# Faculty of Science

## SUMMER VACATION SCHOLARSHIPS (2020/21)

## Research Topics

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## Global Centre for Environmental Remediation:

| Topic No. | Title of Research Topic | Description of Research Project | Principal Supervisor Details | Research Group/ Centre | Discipline | Centre |
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| 1 | **Carbon sequestration in coal tailings** | Coal tailings are rich in clay and carbon contents, and can be used to enhance the health and productivity of sandy soil. Carbon input to soil is very critical in improving the physical (e.g., water holding capacity), chemical (e.g., nutrient retention) and biological (e.g., microbial diversity and function) fertility and productivity. Coal tailings contributes to carbon sequestration in soil through direct input of tailings-derived carbon and increased biomass production via improved soil health. Carbon sequestration through the utilization of coal tailings as a soil amendment is likely to result in reducing the carbon foot print in the coal industry thereby contributing to low carbon future. The overall aim of the project is to quantify the carbon sequestration value of coal tailings following their land application across different farming sectors and agro-climatic conditions. | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| 2 | **Seagrass: a major 'hot spot' for blue carbon sinks** | Coastal marine ecosystems including seagrass meadows, saltmarshes and mangroves contribute to ~70% of the carbon absorption in marine environments, making them "hot spot" blue carbon sinks. Seagrass habitats could sequester carbon much faster than tropical rainforests. The project aims to quantify seagrass-derived carbon sink and also to characterise the distribution of carbon in various seagrass species. | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| 3 | **PFAS – Beyond Defence** | Poly- and perfluoroalkyl substances (PFASs) are a diverse group of synthetic fluorinated compounds which are bio accumulative and toxic to humans and the environment. Aqueous film forming foam (AFFF) used in firefighting is a major source of point source of PFAS input to soil and groundwater. Recently, there have been major concerns about contamination of groundwater sources with PFAS compounds in defence sites that have been testing AFFF for firefighting. Since these chemicals are resistant to heat, water, and oil, they have been widely used in general applications (non-stick cookware, grease-resistant paper, fast food wrappers, stain-resistant carpets and | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |

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| | | fabrics and water-resistant clothing.<br>In addition, PFASs have also been used in different industrial applications (used as surfactants, medical applications, plastic manufacture, textiles, and leather). Incidences of PFAS contamination of soil and groundwater sources have been noticed beyond defence sites that include landfills and wastewater treatment plants. Biosolids and landfills are two other major diffuse sources of PFAS input to soil and groundwater sources. Many studies have found PFAS compounds resulting from aqueous film forming foam (AFFF) used in fire fighting sites, especially in defence sites. There have been limited research on PFAS compounds from other sources and their subsequent contamination in soil and water resources. The aim of this project is to undertake literature review on the sources, distribution, bioavailability and ecotoxicity of PFAS compounds. | | | | |
| **4** | **Biowastes improve soil health** | A large volume of biowastes including biosolids and animal manures ate produced in Australia. These can be used as a major source of nutrient and carbon input to soil. This research project aims to quantify the volume of various biowastes produced in Australia and also to examine their value in improving the physical, chemical and biological fertility of soils. | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| **5** | **Drug from dirt** | Finding new antibiotics is urgently needed because of antibiotic resistance in bacteria. Soil may help us to solve this problem. Many of the most widely used antibiotics have been derived from soil. For example, Penicillin is derived from *Penicillium*, a fungus/actinomycetes found in soil, and vancomycin is derived from a bacterium found in dirt. This project aims to prepare a review on the history of antibiotics derived from soil, and the current approaches to finding new antibiotics from soil. | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| **6** | **Cannabis contamination** | Cannabis products can be contaminated with pesticides, heavy metals, plant growth hormones, and microbiological agents including mould and fungi. Contamination of cannabis occurs at various stages that include cultivation, processing and retailing. These contaminants are likely to impact the medicinal value of cannabis products. The project aims to undertake a review on the sources, distribution, bioavailability, toxicity, and risk assessment of various contaminants in cannabis products. | Prof Nanthi Bolan<br>P: (02) 4913 8750<br>E: Nanthi.Bolan@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |

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| **7** | **Ash to cash: commercial avenues for utilising coal fly ash.** | Greater Newcastle region is home to three coal-fired power station (2 active and 1 de-commissioned). Coal fly ash is the major waste product stored in ash dams and are considered to be hazardous to human and environmental health. The costs involved in remediating the ash dams are enormous and there is a need to reduce the amount of ash deposited in the dams to remediate the contaminated land successfully. Countries like Germany, Japan and United States have high percentage of fly ash utilisation. The proposed research will analyse the fly ash to be collected from Lake Macquarie region (New South Wales, Australia), compare the characteristics with the fly ash data from above countries to explore the potential avenues of utilisation towards environmental remediation suited to our local conditions. | Dr Balaji Seshadri<br>E: Balaji.Seshadri@newcastle.edu.au<br>P: +61249138751 | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| **8** | **Remediation and elimination of heavy metals in the human small intestine** | Ingestion of heavy metals by human beings and other organisms through air, water and food is common in industrialised countries and mining regions, which can lead to toxicity. Body's mechanisms to detoxify and eliminate the heavy metals depends mainly on availability and accessibility of the heavy metals to the receiving cells (mainly in the intestine). There are beneficial bacteria in the human intestine which takes care of the overall health of an individual. The effect of suitable bacteria on heavy metal detoxification in a simulated small intestinal environment will be explored in this research. The proposed work will include toxicity studies and in-vitro intestinal simulation studies. | Professor Ravi Naidu<br>E: Ravi.Naidu@newcastle.edu.au<br>P: +61249138705 | Global Centre for Environmental Remediation | **Environmental toxicity, health and remediation** | GCER |
| **9** | **Concentrations of metal(loid)s and their bioaccessibility in food products** | Food plays an important role in human health. The human body gets essential minerals from foods. Some trace metals such as iron and zinc are important minerals which are essential for the human body. In this project, selected food items available in the supermarkets will be purchased for the determination of metals and metalloids contents. In-vitro simulated digestion procedures will be used for the determination of the bioaccessibility of metal(loid)s in food. Finally, the human health risk estimation based on the recommended portion size will also be assessed. | Dr Mohammad Mahmudur Rahman<br>P: (02) 4913 8754<br>E: mahmud.rahman@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |

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| **10** | **Speciation of metal(loids) in cereal grains** | Total concentration of metals and metalloids may provide useful information. However, the chemical form of metal(loids) are crucial for accurate risk estimation from food. As half of the world population is rely on cereal grains including rice and wheat. This project will investigate the levels of trace metals and metalloids in rice and wheat grain sourced from contaminated areas to determine the chemical species present in the grain. Finally, monte-carlo simulation will be used to estimate both carcinogenic and non-carcinogenic risks. | Dr Mohammad Mahmudur Rahman<br>P: (02) 4913 8754<br>E: mahmud.rahman@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| **11** | **Geochemistry and fractionation of arsenic in coastal sediments and naturally contaminated soils** | Assessing the potential soil and human health risks of toxic elements including arsenic contamination is a major concern worldwide. In this project, the distribution of arsenic, geochemical fractions in the coastal sediments as well as naturally contaminated soils will be assessed. The human health risk assessment from incidental exposure of soils will also be assessed. | Dr Mohammad Mahmudur Rahman<br>P: (02) 4913 8754<br>E: mahmud.rahman@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |
| **12** | **PFAS analytical method optimization** | Poly- and perfluoroalkyl substances (PFASs) are a family of synthetic chemicals over 3000 members. Due to their special physiochemical properties, PFAS have been classed as persistent organic pollutants and have showed bioaccumulation and toxicity to humans. Detection of PFAS in environmental samples have been reported by many studies. To better understand PFAS sources, fate and transport in the environment, we do need a fast, robust and reliable analytical method for qualitative and quantitative analysis of PFAS in water, soil, sediment, sludge and biota samples. GCER is developing and validating a comprehensive method based advanced analytical instrumentation (LC-QQQ and LC-QTOF) to analyse PFAS and other emerging contaminants using SPE technique for water samples, and QuEChERS-dSPE technique for soil, sediment and biota samples. One of major challenges in method development is matrix effects due to co-existing impurities in environmental samples. The aim of this project is to select most effective and efficient solid sorbent to eliminate matrix effect and improve analytical method sensitivity and reliability. | Dr Feng Shi<br>P: 02 49854596<br>E: feng.shi@newcastle.edu.au | Global Centre for Environmental Remediation | **Environmental Remediation** | GCER |

## School of Environmental & Life Sciences:

| Topic No. | Title of Research Topic | Description of Research Project | Principal Supervisor Details | Research Group/ Centre | Discipline | School |
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| **13** | **Exercise and Successful Ageing** | Ageing results in a decline in physical and cognitive capacities. Lifestyle interventions such as exercise have been shown to be effective and low cost, however, more knowledge is required to build recommendations about the optimal exercise for different ageing populations. This project aims to investigate the key aspects of athletic older individual's lifestyles and its effect on successful ageing. This project may consist of direct data collection in ageing and brain health, survey development or data analysis for athletic performance and ageing. This would be a great opportunity for students interesting ageing which will be a major societal issue in our lifetime. | Dr Nattai Borges<br>E: Nattai.borges@newcastle.edu.au<br>P: (02) 4921 6659 | Exercise and Sport Science | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **14** | **The Role of Exercise and Technology in Occupational Injury Management** | Musculoskeletal injury is the most common injury in the workplace which is commonly caused by repetitive actions or overexertion. Currently a poor understanding exists on the physical demands of many highly active occupational roles such as warehouse workers or workers in age-care facilities. Technology can assist in investigating the objective physical demands of different occupational roles which can inform individualised preventative and rehabilitative frameworks. This project will investigate the potential use of technology for occupation role assessment and is currently underway with multiple industry partners. This would be a great opportunity for students looking to engage with industry and learn about the workers compensation landscape. | Dr Nattai Borges<br>E: Nattai.borges@newcastle.edu.au<br>P: (02) 4921 6659 | Exercise and Sport Science | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **15** | **Developing Sport Science in Combat Sports** | Olympic Combat sports such as Taekwondo receive little attention from Australian Sport Scientists but have been identified as a key avenue to increase future Australian medal tallies. This project involves validation and use of novel technologies to assess competitive demands and create training guidelines for multiple combat sports. The project is a joint initiative with Southern Cross University, and some sub-projects with Taekwondo Australia. This project would be a great opportunity for students interested in combat sports, and will directly engage with and inform national sporting bodies. | Dr Nattai Borges<br>E: Nattai.borges@newcastle.edu.au<br>P: (02) 4921 6659 | Exercise and Sport Science | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **16** | **Validation of portable technology in quantifying force-velocity profiles** | Force velocity profiles provide a practical means of monitoring resistance training progression and accumulated fatigue, as well as providing a means to estimate 1RM values. However, the undertaking of force-velocity profiles requires the accurate measurement of bar velocity. A range of portable technology is available to quantify bar velocity during such testing, however further validation is required to ensure that it is suitable across exercise types and loads. This project will require students to undertake a series of force-velocity profiles using a range of technologies to determine their validity, but also explore practical applications of force-velocity profiling. | Associate Professor Ben Dascombe<br>E: ben.dascombe@newcastle.edu.au<br>P: (02) 4348 4005 | Exercise and Sport Science<br><br>Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **17** | **Effect of velocity based eccentric flywheel training on neuromuscular fatigue** | The recent development of flywheel training devices (e.g. K-box and K-pulley) have created a highly practical method of eccentric training through which velocity can be easily manipulated. Eccentric training provides a training stimulus that provides higher morphological and neurological demands. The project will explore how eccentric training delivered through flywheel training apparatus is perceived by participants and how eccentric contraction velocity can affect the accumulated neuromuscular fatigue and perceptual responses. | Associate Professor Ben Dascombe<br>E: ben.dascombe@newcastle.edu.au<br>P: (02) 4348 4005 | Exercise and Sport Science<br><br>Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **18** | **Validation of portable muscle dynamometers across joint positions** | The introduction of the Vald Force Frame technology allows practitioners to undertake a range of force measurements in multiple joints across various positions. Such technology has been routinely sued to quantify changes in hip adduction/abduction strength, but little is known on its ability to accurately and reliability asses strength of other joints. The project would explore the ability of the Force Frame to accurately quantify joint force data across a range of positions. | Associate Professor Ben Dascombe<br>E: ben.dascombe@newcastle.edu.au<br>P: (02) 4348 4005 | Exercise and Sport Science<br><br>Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Exercise & Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **19** | **Force profiling the counter movement jump to monitor neuromuscular status of players during the NBA Academy Games** | The countermovement jump is a frequently performed movement task utilized by both medical providers and strength coaches as part of a movement assessment to assess injury risk, athletic performance, monitor recovery, and effectiveness of training programs. This project will investigate the countermovement jump to monitor neuromuscular status during the NBA Academy Games to identify the effects of a congested fixture on performance. | Dr Suzi Edwards<br>E: suzi.edwards@newcastle.edu.au<br>P: 4349 4428 | Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **20** | **Spatial muscle activation patterns in athlete with and without a history of groin injury** | Altered muscle activation patterns have been shown to predict initial injury and to differentiate between athletes with and without a history of injury. A non-invasive and reliable method to determine relative muscle activity in surface and deep muscles following exercise is muscle functional MRI (mfMRI). mfMRI provides information about metabolic activation of muscle tissue as measured by the water content of the muscle on a T2-weighted MRI image, which is independent of blood flow. To date, mfMRI imaging studies have been limited to evaluating hip muscle activity during various exercises in order to identify the most effective exercises for injury rehabilitation, or to aid in risk factor identification. For groin injuries, muscle activity patterns of hip and thigh muscles have yet to be quantified using mfMRI, despite the evidence indicating that weak hip adductor strength may be associated with injury. This project will be the first to determine whether athletes with a history of a groin injury and healthy controls differ in their spatial activation patterns of the adductor muscles via mfMRI technology, following maximal agility protocol. | Dr Suzi Edwards<br>E: suzi.edwards@newcastle.edu.au<br>P: 4349 4428 | Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **21** | **Imposter feelings and perceived gender stereotype threat in elite female coaches** | Empirical and anecdotal evidence offer some insights suggesting that non-stereotypical behaviours and choices are often the barriers in achieving success at high level and contributing towards feelings of self-doubt and low self-worth. This is true for both female professionals working in the male-dominated fields and male professionals working in the feminine professions.<br><br>We aim at better understanding sport experiences of elite male and female coaches across multiple sports worldwide. This study will shed more light on how we could enhance the experiences of elite coaches and minimise barriers faced on their road to success. This project will help students to better understand how the mixed-methods approach is utilised in practice when conducting applied sport psychology research. The students will be expected to work as part of interdisciplinary team across SELS and School of Psychology. | Dr Kotryna K. Fraser<br>E: Kotryna.fraser@newcastle.edu.au<br>P: 4348 4141 | Exercise and Sport Science<br><br>Social and Organisational Psychology Research Group (SOPRG; School of Psychology) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)**<br><br>**Psychology** | SELS<br><br>PSYC |

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| **22** | **Investigating sports culture for athletes, coaches and support staff across various sports and countries** | Discrimination of different forms is evident in sport with more and more elite athletes advocating for a much-needed change. While there is some evidence to indicate the negative effect discrimination and stereotyping having on performance, little do we know about different types of discrimination (e.g., racism vs. sexism) experienced by sport participants (e.g., players, coaches, support staff, or referees).<br><br>Therefore, there are some opportunities to work as part of on-going national and international projects investigating various types of discrimination and social injustice in sport across multiple levels. These projects aim at gathering evidence to better understand future direction sport should take in creating equity and promoting social justice from practical and research perspectives. The students will have some opportunities to learn more about both quantitative and qualitative research methods and develop their professional skills essential for a successful researcher and practitioner. | Dr Kotryna K. Fraser<br>E: Kotryna.fraser@newcastle.edu.au<br>P: 4348 4141 | Exercise and Sport Science<br><br>Social and Organisational Psychology Research Group (SOPRG; School of Psychology) | **Exercise and Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)**<br><br>**Psychology** | SELS<br><br>PSYC |
| **23** | **Female hormones and exercise performance** | During their reproductive years most women are exposed to continuously changing female steroid hormone profiles throughout the menstrual cycle or through oral contraceptive use. These hormone fluctuations have many physiological effects, which may in turn affect exercise performance. There are many opportunities for research projects in this area on a wide variety of topics, such as the effect of oral contraceptive use on muscle strength. Details of specific projects will be determined in consultation with the academic staff. | Dr Xanne Janse de Jonge<br>P: (02) 4349 4566<br>E: x.jansedejonge@newcastle.edu.au | Exercise and Sport Science | **Exercise & Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **24** | **Adapting resistance training programs to female hormone fluctuations** | During their reproductive years most women are exposed to continuously changing female steroid hormone profiles throughout the menstrual cycle or through oral contraceptive use. These hormone fluctuations have many physiological effects. Oestrogen, is known for its anabolic effects. Therefore, it is expected that conditions for muscle growth are better when oestrogen is elevated. Thus the variability in oestrogen levels due to the menstrual cycle or oral contraceptive use may affect the ability of skeletal muscle to respond to resistance training. This research will investigate how females can adapt their training programs to take advantage of their hormone fluctuations for greater training adaptations. | Dr Xanne Janse de Jonge<br>P: (02) 4349 4566<br>E: x.jansedejonge@newcastle.edu.au | Exercise and Sport Science | **Exercise & Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **25** | **Bone density, body composition and muscle strength in women who have undergone breast cancer treatment** | As breast cancer treatments are improving and survival rates increasing more women are living with the side effects from breast cancer treatment. This project will investigate the effects of breast cancer treatment on bone density, body composition and muscle strength. It will focus on new monitoring systems to facilitate the development of early post treatment exercise interventions aimed at decreasing the negative side effects of breast cancer treatment. | Dr Xanne Janse de Jonge<br>P: (02) 4349 4566<br>E: x.jansedejonge@newcastle.edu.au | Exercise and Sport Science | **Exercise & Sport Science**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **26** | **Investigating fucoidan content in macroalga species on the Central Coast, NSW** | Fucoidan is a polysaccharide commonly found in brown seaweeds, and it has many uses in pharmaceutical and food industry. It has been successfully extracted from kelps and fucoid brown macroalgae in the Northern Hemisphere. The project is dictated by the need to find local sources of fucoidan, which could be used in the food industry. As a first step, we will use common kelp and fucoid algal species that are likely to contain fucoidan for extractions. The species will be sampled from different locations to see if there is spatial variability in fucoidan concentrations. Several extraction methods will be compared to maximise the possible yield. | Dr Taiwo O Akanbi<br>P: (02) 4348 4117<br>E: taiwo.akanbi@newcastle.edu.au<br><br>Dr Maria Schreider<br>P: (02) 4348 4228<br>E: maria.schreider@newcastle.edu.au | Food Science<br><br>Coastal and Marine Science Research Group | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **27** | **Polyphenols for extending the shelf life of fish and meat products** | Polyphenols are a group of plant metabolites recognized for their health benefits, including anti-inflammatory, antimicrobial, and antioxidant effects. These properties make them suitable for use as natural preservatives of meat. Because polyphenols are soluble in either water, oil, or both, these affect their applications. This project will study how some commercially available polyphenols can be used to preserve minced meat and fish. | Dr Taiwo O Akanbi<br>P: (02) 4348 4117<br>E: taiwo.akanbi@newcastle.edu.au | Food Science | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **28** | **Composite antioxidants for stabilizing concentrates of omega-3 fatty acids** | Omega-3 fatty acids are the third most widely used dietary supplements after minerals and vitamins. They are also added to infant formulas because they help with visual function and neural development. However, they are highly oxidatively unstable. Thus, the need for antioxidant addition. Interestingly, the most widely used antioxidants are chemically synthesized. In this project, a combination of natural antioxidants will be studied for their effectiveness in stabilizing these fatty acids. | Dr Taiwo O Akanbi<br>P: (02) 4348 4117<br>E: taiwo.akanbi@newcastle.edu.au | Food Science | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **29** | **Extraction of phytochemicals from winery wastes** | Winemaking leads to the production of large quantities of wastes. These wastes are rich sources of phytochemicals such as anthocyanins, proanthocyanidins, and other polyphenols. Current methods of extracting these compounds involve the use of environmentally unfriendly chemicals. So, there is a need to develop new techniques. In this project, the effectiveness of adsorption resins to extract phytochemicals from winery waste will be investigated. | Dr Taiwo O Akanbi<br>P: (02) 4348 4117<br>E: taiwo.akanbi@newcastle.edu.au | Food Science | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **30** | **Consumer Perception of Alcohol removed beverages** | Alcohol removed beverages such as alcohol-free wine, beer and gin are products in the market that could help to reduce alcohol related harm. This project investigates consumer perception and behaviour related to these new products. The project involves survey and sensory based studies including product tasting. | Dr Tamara Bucher & Emma Beckett<br>E: tamara.bucher@newcastle.edu.au<br>P: 0451 287406 | Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Food Science and Human Nutrition**<br><br>**Consumer Behaviour**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **31** | **Healthy Convenience Foods** | Consumers want to eat healthy sustainable food, but only if it also tastes good and is convenient. This study investigates how consumers interpret and use recipe information convenience foods and how these products could be changed to promote a higher intake of vegetables. The project involves working on data from a survey and assisting with an audit of products currently available in the shops. | Dr Emma Beckett and Dr Tamara Bucher<br>E: Emma.Beckett@newcastle.edu.au<br>P: 4348 1458 | Priority Research Centre for Health Behaviour (PRCHB)<br><br>Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **32** | **Ambient Influences on food choice (Nudging)** | Our environment has a major impact on what and how much we eat. This project aims to test if the user interface in online shops influences food choices and if we can change the interfaces to promote healthier food choices. This is an online study and the student will learn how to do online experiment and do basic data analysis. | Dr Tamara Bucher &<br>Ms Nienke de Vlieger<br>E: tamara.bucher@newcastle.edu.au<br>P: 0451 287406 | Priority Research Centre for Health Behaviour (PRCHB)<br><br>Priority Research Centre for Physical Activity and Nutrition (PRCPAN) | **Food Science and Human Nutrition /SHS**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **33** | **Pre-storage UV-C treatment to extend postharvest life of fruits and vegetables** | UV-C light treatment has been shown to have beneficial effects in maintaining postharvest quality of fresh fruit and vegetables. In a laboratory scale, UV-C treatment has been reported to delay ripening and senescence in non-climacteric and in climacteric, as well as to delay degreening fruits and vegetables. However, there are few reports of semi-commercial UV-C lights treatment on fruits and vegetables qualities. This project will use semi-commercial UV-C lights treatment to maintain fruit and vegetables quality. | Dr Penta Pristijono<br>E: penta.pristijono@newcastle.edu.au<br>P: (02) 4349 4783<br>(Ourimbah Campus) | Food Science<br><br>Horticultural Postharvest | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **34** | **Innovative postharvest technologies to control horticultural postharvest pathogens** | Horticultural postharvest qualities losses due to pathogens occur in many fresh fruit and vegetables between harvest and consumption. The effective control of postharvest pathogens significantly reduces postharvest losses and can improve fruits and vegetables quality during storage. This project will use current postharvest technologies alone or in combination to control horticultural postharvest pathogens. | Dr Penta Pristijono<br>E: penta.pristijono@newcastle.edu.au<br>P: (02) 4349 4783<br>(Ourimbah Campus)<br><br>Dr John Golding<br>E: john.golding@dpi.nsw.gov.au<br>P: (02) 4348 1926 | Food Science<br><br>Horticultural Postharvest | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)**<br><br>**NSW DPI** | SELS |
| **35** | **Combination of UV-C treatment and different packaging materials to maintain fruits and vegetables quality after harvest.** | UV-C treatment has been reported in maintaining vegetables quality after harvest. However, there are few reports on combination treatments of UV-C and different packaging materials on vegetables qualities after harvest. This project will use semi-commercial UV-C treatment to maintain vegetables quality, followed by storage in different packaging materials. The packaging materials will be selected according to its permeability, where gas compositions of carbon dioxide and oxygen; temperature and humidity will be monitored. Vegetables quality will be assessed based on commercial acceptability. | Dr Penta Pristijono<br>E: penta.pristijono@newcastle.edu.au<br>P: (02) 4349 4783<br>(Ourimbah Campus | Food Science<br><br>Horticultural Postharvest | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **36** | **Impact UV-C treatments and different temperature storage on sugar and acids level of fruits.** | Reducing eating quality due to quality deterioration occur in fruits between harvest and consumption. The effective method of maintaining internal quality by preserving sugar and acids level significantly increase eating quality and improve fruits quality during storage. This project will use UV-C treatment alone or in combination with temperature storage to maintain sugar and acids level of fruits. | Dr Penta Pristijono<br>E: penta.pristijono@newcastle.edu.au<br>P: (02) 4349 4783<br>(Ourimbah Campus)<br><br>Dr Tim Kirkman<br>E: timothy.kirkman@newcastle.edu.au<br>P: (02) 4913 8760<br>(Ourimbah Campus) | Food Science<br><br>Horticultural Postharvest | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |

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| **37** | **Potential consumer-acceptable technology of UV-C treatments to improve postharvest quality of fruits and vegetables: A review** | UV treatment has been reported to have beneficial effect on maintaining postharvest quality of many horticultural produce. However, there are limited reviews article on impact of UV-C treatments on horticultural postharvest. This project will review UV-C applications on wide range of fruits and vegetables which will be covering beneficial and detrimental effect, as well as further potential for commercial applications. | Dr Penta Pristijono<br>E: penta.pristijono@newcastle.edu.au<br>P: (02) 4349 4783<br>(Ourimbah Campus) | Food Science<br><br>Horticultural Postharvest | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **38** | **Prevention of acrylamide formation during food processing** | Acrylamide, which is formed from sugars and amino acids in foods during high-temperature processing, such as frying, roasting and baking, is known as hazardous neurotoxins, reproductive toxins, and carcinogens. It is hypothesised that plant extracts and phytochemicals can react with the amide group of intermediates in the Maillard reaction and block acrylamide formation. This project aims to reduce formation of acrylamide in food using extracts and phytochemicals derived from Australian native flora | Dr Quan Vuong<br>E: quan.vuong@newcastle.edu.au<br>P: (02) 4348 4124 | Food Science Research Group | **Food Science and Human Nutrition**<br><br>**Applied Sciences (Ourimbah Campus)** | SELS |
| **39** | **Contribution to Earth Biogenome Project** | The Earth Biogenome Project aims to sequence and characterise the genomes of all of Earth's eukaryotic biodiversity over a period of ten years. A contribution to this remarkable and visionary project is being undertaken by the Sanger Institute in the UK and plans to include a significant number of medicinal plants native to the UK and Australia. This project is a study to establish a priority list of Australian medicinal plant species for sequencing, considered to have efficacious medical properties. A broad survey of literature, grey and otherwise, as well as an investigation of anecdotal information from indigenous sources will be pursued. | Prof Christopher Grof<br>P: (02) 4921 5858<br>E: Chris.Grof@newcastle.edu.au | Centre for Plant Science | **Biological Sciences** | SELS |

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| **40** | **Biofuel feedstocks for arid environments** | Lignocellulosic bioethanol derived from plant biomass will provide a cost effective contribution to environmental sustainability and energy security. *Setaria italica* and *Setaria viridis* (foxtail and green millet respectively) are ideal genetic models to dissect biomass quality traits of $C_4$ monocotyledonous grasses. Genetic engineering of these species is now possible and a very high success rate of transformation of one particular accession of *S. viridis* has recently been reported. This project will endeavour to establish tissue culture and transformation parameters using fluorescent reporter genes, for routine genetic engineering of this accession in our laboratory. | Prof Christopher Grof<br>P: (02) 4921 5858<br>E: Chris.Grof@newcastle.edu.au | Centre for Plant Science | **Biological Sciences** | SELS |
| **41** | **Sustain plant reproductive success under heat stress: A sweet approach** | Plant reproductive processes are highly susceptible to heat stress, which often leads to pollination failure and fruit and seed abortion, hence irreversible yield loss. Our research has established that cell wall invertase (CWIN)-mediated sugar metabolism and signaling may play crucial roles in pollen growth and fruit set under heat stress.<br><br>This project aims to determine how genetic manipulation of CWIN activity may enhance pollen viability and fruit set under heat stress using tomato as a model. The intended outcome is the generation of critical new knowledge that will advance our understanding on reproductive response to heat stress, thereby providing novel ideas and solutions for improving crop yield under Global Warming. | Prof Yong-Ling Ruan<br>E: yong-ling.ruan@newcastle.edu.au<br>P: (02) 4921 7958<br>https://www.newcastle.edu.au/profile/yong-ling-ruan | Australia-China Centre for Crop Improvement / Centre of Plant Science | **Biological Sciences** | SELS |
| **42** | **Supercharge plants for super performance** | Unfolding their leaves as solar panels, plants use light to spark biochemical reactions that convert atmospheric CO2 into sucrose. This essential nutrient and energy currency not only powers growth, but also fortifies defences against all sorts of stresses, pathogens and pest attacks. The partitioning of plant's sucrose between source (leaves) and sink (non-photosynthetic organs such as seed) determines plant architecture and crop yield.<br>We have recently identified CIN as a key player in regulating sugar signalling for energy production and plant growth. By using molecular and genetic approaches, this project aims to manipulate CIN gene expression in 'engine'-like cells to improve energy use efficiency for fitness and food production. | Prof Yong-Ling Ruan<br>E: yong-ling.ruan@newcastle.edu.au<br>P: (02) 4921 7958<br>https://www.newcastle.edu.au/profile/yong-ling-ruan | Australia-China Centre for Crop Improvement / Centre of Plant Science | **Biological Sciences** | SELS |

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| **43** | **Hi, can you see me? -Visualising the crosstalk between sugar- and hormonal signalling** | Sugar and hormonal signalling pathways integrate at the molecular level to regulate plant development. It is, however, technically challenging to assess how the two components cross-talk with each other. This obstacle impedes understating of Plant Biology, hence limiting our avenues to improve plant performance, especially under stress such as heat, cold and drought.<br><br>Through our prior research and international collaboration, we have obtained a suite of transgenic plants where one of the two components are genetically altered and linked with green or red-fluorescent report proteins (GFP, RFP respectively). We will use these materials and the state-of-art molecular techniques, coupled with advanced microscopy, to visualize the crosstalk between sugar and hormone signalling pathways, thereby shedding a light into this 'black box' in Biology. | Prof Yong-Ling Ruan<br>E: yong-ling.ruan@newcastle.edu.au<br>P: (02) 4921 7958<br>https://www.newcastle.edu.au/profile/yong-ling-ruan | Australia-China Centre for Crop Improvement / Centre of Plant Science | **Biological Sciences** | SELS |
| **44** | **Looking for hair tonics for cotton fiber cell development** | Cotton is the most important textile crop worldwide. Each cotton fiber is a single cell developed from cotton seed epidermis. Fascinatingly, only about 25% of the epidermal cells develop into fibers. The question is why? Can we 'wake up' the remaining epidermal cells to become fibers, therefore tripling the cotton fiber yield?<br><br>You will join a team of world-class experts on this topic to explore the molecular network that determines whether a give epidermal cell will develop into fibers or not and how to engineer the process to substantially increase fiber cell number, hence yield. | Prof Yong-Ling Ruan<br>E: yong-ling.ruan@newcastle.edu.au<br>P: (02) 4921 7958<br>https://www.newcastle.edu.au/profile/yong-ling-ruan | Australia-China Centre for Crop Improvement / Centre of Plant Science | **Biological Sciences** | SELS |

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| **45** | **Exploring cyanobacterial specialised metabolism using heterologous expression** | Microbial natural products have served as a major inspiration for the development of novel pharmaceuticals. The search for new natural products is a continuing endeavour, with new niches and microorganisms being probed to determine their ability to produce useful bioactive molecules. Cyanobacteria are a largely untapped phyla that produce a multitude of natural products eliciting a range of pharmaceutically-relevant activities.<br><br>A large limitation for the exploitation of these molecules is the lack of accessibility in the natural host due to slow growth rates, relatively low production levels, and a inability to genetically manipulate the cyanobacteria. Therefore, this project will involve the isolation of cyanobacterial natural product biosynthesis genes, engineering them for heterologous expression in Escherichia coli, and gene knockouts to characterise the enzymology of biosynthesis. | Prof Brett Neilan<br>E: brett.neilan@newcastle.edu.au<br>P: (02) 4921 5544 | Neilan Laboratory of Microbial and Molecular Diversity | **Biological Sciences** | SELS |
| **46** | **Expression and characterization of sunscreen compounds from environmental microorganisms** | This project addresses the fundamental need and growing demand for novel natural compounds in the cosmetic industry and beyond. It is pivotal in light of the growing ban on sunscreens in places such as Hawaii and moving towards an ecologically sustainable alternative. Ancient bacteria that thrived in high UV environments are an ideal source of sunscreen compounds. The discovery of sunscreen molecules with broad and/or stronger absorbance capacity of ultra-violet radiation will improve the protection against the increasing latent skin cancer. | Prof Brett Neilan<br>E: brett.neilan@newcastle.edu.au<br>P: (02) 4921 5544 | Neilan Laboratory of Microbial and Molecular Diversity | **Biological Sciences** | SELS |
| **47** | **Discovery and characterisation of novel lanthipeptide biopreservatives** | For thirty years, lantibiotics such as nisin and its derivatives have been used as food preservatives. While nisin has a broad spectrum of action, there are many bacterial species that escape its activity, and it is crucial to identify new molecules with complementary activities to those already used in the food industry. We aim to discover, test and develop a set of previously unknown lanthipeptide compounds for their potential applications in the food industry. To biologically and structurally characterise the novel lantipeptide we aim to clone the genes responsible for the biosynthesis of the lantitpeptide and express them in an heterologous host. | Prof Brett Neilan<br>E: brett.neilan@newcastle.edu.au<br>P: (02) 4921 5544 | Neilan Laboratory of Microbial and Molecular Diversity | **Biological Sciences** | SELS |

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| **48** | **Water quality and harmful algal blooms.** | Around the globe many significant drinking water sources have or will become infested with harmful algal blooms. The past twenty years has witnessed major advances in our understanding of the genetic basis for toxin production in these microorganisms, however research into the formation of blooms and the prediction of toxic bloom events is required to maintain healthy water supply. As a part of our ongoing commitment to water quality research we offer research projects tailored around specific drinking water and water treatment processes.<br><br>This is an exciting opportunity to learn multidisciplinary and emerging skills such as data processing, bioinformatics and modelling. | Prof Brett Neilan<br>E: brett.neilan@newcastle.edu.au<br>P: (02) 4921 5544 | Neilan Laboratory of Microbial and Molecular Diversity | **Biological Sciences** | SELS |
| **49** | **How to cope if you drop your fork: DNA replication repair in bacteria** | DNA replication is prone to being blocked by DNA damage or tightly bound DNA-protein complexes. Prolonged blockage can lead to replication fork collapse and reversal. This project will make a knockout of the exonuclease gene, *exoI*, which is thought to degrade some of the newly synthesised DNA at the replication fork. The effect on viability and replication restart will be determined. | A/Prof Ian Grainge<br>P: (02) 4921 7238<br>E: ian.grainge@newcastle.edu.au | Priority Research Centre for Chemical Biology and Clinical Pharmacology<br><br>Priority Research Centre in Digestive Health and Neurogastroenterology | **Biological Sciences** | SELS |
| **50** | **Getting cross after dropping your fork: DNA replication repair in bacteria 2** | DNA replication is prone to being blocked by DNA damage or tightly bound DNA-protein complexes. Prolonged blockage can lead to replication fork collapse and reversal that produces a cross-shaped four-way DNA structure- a Holliday Junction (HJ). This project will aim to trap reversed replication forks using a specific peptide that binds to the HJ. The enriched HJs will be identified on a gel and formation followed over time in living cells, and in different mutant backgrounds. | A/Prof Ian Grainge<br>P: (02) 4921 7238<br>E: ian.grainge@newcastle.edu.au | Priority Research Centre for Chemical Biology and Clinical Pharmacology<br><br>Priority Research Centre in Digestive Health and Neurogastroenterology | **Biological Sciences** | SELS |

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| **51** | **Pores in disks** | This project will aim to clone a His-tagged expression vector of the N-terminal domain of the FtsK protein. This protein is involved in cell division and chromosome segregation in bacteria and the N-terminal is thought to form a hexamer in the membrane, and may form a pore through which DNA can be pumped. The tagged protein will be extracted in artificial lipid layers called SMALPs, ready for structural study by cryo-EM. | A/Prof Ian Grainge<br>P: (02) 4921 7238<br>E: ian.grainge@newcastle.edu.au | Priority Research Centre for Chemical Biology and Clinical Pharmacology<br><br>Priority Research Centre in Digestive Health and Neurogastroenterology | **Biological Sciences** | SELS |
| **52** | **Investigating a novel mechanism for the spread of antibiotic resistance** | *Acinetobacter baumanii* is a human pathogen of the highest concern due to its increasing acquisition of antibiotic resistances. This project will examine a novel mechanism used by plasmids of *A. baumannii* to shuffle antibiotic resistance cassettes leading to the spread of antibiotic resistance among strains. | A/Prof Ian Grainge<br>P: (02) 4921 7238<br>E: ian.grainge@newcastle.edu.au | Priority Research Centre for Chemical Biology and Clinical Pharmacology<br><br>Priority Research Centre in Digestive Health and Neurogastroenterology | **Biological Sciences** | SELS |
| **53** | **New Antibiotic Discovery** | We are running out of useful antibiotics and new compounds are urgently needed to combat rising antibiotic resistance. This project is in collaboration with US Drug Discovery company ATOMWISE, and will utilise structural information to target and test new compounds specifically designed to inhibit the essential process of bacterial transcription. This project will provide a background in structure-based drug discovery, microbiology, molecular biology, and drug development. | Prof Peter Lewis<br>E: Peter.Lewis@newcastle.edu.au<br>P: (02) 4921 5701 | Priority Research Centre for Drug Discovery / Molecular Microbiology Research Group | **Biological Sciences** | SELS |
| **54** | **HelD: A new class of transcription factor** | We have recently discovered a new class of transcription factor that targets stalled transcription complexes. This is an important function as these stalled complexes represent roadblocks to DNA replication that must be removed to avoid catastrophic damage to the DNA. HelD has a very unusual two-armed structure, and the arms are required to physically lever stalled RNA polymerase off the DNA. We don't exactly how it does this. This project is designed to provide a background in Molecular Biolgoy through the study of how HelD performs its important function. | Prof Peter Lewis<br>E: Peter.Lewis@newcastle.edu.au<br>P: (02) 4921 5701 | Priority Research Centre for Drug Discovery / Molecular Microbiology Research Group | **Biological Sciences** | SELS |

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| **55** | **Where the hell does HelD come from?** | This project is designed to provide a sound background in bioinformatics through the phylogenetic analysis of a newly discovered bacterial transcription factor called HelD and will be perfomed in collaboration with Prof Brett Neilan and Dr Leanne Pearson-Neilan. Some bacteria contain just a single copy of a *helD* gene, but others contain up to 5 different *helD* genes. Why do some bacteria have so many copies of *helD*, and what do they all do? We also know that HelD is related to a class of proteins called helicases: how did HelD evolve from them? | Prof Peter Lewis<br>E: Peter.Lewis@newcastle.edu.au<br>P: (02) 4921 5701 | Priority Research Centre for Drug Discovery / Molecular Microbiology Research Group | **Biological Sciences** | SELS |
| **56** | **Investigating the molecular transport mechanism in a novel class of multidrug efflux pumps** | Resistance to antibiotics in human pathogens is one of the major challenges facing humanity in the 21st century. Multidrug efflux pumps are a unique class of resistance factor, because they can confer resistance to a massive range of antimicrobials. These pumps sit in the bacterial membrane and catalyse the movement of antimicrobials out of the cell. My group recently discovered a completely new family of multidrug efflux pumps, encoded by some of the deadliest and most drug resistant hospital pathogens. This project seeks to understand how these pump work at the molecular level. This information will help in the development of new drug types that could be used to block antimicrobial transport. | Dr Karl Hassan<br>E: Karl.Hassan@newcastle.edu.au<br>P: 49217236 | Priority Research Centre for Drug Development | **Biological Sciences** | SELS |
| **57** | **Development of a metal ion biosensor in *Acinetobacter*** | This project combines synthetic biology with important basic research into an emerging human pathogen. It aims to develop metal ion biosensors that put fluorescent protein expression under the control of a metal sensing regulatory switch. The sensors will be used to identify factors involved in metal ion homeostasis in *Acinetobacter*. Due to the importance of metals for bacterial survival, these factors could be novel targets for the development of future antimicrobials. | Dr Karl Hassan<br>E: Karl.Hassan@newcastle.edu.au<br>P: 49217236 | Priority Research Centre for Drug Development | **Biological Sciences** | SELS |

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| **58** | **Investigating the global regulatory influences of the ferric uptake regulator in the human pathogen *Acinetobacter baumannii*** | Iron is an essential micronutrient in most cells but can be damaging at high concentrations. Therefore, bacteria must tightly regulate the internal concentration of iron and use a coordinated set of uptake, efflux and detoxification systems. The ferric uptake regulator is a master regulator of iron homeostasis in many Gram-negative cells, controlling many metabolic and transport related genes. This project will combine RNA-Seq, ChIP-seq and molecular microbiology to map precisely the regulatory reach of the ferric uptake regulator in the human pathogen Acinetobacter baumannii. The results of this project will help to determine the potential of this regulator as a future drug target. | Dr Karl Hassan<br>E: Karl.Hassan@newcastle.edu.au<br>P: 49217236 | Priority Research Centre for Drug Development | **Biological Sciences** | SELS |
| **59** | **Regulation of the sperm epigenome by extracellular vesicles: a new paradigm** | The prolonged phases of post-testicular maturation and storage of sperm within the male reproductive tract (epididymis) serve as key determinants of gamete quality and fertilisation competence. It has long been held that such processes are driven by dynamic modification of the sperm proteome. However, we have recently shown that the sperm epigenome [i.e. the small non-coding RNAs (sRNAs) carried by sperm cells] is also markedly altered during their epididymal maturation. Such findings are of interest since this complex repertoire of sperm sRNAs are delivered to the oocyte during fertilisation, and can thereafter regulate gene expression and exert substantial influence over early embryonic development. In this project we aim to explore the role of extracellular vesicles in the transfer of sRNAs to maturing spermatozoa; a pathway that would represent a novel mechanism of soma-to-germline communication. | Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br>P: (02) 4921 6977<br><br>Dr Andy Eamens<br>E: andy.emanes@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |

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| **60** | **Proteomic investigation of sperm during epididymal transit** | Arguably the most important tissue involved in post-testicular mammalian sperm maturation is the epididymis, a highly specialised ductal system that drives dramatic functional changes in spermatozoa. Indeed, it is during epididymal maturation that spermatozoa acquire the competence to engage in fertilisation and surprisingly, these changes occur in the complete absence of endogenous gene transcription or de novo protein translation. Despite years of study, we have yet to fully resolve the key pathways that facilitate and promote epididymal sperm maturation. We seek to enhance our understanding of the factors that promote sperm maturation, by compiling the complete complement of sperm proteins during this transit. This specific project will harness cutting edge mass spectrometry, bioinformatical tools and orthogonal validation techniques. These analyses will provide us with the capacity to progressively track the proteomic changes associated sperm maturation and will help improve our understanding of human male fertility and ultimately infertility. | Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br>P: (02) 4921 6977<br><br>Dr David Skerrett-Byrne<br>E: david.skerrett-byrne@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **61** | **Analysis of the dark phosphoproteome drive the functional maturation of sperm** | The functional maturation of sperm occurs as they transit the male (epididymal maturation) and female reproductive tracts (capacitation). A distinctive feature of these sequential phases of maturation is that they occur in the complete absence of de novo gene transcription and protein translation and are therefore completely reliant on the modification of the intrinsic sperm proteome. Among these modifications, protein phosphorylation has emerged as being of fundamental importance. However, the full cascade of phosphorylation events that promote sperm maturation have yet to be resolved. This specific project will harness cutting edge mass spectrometry, bioinformatical tools and orthogonal validation techniques. This work will form an important part of our goal to systematically map these changes and enhance our understanding of male fertility regulation. | Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br>P: (02) 4921 6977<br><br>Dr David Skerrett-Byrne<br>E: david.skerrett-byrne@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |

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| **62** | **Defining environmental drivers of seminal vesicle secretory function** | The seminal vesicle is a male accessory sex gland whose secretions support male gamete function and influence reproductive success. Alterations to seminal vesicle fluid content not only manifest as impaired fertility, but also influence fetal development and impart long term consequences for offspring health. However, the mechanistic basis by which the seminal vesicles alters their secretions are poorly characterized. In this project, we will explore mouse seminal vesicle function using a well-established paternal acrylamide exposure model. We will assess the impact of acrylamide exposure on seminal vesicle small non-coding RNAs using state of the art small RNA sequencing, bioinformatics and validation approaches. These studies will improve our understanding of the seminal vesicles and may reveal novel mechanisms utilised by the seminal vesicle to influence male and female reproductive health. | Dr John Schjenken<br>E: john.schjenken@newcastle.edu.au<br>P: (02) 4921 6351<br><br>Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br><br>Dr David Skerrett-Byrne<br>E: david.skerrett-byrne@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **63** | **Proteomic characterisation of the mouse seminal vesicle and its secretions** | The seminal vesicle is a male accessory sex gland in all mammalian species whose secretions contribute to the composition of the male ejaculate. These secretions play an important role in male and female reproductive biology, carrying factors which facilitate sperm survival and sperm transport. Additionally, seminal vesicle secretions communicate with the female reproductive tract to influence the quality of pregnancy and health of offspring. Despite the critical role that seminal vesicle secretions play around the period of conception and throughout pregnancy, there are limited studies that have characterized this gland. In this project, students will utilize state of the art proteomic and bioinformatic techniques to characterize the protein composition of the mouse seminal vesicle and its secretions. These studies will improve our understanding of this key male accessory sex gland and may reveal novel functions of the seminal vesicle and its secretions in male and female reproductive health. | Dr John Schjenken<br>E: john.schjenken@newcastle.edu.au<br>P: (02) 4921 6351<br><br>Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br><br>Dr David Skerrett-Byrne<br>E: david.skerrett-byrne@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |

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| **64** | **The impact of PFAS on male reproduction** | Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a diverse family of chemicals, some which are very stable in the environment. As such the risks associated with exposure need to be addressed. One area of particular concern is reproduction. Collectively, we are developing exposure models and assessing many aspects of male reproduction. This project will focus on using a range of molecular techniques to assess protein and RNA expression in tissues such as the testis and the male reproductive tract. In addition sperm from exposed animals will be examined for DNA damage using a suite of established assays. | Prof Brett Nixon<br>E: brett.nixon@newcastle.edu.au<br>P: (02) 4921 6977<br><br>Dr Shaun Roman<br>E: shaun.roman@newcastle.edu.au<br><br>Dr Andy Eamens<br>E: andy.eamens@newcastle.edu.au<br><br>Dr Geoff De Iullis<br>E: geoffry.deiuliis@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science<br><br>PRC for Drug Development | **Biological Sciences** | SELS |
| **65** | **The impact of the chemicals we consume on male reproduction** | Acrylamide and ethanol are chemicals human consume in their food and drink. Ethanol is metabolised in many ways. Acrylamide is only metabolised by one enzyme and that enzyme can also metabolise ethanol. We are determining the consequences of metabolism of the different substrates.<br>We are assessing many aspects of male reproduction. This project will focus on using a range of molecular techniques to assess protein and RNA expression in tissues such as the testis and the male reproductive tract. In addition sperm from exposed animals will be examined for DNA damage using the COMET assay. | Dr Shaun Roman<br>E: shaun.roman@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Drug Development<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **66** | **Understanding the impact of heat stress and poor sperm production** | Although not often publicised, many man suffer from infertility and/or subfertility. This leads to a situation where it can take couples years to conceive a child or require the aid of an IVF clinic.A major cause of poor sperm production is heat stress. This project will look at heat stress in two ways.<br><br>Firstly, mice will be anesthetised and undergo testicular heat stress. We will look at the impact this has on sperm production and where things go wrong.<br><br>Secondly, we have teamed up with a company to look at the effect of scrotal cooling and the ability to improve sperm parameters. At the end of this project, students will learn how to anesthetise mice, look at immunohistochemically analysis of testis and sperm sections and finally analyse the impact of scrotal as a means for improving male fertility. | A/Prof Mark Baker<br>E: mark.baker@newcastle.edu.au<br>P: (02) 4921 7880<br><br>Dr Zamira Gibb<br>E: Zamira.Gibb@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |

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| **67** | **The use of CRISPR/Cas9 to understand male-infertility** | Gene editing technology is an important tool to understand biological process, including cancer, immunology and reproduction. Herein, students will learn how to design vectors for the use of CRISPR/Cas9. Using this technology, we will endeavour to produce mouse genetic knockouts to understand the biology of specific genes. In this case, we are particularly interested in genes whose expression only occurs with the testis. This specific project will enable students to better understand CRISPR/Cas9 which has been touted as a major tool for research into all areas of disease management. | A/Prof Mark Baker<br>E: mark.baker@newcastle.edu.au<br>P: (02) 4921 7880 | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **68** | **Understanding how spermatogonial stem cell function is regulated** | Spermatogonial stem cells (SSCs) are the driving force behind ongoing sperm production and male fertility. These cells have the potential to be used as a therapeutic tool to restore fertility in survivors of childhood cancer that have been rendered permanently infertile by chemotherapy or radiotherapy treatments. Currently, we have a limited understanding of molecular mechanisms that regulate SSC function, and how these molecules may be dysregulated in an in vitro setting (i.e. when preparing cells for clinical use). Thus, in this project, we aim to characterise molecular networks that regulate SSC function, and investigate changes in expression of these molecules following extended periods of in vitro culture. | Dr. Tessa Lord<br>E: Tessa.lord@newcastle.edu.au<br>P: (02) 4055 3026 | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **69** | **Protein modelling and drug interactions** | Male infertility effects 1 in 20 Australian men, therefore the development of rational therapies to minimise fertility issues are greatly needed. Oxidative stress in known to be a key driver of poor sperm function, however the origin of this stressor is poorly defined. We now know that lipoxygenase enzymes in spermatozoa, are a potential driver of oxidative stress and therefore is a valuable target for male infertility therapies. This project will involve the use a combination of online databases and platforms together with dedicated molecular modelling software hosted at the UON, to build virtual enzyme structures, which can used to study drug interactions and enzyme activity. | Dr Geoffry De Iuliis<br>E: geoffry.deiuliis@newcasltle.edu.au<br>P: (02) 4921 7295 | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |

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| **70** | **Sperm RNA binding proteins and measuring RNA damage** | MicroRNA species are a key epigenetic factor that contributes not only to fertility but also to normal embryo development. While the importance of these epigenetic factors in reproduction is now established, how these microRNA species are packaged in the male reproductive tract and therefore their vulnerabilities to damage, particularly oxidative damage, is poorly characterised. This project will use a combination of a bioinformatics and protein/RNA isolation techniques to identify RNA binding protein candidates and to assess RNA oxidative damage. | Dr Geoffry De Iuliis<br>E: geoffry.deiuliis@newcasltle.edu.au<br>P: (02) 4921 7295<br><br>Dr Andy Eamens<br>E: andy.eamens@newcastle.edu.au | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **71** | **How do the electromagnetic fields used by mobile devices stop sperm motility?** | Electromagnetic energy in the radio and microwave spectrum (non-ionising radiation) are currently used for communications between mobile devices and access points (transmission towers and WiFi points). The ubiquitous nature of mobile device use in today's society has called into question the safety of such devices via the chronic exposure to low level, non-ionising radiation. We have found that experimental simulation of these fields are able to stop human sperm motility. This project will involve the exposure of spermatozoa to electromagnetic energy and the subsequent assessment of perturbed biochemical pathways that may lead to the observed motility loss. Understanding the origins of these effects in biology are critical for informing safety standards, while contributing to an area of science in the public spotlight. | Dr Geoffry De Iuliis<br>E: geoffry.deiuliis@newcasltle.edu.au<br>P: (02) 4921 7295 | Reproductive Science Group<br><br>PRC for Reproductive Science | **Biological Sciences** | SELS |
| **72** | **Interfacial Phenomena in Electrochemical Capacitors** | Efficient, reliable and sustainable energy delivery is a key feature of contemporary society. Electrochemical energy storage and conversion is an attractive option. Electrochemical capacitors present a high power option with excellent cyclability due to physical charge storage at the electrode-electrolyte interface. Here we will be examining electrolyte characteristics such as ion size, concentration, polarity and solvation for their impact on charge storage. This project will have a fundamental impact on our understanding of the electrified interface, and will involve aspects of material design and electrochemical characterization. | Professor Scott Donne<br>E: scott.donne@newcastle.edu.au<br>P: (02) 4921 5477 | Priority Research Centre for Frontier Energy Technologies | **Chemistry** | SELS |

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| **73** | **Single Wall Carbon Nanotube Inclusion in Energy Storage Materials** | Electrochemical energy storage and conversion systems quite often use composite electrodes consisting of semiconducting electroactive materials, an electronic conductor (such as graphite) and a binder to hold it all together. Components other than the electroactive material decrease the energy contained within the electrodes, and so their presence must be optimized. Recently we have proposed the concept of 'carbon efficiency' within an electrode to represent the minimum amount of conducting carbon necessary to sustain optimum performance. For that we have developed methods of including single wall carbon nanotubes into electroactive electrode materials, resulting in improved efficiency and performance. This project will expand on this concept to include other electroactive materials. It will involve aspects of material synthesis and characterization, as well as electrochemical evaluation of performance. | Professor Scott Donne<br>E: scott.donne@newcastle.edu.au<br>P: (02) 4921 5477 | Priority Research Centre for Frontier Energy Technologies | **Chemistry** | SELS |
| **74** | **Photo-Assisted Charge Transfer in Energy Storage Materials** | Many electrochemical energy storage and conversion systems use semiconducting positive electrodes. This is quite often necessary because of the need for a high oxidation state material. It has recently been demonstrated that the performance of positive electrode materials can be enhanced under light illumination indicating that the electronic structure of the electrode materials is interacting with the incident light to enhance performance. The focus of this project is on the enhanced understanding of the interaction between light and electrode materials, as well as identifying alternate materials that exhibit the same phenomena. The project will involve aspects of material synthesis and photoelectrochemistry. | Professor Scott Donne<br>E: scott.donne@newcastle.edu.au<br>P: (02) 4921 5477 | Priority Research Centre for Frontier Energy Technologies | **Chemistry** | SELS |

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| **75** | **Electroanalytical Characterization of Battery and Electrochemical Capacitor Systems** | Electrochemical energy storage and conversion systems enable portable electrical energy for many aspects of society. While this has been ongoing for many years, a thorough understanding of the processes occurring within these systems is still lacking. Here we are proposing the use of recently developed electroanalytical tools to examine individual electrode behaviour, as well as interactions between electrodes via the electrolyte; i.e., soluble species formation. Such methods have been used to indicate when electrode dissolution occurs, as well as what impact it has on electrode behaviour. This project will involve aspects of material synthesis and characterization, as well as detailed electrochemical assessment of device behaviour. | Professor Scott Donne<br>E: scott.donne@newcastle.edu.au<br>P: (02) 4921 5477 | Priority Research Centre for Frontier Energy Technologies | **Chemistry** | SELS |
| **76** | **Manipulation of lipid nanostructures by protein attachment** | Drug delivery systems are used to maximise the rate and amount of drug delivered to the site of action whilst minimising side effects that can be caused by acute doses of drug. Lipid nanoparticles are used for this purpose not only because they are biocompatible, but also because the nanostructure that they form dictate the rate of release of drug. The nanostructure that they form can be precisely controlled by subtle manipulations of intermolecular interactions. This project is a mixture of colloidal chemistry, light scattering and drug release kinetics where you will design and create lipid particles which provide on-demand release of drug. | Dr Khay Fong<br>E: khay.fong@newcastle.edu.au<br>P: (02) 4921 7449 | Self-assembled systems/<br>Priority Research Centre for Chemical Biology and Clinical Pharmacology (Drug Development) | **Chemistry** | SELS |
| **77** | **Enhancing drug and nutrient delivery through the manipulation of the microbiome** | Towards the development of better medicines, nanoparticles formed by the self-assembly of lipids have been shown to vastly improve the delivery of drugs via the gastrointestinal tract. However, their application has been limited by the variation in absorption between different patients, potentially due to the differences in one's microbiome. The gut microbiome plays a key role in maintaining your health and wellbeing. As well as influence the way you process and absorb drugs and nutrients. In this project, you will investigate the effect of the microbiome on lipid nanomaterials and vice versa using physicochemical methods. | Dr Khay Fong<br>E: khay.fong@newcastle.edu.au<br>P: (02) 4921 7449 | Self-assembled Systems Research Group/<br>PRC Drug Development | **Chemistry** | SELS |

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| **78** | **Colorimetric sensors for the detection of sulphates** | Excess sulphate anions can wreak havoc on both environmental and industrial processes. Increased concentrations can cause water to have salty taste and bad odour, toxicity when ingested and calcium sulphate scale formation can block processes. Nanomaterials formed by the self-assembly of lipid molecules are ideal matrices for colorimetric detection as they are isotropic and can host a wide range of hydrophilic, hydrophobic and amphiphilic structures. In this project, you will create a nanostructured gel incorporating a proprietary sulphate sensing molecule for the fast and local detection of sulphates in environmental and industrial samples. | Dr Khay Fong<br>E: khay.fong@newcastle.edu.au<br>P: (02) 4921 7449 | Self-assembled Systems Research Group/<br>PRC Drug Development | **Chemistry** | SELS |
| **79** | **Does my seafood have microplastics?** | Approximately 10 million tonnes of plastic are introduced to the oceans annually, primarily from human activities occurring on land. The problem with plastics is that they do not naturally degrade, but age and weather over time due to exposure to UV light and the mechanical action of waves. In this project you will investigate oysters from the NT for microplastics in partnership with Tangaoroa Blue. You will digest the organic material then identify any identified microplastics using FTIR. | Dr Khay Fong,<br>E: khay.fong@newcastle.edu.au<br>P: (02) 4921 7449<br><br>Ms Maddison Carbery<br>E: Maddison.carbery@newcastle.edu.au | Self-assembled Systems Research Group | **Chemistry** | SELS |
| **80** | **Development of MIPs for Aldehydes and Ketones** | This is a novel project that will tackle imprinting of aldehydes and ketones by utilising their characteristic reaction with hydrazines forming hydrazones. Work will entail literature review, design of polymerisable hydrazines/hydrazones and synthesis of MIPs. Extraction will depend on the reversibility of the reaction hence it is also necessary to study the kinetics of the formation and hydrolysis of hydrazones. Potential application of this MIPs is in fragrance industry. | A/Prof Clovia Holdsworth<br>P: (02) 4921 5481<br>E: clovia.holdsworth@newcastle.edu.au | Priority Research Centre for Organic Electronics<br><br>Priority Research Centre for Chemical Biology and Clinical Pharmacology (Drug Development) | **Chemistry** | SELS |

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| **81** | **Preparation of Copolymers for Extraction of Membrane Proteins** | The challenge with the studies of membrane proteins is their extraction while preserving their native lipid environment. Styrene maleic acid copolymers (SMA) copolymers have been found to be successful in solubilising and stabilising the membrane proteins by encapsulation by forming SMA-lipid particles (SMALPs). Other polymer variants to form SMALP-like particles have also been studied. While the performance of the SMA copolymers could be optimised by controlling their lengths and composition, their efficacy is limited to near neutral pH. In this project, we will target copolymers with SMA-like properties which will potentially work at low pH. This project will involve synthesis of copolymers by radical polymerisation, molecular weight determination by size-exclusion chromatography and determination of copolymer composition by $^{1}H$ NMR. Once the copolymers have been characterised and purified, their efficacy in stabilising lipids that contain membrane proteins will be tested, if time permits.<br><br>This part of the project will supervised by Dr Karl Hassan and group (Biological Sciences). | A/Prof Clovia Holdsworth<br>P: (02) 4921 5481<br>E: clovia.holdsworth@newcastle.edu.au | Priority Research Centre for Chemical Biology and Clinical Pharmacology (Drug Development) | **Chemistry** | SELS |
| **82** | **Water Splitting Perovskite Materials** | Hydrogen is a superior energy source due to its high energy density, ease of storage and transportation, and the fact that it produces water as the only chemical product from combustion. One potential method for producing hydrogen is by splitting water, according to the stoichiometric equation $2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$. Being able split water photocatalytically – i.e. using solar irradiation – is the ultimate goal of hydrogen energy technologies. Recently, a new class of photocatalysts – perovskites – have begun to show significant potential in this area. Perovskites are binary metal oxides with chemical structure $ABO_3$, where a metal cation A occupies 12-coordinate interstitial sites within octahedral $BO_6$ units. The aim of this project is to optimise new perovskite materials for photocatalytic water-splitting using computational chemistry. | A/Prof Alister Page<br>P: (02) 4033 9357<br>E: alister.page@newcastle.edu.au | Page Computational Chemistry Group | **Chemistry** | SELS |

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| **83** | **Carbon Nanotube "Nanoreactors"** | A carbon nanotube is a sheet of carbon atoms in a chicken wire pattern, rolled up into a cylinder. Although they are only ~1 nanometer in diameter, they can be several millimeters in length, are ~100 times stronger than Kevlar, and can transport ~1000 times as much electricity as copper wires. Recent experiments have shown that carbon nanotubes may act as 'nanoreactors', or vessels, in which surprising and unexpected chemical processes can take place. While these processes have been demonstrated experimentally, no study of *how* these processes take place has been performed to date. Such study is critical if these processes are to be optimised and applied on commercial/industrial scales. This project will use computational chemistry to simulate how chemical reactions occur inside carbon nanotubes, and what the effects of confinement on chemistry are. | A/Prof Alister Page<br>P: (02) 4033 9357<br>E: alister.page@newcastle.edu.au | Page Computational Chemistry Group | **Chemistry** | SELS |
| **84** | **How do Carbon Nanotubes Grow?** | A carbon nanotube is a sheet of carbon atoms in a chicken wire pattern, rolled up into a cylinder. Although they are only ~1 nanometer in diameter, they can be several millimeters in length, are ~100 times stronger than Kevlar, and can transport ~1000 times as much electricity as copper wires. They can also be both electrically conducting and semiconducting, depending on how the carbon atoms in their structure are arranged. Development of future carbon nanotube-based technologies is currently prevented by our inability to synthesise particular carbon nanotubes selectively. This project will determine how selective carbon nanotube "growth" can be achieved, and will pave the way for the future development of carbon nanotube-based devices. | A/Prof Alister Page<br>P: (02) 4985 4585<br>E: alister.page@newcastle.edu.au | Page Computational Chemistry Group | **Chemistry** | SELS |
| **85** | **Origins of Hofmeister Effects** | In the late 1800s, Franz Hofmeister discovered that, while some salts would decrease the solubility of egg whites in water, others increased their solubility. This phenomenon is known as the Hofmeister effect. Despite its apparent simplicity, consensus over the origins of the Hofmeister effect still has not been reached. In the century since Hofmeister's discovery, the Hofmeister effect has been observed in a wide range of other dissolved solutes, from DNA, enzymes, surfactants and colloidal suspensions. This project will use molecular simulations to understand the origins of the Hofmeister effect in condensed phases, and how dissolved salts influence the solid-liquid interfaces. | A/Prof Alister Page<br>P: (02) 4033 9357<br>E: alister.page@newcastle.edu.au | Page Computational Chemistry Group | **Chemistry** | SELS |

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| **86** | **Electrostatic formation of liquid marbles** | Liquid marbles are liquid droplets coated with colloidal particles such that a collection of these objects has the appearance of a dry powder, but is largely liquid. They have inspired a variety of applications, including pollution and gas sensors, actuators, microreactors and drug delivery vehicles. In a novel electrostatic formation process we are establishing a new design paradigm for liquid marble manufacturing, accessing marble geometries and compositions not previously possible through traditional production methods. This project is a combination of colloid and interface science, particle electrostatics and materials science. | Prof Erica Wanless<br>P: (02) 4033 9355<br>E: Erica.Wanless@newcastle.edu.au | Priority Research Centre for Advanced Particle Processing and Transport | **Chemistry** | SELS |
| **87** | **Smart polymeric coatings** | Polymer films can radically change the surface of a material while leaving the bulk properties of the material intact. The polymer surface coating controls the interaction with other objects through nanoscale forces. We will fabricate a new generation of polymer films that contain an inbuilt molecular-scale switch from attractive to repulsive interactions, offering a means for dictating macroscopic character such as the wettability, adhesion or friction of a surface. Academic and industrial interest in these coatings is increasing rapidly, for potential application as low-friction coatings for confined parts or rheology modifiers.<br><br>This project can have either a polymer synthesis, characterisation, or materials engineering focus. You will join the group effort aimed at synthesising and studying these smart polymer coatings and perform state-of-the-art surface characterisation that will ultimately determine their use! | Prof Erica Wanless<br>P: (02) 4033 9355<br>E: Erica.Wanless@newcastle.edu.au | Priority Research Centre for Advanced Particle Processing and Transport | **Chemistry** | SELS |
| **88** | **Quantifying the fraction of broken waves in the surf zone** | This project will quantify the percentage of waves in the surf that are breaking using field data. Knowing this is a crucial step in improving coastal models that are used for predicting beach change, such as erosion, and for coastal management. The project will use a combination of video data and pressure transducer records to provide clear estimates of the fraction of broken waves and how it varies between beaches. In this project you will learn how to collect and analyse coastal field data. You will also learn computer programming and image analysis techniques. | Dr Hannah Power<br>P: (02)4921-5606<br>EHannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |

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| **89** | **Water velocities and wave heights in the surf zone** | Understanding the link between wave heights and water velocities in the surf zone is crucial for understanding sediment transport on beaches. In this project you will investigate why two waves of the same height can suspend different amounts of sediment. You will conduct a field experiment to obtain data on wave heights, water velocities, and suspended sediment concentrations, and analyse this data to identify which waves suspend the most sediment. In this project you will learn how to collect and analyse coastal field data. You will also learn computer programming techniques. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |
| **90** | **Storm erosion on beaches: A case study of the June 2016 storm** | This project will investigate how beaches respond to storms using the June 2016 east coast low storm as a case study. This storm caused the greatest coastal erosion observed on NSW beaches in over 40 years. This project will use topographic and bathymetric datasets collected before and after the storm to investigate beach change including how beach profiles changed and the magnitude of shoreline erosion. In this project you will learn to use GIS to combine topographic and bathymetric datasets and to conduct your data analyses. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |
| **91** | **Barrier overtopping and dune erosion on NSW beaches** | This project will use a range of data to identify beaches in NSW that are most at risk of wave overtopping due to extreme runup during storms. The project will use high resolution coastal LiDAR data to obtain dune elevations for several study sites. Offshore wave height data will then be used to obtain runup elevations based on standard formulations. The sites at risk of dune overtopping and erosion will then be identified to inform state-wide coastal management. In this project you will complete a thorough literature review of methods for predicting coastal runup and the causes of dune erosion and wave overtopping. You will use GIS to analyse the LiDAR data and NSW offshore wave height data to obtain the input parameters for the runup models. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |

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| **92** | **Wave runup on beaches and rock platforms** | This project will examine wave runup on beaches and rock platforms using field data. Understanding wave runup on beaches is crucial for coastal management including being used for predicting beach erosion during storms and for predicting coastal barrier overtopping due to waves. Understanding wave runup on rock platforms is important for understanding the hazards associated with rock platforms and for coastal management. It is also relevant for other factors such as defining biological habitat zones. The project will use a combination of video data and pressure transducer records to investigate wave runup. In this project you will learn how to collect and analyse coastal field data. You will also learn computer programming and image analysis techniques. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |
| **93** | **Investigation Australia's Continental Margin Submarine Landslides and their deposits** | Submarine landslides have been occurring intermittently on the eastern Australian coastal margin for about 15 million years and can be expected to reoccur in the future. Some of these slides probably generated tsunami similar in size to, or possibly larger than, the 1998 Aitape PNG submarine landslide event (~2000 deaths). Identifying landslide sites, the morphology of their slide scars, and the characteristics of the slope they moved over will help to determine their size and frequency of occurrence. This information will improve evaluation of the hazard and risk to the eastern Australian seaboard communities posed by locally-generated, submarine-landslide induced tsunami. This project will use industry standard software to map and model the potential impact of submarine landslides on coastal communities. You will learn GIS techniques and data analysis techniques. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | Environmental and Climate Change Research Group | **Earth Sciences** | SELS |
| **94** | **Remote Sensing Investigation of sediment dynamics in Rainbow Channel** | This project will investigate the sediment dynamics of Rainbow Channel between North Stradbroke Island and Moreton Island, Queensland, using remote sensing and GIS techniques. The project aims to interpret how sand moves around through the channel and how tides and waves drive this sediment movement. Students will gain skills in GIS analysis and remote sensing using ArcGIS and also skills in data manipulation and analysis in Excel. | Dr Hannah Power<br>P: (02) 4921-5606<br>E: Hannah.Power@newcastle.edu.au | | **Earth Sciences** | SELS |

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| **95** | **Identification and assessment of the status of Squirrel Gliders in Newcastle and Port Stephens** | Squirrel gliders are considered 'vulnerable' in NSW and recent reports indicate that the high-density population in Port Stephens is doing better than the local Newcastle and Lake Macquarie populations which are highly fragmented and at risk of local extinction. We are seeking a student with an interest in developing skills in arboreal mammal ecology to detect squirrel gliders to help define habitat utilisation. This project will assist in developing a dataset that will be used to inform habitat important to squirrel gliders, and answer questions of species density and recruitment. | A/Prof John Clulow<br>E: john.clulow@newcastle.edu.au<br>P: 0401 349 767<br><br>Dr Ryan Witt<br>E: ryan.witt@newcastle.edu.au<br>P: 0421 606 222 | Conservation Biology Research Group | **Environmental Science and Management** | SELS |
| **96** | **Estimating koala presence and density on the Tilligerry Peninsula/Northwest Port Stephens – a historical comparison** | Koalas are persisting on the Tilligerry Peninsula and in the Northwest of Port Stephens despite urban growth and several anthropogenic drivers of decline. However, it largely remains unclear how many koalas remain and if recruitment (successful breeding) is occurring. We are seeking a student with an interest in developing skills in arboreal mammal ecology to detect koalas and help define active breeding habitat. This project will assist in developing an updated dataset that will be used to complete a historical analysis of the koala population. | A/Prof John Clulow<br>E: john.clulow@newcastle.edu.au<br>P: 0401 349 767<br><br>Dr Ryan Witt<br>E: ryan.witt@newcastle.edu.au<br>P: 0421 606 222 | Conservation Biology Research Group | **Environmental Science and Management** | SELS |
| **97** | **Finding frogs in far-flung places** | Many Australian frog populations are in decline. Habitat modification, disease and stream pollution are identified as key threats to population viability of these frog populations. However, most remnant populations are not monitored in terms of population numbers or quantification of threats. This means that we are unable to determine appropriate management responses to protect the viability of threatened frog populations in the wild. In this project we will visit seven coastal NSW national parks (east of the Great Dividing Range) to rediscover historical populations of frogs and determine their population size and health. This includes Davies' Tree Frog which is only recently described and for which very little is known. Transport and accommodation provided (sometimes camping). National Parks include New England, Dorrigo, Werrikimbe, Barrington Tops, Watagans, Blue Mountains and Kanangra-Boyd. | A/Prof Matt Hayward<br>E: matthew.hayward@newcastle.edu.au<br><br>For further information contact:<br>Dr Alex Callen<br>Alex.callen@newcastle.edu.au | Conservation Science Research Group | **Environmental Science/ Biology** | SELS |

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| **98** | **The effects of habitat manipulations on tadpole development of the endangered green and golden bell frogs** | The green and golden bell frog is an endangered species threatened by disease. The disease is caused by an aquatic pathogen known to be mitigated by manipulation of frog habitat. In this field experiment you will monitor tadpoles released into waterbodies that are shaded or exposed to direct summer sunlight to determine how much shade influences water temperature and whether water temperature affects time to and size at development. Some evening surveys will also be required as tadpoles metamorphose into frogs. This project will be conducted at the Hunter Wetlands Centre, a 5 minute drive from Callaghan campus. | A/Prof Matt Hayward<br>E: matthew.hayward@newcastle.edu.au<br><br>For further information contact:<br>Dr Alex Callen<br>Alex.callen@newcastle.edu.au | Conservation Science Research Group | **Environmental Science/ Biology** | SELS |
| **99** | **Sun, surf and sand – Frogs and coastal flooding regimes** | Situated at the entrance of Avoca Lagoon on the sunny central coast, Bareena Wetland is home to a remarkable population of the endangered green and golden bell frog. Remarkable because they have persisted in a modified wetland environment at the mercy of natural coastal zone process such as high seas and lagoon openings, squashed between the lagoon and sprawling suburbia. You will join a field team surveying these frogs weekly (evening and daytime). There will be opportunities for lab work and acoustic data analysis also, if interested. | A/Prof Matt Hayward<br>E: matthew.hayward@newcastle.edu.au<br><br>For further information contact:<br>Dr Alex Callen<br>Alex.callen@newcastle.edu.au | Conservation Science Research Group | **Environmental Science/ Biology** | SELS |
| **100** | **Threatened wallabies** | You will participate in field work to capture threatened wallabies via Thomas traps, and camera trapping in the north-east forests of NSW. This will involve camping for 10 days, and then identifying the animals captured in the camera photos back in the lab. | Dr Matt Hayward<br>E: matthew.hayward@newcastle.edu.au<br>P: 49217472 | Conservation Science Research Group | **Environmental Science** | SELS |
| **101** | **Broad-toothed rats** | You will assist PhD student Charlotte Alley conduct fieldwork in the Barrington Tops National Park looking for broad-toothed rats. This will involve camping for a week or staying in a hut with gas, toilet and water, and assisting with trapping, vegetation quadrats and scat surveys. | Dr Matt Hayward<br>E: matthew.hayward@newcastle.edu.au<br>P: 49217472 | Conservation Science Research Group | **Environmental Science** | SELS |
| **102** | **Using sound to monitor threatened species.** | Using sound recorders to detect cryptic species in remote locations is rapidly becoming a standard methodology for biodiversity monitoring, and being able to analyse these recordings is quickly becoming a desirable skill for environmental work. This project uses sound recorders to monitor for threatened frog species in pristine habitats and areas impacted by mining. This project will involve using the latest audio recognition software to analyse field recordings and establish a call library. Interested candidates may also join field teams to collect sound data. This will be a computer-based project with flexible time requirements, and options to join our field team if desired. | Dr Kaya Klop-Toker<br>E: kaya.klop-toker@newcastle.edu.au<br>P: 0450 127 544 | Conservation Biology Research Group | **Environmental Science and Management** | SELS |

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| **103** | **How water quality affects tadpole growth** | Underground coal mining can cause pond drying and changes in water quality. These habitat changes may impact several pond-breeding frogs in NSW, including threatened heath frogs, *Litoria littlejohni*. This study will experimentally examine how changes in water quality and pond volume have on this *L. littljohni* tadpole development. The project will involve regular checking of tadpole growth rates and fitness, plus opportunities to join field team on regular tadpole surveys in the Watagans National Park. | Dr Kaya Klop-Toker<br>E: kaya.klop-toker@newcastle.edu.au<br>P: 0450 127 544 | Conservation Biology Research Group | **Environmental Science and Management** | SELS |
| **104** | **Assessing how environmental conditions affect wildlife disease** | Many Australian frogs have experienced severe population declines due to the amphibian fungal disease, chytridiomycosis (aka; chytrid). The severity of this disease is influenced by environmental parameters such as temperature, moisture, and salinity. Therefore, it is possible that different land uses could affect chytrid severity. This project will test how chytrid severity differs between pristine and degraded habitats, and before and after bushfire. Infection loads will be determined using real-time PCR techniques to analyse skin-swab samples collected from the field. There are also options to assist with disease culturing. | Dr Kaya Klop-Toker<br>E: kaya.klop-toker@newcastle.edu.au<br>P: 0450 127 544 | Conservation Biology Research Group | **Environmental Science and Management** | SELS |
| **105** | **Is diet quality limiting the reproductive success of urban parrots?** | This project is part of a large study in which we are examining whether diet quality limits the reproductive success of native parrots in our cities. The project will involve fieldwork in and around Newcastle checking nest boxes and managing nest box cameras to record the foods parents feed to chicks. | Dr Andrea Griffin<br>P: (02) 4348 4393<br>E: Andrea.Griffin@newcastle.edu.au | Conservation Biology Research Group | **Psychology** | PSYC<br>SELS |
| **106** | **Habitat use by Eastern curlew in Port Stephens estuary** | This project is part of a long-term study in which we are using automated radiotelemetry to record the movements of Eastern curlew in Port Stephens and Hunter estuaries to understand which areas they use to feed at low-tide and to roost at night. The project will involve observational field work on migratory shorebirds in Newcastle and Port Stephens estuaries, NSW. The project will offer opportunities to participate in bird banding expeditions and to become involved with the local bird stakeholder community. | Dr Andrea Griffin<br>P: (02) 4348 4393<br>E: Andrea.Griffin@newcastle.edu.au | Conservation Biology Research Group | **Psychology** | PSYC<br>SELS |
| **107** | **Scavenging as an indicator of ecosystem function** | Ecosystem function can be assessed in many different ways however, this usually involves conducting complex field experiments. Ecosystem functioning is also important in the assessment of ecosystem health. This project will use scavenging by secondary consumers as an indicator for ecosystem functioning. This project will involve fieldwork using underwater video systems. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |

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| **108** | **Faunal assemblages associated with an endangered soft coral** | Dendronephthya australis is a soft coral that is only known to inhabit Port Stephens and the Brisbane Water estuary. Preliminary studies have shown that other endangered species, such as seahorses, are known to be associated with the soft coral. This project will use underwater technologies such as an ROV to map the population of soft corals and determine the associated faunal assemblages. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **109** | **Crustaceans as an indicator of nutrient source in coastal lagoons** | Sustainable management of coastal lagoons relies upon the identification of stressors to that system. This involves the determination of nutrient sources to these coastal systems so that any adverse impacts due to nutrient loading can be mitigated. Stable isotope analysis is a tool that can identify the dominant source of nutrients to a waterway. This project focuses on using crustacean species as an indicator of nutrient source to coastal lagoons. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **110** | **Novel 3D modelling of oyster shape as an indicator of health** | Wallis Lake is the major oyster growing estuary for NSW. Recent work has shown that growout methods can affect shell shape and oyster size and that hatchery vs wild spat respond differently to environmental conditions. This project will use 3D photogrammetry and modelling software to develop an indicator of oyster health using shape and size. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **111** | **Ecological effects of oyster infrastructure** | Oyster aquaculture is worth over $35M in NSW with 3200 leases in operation. This represents a significant amount of infrastructure within these estuaries. This project will use novel techniques, such as ROV's and underwater cameras, to determine the effect of infrastructure on the abundance, diversity and recruitment of commercial species in the Wallis Lake estuary. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **112** | **Foreshore stabilisation using oyster shells** | In response to erosion concerns of estuarine systems, oyster shells are being trialled as a mechanism of foreshore stabilisation. Oyster shells are intended to moderate wave action to reduce erosion and create habitat for fish and invertebrates. This project will investigate the effect of stabilisation methods on fish and benthic communities in Wallis Lake. This project will involve some field and laboratory work. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |

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| **113** | **Seahorse and pipefish abundance and distribution in Tuggerah Lakes** | Understanding global distribution and habitat preference for rare animals is key to ecology and wildlife conservation. Seahorses are small, cryptic sedentary marine fishes well known for their male pregnancy and charismatic appearance, and whose conservation is of global concern. Given the lack of data for this species in Tuggerah Lakes, this study will conduct an assessment of seahorse and pipefish distribution and abundance. This project will involve some field and laboratory work. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **114** | **Using 3D imagery to determine morphometrics of sharks and rays** | Gathering morphometric data of sharks and rays *in situ* is both problematic and dangerous. Novel techniques, such as 3D mapping using a digital camera, is capable of rendering a scaled image which enables precise morphometric measurements to be taken. This project will use sharks and rays caught in the NSW beach meshing program as subjects for 3D mapping and measurement. This project will involve laboratory and computer work. | Dr Troy Gaston<br>P: (02) 4349 4569<br>E: Troy.Gaston@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **115** | **Rottnest Island marine microbial community dynamics** | Healthy oceans depend on communities of marine bacteria, but scientists are just beginning to understand the important environmental roles that microbes play in marine ecosystems. Seawater samples and a range of environmental parameters were collected at Rottnest Island, Western Australia during 2016 and 2017. This project will examine the dynamics of marine microbial communities in the plankton, based on DNA sequencing data of both the bacterial and microbial eukaryotes. | Dr Megan Huggett<br>E: megan.huggett@newcastle.edu.au<br>P: (02) 4348 4025 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **116** | **Sponge symbiont dynamics in Marmion Marine Park, Western Australia** | Marine sponges host an incredible density and diversity of microorganisms. These microbes can comprise up to 35% of the sponge volume and contribute to a range of nutrient transformations, including key steps of the nitrogen cycle. Tissue samples of the marine sponge *Mycale mirabilis* were collected from two site in Marmion Marine Park, Western Australia, during 2016 and 2017 and a range of environmental parameters measured. This project will examine the dynamics of the sponge-associated microbial communities, based on DNA sequencing. | Dr Megan Huggett<br>E: megan.huggett@newcastle.edu.au<br>P: (02) 4348 4025 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |

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| **117** | **Use of 3D printed coralline algae by sea urchin larvae** | Most marine invertebrates have a larval phase that searches for a suitable habitat before metamorphosing into the adult phase that then inhabits the reef environment. Understanding the processes that influence metamorphosis of benthic organisms (sponges, corals, sea urchins) is a key area of marine ecology. The sea urchin, *Heliocidaris erythrogramma,* preferentially metamorphoses on coralline algae. This project will use 3D printing to create artificial coralline algae and will test the response of sea urchin larvae to these 3D printed habitats. | Dr Megan Huggett<br>E: megan.huggett@newcastle.edu.au<br>P: (02) 4348 4025 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **118** | **Invertebrates as indicators of change in marine systems** | Seafloor invertebrates provide a window to understanding the effects of human-induced changes on ecosystems. Collections of invertebrate samples from under and around aquaculture facilities, such as those from fish farms, mussel and/or oyster leases in NSW enable their assemblage and population characteristics to be addressed and interpreted against known spatial and temporal information, including the stocking and growth of the farmed organisms. This project will involve supervised laboratory activities and a possibility of field work. An exciting opportunity for you to develop further your taxonomic and analytical skills in the marine space, and for to optimise (or find!) your own research interests. | Dr Margaret Platell<br>P: (02) 4349 4809<br>E: Margaret.Platell@newcastle.edu.au<br>(Ourimbah Campus) | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **119** | **Potential effects of climate change on seagrass fish communities** | Thermal effluent from power stations in Lake Macquarie that heats water up to 7° greater than ambient, provides an ideal field situation in which to assess the responses of estuarine assemblages, including seagrass, invertebrates and fish, to this putative climate change effect. This project will involve supervised laboratory activities and field work. | Dr Margaret Platell<br>E: Margaret.Platell@newcastle.edu.au<br>P: (02) 4349 4809 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **120** | **Dynamics of macroalgal blooms in NSW coastal lagoons.** | Nuisance increases in macroalgal biomass (blooms) in coastal lagoons is a wordwide phenomenon. It has been linked to increases in nutrients and temperature in urbanised estuaries but can happen in pristine estuaries as well. There is no real understanding of the causes and dynamics of such blooms. The student will be working alongside a Master's student who developed an index to detect macroalgal blooms using freely available satellite images. The aim of the project is to look at a number of NSW estuaries to determine: 1, whether there is a consistent difference in frequency and magnitude of algal blooms in urbanised and non-urbanised estuaries and 2, whether there is a consistent seasonal pattern in bloom occurrence. You will learn to process and analyse satellite images using the latest version of ArcGIS software. | Dr Maria Schreider<br>E: Maria.Schreider@newcastle.edu.au<br>P: 43484228 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |

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| **121** | **Temporal variability in abundance of blooming macroalgae in Tuggerah Bay, Central Coast, NSW** | Tuggerah bay experiences regular blooms of opportunistic macroalgae (*Ulva intestinalis, Chaetomorpha* sp. and a few other species). The study focusses on collecting data on the seasonal changes in algal abundance using complementary data from drone and satellite images. Specifically, we will analyse temporal dynamics and investigate a relationship between algal abundance and a set of environmental variables. The student will obtain drone and satellite images and apply the latest version of ArcGIS software to process and analyse the data. | Dr Maria Schreider<br>E: Maria.Schreider@newcastle.edu.au<br>P: 43484228 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **122** | **The Christmas worms identity: does morphology correspond to genetics data?** | With the recent surge in the use of molecular techniques in phylogeny and species identification, it is very important to determine how well the identities and taxonomic relationships based on molecular data correspond to those based on traditional morphological criteria. We have sequenced two DNA markers of a coral-associated Christmas worm from *Spirobranchus corniculatus* complex. The project's aim is to collect morphological data on the specimens that had been sequences and determine whether identification based on the structure of the operculum (the main morphological feature used in traditional taxonomic work) is consistent with the identifications based on molecular sequences. | Dr Maria Schreider<br>E: Maria.Schreider@newcastle.edu.au<br>P: 43484228 | Coastal and Marine Science Research Group | **Environmental Science and Management** | SELS |
| **123** | **Assessment and application of new technologies in water quality monitoring and analysis** | Management of water quality in drinking water supply catchments and wastewater systems is increasingly challenging under the pressures of climate change and growing populations. A variety of potential project opportunities exist for students in relation to: application of new technologies for microbial water quality analysis, contamination source tracking, assessment of algal communities in rivers and management of algal growth in wastewater treatment systems; development of a DNA analysis technique for monitoring the impact of wastewater discharges on benthic marine and estuarine communities; and characterising biological stability within the drinking water distribution network. Details of each project will be developed in consultation with the student and participating water industry professionals. | Dr Craig Evans<br>E: craig.evans@newcastle.edu.au<br>P: **(**02**)** 4921 5630 | Environmental Water Science | **Environmental Science and Management** | SELS |

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| **124** | **Metals in Saltmarsh Communities** | The state of New South Wales in Australia has listed saltmarsh as an endangered ecological community. Consequences of this listing are that threats and impacts to the community are ameliorated where possible and that management and regulation ensures that local distributions are not placed at risk of extinction. One of the most important threatening processes for Australian saltmarsh is metal contamination of saltmarsh sediments with potential impacts to saltmarsh dependent biota. Despite this, virtually nothing is known on metal accumulation by Australian saltmarsh dependent taxa, nor the potential effects on saltmarsh productivity and function. The project would involve fieldwork in Newcastle and Sydney, targeting saltmarsh plants and assessing metal uptake and partitioning and at the same time assessing saltmarsh health and productivity. The project would combine ecological field skills, experimental design, as well as laboratory analyses, learning ecotoxicological techniques for the assessment of metals in plant tissues via instrumental analysis (ICP-MS). | Dr Geoff MacFarlane<br>E: Geoff.macfarlane@newcastle.edu.au<br>P: 4921 7858 | Environmental Water Science | **Environmental Science and Management** | SELS |
| **125** | **Urban and Regional Studies** | Project to advance knowledge in the area of social, cultural, or political aspects of urban and regional studies, including the contribution of festivals and events to rural and regional Australia especially in the context of post disaster/ post pandemic; vernacular understandings and practices of resilience; the activation of port and ocean-side public spaces in Newcastle; considering the concept of place through dance as a particular form of sensuous mobility. | A/Prof Michelle Duffy<br>E: Michelle.Duffy@newcastle.edu.au | Centre for Urban and Regional Studies | **Geography & Environmental Studies** | SELS |
| **126** | **Urban and Regional Studies** | Project to advance knowledge in the area of social, cultural, or political aspects of urban and regional studies, including urban regeneration, home and homemaking, homelessness, social housing (including community housing), living in new suburbia, and geographies of mobility. | A/Prof Kathy Mee<br>P: (02) 4921 6451<br>E: Kathy.Mee@newcastle.edu.au | Centre for Urban and Regional Studies | **Geography & Environmental Studies** | SELS |

## School of Mathematical & Physical Sciences:

| Topic No. | Title of Research Topic | Description of Research Topic | Principal Supervisor Details | Research Group/Centre | Discipline | School |
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| **127** | **Experimental Number Theory with Sage** | Sage is a powerful and free mathematical software package that runs on top of Python. In this project you get to use Sage to explore open problems in Number Theory. For example, for which integers d does the equation x^2-dy^2=-4 have solutions in odd integers? This is related to open research problems, and getting more numerical data could help make progress on these problems. | Prof. Florian Breuer<br>E: florian.breuer@newcastle.edu.au<br>P: 040339609 | Computer Assisted Research Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **128** | **The geometry of critical points of complex functions** | Let f(z) be a polynomial with complex coefficients. The Gauss-Lucas Theorem states that the critical points of f (i.e. points where the derivative of f vanishes) lie in the convex hull of the roots of f. In this project, you get to explore variants and generalisations of this theorem. What about rational functions? What about analytic functions with finitely many zeroes? How far can a root be from the nearest critical point? This last question leads to the Sendov Conjecture, which remains unsolved for more than sixty years. | Prof. Florian Breuer<br>E: florian.breuer@newcastle.edu.au<br>P: 040339609 | Computer Assisted Research Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **129** | **Isolated points in colourings of vertex transitive graphs** | The aim of this project is to describe infinite symmetric graphs that admit a rigid colouring. In the case of locally finite graph, the space of all minimal colourings can be naturally seen as a topological space. This project is concerted with the question of to what extent does the topology of the space of colourings correspond to the geometry and symmetries of the graphs. First natural step is to study how far is the space of colourings away from being perfect, i.e. studying the isolated points. In the space of colourings, isolated points correspond to colourings that are rigid, meaning that if any other colouring agrees with it on a large enough finite subgraph, then they have to be the same. The goal of the project is to give some combinatorial of graphs that graphs that admit rigid colourings, or the converse - a combinatorial description of graphs that do not admit rigid colourings.<br><br>The project is part of a program of research on 0-dimensional groups, which includes symmetries of infinite graphs. Students working on this project will further their knowledge of combinatorics and graph theory. Knowledge of point-set topology and group theory is advantageous but not necessary. | Dr Michal Ferov<br>E: michal.ferov@newcastle.edu.au<br>P: (02) 4921 6280 | Computer Assisted Research Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **130** | **Gradient approximation using edge basis functions** | This project is related to approximate the gradient of a function in two dimensions using discrete values in a grid. We would like to find a good approach to approximate the gradient with some approximation properties. The student needs some programming skill of MATLAB. | Dr Bishnu Lamichhane<br>P: (02) 4921 5529<br>E: Bishnu.Lamichhane@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **131** | **Numerical approximation method for singularly perturbed boundary-value problems** | The student will develop a robust numerical technique to approximate solution of a boundary-value problem involving a small parameter. Programming skill using MATLAB is required. | Dr Bishnu Lamichhane<br>P: (02) 4921 5529<br>E: Bishnu.Lamichhane@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **132** | **Vibration of Ice Shelves** | Wave induced vibration of ice shelves has been implicated in their collapse and is a poorly understood process. Extensive measurements have been made, but the match with numerical models is still only qualitative. In this project, you will work on understanding how to model this phenomenon and build and program some simple models which can be compared to experiments. | A/Prof Mike Meylan<br>E: mike.meylan@newcastle.edu.au<br>P: 0249216792 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **133** | **Evolving curves** | Various second and higher order nonlinear parabolic PDE are used to model evolving curves in applications including fire-front propagation and moving interfaces (egs phase transitions, boundary between metals in the annealing process). This project will look at some of the theory behind these models and could include curve shortening (a second order curvature flow), curve diffusion (fourth order) and possibly others. Subtopics can be determined depending on the student's interests and background (eg explicit solutions, numerical modelling, existence theory, long time behaviour, self-similar solutions and possibly investigating new flows). | A/Prof James McCoy<br>E: James.McCoy@newcastle.edu.au<br>P: (02) 4033 9633 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **134** | **SEELAB** | Visualisation of Mathematical Structures is an increasingly important part of both Mathematics Research, eg Aragon et al (2012) and Mathematics Education, eg Tall (2001). CARMA's Seelab enables visualisation through computer simulation (2D and 3D projected) and through the production of physical models using 3D printing. This project may be placed entirely within Mathematics Disciplinary Research or may have a Mathematics Education Research aspect, according to the interests of the participant. Either way, the participant is challenged to come up with areas of Mathematics whose understanding may be enhanced by the creation of visualisations and models. These may either be entirely new projects to CARMA's Seelab, or there is the opportunity to build on existing SEElab projects. Note that in addition to the Visualisation Opportunities, there is also the potential for a person with a strong programming background to work on the Inverse Symbolic Calculator (Plouffe), which is an online tool in which users input a partial decimal expansion of a number, and the program "intelligently guesses" a closed form, eg 23.14049 should return e^pi.<br><br>Aragon, F. J. A., Bailey, D. H., Borwein, J. M., & Borwein, P. B. (2012). Walking on real numbers.<br><br>S. Plouffe, The Inverse Symbolic Calculator, www.cecm.sfu.ca/projects/ISC/.<br><br>Tall, D.O. (2001). “Cognitive Development in Advanced Mathematics Using Technology”, Mathematics Education Research Journal,Vol. 12, No. 3, pp 196-218. | Dr Judy-anne Osborn<br>E: Judy-anne.Osborn@newcastle.edu.au<br>P: (02) 4921 5543<br><br>(with Dr David Allingham) | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **135** | **How much Randomness Do Bees need?** | **Problem:** Colony Collapse Disorder is killing bees, threatening our food supplies. (40% of the world's food depends on bees for pollination.)<br><br>Common theories to explain this include:<br><br>• Monoculture and loss of habitat<br>• Electromagnetic radiation<br>• GMOs and Herbicides<br>• Neurotoxin Pesticides<br>• Trachea and Varroa Mites<br>These are probably all having an effect.<br><br>However, curiously, factors such as Varroa Mites are devastating European bees<br>*(Apis Mellifera)* but have long coexisted with Asian Bees.<br><br>Some authors are considering the possibility that the reason bees are falling prey to threats that hadn't been so devastating before, is that modern selective breeding is undermining their main defence, which is the rapidity with which they can evolve, given unusual factors of their reproduction including their haplodiploid sex system in which male bees have only one parent. Supporting this idea, Puerto Rico evolved some remarkable disease and heat resistant bees in the wild after an escape from a selective breeding program.<br><br>**Hypothesis:** Might bee species survival depend on rapid genetic mixing as happens in wild swarms but not in selection breeding programs?<br><br>**Research Questions:**<br>• Can discrete mathematical models of bee evolution be designed?<br>• Can threats and successful genetic adaptation to threats be incorporated?<br>• Can `amount of randomness for successful adaptation' be characterized? | Dr Judy-anne Osborn<br>E: Judy-anne.Osborn@newcastle.edu.au<br>P: (02) 4921 5543<br><br>(with Dr David Allingham) | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **136** | **Mathematical Systems Theory** | Lyapunov functions associate “energy” to states of a dynamical systems, which can originate from differential or difference equations. They can be used to show that the equilibrium state of a system is asymptotically stable, that is, if a trajectories starting close to the equilibrium and converge to it asymptotically. The difficult part with Lyapunov functions is to find them in the first place. But once you have one, proving asymptotic stability becomes relatively easy. Your help is needed for the difficult part. Possible topics involving Lyapunov functions could be:<br><br>▪ Find Lyapunov functions for queuing networks (various levels of difficulty are possible here); or<br>▪ Investigate how well so-called sum- and max-separable Lyapunov functions can approximate each other (knowledge of linear algebra is desirable).<br>▪ Using Lyapunov functions to investigate the convergence of optimization algorithms like Douglas-Rachford. (Skills in some programming language required, preferrably MATLAB or python.) | Dr Björn Rüffer<br>P: (02) 4913 8989<br>E: bjorn.ruffer@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **137** | **PageRank for Tournaments (Graph Theory and Linear Algebra)** | PageRank is the name Google uses for the algorithm it uses to rank web pages. This algorithm is what started Google's success, and it assigns higher rank to web pages that receive links from other highly ranked web pages. The web pages and links between them can be modelled as a directed graph, and the Perron-Frobenius theorem then asserts the existence of what could be considered an invariant probability distribution of the vertices (or web pages) in that graph by way of a positive eigenvector of the graph's adjacency matrix. The entries of this eigenvector are the PageRank.<br><br>The objective of this project is to develop a group tournament system that could be used for sport events or other competitions to determine a fair ranking among all players, based on a fixed number of matches each player engages in. In contrast, a knockout tournament system is divided into successive rounds, and the winner of each round progresses towards a final match that determines the overall winner. A shortcoming of knockout | Dr Björn Rüffer<br>P: (02) 4913 8989<br>E: bjorn.ruffer@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

tournament systems is that there is no canonical way of ranking among each other those players who lost early.

In the tournament system to be developed here, the graph modelling the matches between players would be set ahead of time, say each player plays exactly three matches. Your task will be to help answer the following questions: How can the match-graph be weighted with game scores without violating important assumptions of the Perron-Frobenius Theorem? What happens if these assumptions do get violated? What conditions ensure a unique ranking of the participants? How important is the number of matches each player participates in for their rank?

Prerequisites: Linear Algebra and a bit of programming for numerical experiments.

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| **138** | **Parameter Estimation** | Many situations in the physical, life and behavioural sciences; engineering; and economics/finance are modelled by differential equations. For example, the growth of a hatchery trout is approximately described by,<br>$\frac{dw(t)}{dt} = \alpha w(t)^{2/3} - \beta w(t), \quad w(0) = w_0,$<br>where $w(t)$ is the weight of the fish after $t$ days, $w_0$ is the initial weight at day 0 and $\alpha$, $\beta$ are parameters. As with many differential equations an explicit solution is not possible. Nonetheless, given a set of observations of a fish's weight on successive days, say $w(n) = w_n$ for $n = k, k+1, k+2, \cdots, K$, we wish to determine values for $\alpha$ and $\beta$ that best fit the observations. This is one instance of a *parameter estimation* problem. The project involves exploring the efficacy of a proposed way of doing this for a variety of different differential equations. This project falls within the realm of *experimental mathematics* and have both a theoretical and computational aspect. Besides encountering some new and interesting mathematics they will involve the vacation scholar learning and applying various computer software:<br>• Maple (or Mathematica)<br>• *Cinderella* A dynamic geometry package, see http://www.cinderella.de/tiki-index.php<br>and possibly<br>• Python (or C++) | Conjoint A/Prof Brailey Sims<br>P: (02) 4921 5540<br>E: Brailey.Sims@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **Mathematics applied to Nanotechnology** ***(see Projects 139 to 141)*** | | Various projects involving mathematics applied to nanotechnology are listed below: | Prof Ngamta (Natalie) Thamwattana<br>P: (02) 4985 4081<br>E: Natalie.Thamwattana@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **139** | ***Project 1:*** **Modelling carbon nanostructures** | This project will consider geometries of carbon nanostructures. Their geometry enables the use of an averaging technique to determine the interaction between two molecules yielding an analytical expression for the interaction energy which generally involves hypergeometric functions.<br><br>The project will also explore the use of calculus of variations to model joining of two carbon nanostructures. | Prof Ngamta (Natalie) Thamwattana<br>P: (02) 4985 4081<br>E: Natalie.Thamwattana@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **140** | ***Project 2:*** **Modelling cell-cell interactions** | This project will investigate the interacting force between cells and how the force term plays a role in determining the solution for a partial differential equation (PDE) for cell population density model. Both analytical and numerical solutions will be developed for the PDE. | Prof Ngamta (Natalie) Thamwattana<br>P: (02) 4985 4081<br>E: Natalie.Thamwattana@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |
| **141** | ***Project 3:*** **Modelling binding between dye and TiO2 in dye-sensitized solar cells** | This project will look at how dye molecules bind to TiO2 and how we can control the orientation of dye molecules to optimize sunlight exposure for dye-sensitized solar cells. | Prof Ngamta (Natalie) Thamwattana<br>P: (02) 4985 4081<br>E: Natalie.Thamwattana@newcastle.edu.au | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **142** | **Local actions of algebraic groups acting on trees** | Symmetry is a fundamental organising principle in mathematics, science and and the arts. It is formalised in the algebraic notion of a 'group'. The symmetry groups of infinite networks, or graphs, constitute a current research frontier. It has proven fruitful to study these groups by analysing their 'local actions', i. e. the permutation groups that the fixator of a vertex in the graph induces on spheres of varying radii around that vertex. The primary aim of this project is to make the local actions of several theoretically derived symmetry groups of graphs tractable by implementing them on a computer using computational group theory tools, such as GAP. A second step would be to study the resulting permutation groups and their interdependence using a mix of theoretical and computational tools.<br>A student who takes this project will extend his/her knowledge of algebra and learn how to use computer algebra systems designed for computations in group theory, including coding skills. | Dr Stephan Tornier<br>E: stephan.tornier@newcastle.edu.au<br>P: (02) 4921 6280 | Computer Assisted Research Mathematics and its Applications | **Mathematics** | MAPS |
| **143** | **Optimisation in Operations Research** | My interest is optimisation, in particular, mixed integer programming. Some possible project topics investigate the strength of mixed integer programming formulations for problems arising in production planning and scheduling.<br><br>(***1) Lot sizing on a cycle.***<br>This project extends the work started by Riley Cooper in his 2017 AMSI Vacation Research Scholarship.<br><br>***(2) Bounded length sequences in production planning and scheduling problems.***<br>This project extends some work started by Riley Clement in his 2015 PhD thesis.<br><br>***(3) Bucket indexed formulations for single machine scheduling problems***.<br>This project extends some work started by Riley Clement in his 2015 PhD thesis. | Dr Hamish Waterer<br>P: (02) 4921 5951<br>E: hamish.waterer@newcastle.edu.au | Centre for Optimal Planning and Operations (C-OPT) | **Mathematics** | MAPS |

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| | | Please arrange a time to meet with me to discuss these topics in more detail, or another potential project, prior to submission of your application. | | | | |
| **144** | **Symmetry of graphs** | A graph (a network of vertices and edges) is *vertex-transitive* if it `looks' the same at all vertices. In algebraic terms, this means that, for any pair of vertices, there is an automorphism of the graph which maps the first vertex to the second. A necessary, but not sufficient, condition for a graph to be vertex-transitive is that all vertices should have the same valency. Analysing graph symmetry therefore involves a deeper study of the relationship between graphs and their automorphism groups than vertex valencies. Vertex-transitive graphs need not be edge-transitive, for example, the horizontal edges of a triangular pyramid lie on 3-cycles in the graph but the vertical edges do not.<br><br>The particular question investigated in this project is how its symmetry group changes as edges are added to, or removed from, a graph. For finite graphs, a classical theorem of Burnside is relevant when the graph has prime order and, for infinite graphs, the goal is to reduce the vertex valency since this number controls important features of the symmetry group.<br><br>Students taking this project will extend their knowledge of combinatorics and algebra, and how these two topics interact. The project will be jointly supervised by Brian Alspach. | Prof George Willis<br>E: george.willis@newcastle.edu.au<br>P: (02) 4921 5666 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Mathematics** | MAPS |

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| **145** | **Geometric representations of self-replicating groups** | This project aims to find geometries that have so-called self-replicating, or fractal, groups as their symmetries. The self-replicating nature of these groups is described by representing them as symmetries of rooted trees but that way of thinking about them hides other patterns that are of interest. The purpose of the project is to see the groups geometrically. Computer algebra software will be used to analyse how the groups act on pairs, triples, *etc.* of vertices of the trees and then study the polyhedra in which these are edges, faces, *etc.* Observed patterns in the geometries may be extrapolated to produce new families of self-replicating groups.<br><br>The project is part of a program of research on symmetry groups of infinite networks, known as 0-dimensional groups. Self-replicating 0-dimensional groups are analogous to eigenvalues and eigenvectors in linear algebra and its applications. It is not necessary to understand this bigger picture in order to do the project however.<br><br>Students taking this project will extend their knowledge of algebra, graph theory and mathematical software. `Group' is an algebraic notion and `rooted tree' is a combinatorial one which arises in the study of data structures. | Prof George Willis<br>E: george.willis@newcastle.edu.au<br>P: (02) 4921 5666 | Computer Assisted Research Mathematics and its Applications | **Mathematics** | MAPS |
| **146** | **Visualising 0-dimensional symmetry** | The word `symmetry' brings to mind visual images and geometry. It has a broader meaning in mathematics, where we think of regularly repeating patterns and invariance under transformations as displaying symmetry, and where the language of algebra is used to describe symmetry. Visualising the patterns or the dynamics of the transformations remains an effective tool for understanding the algebra however.<br><br>This project aims to develop software for visualising various aspects of 0-dimensional symmetry, which is the symmetry of infinite networks and arises in number theory and other parts of algebra as well. The aim is to produce software which may be used by researchers and which will be made available on web-pages of the 0-Dimensional Symmetry project. | Prof George Willis<br>E: george.willis@newcastle.edu.au<br>P: (02) 4921 5666 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA | **Mathematics** | MAPS |

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| | | Students taking this project will extend their knowledge of algebra, analysis, mathematical software and coding skills. `Totally disconnected' and `locally compact' are topological notions; `group' is an algebraic one; and other concepts will be met in the course of the project. | | | | |
| **147** | **Surface Plasmons in Metal Nanostructures** | Surface plasmons are collective excitations of valance electrons that propagate along a surface. They are currently of enormous technological interests for applications such as single molecule detection, sub-wavelength optics and even tumour therapy. Surface plasmons can be generated by light or by fast electrons. There are clear connections between the two types of excitations because both can be represented by time-varying electric fields. However, the time and spatial dependence of these fields is distinctly different. Having computational models available to simulate the plasmonic interactions is essential for development in the field.<br><br>This project will develop computer codes for the calculation of plasmonic interactions. The project is suitable for a student with strong mathematical and programming skills. | A/Prof Vicki Keast<br>P: (02) 4921 6653<br>E: vicki.keast@newcastle.edu.au | Surface and Nanoscience Group | **Physics** | MAPS |
| **148** | **Understanding the Corrosion of Silver Nanoparticles** | Silver nanoparticles are finding widespread application in medical and consumer products due to their antibacterial activity. It is also possible to use the enhanced electromagnetic field generated on their exposure to light in a variety plasmonic applications. However, the particles rapidly corrode which has important consequences for the effectiveness in real-world situations. Further, understanding the corrosion process is important in understanding their ecotoxic behaviour if released to the environment.<br><br>This project will use computational quantum mechanics to explore the changes in silver surfaces that occur at an atomic level. | A/Prof Vicki Keast<br>P: (02) 4921 6653<br>E: vicki.keast@newcastle.edu.au | Surface and Nanoscience Group | **Physics** | MAPS |

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| **149** | **Predicting optical properties of materials** | Most metals are shiny and reflective, but colourless. There are some exceptions such as gold and copper. But there are a range of more unusual metallic compounds, such as AuAl2, CoSi2 and TiAlN that can show a range of colours from violet, deep blue, bright yellow and everything in between. Oxide and ceramic materials can also take on a range of colours depending on slight variations in their composition. The purpose of this project will be to use advanced quantum mechanical calculations to understand how these colours arise. | A/Prof Vicki Keast<br>P: (02) 4921 6653<br>E: vicki.keast@newcastle.edu.au | Surface and Nanoscience Group | **Physics** | MAPS |
| **150** | **Why Don't Girls Do Physics?** | Many other fields have overcome the traditional gender imbalances and yet the number of girls choosing to study physics at the secondary and tertiary level remains stagnant. This project will question and explore the nature of physics itself, in the context of gender interests and preference. The question of if and how the intrinsic nature of physics differs from that of public perception can also be addressed. Investigating the issues around the depiction of physicists in educational and media sources is also an option. | A/Prof Vicki Keast<br>P: (02) 4921 6653<br>E: vicki.keast@newcastle.edu.au | Surface and Nanoscience Group | **Physics** | MAPS |

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| **151** | **Preparation and Characterization of Streptavidin-conjugated P3CT Thin Film for OTFT Biosensors** | With an attempt to prepare for the imminent healthcare revolution, which will bring new clinical testing technologies, the development of biosensors for point-of-care testing (POCT) is attracting tremendous interest. However, until now, biosensors have not entered the market, this might be due to high manufacturing costs. Organic semiconductors can be produced at low cost by use of screen printing and inkjet printing. They can also be easily chemically tailored to adjust their properties, which is crucial for biosensors where the bio-recognition elements have to be attached or grafted. Organic thin-film transistor (OTFT)-based biosensor can contribute to these goals because of their biocompatibility, property tunability, light-weight device, and low-cost fabrication. Streptavidin and biotin will be used as a testbed here. OTFT-based biosensors hold great potential for the commercialization of next-generation biosensor devices in the healthcare industry. Poly[3-(3-carboxypropyl)thiophene-2,5-diyl] (P3CT) is another class of poly(thiophene)s bearing carboxylic acid groups.<br><br>There has been no study of how the nature of the streptavidin side chains affects the performance of the resulting thin film. In an effort to establish P3CT as suitable donor materials for OTFT-based biotin biosensor, this project focuses on the immobilization of Streptavidin onto P3CT thin film and characterization of resulting film for OTFT application. | Dr Swee Lu Lim<br>P: (02) 4033 9253<br>E: swee.lim@newcastle.edu.au | Centre for Organic Electronics (COE) | **Physics** | MAPS |
| **152** | **Chained Magnetic Nanoparticles for Biomedical Imaging** | Magnetic Particle Imaging (MPI) is a new, fast way to assess strokes, as they are happening in patients, to improve their treatment. Recently, it has been claimed that if the magnetic nanoparticles form chains in the blood, then the resolution of imaging is greatly improved! In this computational physics project, the motion of magnetic nanoparticles in a fluid will be investigated. In particular, how long it takes a chain of particles to react to an alternating magnetic field will be calculated. These important results will guide experimental colleagues aiming to help stroke patients. | Dr Karen Livesey<br>E: Karen.Livesey@newcastle.edu.au<br>P: (02) 4055 7559 | Karen Livesey Magnetism Research Group | **Physics** | MAPS |

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| **153** | **Analytic Theory for Magnetic Skyrmions** | Magnetic skyrmions are tiny regions inside a thin film magnet where the magnetisation swirls. One can think of a tiny hedgehog made out of atomic dipoles. Research on them has exploded in the past 10 years due to potential applications in information storage. In this project, an analytic solution for the size and shape of a skyrmion will be found, as a function of magnetic material properties. This is difficult because the skyrmion has cylindrical symmetry. An energy minimisation technique will be used that has been successful in the past for magnetic domain walls, which are simpler one-dimensional variations in the magnetization, rather than cylindrical swirls. | Dr Karen Livesey<br>E: Karen.Livesey@newcastle.edu.au<br>P: (02) 4055 7559 | Karen Livesey Magnetism Research Group | **Physics** | MAPS |
| **154** | **Membranes for redox flow batteries** | Redox flow batteries have emerged as a promising energy storage technology for large scale applications, especially for the renewably sourced grid. However, the cost to performance incentives for such batteries are not yet viable. The paradigm shift from metal based redox active materials (such as for vanadium flow batteries) to organic molecules has been promising, however, high cost, low conductivity, solubility limitations of organic electrolytes limit practical implementation of organic redox flow batteries.<br><br>Research into novel electrolyte systems at the Nann group, has led to the development of an aqueous based electrolyte system which is highly tuneable to suit the needs of specific organic redox molecules. These low-cost electrolytes can be tuned to suit the redox pair in terms of solubility and stability. More interestingly, these aqueous based electrolytes exhibit an electrochemical window (voltage over which the electrolyte is stable) much higher than the theoretical limit for water splitting i.e. 1.23 V. The versatility of these electrolytes combined with the potential for extracting high cell voltages, using cost effective components makes it a promising class of electrolytes for organic redox flow batteries of the future.<br><br>In this project the student will develop and test membrane systems for such electrolyte based full-cell devices. | Prof Thomas Nann<br>P: (02) 4055 3003<br>E: Thomas.nann@newcastle.edu.au | Thomas Nann Research Group | **Physics/ Chemistry** | MAPS |

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| **155** | **Synthesis of ionic liquid electrolytes for ultra energy dense aluminium-ion batteries** | Aluminium-ion (Al-ion) batteries come with a potent energy density due to transferring three electrons per ion. The best electrolytes to date involve using a room temperature ionic liquid for transportation of the Al-ions. This is a salt which is liquid at room temperature. However, the current industry standard involves using an expensive organic salt which limits commercial viability. This organic salt also means promising cathode materials like sulfur dissolve away from the cathode, thus degrading cell performance. We have found an enticing property of sulfur which allows more energy to be stored per sulfur atom.<br><br>This project will involve synthesizing cheaper ionic liquids and testing them against the standard electrolytes to improve the performance of sulfur at a lower price. | Prof Thomas Nann<br>P: (02) 4055 3003<br>E: Thomas.nann@newcastle.edu.au | Thomas Nann Research Group | **Physics/ Chemistry** | MAPS |
| **156** | **Synthesis and characterisation of OSL based phosphor material for radiation dosimeters** | Radiation dosimeters measure the dose of incident ionising radiation on a surface. Currently, thermoluminescence based material is predominantly used in radiation dosimeters. Due to numerous drawbacks, research is progressing into a more advanced Optically Stimulated Luminescence (OSL) based phosphor material in replacing the existing sensor material used in radiation dosimeters. The Nann research group has many years of experience in the synthesis and characterisation of rare-earth doped nanophosphors. Building on this expertise, the student is expected to synthesis, characterise and optimise various OSL nanophosphors, which will be further used in developing radiation dosimeter prototypes. | Prof Thomas Nann<br>P: (02) 4055 3003<br>E: Thomas.nann@newcastle.edu.au | Thomas Nann Research Group | **Physics/ Chemistry** | MAPS |

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| **157** | **Investigating plasma heating in the Sun's atmosphere** | Observations of the Sun reveal that its outer atmosphere ("corona") is around 1000 times hotter than its surface, a fact that has defied explanation since it was first realised nearly 80 years ago. Some of the most prominent features of the hot corona are bright "loop" structures that are visible in X-ray emission. However, how these loops are formed and maintained is not well understood. This project involves investigating the properties of computational models of energy conversion/plasma heating in the Sun's atmosphere. This will primarily involve analysis of the computational data, so a student interested in this project should either have some prior experience in coding or be enthusiastic to learn. The aim is to better understand how the Sun's atmosphere is heated, by investigating whether the computational models are consistent with what is seen by Sun-observing satellites. | A/Prof David Pontin<br>E: david.pontin@newcastle.edu.au<br>P: (02) 4055 3261 | Centre for Space Physics | **Physics** | MAPS |
| **158** | **Formation of extreme electric currents in the Sun's atmosphere** | The Sun's atmosphere is continually filled with "explosions" over a vast range of scales. The largest of these explosions are solar flares (releasing energy equivalent to millions of atomic bombs), while the smallest heat the atmosphere to a thousand time hotter than the surface. At present we don't have a clear picture of what triggers these explosions, though we do know that they require the generation of extremely large electric currents. The aim of this project is to explore the relationship between the structure of the Sun's magnetic field and the generation of large electric currents. This will primarily involve mathematical/computational analysis of magnetic field structures, so a student interested in this project should either have some prior experience in coding or be enthusiastic to learn. | A/Prof David Pontin<br>E: david.pontin@newcastle.edu.au<br>P: (02) 4055 3261 | Centre for Space Physics | **Physics** | MAPS |

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| **159** | **The distribution of explosive energy release events in turbulent, magnetised plasmas** | Magnetic and velocity fields in plasmas exhibit a turbulent behaviour on a wide range of scales, from galaxies to the Sun to laboratory plasmas on Earth. Turbulence appears inherently messy/chaotic, but one path to understanding the energy conversion in such plasmas is to study the spatial distribution of different magnetic field structures. One way of measuring complexity in spatial patterns is the "fractal dimension". Fractals are structures that are self-similar across an infinite range of scales. In other words, when you zoom in on a fractal, you see the same pattern no matter how far you zoom in. This project involves developing (coding) an algorithm to calculate the fractal dimension using the "box counting method". The idea is then to use the algorithm to analyse data from simulations of both fluid turbulence and plasma turbulence – giving insight into explosive energy release in space plasmas. | A/Prof David Pontin<br>E: david.pontin@newcastle.edu.au<br>P: (02) 4055 3261 | Centre for Space Physics | **Physics** | MAPS |
| **160** | **Stretching glowing diamond for better quantum emitters** | Tiny glowing artificial atoms in diamond, called colour centres, can be used to store and process quantum information through the manipulation with laser light and microwaves. Important aspects of these physical interactions are dictated by the exact colour centre shape which in turn is strongly influenced by the surrounding diamond crystal. This project aims to explore the changes in colour centre properties that arise from mechanical deformation of the crystal. The results will fit into the development of strain-engineering as a novel approach to improve quantum memories in diamond. This experimental project will involve measuring glowing diamonds in a fluorescence microscope, optical spectroscopy, and data analysis in python. | Dr Lachlan Rogers<br>E: lachlan.rogers@newcastle.edu.au<br>P: 02 4055 7574 | Quantum Diamond Group | **Physics** | MAPS |
| **161** | **Seeing quantum heat in diamond** | Photons "bunch", or arrive simultaneously in groups, for thermal light, but they do the opposite ("antibunch") when emitted by a single-photon emitter. Atomic impurities in diamond, called colour centres, are excellent single-photon sources. Diamond is also a solid-state crystal and so hosts quantum vibrations called phonons, which are essentially heat energy. This project will use various laser wavelengths to excite colour centres so that information about the phonons can be obtained by optical measurements of photons from the glowing diamonds. | Dr Lachlan Rogers<br>E: lachlan.rogers@newcastle.edu.au<br>P: 02 4055 7574 | Quantum Diamond Group | **Physics** | MAPS |

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| **162** | **Novel quantum emitters in glowing diamond** | Impurity atoms in diamond can give the crystal colour, and some of these so-called “colour centres” can be used to store and process quantum information. A relatively new family of colour centres consist of group-IV impurity atoms (silicon, germanium, tin, etc) and have shown potential as building-blocks for quantum technologies. This project will study germanium-vacancy centres in a range of diamond samples to characterise their properties, and aims to discover more about how to make and use these quantum emitters. | Dr Lachlan Rogers<br>E: lachlan.rogers@newcastle.edu.au<br>P: 02 4055 7574 | Quantum Diamond Group | **Physics** | MAPS |
| **163** | **Glowing diamond exhibition** | A lot of science outreach focusses on classical physics, which seems more “intuitive” to the general public. The dramatic growth in quantum technologies makes it increasingly valuable for society to have a familiarity with quantum physics, and glowing diamonds are an excellent tool for community engagement. This project aims to develop a quantum science exhibit (for a science museum such as Questacon) around glowing diamonds and magnetometry. | Dr Lachlan Rogers<br>E: lachlan.rogers@newcastle.edu.au<br>P: 02 4055 7574 | Quantum Diamond Group | **Physics** | MAPS |
| **164** | **Investigating plasma heating in the Sun’s atmosphere** | Observations of the Sun reveal that its outer atmosphere (“corona”) is around 1000 times hotter than its surface, a fact that has defied explanation since it was first realised nearly 80 years ago. Some of the most prominent features of the hot corona are bright “loop” structures that are visible in X-ray emission. However, how these loops are formed and maintained is not well understood. This project involves investigating the properties of computational models of energy conversion/plasma heating in the Sun’s atmosphere. This will primarily involve analysis of the computational data, so a student interested in this project should either have some prior experience in coding or be enthusiastic to learn. The aim is to better understand how the Sun’s atmosphere is heated, by investigating whether the computational models are consistent with what is seen by Sun-observing satellites. | A/Prof David Pontin<br>E: david.pontin@newcastle.edu.au<br>P: (02) 4055 3261 | Centre for Space Physics | **Physics** | MAPS |

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| **165** | **The Sounds of the Stars** | Stars generate sound waves in the turbulent convection zones. These waves are trapped inside the stars, but cause the stellar surface to expand and contract. A technique called asteroseismology uses observations of these waves to infer the inside structure and dynamics of the stars. The frequencies of the waves are not audible to the human ear. This project will involve using data from NASA's Kepler mission and coding in python to shift the stellar oscillation spectrum to audible frequencies, and create a browser-based educational outreach activity about stellar oscillations. | Dr Hannah Schunker<br>E: Hannah.schunker@newcastle.edu.au<br>P: (02) 4055 3484 | Space Science Centre | **Physics** | MAPS |
| **166** | **Targeted search for extra-terrestrial life** | Recently, there has been an explosion in the number of known exo-planets. They can be detected when they orbit between us and their host star, dimming the light. Perhaps, similarly intelligent life on those distant planets has identified the Earth passing in front of the Sun. The student will write code to trawl data catalogues to identify exoplanets with which we have mutual transits, and explore the possibility that we may be able to "wave" at extra-terrestrial life. | Dr Hannah Schunker<br>E: Hannah.schunker@newcastle.edu.au<br>P: (02) 4055 3484 | Space Science Centre | **Physics** | MAPS |
| **167** | **Using machine learning to identify sunspots** | Sunspots are the most obvious manifestation of the magnetic field on the surface of the Sun. Despite nearly 400 years of sunspot observations, we do not know how or why they form. In order to understand the order of formation of the flows and the sunspot itself, it is important to know when the sunspot forms. Sunspots are clearly identified by eye on the surface of the Sun, however it is not so easy to identify sunspots in an objective way using a straightforward algorithm. The student will write code in python using existing machine learning tools to objectively identify different stages of sunspot formation in state-of-the-art NASA Solar Dynamics Observatory observations. | Dr Hannah Schunker<br>E: Hannah.schunker@newcastle.edu.au<br>P: (02) 4055 3484 | Space Science Centre | **Physics** | MAPS |
| **168** | **Magnetic flux in emerging active regions** | Active regions are regions of strong magnetic activity on the surface of the Sun, which emerge from the interior. The physics of how active regions form is unknown: we do not know when, why or what dictates their lifetimes, nor why they have the sizes and strength they do. The student will use data from NASA's Solar Dynamics Observatory to analyse the flux of hundreds of emerging active regions as a function of time, to understand the dependence on size, magnetic field strength and lifetime of the active region. | Dr Hannah Schunker<br>E: Hannah.schunker@newcastle.edu.au<br>P: (02) 4055 3484 | Space Science Centre | **Physics** | MAPS |

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| **169** | **Time Series Mining and Applications** | (a) Time Series Mining: Clustering; Visualisation; and Anomaly Detection; (b) Applications of Time Series and Dynamic Systems in Modelling and Forecasting: statistical methods; signals, systems and control methods; computational intelligence and machine learning methods. | Prof Ricardo J. G. B. Campello<br>E: Ricardo.Campello@newcastle.edu.au<br>P: (02) 4921 6762 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA) | **Statistics and Data Science** | MAPS |
| **170** | **Machine Learning, Big Data and Randomised Numerical Linear Algebra** | Matrices have extensive applications in applied mathematics, statistics and computer science. Motivated by technological developments that generate extremely large scientific data sets, recent years have witnessed exciting developments in the theory and practice of matrix algorithms. Particularly remarkable is the use of randomisation as an algorithmic or computational resource for the development of improved algorithms for fundamental matrix problems. Randomised Numerical Linear Algebra (RandNLA) is an interdisciplinary research area that exploits randomisation as a computational resource to develop improved algorithms for large-scale linear algebra problems. It is a vital new tool for statistics, optimisation and machine learning and promises a sound algorithmic and statistical foundation for modern largescale data analysis.<br><br>There are a few projects available to develop and implement RandNLA algorithms for analysing big data. | Dr Ali Eshragh<br>E: Ali.Eshragh@newcastle.edu.au<br>P: (02) 4921 5427 | Priority Research Centre for Computer Assisted Research in Mathematics and its Applications (CARMA)<br><br>International Computer Science Institute (ICSI) at the University of California, Berkeley | **Statistics** | MAPS |

## School of Psychology:

| Topic No. | Title of Research Topic | Description of Research Project | Principal Supervisor Details | Research Group/ Centre | Discipline | School |
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| **171** | **Effectiveness of Eucalyptus essential oil as consumer friendly mosquito repellent.** | This aim of this research is to reduce the incidence of mosquito infestation within the internal and external campus environments during the peak mosquito breeding season. The primary outcome of the research will be to determine the effectiveness of commercial eucalyptus essential oil diffusers within staff and student areas of university buildings. This research incorporates knowledge of mosquito sensory and perceptual behaviour together with the established mosquito repellent properties and biodiversity of the Eucalyptus species together with measures of consumer acceptance and preference.<br><br>This project is undertaken at Callaghan Campus. | Dr Bill Budd<br>P: (02) 4348 4135<br>E: Bill.Budd@newcastle.edu.au | Biological Psychology Research Group<br><br>Priority Research Centre for Brain and Mental Health | **Psychology** | PSYC |
| **172** | **Sensory and affective processing of odours.** | The aim of the following research is to gain further understanding of how peripheral psychophysiological measures reflect different aspects of the odour perception. Eucalyptus oils will be used as they are chemically similar to each other but have differences in odourant composition. Although different, eucalyptus oils are a similar class of odours, and they produce similar reactions in the trigeminal and olfactory systems in the brain, which impacts perceptual and affective differences. This project will help develop our understanding of the sensory and affective processes underlying odour discrimination. | Dr Bill Budd<br>P: (02) 4348 4135<br>E: Bill.Budd@newcastle.edu.au | Biological Psychology Research Group<br><br>Priority Research Centre for Brain and Mental Health | **Psychology** | PSYC |
| **173** | **Addressing physical health risk behaviours among persons with a mental illness** | People with a mental illness experience high levels of a range of health risk behaviours, including smoking, poor nutrition, inadequate physical activity and sleep issues. Consequently, this group experiences a high level of preventable morbidity and mortality from associated chronic diseases. There is a relative paucity of research reporting on chronic disease risk behaviours among people with a mental illness, despite a clear need for greater understanding of contributing factors and the development of interventions. | Prof Jenny Bowman<br>P: (02) 4921 5958<br>E: jenny.bowman@newcastle.edu.au | Health and Clinical Psychology Research Group<br><br>Priority Research Centre for Health Behaviour<br><br>HMRI Public | **Psychology** | PSYC |

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| | | This summer scholarship will provide an opportunity to work across a number of descriptive and intervention-based projects being undertaken by the Physical Health in Mental Illness (PHiMI) team. There may be scope to contribute to the development of survey instruments to be administered to staff or clients of mental health services, undertake literature searches to inform grant submissions, and assist in preparing manuscripts for publication. | | Health Program | | |
| **174** | **Community managed organisations: an opportunity to improve the physical health of people with a mental illness?** | People with a mental illness have high levels of a range of chronic disease health risk behaviours, including smoking, poor nutrition and inadequate physical activity. The increasing focus on Community Managed Organisations (CMOs) in the delivery of mental health care may offer a significant opportunity to provide preventative care for health risk behaviours to consumers with a mental illness. However, research is required to understand how the potential of this opportunity may be realised.<br><br>This summer scholarship will involve contributing to a large collaborative project exploring the current practices, barriers and facilitators to CMOs providing care for health risk behaviours. The project is using mixed methodologies, and there may be opportunity to contribute to the design of in-depth interviews for CMO managers, to assist with analysis of quantitative data obtained from an online survey tool for CMO staff, and assist in preparing manuscripts for publication. | Prof Jenny Bowman<br>P: (02) 4921 5958<br>E: jenny.bowman@newcastle.edu.au | Health and Clinical Psychology Research Group<br><br>Priority Research Centre for Health Behaviour<br><br>HMRI Public Health Program | **Psychology** | PSYC |
| **175** | **The human face as an evolved signalling system.** | Human faces convey a wide range of information about identity, age, sex, health, fertility, etc. and movements of the face operate as complex social signals. The summer scholarship student will help to run a project investigating non-verbal dynamic signalling in a variety of social contexts - the way people's facial movements communicate a wealth of subtle information to their social partners. You will help to run participants in the study and to analyse the resulting video footage. Given that we currently know very little about what kinds of signals are conveyed in these contexts, there is an opportunity for you to make a significant intellectual contribution to the project. | Dr Darren Burke<br>P: (02) 4348 4158<br>E: Darren.Burke@newcastle.edu.au<br>(Ourimbah campus ONLY) | Sensory, Cognitive and Affective Neuroscience Research Group<br><br>Priority Research Centre for Translational Neuroscience and Mental Health | **Psychology** | PSYC |

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| **176** | **BabyMinds** | Over the last five years we have been collecting data from a cohort of infants in the Newcastle region. We have been exploring early child cognitive and behavioural development across three time points – 6 weeks, 6 months and 12 months of age. We are currently in the process of commencing a follow up of these young children, at age 3 years. We are seeking an intern to help us start entering, processing and analysing data as well as help prepare for the commencement of the next stage of the research. This position will provide valuable experience in developmental and clinical psychology, data processing skills including statistics, writing, and ethical research skills. | Dr Linda Campbell<br>E: linda.e.campbell@newcastle.edu.au<br>P: 0423977064 | Priority Research Centre for GrowUpWell | **Psychology** | PSYC |
| **177** | **Rare Developmental Disorder: A broader understanding of the lived experience** | With technological advances we are getting better at understanding the genetic underpinnings of a diverse range of developmental disorders. In this project we will provide an intern with experience related to the study of behavioural phenotypes in rare genetic disorders, to set up and design a research study, set up online survey tools and recruit participants from an international cohort. This position will provide valuable experiences in developmental and clinical psychology, data processing skills including descriptive statistics, writing, and ethical research skills. | Dr Linda Campbell<br>E: linda.e.campbell@newcastle.edu.au<br>P: 0423977064 | Priority Research Centre for GrowUpWell | **Psychology** | PSYC |
| **178** | **Personality, Imposter Phenomenon, and Networking Behaviours** | Networking with other people is an important resource for career development. The impacts of personality and imposter feelings on networking behaviours has not been fully explored. This research project involves a literature review of the personality – social network analysis literature to determine how imposter feelings might impede networking behaviours that support career success. | Dr Heather Douglas<br>E: heather.douglas@newcastle.edu.au<br>P: (02) 4913 8773 | Social, Organisational and Personality Research Group (SOPRG)<br><br>Centre for Brain and Mental Health Research (CBMHR) | **Psychology** | PSYC |
| **179** | **Personality, climate change denial, and pseudo-profound statement susceptibility** | Being receptive to statements that seem profound, but are actually meaningless, are associated with a range of individual differences including having more religious and supernatural beliefs, being less reflective, and more interested in conspiracy theories. Some of these same variables are associated with climate change denial. This project will review the literature on pseudo-profound statement | Dr Heather Douglas<br>E: heather.douglas@newcastle.edu.au<br>P: (02) 4913 8773 | Social, Organisational and Personality Research Group (SOPRG) | **Psychology** | PSYC |

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| | | susceptibility, to determine whether it might be associated with climate change denial attitudes. | | Centre for Brain and Mental Health Research (CBMHR) | | |
| **180** | **The effect of past outcomes on current performance: 'Hot Hand' in computer games.** | The 'Hot Hand' phenomenon in basketball (Kahneman & Tversky), or other sports, refers to one's ability to make a successful shot after a sequence of successful shots, compared to her or his chances of making the next shot after unsuccessful shot(s). Presumably, high confidence after a successful trial improves performance on subsequent trial(s). We shall test if the 'Hot Hand' phenomenon exists in computer games, and focus on whether or not gamers are willing to take higher risks after successful trials. | Dr Ami Eidels<br>P: (02) 4921 7089<br>E: Ami.Eidels@newcastle.edu.au | Cognitive Psychology Research Group | **Psychology** | PSYC |
| **181** | **Is this female builder fixing my house?: Stereotypes and counter-stereotypes** | People hold strong views about the likelihood of certain traits. We expect female nurses and male builders, but not so much the opposite. In this project you will study the cognitive mechanisms associated with stereotypical and counter-stereotypical views. [With Dr Mark Rubin, Social and Organisational Psychology Research Group]. | Dr Ami Eidels<br>P: (02) 4921 7089<br>E: Ami.Eidels@newcastle.edu.au | Cognitive Psychology Research Group | **Psychology** | PSYC |
| **182** | **Human behaviour and decision making in Dutch Auctions** | In a Dutch auction scenario, multiple participants observe a particular item for a limited, fixed amount of time. The monetary value of the product starts at some maximum level and goes down with time. In this project you will use computer-based tasks to study the factors affecting bidding decisions. [with Dr Marc Adam, School of Creative Industries] | Dr Ami Eidels<br>P: (02) 4921 7089<br>E: Ami.Eidels@newcastle.edu.au | Cognitive Psychology Research Group | **Psychology** | PSYC |
| **183** | **Cognitive workload: exploring information processing and decision making under increased load** | Pilots and drivers in particular need to make quick and accurate decisions. Yet the modern environment bombards us with an overwhelming amount of information. This overload can potentially compromise the speed and accuracy of our responses. In this project you will use state-of-the-art modelling techniques to study how people are affected by information overload [with Dr Scott Brown - Psychology; and Dr Keith Nesbitt – School of Electrical Engineering & Computing/IT] | Dr Ami Eidels<br>P: (02) 4921 7089<br>E: Ami.Eidels@newcastle.edu.au | Cognitive Psychology Research Group | **Psychology** | PSYC |

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| **21** | **Imposter feelings and perceived gender stereotype threat in elite female coaches** | Empirical and anecdotal evidence offer some insights suggesting that non-stereotypical behaviours and choices are often the barriers in achieving success at high level and contributing towards feelings of self-doubt and low self-worth. This is true for both female professionals working in the male-dominated fields and male professionals working in the feminine professions.<br><br>We aim at better understanding sport experiences of elite male and female coaches across multiple sports worldwide. This study will shed more light on how we could enhance the experiences of elite coaches and minimise barriers faced on their road to success. This project will help students to better understand how the mixed-methods approach is utilised in practice when conducting applied sport psychology research. The students will be expected to work as part of interdisciplinary team across SELS and School of Psychology. | Dr Kotryna K. Fraser<br>E: Kotryna.fraser@newcastle.edu.au<br>P: 4348 4141 | Exercise and Sport Science<br><br>Social and Organisational Psychology Research Group (SOPRG; School of Psychology) | **Exercise and Sport Science**<br><br>**Psychology** | SELS<br><br>PSYC |
| **22** | **Investigating sports culture for athletes, coaches and support staff across various sports and countries** | Discrimination of different forms is evident in sport with more and more elite athletes advocating for a much-needed change. While there is some evidence to indicate the negative effect discrimination and stereotyping having on performance, little do we know about different types of discrimination (e.g., racism vs. sexism) experienced by sport participants (e.g., players, coaches, support staff, or referees).<br><br>Therefore, there are some opportunities to work as part of on-going national and international projects investigating various types of discrimination and social injustice in sport across multiple levels. These projects aim at gathering evidence to better understand future direction sport should take in creating equity and promoting social justice from practical and research perspectives. The students will have some opportunities to learn more about both quantitative and qualitative research methods and develop their professional skills essential for a successful researcher and practitioner. | Dr Kotryna K. Fraser<br>E: Kotryna.fraser@newcastle.edu.au<br>P: 4348 4141 | Exercise and Sport Science<br><br>Social and Organisational Psychology Research Group (SOPRG; School of Psychology) | **Exercise and Sport Science**<br><br>**Psychology** | SELS<br><br>PSYC |

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| **184** | **The impact of father-child play on child development** | Most research looking at child development focusses on maternal influences. This research project instead looks at the unique contributions that father-child play interactions have on child outcomes. The research will require a student to code the father-child play interactions, which will then be used to determine which aspects of play (e.g., dominance, sensitivity etc.) promote healthier child development trajectories. | Dr Emily Freeman<br>P: (02) 4921 6115<br>E: emily.freeman@newcastle.edu.au | Cognitive Research Group<br><br>Priority Research Centre for Brain and Mental Health Research | **Psychology** | PSYC |
| **105** | **Is diet quality limiting the reproductive success of urban parrots?** | This project is part of a large study in which we are examining whether diet quality limits the reproductive success of native parrots in our cities. The project will involve fieldwork in and around Newcastle checking nest boxes and managing nest box cameras to record the foods parents feed to chicks. | Dr Andrea Griffin<br>P: (02) 4348 4393<br>E: Andrea.Griffin@newcastle.edu.au | Conservation Biology Research Group | **Psychology** | PSYC<br><br>SELS |
| **106** | **Habitat use by Eastern curlew in Port Stephens estuary** | This project is part of a long-term study in which we are using automated radiotelemetry to record the movements of Eastern curlew in Port Stephens and Hunter estuaries to understand which areas they use to feed at low-tide and to roost at night. The project will involve observational field work on migratory shorebirds in Newcastle and Port Stephens estuaries, NSW. The project will offer opportunities to participate in bird banding expeditions and to become involved with the local bird stakeholder community. | Dr Andrea Griffin<br>P: (02) 4348 4393<br>E: Andrea.Griffin@newcastle.edu.au | Conservation Biology Research Group | **Psychology** | PSYC<br><br>SELS |
| **185** | **How has COVID-19 impacted the health behaviours and wellbeing of Australian mothers?** | The COVID-19 pandemic of 2020 has resulted in an unprecedented change to the way we live, work, and socialise. While the long-term consequences of these changes are yet to be fully felt, the short-term impacts are already apparent.This project will examine self-reported change in health behaviours and wellbeing during 2020. | Dr Sally Hunt<br>E: sally.hunt@newcastle.edu.au<br>P: (02) 4985 4305 | Health and Clinical Psychology Research Group | **Psychology** | PSYC |
| **186** | **ACTIVate Project** | The ACTIVate Project is investigating how different lifestyle patterns affect thinking ability and brain function in older adults aged 60-70. This project will follow these older adults over the course of three years to determine how lifestyle factors such as diet, physical activity, and sleep impact risk for dementia. | Prof Frini Karayanidis<br>E: Frini.karayanidis@newcastle.edu.au<br>P: 4921 5457 | Stroke and Brain Injury | **Psychology** | PSYC |

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| **187** | **ABC Project** | The ABC Project is investigating the effect of cognitive training on brain health in older adults. This study aims to determine whether Lumosity brain training can change the structure and function of our brains. | Prof Frini Karayanidis<br>E: Frini.karayanidis@newcastle.edu.au<br>P: 4921 5457 | Stroke and Brain Injury | **Psychology** | PSYC |
| **188** | **The effects of various substances on cognitive processes** | Many substances have effects on cognitive processes and the effects of combinations of substances are likely to be greater than the sum of the effects of two individual substances. These effects can be either positive (resulting in enhanced performance) or negative (resulting in decrements in performance) depending on the nature of the substance. Studies will be conducted to further explore the effects on cognitive processes of substances such as alcohol and caffeine using electrophysiological and/or behavioural measures in the general population. | Prof Frances Martin<br>P: (02) 4348 4121<br>E: Frances.Martin@newcastle.edu.au<br>(Ourimbah Campus) | Sensory, Cognitive and Affective Neuroscience Research Group<br><br>Priority Research Centre for Translational Neuroscience and Mental Health | **Psychology** | PSYC |
| **189** | **Emotion and attention** | The literature is divided as to whether emotion affects cognitive processes or whether our cognitive processes affect emotion with some of the literature suggesting that both can occur depending on the nature of the stimuli and the task. The majority of studies investigating the perception (rather than the experience) of emotion have used the International Affective Picture System stimuli, however very few studies have investigated the effects on emotional processing of the various semantic contents of the stimuli. Studies will be conducted to further explore the differences in responses to varying semantic stimuli using electrophysiological, measures. | Prof Frances Martin<br>P: (02) 4348 4121<br>E: Frances.Martin@newcastle.edu.au<br>(Ourimbah Campus) | Sensory, Cognitive and Affective Neuroscience Research Group<br><br>Priority Research Centre for Translational Neuroscience and Mental Health | **Psychology** | PSYC |
| **190** | **Behavioural Addiction** | Recent advances in the field of addiction have given greater emphasis to subjective experience and compulsive behaviour. This signifies an important shift from focusing on the object of addiction to acknowledging that behaviours, which can induce changes in physical arousal and subjective experience, have the propensity to be overused and lead to addiction. Gambling, video-arcade games, computer games, and the Internet have therefore been identified as potentially addictive activities, which like drug use, also exist on a continuum of addiction, ranging from no symptoms of addiction to addiction. Researchers have also emphasised the need to distinguish high engagement in activities and addiction. Studies will be conducted to further explore the nature of internet use and the potential for addiction to occur to the internet. | Prof Frances Martin<br>P: (02) 4348 4121<br>E: Frances.Martin@newcastle.edu.au<br>(Ourimbah Campus) | Sensory, Cognitive and Affective Neuroscience Research Group<br><br>Priority Research Centre for Translational Neuroscience and Mental Health | **Psychology** | PSYC |

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| **191** | **Invisible light stimulation as a treatment for myopia** | The number of people who are short sighted (myopic) has increased dramatically within one generation. It is predicted that ½ the worlds population will be myopic by 2050. High myopia is now a leading cause of blindness worldwide. The Vision Sciences Group are developing treatments for myopia. This project is investigating the use of invisible specialised stimulation of the eye to counteract the progression of myopia using an animal model of myopia. You would be involved in making specialised lenses and helping with hands on animal experiments in a team of researchers. An affinity for animals and a natural ability for constructing small devices is desirable. Successful applicants will need to agree to commercial confidentiality<br>. | A/Prof Sally McFadden<br>E: sally.mcfadden@newcastle.edu.au<br>P: (02) 4921 5634 | Vision Sciences Group<br><br>Priority Research Centre for Brain and Mental Health Research.<br><br>HMRI | **Psychology** | PSYC |
| **192** | **The effect of blur on the choroid in the live eye using OCT** | The choroid is a vascular bed that provides the nutrients for the adjacent neural retina of the eye. When positive or negative spectacle defocus is imposed on the eye, remarkably, the choroid rapidly shrinks or swells respectively by an amount proportional to both the degree and the sign of the imposed defocus. This choroid response leads to the eye growing faster or slower as a permanent way to cancel out the defocus and is a predictor of myopic eye growth. This project aims to non-invasively track these choroid responses in animals by adapting an ocular coherence tomography machine (Zeiss Cirrus HD-OCT 800) and designing appropriate image analysis. Ultimately, we aim to use the diurnal changes in choroid thickness as a fast track method to test treatments designed to reverse myopia. You will work within a team and your role will be matched to your background and interests. | A/Prof Sally McFadden<br>E: sally.mcfadden@newcastle.edu.au<br>P: (02) 4921 5634 | Vision Sciences Group<br><br>Priority Research Centre for Brain and Mental Health Research.<br><br>HMRI | **Psychology**<br><br>**Biomedical Engineering**<br><br>**Physics** | PSYC<br><br>ENGG<br><br>MAPS |
| **193** | **The effects of synthetic atropine derivatives in the eye** | Atropine, derived from the deadly nightshade plant, is used as an eye drop medicine to treat uveitis, early amblyopia and myopia. However, it is an antimuscarinic (a type of anticholinergic) that inhibits the parasympathetic nervous system and paralyses the muscles that control the iris and lens of the eye. Together with a pharmaceutical company, we are developing synthetic derivates that might avoid such side effects while still being effective. This project will use immunohistochemistry to determine how these derivatives perturb muscarinic receptors in the retina and other tissues of the eye. This fundamental work aims to pinpoint the neurons that may be activated by Atropine in the retina. You will work with others in the lab and training will be provided in immunohistochemistry. | A/Prof Sally McFadden<br>E: sally.mcfadden@newcastle.edu.au<br>P: (02) 4921 5634 | Vision Sciences Group<br><br>Priority Research Centre for Brain and Mental Health Research.<br><br>HMRI | **Psychology**<br><br>**Chemistry/ Biology** | PSYC<br><br>SELS |

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| **194** | **Seeking or avoiding diversity? Investigating the predictive role of personality and situational variables including anxiety, self-expansion, and self-knowledge** | Extensive evidence indicates that intergroup contact between individuals of opposing groups (e.g., Anglo-ethnic individuals, straight and gay individuals, young-old people, etc.) diminishes prejudiced attitudes (e.g., racism, homophobic attitudes, ageism, stigma towards mental illness etc.) and increases social integration in society (see Pettigrew & Tropp's 2016 meta-analysis). Willingness to engage with diversity naturally precedes any meaningful contact between people of opposing groups, yet research investigating the determinants of people's seeking/avoiding diversity is surprisingly scant.<br><br>Research in Dr Paolini's social psychology tackles this socially important and academically novel issue. Among other factors, it currently investigates the role that intergroup anxiety, the anxiety experienced when engaging or anticipating and intergroup interaction, has in deterring intergroup contact but at times in propelling people towards diversity (i.e., an ironic effect; for a review of recent studies in her research laboratory, see Paolini, Harris, & Griffin, 2016). Her current work also investigates the role that individuals' need for self-expansion (the desire to expand the resources, perspectives, and identities of the self), and the need for self-knowledge (the desire to expand one's knowledge of the self; for recent empirical work, see Paolini, Wright, Dys-Steenbergen, & Favara, 2016) have in triggering curiosity and interest in diversity.<br><br>The relative predictive powers of these and other critical factors is currently examined in a variety of research projects with a variety of international and national research collaborators. This multi-prong line of research that is sponsored by an Australian Research Council grant uses a mixed-model approach: A combination of natural observation, surveys in the field, experimentation in the laboratory (including physiological responses) or online to investigate individual difference variables and contextual factors that affect people's willingness to engage with or avoid diversity. Dr Paolini's lab is a vibrant environment and welcomes research students at different levels of research training (e.g., undergraduate research volunteers, honours, overseas research visitors, PhD students and Clinical Masters students). | A/Prof Stefania Paolini<br>P: (02) 4921 5938<br>E: stefania.paolini@newcastl.edu.au | Social Psychology Laboratory<br><br>Social Psychology and Organisational Psychology Research Group<br><br>Priority Research Centre for Translational Neuroscience and Mental Health | **Psychology** | PSYC |

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| **195** | **Protecting the Academic Aspirations of Vulnerable Students in the Newcastle area Post-COVID** | Global economic crises, like the one we will experience post-COVID, disproportionately affect vulnerable segments of society. Historical data tell us that they increase disparities and threaten social cohesion.<br><br>A research team led by A/Prof Paolini at UON Psychology has partnered with a local high school to check on the impact that the COVID crisis is having on the academic aspirations of students from disadvantaged backgrounds.<br><br>Even in regular times, vulnerable students, more than other students, struggle to align their aspirations for the future to their academic performance and potential. We have also observed that their academic aspirations tend to decline over time, as vulnerable students approach the time in which they need to make consequential decisions about their future schooling and professional pathways, at the end of middle school.<br><br>This dampening in academic aspirations can undermine efforts at forging positive futures for these students and their families. It can be a key contributor to intransigent cycles of poverty in our local communities.<br><br>This research will track trajectories of academic success and aspirations of these students and their more advantaged counterparts, over a three year period. This investigative effort will help identify the drivers of debilitating dynamics in academic aspirations and protective factors.<br><br>It will help the school put in place strategies to ensure that all students at this local school and around Australia do not miss out on the bright futures they can forge and deserve. | A/Prof Stefania Paolini<br>E: stefania.paolini@newcastl.edu.au<br>P: (02) 4921 5938 | Social Psychology Laboratory<br><br>Social Psychology and Organisational Psychology Research Group<br><br>Centre for Brain and Mental Health Research | **Psychology** | **PSYC** |

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| **196** | **Filtering event relevance** | Summer students would join a team using neuroimaging methods to study cognitive and perceptual processes addressing how the brain filters the relevance of events around us to prioritise certain sources of information while filtering out others. This process is altered in certain conditions such as schizophrenia and changes as we age.<br><br>Summer students would:<br>(1) gain experience in the experimental designs used to study this process;<br>(2) be trained in the methods;<br>(3) collect data on pilot projects; and<br>(4) be exposed to how be analyse the data to obtain meaningful measures of brain processes.<br><br>In addition the student would learn about the studies we are conducting to assess how this filtering process works from the neonate through adulthood and into older ages and clinical groups. | Prof Juanita Todd<br>Juanita.Todd@newcastle.edu.au<br>(02) 49215977 | Sensory Cognitive and Affective Neuroscience | **Psychology** | PSYC |