Flinders UNIVERSITY
College of Science & Engineering

INSPIRING ACHIEVEMENT

College of Science and Engineering Honours Projects

Available to commence

February and/or July 2020

Preface

The projects listed in this booklet are available at the time of publishing. We will endeavour to update the list as new projects become available or as places are filled. This list is intended to be an initial guide to assist students to choose areas of preference. The final details of a project proposal must be established by consultation with your potential supervisor. If you are interested in any of these projects you need to contact the supervisor directly to discuss both the project details and your suitability to undertake the project.

Staff members will, in addition, be happy to talk about any alternative project ideas you may have considered, however there is no guarantee that they will have the capacity to take you on.

Application process

Applications for semester 1, 2020 open on Monday 23 September 2019 and close on Monday 2 December 2019 (late applications up until 17 January 2020 will be accepted however equal consideration of preferred supervisor/project will not be guaranteed).

Before applying you will need to have chosen a research project and have approval of the project supervisor(s).

If you are an internal, external or international student applying for a 1 year Honours Program you can apply online. Please enter the correct 1 year study code **HBSC** **or** **HBIT** **or** **HBDTI** **or** **HBAGIS** **or** **HBEM** to select the correct 1 year course.

If you are enrolled in a 4 year program and are applying to progress through to your Honours year, please email cse.enquiries@flinders.edu.au to request an application form.

If you require any further information regarding studying Honours, please contact the relevant College Honours coordinator listed below.

Discipline	Coordinator	Email
Computer Science	Brett Wilkinson	brett.wilkinson@flinders.edu.au
Biotechnology	Peter Anderson	peter.anderson@flinders.edu.au
Mathematics	Iwan Jensen	iwan.jensen@flinders.edu.au
Natural Sciences	Jean-Marc Hero	jeanmarc.hero@flinders.edu.au
Physics & Molecular Sciences	Mike Perkins	mike.perkins@flinders.edu.au

Projects listed by teaching program

Design, IT, Mathematics and Science Communication

Natural Sciences (including Biology and Environment)

Physical and Molecular Sciences (including Biotechnology)

Medical image segmentation

Commencing: February 2020

Principal Supervisor: Dr Mariusz Bajger

Email: mariusz.bajger@flinders.edu.au

Project summary

In these projects we will look at the methods of segmentation suitable for large images. The most robust segmentation techniques usually involve criterion based on image texture which makes them computationally expensive or even prohibitive. To overcome this issue subsampling is often used. This however leads to loose of information present in the original image which may be critical for further image analysis tasks. Some recent methods have been proposed to deal with this issue for scene images. In this project we will look at ways of applying these methods to medical images.

Location

Flinders University - Tonsley

Assumed knowledge

Basic knowledge of mathematics (first year University level); good programming skills

Further information

flinders.edu.au/people/mariusz.bajger

Classification of breast cancer histology images using Deep Learning techniques

Commencing: February 2020

Principal Supervisor: Dr Mariusz Bajger

Email: mariusz.bajger@flinders.edu.au

Project summary

The project will focus on applications of Convolutional Neural Networks (CNN) to classification of stained breast biopsy images. Different network architectures and parameters would be considered to achieve state-of-the-art performance with classification of tissues into classes such as normal, benign, malignant. Publicly available databases would be used to evaluate performance of the designed networks. The accuracy of such systems is currently about 75-85% leaving significant room for improvement. The project requires access to a PC with a decent GPU.

Location

Flinders University - Tonsley

Assumed knowledge

Basic knowledge of probability, linear algebra and statistics; good programming skills

Further information

flinders.edu.au/people/mariusz.bajger

Medical image segmentation using CNN

Commencing: February 2020

Principal Supervisor: Dr Mariusz Bajger

Email: mariusz.bajger@flinders.edu.au

Project summary

Recently, several systems based on CNNs have been proposed to segment medical images. Systems like V-net, U-net and similar, already show impressive performance on some natural scene images, light microscopy images or MRIs. In this project we will look at the techniques of data augmentation and their impact on the system performance. We may also look at the methods of filter visualization to improve understanding of underlying feature space. The project requires access to a PC with a decent GPU.

Location

Flinders University - Tonsley

Assumed knowledge

Basic knowledge of probability, linear algebra and statistics; good programming skills

Further information

flinders.edu.au/people/mariusz.bajger

Importance of modules in hierarchical games/warfare

Commencing: February 2020

Principal Supervisor: A/Prof Vladimir Ejov

Email: vladimir.ejov@flinders.edu.au

Project summary

To design mathematical models and software to determine the probability of winning a sports competition from any given score on the basis of given elementary probabilities of winning a point, relative to various sports. Derive explicit formulae for the outcome and compare them with the recursive approach. Determine importance of hierarchical events during the competition.

Location

Flinders University - Tonsley

Assumed knowledge

Probablity and statistics topics

Further information

Based on further development of the ideas introduced in

researchbank.swinburne.edu.au/file/edbea937-273d-4a0c-b0ae-60edea4489c8/1/Tristan%20Barnett%20Thesis.pdf

Analytical and computational studies of lattice walk generating functions

Commencing: February or July 2020

Principal Supervisor: Dr Iwan Jensen

Email: iwan.jensen@flinders.edu.au

Project summary

Counting the number of combinatorial objects a(n) of size n and finding the generating function of the sequence is a fundamental pursuit of combinatorics. A time honoured approach is to generate the sequence numerically and then try to "guess" the generating function or one may find functional equations satisfied by the generating function. A number of specific projects related to models of polymer physics is on offer with computational and/or analytical components to meet the interests of any student.

Location

Flinders University - Tonsley

Assumed knowledge

Experience with Matlab or Mathematica, real and complex analysis.

For a computational project, experience with coding in C or Python

Further information

flinders.edu.au/people/iwan.jensen

Computer simulations of non-equilibrium models in statistical physics

Commencing: February or July 2020

Principal Supervisor: Dr Iwan Jensen

Email: iwan.jensen@flinders.edu.au

Project summary

Non-equilibrium models originating in statistical physics has been used extensive to study a range of phenomena such a population growth including the spreading of infectious diseases, forest fires, catalytic chemical processes etc. An example is the simple birth-death process in which individuals can reproduce asexually and die. Embedded on a lattice the reproduction is constrained since a new individual can only arise on an empty site of the lattice.

Location

Flinders University - Tonsley

Assumed knowledge

Experience with coding in C or Python

Further information

flinders.edu.au/people/iwan.jensen

BCI for outreach

Commencing: February or July 2020

Principal Supervisor: Dr Trent Lewis

Email: trent.lewis@flinders.edu.au

Project summary

The Brain Signals Lab at Flinders does some cool work with brain signals. The problem to be addressed here is how to make that work accessible to a broader audience, but mostly to school aged children. Some effort has been put towards developing some straight forward brain computer interfaces (BCIs) that have shown some promise. For example the "turn a light on with your brain" used the change in the brain's Alpha rhythm to trigger an event that switch a wifi light switch on or off. This project would investigate ways to creatively display brain activity through either BCIs or visualisation.

Location

Flinders University – Tonsley

Assumed knowledge

Some knowledge of either programming, visualization or signal processing

Further information

flinders.edu.au/people/trent.lewis

Brain Connectivity in Auditory-Visual Speech

Commencing: February or July 2020

Principal Supervisor: Dr Trent Lewis

Email: trent.lewis@flinders.edu.au

Project summary

Speech is a multimodal activity that relies on both auditory and visual sensory input, particularly to enhance understanding speech in noisy situations. This project would investigate the underlying brain mechnisms by applying connectivity and graph analysis, and also machine learning to EEG to examine the causal relationships between the activities of brain regions involved in auditory-visual speech processing of sentences and during varying levels of acoustic noise.

Location

Flinders University – Tonsley

Assumed knowledge

A level of programming proficiency

Further information

flinders.edu.au/people/trent.lewis

Disease Diagnosis from EEG using Machine Learning

Commencing: February or July 2020

Principal Supervisor: Dr Trent Lewis

Email: trent.lewis@flinders.edu.au

Project summary

There are particular brain-based disorders that do not have any brain structural abnormalities that can be detected using modern brain imaging technologies. However, functionally we might be able to detect subtle differences that lead to the behaviours such as psychosis, anxiety, depression, or dementia. We currently have an EEG dataset that was collected from a variety people with different disorders. The goal of this project is to investigate different machine learning algorithms for classifying and categorizing the EEG data from this dataset.

Location

Flinders University – Tonsley

Assumed knowledge

Programming

Further information

flinders.edu.au/people/trent.lewis

LED Brain Project

Commencing: February or July 2020

Principal Supervisor: Dr Trent Lewis

Email: trent.lewis@flinders.edu.au

Project summary

The goal of the LED Brain Project is to develop a brain sculpture that reflects in real-time the activity in a person's brain. A prototype has been developed that demonstrate the various stages involved in the system, but there still much refinement to reach the end product. The stages in the project can be roughly broken down into

- Modelling
  - Software
  - 3D Printing
- Hardware
  - Electronics
  - Power
  - Computing
  - Enclosure Design
- Software
  - Hardware communication
  - User Interface

Location

Flinders University – Tonsley

Assumed knowledge

Some knowledge around programming, 3D modelling, signal processing

Further information

flinders.edu.au/people/trent.lewis

AI:AudioVisual Speech/Face Emotion/Expression Recognition/Generation

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

This group of projects aims to add the dimension of emotion and expression to avatar and speech generation as well as to the understanding of the humans the talk to.

- AVSpeechRec - speech recognition is still brittle and emotion, expression and accent are often regarded as noise, but adding lip-reading can improve resilience in high noise condition, and rather than try to factor out emotion and expression, why not try to recognize the emotions and expressions.
- AVSpeechGen - a model for recognizing speech, emotions and expressions can also be used to add this dimension to avatar speech.

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Some knowledge of a Matlab, Weka, C++ or Python toolbox for Machine Learning, Neural Networks, Natural Language or Speech processing

Further information

flinders.edu.au/people/david.powers

Artificial Intelligence and Language Technologies

Cognitive Linguistics and Psycholinguistics

The Talking Thinking Teaching Head

AI:Applications of Machine Learning and Neural Networks in Forensics

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

This group of projects is carried out with cooperation and cosupervision from the Forensics Institute.

DNA: Projects include automatically classifying DNA from electropherograms, identifying DNA-contamination on surfaces to swap, counting the number of cells in a sample.

Handwriting/Speech/Text: Identifying people by the handwriting or speech samples, identifying the author of an anonymous note or call, quantifying the likelihood that a particular person is the author a particular note, call or text.

Computer Security applications.

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Some knowledge of a Matlab, Weka, C++ or Python toolbox for Machine Learning, Neural Networks, Natural Language or Speech processing

Further information

flinders.edu.au/people/david.powers

Sydney North Health Network

Flinders Forensic Science cleans up at Awards

AI:Embodied Conversational Agents for Health Interventions and Training

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

Flinders is well known for its Talking Head and Health Technologies. Important projects include teaching social skills to children with autism, providing companionship, advice and audiovisual memory assistance to people with dementa, providing counselling to people with social or health problems, and providing training to health professionals in the motivational interviewing techniques that can help people realize the import and effect of their problems, help them own the treatment program, and help them to properly follow the recommended regime. Tasks

- implement dialogue
- animate AV demos

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Background in interactive application development for mobile and/or fixed platforms. A background in artificial intelligence/intelligent systems would be helpful.

Further information

flinders.edu.au/people/david.powers

Sydney North Health Network

AI:Improved chance-correct Machine Learning and Boosting algorithms

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

Current Machine Learning algorithms and Neural Networks tend top optimize some form of accuracy (maximizing) or error (mininizing) in a way that is easily biased when one of the classes occurs much more than the other. They also tend to be defined fundamentally for the two-class dichotomous case. When a multiclass problem is trained per class with such a classifier, most if not all of the classifiers will be facing exactly the kind of imbalance they are worst at. Later stages of learning on a balanced dataset can also become imbalanced.

- design a classifier/booster to optimize informedness

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Some knowledge of alorithms and ideally a Matlab, Weka, C++ or Python toolbox for Machine Learning or Neural Networks.

Further information

flinders.edu.au/people/david.powers

Artificial Intelligence and Language Technologies

AI:Multimedia Robot World

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

This group of projects aims to provide support for grounded learning by giving the learner access to a virtual and/or real world.

- Virtual world - program animated characters and objects to behave in proactive of reactive ways in a virtual world, make animated vignettes matching a story (represented using a tree structure as might be generated from natural language texted)
- Real world - recognize how real world correlates of animated characters and objects more (e.g. 3D print/scan to transfer between worlds) and generate story (tree or text)
- Hybrid world - virtual+real teaching situation

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Background in interactive application development for mobile and fixed platforms, including ideally 3D graphical design, rendering or interpretation (e.g. of camera input or Kinect of Realsense)

Further information

flinders.edu.au/people/david.powers

Artificial Intelligence and Language Technologies

Cognitive Linguistics and Psycholinguistics

The Talking Thinking Teaching Head

AI:Speech driven applications

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

This group of projects offers a top student the opportunity to work with one of our award winning start up companies as well as partners in health and education.

- YourAmigo is known as the world leader in integral search optimisation due to its patented deep web technologies.
- YourAnswer, it's new sibling was awarded the WorldWide Most Exciting Tech Award at etail 2019 for its voice over phone search technology and shopping experience.
- Clevertar commercializes our Thinking Talking Teaching Head avatar technologies and has a particular focus on health applications and customer service.

Location

Flinders University – Tonsley (Startups in CBD)

Assumed knowledge

Background in interactive application development for mobile and fixed platforms. Some background in artificial intelligence/intelligent systems would be helpful.

Further information

flinders.edu.au/people/david.powers

youramigo.com/ l youranswer.io/ l clevertar.com/

Sydney North Health Network

Improved high efficiency programming language for multimodal AI, IoT and Robotics

Commencing: February or July 2020

Principal Supervisor: Prof David Powers

Email: david.powers@flinders.edu.au

Project summary

Current programming languages are extremely inefficient in their memory usage when it comes to dynamic memory and constructs like extensible arrays or lists, object-oriented programming and API layering. The kinds of programs that used to run in a few Kb can now get to Gb, and memory leaks will eventually bring any modern OS to a standstill.

Matrix/Array Functional Inductive Applicative (MAFIA) programming combines the best points of languages like C, Haskell, Matlab, Perl & Prolog by defining a pointer-free array/stream-based OO model that directly exploits the paging features of modern CPU.

Location

Flinders University – Tonsley (AIRL+MMRF)

Assumed knowledge

Some knowledge of Matlab &/or Prolog & Programming Language Concepts/Theory of Computation, as well as Computer Architecture, Operating Systems & Computer Networks (knowledge of x64 arch/os and Linux very useful)..

Further information

flinders.edu.au/people/david.powers

Decision support for hospital patient flow optimisation

Commencing: February or July 2020

Principal Supervisor: Dr Shaowen Qin

Email: shaowen.qin@flinders.edu.au

Project summary

Many of Australia's public hospitals operate at, or near, full capacity, which is commonly assumed to risk the emergence of significant delays during the admission process for emergency arrivals, and the need to cancel or delay planned admissions to create further capacity. This project aims to develop and validate predictive models for hospital occupancy and test "what-if" interventions for minimising congestion episodes using advance data analysis and simulation modelling approaches.

Location

Flinders University - Tonsley

Assumed knowledge

Data analysis and system modelling skills

Further information

flinders.edu.au/people/shaowen.qin

Patient flow data clustering and modular hospital design

Commencing: February or July 2020

Principal Supervisor: Dr Shaowen Qin

Email: shaowen.qin@flinders.edu.au

Project summary

This project aims to develop a modular hospital design to optimise its service delivery. Data mining/machine learning techniques will be applied to analyse hospital patient flow data for identification and characterization of clusters at various abstraction levels (module, process, and end-to-end care stream) along with their responsibilities and interfaces. The objective is to examine the existing hospital operations and recommend pathways to evolve the hospital to a modular structure for improved patient flow as well as quality and safety of care.

Location

Flinders University - Tonsley

Assumed knowledge

Data analysis skills; programming; object oriented analysis and design

Further information

flinders.edu.au/people/shaowen.qin

Augmented reality decision support system and training application for blood transfusion services

Commencing: February 2020

Principal Supervisor: Dr Brett Wilkinson

Email: brett.wilkinson@flinders.edu.au

Project summary

Develop and evaluate a mobile based AR system that will support practitioners in surgery theatres to interpret and make decisions on trace results from blood tests during surgery and transfusion processes. There will be opportunities to observe surgical procedure to understand the use of the current technology and how the AR app will assist in decision making. Work will be conducted in partnership with ROTEM at the FMC.

Location

Flinders University - Tonsley

Assumed knowledge

Students should have confident skills in programming, UX design and software engineering as acquired through topics (or equivalent) COMP2711, COMP2741, COMP3712, COMP3751, ENGR2792, ENGR3791

Further information

flinders.edu.au/people/brett.wilkinson

Augmented reality music studio

Commencing: February 2020

Principal Supervisor: Dr Brett Wilkinson

Email: brett.wilkinson@flinders.edu.au

Project summary

Development and evaluation of a handheld AR system to produce musical tracks. Create a marker based system that would allow the player to introduce various aspects of a musical piece (percussion, strings, etc., tempo, pitch, etc.) as individual markers into a scene captured by the camera of a tablet.

The intention is to create an experience for a performer that allows a visualisation of the music to be displayed dynamically while the markers are moved within the scene.

Location

Flinders University - Tonsley

Assumed knowledge

Confident skills in programming, UX design and software engineering as acquired through topics (or equivalent) COMP2711, COMP2741, COMP3712, COMP3751, ENGR2792, ENGR3791

Further information

flinders.edu.au/people/brett.wilkinson

Brain-computer interfaces and video games

Commencing: February 2020

Principal Supervisor: Dr Brett Wilkinson

Email: brett.wilkinson@flinders.edu.au

Project summary

Gamepads, mouse, keyboards, wheels, or joysticks are all natural interaction devices for games… but what about your brain? This project will look at the capabilities of existing hardware to provide "brain-based" input into an interactive gaming experience. The project will require the student to design an interaction framework for an existing game or develop a game built around a brain interface. Evaluation of the effectiveness of the input mechanic will be investigated through experimentation.

Location

Flinders University - Tonsley

Assumed knowledge

Confident skills in game design, programming, UX design and software engineering as acquired through topics (or equivalent) COMP2711, COMP2741, COMP3751, COMP3752, COMP3802, ENGR2792, ENGR3791

Further information

flinders.edu.au/people/brett.wilkinson

Interacting with games in a serious and meaningful way

Commencing: February 2020

Principal Supervisor: Dr Brett Wilkinson

Email: brett.wilkinson@flinders.edu.au

Project summary

Controllers and the way a gamer interacts with a game can create beneficial and meaningful immersive experiences. As a traditional player of video games we may take for granted the use of a standard console controller. What type of affordances need to be applied for those players who do not have the same capacity as us? What type of devices are required for specialised game-based training tasks? This project will encourage the student to explore the use of controllers for games and look at how they could be modified or removed to enable engaging play for appropriate audiences.

Location

Flinders University - Tonsley

Assumed knowledge

Confident skills in game design, programming, UX design and software engineering as acquired through topics (or equivalent) COMP2711, COMP2741, COMP3751, COMP3752, COMP3802, ENGR2792, ENGR3791

Further information

flinders.edu.au/people/brett.wilkinson

Virtual environments and the user

Commencing: February 2020

Principal Supervisor: Dr Brett Wilkinson

Email: brett.wilkinson@flinders.edu.au

Project summary

What are the next stages for virtual reality? What types of experiences are users looking for? How can we engage with these virtual worlds in an immersive, meaningful way? This project is flexible and will accommodate students who are interested in HCI, digital media creation, game development, or related areas. The project will look to explore possibilities associated with VR and other mixed reality environments.

Location

Flinders University - Tonsley

Assumed knowledge

Confident skills in game design, programming, UX design and software engineering as acquired through topics (or equivalent) COMP2711, COMP2741, COMP3751, COMP3752, COMP3802, ENGR2792, ENGR3791

Further information

flinders.edu.au/people/brett.wilkinson

Digital footprints of university students

Commencing: February 2020

Principal Supervisor: Prof Trish Williams

Email: trish.williams@flinders.edu.au

Project summary

Footprints create a picture of what each person does online and from the use of information and communication technology (ICT). As a result, data is available from all aspects of our lives creating a personal digital footprint and can be sources of information about an individual's behaviour. As part of the Campus Mental Wellness project, this will further existing research into building maps of digital footprints university students.

Location

Flinders University – Tonsley

Assumed knowledge

Understanding of basic communications technology and networking; Simple mapping and analysis skills

Further information

flinders.edu.au/people/trish.williams

Flinders Digital Health Research Centre

Sentiment (Behaviour) Analysis: Student Mental Wellness

Commencing: February 2020

Principal Supervisor: Prof Trish Williams

Email: trish.williams@flinders.edu.au

Project summary

Research shows that the wellbeing of university students is at risk. Starting a university education is a time of great change. Poor mental wellness can have a significant personal cost, impacting the ability of students to complete studies and can negatively impact future prospects.

The aim of this project is to identify student conversations on one or more social media platforms and determine what these conversations can tell us about student engagement, student retention and ultimately student wellness.
Example: Can predictors of Student Wellbeing be identified from Twitter conversations.

Location

Flinders University – Tonsley

Assumed knowledge

Basic programming skills, data analysis, interest in artificial intelligence

Further information

flinders.edu.au/people/trish.williams

Flinders Digital Health Research Centre

The effect of data quality on patient match rates

Commencing: February 2020

Principal Supervisor: Prof Trish Williams

Email: trish.williams@flinders.edu.au

Project summary

Correct patient matching is critical as increasing numbers of systems are exchanging data. The ability to match patient data is essential to provide quality and appropriate healthcare. However, in the complex healthcare environment whilst systems are inter-operable there is little research into how the quality of data impacts patient matching success rates. The project aims to understand how errors and variations in the quality of patient data in the sending and/or receiving information systems.

Location

Flinders University – Tonsley

Assumed knowledge

An understanding of data quality and data governance concepts; Data science and analytical skills; Basic statistical knowledge

Further information

flinders.edu.au/people/trish.williams

Flinders Digital Health Research Centre

Advancing hydro(geo)logical process understanding and modelling for impact assessment

Commencing: February or July 2020

Principal Supervisor: Prof Okke Batelaan

Email: okke.batelaan@flinders.edu.au

Project summary

For research interest in:

- Regional groundwater modelling
- Catchment hydrology and distributed hydrological modelling
- GIS and Remote sensing applications in hydrological modelling
- Groundwater dependent ecosystems
- Groundwater recharge and discharge estimation
- Groundwater/surface water interaction
- Ecohydrology

contact me and we can discuss a project in more detail.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/okke.batelaan

Conservation management and genetic rescue of Yarra pygmy perch

Commencing: February 2020

Principal Supervisor: Prof Luciano Beheregaray

Email: luciano.beheregaray@flinders.edu.au

Project summary

Genomic approaches can play a major role in conservation. We are working in the emerging field of restoration genomics to address genetic problems typically found in small populations while attempting to restore biodiversity to the wild. This project is part of a multi-institutional effort to restore the lineage of Yarra pygmy perch, a native species that went extinct in the Murray-Darling Basin and is now represented only in captivity. The work might include analyses of reproductive condition, growth rates and genomic variation in the MDB and in a recently translocated coastal lineage.

Location

Flinders University - Bedford Park

Assumed knowledge

Background knowledge in ecology, evolution and genetics

Further information

flinders.edu.au/people/luciano.beheregaray

molecularecology.flinders.edu.au/

Molecular Ecology Lab

Restoration genomics and the adaptive potential of small populations

Commencing: February 2020

Principal Supervisor: Prof Luciano Beheregaray

Email: luciano.beheregaray@flinders.edu.au

Project summary

Understanding the potential of wild populations to respond to the selective pressures imposed by humans is a major research priority. This project will combine genomic and environmental datasets to infer parentage and adaptive potential in a reintroduced population of a threatened fish. It will contribute to a large research program funded by the Australian Research Council that investigates evolutionary potential of small populations in nature. The outcomes will help evaluate and improve local and ecosystem-level initiatives towards the sustainable management of aquatic biodiversity.

Location

Flinders University - Bedford Park

Assumed knowledge

Background knowledge in ecology, evolution and genetics

Further information

flinders.edu.au/people/luciano.beheregaray

Molecular Ecology Lab

Evaluation of the performance of a large high rate algal pond for wastewater treatment

Commencing: February 2020

Principal Supervisor: Prof Howard Fallowfield

Email: howard.fallowfield@flinders.edu.au

Project summary

We have championed the acceptance of high rate algal ponds (HRAPS) for wastewater treatment in SA. HRAPs are shallow, mixed ponds where algae provide photosynthetic oxygen to bacteria, which mineralise organic carbon thereby providing CO2 to the algae. Nutrients are removed by the growth of algae. Federal funding enabled construction of two 5000m2 HRAPs for treatment of wastewater at Peterborough, SA. This is a unique facility in Australia. This project will characterise the hydrodynamics of the HRAP and determine HRAP nutrient, E.coli and F-RNA coliphage removal.

Location

Flinders University - Bedford Park

Assumed knowledge

Microbology, microbial ecology or water chemistry

Further information

flinders.edu.au/people/howard.fallowfield

waterpathogens.org/node/3354

Ticks and lizards (various projects)

Commencing: February and July 2020

Principal Supervisor: A/Prof Mike Gardner

Email: michael.gardner@flinders.edu.au

Project summary

I have several potential projects depending on students interests. These can involve more or less fieldwork and more or less genetics and genomics. All the projects involve work on lizards either from a long term study on sleepy lizards and their ticks, or on the establishment of a new population of the endangered pygmy bluetongue lizard. I have several projects involving genes of the Major Histocompatibility Complex (MHC) which are involved in the immune response and mate choice and also on the analysis of SNP data sets. Organise a time to meet with me to discuss your interests.

Location

Flinders University - Bedford Park

Field sites – mid-north SA

Labs at SA Museum

Assumed knowledge

An interest in molecular ecology. Enthusiasm. Writing skills.

Further information

flinders.edu.au/people/michael.gardner

Lab of Evolutionary Genetics and Sociality

Effects of stormwater harvesting on street trees' amelioration of summer microclimate in Adelaide

Commencing: February 2020

Principal Supervisor: A/Prof Huade Guan

Email: huade.guan@flinders.edu.au

Project summary

With a warming climate, Adelaide is very likely to see more extreme hot days. Urban trees, in addition to providing shade, function as natural evaporative air conditioners if they can access moisture. This project will investigate whether stormwater infiltration using TREENET inlets helps to improve urban trees' amelioration of microclimate. We hypothesize that TREENET Inlet, by enhancing stormwater infiltration, provides more soil moisture for transpiration and therefore moderates summer air temperature. This will be a collaborative project between Flinders University and Mitcham Council.

Location

Flinders University - Bedford Park

Assumed knowledge

A bachelor degree in science or engineering. The project requires field data collection in urban streets. An early start (e.g., December) of the project is preferred.

Further information

flinders.edu.au/people/huade.guan

Mitcham Council - Measuring how much Water our Street Trees Use

Understanding abalone health through gill histopathology

Commencing: February 2020

Principal Supervisor: A/Prof James Harris

Email: james.harris@flinders.edu.au

Project summary

Our lab investigates the effects of different ingredients in formulated feeds for Australian abalone. The aim in several of these studies was to promote survival when elevated water temperature would otherwise cause mortality. Mortality occurs via damage to abalone gill structure and subsequent bacterial infection. Examining gill structure using histology offers insights into how abalone are protected from damage. This work is highly relevant in times of rising seawater temperatures.

Location

Flinders University – Bedford Park/SARDI ASC

Assumed knowledge

Completion of BIOL3732 or equivalent

Further information

flinders.edu.au/people/james.harris

Determining groundwater discharge at Sellick's Beach

Commencing: February and July 2020

Principal Supervisor: Dr Dylan Irvine

Email: dylan.irvine@flinders.edu.au

Project summary

This project seeks to locate and quantify the rates of groundwater discharge to Sellick's Beach, South Australia. Project will utilise a number of techniques including the use of temperature time series data, thermal cameras and other chemical and hydraulic methods to quantify groundwater discharge.

Work with Prof Adrian Werner and Dr Dylan Irvine.

Location

Flinders University - Bedford Park

Assumed knowledge

Knowledge of hydrogeology. Either groundwater modelling or hydrochemistry would be useful.

Further information

flinders.edu.au/people/dylan.irvine

flinders.edu.au/people/adrian.werner

Impacts of the Carmichael coal mine on groundwater dependent ecosystems

Commencing: February and July 2020

Principal Supervisor: Dr Dylan Irvine

Email: dylan.irvine@flinders.edu.au

Project summary

The proposed Carmichael coal mine has been contentious on a number of fronts. It has been suggested that proposed mine will impact the ecologically significant Doongmabulla Spring Complex (DSC), located 8 km from the mining lease area.

This project intends to investigate potential impacts of the Carmichael coal mine on the nearby DSC, Mellaluka Springs, and Carmichael River.

Work with Prof Adrian Werner and Dr Dylan Irvine.

Location

Flinders University - Bedford Park

Assumed knowledge

Knowledge of hydrogeology. Either groundwater modelling or hydrochemistry would be useful.

Further information

flinders.edu.au/people/dylan.irvine

flinders.edu.au/people/adrian.werner

dspace2.flinders.edu.au/xmlui/handle/2328/39203

"Kitchen oceanography": scientific experiments for the classroom

Commencing: February and July 2020

Principal Supervisor: A/Prof Jochen Kaempf

Email: jochen.kaempf@flinders.edu.au

Project summary

The aim of this project is to document (and develop) low-cost physical experiments that can be used in the classroom to demonstrate various oceanographic phenomena or scientific principles involving fluids.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in the natural sciences (and enthusiasm)

Further information

flinders.edu.au/people/jochen.kaempf

A study of atmospheric cyclones in the South East Tropical Indian Ocean (SETIO)

Commencing: February and July 2020

Principal Supervisor: A/Prof Jochen Kaempf

Email: jochen.kaempf@flinders.edu.au

Project summary

Kaempf's research group has recently discovered the existence of short-lived atmospheric cyclones in the South Eastern Tropical Indian Ocean (SETIO). The presence/absence of these cyclones are fundamental in the development of the positive phase of the Indian Ocean Dipole, which influences the monsoonal climate in many countries bordering the Indian Ocean including Australia. The aim of this project is to refine a cyclone-tracking algorithm to statistically analyze the properties of SETIO cyclones.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in the natural sciences and mathematics (and enthusiasm)

Further information

flinders.edu.au/people/jochen.kaempf

Upwelling of particulate matter in deep submarine canyons

Commencing: February and July 2020

Principal Supervisor: A/Prof Jochen Kaempf

Email: jochen.kaempf@flinders.edu.au

Project summary

This project employs process-oriented hydrodynamic models to study the newly discovered process of upwelling of particulate matter in deep submarine canyons. To this end, the honours candidate will undertake selected numerical experiments (under the instructions by the supervisor) to enhance the scientific understanding of this process.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in the marine sciences and mathematics (and enthusiasm)

Further information

flinders.edu.au/people/jochen.kaempf

Forensic DNA typing: transfer and persistence studies

Commencing: February 2020

Principal Supervisor: Prof Adrian Linacre

Email: adrian.linacre@flinders.edu.au

Project summary

Trace DNA is found commonly in forensic DNA investigations and the question is 'how did it get there'. A range of projects are available that try to address this type of question.

The projects may involve DNA profiling using either STRs of SNPs. All work will be conducted in the Forensic DNA Laboratory.

Location

Flinders University – Bedford Park
(Forensic DNA Laboratory)

Assumed knowledge

Completion of BIOL3793 and BIOL3792

Further information

flinders.edu.au/people/adrian.linacre

Detection of latent DNA

Commencing: February 2020

Principal Supervisor: Prof Adrian Linacre

Email: adrian.linacre@flinders.edu.au

Project summary

It is not possible to 'see' DNA when transferred by touch yet touch DNA can be of prime interest in forensic investigations. Work at Flinders University has developed a means to stain and record cellular material. Projects are available that examine the detection of DNA through speaking, touching and transfer.

The projects involve microscopy, fluorescence microscopy, and DNA profiling using either STRs of SNPs. All work will be conducted in the Forensic DNA Laboratory.

Location

Flinders University – Bedford Park
(Forensic DNA Laboratory)

Assumed knowledge

Completion of BIOL3793 and BIOL3792

Further information

flinders.edu.au/people/adrian.linacre

Ancestry informative SNPs

Commencing: February 2020

Principal Supervisor: Prof Adrian Linacre

Email: adrian.linacre@flinders.edu.au

Project summary

There are a number of single base changes that determine our ancestry. A multiplex of these SNPs have been designed on the Y-chromosome and therefore highly informative for male lineages. These will be used to screen populations to assess their predictive value.

The projects involve SNP typing and much performed at Forensic Science South Australia.

Location

Flinders University – Bedford Park
(Forensic DNA Laboratory)

Assumed knowledge

Completion of BIOL3793 and BIOL3792

Further information

flinders.edu.au/people/adrian.linacre

Studies of past sea level variations in Fraser Island (QLD) using foraminifera

Commencing: February 2020

Principal Supervisor: Dr Graziela Miot da Silva

Email: graziela.miotdasilva@flinders.edu.au

Project summary

Past environmental conditions and sea level elevations can be resolved by use of biological indicators present in sedimentary deposits. This project is based on sediment samples obtained in Moon Point (Fraser Island), potentially containing foraminifera species that can be used to pinpoint Holocene (past 10k years) and possibly older sea levels in the region.

Location

Flinders University – Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/graziela.miotdasilva

Beach and nearshore dynamics

Commencing: February 2020

Principal Supervisor: Dr Graziela Miot da Silva

Email: graziela.miotdasilva@flinders.edu.au

Project summary

We are currently working on wave climate and sediment transport along the Adelaide Metropolitan Coast and elsewhere around South Australia. This study involves remote sensing, analysis of currents and wave data and potentially numerical modeling using the software Delft3d.

Location

Flinders University – Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/graziela.miotdasilva

Tattoo and body piercing: knowledge of practitioners in Australia and the UK

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Tattooing and body piercing practitioners receive different amounts of information about protecting themselves and their clients from blood borne illnesses. This variation is both within Australia (across states) and overseas. The experiences from the UK, Ireland, and different states in Australia will be explored in this project to try and determine what information results in best practice. Incidence of infection will also be examined using formal methods (databases from health departments) and informal methods (eg: Twitter posts including the words "tattoo" and "infection").

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

Assessing cockroaches' capacity to spread gastrointestinal worms

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Gastrointestinal worms, including hookworm and Strongyloides stercoralis, are infecting people in remote communities and the method of transmission is unclear. To stop people getting infected, it is important that we understand where in the environment these worms are living. Cockroaches and flies have been proposed as an environmental source of transmission. This project would collect cockroaches to see whether they are carrying pathogens, including worms.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/harriet.whiley

Components of vaping liquid

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

There is very little known about the components of vaping liquid, which is being used as a smoking replacement. This makes it difficult to regulate. Vaping is being marketed as a benefit to public health, but it might actually be quite dangerous. This project will seek to detect the major components of vaping liquid sold in Australia and determine whether they are likely to be toxic by inhalation.

Location

Flinders University - Bedford Park

Assumed knowledge

Some analytical experience desirable

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/kateryna.babina

Food safety and 5 star rating schemes

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Food safety rating schemes have been introduced in Australia and the UK to improve food hygiene in premises serving food to the public. The response to these rating scheme has been mixed. This project seeks to determine whether the schemes are successful in terms of both food handlers' and the public's understanding of food safety. The experiences from the UK, Ireland, and different states in Australia will be explored in this project.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/harriet.whiley

flinders.edu.au/people/j.smith

Lead in soil in metro Adelaide

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Lead left over from when we had leaded fuel is still present in Adelaide however the extent of contamination is not well understood. Data from Melbourne and Sydney indicate that lead levels are often higher than guideline concentrations. The project will investigate lead levels in soils close to main roads within residential areas as a proxy indicator of what lead could be in people's yards where their children play and/or they grow fruit and vegetables.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/kateryna.babina

Methamphetamine residue in cars

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

The risk of exposure to "third hand" methamphetamine is poorly understood. Third hand exposure is exposure to residues resulting from cooking or smoking meth that are left behind. One likely place that meth smoking might take place is in people's cars. This might leave a residue on the internal surfaces of cars. This project seeks to determine whether there is methamphetamine in cars, and if there is, whether the levels detected might pose a public health risk. Levels of meth will initially be assessed using a swab test kit (like a pregnancy test), followed by more accurate quantification.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/harriet.whiley

Bioremediation of methamphetamine contaminated surfaces using microbes

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Methamphetamine contamination resulting from cooking or smoking meth poses a public health risk. Bioremediation (using microbes to break down toxic substances) might be a way to decontaminate surfaces or other objects. This project would look for candidate microbes that can successfully break down meth and see what conditions allows the microbes to multiply. This work builds on a current Honours project undertaken in 2019.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/harriet.whiley

Remediation of methamphetamine contaminated surfaces using UV and ozone

Commencing: February 2020

Principal Supervisor: Dr Kirstin Ross

Email: kirstin.ross@flinders.edu.au

Project summary

Methamphetamine contamination resulting from cooking or smoking meth poses a public health risk. Remediation using ozone or UV might be a way to decontaminate precious objects like photos that can not be allowed to get wet. This project would look at whether UV and/or ozone can successfully break down meth and see under what conditions it is successful.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/kirstin.ross

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/harriet.whiley

Identifying novel metal storage proteins in rice to assist in improving seed nutrition

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Iron and zinc malnutrition affect up to 2 billion people worldwide, many of whom are reliant on cereal-based staple foods, including rice. Deficiency in these elements can cause anemia, stunted growth and reduced immune function. Our ultimate aim is to increase the concentration of these elements in rice grains to improve health outcomes. This project will use cutting-edge biochemical analyses to identify metal storage proteins in rice seeds. The project will survey wild rice relatives and modern varieties to determine the contribution of particular proteins to final grain iron and zinc concentration and identify seed sources for improved nutrition.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/james.stangoulis

Origins of remnant populations of Acanthocladium dockeri in SA

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Acanthocladium dockeri (Spiny Daisy) is the singular representative of the Acanthocladium genus and with only six remaining remnant populations. Spiny Daisy is listed as critically endangered. Little is known about the origins of the SA remnant populations and a current hypothesis is that the populations derive from a single community and have spread via stocking routes. A genetics study will be undertaken to see the level of similarity between the remnant populations and this will involve a comparative analysis study of SNP data between the populations.

Location

Flinders University - Bedford Park

Assumed knowledge

A basic understanding of genetics

Further information

flinders.edu.au/people/james.stangoulis

Physiological determinants of broom (Cytisus scoparius (L.) Link) abundance in the Adelaide Hills

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Broom species (English, Spanish and Montpellier) belong to the Leguminosae and are an invasive introduced pest which can outcompete Australian natives. The Adelaide Hills is one area where broom flourishes. Little is known regarding the physiological adaptations that enable broom to be so invasive in Australian environments. Understanding why they do so well will help in the ongoing management of this invasive plant and assist in conservation efforts. The project will take physiological and ecological measurements in the field.

Location

Flinders University - Bedford Park

Assumed knowledge

A basic understanding of plant physiology

Further information

flinders.edu.au/people/james.stangoulis

The effects of environment on harvester ant preferences for Kangaroo grass

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Harvester ants are often referred to as ecosystem engineers as they affect their immediate surroundings. In 2018/2019, a successful Honours program identified a preference of harvester ants for the native Kangaroo grass whose seeds were higher in micronutrients. This honours thesis aims to assess the impact of environment on harvester ant preferences to Kangaroo grass and further assess the nutritional profile of Kangaroo Grass over different environments. This analysis will include a measure of the ionome, metabolome and lipidome.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/james.stangoulis

The mechanisms associated with micronutrient retranslocation of zinc and iron to developing cereal seeds

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Our understanding of the mechanisms associated with the partitioning of micronutrients to developing seeds is limited. Why do some cereal seeds have higher levels of micronutrient, compared to others? This project will involve growing wheat plants under glasshouse conditions. Leaf, seed and phloem samples will be collected for biochemical and micronutrient analysis along with the taking of physiological measurements during critical stages of seed development. Links between these traits and the final grain micronutrient concentration will be identified to help understand the dynamic of micronutrient translocation in cereal plants.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/james.stangoulis

The role of the plant phloem in salt detoxification

Commencing: February 2020

Principal Supervisor: Prof James Stangoulis

Email: james.stangoulis@flinders.edu.au

Project summary

Salt toxicity is a major abiotic stress to plants. Research into salt tolerance has mainly focused on exclusion mechanisms and little has been done on the role of the phloem in the detoxification process.

The phloem is the major vascular tissue for long-distance carbon transport and from our research, phloem sugar levels increased in plants exposed to salt stress. Furthermore, we found an accumulation of salt in seeds. Could a plant detoxify by partitioning more salt to seed? Ionomic and metabolomic analysis of phloem collected by aphid stylectomy will allow us to answer this question.

Location

Flinders University - Bedford Park

Assumed knowledge

A basic understanding of plant physiology

Further information

flinders.edu.au/people/james.stangoulis

Investigation of coastal groundwater: Seawater-freshwater interactions in complex settings

Commencing: February 2020

Principal Supervisor: Prof Adrian Werner

Email: adrian.werner@flinders.edu.au

Project summary

With most of humanity living near the coast, considerable stresses are placed on the aquifers adjacent to the sea. Coastal aquifers host highly complex processes due to the effects of tides, density differences between fresh groundwater and seawater, the continuation of coastal aquifers below the sea. Managing coastal groundwater resources iis vital to human endeavor in many regions. This project aims to improve the current knowledge of coastal groundwater processes using a combination field, numerical, analytical and laboratory techniques.

Location

Flinders University - Bedford Park

Assumed knowledge

Hydrogeology principles

Further information

dspace.flinders.edu.au/xmlui/handle/2328/26647

groundwater.com.au/news_items/future-fellowship-award-for-prof-adrian-werner

Disinfection resistance of mycobacterium avium complex and its control in swimming pools

Commencing: February or July 2020

Principal Supervisor: Dr Harriet Whiley

Email: Harriet.Whiley@flinders.edu.au

Project summary

Mycobacterium avium complex (MAC) is a group of opportunistic pathogens of major public health concern. It is responsible for a wide spectrum of disease dependent on subspecies, route of infection and patients pre-existing conditions. MAC can maintain long-term contamination of treated water sources through its high resistance to disinfectants, association with biofilms and intracellular parasitism of free-living protozoa. This project will examine common disinfection approaches used to control MAC in swimming pools and identify the best strategies for control. The potential genes enabling disinfection resistance will also be characterised.

Supervisory team: Dr Kirstin Ross, Prof Melissa Brown

Location

Flinders University - Bedford Park

Assumed knowledge

Microbiology

Further information

flinders.edu.au/people/harriet.whiley

flinders.edu.au/water-quality-health

Hospital tap water as a source of antimicrobial resistant hospital acquired infections

Commencing: February or July 2020

Principal Supervisor: Dr Harriet Whiley

Email: Harriet.Whiley@flinders.edu.au

Project summary

Waterborne pathogens are a significant cause of nosocomial infections. With hospital tap water described as the most overlooked, important and controllable source of hospital acquired infections (HAI). This study will investigate the presence of pathogens responsible for HAI in water and biofilm samples collected from an Australian hospital. Comparison of the microbial communities present at the faucet and drain of basins compared to source water will provide insights into the route of contamination for different pathogens. The antimicrobial resistance of these pathogens will be quantified, and the potential transfer of antimicrobial resistance genes will be explored.

Supervisory team: Dr Kirstin Ross, Prof Melissa Brown

Location

Flinders University - Bedford Park

Assumed knowledge

Microbiology

Further information

flinders.edu.au/people/harriet.whiley

Biofilm Research and Innovation Consortium

flinders.edu.au/water-quality-health

Microbial pathogens present in reuse water aerosols

Commencing: February or July 2020

Principal Supervisor: Dr Harriet Whiley

Email: Harriet.Whiley@flinders.edu.au

Project summary

The use of reclaimed water and recycled wastewater brings new challenges for the water industry in terms of maintaining water quality while increasing sustainability. Reuse water may contain opportunistic pathogens such as *Legionella pneumophila,* Mycobacterium avium complex and *Pseudomonas aeruginosa.* The aim of this project is to investigate the presence of these pathogens in aerosols generated during the use of reuse water (cooling towers, spray irrigation and toilet flushing). This information will identify the potential human health risks associated with the different practices.

Supervisory team: Dr Kirstin Ross, Prof Howard Fallowfield

Location

Flinders University - Bedford Park

Assumed knowledge

Microbiology

Further information

flinders.edu.au/people/harriet.whiley

flinders.edu.au/water-quality-health

Risk management of misting systems for opportunistic pathogens in biofilm

Commencing: July 2020

Principal Supervisor: Dr Harriet Whiley

Email: Harriet.Whiley@flinders.edu.au

Project summary

Water misting systems are currently been used as alternative cooling approach for outdoor environments. Water is pressurised and a superfine mist is created, as the mist evaporates it cools the air. However, these systems could potentially contain biofilm contaminated with opportunistic pathogens such as Mycobacterium avium complex (MAC), *Legionella pneumophila* and *Pseudomonas aeruginosa.* This project will examine the potential public health risks associated with the use of these misting systems and identify control strategies for their safe use.

Supervisory team: Dr Kirstin Ross, Prof Melissa Brown and SA Water Scientists

Location

Flinders University - Bedford Park

Assumed knowledge

Microbiology

Further information

flinders.edu.au/people/harriet.whiley

flinders.edu.au/water-quality-health

Aquaporins as anemone toxins

Commencing: February or July 2020

Principal Supervisor: Prof Cathy Abbott

Email: cathy.abbott@flinders.edu.au

Project summary

Anemones produce both mucus and venom that contain numerous toxic proteins. The aims of this project is to characterize and compare aquaporins, or water channels in different anenome species. These aquaproins form an important part of the aenomone's toxic arsenal.

Location

Flinders University - Bedford Park

Assumed knowledge

BIOL3771 in 3rd year, or 2nd year molecular biology.

Further information

flinders.edu.au/people/cathy.abbott

Enzymes in Fish Gut Health

Commencing: February or July 2020

Principal Supervisor: Prof Cathy Abbott

Email: cathy.abbott@flinders.edu.au

Project summary

Enzymes found in the gastrointestinal tract of fish are important for their utilisation of nutrients provided in diets. In this project student will use knowledge gained in their CML project in BIOL3771 to clone and characterize their chosen enzyme gene from Yellowtail Kingfish. This could be a lipase,trypsin or a dipeptidyl peptidase gene. The student will also spend time optimising the assay for the fish enzyme.

Location

Flinders University - Bedford Park
Flinders Medical Centre

Assumed knowledge

BIOL3771 in 3rd year

Further information

flinders.edu.au/people/cathy.abbott

Measuring volatile organic compounds to monitor fish tissue quality

Commencing: February or July 2020

Principal Supervisor: Prof Cathy Abbott

Email: cathy.abbott@flinders.edu.au

Project summary

The time it takes for food to get from farm to plate, varies dramatically depending on food type. In some cases food can be frozen to improve shelf life and for transport, but in some markets, fresh is always better. This project aims to use mass spectrometry techniques to measure and monitor volatile organic compounds and grade fish fillets. Initially the methods will be developed for sardines, but they may also be tested on more high value fish like tuna.

Location

Flinders University - Bedford Park
Flinders Medical Centre

Assumed knowledge

Some knowledge of biochemistry or fish. An interest in aquaculture.

Further information

flinders.edu.au/people/cathy.abbott

flinders.edu.au/people/roger.yazbek

Novel Breath tests for Environmental Enteric Dysfunction detection

Commencing: February or July 2020

Principal Supervisor: Prof Cathy Abbott

Email: cathy.abbott@flinders.edu.au

Project summary

Environmental Enteric Dysfunction (EED) is a debilitating condition affecting the small bowel. It is almost ubiquitous among children living in poverty and it is thought that EED is a major contributing cause of the failure of nutritional interventions to improve child growth. There are no robust biomarkers of EED that can be readily measured in resource-constrained areas where EED is prevalent. This project is using a mice model of EED to test the ability of a newly designed breath test to detect EED.

Location

Flinders University - Bedford Park
Flinders Medical Centre

Assumed knowledge

2nd year Molecular Biology and Biochemistry

Further information

flinders.edu.au/people/cathy.abbott

flinders.edu.au/people/roger.yazbek

Transgenic rice with higher Fe and Zn levels

Commencing: February or July 2020

Principal Supervisor: A/Prof Peter Anderson

Email: peter.anderson@flinders.edu.au

Project summary

Rice feeds over 2 billion people worldwide. Despite this, the milled grain contains very few nutrients beyond that of starch. Consequently, over reliance on white rice leads to malnutrition in humans. We have increased Fe and Zn levels in the grain by engineering the expression of a sucrose transport protein and an metal chelator (nicotianamine) in the endosperm of transgenic rice. Honours projects aim to further characterise these transgenic plants.

Location

Flinders University - Bedford Park

Assumed knowledge

BIOL2772, BIOL3771, BIOL3762 or similar topics

Further information

flinders.edu.au/people/peter.anderson

Function of plant innate immune receptors

Commencing: February or July 2020

Principal Supervisor: A/Prof Peter Anderson

Email: peter.anderson@flinders.edu.au

Project summary

Plant immune receptors recognize invading pathogen molecules enabling the activation of the plant disease resistance response. This is essential for plant survival and a critical trait that is bred into our major crop plants. Our research aims to understand how these receptors work at the biochemical level and the downstream consequence of resistance activation. Projects will involve protein purification and immunoblot analysis to study the biochemical function of these important plant proteins.

Location

Flinders University - Bedford Park

Assumed knowledge

BIOL2772, BIOL3771, BIOL3762 or similar topics

Further information

flinders.edu.au/people/peter.anderson

Animal NLRs provide structural insights into plant NLR function

Biological membranes

Commencing: February 2020

Principal Supervisor: Prof Gunther Andersson

Email: gunther.andersson@flinders.edu.au

Project summary

Cellular membranes are essential parts of biological cell. They ensure compartmentalisation of the cell and are also a matrix hostsing membrane proteins, responsible for many functions of the cell. Malfunctioning of membrane proteins is the origin for many diseases. Performing experiments on natural cell membranes is difficult due to its high complexity. Ingo Koeper's group has developed a range of model systems, which can mimic structure and function of natural membranes. In collaboration with the Koeper group we are investigating the layered structure of the model systems.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in Physics and/or Chemistry

Further information

flinders.edu.au/people/gunther.andersson

Determining sea spray compositions

Commencing: February 2020

Principal Supervisor: Prof Gunther Andersson

Email: gunther.andersson@flinders.edu.au

Project summary

Sea spray aerosols alter climate and the environment in remarkable ways. Marine aerosol particles are created by breaking ocean waves. This top region of the ocean is rich in organic molecules. The breaking waves transfer this biological soup into the droplets as they are jettisoned from the ocean surface. Water droplets can act as miniature catalytic converters for interfacial reactions. The aim of this project is to determine the composition of water droplets directly. Our depth profiling method will be applied in collaboration with Prof Gilbert Nathanson (Madison, USA).

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in Physics and/or Chemistry

Further information

flinders.edu.au/people/gunther.andersson

Dye sensitized solar cells

Commencing: February 2020

Principal Supervisor: Prof Gunther Andersson

Email: gunther.andersson@flinders.edu.au

Project summary

Dye sensitized solar cells (DSCs) are one of the promising technologies for photovoltaic cells. The interface of the titania and the dyes in DSCs is the crucial place for their functionality and efficiency. Interfaces in dye sensitized solar cells: the morphology of dye layers on titania (thickness, coverage and homogeneity) and the electronic structure will be investigated with depth profiling techniques and electron spectroscopy. This is a project in collaboration with Prof Lars Kloo (Sweden).

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in Physics and/or Chemistry

Further information

flinders.edu.au/people/gunther.andersson

Nano clusters for fabrication of solar fuels

Commencing: February 2020

Principal Supervisor: Prof Gunther Andersson

Email: gunther.andersson@flinders.edu.au

Project summary

We are developing catalysts for converting CO2 and H2O back to hydrocarbons, thus develop processes to fabricate solar fuels. The main components are small metal clusters which act as catalysts. The clusters contain only 4 – 100 metal atoms. We can be fabricated the clusters with physical methods in a cluster source or use chemically made clusters. The project is a collaboration between Flinders, Adelaide University, Canterbury University, Newcastle University, the University of Utah (USA) and the National Institute for Material Science (Japan).

Location

Flinders University - Bedford Park

Assumed knowledge

Basic knowledge in Physics and/or Chemistry

Further information

flinders.edu.au/people/gunther.andersson

New marine anti-biofouling surfaces

Commencing: February or July 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

Fouling (the growth of marine organisms) onto ships or other surfaces is a serious problem that dramatically increases fuel costs, damage and spreading of invasive species. To overcome this problem current method uses antifouling paint containing copper compounds. The problem with this method is that it increases the level of copper in the harbours creating a serious environmental problem. The focus of this project is to develop new coatings and to study the growth of biofilm/marine organisms on the surfaces.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/mats.andersson

Biofilm Research and Innovation Consortium

Eco-friendly preparation of organic solar cells

Commencing: February 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

This project is focused on environmentally friendly preparation of polymer solar cells, exploring the potential for truly eco-friendly solar cells. Normally, harmful chlorinated solvents and additives are used for the preparation of efficient cells but in this project the effect of environmentally friendly solvents on the morphology and on the final device efficiency will be studied. Green solvents and additives will provide a significant and unique manufacturing advantage over current materials for efficient organic solar cells.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/mats.andersson

Nanoparticles for polymer solar cells

Commencing: February 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

The aim of this project is to prepare water-dispersed nanoparticles (NPs) from conjugated polymers and electron acceptor materials and to use the NP as the photoactive layer in polymer solar cells. Utilising water based NPs ink in the fabrication of solar cells minimises the amount of organic solvents used during the device preparation. The prepared NPs will be coated on a substrate and after a thermal treatment the nanoparticle layer will be evaluated as the active material in polymer solar cells.

Location

Flinders University - Bedford Park

Assumed knowledge

NANO2701 or equivalent

Further information

flinders.edu.au/people/mats.andersson

Printing polymer solar cells

Commencing: February 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

This project is focused on developing printing techniques of polymer solar cells on flexible plastic substrates. Special emphasis is on developing efficient solar cells using environmentally friendly fabrication processes. This project offers an opportunity to learn about conjugated polymers, how solar cells work and fundamentals of charge generation, as well as getting hands on experience with fabrication (in a Glove box environment as well as on a mini-roll coater) and characterisation of solar cells.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/mats.andersson

Synthesis of electron acceptor polymers for all-polymer solar cells

Commencing: February 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

The materials in organic solar cells normally consist of a blend of an electron donating polymer and electron accepting small molecules. There are many potential advantages to use a polymeric acceptor material instead of small molecules but so far there are only a limited number of acceptor polymers available. In this project, the focus is on modifying and developing new electron acceptor polymers that can be used in all-polymer solar cells. Preparation of solar cells can also be a part of this project.

Location

Flinders University - Bedford Park

Assumed knowledge

CHEM2702 or CHEM3712 or equivalent

Further information

flinders.edu.au/people/mats.andersson

Synthesis of water/alcohol soluble polymers for solar cells

Commencing: February 2020

Principal Supervisor: Prof Mats Andersson

Email: mats.andersson@flinders.edu.au

Project summary

The main goal with this project is to develop truly environmentally friendly polymer solar cells. Polymers are normally soluble in organic solvents and an environmentally friendly preparation requires the materials to be processed from water/alcohol solutions. One possible application is solar cells but there are also many other electronic devices that would benefit from the possibility of preparing the devices from water/alcohol solutions. This demands the development of materials with polar side chains and involves synthesis of new monomers and polymers.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/mats.andersson

Condensed matter/many-body physics

Commencing: February or July 2020

Principal Supervisor: Dr Boris Blankleider

Email: boris.blankleider@flinders.edu.au

Project summary

The physics of many-body systems has wide-ranging applications: from descriptions of neutron stars and exotic quark-matter states, to applications in nanotechnology where it provides the theoretical description of metals, semi-conductors, superconductors, etc. A number of Honours projects are available that will be of particular interest to Nanotechnology students. One example is the study of in-media two- and three-particle correlations, with applications ranging from particle condensation in quark-gluon plasmas to the formation of quasi-particles like excitons and trions in semiconductors.

Location

Flinders University - Bedford Park

Assumed knowledge

Quantum Mechanics

Further information

flinders.edu.au/people/boris.blankleider

Lattice Gases

Commencing: February or July 2020

Principal Supervisor: Dr Boris Blankleider

Email: boris.blankleider@flinders.edu.au

Project summary

Traditionally, the motion of fluids has been described by solving differential equations (e.g. the Navier-Stokes equation). However, modern computer technology enables a very different approach, where the fluid is modeled by fluid "particles" moving on a spatial lattice. The computer then moves and collides these particles according to assumed rules. This approach is known as "cellular automaton lattice gases". Honours projects are available to implement such lattice gases in order to model phenomena (like turbulence) that are difficult to model with differential equations.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/boris.blankleider

Theoretical nuclear and elementary particle physics

Commencing: February or July 2020

Principal Supervisor: Dr Boris Blankleider

Email: boris.blankleider@flinders.edu.au

Project summary

One of the great frontiers of scientific knowledge takes place at a scale more than a million times smaller than that of nanometers. This is the realm of nuclear and elementary particles such as quarks, gluons, pions, neutrons, protons, etc., their mysterious interactions governed by the rules of Quantum Field Theory. At Flinders, we are developing novel theoretical models that aim to provide the most accurate descriptions of basic processes that take place at this scale. Honours projects are available that implement these models, leading to a better understanding of this frontier.

Location

Flinders University - Bedford Park

Assumed knowledge

Quantum Mechanics

Further information

flinders.edu.au/people/boris.blankleider

Antiseptic and disinfectant resistance in the hospital superbug Staphylococcus aureus

Commencing: February or July 2020

Principal Supervisor: Prof Melissa Brown

Email: melissa.brown@flinders.edu.au

Project summary

The golden age of antibiotics is over as multidrug resistant strains of pathogenic bacteria are commonplace in both the hospital environment and community settings. This can be attributed to the multiple mechanisms that bacteria can employ to circumvent the action of antimicrobials. One such mechanism that we investigate is mediated by membrane-bound transport proteins, which actively export compounds out of the cell before they can reach their intracellular target. This project will focus on identifying regions in the staphylococcal QacA protein that are required for resistance to antiseptics

Location

Flinders University - Bedford Park

Assumed knowledge

Theoretical knowledge of molecular biology and microbiology will be required. Hands-on lab-based training will be provided but experience and skills in aseptic techniques will be assumed.

Further information

flinders.edu.au/people/melissa.brown

Multidrug resistance in the sexually-transmitted human pathogen Neisseria gonorrhoeae

Commencing: February or July 2020

Principal Supervisor: Prof Melissa Brown

Email: melissa.brown@flinders.edu.au

Project summary

Multidrug resistant strains of Neisseria gonorrhoeae have now been classified as one of the worst threats to human health as there are limited treatment strategies available. The mechanism fundamental to this problem is mediated by the MtrD membrane-bound transport protein, which actively exports antibiotics and host defence factors out of the cell. This project will focus on identifying regions/amino acids in the MtrD protein that are required for resistance to a broad range of compounds.

Location

Flinders University - Bedford Park

Assumed knowledge

Theoretical knowledge of molecular biology and microbiology will be required. Hands-on lab-based training will be provided but experience and skills in aseptic techniques will be assumed.

Further information

flinders.edu.au/people/melissa.brown

Survival of the fittest; Acinetobacter persistence strategies

Commencing: February or July 2020

Principal Supervisor: Prof Melissa Brown

Email: melissa.brown@flinders.edu.au

Project summary

Our group focuses on working with pathogenic bacteria, analysing the means they use to defend themselves from, and evade strategies employed by, the host for their elimination. Acinetobacter baumannii is one such bacteria that is becoming more prevalent both in the hospital environment and community setting. This project will look at how Acinetobacter has developed into such a successful pathogen. In particular, we will investigate the strategies it uses to persist in the environment, such as surviving desiccation and the action of antiseptics and disinfectants.

Location

Flinders University - Bedford Park

Assumed knowledge

Theoretical knowledge of molecular biology and microbiology will be required. Hands-on lab-based training will be provided but experience and skills in aseptic techniques will be assumed.

Further information

flinders.edu.au/people/melissa.brown

Tools for chemical biology and drug delivery

Commencing: February or July 2020

Principal Supervisor: Dr Justin Chalker

Email: justin.chalker@flinders.edu.au

Project summary

Chemical biology in the Chalker lab spans the development of probes for oxidative stress and new materials for drug release. Current Honours project include:

- Novel probes for the study of cysteine oxidation
- New tools for medical imaging
- Novel polymers for drug release

Location

Flinders University - Bedford Park

Assumed knowledge

General chemistry; organic chemistry; biochemistry (or allied fields)

Further information

chalkerlab.com/

Synthesis and applications of sustainable polymers

Commencing: February or July 2020

Principal Supervisor: Dr Justin Chalker

Email: justin.chalker@flinders.edu.au

Project summary

This area of research features the synthesis of sustainable polymers. Honours projects are currently available in the following areas:

- Recyclable plastics and rubber
- Pollution control
- 3D printing sustainable polymers
- Sustainable gold recovery from primary and secondary sources
- Self-healing materials
- Renewable construction materials
- Sensors and responsive materials
- Precision fertilisers

Location

Flinders University - Bedford Park

Assumed knowledge

General chemistry and organic chemistry

Further information

chalkerlab.com/

Mitochondria, growth, Reactive Oxygen Species (ROS) and environmental stress in legumes

Commencing: February or July 2020

Principal Supervisor: Prof David Day

Email: david.day@flinders.edu.au

Project summary

Legumes are an important crop due to their role in improving soil nitrogen levels through their symbiosis with nitrogen-fixing bacteria. However, commercial cultivars are not ideally suited to growth conditions in Australia, often resulting in stressed plants. Stress results in ROS generation and can cause cellular damage, referred to as "oxidative stress". Plants have mechanisms for protecting themselves against ROS. This project will investigate these pathways, their relationship with plant growth, and the ability of the plants to form a symbiosis with soil rhizobia.

Location

Flinders University - Bedford Park

Assumed knowledge

DNA to Genome, Protein to Proteome, Integrating Molecular Biosciences, Integrating Biotechnology

Further information

flinders.edu.au/people/david.day

flinders.edu.au/people/kathleen.soole

flinders.edu.au/people/crystal.sweetman

A bugs life: Eating Steel and Making Rotten Egg Gas

Commencing: February or July 2020

Principal Supervisor: A/Prof Sarah Harmer

Email: Sarah.Harmer@flinders.edu.au

Project summary

Co-supervisor: Ingo Koeper
Bio-corrosion of microbiologically induced corrosion is a common problem in water pipes and oil and gas production. Specific bacterial strains found in these environments can produce highly corrosive chemicals including H2S (rotten egg gas) accelerating the corrosion of pipelines. This project will focus on the detection and characterisation of corrosion in water pipes accelerated by the presence of bacteria. The effectiveness of anti-corrosive protection in pipeline systems and early detection corrosion will be investigated.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/sarah.harmer

flinders.edu.au/people/ingo.koeper

Biofilm Research and Innovation Consortium

flinders.edu.au/microscopy

Fe 2p Multiplet Structure of Iron Sulfides

Commencing: February or July 2020

Principal Supervisor: A/Prof Sarah Harmer

Email: Sarah.Harmer@flinders.edu.au

Project summary

This project will involve the interpretation of high resolution Synchrotron X-ray Photoelectron Spectroscopy (SXPS) Fe 2p and X-ray Absorption Near Edge Spectroscopy (XANES) Fe L2,3 spectra from in situ fractured samples combined with 1s2p Resonant Inelastic X-ray Scattering (RIXS) experiments at the European Synchrotron Radiation Facility (ESRF) and multi-configurational self-consistent field (MC-SCF) calculations. The outcomes of these experiments will be used to develop a complete model of the electronic structure of Fe1-xS and curve fitting routines for the Fe 2p XPS spectra of Fe1-xS.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/sarah.harmer

flinders.edu.au/microscopy

Spatial arrangement of nitrifiers in biofilm using FISH and annular reactors

Commencing: February or July 2020

Principal Supervisor: A/Prof Sarah Harmer

Email: Sarah.Harmer@flinders.edu.au

Project summary

Co-supervisors: Brendon King, Ben van den Akker
Drinking water disinfection using chloramination has numerous benefits including, but not limited to, better customer aesthetics and improvements on exceedances of regulated Disinfection-By-Products. However, chloraminated distribution systems are susceptible to biological nitrification—problematic for maintaining adequate disinfection. Understanding the spatial arrangement of nitrifying bacteria within biofilms will assist in the management of these systems. An opportunity exists for a student to employ molecular methods that will further our knowledge in this area.

Location

SA Water House/Flinders University - Bedford Park

Assumed knowledge

Microbiology, molecular biology, chemistry

Further information

flinders.edu.au/people/sarah.harmer

Biofilm Research and Innovation Consortium

The Nanoreactor

Commencing: February or July 2020

Principal Supervisor: A/Prof Sarah Harmer

Email: Sarah.Harmer@flinders.edu.au

Project summary

The project will involve the development of a nanoreactor for Scanning Transmission X-ray Microscopy (STXM) especially designed for high resolution spectroscopic imaging in a hydrated and controlled electrochemical states. The nanoreactor allows for the physicochemical composition of heterogeneous catalysts in their working state at the nanometre scale or the study of microbial interaction with surfaces.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/sarah.harmer

flinders.edu.au/microscopy

Investigating clandestine synthesis of illegal drugs

Commencing: February 2020

Principal Supervisor: A/Prof Martin Johnston

Email: martin.johnston@flinders.edu.au

Project summary

Clandestine 'cooks' synthesising illegal drugs are always on the lookout for methods of manufacture that use chemicals that are readily available and not controlled. To this end they are constantly examining new methodologies for synthesis. We have investigated many of these pathways to gain a more thorough understanding of reagents used, reaction conditions, by-products formed as well as potentially new synthetic approaches.

Projects in this area will continue these investigations.

Location

Flinders University - Bedford Park

Assumed knowledge

Organic chemistry and characterisation spectroscopy

Further information

flinders.edu.au/people/martin.johnston

Forensic Chemistry

Commencing: February or July 2020

Principal Supervisor: Prof Paul Kirkbride

Email: paul.kirkbride@flinders.edu.au

Project summary

I can offer projects in an area of crime investigation of particular interest to you. Research could involve synthesis of illicit drugs and discovery of by-products of manufacture, detection of gunshot residues, analysis of ignitable liquid residues, automotive paint, new methods for detection of explosives and investigation of substances of relevance to forensic toxicology. Let me know which broad area you are interested in and I can tailor a project to suit you. Are you interested in the cross-over between forensic biology and chemistry? See my Forensic Chemistry/Biology listing!

Location

Flinders University - Bedford Park

Assumed knowledge

Depending on the project!

Further information

flinders.edu.au/people/paul.kirkbride

Forensic Chemistry/Biology

Commencing: February or July 2020

Principal Supervisor: Prof Paul Kirkbride

Email: paul.kirkbride@flinders.edu.au

Project summary

Adrian Linacre and I are involved in joint research that relates to the visualization of DNA deposits present in fingermarks, especially those present on improvised explosive devices. This work contributes strongly to the field of weapons technical intelligence and counter terrorism. Chemistry-based biological research in this field includes investigation of the fluorescence of DNA, materials that cause PCR inhibition and development of counter-measures against the destructive reaction between DNA and copper on items such as electrical/electronic components and cartridge cases.

Location

Flinders University - Bedford Park

Assumed knowledge

Depending on the project, forensic biology knowledge would be useful or mandatory.

Further information

flinders.edu.au/people/paul.kirkbride

flinders.edu.au/people/adrian.linacre

Are you drinking that? Microplastics in Water

Commencing: February or July 2020

Principal Supervisor: A/Prof Ingo Koeper

Email: ingo.koeper@flinders.edu.au

Project summary

In a close cooperation with SA Water, this project will focus on optimising methods for the quantification of microplastics in waste streams from wastewater treatment plants, with particular emphasis on differentiating best solutions for the analysis of solid vs water samples. The results will also be useful to derive a better understanding of the number, size and type of microplastics in South Australian effluents and sludge, providing a baseline to assess potential risks associated with their disposal or re-use.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/ingo.koeper

Biofilm Research and Innovation Consortium

Model membrane systems

Commencing: February 2020

Principal Supervisor: A/Prof Ingo Koeper

Email: ingo.koeper@flinders.edu.au

Project summary

Research in my group is mainly centred nano-biology. We investigate for example model systems for biological membranes. These structures can be attached to solid supports and then used to incorporate membrane proteins and study their function. The structures can then be used to understand membrane protein function, the interaction of drugs with membranes and membrane proteins or for sensing. Additionally, there are projects around nanoparticles and drug-delivery.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/ingo.koeper

Quantification and identification of microplastics in wastewater streams

Commencing: February or July 2020

Principal Supervisor: A/Prof Ingo Koeper

Email: ingo.koeper@flinders.edu.au

Project summary

The project will have a focus on optimising methods for the quantification of microplastics in waste streams from wastewater treatment plants, with particular emphasis on differentiating best solutions for the analysis of solid vs water samples. The results will also be useful to derive a better understanding of the number, size and type of microplastics in South Australian effluents and sludge, providing a baseline to assess potential risks associated with their disposal or re-use.

Location

SA Water House/Flinders University - Bedford Park

Assumed knowledge

Microbiology, microscopy, chemistry

Further information

flinders.edu.au/people/ingo.koeper

Biofilm Research and Innovation Consortium

Surface Characterisation of X-ray emitters

Commencing: February or July 2020

Principal Supervisor: A/Prof Ingo Koeper

Email: ingo.koeper@flinders.edu.au

Project summary

In collaboration with Micro-X (company located at Tonsley), we will investigate some surface characteristic and physical-chemistry properties of their X-Ray emitters.

We will also look at ways to improve the formulation of their surface architecture, which is composed of a layer of carbon nanotubes attached to a surface.

Location

Flinders University - Bedford Park

Assumed knowledge

A little bit of physical chemistry

Further information

flinders.edu.au/people/ingo.koeper

Aquatic curtain coatings to reduce biofilm growth

Commencing: February or July 2020

Principal Supervisor: A/Prof Sophie Leterme

Email: sophie.leterme@flinders.edu.au

Project summary

Cyanobacteria in reservoirs can have a significant impact on water quality and are a challenge for the water treatment process. Algal curtains hung near the water treatment plant inlet are suggested as a way of preventing inflow of cyanobacteria. However, these structures can support the growth of biofilms containing taste and odour and/or toxin producing organisms. Before considering installation of curtains within a reservoir it is important to understand the composition of these biofilms. Furthermore, are there curtain materials that are more resistant to biofilm formation.

Location

SA Water House/Flinders University - Bedford Park

Assumed knowledge

Microbiology, molecular biology

Further information

flinders.edu.au/people/sophie.leterme

flinders.edu.au/people/mats.andersson

Biofilm Research and Innovation Consortium

Effect of natural extracts in the destabilisation of biofilms

Commencing: July 2020

Principal Supervisor: A/Prof Sophie Leterme

Email: sophie.leterme@flinders.edu.au

Project summary

Biofouling, the unwanted attachment and growth of organisms on a surface, increases the cost and decreases the productivity of reverse osmosis desalination plants. At present there is limited success in removing biofilms from RO membranes using chemical treatments. This project will focus on natural extracts to destabilise biofilms. Single organism to multi organism biofilms will be produced under static and flow cell conditions with a focus on a reduction or increased porosity of biofilm formation.

Location

Flinders University - Bedford Park

Assumed knowledge

Microbiology

Further information

flinders.edu.au/people/sophie.leterme

Biofilm Research and Innovation Consortium

Microbial ecology of ozone/GAC for optimising biological filtration

Commencing: February or July 2020

Principal Supervisor: A/Prof Sophie Leterme

Email: sophie.leterme@flinders.edu.au

Project summary

Pre-ozonation followed by activated carbon adsorption is a widely used treatment process overseas where water sources are often impacted by human activity. Although much less common in Australia, the demand for higher quality water has driven recent interest in this technology. Over time, the activated carbon becomes colonised by natural biota from the water source and this can be used to advantage; however, the nature of this biota is highly application specific and needs to be understood to be optimised.

Location

SA Water House/Flinders University - Bedford Park

Assumed knowledge

Microbiology, molecular biology, chemistry

Further information

flinders.edu.au/people/sophie.leterme

flinders.edu.au/people/melissa.brown

Biofilm Research and Innovation Consortium

Surface Specific Biofilm Growth

Commencing: February or July 2020

Principal Supervisor: Prof David Lewis

Email: david.lewis@flinders.edu.au

Project summary

The hypothesis is that "different" biofilms will grow on a surface from a mixed bacteria population in sea water. This project will create a range of different surface chemistries and structures to systematically explore the rate and type of biofilm growth from a mixed population. The surfaces will encompass producing a range of polymeric systems from hydrophillic to hydrophobic properties on substrates with a focus on the characterisaton of the biofilms that form.

Location

Flinders University - Bedford Park

Assumed knowledge

Knowledge of biological processes

Further information

flinders.edu.au/people/david.lewis

Biofilm Research and Innovation Consortium

Chemical characterisation of the shrew attracting excretion from Nepenthes lowii

Commencing: February or July 2020

Principal Supervisor: A/Prof Mike Perkins

Email: mike.perkins@flinders.edu.au

Project summary

The tropical pitcher plant Nepenthes lowii has been reported to gain 57–100% of foliar Nitrogen input as faecal inputs by the shrew, Tupaia montana in its native habitat (Tree shrew lavatories, Biol. Lett. (2009) 5, 632–635. doi:10.1098/rsbl.2009.0311). The lower surface of the lid in the pitchers is covered with coarse bristles and specialized nectar glands that secrete a buttery, white exudate which the shrews feed on and then defaecate into the pitcher. The aim of project is to fully chemically characterise the exudate. Samples of exudate have been sourced from greenhouse grown plants.

Location

Flinders University - Bedford Park

Assumed knowledge

Knowledge of Organic Chemistry at the level of CHEM3711

Further information

flinders.edu.au/people/mike.perkins

Synthesis of Novel Heterocyclic Compounds (Project 1 & Project 2)

Commencing: February or July 2020

Principal Supervisor: A/Prof Mike Perkins

Email: mike.perkins@flinders.edu.au

Project summary

Up to two projects in the area of medicinal chemistry will be available for 2020. These projects will involve the development of an approach to the synthesis of a new class of heterocyclic compounds and the preparation of a number of analogues. This new class of compounds may have future potential medical/agrochemical use. The projects are in collaboration with CSIRO Molecular Science (Dr Craig L Francis; CSIRO, Melbourne)

The details of this project are potentially subject to an intellectual property agreement and anyone interested should speak to A/Prof Perkins for further information.

Location

Flinders University - Bedford Park

Assumed knowledge

Knowledge of Organic Chemistry at the level of CHEM3711

Further information

flinders.edu.au/people/mike.perkins

Characterisation of Indigenous Australian pigments and analysis of cultural heritage

Commencing: February or July 2020

Principal Supervisor: A/Prof Rachel Popelka-Filcoff

Email: rachel.popelkafilcoff@flinders.edu.au

Project summary

While significant knowledge of past societies is lost to time, we can use analytical and forensic chemistry toward the chemical and physical characterisation of complex cultural materials such as pigments, resins and binders. Aspects of the projects include non-destructive techniques to reconstruct cultural exchange of materials, utilising elemental, microbial DNA and spectroscopic techniques. Opportunities include characterisation of binders in cultural heritage objects (py-GC-MS and IR spectroscopy) and material and pigment analysis by X-ray, microbial DNA and spectroscopic methods.

Location

Flinders University - Bedford Park

Assumed knowledge

Undergraduate in chemistry, physics, biology or related fields

Further information

flinders.edu.au/people/rachel.popelkafilcoff

theconversation.com/when-bacteria-tell-a-story-tracing-indigenous-australian-ochre-sources-via-microbial-fingerprinting-85455

youtube.com/watch?v=E1BsyjJVgRc

Nuclear forensics of uranium materials

Commencing: February or July 2020

Principal Supervisor: A/Prof Rachel Popelka-Filcoff

Email: rachel.popelkafilcoff@flinders.edu.au

Project summary

Understanding the origin of nuclear material can provide critical intelligence to assist criminal prosecutions and the prevention of further proliferation of material. Uranium ore and uranium ore concentrates (UOCs) contain several chemical, elemental, physical and isotopic signatures that can be used to determine a sample's provenance. However, the materials themselves are complex due to their original genesis and materials processing and often require multifaceted analytical approaches. This project explores new approaches to provenance nuclear material.

Location

Flinders University - Bedford Park

Assumed knowledge

Undergraduate in chemistry, physics or related fields

Further information

flinders.edu.au/people/rachel.popelkafilcoff

www-pub.iaea.org/MTCD/publications/PDF/TE-1820_web.pdf

Quantitative analysis of environmental radiation

Commencing: February or July 2020

Principal Supervisor: A/Prof Rachel Popelka-Filcoff

Email: rachel.popelkafilcoff@flinders.edu.au

Project summary

South Australia has a long-standing legacy in mining uranium, however the effects of this and effects of radionuclides in the environment are not well understood. This project will develop an analytically robust isotope ratio data set for the ERICA model for the arid zone environment, specifically in an Australian context. Measurements of local flora, fauna and soil and water will be investigated and analysed by techniques such as alpha and gamma spectroscopy and ICP-MS as well as methods at ANSTO and ARPANSA. Students may attend field trips to industry sites.

Location

Flinders University - Bedford Park

Assumed knowledge

Undergraduate in chemistry, physics or related fields

Further information

flinders.edu.au/people/rachel.popelkafilcoff

news.flinders.edu.au/blog/2018/08/30/research-expands-mine-site-environs/

nera.org.au/Projects/ImprovingRadiologicalRiskAssessments

Analysing malignant plastics in museum collections

Commencing: February or July 2020

Principal Supervisor: A/Prof Rachel Popelka-Filcoff

Email: rachel.popelkafilcoff@flinders.edu.au

Project summary

Museums are confronting plastic or polymer-based collections needing better preservation. With a short life expectancy and contemporary nature of plastics, conservators have comparatively fledgling expertise for facing this issue. Flinders University is contributing to an ARC Linkage between universities, museums and an art gallery to develop methods for predicting and increasing the lifespan of malignant plastics (natural rubber, cellulose nitrate, cellulose acetate, polyurethane, polyvinyl chloride) to study the identification, deterioration and conservation of polymer-based materials.

Location

Flinders University - Bedford Park

Assumed knowledge

Undergraduate in chemistry, physics or related fields

Further information

flinders.edu.au/people/rachel.popelkafilcoff

polymuse.net.au/

Development of a surface carbon hybridisation imaging analysis platform

Commencing: February 2020

Principal Supervisor: Prof Jamie Quinton

Email: jamie.quinton@flinders.edu.au

Project summary

Carbon nanomaterials show significant promise as environmentally favourable alternatives to rare earth minerals for future nanoelectronic device platforms. The ability to pursue them, however, is completely dependent on the ability to image and discern sp2 and sp3 forms.

In our laboratory we have been perfecting a technique for imaging the hybridisation of carbon on surfaces, which has not yet otherwise been achieved. To make this technique a routine form of analysis, a platform for importing, processing and presenting data maps will be needed in Matlab with the image processing toolkit.

Location

Flinders University - Bedford Park

Assumed knowledge

Experience or a significant willingness to learn advanced programming techniques with Matlab or similar software environment

Further information

flinders.edu.au/people/jamie.quinton

Optimising the structure, morphology and electron transport properties of carbon nanomaterial based coatings for thermoelectric applications

Commencing: February 2020

Principal Supervisor: Prof Jamie Quinton

Email: jamie.quinton@flinders.edu.au

Project summary

Intelliparticle is a Sydney-based SME who have been manufacturing thermo-electric coatings for a myriad of applications from anti-icing surfaces to defence IR platforms with Redarc. A key challenge that they have is that their coatings are not configured for optimal performance because more is needed to be understood about the science behind their coatings. Our collaboration with them is aimed at achieving this understanding and optimisation, and this project will be focused toward these outcomes.

Location

Flinders University - Bedford Park

Assumed knowledge

An undergraduate program in Physics, Physical Chemistry, Nanotechnology or Materials Engineering

Further information

flinders.edu.au/people/jamie.quinton

Understanding the links between deposition and solidification mechanisms and overall materials properties in 3D printed metals

Commencing: February 2020

Principal Supervisor: Prof Jamie Quinton

Email: jamie.quinton@flinders.edu.au

Project summary

3D printing is currently undergoing a transformation from plastics and polymers towards metals as the materials of choice and its viability for serious prototyping and manufacture is seeing an explosion in the number of users and companies who are finding it convenient for testing new ideas.

This project will combine physics, nanotechnology and materials engineering to help AML Technologies (an Adelaide based 3D printing company) better understand the influence of numerous printing parameters such as composition, printing speed, and feedstock speed on the properties of the printed material.

Location

Flinders University - Bedford Park

Assumed knowledge

An undergraduate program in Physics, Physical Chemistry, Nanotechnology or Materials Engineering

Further information

flinders.edu.au/people/jamie.quinton

Development of next generation vehicle dynamics control systems

Commencing: February 2020

Principal Supervisor: Prof Jamie Quinton

Email: jamie.quinton@flinders.edu.au

Project summary

In a long-standing partnership with Supashock a number of projects ranging from autonomous, high performance racing and defence vehicles through to monitoring systems of humans and vehicle components. In these projects we will explore new technologies for these systems and tailor a project to the background and interests of the student, could include software and/or hardware development. It will suit a diverse range of students from theoretical, computational to experimental design and implementation, applying skills from electromagnetic systems to imaging and rapid real-time data processing.

Location

Flinders University - Bedford Park

Assumed knowledge

An undergraduate program in Physics, Physical Chemistry, Nanotechnology or Materials Engineering

Further information

flinders.edu.au/people/jamie.quinton

Accelerating enzymatic reactions under flow for the pharmaceutical industry

Commencing: February or July 2020

Principal Supervisor: Prof Colin Raston

Email: colin.raston@flinders.edu.au

Project summary

Enzymatic catalysis is important in the pharmaceutical industry but they are inherently slow. The vortex fluidic device delivers shear stress to liquids which is effective in dramatically accelerating enzymatic reactions, which is understood mechanistically. We are developing such processing where the enzyme is tethered to the surface of the glass tube or is attached to large magnetic particles for ease of separation from the product post VFD processing, or are agglomerated through incorporating the enzymes into metal organic frameworks (MOFs), as strategies for the pharmaceutical industry.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/colin.raston

Raston Laboratory

Continuous flow chemistry under external electric and magnetic fields

Commencing: February or July 2020

Principal Supervisor: Prof Colin Raston

Email: colin.raston@flinders.edu.au

Project summary

Controlling the chemical reactivity and selectivity is important in developing processes the are more sustainable, in reducing side reactions and the generation of waste. Applying external fields to liquids has potential to exquisitely control chemical reactions, but this is not possible using conventional batch processing. We have developed a thin film microfuidic device which has liquids in a rapidly rotating tube under continuous flow conditions, as scalable processing. Electric and magnetic fields can be directed uniformly to the liquid with exciting possibilities in controlling chemistry.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/colin.raston

Raston Laboratory

Redefining organic synthesis under continuous flow

Commencing: February or July 2020

Principal Supervisor: Prof Colin Raston

Email: colin.raston@flinders.edu.au

Project summary

The pharmaceutical industry is transforming small molecule synthesis from batch processing to continuous flow processing, as more energy efficient, waste reducing, and just in time processes. We have developed thin film continuous flow processing as a paradigm shift in the field, where high shear stress and different types of rotational speed dependent sub-micron fluid dynamic effects drives and controls organic reactions. This unique processing beyond diffusion control has exciting potential in developing benign-by-design reactions, with novel chemistry to be discovered.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/colin.raston

Raston Laboratory

Thin film microfluidics - fundamental and applications

Commencing: February or July 2020

Principal Supervisor: Prof Colin Raston

Email: colin.raston@flinders.edu.au

Project summary

The Raston Clean Technology Laboratory incorporates sustainability in the research at its inception, including scalability. The research covers a wide range of chemistry, materials synthesis, device technology, self-assembly, characterisation techniques, and more, at the interface with physics, biology, medicine, food processing and engineering. Projects on offer feature the in house developed vortex fluidic device, for fabricating functional nano-carbon, controlling chemical reactivity and selectivity, manipulating liposomes and exosomes, and wine and food processing, and more.

Location

Flinders University - Bedford Park

Assumed knowledge

None listed

Further information

flinders.edu.au/people/colin.raston

Molecular approaches to Sustainable Food production and quality

Commencing: February or July 2020

Principal Supervisor: Prof Kathleen Soole

Email: kathleen.soole@flinders.edu.au

Project summary

Due to climate change and world population growth, it will be necessary to grow crops in sub-optimal soils with increasing environmental pressures (e.g. temperature extremes). We are exploring the molecular mechanisms that allow plants to tolerate and grow in these conditions, and using molecular breeding techniques to find naturally occurring cultivars. We use SNP markers to analyse genetic polymorphisms of candidate genes important for crop breeding. We also use gene editing technology and transgenic plants with altered expression of gene candidates to explore tolerance to abiotic stresses.

Location

Flinders University - Bedford Park

Assumed knowledge

DNA to Genome, Protein to Proteome, Integrating Molecular Biosciences, Integrating Biotechnology

Further information

flinders.edu.au/people/kathleen.soole

flinders.edu.au/people/yuri.shavrukov

Effects of phages on the wound microbial communities

Commencing: February or July 2020

Principal Supervisor: A/Prof Peter Speck

Email: peter.speck@flinders.edu.au

Project summary

Co-supervisor: Jim Mitchell
The microbial community in a wound, such as a diabetic foot ulcer, includes many microbial species. Phages are species-specific and can remove from the wound microbial community a dominant member such as Staphylococcus aureus. Will this cause the microbial community to collapse, or will other microbes expand and take over? This could be studied either in the setting of actual clinical trials –on humans- or in animal studies, both of which the lab is involved in. DNA sequencing and microbiome analysis techniques would be used to monitor the changes that phage exert in a microbial community.

Location

Flinders University - Tonsley

Assumed knowledge

Virology, either from completion of BIOL2761 or MMED3939

Further information

flinders.edu.au/people/peter.speck

flinders.edu.au/people/jim.mitchell

Biomarker evaluation and quantification in urine and sweat for chronic diseases monitoring

Commencing: February or July 2020

Principal Supervisor: A/Prof Youhong Tang

Email: youhong.tang@flinders.edu.au

Project summary

Measuring health data in real time by consumers presents a significant opportunity for health improvement and management of chronic illness – but we are yet to unlock its full potential. There are a variety of devices that measure discrete biological compounds, targeted for use by patients with specific diseases. However, there are few underlying platform technologies that enable the measurement and monitoring of a range of biological chemicals and that are simple enough to be used by any individual in place. New biosensors can be developed for purpose, associated with evaluation.

Location

Flinders University - Tonsley

Assumed knowledge

Chemistry synthesis or chemical characterization or biomedical or medical or biological or materials background

Further information

flinders.edu.au/people/youhong.tang

Biofilm Research and Innovation Consortium

Personalised medical device with aggregation-induced emission features

Commencing: February or July 2020

Principal Supervisor: A/Prof Youhong Tang

Email: youhong.tang@flinders.edu.au

Project summary

Immunochromatography assays (lateral assays) are one of the most convenient and widely applied technologies for the detection of analytes in biological samples (such as viruses, bacteria and human bio-markers). However, many such tests are purely qualitative, indicating only the presence or absence of the particular analyte in the sample. Aggregation induced emission biosensors offer a quantitative solution through the high sensitivity of their fluorescence, creating the opportunity to detect the target of interest with a versatile tool. Personal medical device with AIEgen could be the answer.

Location

Flinders University - Tonsley

Assumed knowledge

Chemical characterization or medical or biological or materials background

Further information

flinders.edu.au/people/youhong.tang

Biofilm Research and Innovation Consortium

Synthesis AIEgen biosensors with thin film technologies

Commencing: February 2020

Principal Supervisor: A/Prof Youhong Tang

Email: youhong.tang@flinders.edu.au

Project summary

The recently developed VFD by Professor C Raston is a relatively inexpensive research tool for controlling chemical reactivity and selectivity, materials synthesis and probing the structure of self-organized systems, offering a range of benefits over conventional processing. The dynamic thin film within the VFD microfluidic platform is generated in a rapidly rotating surface, imparting high shear stress and micro-mixing. Highly emissive in the aggregated state, AIEgens develop novel sensing strategies that function in a photoluminescence turn-on mode which have not been synthesized by VFD.

Location

Flinders University – Tonsley & Bedford Park

Assumed knowledge

Chemistry synthesis or chemical characterization background

Further information

flinders.edu.au/people/youhong.tang

flinders.edu.au/people/colin.raston

Biofilm Research and Innovation Consortium

Chemical and spectroscopic investigation of blood and bruises

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

This project is a continuation of a series of research projects that combine spectrometric interpretation of the colour of blood and bruises with the chemical analysis of the different chemicals (green biliverdin and orange bilirubin) that give bruises their colour and that change with time. This project will create artificial bruises by combining these chemicals in different combinations in an animal skin model and observing colour and chemical changes over time. No animals (or humans) will be harmed in the project that is co-supervised by FSSA Forensic Pathologist AProf Neil Langlois.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

Breathing Bad - Distinguishing between methamphetamine contamination of houses due to smoking versus synthesis

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

The increase in synthesis and use of methamphetamine - referred to as the 'ice epidemic' in the press - is resulting in an increase in the number of dwellings that are found to be contaminated by methamphetamine and related chemicals. Currently, distinguishing between contamination due to smoking versus synthesis is done on the concentration of 'meth' detected - with more 'meth' present indicating synthesis not smoking. This project will look at detecting the precursors and by-products in contaminated houses to determine if these can be used to unequivocally distinguish smoking vs synthesis.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills (GC etc)

Further information

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/kirstin.ross

Breathing Bad - Adsorption and release of methamphetamine from household items - a health and safety issue

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

The increase in synthesis and use of methamphetamine - referred to as the 'ice epidemic' in the press - is resulting in an increase in the number of dwellings that are found to be contaminated by methamphetamine and related chemicals. It is hypothesized that soft furnishings and toys will absorb more than hard surfaces like plastic bench tops. Also these soft furnishings and toys will release methamphetamine throughout the night - so young children going to bed will be exposed to high levels as they sleep. Head-space analysis of materials will enable this hypothesis to be tested.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills (GC etc)

Further information

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/kirstin.ross

Food and drink provenancing - "Food forensics"

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

This project (which is associated with a multinational Development Program) will advance the analysis and comparison of foods and beverages in countries in the Australasian region. In addition to ensuring we get what we pay for, this project aims to ensure that the food available in developing countries is fit to eat and is not contaminated (accidently - pesticides or deliberately - fillers) or adulterated (substitution of inferior product or harmful material). Such adulteration could be harmful to children who do not get the expected nutrition because their food is diluted or substituted.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

iaea.org/newscenter/news/farm-fork

Determining extent of similarity between multiple samples for forensic or environmental investigations

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

This project is an extension to previous projects that have developed a computer programme to provide a visual interpretation of the extent of similarity (or dissimilarity) between multiple samples for forensic investigations. Initially, designed to compare explosives from different devices this project will now expand to apply the same analytical and computation comparison to a range of other sample types that are used in forensic or environmental investigations.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

Mass spectrometers for forensic, environmental and medical investigations

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

A/Prof Walker has a strong background in the design, development and application of mass spectrometric techniques. These projects will utilize a range of advanced mass spectrometers including- MALDI-tof-MS Matrix Assisted Laser Desorption Ionisation and SALDI Surface Assisted, LC MS/MS, IRMS – Stable Isotope Ratio Mass Spectrometer – used to determine source of N, C, H, O and S in environmental and forensic samples, ICPMS and LA-HR-MC-ICPMS for determining metals and isotopes. Projects using these techniques can be personalised to match the individual interests of the student.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

Computer program to visualise extent of similarity between multiple samples from different geographic origin

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

This project is an extension to previous projects that have developed a computer programme to provide a visual interpretation of the extent of similarity (or dissimilarity) between multiple samples for forensic investigations. Initially, designed to compare materials from different locations this project will now expand the analytical and computation comparison to a range of other sample types that are used in forensic or environmental investigations. This project will involve programming to enable outputs from additional statistical packages to be imported, processed and visualised.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic programming and gaming skills

Further information

flinders.edu.au/people/stewart.walker

flinders.edu.au/people/brett.wilkinson

Forensic toxicology - New analytical techniques for new drugs

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

In addition to having to be able to detect and quantify a full range of established drugs (and metabolites) forensic toxicology labs have also to be alert for new drugs or variations of old drugs that are constantly coming on to the drug market. This project will, in consultation with forensic toxicologists, investigate new analytical techniques that can be used to screen for old and new drugs. Of particular concern is fentanyl and fentanyl analogous - some of which are 10,000 times more potent than morphine - and have caused half of the 70,237 overdose deaths in USA in 2017.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

drugabuse.gov/related-topics/trends-statistics/overdose-death-rates

Determining metal uptake and structural weakness in corals under changing environmental conditions

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

The world's coral reefs are being exposed to changing climatic conditions including temperature and acidification. Recent research has shown that we can create synthetic coral by mixing chemicals in a test-tube or in the Vortex Fluidic Device in the Ralston laboratory. By 'growing' aragonite $CaCO_3$ in a range of different chemical environments (i.e. temperature, pH and heavy metal concentration) we are now able to study the impact of changing environmental conditions on the uptake of metals in coral reefs around the world and verify or modify models that predict the effect of global change.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker

Drilling down on the genetic aberration cause of Autistic Spectrum Disorder

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

"A substantial proportion of the expected genetic contribution [to autism] has not yet been identified" Davis (et. al. 2019). Both genetic (over 100 genes have been identified) and environmental factors may contribute to Autistic Spectrum Disorder (ASD). Identifying the cohort of early stage splitting monozygotic twins and assessing their genetic make up will provide the best chance of finding the single dominant transmitted genetic trait that produces hereditary ASD. This project will combine interrogation of prior databases, literature and family trees to identify the optimal cohort.

Location

Flinders University - Bedford Park

Assumed knowledge

An understanding of the hereditary aspects of diseases

Further information

flinders.edu.au/people/stewart.walker

Detection and discrimination of explosives and precursors

Commencing: February 2020

Principal Supervisor: A/Prof Stewart Walker

Email: stewart.walker@flinders.edu.au

Project summary

Assoc Prof Walker has extensive experience of supervising research projects on the detection and discrimination of explosives (and precursors) with Defence Science and Technology Group (DST Group) and Victoria Police Forensic Science and the French-German Research Institute of St. Louis and other international collaborators. Honours projects will be discussed on an individual basis.

Location

Flinders University - Bedford Park

Assumed knowledge

Basic chemistry and analytical skills

Further information

flinders.edu.au/people/stewart.walker