Faculty of Science ARC Postgraduate Research Scholarship May 2026

Current Projects

1. **Dr Kirsten Barnes - School of Psychology**

   Project title:
   Unravelling nocebo effects: the role of personal and social experiences

   Project summary:
   Did you know that simply watching another person experience pain can significantly increase your own experience of pain? An outstanding PhD candidate is being sought to join a newly-funded ARC project investigating the psychological mechanisms underlying the nocebo effect — the phenomenon whereby negative expectations trigger genuine adverse outcomes. Nocebo effects account for a substantial proportion of medication side effects, contribute to mass communicated illness, and undermine treatment adherence and vaccine uptake, yet the mechanisms distinguishing nocebo effects acquired through observing others from those acquired through direct experience remain poorly understood.

   The PhD candidate will contribute to the broader project, which uses an experimental pain-modulation paradigm to explore how social, attentional, and learning factors impact the nocebo effect. The candidate will work closely with the Brain and Behaviour Lab and Sydney Placebo Lab at the School of Psychology, with access to the recently renovated Pain Hub, housing EEG, TMS, VR, fNIRS, as well as psychophysiological, nociceptive (pathways, TSAs, cold pressor), and eye tracking equipment.

   The position would suit an enthusiastic individual with a strong background in experimental psychology, or a related discipline, keen to develop expertise in experimental methods and psychophysiological measurement.

   Required expertise: training in experimental psychology or related discipline, interest in working with pain stimuli, experience with lab-based testing, strong statistical skills.

   Desirable skills: experience with pain equipment, programming experience, experience with neurophysiological measures, an interest in placebo and nocebo effects or pain perception and modulation more broadly.

2. **Dr Nathan Cross - School of Psychology**

   Project title:

   Sleep-printing: unique sleep traits for predicting memory consolidation

   Project summary:

   This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Psychology, Faculty of Science, at the University of Sydney. The successful applicant will join a multidisciplinary research team investigating how individualised "brain fingerprints" during sleep predict memory formation and cognitive resilience across adulthood and ageing.

   The project combines wearable EEG, functional and structural MRI, computational modelling, and innovative behavioural paradigms to understand how sleep supports memory consolidation. The PhD candidate will contribute to cutting-edge research examining neural signatures of sleep–memory coupling, with opportunities to work across in-home sleep monitoring, multimodal neuroimaging, and advanced data analysis pipelines. This research has strong translational potential for promoting cognitive health and healthy ageing.

3. **Dr Joel Ong - School of Physics**

   Project title:
   Astrophysics of Rotational Twists

   Project summary:
   All stars rotate, but in some stars this happens with a twist: different layers may rotate around differently-oriented axes. The fact that this may be possible has, recently, been shown to significantly interfere with the techniques that we currently rely upon to measure the interior rotation of stars using asteroseismology (the analysis and interpretation of stellar oscillations). Moreover, the unusual geometry of the angular momentum in a star possessing multiple rotational axes may also have astrophysical consequences for the evolution and generation of internal magnetism and surface activity, which have never been studied seriously.

   In this project, you will investigate the astrophysical consequence of such rotational twists, through a combination of numerical experiments and observational data analysis, with the goal of understanding how the rotation and magnetism of rotationally twisted stars may differ from those in ordinarily-rotating ones. This will shed light on the physical mechanisms underlying the evolution of rotation and magnetism in stars more broadly, which remain not very well understood, but nonetheless underpin our general ability to predict the populations, properties, and final evolutionary fates of stars.

   This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Physics, Faculty of Science, at the University of Sydney.

4. **Prof. Manfred Lenzen and Dr Mengyu Li – School of Physics**

   Project title:
   Post-growth futures

   Project summary:
   This PhD project is situated within an ARC Discovery Project involving collaboration with University of New South Wales and Monash University. It investigates post-growth and alternative economic futures, focusing on how deep socio-economic transformations might unfold beyond conventional growth-centric paradigms.
   The project will employ a suite of modelling approaches—such as Integrated Assessment Modelling, multi-region input–output analysis, and representations of carbon–social interactions—to examine post-growth scenarios for Australia, with scope for global extensions. A particular emphasis is placed on non-technological drivers of change, including behavioural shifts, institutional reform, geopolitical realignment, and changing social norms. The research may explore how such drivers reshape energy demand, production systems, trade patterns, and emissions trajectories, and how they interact with technological transitions.

   Requirements:
   Applicants must demonstrate strong programming skills (e.g. MATLAB or Python) and an aptitude for systems-level thinking, including the design and linkage of different model classes. A background in economics, environmental modelling, systems science, or a related field is desirable. Applicants should have excellent analytical reasoning, strong English writing and communication skills, and an interest in post-growth, degrowth, or sustainability transitions literature. Initiative, intellectual curiosity, and the ability to work across disciplinary boundaries are essential.

   This project is open to both Master of Research and Doctor of Philosophy (PhD) candidates, with successful applicants commencing at the School of Physics, Faculty of Science, The University of Sydney.

5. **Prof. Manfred Lenzen and Dr Mengyu Li – School of Physics**

   Project title:
   Sustainability and resilience under climate stress

   Project summary:
   This project examines emerging patterns of economic fragility and failure in a warming world. Recent trends indicate that mean global temperatures are entering ranges that significantly affect crop yields and human habitability, particularly in the Global South. These pressures interact with existing vulnerabilities—such as weak institutions, inequality, demographic change, and geopolitical tension—to produce compound risks that challenge economic stability and social cohesion.
   The project will combine global, desktop-based analyses of failing or fragile economies with targeted field studies of communities under climate stress. Case-study applications may include China, Southeast Asia, and Pacific Island regions. Research themes may include climate-driven livelihood collapse, migration pressures, adaptive capacity, and the gendered and cultural dimensions of economic stress and resilience.

   Requirements:
   Applicants should demonstrate strong cultural and gender awareness, excellent English writing skills, and high-level conceptual and critical thinking ability. Quantitative skills such as programming, data processing, or modelling (e.g. MATLAB or Python) are highly desirable, alongside an openness to integrating qualitative and field-based insights. Experience or interest in development economics, climate impacts, political economy, or human geography will be advantageous. A proactive, independent research style and strong communication skills are essential.

   This project is open to both Master of Research and Doctor of Philosophy (PhD) candidates, with successful applicants commencing at the School of Physics, Faculty of Science, The University of Sydney.

6. **A.Prof Rongkun Zheng - School of Physics**

   Project title:
   Stabilising perovskite photovoltaics by (A,B)-site co-doping

   Project summary:
   This project aims to experimentally identify the optimal (A,B)-site co-doping recipe to achieve highly stable and efficient FAPbI3-based solar cells, leveraging on the team's recent discovery that (A,B)-site co-doping is effective in stabilising FAPbI3 and solving the instability of perovskite solar cells. Improving the long-term stability of perovskite solar cells is a major hurdle to commercialise perovskite solar cells and to minimise climate change. Expected outcomes are new knowledge on FAPbI3 phase transformation, A-/B-site mixed doping method and recipe, and more stable FAPbI3 and FAPbI3-based solar cells. These advances are expected to deliver substantial benefits to green-energy technologies, the environment, and the economy.

   This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Physics, Faculty of Science, at the University of Sydney.

7. **A.Prof Ting Rei - School of Physics**

   Project title:
   Engineering Light–Atom Interactions for Qudit Control in Trapped-Ion Quantum Computers

   Project summary:
   This project will develop experimental methods for precise control of qudits encoded in trapped-ion energy levels. By engineering tailored light–atom interactions, the student will design, implement, and benchmark laser-driven operations that access multi-level quantum states beyond conventional qubits. The work will combine optical control, pulse shaping, calibration protocols, and Hamiltonian engineering to realize robust qudit gates and state preparation. These tools will be applied to quantum information processing and analog/digital quantum simulation of chemically relevant systems, where higher-dimensional encodings can reduce resource overheads. The project offers training in trapped-ion experiments, quantum control theory, and programmable quantum computing hardware and measurement techniques.

   This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Physics, Faculty of Science, at the University of Sydney.

8. **Dr Michael Kertesz - School of Life and Environmental Sciences**

Project title:
Optimising hyphal fusion to build myco-materials

Project summary:
We are seeking a candidate to undertake an exciting PhD project in the field of fungal biology, focussing on the use of hyphal fusion processes to support the use of fungal mycelium as a sustainable fabrication material. This Australian Research Council-funded project forms part of a broader interdisciplinary research program working on myco-materials. The successful candidate will be an analytical, intellectually curious researcher with a background in biochemistry or molecular biology, preferably with experience working with basidiomycete fungi. They will work alongside experts in sustainable fabrication, the use of myco-materials, and circular design methods.
The project will investigate and optimise mycelial growth conditions that maximize the hyphal fusion processes required for bonding components of mycelial design components. This builds on our previous research on the growth of Ganoderma and Pleurotus mycelium (reishi and oyster mushrooms, respectively)[1], which has demonstrated that blocks of mycelium form strong bonds with each other under appropriate conditions, due to the process of hyphal fusion (anastomosis). The project will use a proteomics approach to investigate hyphal fusion process in Australian endemic isolates of Pleurotus ostreatus and Ganoderma steyaertanum, in collaboration with the Proteomics Core Facility at the University of Sydney. This aims to identify and characterise the key proteins involved in cell wall modification and hyphal remodelling during hyphal fusion in these species, and to compare these findings with existing data from the button mushroom (Agaricus bisporus)[2].
Insights from this work will support the development of novel methods and reagents for targeted stimulation of hyphal fusion within mycelium based design components. These innovations will enable applications such as self healing materials, structural bridging between components, and biologically driven gap filling processes.

This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Life and Environmental Sciences, Faculty of Science, at the University of Sydney.

9. **Dr Serafima Guseva - School of Life and Environmental Sciences**

   Project title:
   How DNA controls transcription factor activity

   Project summary:
   Gene expression is controlled by transcription factors, proteins that recognise short DNA sequences to activate or repress target genes. DNA is not a uniform helix, sequence affects its local structure and directly influences how transcription factors bind. Yet most research has focused on the protein side of this interaction, and the role of DNA remains poorly understood. Many fundamental questions remain open: how do transcription factors select specific binding sites from thousands of similar sequences across the genome? How does the same transcription factor activate different genes in different cell types? This project addresses these questions by combining bioinformatics, structural biology and cellular biology to determine how DNA structure and dynamics drive transcription factor activity and gene regulation.
   The position offers training in high-field NMR spectroscopy (including 800 MHz), X-ray crystallography, biophysical methods, and molecular biology. Candidates should hold (or expect to complete) a Master's or Honours degree in biophysics, biochemistry, chemistry or a related field. Experience with NMR or crystallography is advantageous but not essential.

   This Scholarship is funded by the Australian Research Council (ARC) and aims to support a PhD candidate undertaking research within the School of Life and Environmental Sciences, Faculty of Science, at the University of Sydney.

10. **A.Prof Ellis Patrick and Dr Shila Ghazanfar - School of Mathematics and Statistics**

    Project title:
    Statistical methods for the analysis of spatial omics technologies

    Project summary:
    We invite applications for a fully funded PhD position to join an ARC-funded project developing statistical and computational methods for the analysis of emerging spatial omics technologies. These technologies map the molecular profiles of individual cells directly within tissue, revealing how cells organise, communicate and change in health and disease. As datasets become increasingly large and complex, there is a growing need for rigorous statistical approaches that can meaningfully characterise the structure of these cellular environments.
    This project will focus on creating new analytical frameworks that help researchers interpret complex spatial relationships between many types of cells, compare these patterns across heterogeneous tissues, and understand how upstream processing decisions influence biological conclusions. All methods will be released as open-source software to support widespread adoption in biology, medicine and data science.
    The PhD candidate will be jointly supervised by Dr Shila Ghazanfar and A/Prof Ellis Patrick and will join an active research environment spanning statistics, bioinformatics and biomedical collaboration. The School of Mathematics and Statistics and the Sydney Precision Data Science Centre offer strong mentoring, regular training activities and opportunities to connect with leading researchers in spatial omics.
    This scholarship is ideal for candidates with a background in statistics, data science, computer science or bioinformatics.

11. Dr Linh Nghiem - School of Mathematics and Statistics

Project title:
Statistical methodologies for complex data settings

Project summary:
We are seeking up to two PhD students to join our team in developing new theory, methods, and applications of statistical dimension reduction for data with complex structures, including but not limited to, multi-way clustered, spatial-temporal, and network dependence. The student will be undertaking research in connection with the Australian Research Council Discovery Project (DP260100579), addressing important challenges of distilling high-dimensional regression and classification relationships, with little to no loss of information, into results readily understood by domain experts.

The supervision team will include Dr Linh Nghiem, Dr Shila Ghazanfar, A/Prof Rachel Wang (all from the School of Mathematics and Statistics, University of Sydney), and A/Prof Francis Hui from the Australian National University.

Requirements:

- Minimum USyd requirements for all PhD candidates, typically by completing an undergraduate Honours or Master's degree with a research component of at least 25% in the final year of study.
- Pre-requisite courses:
  - Calculus-based probability (equivalent to USyd STAT2x11), introductory statistical inference (equivalent to STAT3x23)
  - At least two courses in applied statistics or relevant, e.g., linear models, statistical/machine learning, deep learning, correlated data analysis
- Familiar with R and/or Python, Latex, and GitHub

Desirable: A (mathematical) real analysis course (measure theory is optional).

12. Dr Caroline Wormell - School of Mathematics and Statistics

Project title:
Quantifying the error of pattern-finding algorithms in dynamical systems

Project summary:
There are many interesting dynamical systems whose laws of evolution we have limited information about, from economies, climate systems, power grids, and fluid flow. We would like to predict these systems' future and identify unexpected patterns in their behaviour, but we may only have a limited amount of observations to work with. Various tools exist to facilitate this: most of these involve approximating these systems' Koopman operator. The Koopman operator is a linear operator on functions that encodes composition by the dynamics: the key to studying many dynamical systems is in its eigenvalues and eigenfunctions. In many chaotic systems, such as turbulent fluids, the stability of the approximated Koopman operator can be highly variable depending on what is being measured. This makes error quantification very important in applications.

This project will develop mathematically rigorous tools to estimate the error of Koopman operator eigenvalues and eigenvectors obtained from data, by generalising a notion known as the sampling pseudospectrum. We will begin by studying a kernel-based algorithm known as kernel Extended Dynamical Mode Decomposition. This will involve applying, and where needed developing, rigorous approximation theory and probability theory in the context of dynamical systems. A strong mathematical background with at least one of functional analysis or probability theory would be desirable.

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