Bachelor of Science Honours

Potential projects

Research can be done in a wide array of scientific fields in a number of Colleges or Research Institutes at CDU. Potential projects are listed here, but students can also contact academics in their area of research interest about developing a suitable project.

Environmental Science

Academics in the Research Institute for the Environment and Livelihoods (www.cdu.edu.au/riel) and can be contacted to discuss potential projects.

Information Technology

Academics in the College of Engineering IT and Environment (www.cdu.edu.au/engineering-it-environment/it) can be contacted to discuss potential projects.

Health and Clinical Science

Academics in the College of Health and Human Sciences (www.cdu.edu.au/health-human-sciences) and Menzies School of Health Research (www.menzies.edu.au) can be contacted to discuss potential projects. Menzies keeps a list of potential Honours projects: www.menzies.edu.au/page/Education_and_Training/Study_with_us/Higher_Degrees_by_Research_HDR/Honours_program.

Environmental Science

Project title:	Mapping conservation value of habitat for native mammals in the Greater Darwin region – habitat quality vs. connectivity
Supervisors:	Prof. Sam Banks
Contact details:	Email: sam.banks@cdu.edu.au Phone: (08) 8946 7166
Location:	Casuarina campus
Timeframe:	Open
Synopsis of project:	Despite ongoing urban development, the Greater Darwin region provides important habitat for a number of native mammal species that are declining across northern Australia. While the loss and fragmentation of habitat are typically considered threats to wildlife, these processes may buffer wildlife against the broader threats of fire and feral animals across that are present in the broader landscape of northern Australia. Given ongoing development pressure in the region, this project will investigate what environmental characteristics, relating to habitat quality, amount and connectivity, are associated with native mammal occurrence across the Darwin region. The project will be supervised by Professor Sam Banks and Associate Professor Brett Murphy. It will involve extensive field-based surveys in the Greater Darwin region and statistical data analysis.

Environmental Science

Project title:	Conservation genetics of rock-rats in northern and central Australia
Supervisors:	Prof. Sam Banks
Contact details:	Email: sam.banks@cdu.edu.au Phone: (08) 8946 7166
Location:	Casuarina campus
Timeframe:	Open
Synopsis of project:	Australia's rock-rats (*Zyzomys*) are a fantastic genus of native rodents found through rocky country in northern and central Australia. This project will use genetic data to understand evolutionary relationships among species and genetic diversity within populations of rock-rat species. This can help us understand the importance of particular locations for conservation of genetic diversity in declining mammals and also provide insights into whether populations in certain areas are more resilient to environmental threats (genetic data can be used to understand changes in population size). The project will be supervised by Prof. Sam Banks, Dr Brenton von Takach Dukai and involve collaboration with external scientists. There will be opportunities for field work, laboratory work and data analysis.

Environmental Science

Project title:	Vibrio ecology in Darwin Harbour
Supervisors:	Dr Anna Padovan
Contact details:	Email: anna.padovan@cdu.edu.au Phone: (08) 8946 6555
Location:	Casuarina campus
Timeframe:	Open
Synopsis of project:	*Vibrio* spp. are common in biota, water and sediment in estuarine and coastal environments including Darwin Harbour. Several vibrio species have human pathogenic strains and globally, are the major cause of bacterial gastroenteritis following the ingestion of uncooked seafood. We found that vibrio prevalence was significantly higher in shellfish in the wet season when water turbidity is higher and salinity is lower due to rainfall. Other studies have shown a link between vibrio abundance and diversity with the amount of particulate matter in the water and zooplankton (Watkins and Cabelli, 1985, Applied and Environmental Microbiology, 49(5), 1307–1313). While we know vibrios are abundant in our waters, we do not know all species present and we do not know how they respond over time and space. The aim of this project is to further understand vibrio ecology in water and biota.
Necessary skills or knowledge:	Microbiological techniques (culturing, plating); molecular techniques (DNA extractions, gel electrophoresis, PCR, qPCR); understanding of and ability to work with biohazards; well-organized.
Methodological approach:	Take replicate seawater and sediment samples from key sites in Darwin Harbour to (1) culture V. parahaemolyticus to enumerate and identify strains using PCR or qPCR; (2) measure key physicochemical parameters. Use multivariate analysis to determine if there is a relationship with vibrio abundance with particular parameters.

Environmental Science

Project title:	Distribution of *Vibrio* bacteria species and strains in environmental samples and biota
Supervisors:	Dr Anna Padovan
Contact details:	Email: anna.padovan@cdu.edu.au Phone: (08) 8946 6555
Location:	Casuarina campus
Timeframe:	Open
Synopsis of project:	*Vibrio parahaemolyticus* and other important vibrio species have been detected in shellfish in Darwin Harbour. To understand the ecology of this potentially human pathogenic bacterium, we need a better understanding of the distribution of key vibrio species and virulent strains in environmental samples including biota from different times and locations to account for different seawater temperature, salinity, rainfall events and nutrients. Multivariate analysis will be performed to determine if there are conditions likely to lead to the proliferation of *V. parahaemolyticus* and other species, particularly virulent strains and similar species.
Necessary skills or knowledge:	Microbiological techniques (culturing, plating); molecular techniques (DNA extractions, gel electrophoresis, PCR, qPCR); understanding of and ability to work with biohazards; well-organized.
Methodological approach:	Take replicate seawater and sediment samples from key sites in Darwin Harbour to (1) culture V. parahaemolyticus and similar to enumerate and identify strains using PCR or qPCR; (2) measure key physicochemical parameters. Use multivariate analysis to determine if there is a relationship with vibrio abundance with particular parameters.

Project title:	Microbial Processes in High-Rate Algal Systems for Wastewater Remediation
Supervisors:	Dr Anna Padovan
Contact details:	Email: anna.padovan@cdu.edu.au Phone: (08) 8946 6555
Location:	Casuarina campus
Timeframe:	Semester 2 2020
Synopsis of project:	Leanyer-Sanderson waste stabilisation ponds (LSWSP), Darwin's largest treatment ponds, use a natural, cost effective form of treatment which relies on sunlight. A small-scale set up of a new treatment technology involving a high-rate anaerobic digestor and high-rate algal ponds (HRAPs) will be fitted to LSWSP in 2020 and monitored for performance. The aim of this Honours project will be to use high throughput sequencing technology to identify microbial communities and key taxa within the anaerobic digesters and HRAPs and track how the communities change over space and time. The results from this work will identify key bacterial communities that are associated with each of the key process operations of the integrated system. Water chemistry parameters will also be undertaken at all microbial sampling points allowing the chemical remediation of the wastewater to be followed through the treatment process and to better understand the relationship between water chemistry and microbial communities. The CRC-P project 'transforming regional treatment in Australia with robust technology' aims to revolutionise rural and regional wastewater treatment in Australia. The integrated low-cost microalgae-based treatment solution will transform inefficient sewage treatment ponds into self-contained environmental assets benefitting regional communities. It has strong market potential worldwide due to the ability to retrofit existing assets. This integrated technology will recover water and valuable nutrients suitable for local agricultural uses, with minimal odour and greenhouse emissions.
Necessary skills or knowledge:	molecular techniques (DNA extractions, gel electrophoresis, PCR, qPCR); understanding of and ability to work with biohazards; well-organized; ability to coordinate and communicate effectively with multiple organisations.

Environmental Science

Project title:	Toxic trace metals in Australia's cities and towns
Supervisors:	Dr Nicola Stromsoe
Contact details:	Email: nicola.stromsoe@cdu.edu.au Phone: (08) 8946 6527
Location:	Preferably Darwin, can be undertaken externally but will need to be able to collect samples from a range of urban environments
Timeframe:	Open
Synopsis of project:	Many people are unaware of just how ubiquitous toxic trace metals (lead and others) are in the environment. Emitted to the atmosphere by coal burning, metal smelting and transport, these metals travel large distances and have been found at greater than natural concentrations as far afield as Antarctica, the remote ocean and Australia's iconic Snowy Mountains. In terms of impacts on humans it is the concentration of these metals in the environments we are exposed to everyday – our homes, gardens, workplaces and playgrounds – that is probably of most interest. We have found surprisingly high levels of toxic trace metals in children's playgrounds in urban environments. Previous studies have documented elevated levels of lead on playgrounds in industrial centres with a known history of metal pollution – such as former mining or smelting towns. However, we don't fully understand the distribution and concentration of metal pollutants in urban environments more generally – in the cities and towns where we live. This project aims to quantify the concentration of metal pollutants on children's playgrounds in urban environments. This project forms part of a larger project building an Australia wide data base of metal concentrations – this honours project will preferably focus on Darwin and it's surroundings but there is potential to undertake this project externally in the students home town.
Necessary skills or knowledge:	Basic (1st year) university chemistry knowledge, the ability to work independently (with guidance) to develop a robust sampling strategy, the ability to collect samples from a range of urban environments, the ability to follow protocol to collect and maintain 'clean' samples, basic maths skills, skills in excel or R and GIS or the ability to learn them.
Methodological approach:	Develop a sampling strategy to reliably quantify trace metal concentrations on children's playgrounds in Darwin and its surroundings (or other towns and cities), undertake a literature review to develop a database of comparable measurements, analyse data to determine concentrations, spatial patterns and potential for harm of toxic trace metals in urban environments.

Environmental Science

Project title:	Drivers of water variability in Australia's wet–dry tropics
Supervisors:	Dr Nicola Stromsoe
Contact details:	Email: nicola.stromsoe@cdu.edu.au Phone: (08) 8946 6527
Location:	Can be undertaken externally
Timeframe:	Open
Synopsis of project:	The variability of water presence and quantity in the rivers, wetlands and aquifers of Australia's wet-dry tropics has a profound effect on the plants, animals and people that rely on them for survival. It is often assumed that the wet-dry tropics are buffered from the effects of dry periods experienced elsewhere in Australia by the annual tropical wet-season – which replenishes environmental water stores. However, recent dryer than usual wet seasons have highlighted the fact that the wet season may not be as reliable as is often assumed – which could impact the availability of water through the dry season and even into subsequent years. While we understand the link between larger scale climate drivers (such as the El Niño–Southern Oscillation) and the year to year variability rainfall in the top end, we don't really know how variability in these systems impacts the presence and quantity of surface water – that is water in wetlands and stream habitats important to plants and animals. The amount of rainfall which appears in these surface habitats is likely to be modulated by the impacts of catchment configuration and connectivity between groundwater and surface water stores. The aim of this project is to understand long term, year-to-year variability of surface water variability in the wet dry tropics and its climatic controls.
Necessary skills or knowledge:	Some understanding of climate and hydrology. Basic maths skills. The capacity to learn new statistical techniques and implement them in the relevant software.
Methodological approach:	Undertake a literature review to identify suitable statistical techniques to analyse streamflow variability and its relationship with relevant climate drivers (e.g. the El Niño–Southern Oscillation, Indian Ocean Dipole), Identify and obtain data on streamflow and climate driver indices, using publicly accessible data, Use statistical analysis to determine relationships between streamflow and climate drivers.