2017/18 UQ Summer Research Scholarship Program

Research Projects offered by Faculty of Science Schools

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How to apply

The UQ Summer Research Scholarship Program is offered by a number of schools in the Faculty of Science during the summer vacation period (mid-November to mid-February). This document provides you with a list of available projects.

1) Browse the projects. You may select a school from the table of contents above to be taken directly to their listed research projects.

2) Contact a potential supervisor in the area of your interest, or the contact person listed, to discuss your interest to undertake their research project. Gain the research project supervisor’s tentative approval, and include this with your full UQ Summer Research Scholarship application.

3) Submit your application via StudentHub
School of Agriculture & Food Science

For a list of research opportunities that are available within SAFS in 2017/2018, please visit the School webpage and search within the applicable discipline: https://agriculture.uq.edu.au/research/projects
### School of Biological Science

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Prof Myron Zalucki</th>
<th>Duration: 8 weeks (27 Nov – 22 Dec 2016; 9 Jan – 2 Feb 2017)</th>
</tr>
</thead>
</table>
| **Contact Details:** | Telephone - +61 7 336 51747  
Email – m.zalucki@uq.edu.au |                                                               |

**The ecology of Ochrogaster lunifer nest-forming processionary caterpillars**

*Ochrogaster lunifer* caterpillars are hairy and a health hazard to humans and animals. The female moths lay egg batches on host trees from late October, and the caterpillars live gregariously in silken nests until mature the following autumn. Little is known of the ecology of a trunk-nesting form of this species, and this will be the focus of intensive ecological research next spring to autumn as part of a larger ARC Linkage project.

This project will involve 1 day per week fieldwork at UQ Gatton campus locating egg masses and nests, collecting specimens and recording data on nests and host trees. Another 1 day per week will be lab work processing specimens etc. in the Goddard Building, UQ St Lucia.

**Expected outcomes** - The student(s) will be trained in field techniques & record keeping of ecological data. Lab work will involve light microscopy and possibly electron microscopy with appropriate training and supervision provided. The student(s) if enrolled in SCIE3241 will produce a comprehensive report including a short literature review and qualitative & quantitative data on egg masses, nests, caterpillar instars, host trees, predators & parasites of caterpillars etc.

**Suitable for** - Two students required. An interest in the biology of insects is essential.

**Other important details** - Students(s) must be available for each of the 8 weeks listed above, and be available for 2 working days per week. Strict OH&S policies are in place and must be followed as these egg masses and caterpillars have irritating scales and hairs.

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Karyn Johnson</th>
<th>Duration: 6-8 weeks (mid-November to mid-February)</th>
</tr>
</thead>
</table>
| **Contact Details:** | Telephone - +61 7 336 51358  
Email – karynj@uq.edu.au |                                                   |

**The impact of miRNA on virus infection in Drosophila**

A library of miRNA knock out flies will be screened for susceptibility to virus infection.

**Other important details** – Commencement is mid November.

Available project placements – two (2)
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Milos Tanurdzic</th>
<th>Duration: 8 weeks (mid-November to mid-February)</th>
</tr>
</thead>
</table>
| **Contact Details:** | Telephone - +61 7 336 52491  
Email – m.tanurdzic@uq.edu.au | |
| **In vivo expression of plant transcription factors** | | |
| Several transcription factors from wheat will be cloned into inducible plant expression vectors and transfected into plant protoplasts. Direct gene targets of the transcription factors will be determined through FACS sorting of protoplasts and RNA sequencing. | | |
| **Other important details** – Commencement is 4 December | | |

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>A/Prof Lyn Cook</th>
<th>Duration: 8 weeks (mid-November to mid-February)</th>
</tr>
</thead>
</table>
| **Contact Details:** | Telephone - +61 7 336 52070  
Email – l.cook@uq.edu.au | |
| **Birds and bees: what difference does pollinator make to endangered pea flowers in a biodiversity hotspot** | | |
| This study will use the "poison" peas of the Stirling Range of SW Western Australia to study the effect of pollinator on distribution and reproductive success. There are a mix of red-flowered bird-pollinated species and yellow-flowered bee-pollinated species across the mountain peaks, several of which are endangered. The project will develop skills in analysing genetic data and trait data (flower morphology). | | |
| **Other important details** – Commencement is early December | | |

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>A/Prof Lyn Cook</th>
<th>Duration: 6-8 weeks (mid-November to mid-February)</th>
</tr>
</thead>
</table>
| **Contact Details:** | Telephone - +61 7 336 52070  
Email – l.cook@uq.edu.au | |
| **Can venoms differentiate species of Australian tarantulas?** | | |
| Australian tarantulas are not very well known taxonomically and morphology is not always reliable at differentiating species. There is a need to be able to assign a specimen to a species without damaging it, and venom profiles are a novel way of potentially doing this. The project will mostly involve computer analysis of venom and phylogenetic data from Australian tarantulas to test where the venoms are reliable identifiers of the spiders. | | |
| **Other important details** – Commencement is early December | | |
Effect of sand type and soil microorganisms on incubation success of sea turtle eggs.

This project will be based at Mon Repos Conservation Park, a sea turtle rookery near Bundaberg, South east Queensland, and the student will need to camp at the research facility for the duration of the project 6-8 weeks.

The project will involve using sand from three different sea turtle nesting areas, Mon Repos (silica based sand), Heron Island (coral rubble based sand) and Raine Island (foram based sand), and two sand treatments (sterilized sand, unsterilized sand) across three incubation temperatures, 27°C, 29°C, 32°C to incubate sea turtle eggs (green, loggerhead and flatback) to investigate how each of these treatments affects embryonic development and survival throughout incubation.

Other important details – For further details contact David Booth, email: d.booth@uq.edu.au
## School of Chemistry & Molecular Bioscience

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Prof Stephen Barker</th>
<th>Duration: 6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>There is no requirement to contact Prof Barker prior to submitting your application. Please reference this instruction within your application.</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental niche-modelling and zoogeography of some Australasian ticks that may transmit diseases-causing bacteria to vertebrates</strong></td>
<td></td>
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<tr>
<td><strong>Aims:</strong></td>
<td>To discover the climatic requirements (environmental niche) of some ticks; and their geographic-distributions and host-distributions.</td>
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<tr>
<td><strong>Methods:</strong></td>
<td>computer work (Microsoft Excel) and environmental niche modelling (various programs).</td>
<td></td>
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<tr>
<td><strong>Expected outcomes</strong></td>
<td>Scholars will gain skills in data collection, handling and analysis, critical-thinking, through one-on-one interaction with Professor Barker.</td>
<td></td>
</tr>
<tr>
<td><strong>Suitable for</strong></td>
<td>This project suits someone with sound computer skills and an interest in arthropod-vectors of disease, climate and maps.</td>
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<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Prof Istvan Toth</th>
<th>Duration: 8-10 weeks</th>
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</thead>
<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>For further details please contact Mariusz Skwarczynski PhD, Editor-in-Chief: Biochemical Compounds, Chemistry Building (No. 68, room 1119), Cooper Road School of Chemistry and Molecular Biosciences  Telephone - (office) +61 7 3346 9894, (lab) +61 7 3346 9891, (mobile) 0405 519 240  E-mail - <a href="mailto:m.skwarczynski@uq.edu.au">m.skwarczynski@uq.edu.au</a></td>
<td></td>
</tr>
<tr>
<td><strong>Development of peptide-based vaccine against Group A streptococcus</strong></td>
<td></td>
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<tr>
<td><strong>Group A streptococcus (GAS) is one of the most common and widespread human pathogens and can result in a range of acute to life threatening diseases. The inability to control GAS infections in developing countries and rural communities (e.g. Aboriginal) with antibiotics has promoted interest into development of vaccine. One of the most favourable strategies for development of such vaccine is the use of peptide derived from GAS virulent factor M-protein. Thus, B-cell and T-helper peptide epitope will be synthesized and incorporated into vaccine delivery system.</strong></td>
<td></td>
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<tr>
<td><strong>Expected outcomes</strong></td>
<td>Scholars will gain skills in peptide synthesis using microwave, purification and characterization with the help of HPLC and ESI-MS.  Students may also have opportunity to incorporate the produced antigens into nano-sized delivery system and characterize it using dynamic light scattering.</td>
<td></td>
</tr>
<tr>
<td><strong>Suitable for</strong></td>
<td>This project is open to applications from students with a background in chemistry (preferably), or biotechnology, or nanotechnology, 3-4 year students.</td>
<td></td>
</tr>
</tbody>
</table>

*Faculty of Science Summer Research Project Listing 2017/2018*

*Last updated 29 August 2017*
**Development of targeted nanocarrier delivery system for gene delivery**

Antisense gene therapy is a technology that uses molecules for treatment of neoplastic diseases. The molecules that are used include antisense oligonucleotides (asODNs) which are short nucleotides. AsODNs act by either activating RNase H or Hybridizing to mRNA and blocking its access to ribosome. Also asODNs can distort DNA transcription. AsODNs are not stable if it is injected directly. Therefore modification works needs to be done. Liposomes are artificial lipid-based vesicles consisted of mono- or bi- lipid layers, which can be used to transport asODNs into the cell.

Chemical coupling of antibodies to the liposomes are needed to make transport more specific. The general objective of this project is to construct and characterize an appropriate nanocarrier (micelle/liposomal based delivery system) in which siRNA can be complexed. In addition to improve the siRNA delivery to specific organs or cells such as the uterus and thyroid glands through the attachment of peptide, antibody or other ligands to the delivery system in order to increase the uptake of the liposomes, deliver the encapsulated siRNA to specific site in the body and increase its release into the cytoplasm.

**Expected outcomes** - During this summer project, student will acquire a number of skills related to drug delivery, organic synthesis, how to use the HPLC, mass spec, NMR, Zeta sizer, also will get good experience in cell culture and how to use Flowcytometry.

**Suitable for** - This project is open to applications from students with a background in chemistry (preferably), or biotechnology, or nanotechnology.

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**Computer simulations of potential new drugs**

This project will use sophisticated computer simulations to study how certain types of drugs interact with biological molecules. The aim of the project is to understand what controls how a drug molecule binds to its intended target in the body, and how to tailor the drug molecule for optimal activity. These insights will help in the design of new anti-cancer drug leads.

**Expected outcomes** - Scholars will gain skills in computer-based molecular modelling. They will use high-performance supercomputer technology to perform quantum chemistry simulations and will learn how these types of simulations can be applied to drug design as well as many other areas of chemistry. Students may be asked to produce a short written report at the end of their project.
**Suitable for** - This project is open to applications from UQ enrolled students at who have studied organic chemistry at 2nd and/or 3rd year level and have an interest in biological, organic, and/or theoretical chemistry.

**Other important details** - Interested students are encouraged to email Dr Elizabeth Krenske (e.krenske@uq.edu.au) to discuss the project.

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**Supervisor** | Prof Mary Garson | **Duration:** 6 weeks
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**Contact Details:** Email – m.garson@uq.edu.au  
Telephone - +61 7 336 53605

**Marine Natural Products**
The project will isolate terpene metabolites from individual marine mollusc samples, and characterise the metabolites using high field NMR studies.

**Expected outcomes** - Students will gain skills in chromatography and in handling small quantities of samples; students will gain experience in keeping laboratory records and in management of spectroscopic data

**Suitable for** - This project is open to applications from UQ-enrolled students who have completed CHEM2050, CHEM2052 or CHEM2054.

**Other important details** - Students should contact Professor Garson prior to submitting an application.

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**Supervisor** | Dr Rachel Stephenson & Prof Istvan Toth | **Duration:** 8-10 weeks
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**Contact Details:** Email – r.stephenson@uq.edu.au  
Telephone - +61 7 334 69893

**Building a novel system for peptide delivery**
Vaccination is one of the most effective public health strategies ever undertaken. Instead of whole killed pathogens, next generation vaccines use pathogen derived peptides, allowing fine control when tailoring the vaccine. This project aims to build a new multi-component self-adjuvanting cyclic carrier system for the delivery of Group A Streptococcus (GAS) antigens.

**Expected outcomes** - This project involves the chemical synthesis of peptide building blocks using solid phase peptide synthesis. Purification and characterization will be done using HPLC and mass spectrometry. Physicochemical analysis of the peptides will be performed using dynamic light scattering and TEM. This work will underpin future publications in this field. Students will also learn how to present their work in Group Meetings using PowerPoint presentations.
**Suitable for** - The project is open to applications from students with a background in chemistry (preferred), nanotechnology or biotechnology, preferably in their 3rd or 4th year. Multiple projects are available in this area.

**Other important details** - For further details please contact:
Dr Rachel Stephenson, School of Chemistry and Molecular Biosciences
http://researchers.uq.edu.au/researcher/2920

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Jack Clegg</th>
<th>Duration: 6 weeks</th>
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</thead>
<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:j.clegg@uq.edu.au">j.clegg@uq.edu.au</a></td>
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**Trapping Guest Molecules in Metal-Organic Frameworks**

Metal-Organic Frameworks are a class of polymeric hybrid material formed from organic and metallic components. These materials have large surface areas and high porosity and are finding application in gas sequestration and separation technologies. Accordingly it is possible to trap a large variety of guest molecules inside them.

**Expected outcomes** - In this project you will investigate the binding of different solvent molecules inside one of these frameworks to explore selectivity and potential separation applications. This project will require some synthetic laboratory work.

**Suitable for** - UQ enrolled students only who have completed CHEM2054 as a minimum.

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Jack Clegg</th>
<th>Duration: 6 weeks</th>
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</thead>
<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:j.clegg@uq.edu.au">j.clegg@uq.edu.au</a></td>
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</table>

**New components for the synthesis of metal-organic frameworks**

Metal-Organic Frameworks are a class of polymeric material formed from organic and metallic components. This project will explore new ways to form these materials following an innovative hierarchical self-assembly methodology.

**Expected outcomes** - A new organic component will be designed and prepared before its interactions with a variety of metal ions will be investigated. This project will require some synthetic laboratory work.

**Suitable for** - UQ enrolled students only who have completed CHEM2054 as a minimum.
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>A/Prof Joe Rothnagel</th>
<th>Duration: 6-8 weeks</th>
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</thead>
<tbody>
<tr>
<td>Contact Details:</td>
<td>Email – <a href="mailto:j.rothnagel@uq.edu.au">j.rothnagel@uq.edu.au</a></td>
<td>Telephone - +61 7 336 54629</td>
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</table>

**Characterisation of peptides encoded by short open reading frames**

Short peptides (sPEPs) that are encoded by short Open Reading Frames (sORFs) are surprisingly common in eukaryote genomes. Recently, a mutation in a sPEP has been associated with a genetic disorder. Recent bioinformatic and ribosomal footprinting studies have identified several thousand sORFs with coding potential and several sPEPs have been identified by mass spectrometry. However, their role in cellular functions remains to be determined. You will identify and characterize sPEPs using bioinformatic tools, proteomics (mass spec) and cell biology. You will help to determine the contribution of sPEPs to the human proteome, and provide insights into their roles. This project will involve analysing raw proteomic (mass spec) data.

**Expected outcomes** - Students will gain skills in mass spec data collection and its analysis. Students may also be asked to produce a report or oral presentation at the end of their project.


**Suitable for** - Students with an interest in biochemistry, molecular biology cell biology and/or bioinformatics.

**Other important details** - Bioinformatics, computational and program skills are beneficial in order to get the most from this project. Start and end dates are negotiable.

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<table>
<thead>
<tr>
<th>Supervisor</th>
<th>A/Prof Mikael Boden</th>
<th>Duration: 8-10 weeks</th>
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<tbody>
<tr>
<td>Contact Details:</td>
<td>Email – <a href="mailto:m.boden@uq.edu.au">m.boden@uq.edu.au</a></td>
<td>Telephone - +61 7 336 51307</td>
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</table>

**Data integration and visualisation of biological data**

Biological data are available in many forms and at scales that challenge our ability to interpret them. This project aims to understand how to represent and visualize a mix of biological data to make it possible for scientists to browse and inspect them jointly, making meaningful relationships between items that come from difference data sources. This project aims to implement and evaluate an interface for displaying biological sequence data as graphs; by allowing a user to zoom in and out of biological detail (akin to Google Maps). New applications to inspect evolutionary relationships between large DNA and protein sequences are envisaged.

**Expected outcomes** - Scholars will gain experience from working in a research project (funded by the ARC). The scholar will contribute towards an existing software suite that run on a compute server, and is presented to end-users through a web interface.

Skills obtained in the project: Bioinformatics, software development, phylogenetics.
**Suitable for** - Computer engineer with bioinformatics expertise; programming skills in Javascript or similar languages.

**Other important details** - Please see [http://bioinf.scmb.uq.edu.au/research](http://bioinf.scmb.uq.edu.au/research) for more on the research group. Contact the supervisor prior to applying.

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Cheryl-lynn Ong &amp; Alastair McEwan</th>
<th>Duration: 6-8 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:y.ong@uq.edu.au">y.ong@uq.edu.au</a></td>
<td>Telephone - +61 7 336 51892</td>
</tr>
</tbody>
</table>

**The importance of biofilm formation in middle ear infections**

Background: Middle ear infections (otitis media) is a major disease in children under 5 years old, and results in over US$3 Billion in healthcare cost in the USA alone annually. Streptococcus pneumoniae is the leading cause of otitis media, and despite the availability of antibiotics, it is still an immense problem. The ability to form biofilms is critical for initial colonisation of the middle ear. Furthermore, cells within the biofilm are protected from antimicrobials and antibiotics. As a result, this disease can be difficult to treat resulting in recurrent infections in an individual.

Aim: The main aim is to understand the pathogenesis of Streptococcus pneumoniae in otitis media and to trial alternative, non-antibiotic therapies to treat this infection.

Approach: The laboratory has access to a collection of clinical isolates, and the first step is to test the biofilm ability of the different strains. Once the biofilm ability has been established, different metal compounds will be used in the assay to test their ability to abolish the biofilm.

**Expected outcomes** - Students will gain skills in microbiology, molecular biology and how to work with pathogenic bacteria. They will also gain an understanding of disease pathogenesis and understand the importance of infection control. Students will be asked to produce a report and a short oral presentation at the end of their project.

**Suitable for** - This project is open to 3rd or 4th year UQ students with a background in Microbiology and some Biochemistry.

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<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Christian Rinke</th>
<th>Duration: 8-10 weeks</th>
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<tbody>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:c.rinke@uq.edu.au">c.rinke@uq.edu.au</a></td>
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</table>

**The superworm symbiosis: a potential solution for polystyrene recycling**

Plastics are used in many everyday products. However the durability of plastics results in negative environmental impacts, for example nearly 269,000 tons of plastic debris are floating in our oceans. Polystyrene (incl. styrofoam) is among the four most common polymers, and recently the common mealworm (*Tenebrio molitor*) has been shown to be able to biodegrade polystyrene.
The aim of this project is to investigate the polystyrene degrading properties of the superworm (*Zophobas morio*), the larva of a darkling beetle, which is larger and faster growing than the common mealworm. In particular, the project will evaluate the microbial community in the worm’s gut, using the state-of-the-art culture independent technique of metagenomics. The microbial community structure will be assessed, followed by genomic and metabolic reconstruction, with the goal to identify key microbes responsible for polystyrene degradation and the genes encoding the main enzymatic pathways involved.

The anatomic description of the superworm host and its digestive tract will be undertaken via Scanning Electron Microscopy (SEM).

**Expected outcomes** - Scholars will gain skills in bioinformatics, including microbial community structure assessments, metagenome assemblies, binning of population genomes, and statistical data analysis. A report and an oral presentation at the end of the project are mandatory.

**Suitable for** - This project is open to applications from students with a general interest in microbial ecology. A background in bioinformatics is preferred. A commitment of at least 8 weeks with a minimum of 20-30 hours per week is required for this project.

**Further Information** - For further info about this and similar projects please contact me directly via email: c.rinke@uq.edu.au with the subject “superworm symbiosis”.

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**Supervisor**  | Dr Mária Džunková  | Duration: 10 weeks
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**Contact Details:** | Email – m.dzunkova@uq.edu.au |

*Bacteriophage induction in human gut bacteria*

The human gut is inhabited not only by millions of bacteria, but also by millions of viruses that infect bacteria. These viruses are called bacteriophages. The lytic phages destroy the bacterial cell during infection, while the lysogenic phages enter to the bacterial cell and get integrated into the bacterial genome as prophages. In certain environmental conditions a dormant prophage can be spontaneously released from the bacterial genome and go to its vegetative life cycle aiming to infect other bacteria.

A bacterium containing a prophage may be a potential source of phages in the future. These phages may be released from the bacterial cell and attack other bacteria changing bacterial species composition of the gut.

The human body gets into a contact with novel bacterial strains every day. It means we are exposed also to novel bacteriophages and prophages. An extreme example of getting a completely new set of bacterial species and phages is a faecal microbiome transplant which is a new emerging intestinal disease treatment. A fecal preparation from a healthy stool donor is transplanted into the colon of a patient. The faecal sample is carefully screened for known disease causing agents, but is usually not screened for the presence of bacteriophages that may modify the gut microbiome structure of the patient.

The sequences of prophages can be mined in the bacterial genomes by computational methods. However, the detection of such a prophage in the bacterial genome does not necessarily mean that this particular prophage can be easily released from the bacterial genome and commence its vegetative life style.

The release of prophages from the culturable bacteria can be stimulated in the laboratory by chemical agents (so called phage induction). However, the majority of human gut bacteria require special growth conditions, so it is nearly impossible to culture them in the laboratory.
In the proposed project, we want to explore whether it is possible to use the chemical agent to induce a collection of prophages from human gut bacteria without the bacterial culture. Bacteria from faeces will be treated by phage induction agents. After the incubation, the viruses present in the reaction buffer will be collected. Presence of phages will be confirmed by transmission electron microscopy. Afterwards, their DNA will be extracted using an optimized protocol for samples containing very small amounts of DNA. The DNA will be sequenced on a next generation sequencing platform. The presence of the phages will be assessed by bioinformatic analysis of the obtained sequences. In addition, DNA of the phages collected directly from the faeces (without any phage induction) will be sequenced.

The sequences of the phages detected after the phage induction will be compared with the phages obtained directly from faeces and they will be compared also with the sequences of prophages found previously in the bacterial genomes (already sequenced by our laboratory). The expected outcome is that the induced phages will be more similar to prophages found in the bacterial genomes. The result will be the list of prophages that are very likely to be induced in changed environmental conditions.

**Expected outcomes** - The applicant will gain both laboratory and bioinformatics skills. The applicant will learn: phage induction, purification of viruses, DNA extraction, DNA sequence assembly, viral detection in metagenomic sequences, basics of bash command language.

The results of this summer project will be possibly included in a larger scientific publication.

The applicant may prepare a short presentation about the performed work for our research group.

**Suitable for** - The applicant should have good background in microbiology and molecular genetics and should be keen to do some simple bioinformatics analysis.

**Further Information** - For more information about the project, the applicants can contact Dr Mária Džunková by email m.dzunkova@uq.edu.au

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**The development and validation of the Automated Topology Builder (ATB).**

The ATB is a web based molecular topology builder and repository used by 1000’s of researchers involved in the refinement of protein structures as well as materials and computational drug design. The site currently contains parameters for over 130,000 compounds (see: https://atb.uq.edu.au). The project is to be part of a team focused on improving the reliability of the parameters generated.

**Expected outcomes** - You will assist the project by either validating the parameters for a range of compounds by calculating their free energy of solvation in different environments or by helping to further develop the algorithms and code underlying the ATB web site.

**Suitable for** - The project would be suitable for a person with a background in physical chemistry, medicinal chemistry, programing or (bio)informatics. Knowledge of python would be an advantage.
**Using computer simulations to understand how bacteria adapt to disinfectants at an atomic level.**

Many of the disinfectants used in hospitals and around the home kill bacteria by disrupting their outer membranes. Some bacteria are adapting to the widespread use of disinfectants by changing the nature of their cell membranes. The aim of the project is to understand how different disinfectants disrupt membranes and how changes in the lipid composition of the cell membranes allow bacteria to survive.

**Expected outcomes** - The project will involve the use of molecular dynamics simulation techniques to model the interaction of different disinfectants with membranes containing different lipids. The aim will be to determine how the disinfectants interact with lipids from sensitive as well as resistant bacteria.

**Suitable for** - Students should have an interest in using computational approaches to solve biomedical problems with some a background in chemistry, biochemistry or biophysics. Experience with Linux based systems is an advantage.
Microbial communities and bore water quality parameters on North Stradbroke island

North Stradbroke Island is a large sand island off the coast of Brisbane with a high annual rainfall (>1500mm), and significant groundwater resources. The water is accessed by local communities, mining companies, and exported to the mainland via a supply pipeline.

North Stradbroke Island is the second largest sand island in the world.

The aim of this project is to investigate the microbial community of the aquifer system on Stradbroke island in relation to water quality parameters. In particular, samples of four bores with different depths will be analysed.

The microbial community structure will be assessed via metagenomics, and the metabolic potential of the community will be analysed by a gene centric approach.

**Expected outcomes** - Scholars will gain skills in bioinformatics, including microbial community structure assessments, metagenome assemblies, binning of population genomes, and statistical data analysis.

A report and an oral presentation at the end of the project are mandatory.

**Suitable for** - This project is open to applications from students with a general interest in microbial ecology. A background in bioinformatics is preferred. A commitment of at least 8 weeks with a minimum of 20-30 hours per week is required for this project.

**Further Information** - For further info about this and similar projects, please contact me directly via email: c.rinke@uq.edu.au with the subject “Straddie groundwater”.

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**Supervisor**
Dr Christian Rinke

**Contact Details:**
Email – c.rinke@uq.edu.au
Telephone - +61 7 336 54957
http://researchers.uq.edu.au/researcher/11449

Duration: 8-10 weeks
Analysis of single-cell sequencing data

The expression of genes can now be quantified for individual cells using single-cell sequencing technology. This enables the separation of cells appearing at different developmental stages; this process depends on significant bioinformatics analyses. This project will analyse a single-cell RNA-seq data set collected for developing cardiac tissue in collaboration with the Palpant lab in the IMB.

Expected outcomes - Scholars will gain experience from working in a research project. The scholar will contribute towards existing efforts to understand determinants of cardiac development.

Skills obtained in the project: Bioinformatics, software development, experience in using single-cell sequencing

Suitable for - Computational scientist with bioinformatics expertise; programming skills

Further Information - Please see http://bioinf.scmb.uq.edu.au/research for more on the research group.
Contact the supervisor prior to applying.

Replication efficiency of Australian insect-specific flaviviruses in mosquito cells infected with Wolbachia

The project involves assessing the ability of novel mosquito-borne viruses to replicate in mosquito cell lines persistently infected with the bacterial symbiont Wolbachia. This will enhance our knowledge of the spectrum of viruses inhibited by Wolbachia in mosquitoes and may identify novel commensal viruses of mosquitoes that are resistant to the antiviral effects of Wolbachia infection.

Expected outcomes - The student will learn the basic skills of cell and virus culture and viral and bacterial detection and quantitation techniques (ELISA, IFA, Western blot, PCR, real-time PCR). The student will also learn the basics of good lab reporting and record keeping, attending and presenting at lab meetings, and operating as a team in performing specific tasks for lab maintenance.

Suitable for - A solid background in cell biology and microbiology would be desirable.
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<tr>
<th>Supervisor</th>
<th>Prof Craig Williams</th>
<th>Duration: 8-10 weeks</th>
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**Organic Synthesis and Method Development**

The project is aimed at giving the student exposure to advanced organic chemistry pertaining to sophisticated organic synthesis.

**Expected outcomes** - The student will gain advanced skills and training in high level organic chemistry.

**Suitable for** - Prospective students must have completed CHEM3001.

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<th>Supervisor</th>
<th>Dr Nick West</th>
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**Characterisation of candidate anti-TB compounds**

Tuberculosis is the leading cause of death globally due to an infectious agent, killing approx. 2 million people year. *Mycobacterium tuberculosis*, the bacterium responsible, currently infects over 2 billion people across the globe and although most cases will respond to standard antibiotic therapy, drug resistant strains are on the rise. **New antibiotics for TB are urgently needed.**

Our laboratory has identified a series of experimental compounds that inhibit the growth of *Mycobacterium smegmatis*, a species related to *M. tuberculosis*. The student will characterise these compounds in terms of standard inhibition characteristics, cytotoxicity, potency in hypoxic conditions and also capacity to inhibit intracellular mycobacteria. The potency of selected compounds will also be tested against *M. tuberculosis* and other key (non-mycobacterial) bacterial pathogens.

**Expected outcomes** - The student will gain advanced skills and training in microbiology and pharmacological principles of antimicrobial development. Techniques learned also include mammalian cell culture and infection, manipulation.

**Suitable for** - A student with a solid background in microbiology and cell biology and those with an interest in development of the next generation antibiotics.
Carbohydrate metabolism in thawing permafrost

Polar regions of the planet are experiencing the greatest temperature rise resulting from global warming. As a consequence, permafrost in these regions is thawing, making available ~1300 Pg of carbon for microbial degradation and further greenhouse gas release. One of the key challenges to developing accurate climate models is understanding the composition of this microbially-generated greenhouse gas. This requires characterisation of the microorganisms found in thawing permafrost environments using tools such as metagenomics, or whole environmental community genomics.

Thawing permafrost at Abisko National Park, Sweden

The successful applicant will work as part of our current research team to identify and assess specifically carbohydrate energy pathways found in lab permafrost degradation experiments. The student will learn state of the art methods for metagenome assembly and assessment, as well as lab techniques for DNA extraction from environmental samples.

Expected outcomes - The student will develop a description of the degradation pathways of key carbohydrates found in the lab permafrost degradation experiments. This will include key pathway products and assessing any changes in the pathways as the permafrost degradation progresses.

A report and oral presentation will be given at the conclusion of the project.

Suitable for - This project is open to 2-4 year UQ students

Further information - Please contact Prof Tyson (g.tyson@uq.edu.au), Dr Woodcroft (b.woodcroft@uq.edu.au), or Dr Hoelzle (r.hoelzle@uq.edu.au) prior to application.
Investigating the microbial symbionts of Acropora tenuis through metagenomics sequencing

Reef building corals are made up of a complex assemblage of organisms, including the coral animal, *Symbiodinium* algae, bacteria, and archaea. The interdependence between coral and its microbial symbionts is so strong that a disturbance in these partnerships can lead to coral sickness or death. The most dramatic and well-known example of this is the ejection of *Symbiodinium* algae due to heat stress during the summer months—i.e. coral bleaching. Corals that stay bleached for too long inevitably die.

While the relationship between *Symbiodinium* and coral is well studied, the relationship between coral and its bacterial and archaeal partners is poorly understood because previous studies of the prokaryotic component of the coral metaorganism relied on specific marker genes (e.g. the 16S rRNA gene) that could identify the microorganisms present but could not speak to their function within the coral. The Discovery Project aims to sample two coral species (Acropora tenuis and Pachyserus speciosa) at Orpheus Island four times per year for two years. Samples will be subjected to next-generation shotgun DNA sequencing to reconstruct microbial genomes to give critical information about how bacteria and archaea interact with corals.
We recently conducted our first sampling expedition to Orpheus Island. A successful candidate will aid in processing these samples for DNA extraction, microscopy, and data analysis. Alternatively, there is also the potential to gain computing experience processing other microbial genome datasets.

**Expected outcomes** - Applicants will learn best practices for working in sterile wet-lab environment that are applicable to a wide array of lab settings. They will also learn common techniques for DNA extraction and processing. If interested in the computing side of this work, students will learn how to work on a linux-based server environment through the use of modern genomic techniques to answer important ecological questions about coral symbiosis. In either case the study will work collaboratively with other researchers but will be expected to complete a project of their own.

**Suitable for** - This project is open to UQ enrolled students in years 2-4 with a background in biology or computational science with strong motivation to do research.

**Further information** - Please contact Gene (g.tyson@uq.edu.au) or Steven (steven.robbins@uqconnect.edu.au) prior to application.

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<th>Supervisor</th>
<th>Dr Kirsty Short</th>
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**Chronic medical conditions & severe influenza virus infections**

Influenza A virus typically causes an acute and self-limiting infection characterised by symptoms such as muscle ache, fever and a dry cough. However, in patients with one or more underlying medical conditions, influenza A virus can cause severe, and even fatal, disease. This interaction between chronic medical conditions and severe influenza was particularly evident after the 2009 H1N1 influenza pandemic. Specifically, this pandemic highlighted that people with diabetes, asthma and obesity suffered from more severe influenza than people with no underlying medical condition. Our research seeks to identify the role of host impairments in the anti-viral response (asthma), chronic inflammation (obesity) and hyperglycaemia/glycaemic variability (diabetes) plays in the pathogenesis of influenza virus.

*Possible summer projects include working in one of the following areas:*
- Defining the role of obesity and asthma in the emergence of influenza virus variants
- Investigating the ability of asthma to facilitate influenza virus reassortment
- Determining the role of diabetic glycaemic variability in severe influenza virus infections

**Techniques you may learn in our group include:** Virus growth and cell culture, primary cell culture, FACS, immunofluorescence, Sanger sequencing, high-resolution melt analysis, qPCR, *in vitro* coculture models, PCR mutagenesis, cloning, immunohistochemistry and high-resolution imaging.

**Expected outcomes** - Proficiency in the associated laboratory techniques as well as a sound understanding of influenza virus and its interactions with chronic medical conditions

**Suitable for** - Students with a background in microbiology/immunology and an interest in a research career
Migration and Environmental Change in the Pacific

Environmental migration is one of the biggest challenges of the 21st century, particularly for Pacific Island communities. While climate change is expected to increase pressure to migrate for Pacific households (UN 2014), little is known about current migration patterns within the region. Using unique datasets of international and domestic migration flows, the student will explore the level and direction of migration in the Pacific. Findings will be used to assess the role of migration as an adaption strategy to climate stressors.

Expected outcomes - An academic publication

Suitable for - A highly motivated student with an interest in migration

Other important details - The project requires manipulation of numerical data in Excel, but does not involve sophisticated mathematics or statistics. Start and end dates are flexible.

Late Quaternary environments of North Stradbroke Island

This project will support one student to investigate the past environments of North Stradbroke Island for the last 50,000 years examining a combination of sediment cores taken from terrestrial sites on the island and from locations in the adjacent Coral Sea. Students will learn palynological and charcoal analytical techniques and there may be the opportunity for a field trip to North Stradbroke Island.

Expected outcomes - Experience in palaeoecological reconstruction techniques, potential to enrol in research course for academic credit and/or involvement in a publication

Suitable for - Science, Environmental Management/Science and Arts students
**Storm hunter: Looking for palaeo-storm evidence in sediments**

Powerful storm systems like Cyclone Debbie pose a significant threat to lives and infrastructures in coastal regions. To properly assess storm risks, it is essential that the recurrence interval and magnitude of storms are well understood; this is however hindered by the short written and instrumental records in Australia, where stronger storms with longer return periods may not be captured. Scientists therefore rely on sedimentary evidence of palaeo-storm events preserved in coastal sediments to reconstruct longer-term history.

This project focuses on deciphering the depositional environment and identifying palaeo-storm deposits in the Wide Bay-Burnett region, southern Queensland. The Scholar will first be directed to study selected literature on storm sedimentary signatures. Cores of sediments (a few metres long) from back barrier environments near Bundaberg will be collected. In the lab, the Scholar will gain hands-on experience in analysing core samples for grain-size composition and microfossil assemblages. The Scholar will make important contribution to the group’s ongoing efforts on understanding the coastal evolution and the nature of storm events in southern Queensland.

**Expected outcomes** - The Scholar will gain knowledge and skills in coastal geomorphology and sediment analyses. The findings should be written as a (or part of a) research paper with intention of publication.

**Suitable for** - 2nd year and beyond. A background in natural hazards, geomorphology and/or sedimentology (e.g. GEOS2100, GEOS2103, ERTH2003, ERTH3110, ENVM3200, GEOS3106) is desirable.

**Other important details** - Priority will be given to a candidate who can participate in a one-week field trip in late November.

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**Frameworks for understanding vulnerability to climate change**

A number of frameworks for understanding the vulnerability of people, households and communities to the impacts of climate change have flourished over the last two decades. These frameworks have been developed by academics, researchers, practitioners and policy-makers. This project will seek to compile,
compare/contrast and analyse the specific components of these frameworks, and then analyse the extent of their application in vulnerability/adaptation studies over the past two decades. By doing so, it is hoped to extrapolate some key global trends on climate change vulnerability.

**Expected outcomes** - A summary document.

**Suitable for** - A highly motivated undergraduate or postgraduate student with good analytical skills and good attention to detail.

**Other important details** - Start and end dates are flexible.

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<tr>
<th>Supervisor</th>
<th>Dr Annie Lau</th>
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**Tropical cyclone and flood risk perceptions in Southeast Queensland**

Tropical cyclones and the associated floods have impacted Southeast Queensland multiple times in recent years. The level of disruption caused by these hazardous events is controlled by the magnitude of the natural event and people’s vulnerability. Minimising vulnerability is one key to natural hazard risk reduction. Understanding how people perceive risk is an important step in assessing vulnerability.

This project aims to investigate how people in the Greater Brisbane prepared for, and responded to recent tropical cyclones; and how they perceive the future risk of natural hazards. The Scholar will be introduced to the study of hazard risk perception, assist in conducting interviews, analyse data, and present the results as a research article. The project findings will feed into a larger project with international collaborations that compares tropical cyclone risk perceptions in multiple coastal cities, with the goal of making recommendations to communities (local and overseas) for disaster risk reduction.

**Expected outcomes** - The Scholar will gain knowledge and experience in natural hazards, hazard risk management, research skills in social studies, and research paper writing. He/she will have the opportunity to contribute to further publications arising from the larger research project.

**Suitable for** - 3rd year and beyond, with a background or interest in human geography, social science, or natural hazards research. Experience of conducting interviews with stakeholders and the public will be an advantage.

**Other important details** - Excellent communication skills for conducting interviews.
### Hail analysis through dual-wavelength weather radar observations

Hailstorms have a significant impact on the Southeast Queensland region every spring and summer, with multiple historical events resulting in losses exceeding $1 billion AUD. This project will explore the application of dual-wavelength hail analysis techniques using datasets collected by the UQ-XPOL radar and Mt Stapylton radar. The combination of these radars allows for X and S band observations of thunderstorms, whereby the ratio of reflectivity provides an indicator for hail presence and size. To achieve this, careful analysis attenuation characteristics and radar scanning geometry is essential. The student will also have the opportunity to extend this work using dual-polarisation observations from each radar to improve hail analysis and the opportunity to participate is a thunderstorm field program in late November with the UQ Climate Research Group.

**Expected outcomes** - The student will develop a high level understanding of weather radar processing and analysis. Preliminary hail analysis prepared will contribute towards validating the hail detection and size algorithms for future hail warnings by the Bureau of Meteorology.

**Suitable for** - Third year maths/physics student with a strong computational background.

**Other important details** - Experience using Python is essential. Experience with weather radar data and thunderstorm analysis is highly desirable.

### Developing a long-term climatology of southeasterly changes in South East Queensland

Southeasterly changes are associated with a majority of the highest impact thunderstorm events in southeast Queensland, but little is known regarding their frequency, variability and spatial structure. Furthermore, the mechanisms which favour the development of severe thunderstorms remain a significant unknown to forecasters. This project will develop the first long-term climatology of southeasterly air mass changes for SEQ using meteorological observations. Datasets for analysis include the UQ ceilometer, radiosonde, weather radar and surface stations. The student will also have the opportunity to collaborate with forecasters at the Bureau of Meteorology regional forecasting center.

**Expected outcomes** - The climatological analysis will support the development of a forecasting process for southeasterly changes which may be suitable for publication in an international journal.

**Suitable for** - Third year geographical sciences student with second or third year level maths
**Other important details** - Experience using Python is essential. Experience with meteorological observations and their analysis is highly desirable.

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<tr>
<th>Supervisor</th>
<th>Dr Thomas Sigler &amp; Elin Charles-Edwards</th>
<th>Duration: 6-8 weeks (flexible)</th>
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<tr>
<td><strong>Contact Details:</strong></td>
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<tr>
<td>Dr Sigler</td>
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**Uber, Airbnb and the sharing economy**

Uber, Airbnb and other digital applications have revolutionised the way we go about our daily lives. These ‘disruptive’ platforms have made it now possible to move from city to city using a handful of apps to seamlessly acquire a range of goods and services from one’s phone using common digital payment systems. This has widespread implications for logistics, organised labour, job skilling, product delivery, and more. Students will be engaged in basic data collection and analysis on this theme as discussed with their supervisor (Dr Thomas Sigler).

**Expected outcomes** - Students will collect and analyse data from one of several relevant firms in the sharing economy. The project can be tailored to the student’s interests.

**Suitable for** - Any student with an interest in the sharing economy

**Other important details** - Data management, spreadsheets, basic data collection. No experience needed, but an interest in data is helpful. Available project placements – two (2)

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<th>Supervisor</th>
<th>Dr Teresa Ubide</th>
<th>Duration: 6 weeks</th>
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**Volcanic crystals as archives of pre-eruptive processes**

This project will investigate deep magmatic processes leading to the onset volcanic eruptions, through the study of crystals formed at depth and transported to the surface by erupting magmas. The student will undertake sample preparation and investigation of crystal zoning under the microscope and with in-situ analytical techniques.

**Expected outcomes** - The student will join an active research group studying the triggers of volcanic eruptions. Morphological and chemical characterisation of the crystals will be used to reconstruct the architecture of the magma plumbing system and identify the history of processes preceding eruption.

**Suitable for** - Undergraduate, Honours and Master students in Earth Sciences-related majors
**Other important details** – Start in mid-November 2017. Available project placements – two (2)
### Power rankings and predictions in sports using extended Bradley-Terry models

A novel application of generalized linear models is in the power rankings and predictions for sports teams in head-to-head competitions. This project will look at extensions of classical Bradley-Terry models that allow for multivariate skill dimensions and differential home-ground advantages.

#### Expected outcomes - Two outcomes for this project are:

1. Software package for implementing extended Bradley-Terry models.
2. Report detailing the findings that can be published in the magazine of the Statistical Society of Australia or the Australian Mathematics gazette.

#### Suitable for - Third year and honours-level students in statistics, mathematics and/or computer science.

#### Other important details - Familiarity with R or Matlab is highly desirable.

### The mathematics of neural coding

In the lab we are imaging the activity of many neurons in the zebrafish brain simultaneously. This leads to large and complex datasets which we are mining to understand more about the mathematical/computational principles for how information about the world is represented in patterns of neural activity.

#### Expected outcomes - You will help develop mathematical/computational techniques to analyse these data.

#### Suitable for - A strong mathematical background and good programming skills are essential. Prior knowledge of neuroscience is not required.

#### Other important details - Please see [https://qbi.uq.edu.au/goodhillgroup](https://qbi.uq.edu.au/goodhillgroup) and [http://cns.qbi.uq.edu.au](http://cns.qbi.uq.edu.au) for more information about the lab. You can contact Prof Goodhill at g.goodhill@uq.edu.au; all enquiries should be accompanied by your CV and academic transcripts.
**Computational analysis of single-molecule movements**

With developments in super-resolution microscope technology, it is now possible to image the movement of individual molecules in living neurons. Interpreting these experiments, however, requires advanced mathematical/computational models and tools. The student will develop algorithms in Matlab to help understand these data.

**Expected outcomes** - Improved algorithms for the analysis of single-molecular imaging experiments.

**Suitable for** - A strong mathematical background and good programming skills are essential. Prior knowledge of neuroscience is not required.

**Other important details** - Please see [https://qbi.uq.edu.au/goodhillgroup](https://qbi.uq.edu.au/goodhillgroup) and [http://cns.qbi.uq.edu.au](http://cns.qbi.uq.edu.au) for more information about the lab. You can contact Prof Goodhill at g.goodhill@uq.edu.au; all enquiries should be accompanied by your CV and academic transcripts.

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**Hybrid Monte Carlo and PDE methods for valuation adjustments in finance**

The project is motivated by a number of significant new computational challenges arising from the computation of valuation adjustments, collectively referred to as xVA, of over-the-counter derivatives and risk-management (hedging) of associated risks, as required by the on-going financial regulatory reform in response to the 2007-2008. We focus on adapting the novel hybrid Monte Carlo and Partial Differential Equation approach developed in Dang et al. (2015) for computation of xVA of exotic options under the Heston and Heston-Hull-White models. The core of the method is the derivation of an approximation to the solution of the conditional PIDE using a Fourier cosine or Shannon wavelet expansions.

**Expected outcomes** - A successful project should lead to a publishable paper.

**Suitable for** - Master/Honours students with an excellent background in computational mathematics and a strong interest/background in finance (e.g. Master of Financial Mathematics)

**Other important details** – start date is flexible, but preferably by the last week of November.

**Reference:**


Edouard Berth, Duy-Minh Dang, and Luis Ortiz-Gracia, A Shannon wavelet method for foreign exchange options under the Heston multi-factor CIR model (submitted)

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<tr>
<th>Supervisor</th>
<th>Dr Duy-Minh Dang</th>
<th>Duration: 10 weeks</th>
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67-752, School of Mathematics and Physics |                     |

**Hybrid Monte Carlo and Partial Differential Equation computational methods for exotic options**

The project will focus on the development of hybrid Monte Carlo and Partial Differential Equation computational methods for exotic financial options. The project will also focus on design and implementation in C++ of the resulting algorithm.

**Expected outcomes** - The expected outcome of this project is a C++ software package for hybrid Monte Carlo and Partial Differential Equation computational approach for exotic option pricing.

**Suitable for** - Master/Honours students with a good background in computational mathematics and/or scientific computing. **Proficiency in C++ is a must.**

**Other important details** – start date is flexible, but preferably by the last week of November.

**Reference:**


Edouard Berth, Duy-Minh Dang, and Luis Ortiz-Gracia, A Shannon wavelet method for foreign exchange options under the Heston multi-factor CIR model (submitted)
### Network models of the human brain

We will investigate how different types of node interconnectivity patterns affect simulated EEG patterns in network models of brains. We will compare the output of the models with human EEG patterns. Knowledge of systems of differential equations, and some numerical methods for their solution would be very useful. We will investigate how different types of node interconnectivity affect simulated EEG patterns in network models of brains.

**Suitable for** - 2nd or 3rd year

**Other important details** – Must have programming skills, knowledge of systems of differential equations

### An undergraduate applications simulation tool

Understanding the differential equations in many applied mathematics problems involves having a good understanding of the behaviour of elastic materials. We wish to develop a simulation tool, with good graphics capabilities, which will allow visualization of how materials deform. It will be used as an “experimental” tool to help students gain an understanding of the assumptions made in deriving equations. Quantitative results of the model will be compared with the solutions of ordinary and partial differential equations.

**Suitable for** - 2nd or 3rd year student

**Other important details** – Knowledge of mechanics, differential equations, good programming
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<th>Supervisor</th>
<th>A/Prof Anthony Roberts &amp; Dr Vivien Challis</th>
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**Fracture in two dimensional porous materials.**

There remain questions about how failure initiates in complex geometrical situations. We will model the stress fields in two dimensional plates with pores. The work will be performed alongside experiments being conducted at the University of Western Australia.

**Suitable for** - 3rd year student

**Other important details** – Good programming background. Knowledge of partial differential equations.

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<th>Supervisor</th>
<th>Prof Matthew Davis</th>
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**Nonequilibrium superfluid flows**

The aim of this project is to make a connection between classical mechanics and quantum mechanics - looking for the signatures of classical trajectories in the quantum wavefunctions. This is potentially interesting for superfluids, as to some extent they behave as classical fluids. This would require adding the effects of interactions - an additional nonlinear term in the Schrodinger equation.

**Expected outcomes** - Student will learn how to solve the linear and nonlinear Schrodinger equation. Results may influence UQ experimental program on Bose-Einstein condensates.

**Suitable for** - Students interested in theoretical and computational quantum physics.

**Other important details** – Eight weeks length preferred. Start and finish times flexible. Please email mdavis@physics.uq.edu.au before applying.
Superfluidity under a quench of interaction strength in a persistent current.

One of the key insights of Landau was to derive a phenomenological formula for the critical velocity in a superfluid. In a Bose gas this is related to the speed of sound, which is directly related to the strength of repulsive interaction between particles. By making use of something known as a “Feshbach resonance” in the scattering properties of two atoms, it is experimentally possible to tune the strength of interactions in a Bose gas. This project will look at a ring system in which there exists a persistent current that if left undisturbed will never decay. However, if the interaction strength is sufficiently reduced, the speed of sound will decrease below the speed of the current and the superflow will break down. This project will characterize the non-equilibrium dynamics as the flow breaks down and thermalizes. It should be able to be related to the well-known “Kibble-Zurek” mechanism for phase transitions.

Expected outcomes - A complete set of results with appropriate interpretation could be turned into a publication.

Suitable for - Students interested in theoretical and computational quantum physics.

Other important details – Eight weeks length preferred. Start and finish times flexible.

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Pairing phase of the attractive Bose gas

In the 1970s there was speculation that the cause of superfluidity in helium-4 was not due to Bose-Einstein condensation, but a form of Cooper pairing between attractive bosons, similar to that which occurs for electrons in superconductors. More recent calculations for the homogeneous system suggest that the temperature for the pairing transition is higher than for BEC - but that both are preceded by the mechanical collapse of the gas. This collapse is however prevented in finite systems. This project will use the classical field method to determine whether a pairing phase is possible for degenerate Bose gas with attractive interactions, and compare the results to the predictions of the Hartree-Fock-Bogoliubov method.

Expected outcomes - The student will learn how to apply analytical and computational quantum-many body methods to Bose-Einstein condensates. The hope is to uncover a new possible phase of matter, and to describe how to observe it in the laboratory.

Suitable for - Students interested in theoretical and computational quantum physics.
**Other important details** – Eight weeks length preferred. Start and finish times flexible.

**Supervisor** | Prof Matthew Davis | **Duration:** 8 weeks
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**Contact Details:** | Email – mdavis@physics.uq.edu.au  
Telephone - +61 7 3346 9824  
Physics Annexe 06-309, School of Mathematics and Physics

*Physics models of higher-order interactions in plant communities*

This project aims to use the methods of statistical physics to help understand the equilibrium and dynamics and of interacting plant communities with A/Prof Margie Mayfield in the School of Biological Sciences. See:

Higher-order interactions capture unexplained complexity in diverse communities  
Margaret M. Mayfield & Daniel B. Stouffer  
Nature Ecology & Evolution 1, Article number: 0062 (2017)  
doi:10.1038/s41559-016-0062

**Expected outcomes** - Hopefully we will show that physics methods can be used to help understand the interactions between plants in a community.

**Suitable for** - Students interested in theoretical and computational quantum physics.

**Other important details** – Eight weeks length preferred. Start and finish times flexible.

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**Supervisor** | Dr Anthony Jacko | **Duration:** 6-8 weeks
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Room 434, Physics Annex (Bldg 6), School of Mathematics and Physics, St Lucia

*Quantum properties of molecular crystals*

Molecular crystals often have strange electronic and magnetic properties; splitting the electron, or having topological spin-liquid states. In this project you would learn to apply a very successful computational approach, density functional theory, to an exciting new class of. As well as learning new things about these systems, you will learn to use this powerful cutting edge technique, and how to use supercomputers for large scale computation.
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<th>Supervisor</th>
<th>Dr Steve Mehrkanoon</th>
<th>Duration: 8 weeks</th>
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<td>Hours expected per week: 36</td>
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**Contact Details:**
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UQ Centre for Clinical Research, Herston

*Simulation of brain network*
We will investigate how different types of node interconnectivity patterns affect simulated electrical activity patterns (EEG) in network models of brains. The aim of this project is to identify the relationships between network topology and collective dynamics observed in EEG signals. We hypothesize that topology and wiring pattern of a network are central in the emergence of a collective behaviour (or emergent dynamics). The successful candidate will simulate a number of network models to infer the EEG-like dynamics [1].


**Expected outcomes** - Student involved in this project will gain skills in the following domains:

- Network theory and simulation of large-scale brain network.
- Have a great opportunity to learn how to develop a MATLAB program in order to generate network models with respect to the nature of EEG features.
- Have a window of opportunity to generate a unique multidisciplinary scientific article that embeds mathematics onto neuroscience for better understanding of how human brain network operates.

**Suitable for** - This project is suitable to applications from students with a background in Applied Mathematics, Physics and Electrical Engineering with ODE/Matlab and/or C/C++ knowledge with an interest in HDR pathway

**Other important details** – The supervisor MUST be contacted by students prior to submission of an Application.

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**Patterns of EEG in network models of human brains**
We will investigate how different types of node interconnectivity patterns affect simulated EEG patterns in network models of brains. We will mathematically and statistically compare the output of the models analysed/simulated by the Honours student with human EEG-driven network patterns. Knowledge of the systems of differential equations, and some numerical methods would be very useful. We will initially study the publication: Which Model to Use for Cortical Spiking Neurons? and extend the ideas to more complex network models such as those used in Dynamics of Networks of Leaky-Integrate-and-Fire.
Neurons. In particular, dynamics of the Hindmarsh-Rose neuron model will be mathematically analysed and simulated both individually and on networks.


**Expected outcomes** - Student will gain the following skills:

1. Biomedical data-driven modelling in a research partner engagement.
2. Translation of the knowledge of differential equations into simulation of network models of brain.
3. Have a unique opportunity to learn computational neuroscience and signal processing techniques.
4. Have an opportunity develop a scientific article with the first author role as well as to develop a future research plan for higher graduate degree.
5. Have a unique opportunity to learn neonatal human brain structure and function.

**Suitable for** - This project is open to applications from students with a background in mathematics, physics, electrical engineering and biomedical engineering interested in HDR pathway

**Other important details** – The supervisor MUST be contacted by students prior to submission of an Application.

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**Supervisor** | Dr Tyler Neely | **Duration:** 6-8 weeks
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**Contact Details:** | Email – t.neely@uq.edu.au | 
| Telephone - +61 7 334 67715 |

**Real time measurement of Bose-Einstein condensate position and moments**

Existing at temperatures near absolute zero, BECs are fragile creatures. However, one can utilise minimally-destructive imaging techniques that tune off-resonance and measure the phase shift imparted on the light by the BEC. This technique can enable hundreds of images of the same condensate.

We propose to combine two techniques for a powerful real-time measurement of BEC position and moments. First, we can apply a RF sideband to the off-resonant light using an electro-optic modulator, enabling a real-time measurement of condensate density with matched photodiodes. By using a dynamic pattern of the imaging light produced by a rapidly configurable digital micromirror device, we can utilise the techniques of a “single pixel camera” to produce real-time images of the condensate.

These techniques will lay the groundwork for real-time manipulation of the trapped condensate.
### Demonstrating the Jarzynski equality in a superfluid

The Jarzynski equality is a thermodynamic relationship discovered relatively recently that relates the free energy difference of two equilibrium states to the mean of the work distribution of the transformation between the states. This is exciting, as it holds true for any nonequilibrium process between the two states, and so has potential to teach us about features of nonequilibrium phenomena.

This project will investigate how the Jarzynski equality is realized in the transformation of a finite temperature Bose-Einstein condensate. This is novel as it is yet to be demonstrated how the inequality is realized in a non-linear, self-equilibrating system.

**Expected outcomes** - Scholars will learn how to
- Solve stochastic partial differential equations.
- Generate and store simulation data.
- Perform statistical analyses and calculate thermodynamic observables from simulation data.

Scholars will be asked to write a report on their project, which if successful will contribute to a manuscript to be submitted for publication.

**Suitable for** - Students with an interest in computational science and theoretical quantum physics. Students should have completed at least two years of physics study, and be familiar with quantum mechanics, thermodynamics, and preferably statistical mechanics.

**Other important details** – Eight weeks length preferred. Start and finish times flexible. Please email mdavis@physics.uq.edu.au before applying.

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### Splitting the electron in a spin liquid

Spin liquids are exotic phases of matter where quantum fluctuations suppress classical long-range order. They are of particular interest because they may support deconfined fractionalised excitations. Fractionalised particle behaves like we have split the underlying particles, for example spinons that carry spin but not charge when the underlying degrees of freedom (electrons) confine the spin and charge to

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**Faculty of Science Summer Research Project Listing 2017/2018**

**Last updated 29 August 2017**
move together. While confinement is a key property of many physical theories, including famously quantum chromodynamics (QCD), condensed matter systems provide the possibility of studying confinement—deconfinement transitions in the laboratory. However, spin liquids are frustratingly difficult to find. In this project you will use advance quantum many—body techniques to predict the properties of spin liquids to aid in the search to identify these materials experimentally.

**Expected outcomes** — Basic science

**Suitable for** — Advanced undergraduates

**Other important details** — Strong physics background

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<th>Supervisor</th>
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<td>Contact Details:</td>
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### Quantum many—body theory of organic superconductors

High temperature superconductivity is one of the great unsolved problems in physics. In order to understand it we must solve the Schrodinger equation for ~10^23 electrons that are interacting strongly with one another, which is technically extremely demanding. Organic superconductors are a class of high temperature superconductors that are extremely flexible because of the control that organic chemists can achieve.

In this project you will use advanced quantum mechanical techniques to predict the properties of these materials and make direct comparison with experimental results from some of the world’s leading groups.

**Expected outcomes** — Basic science

**Suitable for** — Advanced undergraduates

**Other important details** — Strong physics background

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### Design of organic solar cells and organic light—emitting diodes (OLEDs)

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To head off the threat to the planet posed by climate change we need to develop radically new technologies that change the way we generate and use electricity. Solar cells and OLEDs represent two sides of this coin (light \(\rightarrow\) electricity) and (electricity \(\rightarrow\) light).

In this project you will perform state-of-the-art relativistic quantum mechanical calculations using the most powerful supercomputer in Australia. You will computationally discover new design principles and, in close collaboration with colleagues in synthetic chemistry, invent new active materials for solar cells and/or OLEDs.

**Expected outcomes** – Basic science

**Suitable for** – Advanced undergraduates

**Other important details** – Strong physics or chemistry background

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<th>Supervisor</th>
<th>Prof Matthew Davis</th>
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<td>Email – <a href="mailto:mdavis@physics.uq.edu.au">mdavis@physics.uq.edu.au</a></td>
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<td>Telephone - +61 7 3346 9824</td>
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<td>Physics Annexe 06-309, School of Mathematics and Physics</td>
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**Quantum card games**

Classical information is represented as bits in a string of 0s and 1s. In quantum mechanics, anything in between is possible - you can have superpositions of 0s and 1s. The goal of the project is to develop a turn-based card game based on manipulating quantum bits, building on an outline that is already developed. It will require developing a deep understanding of the concepts of quantum mechanics, and will require a lot of creativity and design skill. The rules will need to be developed and redefined in order to enhance the gameplay.

**Expected outcomes** - The goal is to develop a working prototype of a game that can be used for outreach, and distributed to eg high school students and the general public. This will include the set of cards themselves, and a document describing the rules and their application.

**Suitable for** - Students with an interest in quantum physics.

**Other important details** – Eight weeks length preferred. Start and finish times flexible. Please email [mdavis@physics.uq.edu.au](mailto:mdavis@physics.uq.edu.au) before applying.
**Black holes in star clusters**

Some star clusters seem to be too massive for the number of stars they contain. This may be due to a black hole hidden in the centres of these clusters. We will test if a large star cluster near the centre of our Milky Way galaxy contains a black hole by looking for very fast-moving stars near the centre of the star cluster. We will measure the velocities of the stars using data we recently obtained from the Keck Telescope in Hawaii.

**Expected outcomes** - We will measure velocities for some 800 stars. These will then be used by a colleague for detailed numerical modelling to test if a black hole is present. But if we find sufficiently high velocities we could have evidence of the black hole immediately.

**Suitable for** – 1-2 students

**Other important details** – The project will require basic programming skills, ideally with a scripting language like Python, Matlab, or IDL.

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**Cosmology with the Dark Energy Survey**

This project will perform cosmological measurements for the Dark Energy Survey (DES). DES is an international collaboration in its fifth year of a five year observing project, in which we are measuring 5000 square degrees of the sky (about 1/8th of the entire sky) and expect to detect 300 million galaxies. In addition, we are performing a time-lapse survey of 30 square degrees in which we have discovered thousands of supernovae and are monitoring 771 supermassive black holes.

This project will perform cosmological measurements using supernovae in different parts of the sky to look for anisotropies. We expect the universe to be homogeneous and isotropic (the cosmological principle). Therefore if we make cosmological measurements in different parts of the sky we should derive consistent answers. This project will test whether that is true for type Ia supernova observations. If differences are found we will investigate whether they can be explained by known physical effects like peculiar velocities and gravitational lensing (and thus improve cosmological measurements by quantifying those effects) or whether the differences appear in forms that can not be easily explained within our current models.

**Expected outcomes** - Cosmological measurements in different regions of the sky.
**Suitable for** – High level undergraduate with physics experience and ability to code in python (or desire to learn).

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<th>Supervisor</th>
<th>Dr Zoltan Neufeld</th>
<th>Duration: 6-8 weeks</th>
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<td>Contact Details:</td>
<td>Email – <a href="mailto:z.neufeld@uq.edu.au">z.neufeld@uq.edu.au</a>&lt;br&gt;Telephone – 0452 413 659&lt;br&gt;69-710 School of Mathematics and Physics</td>
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**Mathematical/computational modelling of tissue morphology and tumour growth**

The research projects will investigate the role of mechanical interactions between cells in determining the structure and morphology of different types of biological tissues. Multicellular biomechanics plays an essential role in a range of different biological contexts including embryo development and morphogenesis, maintenance and regeneration of adult tissues, and the spread of cancer cells. The projects will use mathematical models and computer simulations, based on differential equations and stochastic dynamics, aiming to contribute to the understanding of the mechanical regulation of multicellular systems and help optimising cancer treatment strategies. The projects provide opportunity for interdisciplinary interactions with biologists at the UQ Institute for Molecular Biosciences. There is also opportunity for extending the work through paid research internship during the semester.

**Expected outcomes** - mathematical and computational models for tissue modelling. The projects have good potential for generating results that may contribute to research publications.

**Suitable for** – 2nd/3rd year students with background in mathematics, physics, engineering who are interested in the applications of mathematical models and computer simulation into cell biology and medicine (previous background in biology is not required), dates are flexible

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<th>Supervisor</th>
<th>Prof Andrew White, Dr Marcelo Almeida, Dr Jacqui Romero &amp; Dr Till Weinhold</th>
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<tr>
<td>Contact Details:</td>
<td>Email – <a href="mailto:andrew.white@uq.edu.au">andrew.white@uq.edu.au</a>&lt;br&gt;Telephone – +61 7 336 57902 or +61 7 336 53415</td>
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**Quantum Technology Lab. Quantum optical measurements of sonoluminescence**

**Other important details** – Please contact Prof Andrew White for further information.
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<td>Quantum Technology Lab. Measurement of the reality of the quantum wavefunction</td>
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<td>Quantum Technology Lab. Machine learning and automated alignment in quantum photonics</td>
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### Use of thermal imaging technology to compare thermal stability of native and European bee hives

Small hive beetle (SHB) (*Aethina tumida*) is an African small brown-black beetle that has caused a major impact to honey bee colonies throughout the warm and humid coastal strip between Victoria and North Queensland. SHB is attracted to active hives because of the availability of food and the larval stage of its life cycle is considered the most damaging to active hives. The development of SHB throughout its lifecycle depends primarily on optimal humidity, temperature and food availability. SHB attack rates are considered a problem for European bee hives compared with native bee hives. Therefore, the hypothesis of this study European bee hives provide optimum conditions that attract SHB compared with native bee hives.

**Expected outcomes** - Better understanding of the association between hives thermal stability and the risk SHB infestation.

**Suitable for** – Science students

**Other important details** – Start date to be agreed.

### Comparative study of side effects of Hendra, strangles and tetanus vaccination in horses

Data collected in a survey to describe horse owners’ attitudes towards Hendra vaccination will be analysed in this project to compare reported side effects of Hendra, strangles and tetanus vaccination in horses. The applicant for this research project is expected to conduct data management and data analysis under supervision.

**Expected outcomes** - The applicant will gain skills in data analysis. It is expected that a report will be produced by the applicant, which should lead to a scientific application.

**Suitable for** - This project would suit a Bachelor of Veterinary Science student with demonstrated experience in Hendra research and data analysis. As this project will require the analysis of survey data, skills in database software and statistical modelling are required.
**Other important details** - The start date is flexible and will be discussed between the supervisor and the successful applicant.

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<tr>
<th>Supervisor</th>
<th>Dr Joerg Henning</th>
<th>Duration: 6 weeks (20 hours per week)</th>
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**Contact Details:**
Email – j.henning@uq.edu.au
Telephone - +61 7 5460 1846
School of Veterinary Science, Gatton

**The role of moving duck farming for the spread of avian influenza virus in Vietnam**

Data collected in a repeated cross-sectional study of moving duck flock farmers in Vietnam will be analysed to describe movement patterns of moving duck flocks and management practices that are associated with increased risk of avian influenza infection and spread. The applicant for this research project is expected to conduct data management and data analysis under supervision.

**Expected outcomes** - The applicant will gain skills in data analysis. It is expected that a report will be produced by the applicant, which should lead to a scientific application.

**Suitable for** - This project would suit a Bachelor of Veterinary Science student with a strong interest in data analysis. As this project will require the analysis of data, basic skills in spreadsheets, database software and statistical analysis are required.

**Other important details** - The start date is flexible and will be discussed between the supervisor and the successful applicant.

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**Contact Details:**
Email – j.henning@uq.edu.au
Telephone - +61 7 5460 1846
School of Veterinary Science, Gatton

**Descriptive analysis of biosecurity practices implemented for moving duck flocks in Indonesia and Vietnam**

Data collected in surveys of transporters of moving duck flocks, rice paddy owners, hatchery owners in Vietnam and Indonesia will be analysed to describe bio-security and moving duck flock management practices that might be related to the spread of avian influenza virus. The applicant for this research project is expected to conduct data management and data analysis under supervision.
**Expected outcomes** - The applicant will gain skills in data analysis. It is expected that a report will be produced by the applicant, which should lead to a scientific application.

**Suitable for** - This project would suit a Bachelor of Veterinary Science student with a strong interest in data analysis. As this project will require the analysis of data, basic skills in spreadsheets, database software and statistical analysis are required.

**Other important details** - The start date is flexible and will be discussed between the supervisor and the successful applicant.

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<th>Supervisor</th>
<th>Dr Allison Stewart</th>
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<td>Email – <a href="mailto:allison.stewart@uq.edu.au">allison.stewart@uq.edu.au</a></td>
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<td>Equine Specialist Hospital, School of Veterinary Science</td>
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**Determination of student learning outcomes using catalogued recorded case presentations of real life equine cases**

An online computer based cataloguing system will be created to organise existing PowerPoint and recorded student and intern presentations of equine clinical cases prepared from equine specialist hospital. An index of the cases will be supplied to lectures for linkage to relevant lectures. Veterinary students will be allowed access to the cases to enhance their learning experience. A method to assess learning from this case material will be created. A human ethics application will be submitted to allow testing of the enhanced student experience. Survey information from participating students will eventually be statistically assessed.

**Expected outcomes** - This study will likely result in a publication in Equine Veterinary Education. It will also provide UQ students and clinicians an organised collection of searchable real-life cases to assist in education.

**Suitable for** - Veterinary students, veterinary technology students.

**Other important details** - An interest in horses is desirable, but not necessary. Basic anatomy knowledge will be required. Preference given to students in the later years or those with experience in online website creation.
### Incidence of blood gas abnormalities in anaesthetised horses

The incidence of hypoxaemia in healthy horses undergoing general anaesthesia for a variety of elective procedures has not been reported. The purpose of this study is to retrospectively determine the incidence of hypoxaemia and other blood gas abnormalities in horses undergoing anaesthesia for elective and emergency procedures in a University Teaching Hospital.

**Overview:**

Anaesthetic records from 2013 to 2017 will be reviewed and the following data will be recorded: arterial blood gas values, electrolytes, lactate, pH and base excess, type of procedure, recumbency, ASA status, and complications following anaesthesia.

**Expected outcomes** - Scholars will gain skills in data collection and basic statistical analysis. There may be an opportunity to prepare a paper for publication and present the data at the end of the project. Through this process the scholar may gain skills in blood gas analysis and an understanding of the physiological changes that occur during general anaesthesia in the horse.

Familiarity with the use of Microsoft Excel will be gained following during data entry and statistical analysis.

**Suitable for** - The project is open to applications from students enrolled in any year of BVSc or BVetTech program. It would be particularly suited to students with a particular interest in veterinary anaesthesia or equine veterinary science.

### Immunohistochemical expression of cytokeratins in canine testicular tumours

Human Sertoli cell tumours are characterised by re-expression of cytokeratins, cytoskeletal proteins normally found in the cytoplasmic of epithelial cells. No information are currently available on the involvement of these proteins in the testicular carcinogenesis in dogs. Therefore, the aim of this study is to evaluate the expression of cytokeratin 5, 8/18, 14 and pancytokeratin in the three most common tumours affecting canine testis (seminoma, Sertoli cell tumour, Leydig cell tumour).

**Expected outcomes** - The presence of these proteins may be eventually used as a diagnostic marker and as a possible indicator of a de-differentiation process of the neoplastic cells during transformation.
The student will acquire a valuable laboratory experience and will be fully engaged in the research process including final manuscript/abstract submission for publication. Please contact Chiara Palmieri for further details.

**Suitable for** - Students with a science/biomedical science/veterinary science background

**Other important details** - An interest in pathology will make the project more beneficial to the student but not essential. Laboratory skills will be acquired during the research scholarship program.

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<th>Supervisor</th>
<th>A/Prof Chiara Palmieri</th>
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**Characterisation of epithelial cells in the normal prostate of male koalas (Phascolarctos cinereus)**

Different epithelial cells have already been identified in humans and domestic animal species (secretory type, basal cells, intermediate cells, neuroendocrine cells), each with specific function, degree of differentiation and expression of genes and proteins. The histogenesis of the prostate gland (and other accessory glands) in koalas and marsupials in general is currently unknown. Therefore, this study aims to identify and characterise the different cell populations of the normal prostate in male koalas by the immunohistochemical expression of selected markers (cytokeratins, androgen receptor, p63).

Understanding the stages of cell differentiation in the normal prostate epithelium is essential for a better understanding of the anatomical and functional dynamics of the male reproductive tract and for identifying the cell types involved in pathological lesions.

**Expected outcomes** - The student will acquire a valuable laboratory experience and will be fully engaged in the research process including final manuscript/abstract submission for publication. Please contact Chiara Palmieri for further details.

**Suitable for** - Students with a science/biomedical science/veterinary science background

**Other important details** - Laboratory skills will be acquired during the research scholarship program.

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<td>School of Veterinary Science, Gatton campus</td>
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**Expression of c-Met and phospho-c-Met in canine cancers**
The aim of this project is to evaluate the immunohistochemical expression of the receptor c-Met and its phosphorylated form in tissue samples of dogs with different tumours according to the students’ choice and specific interest (e.g. prostate cancer, osteosarcoma...). Data will be statistically analysed and correlated with the aggressiveness and the metastatic potential of each case.

**Expected outcomes** - The student will acquire a valuable laboratory experience and will be fully engaged in the research process including final manuscript/abstract submission for publication. Please contact Chiara Palmieri for further details.

**Suitable for** - Students with a science/biomedical science/veterinary science background

**Other important details** - Interest in microscope work. An interest in pathology will make the project more beneficial to the student but not essential.

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<th>Supervisor</th>
<th>A/Prof Rachel Allavena</th>
<th>Duration: 8 weeks</th>
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| **Contact Details:**| Email – r.allavena@uq.edu.au  
Telephone – +61 7 5460 1826  
School of Veterinary Science, Gatton campus |

*Investigation of biomarker expression in canine brain cancer*

Brain cancer has one of the most devastating prognoses of any cancer in dogs or people. This project will explore the expression intensity and distribution of novel biomarkers in a historical bank of canine brain tumour samples, relative to normal brain and potentially other tissues. Targets explored will be used to guide the development of future novel theranostics for dogs and people using the principles of translational and comparative medicine. The techniques learnt will include histology sectioning, immunohistochemical staining, and analysis of results by microscopy. It is expected that the work will contribute to a scientific manuscript, so the student will participate in results analysis and learn scientific writing and presentation skills.

**Expected outcomes** - On completing this program the student will have a good understanding of the scientific methodology and approach to the validation and analysis of novel biomarkers via the technique of immunohistochemistry. This project offers the opportunity to acquire skills in multiple laboratory techniques, scientific analysis and writing, and to contribute to outputs like manuscripts and posters.

**Suitable for** - On completing this program the student will have a good understanding of the scientific methodology and approach to the validation and analysis of novel biomarkers via the technique of immunohistochemistry. This project offers the opportunity to acquire skills in multiple laboratory techniques, scientific analysis and writing, and to contribute to outputs like manuscripts and posters.

**Other important details** - The project duration is at least 8 weeks, however start date is negotiable.
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Ben Ahern</th>
<th>Duration: 6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Details:</td>
<td></td>
<td></td>
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<tr>
<td>Email –</td>
<td><a href="mailto:b.ahern@uq.edu.au">b.ahern@uq.edu.au</a></td>
<td></td>
</tr>
<tr>
<td>Telephone –</td>
<td>+61 7 5460 1799</td>
<td></td>
</tr>
<tr>
<td>School of Veterinary Science, Gatton campus</td>
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**Retrospective analysis of equine clinical cases over a 5 year period**

Retrospective analysis and compilation of images from 5 years of equine specialist sports medicine practise

**Expected outcomes** - Exposure to a broad range of equine sports medicine and surgical related cases / reports. Develop a teaching resource for future veterinary student education. Potentially identify case reports or case series for publication

**Suitable for** - Veterinary students with an equine interest seeking exposure to a broad range of case summaries / images

**Other important details** - Computer skills and organisation skills required

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Dr Rebecca Dunlop</th>
<th>Duration: 8 weeks</th>
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<tbody>
<tr>
<td>Contact Details:</td>
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<tr>
<td>Email –</td>
<td><a href="mailto:r.dunlop@uq.edu.au">r.dunlop@uq.edu.au</a></td>
<td></td>
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<tr>
<td>Telephone –</td>
<td>+61 7 5460 1963</td>
<td></td>
</tr>
<tr>
<td>Building 8196, School of Veterinary Science, Gatton Campus</td>
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**The vocal response of humpback whales to seismic air gun noise**

The vocal response of humpback whales to seismic air gun noise will be quantified using recordings from acoustic digital tags. These tags, which record sounds produced by the whales, have been deployed onto the backs of humpback whales during behavioural response experiments. The experiments were designed to assess the behavioural and vocal response of whales to seismic air gun sounds. Vocalisation parameters (such as vocal rate, sound types used, sounds used at depth, sound level and sound measures) will be measured before, during and after the whales are exposed to seismic air gun noise.

**Expected outcomes** - Quantified changes in vocal measures of humpback whales during exposure to seismic air gun sounds to contribute to a research paper on this topic

**Suitable for** - Science students, especially those interested in animal behaviour

**Other important details** - Students will be required to be at the Gatton campus at least 3 days per week
Start and end dates are flexible within the scholarship timeframe and can be negotiated
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Duration: 8 weeks</th>
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</thead>
<tbody>
<tr>
<td><strong>Supervisor</strong></td>
<td>Prof Clive Phillips</td>
<td></td>
</tr>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:c.phillips@uq.edu.au">c.phillips@uq.edu.au</a></td>
<td>Telephone – +61 7 5460 1158</td>
</tr>
<tr>
<td></td>
<td>White House, Gatton campus</td>
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<tr>
<td><strong>Effect of climate variation on wildlife survival</strong></td>
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<td>This study will identify estimates of variability of climatic conditions on feed availability and other environmental factors that influence the survival rate of animals in the wild. It will attempt to link this to genetic variation in animal survival traits to examine how genetic change can influence the ability of species to survive climate variation.</td>
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<tr>
<td><strong>Expected outcomes</strong></td>
<td>An understanding of the welfare impact of climate change on the ability of different species to survive.</td>
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<tr>
<td><strong>Suitable for</strong></td>
<td>B. Animal and Veterinary Bioscience students, students of zoology, biology and veterinary students.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Duration: 6-8 weeks</th>
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</thead>
<tbody>
<tr>
<td><strong>Supervisor</strong></td>
<td>Dr Allison Stewart</td>
<td></td>
</tr>
<tr>
<td><strong>Contact Details:</strong></td>
<td>Email – <a href="mailto:allison.stewart@uq.edu.au">allison.stewart@uq.edu.au</a></td>
<td>Telephone – 0432 981 379</td>
</tr>
<tr>
<td></td>
<td>Equine Specialist Hospital, School of Veterinary Science, Gatton campus</td>
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<tr>
<td><strong>Retrospective study of the Microbiological culture and sensitivity results for equine bacterial infections</strong></td>
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<td>Data will be collated from the database of the microbiological laboratory for all positive samples submitted for culture. The aim is to determine the antimicrobial resistance of common equine pathogens to commonly used antimicrobial drugs.</td>
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<tr>
<td><strong>Expected outcomes</strong></td>
<td>This study will likely result in a publication to assist veterinary practitioners choose appropriate antimicrobial drugs for their equine patients.</td>
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<tr>
<td><strong>Suitable for</strong></td>
<td>Veterinary students, veterinary technology students, or science student with a background in microbiology and epidemiology</td>
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<tr>
<td><strong>Other important details</strong></td>
<td>An interest in microbiology and epidemiology. Previous excel spreadsheet experience would be useful. An interest in horses is desirable, but not necessary. If there is time, then the project will be expanded to cover other species- cattle, sheep, goats, dogs, cats etc.</td>
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