the sum of the interior angles can be more than 180 degrees. In a saddle surface, the sum of the interior angles of a triangle can be less than 180 degrees. These are examples of 2-dimensional spaces with elliptic and hyperbolic geometries respectively. In this project, we will learn and study hyperbolic geometry of 3-dimensional spaces such as knot complements in the 3-sphere and spaces related to existing crystal structures, which has been an interesting and active research area in low-dimensional topology. Students will learn about 3-dimensional spaces through triangulations, hyperbolic geometry, beautiful mathematical results, and a helpful computer software called SnapPy.

Project Details

Supervisor(s): Dr Connie On Yu Hui
Contact: connie.hui@sydney.edu.au

Maximum number of places available: 4

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Students with basic knowledge on topology and/or differential geometry will be preferred.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
50% onsite, 50% online
The attendance mode can be flexible depending on students' travelling schedule.

Location Details:
Sydney Mathematical Research Institute (SMRI), Level 4, Quadrangle A14, or Zoom

Ethics Protocol Requirement:
N/A

MATH03: Scalable statistical models with Gaussian processes

Project Subject Area: Statistics

Gaussian processes are popular models used in a wide range of disciplines, including statistics, machine learning, environmental science and ecology, especially for modeling spatial and temporal dependence structure. However, Gaussian processes can become computationally infeasible with a large number of observations. This project investigates different approaches to construct scalable Gaussian-process-based models.

Over six weeks, the student will learn the mathematical and statistical formulation of these models, implement scalable computational methods in R, apply the models to real-world datasets, and write a short report. This project is ideal for statistics or data science students with a strong interest in statistical methodology with real-world applications.

Project Details

Supervisor(s): Dr Quan Vu
Contact: quan.vu@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Completion of STAT2X11 and DATA2X02.
- Additional knowledge of statistical modeling, such as linear models, mixed models, generalized linear models, and/or models with spatial/temporal dependence, is desirable.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
At least one on-campus meeting each week

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH04: Weak Mixing and the Pascal Adic Transformation

Project Subject Area: Mathematical Sciences

The Pascal adic transformation is a dynamical system built from Pascal's triangle, whose long-term behaviour remains partly mysterious. The student/s will learn basic ideas from ergodic theory, symbolic dynamics and Bratteli–Vershik systems while investigating whether the transformation is measure-theoretically weakly mixing. The project will combine theoretical arguments and concrete computations to explore return times, eigenvalues and mixing properties, providing an accessible introduction to a genuine open problem in modern dynamical systems.

Project Details

Supervisor(s): Dr Shrey Sanadhya
Contact: shrey.sanadhya@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Undergraduate level measure theory MATH 3969.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
80% online and 20% onsite (we will have bi-weekly meetings)

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH05: How Many Clusters? Exploring the Pitman–Yor Process

Project Subject Area: Statistics

The Pitman–Yor process is a flexible probabilistic model widely used in Bayesian nonparametrics to represent data with an unknown number of groups. Its two main parameters control both the formation of new clusters and the distribution of observations among existing clusters. This project will investigate how these parameters affect clustering behaviour, including the expected number of clusters, the distribution of cluster sizes, and the occurrence of a few large clusters alongside many small ones. The student will combine theoretical calculations with simulation studies to explore finite-sample and asymptotic properties of the model. The project will provide an introduction to Bayesian nonparametric methods, random partitions, and computational statistics, and may include comparisons with the Dirichlet process and other commonly used clustering models.

Project Details

Supervisor(s): Associate Professor Clara Grazian
Contact: clara.grazian@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
– MATH1062/1962, MATH1080

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
On campus meetings and unsupervised learning.
It is possible to organise online meetings as well.

Location Details:
Carslaw Building (F07) and online

Ethics Protocol Requirement:
N/A

MATH06: Learning from Differential Equation Models Using Approximate Bayesian Computation

Project Subject Area: Statistics

Differential equations are used to describe evolving systems in areas such as epidemiology, ecology, biology, and physics. Estimating the parameters of these models from observed data can be challenging, particularly when the likelihood function is difficult or computationally expensive to evaluate. Approximate Bayesian computation (ABC) offers an alternative by comparing observed data with data simulated from the model. This project will investigate how ABC can be used to estimate parameters and quantify uncertainty in differential equation models. The student will implement numerical solvers and ABC algorithms, and study how choices such as the distance measure, summary statistics, and acceptance tolerance affect the resulting inference. The methods will be examined using simulated data and a selected application, with comparisons to likelihood-based approaches when these are available.

Project Details

Supervisor(s): Associate Professor Clara Grazian
Contact: clara.grazian@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- MATH1062/1962, MATH1080

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
On campus meetings and unsupervised learning.
It is possible to organise online meetings as well.

Location Details:
Carslaw Building (F07) and online

Ethics Protocol Requirement:
N/A

MATH07: Differential equations on spaces with Gaussian measure

Project Subject Area: Mathematical Sciences

Harmonic oscillator is a fundamental object of quantum mechanics. The associated partial differential equation can be studied in n-dimensional space endowed with a multivariate Gaussian distribution. The aim of the project is to solve this equation for a large set of initial data. The student will learn about solving partial differential equations and analysis on Gaussian spaces. This is a Pure Maths project.

Project Details

Supervisor(s): Professor Ben Goldys
Contact: beniamin.goldys@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- MATH2923
- MATH2922 (linear algebra part)

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
90% and 10% online

Location Details:
Carslaw Building (F07), Level 7, Room 709 and online

Ethics Protocol Requirement:
N/A

MATH08: New data science approached for single cell spatial genomics

Project Subject Area: Data Science

Recent developments in single cell RNA-sequencing and spatially resolved genomics (e.g. seqFISH, 10X Visium) have resulted in immense datasets corresponding to hundreds of thousands of observed cells and thousands of measured features. The overarching goal is to understand these data and develop new data science approaches to addressing questions in biology. There are opportunities to build capacity in terms of computational modelling, effective data visualisation and interaction, and software scalability.

Project Details

Supervisor(s): Dr Shila Ghazanfar
Contact: shila.ghazanfar@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- DATA2x02
- Strong understanding of R analysis and package creation

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Mostly online, on-campus for meetings

Location Details:
Charles Perkins Centre (D17) and online

Ethics Protocol Requirement:
N/A

MATH09: AI agents for science: Building a living evidence system for glaucoma

Project Subject Area: Data Science

This project will build prototype AI agents to support glaucoma neuroprotection research and therapeutic discovery, with the opportunity to work with members of the Snow Vision Accelerator. Students will help design tools that can read scientific literature, extract structured biomedical evidence, organise it into knowledge-graph-ready formats, and identify key evidence gaps for translation. Participants will gain hands-on experience with agentic AI, biomedical data science, literature mining, knowledge representation, and human-supervised AI workflows. The project is ideal for students who want to use data science or AI to accelerate biomedical discovery.

Project Details

Supervisor(s): Dr Jean Yee Hwa Yang
Contact: jean.yang@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- DATA2002 or equivalent
- Coding experience in either Python or R

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
The project is delivered in hybrid mode. Students will have access to the Charles Perkins Centre and may complete up to 60% of the project online.

Location Details:
Charles Perkins Centre (D17) and online

Ethics Protocol Requirement:
N/A

MATH10: Finite Fields, Infinite Security: Orthogonal Polynomials in Post-Quantum Cryptography

Project Subject Area: Mathematical Sciences

Orthogonal polynomials have a long and distinguished mathematical tradition, having been studied by many of the great mathematicians of the past. In this project, we give new life to this classical subject by transporting it to the setting of finite fields. Besides opening up fascinating mathematical questions, this new perspective may lead to entirely new hardness assumptions for post-quantum cryptography.

Project Details

Supervisor(s): Dr Tomas Lasic Latimer, Professor Nalini Joshi and Dr Pieter Roffelsen
Contact: tomas.lasiclatimer@sydney.edu.au

Maximum number of places available: 4

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Required: First year math courses. Familiarity with linear algebra and modular arithmetic.
- Optional: MATH2022 - Linear and Abstract Algebra and MATH2088 -Number Theory and Cryptography.

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
On campus and weekly meetings

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH11: Predicting the popularity of petitions

Project Subject Area: Data Science

How many signatures will an online petition receive? What factors contribute to the success of petitions? In this project we will approach these questions using large online databases (e.g. as the petitions to the Australian parliament) and different prediction techniques.

The interest on this specific problem is that it is representative of a much larger class of problems that Data Science addresses. Human attention is very unevenly distributed, with a few items (petitions, books, movies, memes, etc.) receiving the majority of the collective attention and the majority of items receiving virtually no attention. The fat-tailed distributions underlying these problems make predictions more difficult and interesting. Exploring different textual and numerical features underlying the data, we will learn different techniques on natural language processing and statistics.

Project Details

Supervisor(s): Professor Eduardo G. Altmann
Contact: eduardo.altmann@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- First year Statistics or Data science.
- Fluency in coding, Python preferred.

Student Preparation:
N/A

Attendance Mode:
On Campus

Attendance Details:
In person discussions, meetings, and presentations are essential.
Working from home on 50% of the time is possible.

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH12: Do molecules and anatomy agree? AI analysis of kidney transplant biopsies

Project Subject Area: Data Science

Kidney transplants often fail because of rejection, which pathologists grade using Banff scores. This project will combine biopsy images, spatial gene activity, and structure-aware AI to test whether molecular signals and anatomy-based injury measurements agree with pathologist assessments.

Students will work with real transplant biopsy data to build models that understand nested kidney structures, generate per-region injury measurements, and link these to Banff scores and spatial molecular patterns. They will gain hands-on experience in computer vision, spatial statistics, deep learning, and medical AI.

Project Details

Supervisor(s): Professor Jean Yee Hwa Yang
Contact: jean.yang@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- DATA2002 or equivalent
- Coding experience in either Python or R

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Students will have access to the Charles Perkins Centre and may complete up to 60% of the project online.

Location Details:
Charles Perkins Centre (D17) and online

Ethics Protocol Requirement:
N/A

MATH13: Evaluation of stable clusters obtained from consensus spatial omics clustering

Project Subject Area: Data Science

This project involves application of spatial clustering methods to spatial transcriptomics data from various biological tissues. Over 6 weeks, the student will gain hands-on experience in working with spatial transcriptomics data, and use computational tools for spatial omics analysis.

Project Details

Supervisor(s): Dr Pratibha Panwar
Contact: pratibha.panwar@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- DATA1001: Foundations of Data Science
- DATA2002: Data Analytics: Learning from Data
- Basic experience in R coding

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
90% online, 10% on campus

Location Details:
Carslaw Building (F07), Level 4, Room 483 and online

Ethics Protocol Requirement:
N/A

MATH14: Expanding applicability of MoleculeExperiment R package to various spatial transcriptomics technologies

Project Subject Area: Data Science

This project involves extending an existing R package to improve its applicability to various types of spatial omics technologies. Over 6 weeks, the student will gain an understanding of existing spatial transcriptomics technologies and how R packages are developed and maintained.

Project Details

Supervisor(s): Dr Pratibha Panwar
Contact: pratibha.panwar@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- DATA1001: Foundations of Data Science
- DATA2002: Data Analytics: Learning from Data
- Basic experience in R coding

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
90% online, 10% on campus

Location Details:
Carslaw Building (F07), Level 4, Room 483 and online

Ethics Protocol Requirement:
N/A

MATH15: Exploring learning environment designs to improve student's sense of belonging in first year statistics and data science courses

Project Subject Area: Science Education

This project investigates how randomly allocating students to small groups in first-year mathematics and statistics workshops influences their sense of belonging, participation and connections with their peers. Students will help analyse evidence gathered through surveys, classroom observations and focus groups to understand students' experiences and identify which approaches to group formation work best. Through the project, they will gain practical experience in mixed-methods educational research, including data analysis, qualitative coding and the ethical handling of research data. They will also contribute to translating the findings into recommendations for improving university teaching and may have opportunities to be included in research presentations or publications.

Project Details

Supervisor(s): Dr Yeeka Yau
Contact: yeeka.yau@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Data analysis skills in R or Python
- An interest in scholarship of teaching and learning research

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Project is hybrid and we can be flexible based on student's preferences.

Location Details:
Carslaw Building (F07), Level 6 and 7 office spaces and online

Ethics Protocol Requirement:
N/A

MATH16: Robust statistical modelling of sensor data in the livestock industry

Project Subject Area: Statistics

This project will investigate statistical methods for analysing sensor data from livestock, with a particular focus on animal wearable data. Such data can be noisy and affected by outliers, sensor failures and other artefacts, motivating the use of robust modelling approaches. Potential directions include robust state-space modelling, extracting interpretable behavioural or physiological features from sensor data, and linking these measurements to animal health outcomes.

Project Details

Supervisor(s): Associate Professor Garth Tarr
Contact: garth.tarr@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- DATA2X02

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Project is hybrid and we can be flexible based on student's preferences.

Location Details:
Carslaw Building (F07) and online

Ethics Protocol Requirement:
N/A

MATH17: Multiple Learning Pathways in DATA2x

Project Subject Area: Data Science

Given competing pressures, including time constraints, cost-of-living concerns, and mental health challenges, many university students make highly strategic decisions about how they engage with a unit. Framing these decisions as learning pathways, this project examines engagement and learning in DATA2X using multiple sources of data, including surveys, learning analytics, academic outcomes, and student-generated exam summary sheets. Student researchers will have the opportunity to work with both quantitative and qualitative data to investigate how students learn in flexible educational environments. The findings will help shape the future design of large university courses to improve the student learning experience.

Project Details

Supervisor(s): Associate Professor Di Warren
Contact: diana.warren@sydney.edu.au

Maximum number of places available: 7

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- DATA1001 or 1901: Foundations of Data Science
- DATA2002 or 2902: Data Analytics
- Leadership skills
- Ability to learn independently

Student Preparation:
- There will be a team induction & overview session in December 2026.

Attendance Mode:
Hybrid

Attendance Details:
The project will involve regular team meetings on campus, involving independent and team-based research.

Location Details:
Carslaw Building (F07), Level 5, Room 527 (team meetings) and online

Ethics Protocol Requirement:
N/A

MATH18: Computing the fractal dimensions of Julia sets

Project Subject Area: Mathematical Sciences

Julia sets are beautiful, intricate shapes in the complex plane that are invariant under the mapping f(z) = z^2 + c, with deep connections to the famous Mandelbrot set. Each of them has its own fractal structure, with a dimension between 0 and 2 (and typically not a whole number). In this project we will make sense of the structure of some Julia sets and compute their fractal dimensions: in particular, we will look at disconnected Julia sets, the ones that look like "dust".

Project Details

Supervisor(s): Dr Caroline Wormell
Contact: caroline.wormell@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Knowledge of a scientific computing language (e.g. Julia, Python)
- MATH2X22

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Majority of the time students can work from wherever they choose. Several meetings on campus will be required.

Location Details:
Carslaw Building (F07)

Ethics Protocol Requirement:
N/A

MATH19: Telling a Real Smile from a Fake One

Project Subject Area: Statistics

Humans are surprisingly bad at telling whether a smile is real or fake, but does that mean the information is not there, or are we simply not very good at using it? In this project, the student will use facial-expression data from a large selection of smile episodes to investigate whether statistical and machine-learning models can distinguish spontaneous from performed smiles. The student will learn about classification, feature engineering and cross-validation for repeated measurements, with a particular focus on whether models can generalise to people they have never seen before. The results will help us understand how much information about authenticity is actually contained in a smile.

Project Details

Supervisor(s): Dr Jie Kang
Contact: jie.kang@sydney.edu.au

Maximum number of places available: 1
Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Working knowledge of R or Python and basic statistics.
- Familiarity with classification and cross-validation would be helpful but is not required.
- No prior background in psychology or facial-expression research is required.

Student Preparation:
- Before the program begins, the student will need a working installation of R or Python, Git and a GitHub account for access to the project repository.
- The student will also complete the required Charles Perkins Centre building induction for Level 6 access.

Attendance Mode:
Hybrid

Attendance Details:
Approximately 60% online (remotely) and 40% on campus.
The student may undertake data analysis independently between regular meetings with the supervisor and research team.

Location Details:
Charles Perkins Centre (CPC)

Ethics Protocol Requirement:
N/A

MATH20: Determining biologically meaningful cell states in spatial omics

Project Subject Area: Data Science

This project aims to develop a computational method for determining biologically meaningful clustering resolutions in spatial transcriptomics and proteomics. We will investigate how different resolutions capture biological organisation, from cell types and states to spatial niches and tissue compartments, and develop quantitative approaches to distinguish meaningful populations from over-clustering. Students will gain hands-on experience in spatial omics analysis, clustering and statistical method development.

Project Details

Supervisor(s): Dr Lijia Yu
Contact: lijia.yu@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Strong programming skills
- Basic knowledge of clustering.

Student Preparation:
- Before the program begins, the student will need a working installation of R or Python, Git and a GitHub account for access to the project repository.
- The student will also complete the required Charles Perkins Centre building induction for Level 6 access.

Attendance Mode:
Hybrid

Attendance Details:
50% onsite, 50% online

Location Details:
Charles Perkins Centre (CPC), Level 6

Ethics Protocol Requirement:
N/A

MATH21: Robust Evaluation of Peer-Assisted Study Sessions Using Observational Data

Project Subject Area: Statistics

Peer Assisted Study Sessions (PASS) are voluntary academic-support sessions designed to help students succeed in challenging university units. This project will investigate how estimated differences in academic outcomes between PASS participants and non-participants change after accounting for observable differences between the students, and how sensitive those adjusted estimates are to possible unmeasured differences.

The student will work with real-world educational data from selected University of Sydney units and gain experience in statistical modelling, observational study design, causal inference and sensitivity analysis. The project will provide practical experience in using quantitative methods to address an important challenge in evaluating voluntary student-support programs.

Project Details

Supervisor(s): Dr Ken Ly
Contact: ken.ly@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Intermediate undergraduate statistics or data science, such as DATA2x02 or equivalent.
- Familiarity with regression modelling and experience using R for data manipulation, analysis and visualisation would be beneficial.
- No prior experience with causal inference or sensitivity analysis is required.

Student Preparation:
- Prior to the January-February intensive period, successful students will be provided online with a small selection of journal articles on PASS/SI evaluation and observational research to familiarise themselves with the project context.
- No substantial pre-program work or formal assessment will be required.

Attendance Mode:
Online

Attendance Details:
100% online.

Location Details:
Online

Ethics Protocol Requirement:
Successful applicants will be added to the relevant ethics protocol before commencing the research. The project supervisor will submit an ethics amendment to include the successful applicants as research assistants on the existing ethics application. Students will only commence research activities involving the approved data once the amendment has been approved and any relevant ethics requirements have been completed.

MATH22: Developing Statistical and Machine Learning Methods for Biological and Biomedical Data

Project Subject Area: Data Science

This project aims to develop new statistical, machine learning, and computational methods for analysing complex biological and biomedical data, including genomic and other high-dimensional molecular data. Students will work on a methodological research problem motivated by a real biological application, with opportunities to explore areas such as statistical modelling, machine learning, high-dimensional data analysis, and computational biology. Through the project, students will gain experience in developing and evaluating new quantitative methods, implementing them in R or Python, and applying them to real-world datasets. The specific project will be tailored to the student's background and interests.

Project Details

Supervisor(s): Associate Professor Heejung Shim
Contact: heejung.shim@sydney.edu.au

Maximum number of places available: 2
Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Strong background in statistics, data science, machine learning, mathematics, or a related quantitative discipline.
- A good understanding of probability, statistical modelling, or machine learning, together with programming experience in R or Python, is desirable.
- Experience with biological or genomic data is helpful but not required.
- The project is particularly suited to students interested in applying, evaluating, or developing statistical and machine learning methods for real-world biological problems.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
50% online, 50% on campus

Location Details:
Charles Perkins Centre (CPC) and online

Ethics Protocol Requirement:
N/A

MATH23: How Data Science Can Help Breed Better Beef

Project Subject Area: Quantitative Genetics

Animal breeding is essentially a prediction problem: how can we use the data we have today to breed better cattle tomorrow? In this project, we will explore how pedigree, performance and genomic data can be combined to predict the genetic merit of beef cattle. The student will work with simulated and real data and learn the fundamentals of quantitative genetics, statistical modelling and genomic prediction. By the end of the project, they will understand how data science can help turn millions of genetic and performance records into better breeding decisions.

Project Details

Supervisor(s): Dr Jie Kang
Contact: jie.kang@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Basic knowledge of statistics and data analysis, with some experience using R, Python or a similar programming language.
- An interest in genetics, data science or animal breeding would be helpful, but prior knowledge of quantitative genetics or genomic prediction is not required.

Student Preparation:
- Students will be provided with introductory reading and relevant project materials before commencement, with any required training or orientation completed during the first week of the project.

Attendance Mode:
Hybrid

Attendance Details:
Approximately 60% on campus and 40% working remotely.
On-campus time will include regular meetings with the supervisor and research team, while data analysis and coding can be completed either on campus or remotely. Students may undertake independent data analysis between meetings, with regular supervision and support available throughout the project.

Location Details:
Charles Perkins Centre (CPC) and online

Ethics Protocol Requirement:
N/A

MATH24: Building a Foundation Model for Animal Health

Project Subject Area: Data Science

What if we could build one model that learns from everything we know about an animal? In this project, we will explore how wearable sensors, GPS, biomarkers, images and genomic data can be brought together to develop the foundations of a multimodal model for animal health. Students will work with real livestock datasets and learn how to process, represent and integrate very different types of biological and sensor data using modern statistical and machine-learning methods. The longer-term goal is to develop a foundation model that can learn across animals, farms and data types, and be adapted to different animal health problems.

Project Details

Supervisor(s): Dr Jie Kang
Contact: jie.kang@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- A good foundation in machine learning and basic experience with deep learning are expected, including familiarity with neural networks, model training and evaluation.
- Students should be comfortable programming in Python and working with data using common machine-learning libraries. Familiarity with PyTorch or TensorFlow, representation learning, transformers or other foundation-model concepts would be helpful but is not essential.
- Prior experience with animal health or livestock data is not required.

Student Preparation:
- Students will be provided with introductory reading and relevant project materials before commencement, with any required training or orientation completed during the first week of the project.

Attendance Mode:
Hybrid

Attendance Details:
Approximately 60% on campus and 40% working remotely.
On-campus time will include regular meetings with the supervisor and research team, while data analysis and coding can be completed either on campus or remotely. Students may undertake independent data analysis between meetings, with regular supervision and support available throughout the project.

Location Details:

Charles Perkins Centre (CPC) and online

Ethics Protocol Requirement:
N/A

Sydney School of Veterinary Science

SSVS01: Can Gene Expression Tell Us Which Animals Are at Risk of Disease?

Project Subject Area: Data Science

A single biological sample can contain measurements from thousands of genes, but only a small number may be needed to identify animals at risk of disease. This project will use transcriptomic data to discover gene-expression signatures associated with animal health and reduce thousands of potential signals to a small and interpretable biomarker panel. Students will apply statistical and machine-learning approaches to identify candidate biomarkers and evaluate how accurately they predict health outcomes in unseen animals. The project provides hands-on experience in translating complex biological data into potential diagnostic tools for earlier and more targeted animal-health decisions.

Project Details

Supervisor(s): Dr Karren Plain
Contact: karren.plain@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Working proficiency in R or Python.
- A foundation in statistics, data science or molecular biology would be helpful.
- Previous experience with transcriptomics or biomarker discovery is not required.

Student Preparation:
- A working installation of R or Python and Git.
- Introductory material on transcriptomics, differential expression and biomarker discovery will be provided before the program.

Attendance Mode:
Hybrid

Attendance Details:
The student will undertake a combination of supervised on-campus research and independent computational analysis. Regular meetings with the supervisory team will cover transcriptomic analysis, biomarker discovery, predictive modelling and

biological interpretation. The project will primarily involve computational analysis of existing transcriptomic and animal-health datasets.

Location Details:
Sydney School of Veterinary Science, University of Sydney.

Ethics Protocol Requirement:
N/A

SSVS02: The shape of disease: quantifying bone changes in a novel model of hip osteoarthritis

Project Subject Area: Biology

Osteoarthritis is one of the most common musculoskeletal diseases affecting both humans and animals, yet the mechanisms driving disease progression in different joints, such as the hip and knee, remain poorly understood. This project will use micro-computed tomography (microCT) imaging and a newly developed mouse model of hip osteoarthritis to investigate how bone structure changes throughout disease progression. The student will develop and apply image analysis pipelines to quantify parameters such as bone volume, subchondral bone thickness, and cortical bone morphology, while exploring differences between males and females, and different stages of disease.Through this project, the student will gain experience in 3D image analysis, quantitative morphometry, data visualisation, and statistical analysis while contributing to the development and characterisation of a novel preclinical model of hip osteoarthritis and broader research aimed at improving our understanding of osteoarthritis progression.

Project Details

Supervisor(s): Dr Carina Blaker
Contact: carina.blaker@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- No prior experience with microCT analysis is required.
- An interest in anatomy, musculoskeletal biology, veterinary science, biomedical science, or data analysis is desirable.
- Familiarity with image processing or analysis, image reconstruction or programming language/software will be advantageous, but training will be provided.
- Students who enjoy combining biological questions with quantitative data analysis are particularly encouraged to apply.

Student Preparation:
- Prior to commencement, students will be required to complete several onboarding activities, including building access paperwork and inductions. These activities will be preferably completed before end of year (2026).

Attendance Mode:
Hybrid

Attendance Details:
Approximately 70% onsite (Kolling Institute) and 30% online, with flexibility depending on individual circumstances
Due to the digital nature of the imaging datasets, this project has some flexibility in how work is completed. Students are encouraged to attend onsite regularly to receive training, engage with the research team, and discuss project progress, although some remote participation can be accommodated. Components of the project, including image analysis, data processing, and literature review activities, may be undertaken independently between scheduled meetings with supervisors.

Location Details:
The Kolling Institute in St. Leonards (Northern Sydney Precinct, RNSH Building No. 6)

Ethics Protocol Requirement:
N/A

SSVS03: Innovative Approaches to Combating Antimicrobial Resistance in Veterinary Bacterial Pathogens

Project Subject Area: Animal Health and Veterinary Science

This project will involve a range of research activities aimed at advancing antimicrobial resistance diagnostics, surveillance, and novel treatment strategies for veterinary bacterial pathogens. Aims of the research will include validating a novel high-throughput antimicrobial susceptibility testing (AST) platform, applying this technology in a national surveillance study of resistance in E. coli and Staphylococcus spp. isolates in companion animals, and using advanced microscopy techniques (scanning and transmission electron microscopy, confocal microscopy) to visualise bacterial capsule and biofilm morphology and the effects of novel treatments such as bacteriophages and antimicrobial peptides. Students will gain experience in microbiological laboratory work, including bacterial culture and AST testing, sample cataloguing, data entry and analysis, microscopy sample preparation and potentially literature review (if further research is required). As such students will develop valuable scientific, analytical, and research skills while contributing to real-world problem solving projects with direct relevance to One Health.

Project Details

Supervisor(s): Dr Katharine Muscat
Contact: katharine.muscat@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Experience with excel and basic computer skills
- Experience in laboratories preferred, PC2-level lab experience ideal

Student Preparation:
- Completion of University safety modules: Biosafety, chemical safety (modules 1 and 2) needed prior to commencement
- In-person inductions of laboratories

Attendance Mode:
Hybrid

Attendance Details:
60-80% onsite, 20-40% online
Following appropriate training and demonstration of efficiency in tasks, some laboratory work will be unsupervised

Students will likely assist with culturing and AST testing of bacterial isolates for AST testing at EMAI in Menangle. Other microbiological work (bacterial culturing, biofilm assays) may be performed at McMaster Building B14 Camperdown, sample preparation and visualisation with microscopy will be performed in Madsen Building F09, Camperdown. Sample cataloguing, data entry and analysis, literature review and any other helpful admin tasks can be performed from home/remotely.

Location Details:
McMaster Building (B14) and Madsen Building (F09), Camperdown campus
Elizabeth MacArthur Agricultural Institute (NSW DPI laboratory) - Travel to Menangle required
Potential involvement with laboratory work in Camden may be an option if the student is interested

Ethics Protocol Requirement:
N/A

School of Psychology

PSYC01: Investigating gender based violence using legal psychology: From memory to psychological wellbeing and everything in between!

Project Subject Area: Psychology

Gender-based violence, such as sexual, domestic, and family violence is a prominent issue in Australia and globally. Our legal system can be improved in how it deals with these cases. From how we collect the most accurate memory statements, to how we can protect the psychological wellbeing of those involved. From police interviews to court room testimonies. In this project you will assist with reviewing literature, data collection, coding, and interpretation. This project will help you develop skills and knowledge to tackle these real-life issues.

Project Details

Supervisor(s): Associate Professor Celine van Golde
Contact: celine.vangolde@sydney.edu.au

Maximum number of places available: 4

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Introductory Psychology units of study
- Comfortable with computers and basic statistics

Student Preparation:
- Research induction on the topic and the various tasks involved. As part of this induction student(s) will be assessed on how comfortable they are with the research topics, and together with the supervisor the student(s) will decide what topics they will be working on.
- Guidance regarding emotional responses to the topic will be provided, and there are various distress protocols in place if needed.

Attendance Mode:
Hybrid

Attendance Details:
The student(s) will be expected to be on campus at least 3 days a week, as the project requires testing participants in person.

Location Details:
School of Psychology, Brennan MacCallum Building (A18) and Griffith Taylor Building (A19).

Ethics Protocol Requirement:
Student will need to complete the Ethics Training Module, so they can be added to any ethics protocols. Successful applicants will be directed to contact the supervisor to arrange this.

PSYC02: Predictors of successful dog and cat adoptions from RSPCA shelters

Project Subject Area: Psychology

This is an industry-linked project with RSCPA NSW. To monitor animals and guide decision making for shelter dogs and cats, RSPCA adopts a system of Behaviour (B) and Medical (M) scoring of animals in the shelter. These are assessed and recorded at several time points during an animal's stay, according to a detailed matrix. The aim of this project is to analyse relationships between B and M scores prior to adoption to the behaviour and health observed by the owner post adoption, and whether there is a relationship between scores at the time of adoption and owner satisfaction.

Project Details

Supervisor(s): Associate Professor Ian Johnston
Contact: i.johnston@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Statistical knowledge from undergraduate Psychology majors, Maths majors, or Data Science.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
5% onsite, 95% on campus or online

Location Details:
The student will be trained at RSPCA Head Office at Yagoona but analysis can be performed on campus and/or online.

Ethics Protocol Requirement:
Student researchers will be added to an ethics protocol as a research assistant. No checks or licenses are required.

PSYC03: Wearables for dog welfare

Project Subject Area: Psychology

This is an industry-linked project with RSCPA NSW. They have invested in wearable accelerometers for dogs in their care to measure time sleeping and chewing - established markers of welfare. They are offering a project to investigate the reliability and validity of these devices to enhance their ability to monitor dog wellbeing in their care.

Project Details

Supervisor(s): Associate Professor Ian Johnston
Contact: i.johnston@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Introductory grounding in data analysis (e.g., PSYC2012, DATA1001, other introductory statistics units of study).
- Students will be taught how to prepare datasets and conduct analyses for this project.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
50% on campus, 50% onsite Yagoona

Location Details:
School of Psychology, Brennan MacCallum Building (A18) and RSPCA NSW Sydney Adoption Centre, Yagoona.

Ethics Protocol Requirement:
Students will be covered by an ethics protocol and will need to be added. There are no requirements for this approval.

PSYC04: Designing a caregiver self-reported companion animal wellbeing scale

Project Subject Area: Psychology

This is an industry-linked project with RSCPA NSW. There is currently no population measure of companion animal welfare across NSW. Ideally, animal census data would be available to monitor animal welfare trends in Australia. Creating a simple question or limited series of questions reflecting the general wellbeing of companion animals is an important step in working towards this goal. RSPCA NSW is seeking a researcher to review the available literature to recommend an appropriate quality of life question for animal caregivers. This question could be piloted with RSPCA clients to create an initial data set.

Project Details

Supervisor(s): Associate Professor Ian Johnston
Contact: i.johnston@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Introductory units involving the assessment of the validity and reliability of questionnaires. E.g., PSYC2017 or from other disciplines.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
90% on campus, and 10% on site at Yagoona

Location Details:
School of Psychology, Brennan MacCallum Building (A18) and RSPCA NSW Head Office, Yagoona.

Ethics Protocol Requirement:
N/A

PSYC05: Understanding carers' experiences of social connectedness in online spaces

Project Subject Area: Psychology

Family members and friends who care for someone with cancer, or another serious illness, provide essential emotional and practical support. However, caring can also be demanding and isolating. Online platforms may offer carers flexible ways to connect with people who understand their experiences. This project will examine cancer carers' experiences of online communities. Students will have the opportunity to learn about qualitative coding techniques and data analysis to understand carer experiences in-depth. Students would be working with researchers from Psycho-Oncology Co-operative Research Group and the Acquired Brain Injury Communication Lab on this project.

Project Details

Supervisor(s): Dr Kyra Webb
Contact: kyra.webb@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
N/A

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
Three days on campus and two days online.

Location Details:
Griffith Taylor Building (A19) and Susan Wakil Building (D18)

Ethics Protocol Requirement:
An ethics application is currently in preparation for this project and will be submitted through the School of Psychology Human Research Ethics Committee. Students will be required to complete the Responsible Research Practice Training Module on Canvas. This module will take 10 – 40 minutes to complete. Once completed, students will need to create a myResearch Ethics account before they can be added to the project. The Chief Investigator will then complete an ethics amendment to add the student(s) to the project.

PSYC06: Investigating biases in judgements

Project Subject Area: Psychology

Our current research examines the cognitive processes that shape how people make judgements. We focus on investigating why individuals sometimes misjudge their knowledge or perceive patterns that are not there. Using behavioural experiments, we aim to identify the conditions that amplify or reduce these biases. The project will involve literature review and/or in-lab experimentation.

Project Details

Supervisor(s): Dr Hilary Don
Contact: hilary.don@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Completion of first year psychology.
- Interest in cognitive psychology.
- Undergraduate major in Psychology/Neuroscience is helpful, but not necessary.

Student Preparation:
- An initial one-hour meeting with the research team, date and time TBD

Attendance Mode:
On Campus

Attendance Details:
Students will attend on campys for regular meetings with the supervisor and independent data collection activities. Some project activities, such as data analysis and reading, will be conducted independently and unsupervised.

Location Details:
Badham Building (A16), Griffith Taylor Building (A19) and Brennan MacCallum Building (A18)

Ethics Protocol Requirement:
Students will be added to the existing ethics protocol and will be required to complete the ethics training module.

PSYC07: Investigating cognitive control

Project Subject Area: Psychology

We experience conflict every time we try to do two things at once, or get distracted while completing a task. Cognitive control refers to the processes that we use to respond to this conflict. Problems with cognitive control are linked to mental health issues like anxiety and behavioural disorders. In studying it, we hope to understand how our experiences help to regulate cognitive control processes, for instance how we can learn to anticipate conflict and prepare accordingly. This project will be run in the Brain and Behaviour Lab, where we use a variety of psychological and neurophysiological techniques (computer-based behavioural tasks, TMS, EEG) to study experimental manipulations of cognitive control. We are also interested in how cognitive control mechanisms differ across individuals.

Project Details

Supervisor(s): Professor Evan Livesey
Contact: evan.livesey@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- Completion of first year psychology.
- Interest in cognitive psychology.
- Undergraduate major in Psychology/Neuroscience is helpful, but not necessary.

Student Preparation:
- Two initial meetings with the research team (approximately one hour each), date and time TBD.

Attendance Mode:
On Campus

Attendance Details:
Preference for 100% on campus, but can be flexible with a minimum of 60% on campus.

Location Details:
Badham Building (A16) and Griffith Taylor Building (A19)

Ethics Protocol Requirement:
Students(s) will be added to an existing ethics protocol which is already approved for human research by HREC. Student(s) will complete lab induction and any required training in the lab before recruitment/data collection from human participants.

PSYC08: Factors influencing the impact of propoganda

Project Subject Area: Psychology

Online propaganda appears to be having a strong impact on at least some people's political opinions and actions. We are looking at the psychological factors that influence the effectiveness of propaganda. Currently we are preparing a preliminary study which may be run in January/February in which case the student will run that as an online experiment. As well as this the student will be conducting a literature review of the psychology of propaganda.

Project Details

Supervisor(s): Dr Bruce Burns
Contact: bruce.burns@sydney.edu.au

Maximum number of places available: 1

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Effective use of library resources.

Student Preparation:
N/A

Attendance Mode:
Hybrid

Attendance Details:
90% online and 10% onsite

Location Details:
Griffith Taylor Building (A19)

Ethics Protocol Requirement:
The student will need to be added to the ethics protocol, which involves providing their unikey.

PSYC09: The development of thinking in childhood and adolescence

Project Subject Area: Psychology

This research investigates how thinking changes through childhood, adolescence and into adulthood. Students will gain experimental-psychology research skills, including experience in research design, measurement, and data-analysis. These skills are applicable to a wide range of future careers (anything that involves data and humans) both inside and outside the university.

Project Details

Supervisor(s): Associate Professor Micah Goldwater
Contact: micah.goldwater@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Experience working with children and comfortable talking with strangers (as the student will have to talk with families to recruit them for research).
- Ideally the student will also have abilities to use statistical software such as R, JASP, or Jamovi.

Student Preparation:
- Working with Children's Check is required
- Online university training modules concerning working with children
- General human research ethics online modules

Attendance Mode:
Onsite

Attendance Details:
60% onsite (locations TBD), 20% on campus, and 20% online.
Data collection for this project involves recruitment of families to join the research in public places such as parks, around Sydney (near campus or other locations that are convenient). In addition, we will have team meetings on campus to update. Some activities will be doable over zoom, but students must be available for onsite research throughout the summer period.

Location Details:
Onsite (locations TBD), Brennan MacCallum Building (A18) and online

Ethics Protocol Requirement:
The student will be added to the relevant ethics protocol.

PSYC10: Can a non-hallucinogenic 5-HT2A agonist improve cognitive flexibility? A rat reversal learning study

Project Subject Area: Psychology

Psychedelics show promise for treating psychiatric disorders, and one hypothesised mechanism is improved cognitive flexibility via 5-HT2A receptor-driven neuroplasticity. Our lab has shown psilocybin and other classic psychedelics improve cognitive flexibility in rats, measured using reward-based operant reversal learning. This project tests whether a clinically-used, non-hallucinogenic 5-HT2A agonist can reproduce that cognitive benefit without the hallucinogenic effects, which would support a non-hallucinogenic drug development pathway for psychiatric indications. The student will run the full behavioural pipeline: rat handling, operant training and testing, and data analysis, and will be educated in receptor pharmacology, neuroplasticity, prefrontal cortex function and psychedelic science. The project contributes to a broader planned publication and the student will work directly with PhD students, postdocs and the lab head.

Project Details

Supervisor(s): Dr Nicholas Everett
Contact: nicholas.everett@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- No formal assumed knowledge, no coding required.
- Some background in operant conditioning is expected.
- Genuine interest in psychopharmacology and psychiatric drug development, and an interest in psychedelic science and rodent behaviour is expected.
- Prior Python/R experience, or experience using generative AI tools for coding, is advantageous but not required.

Student Preparation:
- Lab induction and animal ethics/handling training, ideally completed in December so the student can begin data collection immediately in January. The lab will help coordinate this.

Attendance Mode:
On Campus

Attendance Details:
100% on campus

Location Details:
The Brain and Mind Centre (BMC), Level 4

Ethics Protocol Requirement:
Student will be added as a listed investigator on an AEC protocol prior to commencement, coordinated by the lab.

PSYC11: Evaluating Interactive Digital Tools to Reduce Online Gambling Harm

Project Subject Area: Psychology

This project is an evaluation of an interactive digital tool designed to build informed decision-making among online bettors. The tool draws on human-centred design and human-computer interaction principles, sitting at the intersection of psychology, behavioural science, and digital health. Students will gain hands-on experience across the full research process: literature review, research design, participant recruitment, and qualitative and quantitative data collection and analysis. You will work with an experienced research team at the University of Sydney's Gambling Research and Policy Unit and Brain and Mind Centre, contributing to research with direct implications for gambling policy and harm prevention in Australia.

Project Details

Supervisor(s): Professor Sally Gainsbury
Contact: sally.gainsbury@sydney.edu.au

Maximum number of places available: 7

Final Assessment: Project report (1-2 pages)

Assumed Knowledge:
- Undergraduate coursework in psychology or behavioural science
- Familiarity with quantitative and/or qualitative research methods
- Interest in applied research, human-centred design, human-computer interaction, coding, or data science

Desirable:
- Experience with data collection or analysis beyond core unit requirements
- Experience contributing to a research project, internship, or applied setting

Student Preparation:
- Pre-reading materials will be made available prior to the commencement of the program.

Attendance Mode:
Hybrid

Attendance Details:
60% onsite and 40% online

Location Details:
The Brain and Mind Centre (BMC)

Ethics Protocol Requirement:
Ethics protocols exist and will be in place

PSYC12: Sleep, eating and pharmacology: Using machine learning to understand sleep-wake behaviour

Project Subject Area: Neuroscience

Sleep and circadian rhythms interact closely with motivated behaviours such as eating, and medications that alter these behaviours may also have important effects on sleep and alertness. This project will use EEG/EMG recordings from preclinical feeding and pharmacology experiments to investigate how behavioural and pharmacological manipulations influence sleep-wake patterns and sleep propensity.

The student will gain hands-on experience in sleep neuroscience, including semi-automated, machine-learning-assisted sleep scoring, quality control and analysis of physiological data, and interpretation of findings in the context of behavioural neuroscience. They will also gain experience working within a research team and learn how experimental data are transformed into findings suitable for scientific presentation and publication.

Project Details

Supervisor(s): Dr Morgan James
Contact: morgan.james@sydney.edu.au

Maximum number of places available: 2

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- This project is suitable for students who have completed at least two years of undergraduate study in psychology, neuroscience, physiology, biomedical science, or a related discipline.
- A basic understanding of neuroscience, physiology, and/or experimental design would be beneficial.
- Familiarity with data analysis software (e.g., Excel, GraphPad Prism, R, or similar software) is advantageous but not required.
- No previous experience with EEG/EMG analysis, sleep scoring, or machine learning is required, as training will be provided.

Student Preparation:
- No substantial preparation is required prior to commencement of the January-February intensive.
- Students will receive training at the beginning of the project covering laboratory orientation, basic sleep physiology, EEG/EMG interpretation, and the use of Somnivore for semi-automated sleep-wake classification and quality control.
- Any required University or laboratory inductions will be completed before students undertake relevant project activities independently.

Attendance Mode:

Hybrid

Attendance Details:
70% on campus and 30% online
On-campus activities will include initial training in EEG/EMG analysis and sleep scoring, regular meetings with the research team, data analysis and interpretation, and participation in relevant laboratory activities and meetings. Once competency has been established, some sleep scoring, quality control and data processing may be completed independently and remotely, with regular supervision and opportunities to discuss ambiguous recordings or scoring decisions.

Location Details:
The Brain and Mind Centre (BMC), Level 7

Ethics Protocol Requirement:
N/A

PSYC13: Optimising Digital Homework Tools to Support Cognitive Behavioural Therapy Practice

Project Subject Area: Psychology

Psychologists may see clients for one hour each week, but much of the work of therapy occurs in the time between sessions. Currently, this period can be a blind spot: homework may be fragmented, clients receive limited structured support, and clinicians may begin the next session without a clear understanding of what was completed, what worked, or where difficulties arose. This project will explore how digital CBT homework tools, including AI-supported worksheets and reflective activities, can be designed to improve engagement, adherence, and the effectiveness of between-session therapeutic practice. Students will gain experience in digital mental health, evidence synthesis, psychological intervention design, and the responsible application of AI within clinician-led care.

Project Details

Supervisor(s): Professor Caroline Hunt and Mr William Swann (PhD Candidate)
Contact: william.swann@sydney.edu.au

Maximum number of places available: 3

Final Assessment: Project presentation (5-10 minutes)

Assumed Knowledge:
- A foundational understanding of the scientific method and basic psychological science is assumed.
- Familiarity with research methods, academic literature, and core concepts in psychology would be helpful, but no specific technical or programming skills are required.

Student Preparation:
Prior to the commencement of the program, students will attend an initial in-person meeting with Professor Caroline Hunt and Mr William Swann at the University of Sydney's Brain and Mind Centre. This meeting will include personal introductions, an overview of the project, and completion of relevant Brain and Mind Centre work health and safety (WHS) induction requirements.

Attendance Mode:
Hybrid

Attendance Details:
60% on campus and 40% online
On campus days will include supervision, collaborative project work, research discussions, and development activities, while online days will support independent research, literature review, and resource development. Some independent and unsupervised research activities will be undertaken, with regular supervision and

opportunities for consultation throughout the project - including students having daily consults with Mr Swann and weekly meetings with Professor Hunt.

Location Details:
The Brain and Mind Centre (BMC), Level 3

Ethics Protocol Requirement:
N/A

Contact

Faculty of Science, Education Operations

science.educationoperations@sydney.edu.au

CRICOS 00026A

THE UNIVERSITY OF SYDNEY