School of Life and Environmental Sciences

HDR Project List

Melbourne Burwood, Geelong Waurn Ponds, Warrnambool and Deakin Queenscliff Marine Science Centre

The School of Life and Environmental Sciences research focuses on national priorities. These are important for future social, economic and environmental development and the wellbeing of Australia and the rest of the world. Researchers collaborate with government departments, as well as industry and leading international scientists to find solutions to real-world problems. With our high-level research capabilities, specialist equipment and internationally recognised academics, our research helps shape the world.

Need a supervisor? Explore the project list to connect with academics across our mix of disciplines, which include biological and biomedical science, biotechnology, chemistry and pharmaceutical science, environmental management and sustainability, environmental science, forensic science, fisheries and aquaculture, marine and freshwater biology, mathematical modelling, sustainable regional development, wildlife and conservation biology, zoology and animal science.

Project list

Understanding how Combined Defects in Fat and Sugar Metabolism Cause Mitochondrial Disease

Abstract: Mitochondria oxidize sugars and fats by oxidative phosphorylation (OXPHOS) and fatty acid oxidation (FAO) to generate energy for the cell. Defects in either of these two biochemical pathways can result in mitochondrial disease, which in many cases is fatal at an early age. This project will use cells from patients with mitochondrial disorders to investigate how pathogenic mutations in mitochondrial genes disrupt the assembly and stability of OXPHOS and FAO enzyme complexes. Mitochondrial dysfunction will be assessed using a range of biochemical techniques, such as oxygen consumption analysis, while methods such as Blue Native gel electrophoresis will be used to examine protein complex assembly. Molecular cloning and confocal microscopy will also be employed to visualize mitochondrial protein localization and overall mitochondrial structure. This project will help to determine how the disruption of OXPHOS and FAO protein complex assembly and stability contributes to mitochondrial disease pathogenesis and identify potential targets for developing new treatments for mitochondrial disease.

References:

Burgin H, Sharpe AJ, Nie S, Ziemann M, Crameri JJ, Stojanovski D, Pitt J, Ohtake A, Murayama K, McKenzie M (2023) Loss of mitochondrial fatty acid β-oxidation protein short-chain Enoyl-CoA hydratase disrupts oxidative phosphorylation protein complex stability and function. The FEBS journal 290: 225-246.

Burgin HJ, Crameri JJ, Stojanovski D, Sanchez M, Ziemann M, McKenzie M (2022) Stimulating Mitochondrial Biogenesis with Deoxyribonucleosides Increases Functional Capacity in ECHS1-Deficient Cells. Int J Mol Sci 23.

Lim SC, Tajika M, Shimura M, Carey KT, Stroud DA, Murayama K, Ohtake A, McKenzie M (2018) Loss of the Mitochondrial Fatty Acid β-Oxidation Protein Medium-Chain Acyl-Coenzyme A Dehydrogenase Disrupts Oxidative Phosphorylation Protein Complex Stability and Function. Sci Rep 8: 153.

Key words: Mitochondrial disease, Oxidative phosphorylation, Fatty acid oxidation and Enzyme complexes

Principal Supervisor:	Dr Matthew McKenzie
Associate Supervisor:	Dr Greg Kowalski
School	School of Life and Environmental Sciences
Course	S911 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds
Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Modulating Mitochondrial Metabolism to Kill Cancer Cells

Abstract: Disruption of cell metabolism is a hallmark of cancer, with tumour cells using glycolysis for energy production even in the presence of oxygen (Warburg effect). However, many cancer cells maintain mitochondrial function, which appears to be essential for their continued survival and growth. This allows for the possibility to develop novel anti-cancer drugs that target mitochondrial function. This project will examine how compounds that stimulate mitochondrial biogenesis can induce cell death in cancer cells. New combinations of compounds will be tested on a range of different human cancer cell lines, with the induction of cell death measured using fluorescent-based flow cytometry. Changes in mitochondrial biogenesis will be assessed by determining mitochondrial DNA copy number by quantitative PCR and steady-state levels of mitochondrial protein complexes using native gel electrophoresis. Mitochondrial respiratory capacity will be measured using state-of-the-art high resolution respirometry, and changes in global gene expression assessed by RNA-seq and downstream bioinformatics pipelines. The findings of this project will help to characterize a new combination of molecules that can induce death in cancer cells and to the development of future therapies for treating cancer that target mitochondrial metabolism.

References:

Martinez-Outschoorn UE, Peiris-Pages M, Pestell RG, Sotgia F, Lisanti MP (2017) Cancer metabolism: a therapeutic perspective. Nat Rev Clin Oncol 14: 11-31

Key words: Mitochondria, Cancer, Metabolism, Cell death, Treatment and Reactive oxygen species

Principal Supervisor:	Dr Matthew McKenzie
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School	School of Life and Environmental Sciences
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Improving the sustainable management of agricultural ponds

Abstract: Australian farm dams have some of the highest greenhouse gas (GHG) emissions per area among freshwater ecosystems. In Victoria alone, we estimated they release over 4,800 tonnes of CO2-equivalent each day, which is 4.5% of all the State's agricultural emissions. These recently discovered emissions are triggered by fertiliser and manure run-off increasing nutrients, reducing water quality, and creating the ideal conditions for producing methane (CH4) – a gas with 20-30 times greater warming potential than carbon dioxide (CO2). There is an exciting opportunity to join the Blue Carbon Lab (Deakin University) to investigate the effects of enhancing farm dam conditions on reducing methane emissions and improving water quality. Under the supervision of Dr Martino E. Malerba, the successful candidate will carry out field campaigns using tailor-made sensors to investigate the dynamics of farm dams. The specific chapters of the PhD project are flexible and can include the following aspects: - Investigate the role of biotic (e.g., vegetation) and abiotic (e.g., climate) factors on water quality and greenhouse gas emissions - Determine the impact of management interventions (e.g., fencing) and land use type (e.g., livestock, crops) on water quality and greenhouse gas emissions - Analyse the role of microbial communities on methane emissions To learn more, visit https://www.bluecarbonlab.org/farm-dams.

References:

Bastviken, David, Claire C. Treat, Sunitha Rao Pangala, Vincent Gauci, Alex Enrich-Prast, Martin Karlson, Magnus Gålfalk, Mariana Brandini Romano, and Henrique Oliveira Sawakuchi. "The importance of plants for methane emission at the ecosystem scale." Aquatic Botany 184 (2023): 103596.

Ollivier, Quinn R., Damien T. Maher, Chris Pitfield, and Peter I. Macreadie. "Punching above their weight: Large release of greenhouse gases from small agricultural dams." Global change biology 25, no. 2 (2019): 721-732.

Malerba, Martino E., David B. Lindenmayer, Ben C. Scheele, Pawel Waryszak, I. Noyan Yilmaz, Lukas Schuster, and Peter I. Macreadie. "Fencing farm dams to exclude livestock halves methane emissions and improves water quality." Global Change Biology 28, no. 15 (2022): 4701-4712.

Malerba, Martino E., Tertius de Kluyver, Nicholas Wright, Lukas Schuster, and Peter I. Macreadie. "Methane emissions from agricultural ponds are underestimated in national greenhouse gas inventories." NatureCommunications Earth & Environment 3, no. 1 (2022): 306.

Malerba, Martino E., Nicholas Wright, and Peter I. Macreadie. "Australian farm dams are becoming less reliable water sources under climate change." Science of the Total Environment 829 (2022): 154360.

Key words: Farm dams, Aquatic freshwater systems, Teal carbon, Sustainable agriculture and Greenhouse gas emissions

Principal Supervisor:	Dr Martino Malerba
Associate Supervisor:	Prof Peter Macreadie
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Innovative Approaches to Maximize the Benefits of Blue and Teal Carbon Ecosystems

Abstract: There is an untapped potential to develop low-cost strategies for managing coastal and inland wetlands to maximise their long-term carbon sequestration and other co-benefits such as fisheries. Blue/teal carbon is the carbon trapped and stored in coastal (blue) or freshwater vegetated (teal) ecosystems. Contributing to Australia's commitment to tackling climate change and improving natural capital, this PhD project aims to develop new knowledge on Australia's wetlands. We are seeking applicants to join Deakin University's Blue Carbon Lab across a range of research fields. Example projects include: Develop novel solutions to reduce greenhouse gas emissions and maximise wetland carbon sequestration Develop and improve on restoration monitoring outcomes using a range of metrics (e.g. vegetation/seaweed, soil, greenhouse gas flux, spatial analyses, biodiversity, social impact/benefits) Quantify the improvements in ecosystem services of wetland management. Use AI with satellites, drones, and IoT sensors to automatically quantify wetland benefits (e.g., carbon, biodiversity, water quality, and farm productivity) Establish citizen-science projects to promote sustainable management of wetlands Improve restoration methods to upscale wetland restoration Applicants can have range of backgrounds to contribute to the above projects, including plant/seaweed or animal ecology, biogeochemistry, microbial ecology, spatial analysis, environmental economics, social sciences and information technology.

References:

Malerba, M. E., Friess, D. A., Peacock, M., Grinham, A., Taillardat, P., Rosentreter, J. A., Webb, J., Iram, N., Al-Haj, A. N., & Macreadie, P. I. (2022). Methane and nitrous oxide emissions complicate the climate benefits of teal and blue carbon wetlands. One Earth, 5(12), 1336-1341.

Malerba, M. E., Lindenmayer, D. B., Scheele, B. C., Waryszak, P., Yilmaz, I. N., Schuster, L., & Macreadie, P. I. (2022). Fencing farm dams to exclude livestock halves methane emissions and improves water quality. Global Change Biology, 28, 4701-4712

Duarte de Paula Costa, M., & Macreadie, P. I. (2022). The Evolution of Blue Carbon Science. Wetlands, 42(8), 1-12.

Trevathan-Tackett, S., Sherman, C., Huggett, M. J., Campbell, A. H., Laverock, B., Hurtado-McCormick, V., Seymour, J., Firl, A., Messer, L., Ainsworth, T., Negandi, K., Daffonchio, D., Egan, S., Engelen, A. H., Fusi, M., Thomas, T., Vann, L., Hernandez-Agreda, A., Gan, H. M., Marzinelli, E. M., Steinberg, P. D., Hardtke, L., & Macreadie, P. I. (2019). A horizon scan of priorities for coastal microbiome research. Nature Ecology and Evolution, 3, 1509-1520.

Key words: Blue carbon, Teal carbon, Mangroves, Wetlands and Nature-based solution

Principal Supervisor:	Dr Martino Malerba
Associate Supervisor:	Prof Peter Macreadie, Dr Stacey Trevathan-Tackett, Dr Micheli Costa and/or Dr Paul Carnell, Dr Melissa Wartman, Dr Maria Palacios
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science) S810 Master of Science (Environmental Sciences)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

What physiological and behavioural traits in fish prepare them for climate change?

Abstract: Climate change is impacting fish populations, whether it be linked with warming, acidification, or deoxygenation of aquatic environments. There exists variability across individuals within each fish population, so some individuals will be more resilient than others when faced with an environmental challenge. These resilient individuals are more likely to survive, grow quickly and reach reproductive maturity. Interestingly, even closely related individuals (e.g., siblings) can vary greatly in their resilience to environmental challenges, yet almost nothing is known of the phenotypical traits that cause this variability. Based largely at the Queenscliff Marine Centre, this PhD project will investigate the physiological traits (e.g., metabolism, blood properties) and behavioural traits (e.g., bold vs. shy personality) that underlie inter-individual differences in climate change resilience. Outcomes will be relevant to (1) forecasting how climate change is likely to impact fish populations and fisheries, and (2) selecting phenotypic traits in aquaculture that maximise resilience, sustainability and profitability.

References:

Goodrich, H. R. and Clark, T. D. (2023). Why do some fish grow faster than others? FISH and FISHERIES 24, 796-811.

Scheuffele, H., Jutfelt, F. and Clark, T. D. (2021). Investigating the gill-oxygen limitation hypothesis in fishes: intraspecific scaling relationships of metabolic rate and gill surface area. Conservation Physiology 9, coab040.

Skeeles, M. R. and Clark, T. D. (2023). Evidence for energy reallocation, not oxygen limitation, driving the deceleration in growth of adult fish. Journal of Experimental Biology 226, jeb246012.

Key words: Metabolism, Climate warming, Growth, Fisheries and Aquaculture

Principal Supervisor:	A/Prof. Timothy Clark
Associate Supervisor:	Prof John Donald
School	School of Life and Environmental Sciences
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Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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More information	Contact sebe-hdr-admissions@deakin.edu.au

Assessing photooxidative, mechanochemical, and biodegradation pathways of common commercial plastics

Abstract: Bioplastics are believed to be an eco-friendly alternative to traditional plastics. However, recent studies suggest that even biodegradable plastics may end up with micro- and nano-scale plastics particles which can be detrimental to the natural ecosystems. Significant gaps in research exist in understanding degradation pathways, micro-bioplastic formation rates, and the impact of real environmental factors on the degradation of bioplastics. There is also a misleading disconnection between research findings and the veracity of commercially available bioplastic labels in terms compost degradation and end products. This project aims to; (1) investigate factors affecting photo-oxidative/UV degradation, mechanochemical degradation, and biodegradation of bioplastic polymers in comparison with conventional plastics, (2) evaluate degradation rates and micro- and nano-plastic formation, (3) develop potential kinetic models for biodegradation by microorganisms, and (4) conduct field experiments in freshwater and marine environments to validate laboratory findings. The present project will shed light on assessing the hidden microplastic pollution from bioplastics. The inclusion of both field and laboratory experiments will provide a holistic understanding of degradation processes in real-environmental scenarios. The research outcomes will benefit to establish standardized testing protocols, guide policymakers in designing sustainable materials, and contribute to reducing the environmental impact of plastic degradation.

References:

Piyathilake, U., Lin, C., Bundschuh, J., Herath, I., 2023. A review on constructive classification framework of research trends in analytical instrumentation for secondary micro(nano)plastics: What is new and what needs next? Environmental Pollution 335, 122320.

Qin, J., Liang, B., Peng, Z., Lin, C., 2021. Generation of microplastic particles during degradation of polycarbonate films in various aqueous media and their characterization. Journal of Hazardous Materials 415, 125640.

Qin, J., Zeng, S., Wang, X., Lin, C., 2022. Generation of micro(nano)plastics and migration of plastic additives from Poly(vinyl chloride) in water under radiation-free ambient conditions. Chemosphere 299, 134399.

Key words: Bioplastics, Biodegrdation, Photooxidation, Microorganisms and Conventional plastics

Principal Supervisor:	Prof Chu Xia Lin
Associate Supervisor:	Dr Indika Herath
School	School of Life and Environmental Sciences
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Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
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The effect of snow cover on alpine plant community composition and function

Abstract: Snow is one of the most important factors controlling microclimate and plant growing conditions in alpine ecosystems. It decouples life conditions from ambient atmospheric conditions and ensures often non-freezing conditions during winter. Snow distribution caused by the interaction of wind and topography creates a mosaic of habitats with either no winter- time freezing or severe freezing stress over a distance of a few metres. Thus, the environmental gradient in the amount and duration of snowpack, and resulting soil water availability, drive plant communities and species traits across alpine landscape. However, snow cover dynamics, especially at the microclimate and small plant-level scales, are rarely incorporated into ecosystems models, and so our understanding of how alpine ecosystems will respond to a warmer, snow-free climate are limited. The aims of this study are: i) To unravel the overall effect of snow cover in plant species composition and plant traits diversity along the natural snow cover gradients; ii) Explore the extent to which snow manipulation experiments alter species composition, plant functional traits; and iii) to compare these results with other manipulative experiments elsewhere in the world.

References:

Unterholzner, L., Prendin, A.L., Dibona, R., Menardi, R., Casolo, V., Gargiulo, S., Boscutti, F. and Carrer, M., 2022. Transient Effects of Snow Cover Duration on Primary Growth and Leaf Traits in a Tundra Shrub. Frontiers in Plant Science, 13, p.822901.

Rumpf, S.B., Semenchuk, P.R., Dullinger, S. and Cooper, E.J., 2014. Idiosyncratic responses of high arctic plants to changing snow regimes. PLoS One, 9(2), p.e86281.

Venn, S.E., Green, K., Pickering, C.M. and Morgan, J.W., 2011. Using plant functional traits to explain community composition across a strong environmental filter in Australian alpine snowpatches. Plant Ecology, 212, pp.1491-1499.

Good, M., Morgan, J.W., Venn, S. and Green, P., 2019. Timing of snowmelt affects species composition via plant strategy filtering. Basic and Applied Ecology, 35, pp.54-62.

Key words: Snow science, Alpine plant ecology, Plant functional traits and Manipulative experiments

Principal Supervisor:	A/Prof. Susanna Venn
Associate Supervisor:	Dr Megan Hirst
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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More information	Contact sebe-hdr-admissions@deakin.edu.au

Building Nanoarchitectonics for Enantioselective Biosensing

Abstract: Chiral molecules have identical molecular formulas, atom-to-atom linkages, and bonding distances and as such, they are difficult to determine both selectively and sensitively. The project aims to address key questions in developing enantioselective and ultrasensitive biosensing technology by fundamentally understanding chiral recognition and engineering nanostructured materials with predictable properties. A soft nanoarchitectonics approach will be used to guide the design and development of enantioselective biosensing platforms. Expected outcomes from this project will include new knowledge of fabrication, characterisation of nanoscale materials and the creation of a prototype device for ultrasensitive detection of chiral biomolecules.

Reference:

Liu J. et.al. Acc. Chem. Res. 2021, 53 (3), 644-653

Key words: Biosensing, Nanotechnology and Surface Engineering

Principal Supervisor:	A/Prof Wenrong Yang
Associate Supervisor:	A/Prof Xavier Conlan
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Chemical analysis of complex samples matrices; forensic chemistry and agricultural biotechnology

Abstract: There are many real-world problems that can be better understood by detailed chemical analysis. This project looks to develop new approaches with the aid of separation science, mass spectrometry and chemometrics to better understand complex chemical systems. This work looks to solve problems in forensic drug characterisation, ballistics, DNA transfer, plant biotechnology and soil chemistry. The project work closely with industry partners and utilises the advanced chemical analysis suite on Deakin University Waurn ponds Campus. The project involves the development of novel separation technology coupled with detection chemistry in order improve both sensitive and selectivity of key chemical analytes of interest. The large data sets generated require new approaches to chemometrics in order to fully utilise the chemical data generated from the systems.

Reference:

D.A. Hughes, B. Szkuta, R.A.H. van Oorschot, X.A. Conlan, How changes to the substrate's physical characteristics can influence the deposition of touch and salivary deposits, Forensic Science International, 343, 111546 (2023)

Key words: Analytical Chemistry; Forensic Chemistry, Plant Biotechnology and DNA Transfer

Principal Supervisor:	A/Prof Xavier Conlan
Associate Supervisor:	Dr Lawrence Webb, A/Prof. Fred Pfeffer and Dr Annalisa Durdle
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Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
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Investigation of an Environmental Recycling System for valorisation of organic wastes

Abstract: ERS is the world's most efficient aerobic fermentation technology commercialised and uses 3 types of microbes to recover organic resources in a 3 hour process. The ERS process breaks organic material down into fine granules and reduces moisture content to 30%. After the ERS process, inorganic contaminants such as plastic food packaging are separated, and the resulting output is easier to store, transport and use in the circular economy. This PhD project aims to determine how the JET system impacts upon components of organic biomass (eg. identify degradation or modification of protein, amino acids, lipid, and cellulose). The project will involve characterisation of treated waste biomass to produce a business case for development of multiple or single product outputs- fertiliser, aquafeed, textile fibres (ie. cellulose), phenolics. This will project will contribute to JET's aims of increasing organic recovery capacity, building the circular economy, and reducing carbon emissions in Australia.

Reference

Gowman, A. C.; Picard, M. C.; Lim, L.-T.; Misra, M.; Mohanty, A. K. Fruit Waste Valorization for Biodegradable Biocomposite Applications: A Review. Bioresources 2019, 14 (4), 10047– 10092 2)

Bilal, M.; Iqbal, H. M. N. Sustainable Bioconversion of Food Waste into High-Value Products by Immobilized Enzymes to Meet Bio-Economy Challenges and Opportunities-A Review. Food Res. Int. 2019, 123, 226– 240, 3)

Ebikade, E.; Athaley, A.; Fisher, B.; Yang, K.; Wu, C.; Ierapetritou, M. G.; Vlachos, D. G. The Future Is Garbage: Repurposing of Food Waste to an Integrated Biorefinery. ACS Sustain. Chem. Eng. 2020, 8 (22), 8124– 8136,

Key words: Sustainable bioproducts, Circular economyfood waste and Agricultural waste

Principal Supervisor:	Dr Motilal Mathesh Shanmugam
Associate Supervisor:	Prof Colin Barrow
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S910 Doctor of Philosophy (Environmental Science) S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
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Extraction of Pigments from Microalgae and Cyanobacteria

Abstract: Pigments from microalgae and cyanobacteria have attracted great interest for industrial applications due to their bioactive potential and their natural product attributes. These pigments are usually sold as extracts, to overcome purification costs. The extraction of these compounds is based on cell disruption methodologies and chemical solubility of compounds. Different cell disruption methodologies have been used for pigment extraction, such as sonication, homogenization, high-pressure, CO2 supercritical fluid extraction, enzymatic extraction, and some other promising extraction methodologies such as ohmic heating and electric pulse technologies. The biggest constrain on pigment bioprocessing comes from the installation and operation costs; thus, fundamental and applied research are still needed to overcome such constrains and give the microalgae and cyanobacteria industry an opportunity in the world market. In this review, the main extraction methodologies will be discussed, taking into account the advantages and disadvantages for each kind of pigment, type of organism, cost, and final market.

Reference

Panis, G.; Carreon, J.R. Commercial astaxanthin production derived by green alga Haematococcus pluvialis: A microalgae process model and a techno-economic assessment all through production line. Algal Res. 2016, 18, 175–190

Aarthy, A.; Kumari, S.; Turkar, P.; Subramanian, S. An insight on algal cell disruption for biodiesel production. Asian J. Pharm. Clin. Res. 2018, 11, 21–26.

Vernès, L.; Li, Y.; Chemat, F.; Abert-Vian, M. Biorefinery Concept as a Key for Sustainable Future to Green Chemistry—The Case of Microalgae BT—Plant Based "Green Chemistry 2.0": Moving from Evolutionary to Revolutionary. In Plant Based "Green Chemistry 2.0.

Li, Y., Chemat, F., Eds.; Springer: Singapore, 2019; pp. 15–50.

Key words: Supercritical fluid extraction, Green solvent and Carotenoids

Principal Supervisor:	Dr Motilal Mathesh Shanmugam
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School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
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Novel Enzyme-Powered Autonomous Two-Dimensional Nanomotors for Biological Applications

Abstract: Bioinspired autonomous nanomachines are a new way of approaching and solving problems. Unlike current passive, diffusion-based nanosystems, these nanomachines can target cells in biological systems to deliver cargo, e.g drugs or nutrients or act as efficient environmental micro-cleaners. The unique fabricated systems can achieve autonomous navigation that can be highly controlled to execute tasks “on-demand” in response to a chemical stimulus..This whole concept is new and largely untested and therefore this project will explore the fundamentals of motion mechanics, chemical communication, and chemotactic swarming behaviour of 2D nanomotors that are powered by a select group of enzymes and their combination (glucose oxidase, catalase, urease) using biocompatible fuels (glucose and urea). To demonstrate the potential of these novel enzyme-powered 2D nanomotors, I will develop them as (i) site-specific delivery vehicles to cell organelles and (ii) mobile systems to perform chemistry “on-the-fly”. The fundamental insights gained during this project will have far reaching impacts on technologies for Australian agriculture, environment, and biomedical industries in terms of developing next generation technologies.

Reference

Mathesh, M, Bhattarai, E, et al. 2022, Angew. Chem. Int. Ed., p. e202113801.

Mathesh, M, Liu, J, et al. 2017, Chem. Eur. J., vol. 23, no. 2, pp. 304-11.

Mathesh, M, Liu, J, et al. 2013, J. Mater. Chem. C, vol. 1, no. 18, pp. 3084-90.

Mathesh, M, Luan, B, et al. 2016, ACS Catal., vol. 6, no. 7, pp. 4760-8.

Key words: Nanomotors, Enzymes, Nanotechnology and Biomedical

Principal Supervisor:	Dr Motilal Mathesh Shanmugam
Associate Supervisor:	A/Prof. Wenrong Yang
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Nanostructured surfaces for understanding fundamental catalytic processes

Abstract: The aim of this project is to develop graphene-based nanocarriers for lipase immobilisation as a new class of biocatalyst. Catalyst development will integrate novel surface functionalization strategies and bio interaction studies in organic media. This research will pioneer the development of a biocatalysis system that maximizes activation through determining and utilising lipases-graphene oxide interactions, which will increase lipase activity, specificity and stability. The research will lead to an understanding of the basic mechanisms of protein self-assembly. This project will use rational design, advanced surface modification and interdisciplinary collaboration to generate next-generation nanocarriers for bio-applications.

Reference

Mathesh M. et. al. ACS Catal. 2016, 6, 7, 4760–4768

Key words: Nanomaterials, Enzyme and Immobilisation

Principal Supervisor:	A/Prof Wenrong Yang
Associate Supervisor:	Dr Motilal Mathesh Shanmugam and Prof Colin Barrow
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Electrochemical engineering of interfacial chemical reactions at the single-molecule level

Abstract: The ability to detect and study a specific single molecule represents the ultimate challenge for molecular sensors. Chiral molecules have identical molecular formulas, atom-to-atom linkages, and bonding distances and as such they are difficult to determine sensitively and selectively. The aim of this project is to design and generate dynamic plasmonic molecular junctions by fundamentally understanding chiral recognition and engineering nanostructured materials with programmable structures and predictable properties, toward creating the next generation of chiral molecule biosensors. The outcomes of the project will be new knowledge and technology for the creation of a biosensor for ultrasensitive detection of chiral molecules.

Reference:

Kong N. et.al. J. Am. Chem. Soc. 2021, 143, 26, 9781–9790

Key words: Single-Molecule, Electrochemistry and Biosensing

Principal Supervisor:	A/Prof Wenrong Yang
Associate Supervisor:	A/Prof Fred Pfeffer
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Decomposer invertebrates in Australia's semi-arid ecosystems

Abstract: An exciting new project is available to conduct research on invertebrate biodiversity in Australia's semi-arid interior. The decomposition of dead plants and animals is important for the functioning of ecosystems globally, but little is known about this process in low- and variable-rainfall environments. Microbes are often considered the primary agents of decomposition, but moisture limitation in dry environments curtails microbial activity. Photodegradation also plays a critical role in the decomposition of plant matter but is limited to biomass above ground. The missing link could be invertebrate decomposers that are active in dry environments and can move both above and below ground. This project will investigate the biodiversity of invertebrate decomposers across an aridity gradient from coastal Victora through to semi-arid south-west NSW. The study area will include Nanya Research Station and surrounding rangelands located approximately mid-way between Mildura, Victoria and Broken Hill, NSW. The candidate will have the opportunity to work with a range of ecologists with expertise in insects, plants, soils and arid landscapes, and must be prepared to undertake both lab work and remote area field work.

References:

Barton, P. S., Evans, M. J., Foster, C. N., Pechal, J. L., Bump, J. K., Quaggiotto, M.-M., & Benbow, M. E. (2019). Towards quantifying carrion biomass in ecosystems. Trends in Ecology & Evolution, 34(10), 950-961.

Benbow, M. E., Barton, P. S., Ulyshen, M. D., Beasley, J. C., DeVault, T. L., Strickland, M. S., Pechal, J. L. (2019). Necrobiome framework for bridging decomposition ecology of autotrophically and heterotrophically derived organic matter. Ecological Monographs, 89(1), e01331.

Ulyshen, M. D., & Wagner, T. L. (2013). Quantifying arthropod contributions to wood decay. Methods in Ecology and Evolution, 4(4), 345-352.

von Hoermann, C., Benbow, M. E., Rottler-Hoermann, A. M., Lackner, T., Sommer, D., Receveur, J. P., Muller, J. (2023). Factors influencing carrion communities are only partially consistent with those of deadwood necromass. Oecologia, 201(2), 537-547.

Key words: Insects, Decomposition, Arid ecology, Conservation and Ecosystems

Principal Supervisor:	Dr Philip Barton
Associate Supervisor:	Prof Don Driscoll
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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More information	Contact sebe-hdr-admissions@deakin.edu.au

Small mammal responses to fire and climate in the Grampians landscape

Abstract: Building on a 15 year long-term research project in the Grampians landscape, this project aims to further build our understanding of how species respond to fire (both wildfire and management-based fire), shifts in rainfall and vegetation composition and structure. Ultimately the research conducted in the Grampians is trying to more clearly understand the impact of potential climate change, and how this knowledge can be used to manage species and ecosystems to increase resilience to climate change in the future.

References:

White, J.G., Sparrius, J., Robinson, T., Hale, S., Lupone, L., Healey, T., Cooke, R., Rendall, A.R. (2022) Can NDVI identify drought refugia for mammals and birds in mesic landscapes? Science of the Total Environment, 851, art. no. 158318.

Hale, S., Mendoza, L., Yeatman, T., Cooke, R., Doherty, T., Nimmo, D., White, J.G. (2022) Evidence that post-fire recovery of small mammals occurs primarily via in situ survival Diversity and Distributions, 28 (3), pp. 404-416

Hale, S., Nimmo, D.G., Cooke, R., Holland, G., James, S., Stevens, M., De Bondi, N., Woods, R., Castle, M., Campbell, K., Senior, K., Cassidy, S., Duffy, R., Holmes, B., White, J.G. (2016) Fire and climatic extremes shape mammal distributions in a fire-prone landscape, Diversity and Distributions, 22 (11), pp. 1127-113

De Bondi, N., White, J.G., Stevens, M., Cooke, R. (2010) A comparison of the effectiveness of camera trapping and live trapping for sampling terrestrial small-mammal communities, Wildlife Research, 37 (6), pp. 456-465

Key words: Biodiversity, Climate, Fire and Conservation

Principal Supervisor:	A/Prof John White
Associate Supervisor:	A/Prof Raylene Cooke and Dr Anthony Rendall
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Ecology of nocturnal birds in modified landscapes

Abstract: Raylene leads the Deakin University Powerful Owl Research Team (DUPORT) and this team has a focus on raptors and how they utilize different land-use types including urban, agricultural and forested landscapes. Much of the fieldwork is undertaken at night investigating the movement and behaviour of nocturnal birds (owls and frogmouths) and their prey (possums and gliders) so a willingness to work at night is a must.

References:

Cooke, R., Whiteley, P., Death, C., Weston, M.A., Carter, N., Scammell, K., Yokochi. K., Hguyen, H., and White, J.G. (2023). Silent killers? The widespread exposure of predatory nocturnal birds to anticoagulant rodenticides. Science of the Total Environment.

Bradsworth, N., White, J.G., Rendall, A.R., Carter, N., Whisson, D.A., Cooke, R. (2022). Using thresholds to determine priorities for apex predator conservation in an urban landscape. Landscape and Urban Planning 228, 104559

Carter, N., Cooke, R., White, J. G., Whisson, D. A., Isaac, B., and Bradsworth, N. (2019). Joining the dots: How does an apex predator move through an urbanizing landscape? Global Ecology and Conservation 17(e00532), 1–12.

Bradsworth, N., White, J. G., Isaac, B., and Cooke, R. (2017). Species distribution models derived from citizen science data predict the fine scale movements of owls in an urbanizing landscape. Biological Conservation 213, 27–35.

Isaac, B., Cooke, R., Ierodiaconou, D., & White, J. G. (2014). Does urbanization have the potential to create an ecological trap for powerful owls (Ninox strenua)? Biological Conservation, 176, 1–11.

Key words: Raptors, Movement, GPS tracking, Urbanization and Ecology

Principal Supervisor:	A/Prof Raylene Cooke
Associate Supervisor:	A/Prof. John White
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Understanding Invasive species dynamics with respect to threatened species communities.

Abstract: My research focusses on understanding how invasive species communities inter-relate with each other, and how these communities can be better managed to support threatened species recovery efforts. I take a holistic approach to this research without taxonomic bias.

References:

Halstead, L. M., Sutherland, D. R., Valentine, L. E., Rendall, A. R., Coetsee, A. L., & Ritchie, E. G. (2020). Digging up the dirt: Quantifying the effects on soil of a translocated ecosystem engineer. Austral Ecology, 45(1), 97–108. Link

Miritis, V., Rendall, A. R., Doherty, T. S., Coetsee, A. L., & Ritchie, E. G. (2020). Living with the enemy: a threatened prey species coexisting with feral cats on a fox-free island. Wildlife Research, 47(8), 633. Link

Randall, G. M., Weston, M. A., Rypalski, A., & Rendall, A. R. (2023). Interactions between European rabbits and native marsupials in the absence of terrestrial predators. Austral Ecology, November 2022, 1–19. Link

Rendall, A. R., Sutherland, D. R., Baker, C. M., Raymond, B., Cooke, R., & White, J. G. (2021). Managing ecosystems in a sea of uncertainty: invasive species management and assisted colonizations. Ecological Applications, 31(4), e02306. Link

Rendall, A. R., Sutherland, D. R., Cooke, R., & White, J. G. (2022). Does the foraging ecology of feral cats change after the eradication of foxes? Biological Invasions. Link

Key words: Invasive species, Threatened species and Ecology

Principal Supervisor:	Dr Anthony Rendall
Associate Supervisor:	Prof Euan Ritchie
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

The transfer, persistence, prevalence and recovery of DNA in a forensic context

Abstract: DNA genotyping is recognised in law courts as being underpinned by robust science. This means that rather than asking "whose DNA is it?" the judiciary in criminal cases now focus on the "how did the DNA get there?" To answer this, the variables that affect the rate of human DNA transfer, how long DNA remains in the environment, how much DNA exists in the environment at any given time and how DNA relevant to a crime is best recovered need to be explored. This is a growing area of research that aims to equip forensic science practitioners with the data they require to provide the courts and investigators with the most accurate interpretation of evidence particular to a given case.

References:

R.A.H. van Oorschot, G.E. Meakin, B. Kokshoorn, M. Goray, B. Szkuta, DNA transfer in forensic science: recent progress towards meeting challenges, Genes 12 (11) (2021) 1766

Reither, Jack & Oorschot, Roland & Durdle, Annalisa & Szkuta, Bianca. (2023). DNA transfer to placed, stored, and handled drug packaging and knives in houses. Forensic Science International: Genetics. 65.

Key words: Forensic science, DNA and DNA-TPPR

Principal Supervisor:	Dr Annalisa Durdle
Associate Supervisor:	Dr Bianca Szkuta
School	School of Life and Environmental Sciences
Course	S911 Doctor of Philosophy (Biology and Chemistry)
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Impact Theme	Advancing, society, culture and the economy
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Development of low-cost biofuels

Abstract: Global energy demand is expected to continue growing significantly into the future as human population and activity expands. It's widely recognised that alternative, sustainable solutions to fossil fuels are required to continue meeting our energy needs and to reducing our environmental impact. Biofuels produced from living materials are one replacement for fossil fuels. Biofuels have been produced from materials including wood offcuts, agricultural by-products, used cooking oil, beef tallow and algae. Biofuels are generally less harmful to the planet and human health than non-renewable fossil fuels but function similarly by burning when ignited, releasing energy to power transportation or homes. Widespread adoption of biofuels is currently hampered by factors including high cost. For instance, biofuels are commonly 10 times more expensive than fossil fuels, due largely to the higher cost feedstocks. To help create a cost competitive renewable fuel alternative for Australia we are currently exploring a range of low-cost biodiesel feedstocks, identifying improvements and cost savings to the fuel production process, and monitoring quality. This PhD project aims to use a capability of the Centre for Sustainable Bioproducts, resources of multiple industry partners, and facilities of the Deakin BioFactory to produce a low-cost, high-quality biodiesel alternative.

References:

Ramos JL, Valdivia M, García-Lorente F, Segura A. Benefits and perspectives on the use of biofuels. Microbial Biotechnology 2016 Jul; 9(4): 436-440.

Key words: Green Chemistry, Biofuel and Sustainability

Principal Supervisor:	Dr Brendan Holland
Associate Supervisor:	Prof Colin Barrow
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Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Formulation and characterization of encapsulated marine floral pigments

Abstract: Marine organisms represent approximately half of total global biodiversity, and this source has been poorly exploited. Various bioactive compounds such as astaxanthin, carotenoids, phycobiliproteins, polysaccharides, proteins, polyunsaturated fatty acids, polyphenols and other antioxidants are found in abundance in several marine flora such as algae, sponges, cnidarian and marine plants. Many of these compounds are high value and possess known therapeutic effects. Recent research has explored the self-emulsified potential of marine flora. The idea is to generate food and cosmetic products using self-emulsifying abilities of marine flora especially marine floral pigments. Chemical cosmetic products are less popular because of their hazardous effects on human health due to the incorporation of some additives that possess greater toxicity. The self-emulsifying ability of marine floral pigments can be utilized to generate products that has no harmful effects on the health of people due to certain bioactive compounds present in them which possess surface structure modulation. Coastal areas of Australia and Pakistan are rich in marine biodiversity. The ample route for exploration lead towards the industrial significance in terms of multi-million-dollar industry for the development of safe, sustainable and self-emulsified cosmetic and food products.

References:

Khalid, N, Shu, G, Holland, B, Kobayashi, I, Nakajima, M, Barrow, C. (2017) Formulation and characterization of O/W nanoemulsions encapsulating high concentration of astaxanthin, Food Research International,102, pp. 364-371.

Key words: Microencapsulation, Marine products and Bioactive compounds

Principal Supervisor:	Dr Brendan Holland
Associate Supervisor:	Prof Colin Barrow
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Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Bioprocessing of agricultural waste to valuable products

Abstract: Organic agricultural waste contains key macromolecules including protein, lipids, and carbohydrates in addition to minor levels of antioxidants, and bioactive compounds. This material can be separated using a biorefinery approach and diverted from landfill or low value applications to uses including feed for livestock and petfood, textile and fibre development, biodegradable structures for ecosystem restoration, packaging and bioplastics, and as a biocomposite additive. The material can also be used as a growth media for fermentation of bacteria for biofertilizer production or for producing lactic acid for chemical and cosmetic applications and to prepare polylactic acid for bioplastics. This project aims to capture novel organic agricultural waste sources and upscale bioprocessing solutions for product development using resources of the Deakin BioFactory. The project will optimise value recovery steps, analyse product quality, and evaluate the environmental benefits of a biorefinery approach to new product development.

References:

Caroline Trevisan Weber, Luciane Ferreira Trierweiler, Jorge Otávio Trierweiler, Food waste biorefinery advocating circular economy: Bioethanol and distilled beverage from sweet potato, Journal of Cleaner Production, Volume 268, 2020, 121788,

Key words: Bioprocessing, Analytical chemistry and Waste reduction

Principal Supervisor:	Dr Brendan Holland
Associate Supervisor:	Prof Colin Barrow and Dr Sachin Talekar
School	School of Life and Environmental Sciences
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Biomass waste derived cellulose fibres for textile applications.

Abstract: The development of natural and sustainable textile fibres as a replacement for synthetic fossil-based fibres is central to the eco-fashion movement. In this regard, waste biomass-based natural fibres are an appealing alternative to both synthetic fibres and traditional natural fibre sources. The project will use a biorefinery approach in the Deakin BioFactory to develop a green and cost-effective technology to produce cellulose-based fibres from apple pomace (waste biomass generated by apple processors), preferably with additional co-products such as pectin (commercial gelling agent), polyphenols (natural antioxidant), and sugars (hemicellulose and simple sugars). The obtained products will be analysed using various analytical techniques to determine their commercial applicability. This project will be carried out in collaboration with two industry partners: Bellevue Orchard, a major Victorian apple juice producer, and HieQ, a company that has established a market pathway for cellulose for textile applications. The apple pomace will be sourced from Bellevue Orchard and HieQ will provide testing capability for the potential use of cellulose obtained from apple pomace in textile applications. This project reduces apple waste by redirecting it to another product's life cycle while increasing profit, demonstrating the circular economy.

References:

Zhang, L.; Leung, M. Y.; Boriskina, S.; Tao, X., Advancing life cycle sustainability of textiles through technological innovations. Nature Sustainability 2023, 6 (3), 243-253.

Li, T.; Chen, C.; Brozena, A. H.; Zhu, J.; Xu, L.; Driemeier, C.; Dai, J.; Rojas, O. J.; Isogai, A.; Wågberg, L., Developing fibrillated cellulose as a sustainable technological material. Nature 2021, 590 (7844), 47-56.

Shadhin, M.; Rahman, M.; Jayaraman, R.; Chen, Y.; Mann, D.; Zhong, W., Natural biomass & waste biomass fibers–Structures, environmental footprints, sustainability, degumming methods, & surface modifications. Industrial Crops and Products 2023, 204, 117252.

Wang, T.; Jung, J.; Zhao, Y., Isolation, characterization, and applications of holocellulose nanofibers from apple and rhubarb pomace using eco-friendly approach. Food and Bioproducts Processing 2022, 136, 166-175.

Qin, S.; Giri, B. S.; Patel, A. K.; Sar, T.; Liu, H.; Chen, H.; Juneja, A.; Kumar, D.; Zhang, Z.; Awasthi, M. K., Resource recovery and biorefinery potential of apple orchard waste in the circular bioeconomy. Bioresource Technology 2021, 321, 124496.

Key words: Waste biomass, Biorefinery, Cellulose and Natural textile fibers

Principal Supervisor:	Dr Sachin Talekar
Associate Supervisor:	Dr Hoang Chinh Nguyen
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Using Australian biomass waste to design biodegradable habitats that enhance ecosystem restoration

Abstract: Wetland ecosystems are declining at unprecedented rates in human history, particularly in Australia, threatening biodiversity and the services provided by these systems to humans, such as carbon sequestration, coastal protection, biodiversity, pollution filtration, and food provision. While restoration methods are being developed and implemented, some habitats are so degraded that recovery of wetland plants is not possible. Biodegradable infrastructure is an innovative solution to break negative feedback loops to help establish vegetation, while also being safe for the ecosystem and naturally degrading when the function of the infrastructure is no longer needed. Australia is home to a wealth of agricultural and food waste that had potential for novel biopolymer development. Further, with the advancements in 3D printing and scalability of mould injection, there is immense opportunity to design innovate infrastructure designs that facilitate wetland restoration. The aim of this multidisciplinary project is to investigate waste biomass-derived biopolymers for the preparation and evaluation of biodegradable 3D printed and mould injection prototypes for wetland ecosystem restoration. In this project, we aim to reduce the environmental impacts of biomass waste, lower the cost of prototype production, and eliminate plastic release caused by plastic-based materials used for wetland restoration.

References:

O. Serrano, C. E. Lovelock, T. B. Atwood, P. I. Macreadie, R. Canto, S. Phinn, A. Arias-Ortiz, L. Bai, J. Baldock and C. Bedulli, Nature communications, 2019, 10, 4313.

R. J. Temmink, M. J. Christianen, G. S. Fivash, C. Angelini, C. Boström, K. Didderen, S. M. Engel, N. Esteban, J. L. Gaeckle and K. Gagnon, Nature communications, 2020, 11, 3668.

K. Gautam, R. Vishvakarma, P. Sharma, A. Singh, V. K. Gaur, S. Varjani and J. K. Srivastava, Bioresource Technology, 2022, 127650.

Liu, J.; Sun, L.; Xu, W.; Wang, Q.; Yu, S.; Sun, J., Current advances and future perspectives of 3D printing natural-derived biopolymers. Carbohydrate polymers 2019, 207, 297-316.

Key words: Wetland ecosystem, Wetland restoration, Biomass waste, Biopolymers and 3D printings

Principal Supervisor:	Dr Sachin Talekar
Associate Supervisor:	Dr Stacey Trevathan-Tackett, Dr. Martino Malerba and Dr Ali Zolfagharian
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Conservation biogeography of the terrestrial invertebrate fauna of the South-eastern Australian alpine archipelago

Abstract: This project, with two seasons of fieldwork (2024/2025) funded by the Hermon-Slade Foundation, will research patterns of species richness and endemism in the diverse invertebrate fauna of the Australian Alps. The distinctive biota of this region is threatened by altered fire regimes, invasive species like feral horses and deer, and climate change. To better understand the potential impacts of these threats we need contemporary data on the composition of the fauna, and how it changes across space in relation to landscape scale gradients. This information is critical to the recognition of refugia that are key to the maintenance of this biota in the face of ongoing threats. The project would likely focus on beetles but could include work on other invertebrate taxa.

References:

Endo Y, et al. 2014. Comparative phylogeography of alpine invertebrates indicates deep lineage diversification and historical refugia in the Australian Alps. Journal of Biogeography 42, 89-102.

Saunders ME, et al. 2021. Limited understanding of bushfire impacts on Australian invertebrates. Insect Conservation and Diversity 14, 285-293.Wagner DL. 2020. Insect declines in the Anthropocene. Annual Review of Entomology 65, 457-480.

Key words: Biodiversity, Conservation, Climate Change, Insects and Extinction

Principal Supervisor:	Dr Nicholas Porch
Associate Supervisor:	Prof Don Driscoll
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science) S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Understanding narrow-range endemism in the wet forest beetle fauna of south-eastern Australia

Abstract: The terrestrial invertebrate fauna of the wet forests of SE. Australia is rich in species that are found nowhere else. These narrow-range endemic species are restricted to the upland wet forests of the region, a consequence of the long-term drying of the Australian continent. Focussing on the upland regions around Melbourne (Otway Ranges, Mount Macedon, Dandenong Ranges, Central Highlands, South Gippsland Uplands, Baw Baw Plateau, Wilsons Promontory) the project will focus on the leaf litter beetle fauna using established methods and reference materials present at Deakin. The aim is to establish the relative significance of these regions for narrow range endemic taxa and to determine the which places are critical to the survival of the biota in the long term. There may be the potential to work on the phylogeography of selected taxa.

References:

Harvey MS, et al. 2011. Protecting the innocent: Studying short-range endemic taxa enhances conservation outcomes. Invertebrate Systematics 25, 1–10.

Marsh JR, et al. 2022. Accounting for the neglected: Invertebrate species and the 2019–2020 Australian megafires. Global Ecology and Biogeography 31, 2120–2130

Saunders ME, et al. 2021. Limited understanding of bushfire impacts on Australian invertebrates. Insect Conservation and Diversity 14, 285-293.

Wagner DL. 2020. Insect declines in the Anthropocene. Annual Review of Entomology 65, 457-480.

Key words: Biodiversity, Biogeography, Insects, Conservation and Climate Change	
Principal Supervisor:	Dr Nicholas Porch
Associate Supervisor:	Prof Don Driscoll
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science) S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Threatened species and threatening processes

Abstract: Australia and its offshore islands foster incredible biodiversity, buy many endemic species are threatened by invasive species and habitat destruction. Feral herbivores and invasive predators continue to drive species towards extinction and the invasive disease caused by chyrid fungus has driven declines in forty-three Australian frog species, including seven extinctions (Scheele et al. 2017). Frog species are also threatened by agricultural intensification due to rising demands for resources (Driscoll et al. 2014, Ng et al. 2018, Balouch et al. 2022) and drought linked to intensifying climate change (Scheele et al. 2012, Scheele et al. 2016). Impacts of invasive species are particularly acute on Australia's Christmas Island (Andrew et al. 2016, Emery et al. 2021). A PhD project in this area could explore how agricultural intensification affects frog, reptile, or other communities, or how chytrid fungus interacts with drought and drought-relief interventions to affect threatened frogs. This project could also be directed toward threatened and invasive species management on Christmas Island, including risks of hybridisation of Listers' gecko with other geckos; metapopulation dynamics of invasive wolf snakes using eDNA and other methods; low-input monitoring using novel cameras and AI image processing or developing new techniques to trap and exclude wolf snakes.

References:

Andrew, P., H. Cogger, D. A. Driscoll, S. Flakus, P. Harlow, D. Maple, M. Misso, C. Pink, K. Retallick, K. Rose, B. Tiernan, J. West, and J. Woinarski. 2016. Somewhat saved: a captive breeding program for two endemic Christmas Island lizard species, now extinct in the wild. Oryx 52:171-174.

Balouch, S., D. A. Driscoll, A. Naseer, R. Muhammad, and T. S. Doherty. 2022. Impacts of land cover on reptile movement and habitat use in farming landscapes. Animal Conservation 25:837-848.

Driscoll, D. A., J. A. Catford, J. N. Barney, P. E. Hulme, Inderjit, T. G. Martin, A. Pauchard, P. Pyšek, D. M. Richardson, S. Riley, and V. Visser. 2014. New pasture plants intensify invasive species risk. Proceedings of the National Academy of Sciences USA 111:16622–16627.

Emery, J.-P., N. J. Mitchell, H. Cogger, J. Agius, P. Andrew, S. Arnall, T. Detto, D. A. Driscoll, S. Flakus, P. Green, P. Harlow, M. McFadden, C. Pink, K. Retallick, K. Rose, M. Sleeth, B. Tiernan, L. E. Valentine, and J. Z. Woinarski. 2021. The lost lizards of Christmas Island: A retrospective assessment of factors driving the collapse of a native reptile community. Conservation Science and Practice 3:e358.

Ng, K., P. S. Barton, W. Blanchard, M. J. Evans, D. B. Lindenmayer, S. Macfadyen, S. McIntyre, and D. A. Driscoll. 2018. Disentangling the effects of farmland use, habitat edges, and vegetation structure on ground beetle morphological traits. Oecologia 188:645-657.

Scheele, B. C., D. A. Hunter, S. Banks, J. Pierson, L. F. Skerratt, R. Webb, and D. A. Driscoll. 2016. High adult mortality in disease-challenged frog populations increases vulnerability to drought. Journal of Animal Ecology 85:1453-1460.

Key words: Agricultural intensification, Conservation biology, Chytrid fungus, Drought, frogs, Threatened Island reptiles and Invasive species

Principal Supervisor:	Prof Don Driscoll
Associate Supervisor:	To be confirmed
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Movement ecology using high resolution automated tracking

Abstract: Habitat fragmentation and loss is the major cause of the current biodiversity crisis. Human use of landscapes, particularly in agricultural regions, has left only a small percentage of the native vegetation, and this is often in narrow remnants and isolated patches. While many native species persist, some are headed towards extinction without appropriate intervention (Driscoll 2004, Bell et al. 2022). Similarly, inappropriate fire regimes are a major contributing threat to Australia's endangered species (Kearney et al. 2019). Fires create spatial mosaics, but how these mosaics influence persistence of species is poorly understood (Smith et al. 2016). In landscapes fragmented by habitat loss or fire, a key cause of decline is the limited capacity of species to move between habitat patches (Driscoll et al. 2013, Driscoll et al. 2021). It is therefore critical to understand the circumstances that enable movement, with implications for metapopulation and metacommunity dynamics (Driscoll and Lindenmayer 2009). This project will deploy a new automated tracking system (ATLAS, Beardsworth et al. 2022) in landscapes fragmented by fire or habitat clearing to understand how movement behaviour interacts with land management practices. This exciting new project is a cross disciplinary collaboration with Deakin University's A2I2, and the Melbourne Zoo.

References:

Beardsworth, C. E., E. Gobbens, F. van Maarseveen, B. Denissen, A. Dekinga, R. Nathan, S. Toledo, and A. I. Bijleveld. 2022. Validating ATLAS: A regional-scale high-throughput tracking system. Methods in Ecology and Evolution 13:1990-2004.

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Driscoll, D. A., D. Armenteras, A. F. Bennett, L. Brotons, M. F. Clarke, T. S. Doherty, A. Haslem, L. T. Kelly, C. F. Sato, H. Sitters, N. Aquilue, K. Bell, M. Chadid, A. Duane, M. C. Meza-Elizalde, K. M. Giljohann, T. M. Gonzalez, R. Jambhekar, J. Lazzari, A. Moran-Ordonez, and T. Wevill. 2021. How fire interacts with habitat loss and fragmentation. Biological Reviews 96:976-998.

Driscoll, D. A., S. C. Banks, P. S. Barton, D. B. Lindenmayer, and A. L. Smith. 2013. Conceptual domain of the matrix in fragmented landscapes. Trends in Ecology and Evolution 28:605-613.

Driscoll, D. A., and D. B. Lindenmayer. 2009. Empirical tests of metacommunity theory using an isolation gradient. Ecological Monographs 79:485-501.

Key words: Movement ecology, Animal tracking, Habitat fragmentation, Fire ecology, Programming and computer systems an Radio communications

Principal Supervisor:	Prof Don Driscoll
Associate Supervisor:	Dr Adrian Bingham
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Small animal responses to habitat loss and disturbance using novel monitoring technology.

Abstract: How small animals survive in landscapes fragmented by agriculture, urbanisation or fire is an area of active research interest (Driscoll et al. 2020, Driscoll et al. 2021, Sweaney et al. 2021, Lazzari et al. 2022). However, one of the key constraints for understanding responses to land management is the labour-intensive nature of sampling, placing limitations on data collection. With advances in AI for processing images, it is now feasible to ask novel questions about the ecology and behaviour of wildlife using data collected from automated cameras. While commercial camera traps are largely limited in application to warm-blooded animals, new approaches allow video monitoring of all animals, including reptiles, frogs, and invertebrates (Corva et al. 2022, Nguyen et al. 2023). This project would examine how small animals are affected by fire, habitat loss and land management using video data collected with novel video traps. The project would involve field work to strategically collect data from contrasting landscape elements, then labelling videos, and working with collaborators in Deakin's School of IT to train machine learning algorithms. The project will contribute towards a new understanding about small, hard to survey animal responses to land clearing, habitat degradation and/or fire mosaics.

References:

Corva, D. M., N. I. Semianiw, A. C. Eichholtzer, S. D. Adams, M. A. P. Mahmud, K. Gaur, A. J. L. Pestell, D. A. Driscoll, and A. Z. Kouzani. 2022. A Smart Camera Trap for Detection of Endotherms and Ectotherms. Sensors 22, 4094. Link.

Driscoll, D. A., D. Armenteras, A. F. Bennett, L. Brotons, M. F. Clarke, T. S. Doherty, A. Haslem, L. T. Kelly, C. F. Sato, H. Sitters, N. Aquilue, K. Bell, M. Chadid, A. Duane, M. C. Meza-Elizalde, K. M. Giljohann, T. M. Gonzalez, R. Jambhekar, J. Lazzari, A. Moran-Ordonez, and T. Wevill. 2021. How fire interacts with habitat loss and fragmentation. Biological Reviews 96:976-998.

Driscoll, D. A., A. L. Smith, S. Blight, and I. Sellar. 2020. Interactions among body size, trophic level and dispersal traits predict beetle detectability and occurrence responses to fire. Ecological Entomology 45:300-310.

Lazzari, J., C. F. Sato, and D. A. Driscoll. 2022. Traits influence reptile responses to fire in a fragmented agricultural landscape. Landscape Ecology in press 6/2/22.

Nguyen, T. T. T., A. C. Eichholtzer, D. A. Driscoll, N. I. Semianiw, D. Corva, A. Kouzani, T. T. Nguyen, and D. T. Nguyen. 2023. SAWIT: A Small-sized Animal Wild Image daTaset with annotations. Multimedia Tools and Applications.

Sweaney, N., D. B. Lindenmayer, and D. A. Driscoll. 2021. Movement across woodland edges suggests plantations and farmland are barriers to dispersal. Landscape Ecology. Link.

Key words: Fire, Habitat fragmentation, Reptiles, Frogs, Invertebrates, Beetles, Automated video traps, AI and Machine Learning,

Principal Supervisor:	Prof Don Driscoll
Associate Supervisor:	Dr Duc Thanh Nguyen
School	School of Life and Environmental Sciences
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Physiological, endocrine, and molecular responses in in fishes exposed to long-term thermal stressors

Abstract: I am interested in understanding the stress response in fish to aquaculture-related and environmental stressors. An integrated and multi-level approach, including physiological, endocrine, and cellular responses, is used to: 1) examining the ability of fish to cope with stress, and 2) developing novel and reliable biomarkers of stress in fish for a variety of applications. Projects will allow learning opportunities in field sampling collection, and techniques such as standard and quantitative polymerase chain reaction (PCR), enzyme-linked immunosorbent assays (ELISAS) for determining hormone levels, other biochemical assays for determining enzyme and intermediate metabolites levels, SDS-PAGE and Western blot. Stressors to be studied include thermal stress, crowding, transport, hypoxia, and environmental pollutants.

References:

Afonso, L.O.B., 2020. Identifying and managing maladaptive physiological responses to aquaculture stressors, in: Farrell, A.P., Brauner, C., Benfey, T. (Eds.), Fish Physiology. Academic Press. Volume 38, 163-191. Link

Tromp, J.J., Jones, P.L, Brown, M.S., Donald, J.A., Biro, P.A., Afonso, L.O.B. 2018. Chronic exposure to increased water temperature reveals few impacts on stress physiology and growth responses in juvenile Atlantic salmon. Aquaculture 495, 196-204.

Key words: Stress, Welfare, Fish, gene expression, Metabolomics and Proteomics

Principal Supervisor:	A/Prof Luis Afonso
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School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

The risk of living in a plastic world: Assessing the presence, fate and toxicity risk of micro and nanoplastics to freshwater and marine environments, and human health.

Abstract: In freshwater and marine environments, plastic pollution has become prolific and over time via weathering, larger plastic fragments break down to form tiny micro/nano-size particles. These microscopic plastic particles or microplastics can be composed of hundreds of different toxic chemicals and are easily ingested by organisms and transported through the food chain. This presents a significant health risk to aquatic organisms and the terrestrial animals and humans that feed on them. Dr Aaron Schultz leads the Environmental Toxicology Lab in the School of Life and Environmental Sciences at Deakin University that is studying the presence, fate and toxicity risk of micro and nanoplastics to freshwater and marine environments, and human health. Several PhD research projects are currently available in the Environmental Toxicology Lab that aim to generate important new data and information on: (1) microplastic types and concentrations present in ecologically important freshwater and marine ecosystems in Port Phillip Bay and South Western Victoria; (2) the bioavailability and toxicity risk of different polymer based micro/nanoplastics, secondary microplastics and/or bioplastics to zebrafish embryos in environmentally realistic conditions; (3) the toxicity risk of different polymer based micro/nanoplastics, secondary microplastics, and/or bioplastics to humans using a variety of human cell lines as models; and (4) the interaction of microplastics with the gut microbiome in fish and formation of micro/nanoplastic biological corona's.

References:

Priyam, A., Singh, P.P., Afonso, L.O.B., and Schultz, A.G. (2022) Exposure to biogenic phosphorus nano-agromaterials promotes early hatching and causes no acute toxicity in zebrafish embryos. Environmental Science: Nano, Advanced article.

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Priyam, A., Afonso, L.O.B., Schultz, A.G. and Singh, P.P. (2021). Investigation into the trophic transfer and acute toxicity of phosphorus-based nano-agromaterials in Caenorhabditis elegans. NanoImpact, Volume 23, 2021, 100327.

Ortega, V.A., Cameron, M.S., Stafford, J.L., Goss, G.G., Donald, J.A., and Schultz, A.G. (2020). Polyacrylic acid coated nanoparticles elicit endothelial cell apoptosis and diminish vascular relaxation in ex vivo perfused iliac arteries of the cane toad (Rhinella marina). Environmental Science – Nano. 7: 1912 – 1926.

Key words: Microplastic, Pollution, Toxicity, Marine, and Freshwater.

Principal Supervisor:	Dr Aaron Schultz
Associate Supervisor:	Dr Andrew Oxley and/or A/Prof. Beata Ujvari and/or A/Prof. Luis Afonso
School	School of Life and Environmental Sciences
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Physiological and Molecular Indicators of Smoltification in Atlantic salmon (Salmo salar)

Abstract: Smoltification is a crucial phase in the life cycle of the anadromous Atlantic salmon (Salmo salar). In the wild, S. salar migrates from freshwater to seawater after spending approximately one year in freshwater (from hatching to the juvenile stage). Throughout the period in freshwater, juvenile fish will undergo physiological and morphological changes (the smoltification process) that will enable them to migrate and live in seawater. Usually, the degree of smoltification can be determined by morphological and physiological indicators, including loss of par marks, silvering of scales, darkening of fin margins, the biochemical determination of sodium, potassium-activated adenosine triphosphatase (Na+, K+-ATPase) gill levels, and plasma levels of the thyroid hormone, thyroxine (T4). One of the problems affecting the Atlantic salmon farming industry is the quality (preparedness to osmoregulate in sea water) of the smolt entering sea water. Timing of sea water entrance can affect resistance to diseases, growth, and survival, and therefore impact viability and profitability of the companies. This project aims at identifying reliable biomarkers of smoltification in fish.

References:

van Rijn, C.A., Jones, A.G., Evans, B.S., Afonso, L.O.B., 2021. Physiological and growth responses of juvenile Atlantic salmon (Salmo salar) transferred to seawater during different stages of smolt development. Aquaculture 538, 736527. Link

van Rijn, C.A., Jones, P.L., Schultz, A.G., Evans, B.S., McCormick, S.D., Afonso, L.O.B., 2020. Atlantic salmon (Salmo salar) exposed to different preparatory photoperiods during smoltification show varying responses in gill Na+/K+-ATPase, salinity-specific mRNA transcription and ionocyte differentiation. Aquaculture 529, 735744. Link

Key words: Smoltification, Atlantic salmon, Na/K ATPase and Gene expression

Principal Supervisor:	A/Prof Luis Afonso
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Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Empowering natural climate solutions: optimizing kelp restoration for building resilient marine ecosystems

Abstract: Kelp forests are key to the health and function of marine ecosystems along the southern temperate region of Australia. This 8000km stretch of coastline, the Great Southern Reef, is a biodiversity hotspot where kelp forests are relied upon for economic, social and cultural values. However, several kelp species such as Macrocystis pyrifera (Giant Kelp) and Ecklonia radiata (Golden Kelp) have suffered declines in recent decades due to habitat disturbances. Intervention initiatives are now required to restore depleted kelp and enhance the resilience of existing populations in the face of rapid climate change. Active restoration of seeded twine and green gravel are novel techniques that are being trialled globally to mixed success. The variability of these initiatives underscores the need to tailor restoration techniques to the specific needs of local ecosystems. This project will focus on optimisation of restoration techniques and practices specific to Victorian populations of M. pyrifera and E. radiata. Cultivation experiments and optimising restoration techniques will be conducted at Deakin's state-of-the-art aquaria facilities at the Queenscliff Marine Science Centre where outputs from this project will inform both conservation efforts and large-scale natural climate solutions specific to protection and recovery of kelp forests along the Victorian coastline, and more broadly, the Great Southern Reef.

References:

Young, Mary; Critchell, Kay; Miller, Adam; Treml, Eric; Sams, M; Carvalho, R; et al. (2023). Mapping the impacts of multiple stressors on the decline in kelps along the coast of Victoria, Australia. Deakin University. Link

TNC-KFA-Kelp-Guidebook-2022

Key words: Kelp, Seaweed, Restoration, Great Southern Reef and Natural climate solutions

Principal Supervisor:	Dr Prue Francis
Associate Supervisor:	A/Prof. Adam Miller
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Awakening ocean stewardship: fostering ocean literacy through innovative education in Australia

Abstract: Australia is a marine nation with unique marine ecosystems and rich indigenous knowledge systems. Given the rapid environmental challenges and the critical role the ocean plays in global sustainability, protecting and conserving the ocean holds immense significance. Nurturing ocean literacy from an early age is essential for students to develop a deep understanding of ocean systems, its significance and the human interaction with the ocean to foster a sense of stewardship and responsibility for the ocean. This project will endeavour to enhance ocean literacy within the Australian context, with a distinct emphasis on educational strategies and initiatives. The study aims to evaluate the current state of ocean literacy in Australian schools and collaborate with educators, policymakers and local communities to develop an innovative and culturally sensitive ocean literacy framework that is integrated with the national curriculum.

References:

Towards a 2025 National Ocean Literacy Strategy: Current Status and Future Needs in Primary Education

Fostering ocean literacy through informal marine education program

Key words: Ocean literacy, Marine education, Ocean stewardship and Science communication

Principal Supervisor:	Dr Prue Francis
Associate Supervisor:	Dr Paul Venzo and Dr Adam Cardilini
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Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Ecology and movement of Victorian coastal sharks and rays

Abstract: Elasmobranchs (sharks and rays) play an important ecological role in marine ecosystems and are both an important fishery and tourism attraction in Port Phillip Bay (PPB). However, little is known about elasmobranch movement ecology or habitat use within PPB. Such information is vital for safeguarding populations into the future. Capitalising on an existing acoustic array in PPB (i.e., a system of loggers that are already deployed in the bay), this project will investigate the movement ecology of key elasmobranch species in PPB. Through community engagement and education, the project will also increase the public's custodianship of the bay's unique environmental assets and culturally import species.

References:

Bass, N. C., Day, J., Guttridge, T. L., Mourier, J., Knott, N. A., Vila Pouca, C., & Brown, C. (2021). Residency and movement patterns of adult Port Jackson sharks (Heterodontus portusjacksoni) at a breeding aggregation site. Journal of Fish Biology, 99(4), 1455-1466.

Key words: Shark, Acoustic telemetry, Movement and Fiddler ray

Principal Supervisor:	Dr Samantha Sherman
Associate Supervisor:	Dr Ty Matthews and A/Prof. Daniel Ierodiaconou
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science) S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Cracking the code on captive breeding of Macquarie perch

Abstract: Macquarie perch, Macquaria australasica, was one of the most abundant large bodied native freshwater fish through its range across Victoria, NSW and ACT. This iconic Australian freshwater fish species historically supported popular and productive recreational fisheries for food and sport. Impacts from a variety of factors, including habitat loss, stream barriers, cold-water discharges, disease and exotic species have contributed to a huge decline in the range and abundance of Macquarie perch. The distribution of Macquarie perch is now fragmented into only a handful of small discrete populations, that are reproductively isolated by a combination of distance and physical barriers. Macquarie perch is now a federally listed endangered species and the trajectory of the species is headed towards extinction. This PhD project aims to 'crack the code' on captive breeding of Macquarie perch via the development of nutritionally fortified feeds, allowing for the species to be bred in captivity using hatchery broodstock, rather than relying on harvest of broodstock from dwindling wild populations. This work will save Macquarie perch from local extinction and, in the longer-term, re-establish recreational fisheries for Macquarie perch across its former range in Victoria, NSW and ACT.

References:

Lintermans, M., 2013. The rise and fall of a translocated population of the endangered Macquarie perch, Macquaria australasica, in south-eastern Australia. Marine and freshwater research, 64(9), pp.838-850.

Ingram, B.A., 2009. Culture of juvenile Murray cod, trout cod and Macquarie perch (Percichthyidae) in fertilised earthen ponds. Aquaculture, 287(1-2), pp.98-106.

Bylemans, J., Furlan, E.M., Hardy, C.M., McGuffie, P., Lintermans, M. and Gleeson, D.M., 2017. An environmental DNA-based method for monitoring spawning activity: A case study, using the endangered Macquarie perch (Macquaria australasica). Methods in Ecology and Evolution, 8(5), pp.646-655.

Key words: Conservation aquaculture, Nutrition, Fatty acids and Roodstock

Principal Supervisor:	A/Prof. David Francis
Associate Supervisor:	Dr Tom Mock
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Developing tools and knowledge for intertidal seagrass restoration in temperate Australia

Abstract: Seagrasses are important marine habitats providing a range of important ecosystem services including nutrient cycling, carbon sequestration, and providing habitat to a variety of species. However, seagrasses are declining globally and there is an urgent need to develop the tools and knowledge to undertake restoration and rehabilitation of these ecologically important habitats. This project will develop restoration and recovery methodology for intertidal seagrass meadows in Western Port, south-eastern Australia. The program will use a multidisciplinary approach that combines field-based trials and nursery experiments to develop the appropriate methodologies needed for seagrass habitat restoration in Western Port. The candidate will have the opportunity to develop a range of field, GIS, molecular laboratory and statistical analysis skills during their candidature.

References:

Yi-Mei Tan, Oliver Dalby, Gary A. Kendrick, John Statton, Elizabeth A. Sinclair, Peter I. Macreadie, Chris Gillies, Michelle Waycott, Kor-jent van Dijk, Adriana Vergés, Jeff D. Ross, Marnie L. Campbell, Fleur E. Matheson, Emma L. Jackson, Andrew D. Irving, Laura L. Govers, Rod M. Connolly, Ian McLeod, Michael Rasheed, Hugh Kirkman, Adam D. Miller, Mogens R Flindt, Troels Lange, Craig D. H. Sherman (2020) Seagrass restoration is possible: Insights and lessons from Australian and New Zealand. Frontiers in Marine Science. 7:617. Link

Tan YM, Coleman RA, Biro P, Dalby O, Jackson EM, Govers LL, Heusinkveld JHT, Macreadie PI, Flindt MR, Dewhurst J, Sherman CDH (in review) Developing seed- and shoot-based restoration approaches for the seagrass, Zostera muelleri. Restoration Ecology. E13902.

Dalby O, Pucino N, Tan YM, Jackson EL, Macreadie PI, Coleman RA, Young MA, Ierodiaconou D, Sherman CDH (2022) Identifying spatio-temporal trends in seagrass meadows to inform future restoration. Restoration Ecology. e13787.

Sinclair EA, Sherman CDH, Statton J, Waycott M, McLeod IM, Kendrick GA (2021) Breakthroughs in seagrass restoration using seed-based approaches. Ecological Management & Restoration. Link

Jackson EL, Smith TM, York PH, Nielsen J, Irving AD, Sherman CDH (2020) Setting the gene-scape for restoring the seagrass seascape. Restoration Ecology. Link

Key words: Restoration, Seagrass, Genetics, GIS and Ecology

Principal Supervisor:	A/Prof. Craig Sherman
Associate Supervisor:	Prof Marnie Campbell and A/Prof. Adam Miller
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Adaptation of native species to invasive marine predators

Abstract: The introduction of non-native species provides an excellent opportunity to study rapid evolutionary change. This is because invasive species have to adapt to a range of novel conditions, while native species often have to evolve novel responses to invasive predators. The Northern Pacific seastar is ranked as one of the top ten most potentially damaging invasive species. It is a ferocious marine predator of marine bivalves and other invertebrates and can have a devastating effect on the biodiversity of native marine communities. Recent work has indicated that some native species are able to rapidly adapt and evolve in response to this introduced predator. This project will use a combination of ecological field experiments, control laboratory behavioural trials and molecular approaches to assess adaptive changes in native species in response to an invasive predator.

References:

Ellis M, Clark Z, Treml EA, Brown M, Mathews TG, Pocklington JB, Stafford-Bell RE, Nai Y, Miller AD, Sherman CDH (2022) Detecting marine pests using environmental DNA and biophysical models. Science of the Total Environment. 816: 151666.

Ellis MR, Sherman CDH, Matthews TG (in review) Anti-predatory responses of two native gastropods to an invasive predator. Journal of Experimental Marine Biology and Ecology. 816: 151666

Key words: Adaptation, Invasive species, Marine, Evolution and Genetics

Principal Supervisor:	A/Prof. Craig Sherman
Associate Supervisor:	A/Prof. Adam Miller and Dr Ty Matthews
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Deakin Marine Research and Innovation Centre
Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Geelong Waurn Ponds and Deakin Queenscliff Marine Science Centre
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Forensic Botany: the use of plants to establish a PMI in forensic cases

Abstract: Forensic botany utilises a range of plant matter to provide information in a forensic case, for example, the location of a clandestine grave, the use of plant evidence to sequence events and ultimately the postmortem interval (PMI). This project will build on previous work in the Forensic Taphonomy group to examine the plant succession that follows disturbance of grave soil, the effects of decomposing substrate on plant growth, and other information obtainable from botanical evidence in such contexts. This will have significant impact in the taphonomic aspect of forensic science.

References:

Coyle HM. Forensic Botany: Evidence and Analysis. Forensic Sci Rev. 2009 Jan;21(1):15-23. PMID: 26242238.

Key words: Forensic botany, Taphonomy and Decomposition

Principal Supervisor:	Prof Michelle Harvey
Associate Supervisor:	Dr Andrew Oxley and/or EmPr David Cahill
School	School of Life and Environmental Sciences
Course	S911Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Building safe and secure communities
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Competitive blowfly feeding behaviour and climate change impacts

Abstract: Certain blowfly species exhibit feeding behaviour governed by competitive dynamics that may affect developmental and survival rates, with consequences for myiasis, forensics and other areas. With increasing temperatures globally, invasive species particularly are displaying temporal and spatial population shifts, which will impact future control measures particularly in the important area of livestock myosis. This project seeks to understand the mechanisms that affect the dynamics between Chrysomya rufifacies (hairy maggot blowfly) and primary species such as Calliphora stygia, Lucilia cuprina, Lucilia sericata and Calliphora augur. The project will include field and laboratory studies, examining population studies, attraction, oviposition and feeding behaviour. This will support improved preventive measures for livestock growers, and more informed approaches to postmortem interval estimation in forensics.

References:

Dawson BM, Wallman JF, Evans MJ, Butterworth NJ, Barton PS. Priority effects and density promote coexistence between the facultative predator Chrysomya rufifacies and its competitor Calliphora stygia. Oecologia. 2022 May;199(1):181-191. Link

Key words: Blowfly, Calliphoridae, Decomposition, Myiasis and Competition

Principal Supervisor:	Prof Michelle Harvey
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Healthy and sustainable food systems: environmental and nutritional implications of food production, trade, and consumption

Abstract: Current food production and consumption trends are not in line with achieving the Sustainable Development Goals including No Hunger, Climate Action, Life on Land and Life Below Water. Food systems are major drivers of global environmental change through greenhouse gas emissions, water use, land use, and a range of different pollutants. This exerts significant risk across key environmental limits (planetary boundaries) that define the safe operating space for humanity and threatens food availability, quality, and stability. In parallel, the triple burden of malnutrition; that is, undernutrition, overnutrition, and micronutrient deficiencies, continues to increase because of persistent inequalities as well as changes in food consumption and lifestyle patterns associated with rising incomes. A large body of literature calls for a food system transformation through production- and consumption-side interventions. This project employs a range of methods and tools and concepts such as life cycle assessment and environmentally extended input-output analysis, scenario analysis, and optimisation to understand trends and interlinkages across key food system drivers (e.g., population, dietary preferences, and trade). The project will examine key synergies and trade-offs associated with key interventions across a broad range of sustainability indicators to identify optimal pathways for sustainable food systems at the global and national level.

References:

Hadjikakou, M et al. (2023) Reducing risk of exceeding environmental limits requires highly ambitious interventions across the global food system. EarthArXiv X50H2B [Preprint] April 06, 2023 [accessed 2023 August 10]. Link

Geyik, Ö., Hadjikakou, M. & Bryan, B.A. Climate-friendly and nutrition-sensitive interventions can close the global dietary nutrient gap while reducing GHG emissions. Nature Food 4, 61–73 (2023). Link

Geyik, O., Hadjikakou, M., Karapinar, B., Bryan, B.A., 2021. Does global food trade close the dietary nutrient gap for the world's poorest nations? Global Food Security. 28, 100490. Link

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Willett, W. et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. Lancet 393, 447–492 (2019).

Key words: Sustainable food systems, Life cycle assessment, Healthy and sustainable diets, Climate change mitigation and Planetary boundaries

Principal Supervisor:	Dr Michalis Hadjikakou
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Feeding a growing sub-Saharan African population within environmental limits

Abstract: Urban centres in several Sub-Saharan African countries are growing rapidly in response to rapid population growth and rural-urban migration. In an area still experiencing some of the highest rates of undernourishment, expected trends towards more affluent urban lifestyles and higher demand for food, this puts pressure on the immediate hinterland to produce enough food to ensure food and nutrition security. Using a mixed-methods approach that combines quantitative statistical methods, remote sensing, and integrated sustainability assessment methods, with qualitative surveys of farmers and key decision makers, this project aims to quantify the sustainability (including food security, livelihoods, resource and GHG emissions) implications of business-as-usual and alternative development trajectories for rapidly growing Sub-Saharan countries and urban centres. The project will assess the effectiveness of solutions to reduce pressure on land and other resources while respecting the unique socio-cultural and agro-ecological contexts of sub-Saharan Africa. The outputs of this project are expected to provide valuable insights for policymakers, international organizations, and development agencies, guiding the formulation of evidence-based strategies to transform sub-Saharan Africa's food systems to ensure food security, climate change adaptation and mitigation, ecosystem protection, and to sustain livelihoods in the face of ongoing global changes.

References:

Clapp, J., Moseley, W. G., Burlingame, B., & Termine, P. (2022). The case for a six-dimensional food security framework. Food Policy, 106, 102164.

Geyik, Ö., Hadjikakou, M. & Bryan, B.A. Climate-friendly and nutrition-sensitive interventions can close the global dietary nutrient gap while reducing GHG emissions. Nature Food 4, 61–73 (2023). Link

Van Dijk, M., Morley, T., Rau, M.L., & Saghai, Y. "A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050." Nature Food 2, no. 7 (2021): 494-501.

van Loon, M. P., Hijbeek, R., Ten Berge, H. F., De Sy, V., Ten Broeke, G. A., Solomon, D., & van Ittersum, M. K. (2019). Impacts of intensifying or expanding cereal cropping in sub-Saharan Africa on greenhouse gas emissions and food security. Global change biology, 25(11), 3720-3730.

Key words: Food security, Nutrition security, Sustainability assessment, Food systems and Sub-Saharan Africa

Principal Supervisor:	Dr Michalis Hadjikakou
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Developing innovative tools and pathways (qualitative and quantitative) with stakeholders to support local scale action towards achieving the Sustainable Development Goals.

Abstract: The localisation of Sustainable Development Goals (SDGs) is an important step towards developing and implementing locally meaningful and appropriate sustainability plans that align with achieving global SDGs. The local scale requires a different approach to planning as local areas are much less homogenised and encompass a greater diversity across a smaller population compared to national or global scales. Using localised SDGs provides a way to manifest diversity while remaining aligned to a common sustainability agenda. Planning for local sustainability using the SDGs contributes to global SDG achievement and empowers local communities to take ownership of their local sustainability priorities and advocate for themselves with outcomes that scale to national or global goals. Context matters in local sustainability – methods need to be fit for purpose and specific to the stakeholder context and location. A transdisciplinary lens to local problems and sustainability challenges are also important and local issues must be considered within a broader national and global context to account for interactions between locations and across scales i.e., trade-offs and synergies. This project aims to develop innovative tools (e.g., interactive dashboard, systems modelling, visualisation tools, serious games etc) that enable stakeholders to explore locally derived sustainability pathways (qualitative and quantitative) and support the development of local scale sustainability plans aligned with global SDGs.

References:

Development Goals, characterising interactions, and identifying solutions for local sustainability', Environmental Science & Policy, 127:325-336. Link

Moallemi EA, de Haan FJ, Hadjikakou M, Khatami S, Malekpour S, Smajgl A, Smith MS, Voinov A, Bandari R, Lamichhane P, Miller KK, Nicholson E, Novalia W, Ritchie EG, Rojas AM, Shaikh MA, Szetey K and Bryan BA (2021) 'Evaluating Participatory Modeling Methods for Co-creating Pathways to Sustainability', Earth's Future, 9(3) Link

Moallemi EA, Malekpour S, Hadjikakou M, Raven R, Szetey K, Moghadam MM, Bandari R, Lester R and Bryan BA (2019) 'Local Agenda 2030 for sustainable development', The Lancet Planetary Health, 3(6):e240-e241. Link

Moallemi EA, Malekpour S, Hadjikakou M, Raven R, Szetey K, Ningrum D, Dhiaulhaq A and Bryan BA (2020) 'Achieving the Sustainable Development Goals Requires Transdisciplinary Innovation at the Local Scale', One Earth, 3(3):300-313. Link

Szetey K, Moallemi EA, Ashton E, Butcher M, Sprunt B and Bryan BA (2021a) 'Co-creating local socioeconomic pathways for achieving the sustainable development goals', Sustainability Science, 16(4):1251-1268. Link

'Participatory planning for local sustainability guided by the Sustainable Development Goals', Ecology and Society, 26(3). Link

Key words: Sustainable Development Goals, Knowledge co-production, Systems modelling and Trade-offs and synergies

Principal Supervisor:	Alfred Deakin Professor Brett Bryan
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

National scale land use and food systems modeling for socio-economic and environmental sustainability along pathways to net zero emissions.

Abstract: Feeding the increasing global population while cutting down greenhouse gas (GHG) emissions from the agricultural sector is a challenge. Modeling links between agriculture, socioeconomic factors, and the environment at a national level but at high spatial and temporal resolution offers feasible strategies for achieving net-zero emissions while ensuring land and food system sustainability. The project combines remote sensing, big data, integrated systems modelling, and deep learning techniques to map and simulate future land use change at a national level with high spatial resolution. This project extends the LUTO (Land UseTrade-Offs) version 2 model of Australian land use and food system sustainability and introduces a range of new land-use and land management types to reduce GHG emissions and sequestration and promote biodiversity, from land use change, providing spatially explicit solutions for achieving net zero emissions which achieve food demand from Australian agriculture maximise profit and abide by catchment-level water availability constraints. This project integrates global scenarios including trade, diet shifts, GDP, population, and climate change projections, to project food demand and models 28 agricultural land uses to assess land system sustainability under alternative net-zero emissions pathways.

References:

Bryan, Brett A., Martin Nolan, Lisa McKellar, Jeffery D. Connor, David Newth, Tom Harwood, Darran King et al. "Land-use and sustainability under intersecting global change and domestic policy scenarios: Trajectories for Australia to 2050." Global Environmental Change 38 (2016): 130-152.

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Van Dijk, Michiel, Tom Morley, Marie Luise Rau, and Yashar Saghai. "A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050." Nature Food 2, no. 7 (2021): 494-501.

Riahi, Keywan, Detlef P. Van Vuuren, Elmar Kriegler, Jae Edmonds, Brian C. O'neill, Shinichiro Fujimori, Nico Bauer et al. "The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview." Global environmental change 42 (2017): 153-168.

Khan, M.S., Moallemi, E., Nazari, A., Thiruvady, D., Bryan, B.A. (2023). Quantifying the safe operating space for land-system SDG achievement via machine learning and scenario discovery. Earth's Future 11, e2022EF003083. Link

Key words: Sustainability, Net-zero emissions, Food systems, Diet shift and Land use change

Principal Supervisor:	Alfred Deakin Professor Brett Bryan
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Integrating nature-based solutions to restore natural capital and enhance the resilience of Australia's terrestrial biodiversity to climate change

Abstract: Expansionary pressure exists for Australia to increase agri-food production to meet the needs of a growing domestic population and surging global demand. However, Australia's food and land system is already approaching or exceeding environmental limits for land-use change, freshwater use, climate change, biodiversity loss, and nutrient pollution, and expansion risks intensifying these pressures. Nature-based solutions (NbS) are changes in land-use and management that work with nature to address societal challenges and jointly benefit people and biodiversity. In the context of Australia's food and land system, examples include protection of natural areas, avoided land clearance, and reforestation. NbS can recreate ecosystems and habitat to support the recovery of native plant and animal species. However, NbS are costly, and have multiple synergies (e.g., carbon sequestration) and trade-offs (e.g., depleting water resources and displacing agriculture). This project will utilise advanced, spatially-explicit modelling to identify the specific mix and location of NbS required to stem the precipitous rate of extinction of Australia's native plant and animal communities under climate change and to spatially target solutions to maximise co-benefits and minimise trade-offs between competing objectives.

References:

Gao L, Bryan BA 2017. Finding pathways to national-scale land-sector sustainability. Nature 544:217-22.

Seddon N, et al. 2020. Global recognition of the importance of nature-based solutions to the impacts of climate change. Glob Sustain 3:e15 Key IB, et al. 2022. Biodiversity outcomes of nature-based solutions for climate change adaptation: Characterising the evidence base. Front Environ Sci 10.

Bryan B, et al. 2016. Designer policy for carbon and biodiversity cobenefits under global change. Nat Clim Change 6:301-+.

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Key words: Nature-based solutions, Nature positive, Conservation, Ecosystems, Biodiversity, Modelling and Land-use change.

Principal Supervisor:	Alfred Deakin Professor Brett Bryan
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Impact Theme	Enabling a sustainable world
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Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Public perceptions of invasive species management

Abstract: One of the greatest obstacles to effective management of invasive species is public perception. Government agencies and conservation organisations often adopt strategies according to which actions the general populace deem appropriate, humane, and effective – despite opinions not always aligning with the scientific evidence. This can lead to ineffective management strategies that are undermined by a need to make them politically and socially palatable. Despite the public's agency in shaping wildlife management, decision makers often have a poor grasp of what the public wants. This makes it difficult to effectively account for differing values and provide the public with reliable information that supports management decisions. To address knowledge gaps, we aim to carry out a comprehensive survey-based study investigating attitudes towards different invasive species management approaches and assessing their efficacy.

References:

Stop Jumping the Gun: A Call for Evidence-Based Invasive Predator Management. Link

Key words: Invasive species, Wildlife conservation and management and Environmental policy.

Principal Supervisor:	Prof Euan Ritchie
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Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Mammal Ecology and Conservation

Abstract: A range of projects are available, in discussion with a suitable candidate and their interests. Focus areas include but are not limited to; artificial structures for arboreal mammal conservation, conserving threatened mammals in agricultural landscapes, invasive species management, and species reintroductions.

Key words: Ecology, Conservation, Mammal, Wildlife management and conservation an Invasive species.

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Evolutionary Ecology of Human and Wildlife Diseases

Abstract: The project focuses on interactions between organisms and their environment and their synergistic impact on organismal fitness. The research aims to explore the significance of genetic and phenotypic organismal responses to both macro- and micro environmental challenges.

References:

Ujvari, B., Raven, N., Madsen, T., Klaassen, M., Dujon, A. M., Schultz, A. G., . . . Thomas, F. (2022). Telomeres, the loop tying cancer to organismal life-histories. Molecular Ecology, 13 pages. Link.

Ujvari, B., Roche, B., & Thomas, F. (2017). Ecology and evolution of cancer. B. Ujvari, B. Roche, & F. Thomas (Eds.), Amsterdam, The Netherlands: Elsevier. Link

Ujvari, B., Klaassen, M., Raven, N., Russell, T., Vittecoq, M., Hamede, R., Madsen, T. (2018). Genetic diversity, inbreeding and cancer. Proceedings of the Royal Society B: Biological Sciences, 285(1875). Link

Martin, L. B., Addison, B., Bean, A. G. D., Buchanan, K. L., Crino, O. L., Eastwood, J. R., Grogan, L. F. (2019). Extreme competence: keystone hosts of infections. Trends in ecology & evolution, 34(4), 303-314. Link

Madsen, T., Loman, J., Anderberg, L., Anderberg, H., Georges, A., & Ujvari, B. (2020). Genetic rescue restores long-term viability of an isolated population of adders (Vipera berus). Current Biology, 30(21), R1297-R1299. Link

Key words: Evolution, Ecology and Genetics

Principal Supervisor:	A/Prof. Beata Ujvari
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Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Evolution and ecology of organisms exposed to oncogenic environments.

Abstract: Animal species are increasingly exposed to a range of cancer risk factors which interacts in complex landscapes increasing the probability they develop tumours. From a biodiversity conservation and ecosystem sustainability perspective, it is becoming crucial to understand how tumoral processes have the potential to alter the ecology of animal species from the scale of individual to whole ecosystems. Our current understanding of how cancer negatively affects ecosystems focuses primarily on the late metastatic and transmissible cancer stages, when it kills the host. This PhD project aim to use a mix of invertebrate laboratory models (Australian freshwater hydra and planaria), comparative statistical analyses across taxa, and modelling to understand how the early stage of carcinogenesis impacts important parameters of the ecology of species such as behaviour, life history traits, risk of predation or host parasites interactions. This PhD project will be conducted in close collaboration with the French National Centre for Scientific Research and the University of Montpellier.

References:

Dujon, A.M., Boutry, J., Tissot, S., Lemaître, J.-F., Boddy, A.M., Gérard, A.-L., et al. (2022a). Cancer Susceptibility as a Cost of Reproduction and Contributor to Life History Evolution. Front. Ecol. Evol., 10, 861103.

Dujon, A.M., Brown, J.S., Destoumieux-Garzón, D., Vittecoq, M., Hamede, R., Tasiemski, A., et al. (2021a). On the need for integrating cancer into the One Health perspective. Evol. Appl., 14, 2571–2575.

Dujon, A.M., Ujvari, B. & Thomas, F. (2021b). Cancer risk landscapes: A framework to study cancer in ecosystems. Sci. Total Environ., 763, 142955.

Tissot, S., Gérard, A.L., Boutry, J., Dujon, A.M., Russel, T., Siddle, H., et al. (2022). Transmissible Cancer Evolution: The Under-Estimated Role of Environmental Factors in the "Perfect Storm" Theory. Pathogens, 11, 9–14.

Boutry, J., Mistral, J., Berlioz, L., Klimovich, A., Tökölyi, J., Fontenille, L., et al. (2022). Tumors (re)shape biotic interactions within ecosystems: Experimental evidence from the freshwater cnidarian Hydra. Sci. Total Environ., 803, 149923.

Key words: Evolutionary biology, Experimental ecology, Wildlife conservation, Oncology and Quantitative ecology

Principal Supervisor:	Dr Antoine Dujon
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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The Role of Epigenetics in Neuroendocrine Cancer Chemotherapeutic Drug Resistance

Abstract: Current research emphasises the significant role of environmental factors, including exposure to toxins, drugs, and alcohol, in cancer development, outweighing hereditary factors. Toxic environmental factors trigger epigenetic modifications that change the activity of genes, leading to cancer. Recent studies also associate environmental factors with drug resistance in cancer treatment. Neuroendocrine cancers are aggressive tumours that develop quickly and are rapidly fatal. Chemotherapeutic drugs are the primary form of treatment. However, the emergence of drug resistance is a common occurrence, where patients become unresponsive to the drugs, leading to the rapid progression of their disease. Drug resistance is linked to epigenetic changes such as methylation in the cancer cells. Manipulation of the methylation status of cells will enable the transition from a drug-resistant to a drug-sensitive profile, providing an opportunity to improve treatment options for individuals with this and other forms of cancers. This project will utilise a cultured pancreatic neuroendocrine tumour model (Bon-1) to track epigenetic shifts in drug resistance development and the alterations in cellular and molecular pathways underlying this process. Analysing molecular profiles before and after drug resistance onset could offer insights into novel treatments, such as methylation inhibitors, thus improving outcomes for patients with aggressive cancers.

References:

Taby, R. & Issa, J. (2010) 'Cancer Epigenetics', A Cancer Journal for Clinicians, 2010. 60(6), pp. 376- 392. 2. Maharjan, C., et al. (2021) 'Pancreatic Neuroendocrine Tumors: Molecular Mechanisms and Therapeutic Targets', Cancers, 13(20), pp. 5117. 3.

Brown, R., et al. (2014) 'Poised epigenetic states and acquired drug resistance in cancer', Nature Reviews Cancer, 14(11), pp. 747-753. 4. Sharma, S., et al. (2010) 'A chromatin-mediated reversible drug-tolerant state in cancer cell subpopulations', Cell, 141(1), pp. 69-80. 5.

Yang, L., et al. (2021) 'Histone H3K4 Methyltransferases as Targets for Drug-Resistant Cancers', Biology, 10(7), pp. 581

Key words: Cancer, Environmental toxins, Epigenetics, Drug-resistance and Tumours

Principal Supervisor:	Dr Agnes Michalczyk
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Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Product development from red seaweeds

Abstract: Red seaweeds are a rich source of protein, sulphated polysaccharides, cellulose, and other components, that can be further used in many industries including food/feed, textiles, and packaging. There is potential to separate these components, such as sulphated polysaccharides for pharmaceutical use or developing more specific bio-composite formulations such as bioplastics. The separation strategy would also enable other components to be utilised for other products creating a biorefinery approach for residue utilisation (e.g., protein for aquafeed and cellulose for textile additives). Therefore, this project aims to test the feasibility of developing multiple products through advanced separation focused on protein for aquafeed, carrageenan for bioplastics, and cellulose for textile additives.

Reference:

Qiu SM, Aweya JJ, Liu X, Liu Y, Tang S, Zhang W, Cheong KL (2022) 'Bioactive polysaccharides from red seaweed as potent food supplements: A systematic review of their extraction, purification, and biological activities', Carbohydrate Polymers, 275, pp. 118696.

Key words: Red seaweed, Cellulose and Biocomposite,

Principal Supervisor:	Dr Hoang Chinh Nguyen
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Course	S911 Doctor of Philosophy (Biology and Chemistry) S810 Master of Science (Environmental Sciences)
Campus	Geelong Waurn Ponds
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Fractionation, characterization, and biological activity of polysaccharides from seaweeds

Abstract: Green seaweeds are potential source of bioactive polysaccharides that can be further used in food and pharmaceutical industries. This project aims to optimize the extraction conditions for maximizing the recovery of bioactive polysaccharides from green seaweed. The extracted polysaccharides will be then fractionated to obtain different fractions. Finally, these fractions will be characterized and studied for their biological activities (e.g., antioxidant, anti-inflammatory, and anticancer activities). In addition, the extracted components will be used for the preparation of hydrogel for wound healing.

Reference:

Gan A, Baroutian S. (2022) 'Subcritical water extraction for recovery of phenolics and fucoidan from New Zealand Wakame (Undaria pinnatifida) seaweed', The Journal of Supercritical Fluids;190, p. 105732.

Key words: Seaweeds, Bioactive polysaccharides and Hydrogel

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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Development of biocomposite for packaging from seaweed byproducts

Abstract: Seaweeds, or marine macroalgae, are increasingly attracting interest for industrial applications as they contain multiple valuable micro- and macro-nutrients and bioactive compounds. The current seaweed industries generate a huge a mount of seaweed residues that are mainly discarded, consequently affected the environment. However, these residues are a potential source of cellulose that has potential commercial value. In addition, they are a fibre-rich material that can be directly used as an inexpensive bio-composites for packaging. Therefore, this project aims to produce bioplastics for packaging and to produce paper. To enhance the property of the biocomposite, different biopolymers will be blended with seaweed residues. In addition, nanoparticle will be synthesized and incorporated to the biocomposite to enhance its function.

Reference:

Cebrián-Lloret V, Metz M, Martínez-Abad A, Knutsen SH, Ballance S, López-Rubio A, Martínez-Sanz M. (2022) 'Valorization of alginate-extracted seaweed biomass for the development of cellulose-based packaging films', Algal Research, 61, pp. 102576

Key words: Bioplastic, Biocomposite, Bioactivity, Seaweed and Nanomaterial

Principal Supervisor:	Dr Hoang Chinh Nguyen
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Comprehensive profiling of lipid oxidation products

Abstract: Lipids are a diverse group of molecules, most commonly known for their roles in cell membrane structure and energy storage but are also vital signalling molecules whose importance is only recently being fully recognised. Lipids are a component of many foods and a vital part of a healthy diet. Lipid oxidation in food systems is one of the most important factors affecting food quality, nutrition, safety and consumer acceptance. The current industry standard for assessing lipid oxidation is the peroxide value, which only measures one of the multiple products of lipid oxidation and has been found to be a poor measure of the overall oxidation status of a sample. The aim of this project is to develop methods for the comprehensive profiling of lipid oxidation products in a range of industrially relevant samples, to provide a method to better assess the oxidation state of samples and to work towards the development of better antioxidant systems. The project would employ a range of techniques and instruments available at Deakin University, including HPLC, GC and GC×GC, NMR, EPR and MS.

Reference

Schaich, KM. (2012) 'Thinking outside the classical chain reaction box of lipid oxidation', Lipid Technology, 24(3), pp. 55-58.

Schaich, KM. Xie, J. Bogusz, BA. (2017) 'Thinking outside the classical chain reaction box of lipid oxidation: Evidence for alternative pathways and the importance of epoxides', Lipid Technology, 29(9-10), pp. 91-96.

Key words: Lipids, oxidation, Analytical and Chemistry

Principal Supervisor:	Dr Jacqui Adcock
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Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Sensing and Imaging using functionalised 1,8-naphthalimides

Abstract: Seaweeds, or marine macroalgae, are increasingly attracting interest for industrial applications as they contain multiple valuable micro- and macro-nutrients and bioactive compounds. The current seaweed industries generate a huge a mount of seaweed residues that are mainly discarded, consequently affected the environment. However, these residues are a potential source of cellulose that has potential commercial value. In addition, they are a fibre-rich material that can be directly used as an inexpensive bio-composites for packaging. Therefore, this project aims to produce bioplastics for packaging and to produce paper. To enhance the property of the biocomposite, different biopolymers will be blended with seaweed residues. In addition, nanoparticle will be synthesized and incorporated to the biocomposite to enhance its function.

Reference:

I. R. D. Johnson, E. E. Rudebeck, M. J. Sweetman, A. Sorvina, T. D. Ashton, F. M. Pfeffer, D. A. Brooks, S. M. Hickey, A 3,4-dimethoxy-1,8-naphthalimide for lipid droplet imaging in live and fixed cells, Sensors and Actuators B: Chemical, 2022, 365. Link

E. E. Rudebeck, R. P. Cox, T. D. M. Bell, R. Acharya, Z. Feng, N. Gueven, T. D. Ashton, T. D. Ashton, T. D. Ashton, F. M. Pfeffer, Mixed alkoxy/hydroxy 1,8-naphthalimides: expanded fluorescence colour palette and: In vitro bioactivity, Chemical Communications. Link

C. L. Fleming, A. Natoli, J. Schreuders, M. Devlin, P. Yoganantharajah, Y. Gibert, K. G. Leslie, E. J. New, T. D. Ashton, F. M. Pfeffer, Highly fluorescent and HDAC6 selective scriptaid analogues, European Journal of Medicinal Chemistry, 2019, 162, 321-333. Link

K. N. Hearn, T. D. Nalder, R. P. Cox, H. D. Maynard, T. D. M. Bell, F. M. Pfeffer, T. D. Ashton, Modular synthesis of 4-aminocarbonyl substituted 1,8-naphthalimides and application in single molecule fluorescence detection, Chemical Communications, 2017, 53. Link.

Key words: Synthesis, Fluorescence, Sensing, Imaging and 1,8-Naphthalimide

Principal Supervisor:	A/Prof. Fred Pfeffer
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Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technology
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Supramolecular assemblies as new materials

Abstract: We have recently obtained high quality crystallographic data that clearly shows the formation of a highly porous 2-D coordination polymer (2-D net) from fused norbornane ligands. The extended porous structures have potential applications in fields such as gas storage (hydrogen economy) and sieving as well as catalysis. We have also recently obtained X-ray data confirming the synthesis of large covalent macrocycles made from norbornane diols and commercially available boronic acids. These linkages are unique to our research group and are remarkably stable. Projects are available in which new assemblies (either metallo or covalent) will be designed, synthesised and evaluated. Aspects of characterisation will be performed using the Australian synchrotron and in collaboration with groups from UNSW and Melbourne University.

Reference:

M. D. Johnstone, E. K. Schwarze, G. H. Clever, F. M. Pfeffer, Modular synthesis of linear bis- and tris-monodentate fused [6]polynorbornane-based ligands and their assembly into coordination cages, Chemistry - A European Journal, 2015, 21, 3948-3955. Link

M. D. Johnstone, E. K. Schwarze, J. Ahrens, D. Schwarzer, J. J. Holstein, B. Dittrich, F. M. Pfeffer, G. H. Clever, Desymmetrization of an Octahedral Coordination Complex Inside a Self-Assembled Exoskeleton, Chemistry - A European Journal, 2016, 22, 10791-10795. Link

R. N. Robson, B. P. Hay, F. M. Pfeffer, To Cooperate or Not: The Role of Central Functionality in Bisthiourea [6]polynorbornane Hosts, European Journal of Organic Chemistry, 2019, 2019, 6720-6727. Link

Key words: Assembly, Supramolecular Chemistry, Coordination Polymer and Porous Materials

Principal Supervisor:	A/Prof. Fred Pfeffer
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Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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High-throughput Evaluation of Aggregation Induced Emission in Cyclometalated Iridium(III) Complexes

Abstract: Most luminophores are susceptible to emission quenching upon aggregation, which limits the utility of a given luminophore in applications where such aggregates may form. In contrast, aggregation induced emission (AIE) affords increased luminescence when photoactive molecules form higher order aggregates. This is particularly beneficial for applications that require high-intensity luminescence such as optoelectronics (e.g. OLEDs), bio-imaging, and sensing. Cyclometalated iridium(III) complexes are versatile luminophores owing to their tunable emission energy, good photostability and high quantum yields. While select iridium(III) complexes are known to exhibit AIE, previous studies are ad hoc by design and the structural factors that elicit this phenomena remain poorly understood. This project utilises a bespoke high-throughput photoreactor to evaluate the AIE properties across a large library of >2000 discrete heteroleptic iridium(III) complexes of the type [Ir(C^N)2(N^N)]+, where C^N is a cyclometalating and N^N a diimine ancillary ligand (Figure 1, proof-of-concept experiments have validated measurement accuracy). Following the high-throughput screening, the brightest iridium(III) aggregates will be tested for aggregation induced electrochemiluminescence (AIECL). This technique is an emerging approach that may achieve exceptionally sensitive ECL detection, commonly used in commercial sensing for affinity-based biosensing.

Reference:

Mei, J.; Leung, N. L. C.; Kwok, R. T. K.; Lam, J. W. Y.; Tang, B. Z. (2015) 'Aggregation-Induced Emission: Together We Shine, United We Soar!' Chemical Reviews , 115(21), pp11718–11940.

Moreno-Alcantar, G., Aliprandi, A., De Cola, L. (2022) 'Aggregation-Induced Emission in Electrochemiluminescence: Advances and Perspectives.'

In: Tang, Y., Tang, B.Z. (eds) Aggregation-Induced Emission. Topics in Current Chemistry Collections. Springer, pp. 65-90.

Key words: Organometallic, Luminescence and Coordination Complex

Principal Supervisor:	Dr Tim Connell
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Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Redox-Mediated Electrogenerated Chemiluminescence

Abstract: Electrogenerated chemiluminescence (ECL) is a highly sensitive mode of detection, in which electrochemically generated reactants form electronically excited products that emit light. The majority of ECL applications make use of tris(2,2'-bipyridine)ruthenium(II) as the luminophores and tri-n-propylamine as a 'co-reactant'. Alternative luminophores and co-reactants have been explored, but several new approaches to enhance this 'gold-standard' ECL system have recently emerged. These include the use of a second tertiary amine co-reactant, ultrasound irradiation, conductive microbeads, and vesicle microenvironments. One of the most promising of these approaches is the addition of a redox mediator, which enables faster electron transfer and generation of the electronically excited state responsible for the emission of light. In this project, the key attributes of redox-mediator enhancers and quenchers will be elucidated. New redox mediators will be designed to develop single- and multi-colour ECL systems for a wide range of analytical applications.

Reference:

Kerr, E.; et al. (2022) 'A redox-mediator pathway for enhanced multicolour electrochemiluminescence in aqueous solution', Chemical Science, 13, 469-477.

Key words: Electrogenerated Chemiluminescence, Electrochemiluminescence, Analytical Chemistry, Electrochemistry and Molecular Luminescence Spectroscopy

Principal Supervisor:	Prof Paul Francis
Associate Supervisor:	Dr Egan Doeven
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Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Multi-colour 'Switchable' Electrochemiluminescence for Multiplexed Detection.

Abstract: The capacity to diagnose disease in the human body and identify dangerous pollutants in our environment is fundamentally limited by the speed, selectivity, accuracy and sensitivity that we can measure molecules. Electrochemiluminescence (ECL) is a highly sensitive mode of detection that is used in commercial immunodiagnostic systems and many other analytical applications. Multi-colour ECL is a recent innovation in which molecules that emit different coloured light can be selectively switched-on or switched-off by applying different electrochemical potentials. This provides opportunities for simultaneous (multiplexed) ECL detection events for time-critical analytical applications. This project explores novel, tailored luminophores and new approaches to multi-colour ECL detection for a variety of applications.

Reference:

Doeven, E. H.; et al. (2014) 'Red-green-blue electrogenerated chemiluminescence utilizing a digital camera as detector'. Analytical Chemistry, 86, 2727-2732.

Key words: Analytical Chemistry, Electroanalytical chemistry, Luminescence Spectroscopy, Electrochemiluminescence, Transition Metal Complexes

Principal Supervisor:	Prof Paul Francis
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Campus	Geelong Waurn Ponds
Impact Theme	Creating smarter technologies
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

STEM employability

Abstract: Employability is a complex but important aspect of any STEM degree. Preparation at university for future employment, transition to employment, and the first 3-5 years out in the workforce are all crucial times for young graduates. We need research to better understand how to prepare students for an ever-changing work environment. Within this field of STEM employability choose from 1) a focus on Graduate Outcome Survey results (the GOS is a national survey all grads are invited to fill out), 2) a clean economy focus, 3) a focus of your own (e.g., demographics, a particular subject/discipline, gender, etc.) or your own combination. You will use existing data and collect your own data to understand how graduates learning at university impacts their career experiences and decisions later. Probe complicated issues like the impact of demographics on education and career thinking or work to develop a more quantitative project using a large backlog of national and institutional data. You will be working to develop your own employability skills using specialty software, developing relationships with employers and better understanding how we weave employability into different areas of the STEM curriculum.

Reference:

Gouda-Vossos, A., Sarkar, M., Thompson, C., Overton, T., & Ziebell, A. (2023). An Evidence-Based Approach to Employability Curricula and Transferable Skill Development: A Mixed Methods Study. Journal of University Teaching & Learning Practice, 20(5). Link

Sarkar, Mahbub, Tina Overton, Christopher Thompson, and Gerry Rayner. 'Graduate Employability: Views of Recent Science Graduates and Employers'. International Journal of Innovation in Science and Mathematics Education (Formerly CAL-Laborate International) 24, no. 3 (2016).

Sarkar, Mahbub, Tina Overton, Christopher D Thompson, and Gerry Rayner. 'Academics' Perspectives of the Teaching and Development of Generic Employability Skills in Science Curricula'. Higher Education Research & Development, 2019, 1–16.

McGunagle, Doreen, and Laura Zizka. 'Employability Skills for 21st-Century STEM Students: The Employers' Perspective'. Higher Education, Skills and Work-Based Learning, 2020. Knight, Peter T, and Mantz Yorke. 'Employability through the Curriculum'. Tertiary Education and Management 8, no. 4 (2002): 261–76.

Key words: Employability, STEM, career confidence, Qualitative/quantitative and STEM education

Principal Supervisor:	Dr Angela Ziebell
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Impact Theme	Advancing, society, culture and the economy
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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A new strategy for embedding career education to enhance the employability and career management skills of science graduates.

Abstract: Career education (CE) is critical for enhancing graduate employability and work readiness. Deakin is a leader in embedding CE, including within the science degrees. A new evidence-based CE intervention is being contextualised and implemented across Deakin science courses in a systematic, programmatic approach. This research project seeks to evaluate the effectiveness of the CE intervention on students': graduate employment outcomes; self-reported work readiness; competency in core career management skills; and perceived confidence in their ability to obtain graduate employment. This longitudinal study will involve multiple stakeholders (students, staff, industry professionals) and a mixed methods approach to collect quantitative (participant surveys, publicly available data) and qualitative data (open-ended survey questions, student focus groups, academic and employer interviews, autoethnographic approaches). The study will: evaluate the effectiveness of the new curriculum interventions in preparing science graduates for graduate employment and their career; work with stakeholders to co-create and co-design innovative educational learning and assessment opportunities to enhance the career development learning and employability skills development of science graduates; map employment outcomes of past, current and future science graduates utilising a range of tools and platforms; and provide baseline data for evaluation of the sustainable employability and career development outcomes for science graduates.

Reference:

Bridgstock, R. (2009). The graduate attributes we've overlooked: enhancing graduate employability through career management skills. Higher Education Research & Development, 28(1), 31-44.

Bridgstock, R. and Hearn, G. (2012). A conceptual model of capability learning for the twenty-first-century knowledge economy. In G. Hearn, D. Rooney and T. Kastelle (Eds.), Handbook on The Knowledge Economy, Vol. 2, pp. 105-119, Edward Elgar Publishing.

Hansen, L., La Fontaine, S., & Caballero, C. (2022). The Stepping Stones Framework: lessons from an evidence-based, practice-led approach to embedded career education. [conference session] HERDSA Conference 2022, Melbourne, Australia

Watts, A. G. (2006). Career development learning and employability. Higher Education Academy York.

Key words: Career education, Employability and Science graduates

Principal Supervisor:	A/Prof. Sharon La Fontaine
Associate Supervisor:	Dr Prue Francis, Dr Jen Chung and Dr Lauren Hansen
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Campus	Melbourne Burwood
Impact Theme	Advancing, society, culture and the economy
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Indigenous Science

Abstract: As an important reconciliation step many universities are introducing Indigenous contexts, perspectives, and content into the curriculum. It is important to ensure that this is done well and to understand the experience of all students who are learning about this material. Unfortunately, even when material is written well, it is often a superficial engagement with the content that still privileges non-Indigenous ways of conceptualising Science. The resources can further embed negative assumptions and biases, reinforcing a neo-colonial privileging of Western ontological and epistemological concepts of science. Lack of consultation also continues the process of colonisation as non-First Nations people speak for First Nations peoples, removing the chance for First Nations self-determination. This project will look at the ways that Indigenous Science is being developed in a consultative manner across different university/school systems in Australia and explore the depth in which it is being conducted. You will use quantitative and qualitative approaches to understanding how the learning material is built and assessed and its impact on the students. It is also important to understand the experience of educators (both Indigenous and non-Indigenous) in these environments and how best to prepare staff. A staff focus for this research is also possible.

Reference:

Undergraduate Teaching Laboratory, International Journal of Innovation in Science and Mathematics Education, 29(2), 32-46. Baynes, R. (2015) Teachers' Attitudes to Including Indigenous Knowledges in the Australian Science Curriculum, Australian Journal of Indigenous Education 45(1), 80-90.

Bodkin-Andrews, G. Page, S. and Trudgett, M. (2019) Working towards accountability in embedding Indigenous studies: Evidence from an Indigenous Graduate Attribute evaluation instrument, Australian Journal of Education, 63(2), 232-260.

O'Dowd, Mary Fances, and Robyn Heckenberg. 'Explainer: What Is Decolonisation?' The Conversation, 23 June 2020. Link

Aikenhead, Glen. 'Science: A Way of Knowing'. The Science Teacher 46, no. 6 (1979): 23–25.

Key words: Indigenous Science, Indigenous perspective, Ways of knowing; Reconciliation through education and Co-design of curriculum

Principal Supervisor:	Dr Angela Ziebell
Associate Supervisor:	Dr Al Fricker
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Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Industry-linked context-based learning

Abstract: Engaging teaching is essential for making the most of students' years at university. One way that learning can be made more engaging is to link it to real world use of the science through showing how industry uses that science every day. You would work with industry partners to develop industry-linked context-based learning approach in your STEM area and follow the student reaction to that learning, including any improvements to engagement or student confidence in understanding and using the science involved. This might include building resources that bring industry partners to life in the classroom to further improve engagement (video interviews, videos from site tours, activities from websites etc.). This project could also probe career related issues e.g., affinity to work in an area based on learning experience or impact of the changed learning approach across demographics. Projects may focus on a particular aspect of learning (e.g., seminars or tutorials or exam questions) in the candidate's area of technical interest within science. The work will help students improve both their technical and their transferrable skills in preparation for their life post-graduation.

Reference:

Ziebell, A., George-Williams, S., Danczak, S., Ogunde, J., Hill, M., Fernandez, K., Sarkar, M., Thompson, C., Overton, T. (2019). Overturning a laboratory course to develop 21st century skills. In Michael K. Seery and Claire Donnell (Eds.), Teaching Chemistry in Higher Education: A Festschrift in Honour of Professor Tina Overton, (pp. 363-376).

Dublin: Creathach Press. George-Williams, S., Ziebell, A., Thompson, C., Overton, T. (2020). Inquiry-, problem-, context- and industry- based laboratories: an investigation into the impact of large-scale, longitudinal redevelopment on student perceptions of teaching laboratories. International Journal of Science Education, 42(3), 451-468

George-Williams, S., Ziebell, A., Kitson, R., Coppo, P., Thompson, C., Overton, T. (2018). 'What do you think the aims of doing a practical chemistry course are?' A comparison of the views of students and teaching staff across three universities. Chemistry Education Research and Practice, 19(2), 463-473.

Overton, Tina. 'Context-Based Learning'. New Directions in the Teaching of Physical Sciences, 23 February 2016, 7–12. Link

Sarkar, Mahbub, Tina Overton, Christopher Thompson, and Gerry Rayner. 'Graduate Employability: Views of Recent Science Graduates and Employers'. International Journal of Innovation in Science and Mathematics Education (Formerly CAL-Laborate International) 24, no. 3 (2016).

Key words: Industry-linked learning, Engagement, Context-based learning, Laboratory learning and Transferable skills

Principal Supervisor:	Dr Angela Ziebell
Associate Supervisor:	A/Prof. Damien Callahan
School	School of Life and Environmental Sciences
Strategic Research and Innovation Centre	Centre for Sustainable Bioproducts
Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Melbourne Burwood
Impact Theme	Advancing, society, culture and the economy
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Phycoremediation of common pharmaceuticals from treated wastewater by cosmopolitan marine algal species.

Abstract: The efficacy of current tertiary level municipal wastewater treatment varies considerably (Gerba et al 2019), and is often inadequate in effectively removing particular pharmaceutical and personal care contaminants prior to discharge into aquatic environments (Bassin et al, 2021). Advanced tertiary treatment designed to remove all non-biodegradable, inorganic and synthetic organic compounds including pesticides, fungicides and pharmaceuticals, can be achieved but requires state-of- treatment facilities which can also be cost prohibitive, particularly for smaller-city municipal treatment facilities (M. Jeffries, pers.comm. Wannon Water Corporation). Pharmaceutical contaminants in particular represent an emerging, highly significant environmental concern (Dhodapkar et al.2019). Evidence that pharmaceuticals are at detectable levels in rivers and estuaries across all continents highlights the now ubiquitous global distribution of pharmaceuticals in aquatic ecosystems (Wilkinson et al 2022). Alternative low-technology methods to extract pharmaceuticals from treated wastewater prior to release into rivers and oceans are needed. Effective use of large seaweed species to phycoremediate marine water quality has been demonstrated in the aquaculture industry (Hadley et al. 2014). Effective use of large seaweed species to phycoremediate marine water quality has been demonstrated in the aquaculture industry (Hadley et al. 2014).

Reference:

De Oliveira VP, Martins NT, de Souza Guedes P (2016) Bioremediation of nitrogenous compounds from oilfield wastewater by Ulva lactuca. Bioremediation Journal 20(1), 1-9. Link

Dhodapkar RS, Gandhi KN (2019) Pharmaceuticals and personal care products in aquatic environments: chemicals of emerging concern? In Prasad MNV, Vithanage M, Kapley A (eds) Pharmaceuticals and personal Care Products: waste management and Treatment Technology: emerging contaminants and micropollutants. Butterworth-Heinemann.

Hejna H , Kapu´sci´ nska D, Aksmann A (2022) Pharmaceuticals in the Aquatic Environment: A Review on Eco-Toxicology and the Remediation Potential of Algae. International Journal of Environmental Research and Public Health 19: 7717. Link

Smii H, Leite C, Pinto J, Freitas R (2023) The environmental remediation capacity of Ulva lactuca: the potential of macroalgae to reduce the threats caused by Titanium in marine invertebrate species. Science of the Total Environment 858 (2023) 159586. Link

Qui S, Ge S, Champagne P, Robertson RM (2017a) Potential of Ulva lactuca for municipal wastewater bioremediation and fly food. Desalination and Water treatment.91:23-30. Link

Key words: Pharmaceuticals, Wastewater, Algae and Bioremediation

Principal Supervisor:	A/Prof. Julie Mondon
Associate Supervisor:	Dr Patricia Corbett and A/Prof. Damien Callahan
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Course	S910 Doctor of Philosophy (Environmental Science)
Campus	Warrnambool
Impact Theme	Improving health and wellbeing
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Pesticide monitoring to improve water quality, safeguard ecosystems, and protect public health

Abstract: There are more than 18,000 pesticides products registered by the Australian government and we don't know how much are entering our waterways. Measuring pesticides in Australia's creeks and rivers is vital. It ensures we understand the impact of these chemicals on our environment, aquatic life, and drinking water sources. By monitoring and managing pesticide levels, we promote sustainable practices, reduce contamination risks, and ensure the vitality of our precious waterways for generations to come. This project will utilise state of the art mass spectrometry techniques to carry out pesticide measurements from Australia creeks and rivers. Techniques develop at Deakin's mass spectrometry laboratory can detect approximately 800 target compounds. Sample collection will be carried out utilising a network of citizen science and school groups who will collect regular samples from their local waterways. Monitoring is a cornerstone of ecosystem management and conservation. It provides the data and insights needed to make informed decisions, protect vulnerable ecosystems, and ensure the long-term health and sustainability of our natural world therefor this is an important project which combines analytical and environmental chemistry to help identify areas of concern and provide data for improved decision making.

Reference:

Beketov, M. A., Kefford, B. J., Schäfer, R. B., & Liess, M. (2013). Pesticides reduce regional biodiversity of stream invertebrates. Proceedings of the National Academy of Sciences, 110(27), 11039-11043.

Hegarty, S., Hayes, A., Regan, F., Bishop, I., & Clinton, R. (2021). Using citizen science to understand river water quality while filling data gaps to meet United Nations Sustainable Development Goal 6 objectives. Science of The Total Environment, 783, 146953

McKnight, U. S., Rasmussen, J. J., Kronvang, B., Binning, P. J., & Bjerg, P. L. (2015). Sources, occurrence and predicted aquatic impact of legacy and contemporary pesticides in streams. Environmental Pollution, 200, 64-76.

Key words: Pesticides, Mass spectrometry, Analytical chemistry, Environmental chemistry and Citizen science

Principal Supervisor:	A/Prof. Damien Callahan
Associate Supervisor:	Dr Aaron Schultz
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Course	S911 Doctor of Philosophy (Biology and Chemistry)
Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
More information	Contact sebe-hdr-admissions@deakin.edu.au

Generation of volatile organic compounds by microalgae - a field and laboratory based project

Abstract: Phytoplankton, found in marine and freshwater ecosystems, play a crucial role as primary producers. Their growth relies on the utilisation of solar radiation to fix carbon dioxide concurrently releasing oxygen. However, as part of their metabolism many species of phytoplankton emit volatile organic compounds (VOCs) (Lim et al. 2017). A group of particularly reactive VOC's are the halogen containing compounds such as bromoform, also known as halocarbons. These compounds are subsequently released from the ocean into the atmosphere (Kim et al. 2017; Sanchez et al. 2020; Halsey and Giovannoni 2023), where they can act as cloud condensation nuclei or produce highly reactive radicals that can impact the oxidative capacity of the troposphere. More measurements are needed in this area to understand the impact of these biogenic emissions. This project will aim to carry out field-based measurements of halocarbon compounds in both land and ship-based deployments of instrumentation. The project will also aim to identify key species and determine the factors that influence the production of these gases. This exciting, multidisciplinary project combines field work, potentially on the RV Investigator (CSIRO research vessel) and/or the RV Nuyina (Australia's Antartic ice breaker) and lab-based experiments on phytoplankton. This will build on a recent project which was carried out on the Maritime continent off the NW coast of Australia and will include collaborators from CSIRO and The University of Melbourne.

Reference:

Lim Y, Phang S, Rahman NA, Sturges W and Malin G (2017) 'Halocarbon emissions from marine phytoplankton and climate change', International journal of environmental science and technology, 14(6):1355-1370.

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Key words: Phytoplankton, Halocarbons, Analytical chemistry and Environmental chemistry

Principal Supervisor:	A/Prof. Damien Callahan
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Campus	Melbourne Burwood
Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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The implications of allergen-induced neuroinflammation

Abstract: Neuroinflammation refers to inflammation of the central nervous system (CNS), activated in response to homeostatic disturbance. Neuroinflammation has a pivotal role in many disorders, which is a consistent component of neurodegenerative disorders, such as Multiple sclerosis, Alzheimer's Disease and Amyotrophic Lateral Sclerosis. The production of neurotoxic protein aggregates, metabolites, and the degeneration of neurons in such disorders is commonly associated with sustained immune cell activation. During neuroinflammation, CNS glial cells produce inflammatory mediators, disrupt the blood brain barrier, and recruit peripheral immune cells, potentially leading to harmful health outcomes. Investigating the interface between neuroinflammation and peripheral immune cell activation could shed novel light on dysfunctional neuroinflammation. Activation of neuronal cells by allergens could establish a connection to neuroinflammation, which remains unreported in literature. Due to the global prevalence of individuals affected by allergens, exploring these potential interactions that induce neuroinflammatory activation is of high significance. By establishing and characterising an in vitro blood brain barrier model, in combination with multi-cellular cerebral organoids, this project seeks to model, comprehend, and uncover the pivotal interplay between allergic reactions and the ensuing neuroinflammation. Thus, creating new avenues for therapeutic strategies to mitigate neuroinflammation that contribute to the onset and progression of neurodegenerative disorders.

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Key words: Neurological, Allergy, Neuroinflammation, Neurodegeneration and Immunology

Principal Supervisor:	A/Prof. Cenk Suphioglu
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Metformin in the prevention of corneal structural rigidity loss due to preserved eyedrops

Abstract: Ocular allergies affect approximately 10% of people worldwide[1]. Symptoms such as itchiness and inflammation can influence those affected to rub their eyes and self-medicate with anti-allergy eyedrops. Common eyedrop preservative benzalkonium chloride (BAK), has been shown in previous studies to impact corneal cell viability[2]. Localised inflammation due to allergy and pressures from eye-rubbing; have been previously implicated in the development of Keratoconus[3], a disease that causes progressive thinning and protrusion of the cornea leading to potential vision loss and ocular scarring. It is possible that the collagen networks that maintain corneal rigidity are impacted by atopy, eye-rubbing and BAK induced toxicity[4]. Metformin, the biguanide type 2 diabetes medication, has demonstrated anti-inflammatory and collagenase-inhibitory properties[5]. The proposed research project seeks to investigate the impact of BAK on corneal rigidity as well as the inhibition of corneal degradation by metformin. The aim is to form a basis for the therapeutic and harmful effects of metformin and BAK in ocular allergy symptom mitigation. Using cultured human corneal epithelial cells in vitro, an established cell model that is routinely used in my laboratory, corneal cell viability and cellular rigidity will be measured using cell viability assays and proteomic, genomic, metabolomic, and lipidomic analyses.

Reference:

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Key words: Keratoconus, Metformin, Benzalkonium chloride and Ocular allergy Collagen degradation

Principal Supervisor:	A/Prof. Cenk Suphioglu
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Diagnostic and therapeutic potential of recombinant chicken egg allergens and hypoallergens

Abstract: Current diagnostic and prophylactic treatments for food allergies demonstrate vast areas for potential improvement. Allergen immunotherapy, whilst mostly effective, poses serious safety concerns among highly allergic individuals, and available diagnostic techniques are unrefined at best (Palmer et al., 2022). Our previous work has identified 6 major egg allergens, which were sequenced, genetically altered and recombinantly produced in bacterial vectors. Initial stages of this project will involve performing sequencing to confirm allergen identity and subsequent cloning into bacterial and yeast vectors to obtain maximal recombinant expression levels of all 6 egg allergens and their hypoallergenic variants. Once purified with ion-exchange and size-exclusion chromatography, the panel of allergens and hypoallergens will be subjected to immunoassays to investigate the abrogation of immunoreactivity of hypoallergens and ability of recombinant allergens to mimic IgE-reactivity of the naturally derived allergens. Additionally, in collaboration with Royal Children's Hospital, this project will evaluate the efficacy of ongoing egg allergy trials in increasing allergen tolerance. Furthermore, the pursuit of developing an allergen-free egg will be explored in collaboration with the CSIRO. This project will prepare and test all 6 recombinant allergens for their potential future use as refined diagnostics, while their hypoallergenic variants as safe and effective therapeutics.

Reference:

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Key words: Egg, Allergy, Hypoallergen, Allergen and Immunotherapy

Principal Supervisor:	A/Prof. Cenk Suphioglu
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Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship

Population dynamics of migratory shorebird in the face of global change in a migratory flyway: with special reference to pollution and emerging infectious diseases

Abstract: Migratory shorebirds of the East Asian-Australasian Flyway have experienced rapid declines of up to 80% in recent decades. Key drivers of decline are thought to be habitat destruction and climate change, and these may be compounded by both environmental pollution and disease. While environmental contamination by historic legacy pollutants has decreased over recent decades, new environmental pollutants are continually being discovered that impinge on wildlife health. Shorebird migrations can expose the birds to pollutants the full length of the flyway. Furthermore, shorebirds are reservoirs for diseases such as avian influenza, a virus responsible for unprecedented global mortalities of wild birds since 2021. Paired with immunomodulatory properties of certain pollutants, these threats may significantly worsen the outlook for shorebird populations. Using over 40 years of shorebird banding data, as well as over 10 years of blood and cloacal sampling for pollutants and viruses, a range of advanced molecular, chemical and statistical techniques, this project will disentangle the effects of pollution and disease on survival in migratory shorebirds. Such insights may prove invaluable to conservation efforts, as well as serve to inform policies that aim to curb the declines of these long-distance migrants in the face of global anthropogenic change.

References:

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Key words: Survival, Disease, Shorebirds, Pollution and Migration

Principal Supervisor:	Prof Marcel Klaassen
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Movements of waterfowl in a dynamic landscape and its relevance to duck hunting and spread of emerging infectious diseases

Abstract: Waterbirds and notably ducks play an important role in the epidemiology of some key emerging infectious pathogens, notably avian influenza virus (AIV) and Japanese Encephalitis Virus (JEV). At the same time ducks are also a prime recreational hunting species. The limited tracking done on ducks in Australia thus far highlights that their movement patterns are much more difficult to understand and predict than for most ducks elsewhere on this globe, which is likely due to the erratic weather conditions prevailing across our continent. In this study we will track a large number of ducks of a variety of common dabbling duck species across southeast Australia, using state of the art GPS transmitters. Next, we will model their behaviour in relation to the changing availability of water in the landscape from satellite imagery. Results will be used to inform disease epidemiology and dispersal models for diseases where ducks are important host species, but also to inform hunting policies such as annual hunting bags in Victoria.

References:

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Key words: Ducks, Tracking, Disease, Hunting and Modelling

Principal Supervisor:	Prof Marcel Klaassen
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Course	S910 Doctor of Philosophy (Environmental Science)
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Impact Theme	Enabling a sustainable world
Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Determinants of animal shape-shifting responses to climate warming

Abstract: Climate change is having drastic effects on animal biology, threatening many species. Recent data collected by our group suggests that there are widespread changes in body size and shape (the size of appendages) across endotherm groups (particularly birds). These may represent an evolutionary adaptation to climate change: smaller bodies and larger appendages aiding in the dissipation of body heat in hot conditions, reducing heat stress. However, we know relatively little about how species ecology, behaviour and physiology affects this response, and how climate-related changes in body size interact with body shape. Likewise, we know little about how these changes are affecting population trends. Using museum collection data and cross-species comparative analyses, this project will drill down into the factors underlying morphological change (shapeshifting) with a particular focus on endotherm lineages. The project would suit a student with good analytical skills and interests in evolutionary ecology and animal responses to climate change.

References:

Ryding, S. et al (2021) 'Shape-shifting: changing animal morphologies as a response to climatic warming'. Trends in Ecology and Evolution 36, pp. 1036-1048

McQueen, A. et al (2022) 'Thermal adaptation best explains Bergmann's and Allen's rules across ecologically diverse shorebirds', Nature Communications 13, 4727.

Campbell-Tennant, D.J.E. et al (2015) 'Climate-related spatial and temporal variation in bill morphology over the past century in Australian parrots', Journal of Biogeography, 42, 1163-1175.

Key words: Evolutionary ecology, Body shape, Morphology, Climate change and Endotherms

Principal Supervisor:	A/Prof. Matthew Symonds
Associate Supervisor:	Prof Marcel Klaassen
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Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
Scholarship	Applicants will need to complete an Expression of Interest and if successful apply for a Deakin University Postgraduate Research Scholarship
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Evolving escape: natural selection and bird anti-predator responses

Abstract: This project will examine how escape responses to predators by birds evolve through natural selection, and whether environmental regimes including conservation management affect this evolution. Currently, there is little direct evidence for how or whether propensity to escape evolves, or its link to individual survival, but this evidence is critical to management of threatened species. This research will provide much needed direct evidence for the way environment, genetic factors, and individual fitness (selection) affect escape responses. The project will be beneficial by enabling conservation groups to make more informed choices about management initiatives they have implemented to protect threatened species. The project would suit a student with good field work skills, with particular interest in bird behaviour and conservation.

References:

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Weston, M.A. et al (2020) 'Escape responses of terrestrial and aquatic birds to drones: towards a code of practice to minimise disturbance', Journal of Applied Ecology, 57, 777-785

Key words: Anti-predator behaviour, Birds, Natural selection, Management and Threatened species

Principal Supervisor:	A/Prof. Matthew Symonds
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Avian clocks: from development, evolution to ecological impact

Abstract: We are seeking an outstanding, highly motivated PhD candidate to work on a new project examining the role of photoperiod in determining the ontogeny of the avian clock, as well and the timing of life events, such as hatching and reproduction in wild zebra finches. The student will be building on our earlier work demonstrating the fundamental role which early life conditions play in determining developmental programming for later life conditions. The student will quantify the role of photoperiod for reproductive timing, running a common garden experiment quantifying gene expression, development and behaviour. The work will involve remote fieldwork, catching wild birds to relocate to breed in captivity. The PhD student will work in a vibrant and productive research team testing the role of environmental cycles for early avian development. The student can potentially learn a range of molecular techniques, endocrine and behavioural assays, neural gene expression and genomics analyses to assess physiological processes, as well as functional impacts. The student will be based at Deakin University, Geelong and co-supervised by Assoc Prof F Gachon (University of Queensland).

References:

Mariette, M.M., D.F. Clayton, and K.L. Buchanan, 2021 Acoustic developmental programming: a mechanistic and evolutionary framework, Trends in Ecology & Evolution, 36(8): p. 722-736.

Key words: Gene expression, Behaviour, Physiology and Evolution

Principal Supervisor:	Prof Kate Buchanan
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Expression of Interest	Applicants are encouraged to contact the nominated principal supervisor to discuss project suitability and complete and Expression of Interest form
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Animal personality, performance and pace-of-life.

Abstract: The inter-relationships between physiology, behaviour, performance and life history are fundamental to understanding the function and evolution of individual phenotypes. Studying these relationships can help us understand why highly flexible traits like behaviour and physiology can consistently differ among individuals. At the same time, studying individual variation in physiology and behaviour can help us understand animal performance (e.g. endurance, VO2max) and life history, including growth, reproduction and immune function. This very broad focus includes and combines areas of study such as animal personality, behavioural plasticity, evolution, developmental plasticity and energetics. The implications of understanding these trait linkages at the individual level are fundamental for understanding animal adaptation to changing environments, and for understanding the highly individual nature of health and disease resistance in humans and other animals.

Key words: Behaviour, Individuality, Physiology

Principal Supervisor:	A/Prof. Peter Biro
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Avian ecology and behaviour

Abstract: Seeking highly qualified and motivated students to work on a field-based research projects on ecology and evolution in passerine birds (i.e., Grey Fantails or Spotted Pardalotes, etc.). Projects could include topics such as the function of female song, effects of parental coordination at the nest on fitness, breeding ecology, design and function of nests, and/or life history theory. These field projects can include both descriptive and experimental hypotheses testing. There is scope to adapt projects to the prospective students' interests. We are looking for enthusiastic students with a passion for field work and evolutionary ecology. Useful skills include experience with one or more of the following: bird-banding, behavioural observations, nest searching, running automated cameras, recording and analysis of bird song, or other ornithological skills, valid drives licence.

Key words: Bird, Behaviour, Song and Nest

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